School of Psychology

Health Related Behaviours, Autistic and ADHD Traits, and Well-being in Students.

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Summary

Background: The recent increase in chronic diseases and mental health problems has piqued the interest of researchers in understanding healthy behaviour. Health-related behaviours (HRBs) are essential for determining physical and mental health outcomes. Therefore, positive health behaviours can result in enhanced health outcomes and well-being. Conversely, negative health behaviours can lead to various harmful health influences and the adoption of risky behaviours. Adolescents frequently engage in behaviours that impair their health and well-being, including the high consumption of sugary food and lack of physical activity. Moreover, adolescents and young adults with ADHD/autism traits have lower well-being.

Aims and Methodology: This thesis investigates the associations between HRBs and ADHD/autism traits, well-being, and behavioural outcomes. Moreover, it aims to replicate the results found in WPQ studies using multivariate analyses in different populations.

Results: According to univariate analysis, there is a significant correlation between health-related behaviours and well-being and SDQ outcomes. Similar findings were found between ADHD/autism traits and well-being and SDQ outcomes. When including HRBs and ADHD/autism traits in multivariate analyses, most significant correlations disappeared after controlling for well-being predictors. However, some HRBs remained significant, such as tea consumption increased flourishing among secondary students, and physical health in university students. In addition, high fruit and vegetable consumption increased prosocial behaviours among secondary and university students. It is observed that ADHD/autism traits correlated with SDQ outcomes but not well-being outcomes.

Conclusion: The results showed that while HRBs are linked to well-being outcomes in univariate analyses, they often have less predictive power when other well-being predictors are taken into account. This research emphasises the importance of considering multiple factors when examining the relationship between lifestyle behaviours and well-being. Moreover, the fact that some HRBs remained significant indicates that promoting healthy behaviours improves health and well-being.

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Publications in Thesis

The secondary analyses conducted in this thesis have been published in the following publications. Additionally, these papers are further summarised and included in Chapter 4.

Almobayed, S., & Smith, A. (2023). Associations between diet, other health-related behaviours, well-being, and general health: A survey of university students.
Publication status: **Published work**
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SA contribution: 80%
SA designed the methodology with AS's assistance and conducted the analysis. SA led the writing of the article, using reviewers' suggestions and AS's advice. And it has included in Chapter 4.

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SA designed the methodology with AS's assistance and conducted the analysis. SA led the writing of the article, using reviewers' suggestions and AS's advice. It has summarised in Chapter 4.

Table of Contents

List of Figures

List of Tables

Chapter 1: Introduction

1.1 General Introduction

Adolescence is a crucial period distinguished by rapid physical, cognitive, social, and emotional growth (Yurgelun-Todd, 2007). The events and behaviours developed during this period can have an essential and persistent effect on an individual's future well-being throughout adulthood (Lawrence, Mollborn, & Hummer, 2017). Providing adolescents with enough support and resources to flourish is imperative, as this is vital for their holistic growth and achievement. Furthermore, it is worth noting that mental health disorders are prevalent among adolescents, affecting 13% of those aged 10 to 19 worldwide (WHO, 2021); for example, anxiety, depression, and behavioural problems such as ADHD can substantially impact school attendance, academic achievement, social interactions, and well-being. Measuring well-being requires a comprehensive, multidomain approach considering several factors influencing well-being, such as stressors, social support, coping strategies, and individual differences (Reavley & Sawyer, 2017; Andrew Smith, 2021, 2022).

The increased belief in the underlying relationship between behaviour and well-being has led to significant shifts in the last three decades in understanding and promoting health and the possibility of influencing the individual (Raude, MCColl, Flamand, & Apostolidis, 2019). It is generally agreed that health-related behaviours can significantly prevent and manage diseases and promote health and well-being (Burdette, Needham, Taylor, & Hill, 2017; Lawrence et al., 2017; Tan et al., 2018). Moreover, evidence indicates that implementing suitable dietary and nutritional interventions may have a substantial impact on decreasing mental health problems, such as depression and anxiety while enhancing health and well-being (Bamber, Stokes, & Stephen, 2007). However, researchers who have attempted to evaluate the impact of HRBs on well-being have focused on single behaviours, such as exercise, sleep, or particular food and supplementation, using univariate analyses. This leads to limitations in interpretation because real-life processes often involve multiple interacting factors that need to be understood together to gain comprehensive insights.

Health-related behaviours such as exercise, good sleeping, and healthy eating are crucial throughout adolescence. Studying and understanding the impact of health-related behaviours, especially diet, on an individual's physical and mental health is an important issue, mainly through adolescence, because it is a period of development and growth (Burdette et al., 2017). Moreover, modifying a healthy lifestyle can significantly improve well-being and mental health (Samuelson, 2017). Adolescents often behave in a manner that risks their health and well-being, such as overeating sugar and not participating in enough exercise (Almobayed & Smith, 2023b; 2023c; Smith & James, 2023; van Sluijs et al., 2021). Previous studies confirm that many of the habits and behaviours in the adolescent stage continue into adulthood (Burdette et al., 2017; Lawrence et al., 2017). Hence, due to the changes and behaviours that occur throughout this period, young people's health may be negatively affected either currently or in the future (Barnawi et al., 2023).

1.2 Topics Covered in the Present Research

1.2.1 Well-being

Numerous theories and definitions have emerged due to the multi-dimensional and complex concept of well-being (Knight & McNaught, 2011; Norozi, 2023). For instance, hedonic well-being is determined by the presence of positive affect and the absence of negative affect, while eudaimonic well-being focuses on personal growth and thriving (Mackean, Shakespeare, & Fisher, 2022). The World Health Organization (WHO, 2024) defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". This holistic approach emphasises the prevention and promotion of health and well-being rather than just treatment. Thus, recent research focuses on subjective well-being, such as positive emotions, life satisfaction, and flourishing (Norozi, 2023) and negative factors, such as anxiety and depression.

1.2.2 Diet

Recent research has focused on the influence of diet and nutrition on positive well-being or the increase in mental health problems. Studies on adult individuals have shown a correlation between a healthy diet and improved well-being and health outcomes (Conner, Brookie, Richardson, & Polak, 2015; Wickham, Amarasekara, Bartonicek, & Conner, 2020). Moreover, the regular consumption of refined food, including junk meals, has been related to an increased probability of depression (Li et al., 2017; Samuelson, 2017). Moreover, studies have revealed that good health and happiness in adulthood are outcomes of healthy lifestyle choices made during adolescence, including regular exercise, nutritious eating, and good sleep habits (Burdette et al., 2017; Lawrence et al., 2017). It has also been reported that there has been an increase in mental health issues such as depression and anxiety, while eating patterns have changed from consuming whole foods to consuming less nutritious, more processed food such as junk food and snacks (Bottomley & McKeown, 2008). Research indicates that the rise in issues with mental health over recent years may be associated with this shift in eating habits (Samuelson, 2017). Studies confirm that there has been a significant shift in food consumption habits during the past century. In 1909, fats from foods provided 32% of calories, increasing to 43% in the 1990s (Greenstone, 2007; Samuelson, 2017). Furthermore, the growth in fast food options in recent years, in addition to the increased consumption of highly caffeinated drinks and processed and refined meals that lack significant nutritional content, may contribute to an increase in the prevalence of mental health problems. One of the most essential hormones for growth in the brain is brain-derived neurotrophic factor, and research has found that fast food and processed diets can inhibit its action. This leads to chronic inflammation and disrupts the normal functioning of the immune system and the brain (Greenstone, 2007; Samuelson, 2017). The current thesis will focus primarily on diet as the most critical aspect of health-related behaviours to be addressed. Additional factors impacting an adolescent's life include sleep quality and physical activity, which will be investigated here.

1.2.3 ADHD

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental condition distinguished by constant features of inattention, hyperactivity, and impulsivity that disrupt normal functioning or growth. It is one of the most common disorders affecting children and often continues into adulthood (Drechsler et al., 2020). Danckaerts et al. (2010) conducted a systematic review involving 36 articles to examine the quality of life in children and adolescents with ADHD. The findings revealed that ADHD has a significant negative impact on the well-being outcomes of children and young people, particularly from the perspective of their parents. Parents consistently report substantial adverse effects across various domains, including psycho-social functioning, academic achievement, and self-esteem. In addition, higher levels of ADHD symptoms and functional impairments are linked to poorer well-being.

1.2.4 Autism

Autism spectrum disorder (ASD) is a complicated neurological and developmental condition that influences how people interact with others, communicate, learn, and behave; the most common traits of this disorder are lack of social communication and interaction deficits, language difficulties, and repeated behaviours (Hodges, Fealko, & Soares, 2020). A systematic review conducted by Ayres et al. (2018) It involved 14 articles and emphasised low quality of life experienced by people with autism spectrum disorder.

1.3 Research Objectives

This thesis aimed to examine the relationships between health-related behaviours (especially diet factors), ADHD, autistic traits, well-being, and behavioural outcomes through several empirical studies conducted with adolescent and young adult populations. It employed the well-being process model (G. M. Williams & Smith, 2012) based on the Demands–Resources–Individual Effects (DRIVE) model (G. M. Mark & Smith, 2008) as a theoretical framework for the research. It involved a holistic approach, integrating the effects of health-related behaviour variables, ADHD/autistic traits, established psychosocial predictors, and well-being and behavioural outcomes. Previous studies have explicitly focused on one health behaviour and may not capture the full complexity of the relationships between health-related behaviours and well-being outcomes. Multivariate research is needed to explore other relevant factors and their potential interactions. Thus, this research aims to determine whether the association between health-related behaviours, ADHD/autistic traits and well-being remains significant after controlling for well-being predictors.

The specific objectives are as follows:

- To review the literature, and to explore the influence of health-related behaviours on well-being. This work is divided into two parts: an umbrella review to explore the association between diet and well-being among adolescents, and a narrative review to evaluate the association between diet and well-being in those with ADHD and autism.
- To conduct secondary analyses using a multivariate approach, and to investigate the effect of health-related behaviours on well-being after controlling for predictors of well-being among university students (two studies). The first

study examines university students before they start their university courses, and the second study investigates university students during their studies.

- To conduct primary empirical studies of university and secondary students using multivariate analyses, and to investigate the effect of health-related behaviours and ADHD/autistic traits on well-being and behaviour outcomes after controlling for well-being predictors.
- To investigate the differences between three groups of students (i.e., students with prior diagnoses of ADHD, students with prior diagnoses of autism, and students with no ADHD/autism diagnoses) in terms of well-being after controlling for health-related behaviour variables and predictors of well-being.
- To explore how ADHD traits and autistic traits influence the relationship between health-related behaviours and well-being alone and in combination among different populations.
- To explore the mechanism of factors influence well-being outcomes through a mediator variable:
  A. To investigate how life stress and life satisfaction mediate the relationship between well-being predictors and positive and negative well-being outcomes.
  B. To investigate how dietary factors mediate the relationship between ADHD/autistic traits and positive and negative well-being outcomes.
  C. To investigate how ADHD/autistic traits mediate the relationship between diet factors and positive and negative well-being outcomes.

1.4 Importance of the Research

Examining the relationship between health-related behaviours and well-being outcomes in individuals with ADHD and autistic traits is motivated by several points. Firstly, mental health issues are prevalent in people with ADHD and autism (Pan & Yeh, 2017). Moreover, adolescents and young adults with ADHD/autistic traits are more dissatisfied with their quality of life (Canha, Simoes, Matos, & Owens, 2016). At the same time, research suggests that appropriate health-related behaviours are associated with greater well-being and better educational outcomes (Li et al., 2017; Wickham et al., 2020). Therefore, it is important to improve the quality of life of this population, as it will impact their future lives.

The justification for such research stems from the need to better understand how these traits interact with health behaviours and well-being outcomes, which can help inform interventions to improve quality of life. For example, reduced physical activity and poor nutritional habits are common among individuals with these traits, particularly during the adolescent stage, such as unhealthy dietary habits, lack of exercise, and sleepiness. These behaviours might negatively impact quality of life across physical, psychological, and social aspects (Bamber et al., 2007). Individuals with ADHD and autistic traits face elevated risks of anxiety, depression, and other mental health challenges, in addition to decreased positive well-being (Canha, Simoes, Matos, & Owens, 2016).

Most studies take a univariate approach and consider a dietary variable in isolation. If the study is investigating acute effects, it also needs to address whether these will occur with repeated ingestion, other food consumption, or an altered lifestyle. A multivariate approach enables the evaluation of interactions between variables and the statistical control of confounding factors. Additionally, it is more likely to represent real-world processes.

Most previous studies have used cross-sectional approaches to investigate the association between HRBs and the well-being of people with ADHD/autistic traits. However, using a cross-sectional approach makes it difficult to infer causality, and longitudinal studies are needed to give a clearer view of causal mechanisms. Therefore, the research aims to explore how health-related behaviours, such as exercise or dietary habits, might affect mental health problems and increase well-being using multivariate analyses.

Moreover, ADHD and autistic traits often lead to maladaptive cognitions and emotional stress, which influence health behaviours like sleep hygiene or dietary habits. Conversely, poor health behaviours exacerbate emotional difficulties, the research suggests that ADHD/autistic traits influence health-related behaviours, while these behaviours also impact the severity and outcomes of these traits, which may indicate a bidirectional relationship between health-related behaviours and ADHD/autistic traits. For example, impulsivity and hyperactivity can lead to irregular sleep patterns, poor dietary choices, and reduced engagement in structured physical activities. These behaviours may exacerbate emotional problems and stress. On the other hand, autistic traits, Sensory sensitivities and rigid routines can affect eating habits (e.g., selective eating) or limit participation in physical activities due to discomfort in social or sensory environments, which may lead to depression, anxiety, and decreased well-being (Mian et al., 2019, Harris et al., 2022, Lange et al., 2023).

1.5 Structure of the Thesis

The rationale for these studies is to address the gap in existing literature regarding the relationship between health-related behaviours and well-being by investigating these relationships in a diverse student sample. While previous research has established links between lifestyle factors and mental health, few studies have examined these associations using multidimensional measures of well-being. The framework of this thesis is the Wellbeing Process Model, which predicts that established predictors (students' stressors, social support, positive coping, negative coping, psychological cap) are important for well-being assessment. In addition, much of the literature on diet is very general, and the literature between health-related behaviours and well-being for people with autistic and ADHD traits is largely absent. This led to the use of a data-driven approach to explore additional patterns in the data. The thesis leveraged many datasets and statistical tools, such as multiple linear regression, to uncover relationships within the data, with results from initial studies leading to testable hypotheses in subsequent studies. This dual focus enables the work to address existing gaps in the literature while remaining responsive to the complex, real-world relationships observed in the dataset. This approach enhanced the objectivity of the findings and allowed for the discovery of trends that extend beyond current theoretical frameworks. The research is divided into five parts. The first part involves conceptualisation and literature reviews. Chapters 1, 2, 3, and 5 detail the background, definition of the variables, theoretical framework, and objectives, and review the previous literature. The second part investigates the relationship between health-related behaviours and well-being outcomes among university students while controlling for well-being predictors. This part of the research will be presented as two secondary analysis studies in Chapter 4. The third part investigates the effect of health-related behaviours on well-being, behaviour outcomes, and academic performance among secondary school students with special educational needs, and this will be presented as the third secondary analysis study in Chapter 4. The weakness of this study is that it did not control for psychosocial well-being predictors. For this reason, the fourth part of the research explored the effects of health-related behaviours and ADHD/autism traits on well-being and behaviour outcomes among university and secondary students after controlling for well-being predictors to determine whether the effects of HRBs and ADHD/autistic traits remain significant after adjusting for well-being predictors. These studies are presented in Chapters 6 and 7. The final part of the research examined the effect of health-related behaviours and ADHD/autistic traits on well-being and behaviour outcomes among students with prior diagnoses of ADHD and autism after controlling for well-being predictors in the longitudinal design, and this is presented in Chapters 8 and 9. The following section describes each chapter in more detail.

Chapter 1 introduces the research background on health-related behaviours and well-being, particularly among adolescents and young adults, as these populations are under consideration. It summarises the importance and objectives of the research and provides an outline of the thesis structure.

Chapter 2 defines and conceptualises the factors under investigation and introduces the research's theoretical framework. Moreover, it summarises previous studies that address the relationship between health-related behaviours and well-being using a holistic approach in different populations.

Chapter 3 presents an umbrella review covering the existing literature on diet and well-being among adolescents and emerging adults, then identifies gaps in the current knowledge.

Chapter 4 summarises the three secondary analyses relevant to this thesis. The first secondary analysis investigated the effect of HRBs on well-being outcomes after adjusting for well-being predictors for university students about to start their studies. The second study was similar but used a sample of established university students. Although existing literature has established that health-related behaviour factors such as diet and exercise are linked to well-being, most research has focused on general adult populations, with limited attention to university students. Furthermore, previous studies often use unidimensional measures of well-being, potentially overlooking important facets. These studies address these gaps by examining the associations between multiple health-related behaviours and multidimensional well-being among university students. The first and second studies aim to fill this gap by finding the associations between HRB and well-being after controlling for established predictors in two different university samples. Therefore, the hypotheses are that associations between the diet factors and the well-being outcomes would be observed in the univariate analyses. It was predicted also many of these associations would no longer be significant when established predictors of well-being were included in the analyses.

The third secondary analysis examined the effect of health-related behaviours on the well-being, behavioural outcomes, and academic performance of secondary students with special educational needs.

Chapter 5 provides a conceptualisation of ADHD/autistic traits and discusses the previous literature about the relationship between health-related behaviours and the well-being of people with ADHD/autism.

Chapter 6 describes the first cross-sectional study, which used a holistic approach to investigate the relationship between health-related behaviours, ADHD/autism traits, well-being, and SDQ outcomes among university students. ADHD and autistic traits impact well-being; their specific relationships with well-being and health behaviours in non-clinical student populations remain underexplored. Existing research tends to focus on clinical diagnoses, while research on diet, ADHD, and autistic traits is sparse. To address this, a data-driven approach is warranted to uncover additional. This study aims to fill this gap by investigating how varying levels of ADHD and autistic traits relate to well-being and health-related behaviour factors in university students. Hypotheses of the study are there will be significant correlations between the frequency of health-related behaviours, ADHD traits, autism traits, well-being and behavioural outcomes. As discussed earlier, multivariate analyses are essential in this type of study. The frequency of health-related behaviours, ADHD traits, and autism traits will be significant predictors of well-being and behavioural outcomes after controlling for well-being predictors.

Chapter 7 describes the second cross-sectional study, using a holistic approach, that investigates the relationship between health-related behaviours, ADHD/autism traits, well-being, and SDQ outcomes in a different population, which is secondary school students. One of the aims of the thesis, find the associations between HRBs and well-being among different student samples. This study is similar to the previous study, while the main differences are that the students in this study are from secondary schools, and the established predictors are combined into one factor. Hypotheses of the study are the usual profile of associations will be observed for the WPQ variables, with the combined predictors variable showing the strongest associations. The WPQ predictors will show weaker associations with the SDQ outcomes. Univariate analyses will show significant associations between health-related behaviours and outcomes. These critical effects will significantly reduce in multi-variate analyses, covarying the established predictors. Univariate analyses will show significant associations between ADHD/autistic traits and outcomes. These significant effects will be significantly reduced in multivariate analyses covarying the established predictors.

Chapter 8 Most prior research on health behaviours and well-being is cross-sectional, limiting the ability to infer temporal relationships. There is a need for longitudinal evidence to determine whether health behaviours and ADHD/autistic traits measured at one point can predict well-being outcomes at a later time. This study employs a longitudinal design to investigate the effect of health-related behaviours, ADHD, and autism traits on well-being and SDQ outcomes among students with prior diagnoses of ADHD and autism. The study hypothesises that there will be fewer significant associations between the established predictors and the SDQ outcomes. Associations between the ADHD/autism traits, HRB scores, and well-being outcomes will essentially become non-significant when the established well-being predictors are included in the analyses. Associations between the ADHD/AQ variables and the SDQ outcomes will be more robust and remain significant even when the established predictors are included in the analyses.

Chapter 9 continues the analysis of data from the longitudinal study. It explores (1) the associations between predictors at Time 1 and outcomes at Time 2, (2) interaction relationships between ADHD/autism traits and diet variables on well-being and SDQ outcomes, and (3) the mediation processes linking the key variables.

Chapter 10 include general discussions, limitations, recommendations and implication of the research.

Chapter 2: Conceptualisation and Theoretical Framework

2.1 Introduction

Health behaviours can be impacted physically and psychologically. Recently, the understanding of health behaviours has received significant attention from researchers, especially with the development of chronic diseases among young people (Spring, Moller, & Coons, 2012; Watson, 2022). Studies have proven that the practice of health-related behaviours can reduce the risks of these diseases and increase individuals' well-being (Solley & Lyttle, 2012; Watson, 2022). Adolescents often behave in a manner that poses a risk to their health and well-being, such as overeating sugar and sitting for long periods in front of the TV or computer, which may contribute to a lack of exercise. The increased belief in the underlying relationship between behaviour and mental health has led to significant shifts in the last three decades in understanding health and its promotion and the possibility of influencing individuals' behaviour (Raude et al., 2019). This chapter provides an introductory exploration of theories and definitions to support a better understanding of the topic under investigation. It will also summarise the studies conducted on health-related behaviours in different contexts and discuss key health behaviours such as diet, exercise, sleep, and well-being.

2.2 Health-Related Behaviours

2.2.1 Concept of Health-Related Behaviours

Health-related behaviour is the actions a person needs to undertake to improve their physical and mental health or reduce disease progression (Conner & Norman, 2005). It is defined as “any activity undertaken by a person believing himself to be healthy for preventing disease or detecting it at an asymptomatic stage” (Kasl & Cobb, 1966:246, cited in Conner & Norman, 2005). However, Gochman (2013) defined Health-related behaviours as the conscious perception and structured experiences that positively reflect the individual’s physical and psychological health practices to maintain an appropriate health level and preserve the environment.

2.2.2. Dimensions of Health Behaviours

Health behaviour is divided into positive health-promoting behavioural and negative health-promoting behavioural patterns that harm health. Health-promoting behavioural patterns include exercising and healthy food consumption habits such as drinking water and eating fruit and vegetables (Andrew Smith & James, 2023; AP Smith & Kendrick, 1992). Such behaviours protect the individual from disease and promote health and well-being (Andrew Smith & James, 2023). Conversely, a person might be at risk of different problems due to the practice of unhealthy habits such as smoking (Almobayed & Smith, 2023c; M. Conner, McEachan, Taylor, O'Hara, & Lawton, 2015), consuming energy drinks, and unhealthy food (A. P. Smith & Richards, 2018). For example, one study examined the effect of smoking on susceptibility to the common cold and found that smokers are more susceptible to both infection and transmission of the disease than non-smokers (Cohen et al., 1993).

2.2.3 Health-Related Behaviours and Adolescence

Many previous studies have focused on health-related behaviours in adolescents and adults because adolescence is an essential period for practising healthy behaviours (Mollborn et al., 2014). There are studies have confirmed that the effects of health-related behaviours such as sleep, smoking, and diet in adolescence can extend into adulthood (Burdette et al., 2017; Lawrence et al., 2017). As reported by Frech (2012) and Ashraf & Najam (2017), adolescence is a developmental period described as being a stressful period of change, with these changes explaining the increased risk of mental health problems. Richards (2016) further confirms that the consumption of an unhealthy diet was associated with low general health among university students, while high caffeine consumption is associated with mental health problems among secondary students. Conversely, a study by Smith and Smith (2011) examined the relationship between breakfast and mood in children and adolescents and found that breakfast consumption was positively associated with positive mood. However, it has been reported that having a preference for junk food such as takeaway meals, chocolate, salty snacks, sweets, and fizzy drinks can improve mood, which can lead to a persistent need for these types of meals (Hayward et al., 2016; Oddy et al., 2009; Samuelson, 2017). This mechanism might explain why adolescents choose junk food over fruits, vegetables, and homemade meals (Bamber et al., 2007; Samuelson, 2017; Sinclair et al., 2016). At the same time, it has been found that adolescents who consume refined food and have a poor-quality diet are more likely to experience an increase in depressive symptoms (Bamber et al., 2007). Thus, the present research examines diet and well-being, and the next section discusses the definition of well-being and its theoretical concepts.

2.3 Well-being

2.3.1 Concept of Well-being

Well-being is a multifaceted and complex construct conceptualised differently across various disciplines. Therefore, there is currently no consensus on a specific definition of the concept (Anderson, Jané-Llopis, & Cooper, 2011). However, there is agreement that it must cover the presence of positive effects and absence of negative affects, as well as life satisfaction and positive functioning (Frey & Stutzer, 2010). For example, well-being has been described as the state of absence of illness and disease (Speight, McMillan, Barrington, & Victor, 2007). This definition focuses on the physical and biological aspects of health and illness. Even though the absence of disease is a critical aspect of well-being, it cannot accurately represent the complexity and multidimensionality of human health and functioning (McDowell, 2010). Thus, Ryan and Deci (2001) described well-being as happiness and quality of life. Another definition states that subjective well-being is the cognitive and affective evaluation of a person's life (Diener et al., 2002). Moreover, as mentioned earlier, the World Health Organization (WHO) defines health as a state that contains social, physical, psychological, and emotional well-being rather than only the absence of illness (WHO, 2024). The phrase emphasises that health encompasses more than the absence of diseases; it represents a positive state, prevention of diseases, and health promotion. Therefore, the absence of disease and positive elements and functioning must be combined to understand well-being comprehensively (Ryan & Deci, 2001).

2.3.2 Theories of Well-being

In recent decades, well-being theories have grown in depth and breadth (Diener & Ryan, 2009), and the concept has been related to psychological, social, and physical factors that lead to thriving physical and mental health (Keyes & Annas, 2009). In the following subsections, various theories and models of well-being are explored in more detail.

2.3.2.1 Hedonic Well-being

The hedonic approach to well-being marks the first psychological interest in this concept (Bradburn, 1969). The most widely used model of hedonic well-being is Diener's (1984) three-part model, in which life satisfaction is combined with the balance between positive and negative affect to produce well-being. With this approach, hedonic theory has gained broad acceptance in recent years. According to hedonic theory, a person has a default, genotypically fixed level of happiness that is only thrown out of balance when extraordinary events, good or bad occur. Nonetheless, a person adapts quickly and is only temporarily affected by such events (Brickman, Campbell, & Appley, 1971). Under this model, Well-being would be described as happiness. According to this view, if a person maximises pleasing experiences and minimises distress, they can achieve the highest levels of well-being. (Vanhoutte & Nazroo, 2014).

2.3.2.2 Eudaimonic Well-being

Eudaimonic well-being focuses on the component of cognitive thought. It centres on the realisation of human potential as it defines well-being as employing one's abilities through the process of self-actualisation (Ryan & Deci, 2001). However, it points out that well-being is different from pleasure and happiness. Therefore, this approach is concerned with the activities of individuals and the challenges associated with developing and realising individual capabilities by important values and self-rootedness. The level of individual well-being can be derived through six main dimensions (i.e., autonomy, environmental coping, positive relationships with others, life purpose, personal growth, and self-acceptance). Each of these dimensions reflects the individual's challenges in growth and development. Ryff and Keyes (1995) used these six aspects of actualisation to measure psychological well-being. Hedonic and eudaimonic well-being could be contrasted on some level: the former focuses on the emotional component of well-being, while the latter addresses cognitive and affective aspects (Diener, 1984).

The concept of well-being can be seen from various perspectives due to its complexity and multidimensional nature. While hedonic approaches focus on happiness and positive feelings, eudaimonic approaches involve more than mere pleasure; they argue for the need for self-actualisation and cognitive functioning by one's potential

(Ryan & Deci, 2001). However, Frey and Stutzer (2010) emphasise including physical well-being in the definition, such as feeling stable, performing well, and feeling healthy and full of energy. A comprehensive understanding could require combining the two perspectives, which involve factors influencing well-being. Nevertheless, empirical research found substantial correlations (approximately r = 0.80) between hedonic and eudaimonic well-being, which can be considered complementary theories (Gallagher et al., 2009; Keyes et al., 2002). Accordingly, research continues to refine the conceptualisation and the measurement of well-being. The following sections will discuss the Demands–Resources–Individual Effects model (Mark-Margrove & Smith, 2008), and the well-being process model (G. M. Williams, H. Pendlebury, K. Thomas, & A. Smith, 2017), a comprehensive framework for studying and measuring well-being that integrates the various factors to create a holistic approach.

2.3.3 Demands–Resources–Individual Effects (DRIVE) Model

The DRIVE model was developed by Mark-Margrove and Smith (2008). It is a comprehensive framework for understanding the complex relationship between work characteristics, individual differences, and well-being outcomes. It was initially used to measure occupational stress and predict adverse health outcomes and job satisfaction. The model integrates critical features of earlier stress models (G. M. Williams & A. P. Smith, 2018), which are transactional stress models and interaction stress models. Transactional stress models include coping behaviours (Lazarus & Folkman, 1984). Moreover, it emphasises cognitive approaches. Hence, factors such as coping, personality, and attributions play a role in the perception of stress. Conversely, interaction stress models such as the Demands–Control–Support (DCS) (Karasek, 1979) model and the Effort–Reward Imbalance (ERI) model (Siegrist, 1996) Focus on environmental factors.

The DRIVE model proposes that work demands, work resources, and individual differences directly influence health outcomes and job satisfaction. Work demands refer to the job's physical, psychological, social, or organisational factors that require continuous effort or skills (Xanthopoulou et al., 2007), such as workload, time pressure, and emotional demands. Work resources are the aspects of the job that help achieve work goals, reduce demands, or stimulate personal growth, such as job control, social support, and rewards. In addition, greater emphasis is placed on individual factors and resources, such as personal characteristics and coping strategies. Personal characteristics can influence how individuals perceive and respond to work demands and resources. In addition, the model suggests that these individual differences can directly impact well-being outcomes and moderate the relationships between work demands, resources, and outcomes. It also suggests that work resources and individual differences can buffer the negative impact of work demands on health outcomes (see Figure 2.1). Additionally, it is suggested that individual variations (in the form of expectations and resources) can significantly impact health outcomes and how stressful work is viewed. They can alter the association between perceived stress and outcomes and the relationship between environmental factors and perceived stress (Mark-Margrove & Smith, 2022).

The model has been utilised in many occupational populations, such as university staff (Andrew P Smith & Smith, 2019; GM Williams & Smith, 2016; Gary Williams, Thomas, & Smith, 2017), train staff (J. Fan & A. P. Smith, 2017), healthcare providers (G. Mark & Smith, 2012; GM Williams, Pendlebury, & Smith, 2017; Zurlo, Vallone, & Smith, 2018), individuals from various countries (Alheneidi, 2019; Capasso, Zurlo, & Smith, 2018; Nelson, 2017), and educational environments such as university students (Alharbi & Smith, 2019; Alheneidi, 2019; Omosehin, 2021; Andrew P Smith & Firman, 2019; Andrew P Smith & Firman, 2020), and secondary school students (Andrew Smith, Garcha, & James, 2023; Andrew Smith & James, 2023) it is showing its enormous applicability. The findings of studies employing the DRIVE model have consistently confirmed the direct impact of work demands, resources, and individual characteristics on different well-being outcomes (Alheneidi, 2019; J. Fan & A. P. Smith, 2017; Nelson, 2017; Andrew P Smith & Firman, 2020; Andrew P Smith & Smith, 2019; GM Williams et al., 2017; GM Williams & Smith, 2016; Gary Williams et al., 2017). Nevertheless, there is insufficient evidence to support the predicted interaction effects.

According to Mark and Smith (2008), the original intent of the DRIVE model was to provide a theoretical framework that would allow for the inclusion of any relevant variables in the study rather than to function as a predictive model. Thus, adaptability and flexibility were among its most outstanding features. Moreover, the DRIVE framework emphasised the relationships between variables rather than the mechanisms or reasons behind them. It did not make assumptions about an individual's internal mental or psychological processes (Mark-Margrove & Smith, 2022; G. M. Mark & Smith, 2008; Omosehin, 2021).

The model functions as a comprehensive framework that enables researchers to integrate variables specific to their research questions and pertinent to the study. This has resulted in a more developed well-being process model incorporating a broader range of well-being outcomes, including positive measures such as happiness, positive affect, and job satisfaction (Gary Williams et al., 2017). In addition, William and Smith (2016) developed the Well-being Process Questionnaire (WPQ). This short questionnaire measures the model's key components using single items to facilitate the practical application of the DRIVE model. The WPQ has been validated and shown to replicate the associations between established predictors and well-being outcomes. It is a valuable tool for assessing the well-being process in various settings. The following subsection will describe and review the well-being process model and questionnaire.

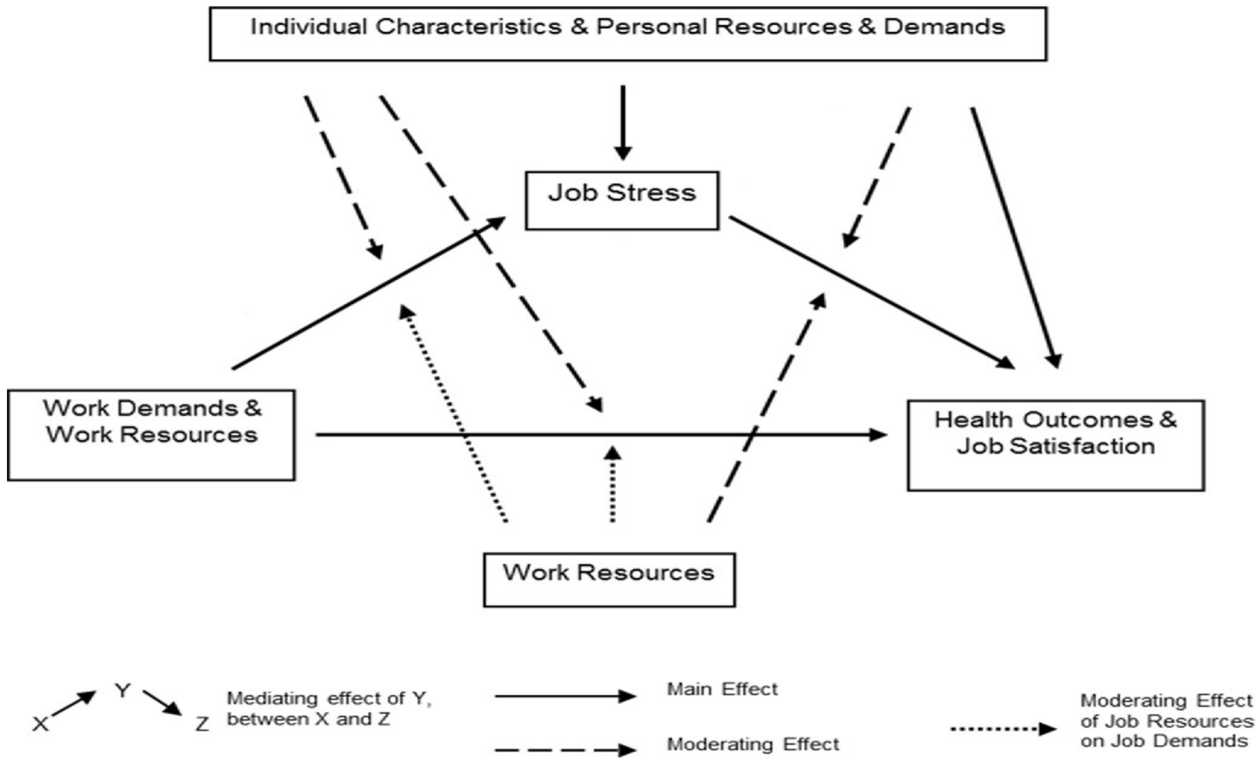

Figure 2.1 Demands–Resources–Individual Effects Model (Derived from Mark and Smith, 2008).

2.3.4 Well-being Process Model

Williams and Smith developed the well-being process approach based on DRIVE model (Gary Williams et al., 2017; G. et al. Smith, 2017; G. et al., 2012). The DRIVE model, originally designed to assess occupational stress and its impact on health outcomes (i.e., anxiety and depression) and job satisfaction. It has been modified to measure the factors that influence positive and negative well-being. The adjustments and additions made to the DRIVE model have successfully transformed it from a stress model, which initially focused on predicting anxiety and depression, into a holistic framework that comprehensively measures well-being, encompassing both positive and negative aspects. The model offers a comprehensive framework for evaluating well-being in educational and professional environments. It is an extension of the DRIVE paradigm, which suggests that job demands, resources, and individual differences influence well-being outcomes. It distinguishes between positive well-being outcomes (e.g., happiness, positive affect, job satisfaction) and negative well-being outcomes (e.g., stress, anxiety, depression) (A. Smith, 2023a). Rather than considering them as opposite ends of a single continuum, positive and negative well-being are considered different dimensions. According to Diener (1984), the absence of negative impacts does not necessarily suggest the presence of positive well-being, and vice versa. The development of the Well-being Process Questionnaire by William and Smith (Gary Williams et al., 2017) provides an instrument that implements the model by employing single items to evaluate several dimensions (e.g., personality, negative and positive coping, social support, and stressors), and positive and negative well-being as outcomes (Omosehin & Smith, 2019). This instrument has been applied in recent studies (GM Williams et al., 2017; GM Williams & Smith, 2016; Gary Williams et al., 2017) to examine factors contributing to positive well-being, such as happiness, positive affect, and flourishing. As the DRIVE model allows the inclusion of variables related to the well-being outcomes and relevant to the study topics, additional predictor variables were included in different research, such as workload (Andrew Smith, 2019), work-life balance (J. Fan & A. Smith, 2017), daytime sleepiness (Howells & Smith, 2019), flow, and rumination (Zhang & Smith, 2021). The results showed replicated associations between well-being outcomes and established predictors by covering several components such as job characteristics, personality, coping styles, and positive and negative outcomes. In addition, the research that applied the WPQ found that positive personality traits (such as self-efficacy and optimism) and positive job characteristics (such as control and support) predict positive outcomes. In contrast, job demands and negative coping predict negative outcomes (Omosehin & Smith, 2019). In addition, positive appraisals (e.g., job satisfaction) mediate the effects of job resources on positive outcomes, while negative appraisals (e.g., perceived stress) mediate the effects of job demands on negative outcomes. The concept has been used across different occupational populations, including university staff (Andrew P Smith & Smith, 2019; Gary Williams et al., 2017), nurses (GM Williams et al., 2017), train staff (J. Fan & A. Smith, 2017), and police officers (Nelson, 2017). As a result, additional questionnaires, such as the Smith Well-being Questionnaire (SWELL) (Andrew Smith, 2020b), were created, which contained a more comprehensive range of relevant occupational factors.

In addition, the Well-being Process Questionnaire has been modified for university students to develop the Student Well-being Process Questionnaire (Student WPQ) (A. P. Smith, 2023; G. M. Williams et al., 2017). The Student WPQ evaluates essential elements of the model and contains six dimensions which are stressors that students face is assessed using single items based on the Inventory of College Students' Recent Life Experiences (ICSRLE), resources such as social support were based on items from the Interpersonal Support Evaluation List (ISEL), individual factors such as positive personality were derived from 'self-efficacy + self-esteem + optimism', positive coping style was derived from 'seeks social support + problem-solving', and negative coping was derived from 'avoidance + wishful thinking + blame self' and 'conscientiousness', in addition to positive and negative outcomes associated with well-being (A. P. Smith, 2023; G. M. Williams et al., 2017). The questionnaire uses single-item measures to assess multiple constructs related to well-being, allowing for a multidimensional approach while keeping the survey brief. This makes it possible to measure well-being as a holistic questionnaire without burdening the participants. Research using the Student WPQ (Alheneidi, 2019; Howells & Smith, 2019; Andrew P Smith & Firman, 2019; Andrew P Smith & Firman, 2020; G. Williams & A. Smith, 2018; G. M. Williams et al., 2017). It has consistently been found that a positive personality, social support, low stressors, and low negative coping predict positive well-being. High stressors, negative coping, low positive personality, and weak social support indicate negative outcomes. (A. P. Smith, 2023).

2.3.4.1 Established Predictors of WPQ

The student WPQ/SWELL shows replicable effects when administered. The established predictors for such tools include student stressors, social support, positive personality traits, negative coping, and positive coping strategies, with outcome variables that have been measured as happiness, life satisfaction, positive affect, negative affect, stress, depression, anxiety, and cognitive problems (G. et al., 2018; G. et al. et al., 2017). Other measuring instruments focus on well-being outcomes without considering established predictors (Andrew Smith, 2020a). Therefore, the results usually replicate the effects of positive and negative predictors, with positive well-being being typically associated with positive predictors such as positive coping and psychological capital (A. P. Smith, 2023). At the same time, poor well-being was typically associated with negative predictors. The original study by Williams, Pendlebury, Thomas, and Smith (2017) found that negative outcomes were associated with increased levels of student stressors, negative coping strategies, decreased levels of social support, and positive personality traits. Conversely, positive outcomes have been related to increase levels of social support, positive personality traits, and positive coping strategies while also being associated with decreased degrees of negative coping strategies and student stressors. Moreover, the observed impacts persisted even after accounting for other predictors. For example, the impact of aircraft noise on well-being became insignificant when the established predictors were considered (Smith, 2017). Alheneidi and Smith (2020b) also found similar results, showing that internet addiction did not significantly impact negative and positive well-being. However, the authors observed established predictor effects on well-being outcomes, and these effects were consistent across the countries studied (Alheneidi & Smith, 2020a, 2020b, 2020c). In general, such research has demonstrated that the established effects are consistently detected whenever the student WPQ/SWELL is administered, and these effects persist even when additional variables are introduced (Omosehin, 2021).

2.3.4.2 Health-Related Behaviours and Holistic Well-being

Using a comprehensive approach, three studies have examined the relationship between health-related behaviours and well-being outcomes in different populations, such as nurses, university workers, and secondary students. The first study was conducted by Smith (2023b) with a sample size of 170 nurses. The study used the

Well-being Process Questionnaire to assess well-being, in addition to questions regarding diet, smoking, alcohol usage, exercise, and sleep. The WPQ is derived from the DRIVE model, which evaluates positive and negative dimensions of well-being. The univariate analyses showed significant associations between good health behaviours and positive outcomes related to well-being. For example, the results showed that positive well-being was correlated with avoiding smoking, having a longer sleep duration, consuming fruit and breakfast more frequently, having a greater tea intake, and consuming less chocolate and cola. In contrast, low well-being was linked to a contrasting HRB pattern. Nevertheless, once established predictors of well-being, such as personality traits and social support, were added to the multivariate regression analysis, most of the correlations between health-related behaviours and well-being outcomes lost statistical significance. Regular fruit and breakfast consumption were the only factors consistently associated with positive well-being. However, short sleep duration significantly predicted negative well-being (A. Smith, 2023b).

The second study examined the relationship between health-related behaviours and well-being using a holistic approach but with a university staff population. One hundred twenty individuals from various sectors of Cardiff University participated in the study. The univariate analysis results revealed that there was a negative association between positive well-being and alcohol consumption and sleep problems. Moreover, negative well-being was positively associated with sleep problems and negatively correlated with coffee and fruit consumption among the university staff. (A. P. Smith, 2023). When the established predictors were controlled, most associations observed between health-related behaviours and well-being were no longer significant except for fruit and vegetable consumption and positive well-being, while sleep problems increased negative well-being. However, the established predictors that remained significant in the multivariate analyses were high psychological capital and social support, which are good predictors of positive well-being. In contrast, negative well-being was predicted by high job demands and negative coping. (A. Smith, 2023a).

The third study was conducted among secondary school students. This study investigated the relationships between dietary variables, other health-related behaviours such as exercise and sleepiness, and well-being outcomes in a sample of 155 secondary school students from South Wales. Through an online survey, participants were asked about their well-being via the WPQ. In addition, a short Diet and Behaviour Scale (DABS) was used to evaluate dietary variables and other HRBs. The outcomes were consistent with the results obtained by previous studies in univariate analyses, and there were significant correlations between HRBs and well-being and outcomes. In particular, there was a correlation between positive well-being and increased consumption of fruits and vegetables, increased physical activity, and decreased sleepiness. Contrastingly, a negative association was found between low well-being and daytime sleepiness, as well as the opposite patterns of food and exercise. When well-being predictors such as student stress, psychological capital, and coping strategies were included in the multivariate regression analysis, many of the relationships that had previously existed between HRBs and well-being outcomes were no longer significant. The exceptions were the consumption of fruit and vegetables, which continued to be significantly related to positive well-being, and the consumption of fast food and takeaways, which was inversely connected with positive well-being and flourishing (Andrew Smith & James, 2023).

Most of these studies that used the WPQ involved samples of workers such as nurses or university students. However, the results need to be replicated with other populations, such as students with ADHD/autistic traits.

2.4 Conclusion

Appropriate health-related behaviours help people achieve optimal emotional and physical well-being. Moreover, higher levels of subjective well-being are associated with increased creativity, decreased susceptibility to illness, increased self-confidence, and positive affect. In the current chapter, the concept of health-related behaviours was discussed, and the concept of well-being, its theories, and its determinants were introduced. As discussed previously, this thesis primarily focuses on diet, and the following chapter provides information about existing literature on the association between diet and well-being among adolescents and young adults using an umbrella review approach.

Chapter 3: Umbrella Review for Health-Related Behaviours and Well-being

3.1 Introduction

Numerous studies have explained the associations between health-related behaviours, especially diet, and mental health outcomes in the adolescent population, but it is still not fully understood. This chapter provides an umbrella review of the topic.

3.2 Overview of the Umbrella Review

This umbrella review was conducted because there are a large number of literature reviews related to the association between dietary patterns and well-being in adolescents and young adults. Poole et al. (2017) describe umbrella reviews as meticulously exploring, arranging, and assessing the available evidence from various systematic reviews and meta-analyses. Associations were examined between dietary variables existing in current research, such as breakfast consumption, fruits and vegetables, junk snacks, junk meals, energy drinks, cola, coffee, and tea, and well-being outcomes based on the WPQ model. These included positive well-being, negative well-being, anxiety, and depression. This umbrella review investigated the association between dietary consumption and well-being in adolescence and early adulthood.

3.3 Literature Search

The search engines PsycINFO, Medline, Web of Science, and Scopus were used to search for articles published between 2010 and 2023. The reference lists of relevant papers and reviews were searched as well. A scoping search strategy was conducted to identify appropriate and database-specific keywords to obtain relevant articles. The final search strategy consisted of paired keywords for diet (diet* OR "healthy food*" OR "unhealthy food*" OR "junk food*" OR "junk snack*" OR "processed meat" OR cola OR soda OR "soft drink*" OR beverage* OR "energy drink*" OR coffee OR tea OR caffeine OR "fruit* and vegetable*") AND well-being ("well-being" OR wellbeing OR stress OR health OR anxiety OR depression) AND adolescence (adolescent* OR adolescence* OR "university student*" or "young adult*" or "early adulthood") AND “systematic review”. English language and publication date filters (2010 to 2023) were used in all databases. The article type filter was used in Scopus to include article documents.

3.4 Inclusion and Exclusion Criteria

The review included observational studies (cohort, case-control, cross-sectional) investigating this association. Systematic reviews included both observational and intervention studies, with the observational studies analysed separately. The review excluded studies focusing on children and adolescents with chronic diseases, adults, individual nutrients or supplements, eating disorders, emotional eating, letters, comments, narrative reviews, animal studies, duplicate studies, randomised controlled trials, and intervention studies. The review aimed to assess the relationship between diet quality or dietary patterns and well-being outcomes rather than examining dietary intervention effects. It focused on studies involving adolescents, excluding those with adult participants or published in languages other than English.

3.5 Procedure

The final search of the four databases and other resources yielded 1152 potentially relevant papers. A manual duplicate check of the combined citations resulted in 180 removed duplicates, leaving 972 available for screening. The screening process consisted of reviewing titles and abstracts, resulting in the exclusion of 870 papers. The final step was a full-text review of 102 articles, which resulted in 8 articles that met the inclusion criteria (see Figure 1). The articles included that systematic reviews (n=5), systematic reviews and meta-analysis articles (n=3).

3.6 Data Extraction

The first author, publication year, population, and outcome examined were extracted. Then, the diet type, total participant number, number of total studies, and study design (cohort, case-control, cross-sectional) were obtained. Furthermore, effect sizes and 95% confidence intervals (CIs) were extracted when possible, and the type of effect model and publication. Any differences in the extracted data were reported by discussion.

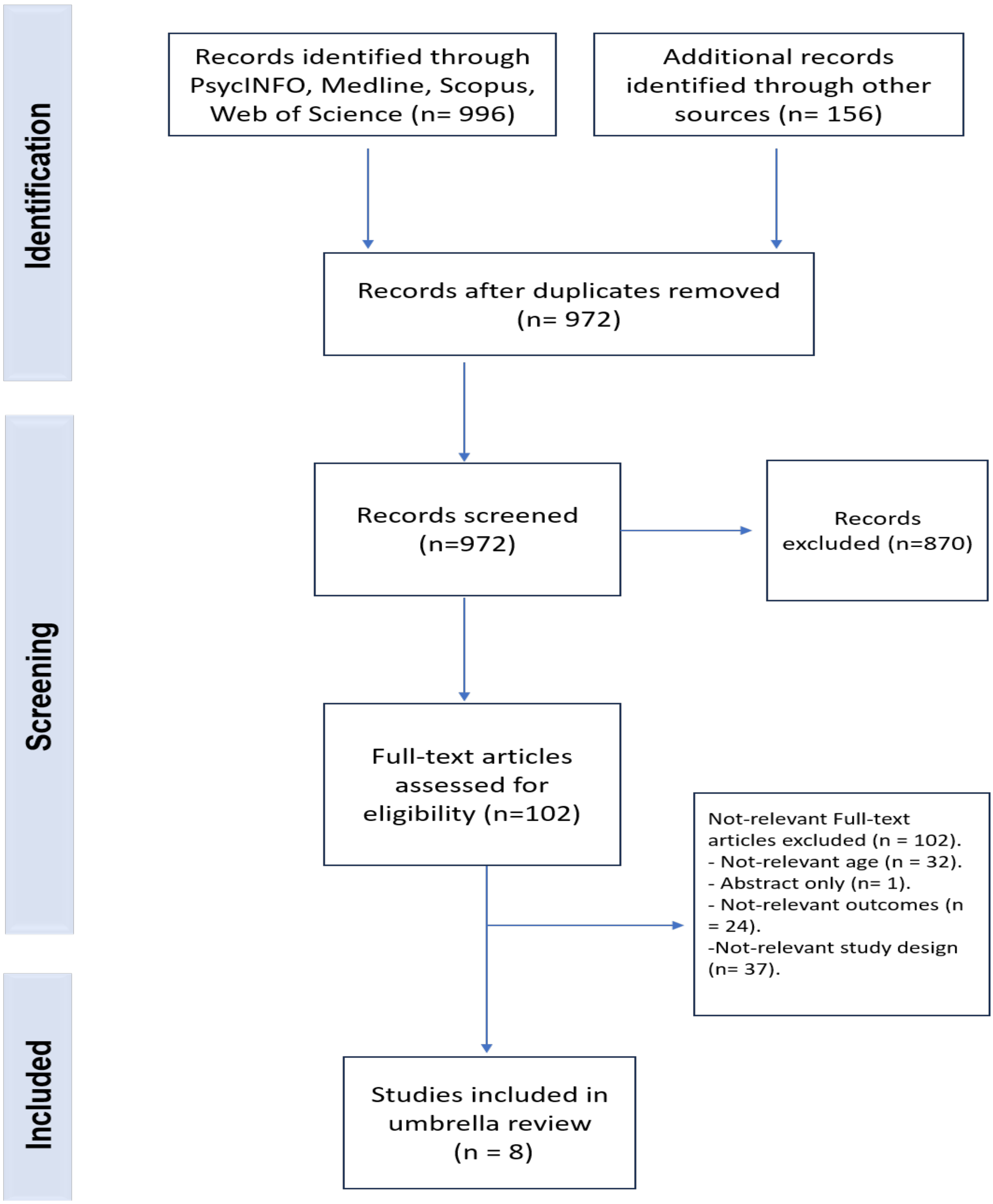

Figure 3.1 Flowchart of procedure for selecting studies to be included in the umbrella review[1]

[1] The flowchart design was from (Page et al., 2021)

3.7 Results

The details of the reviews are shown in Tables (3.1 and 3.2) and summarised below.

3.7.1 Diet

A systematic review was conducted by O'neil et al. (2014) that explored the relationship between diet quality, food consumption, and mental health in children and adolescents. The review includes nine studies that examine the association between diet and mental health in this population. The studies included in the review used different instruments to measure mental health outcomes, such as the Child Behaviour Checklist, the Strengths and Difficulties Questionnaire, and the Short Mood and Feelings Questionnaire. These instruments assessed symptoms of depression, low mood, and anxiety. Although the results showed that there were consistent results of the association between unhealthy patterns and poor mental health, there were conflicting findings regarding the specific associations between healthy food and better mental health. They found that only three out of the six studies were significant. There was also some evidence of a consistent trend between a good-quality diet and better mental health. However, the findings were inconsistent with lower diet quality and poor mental health. The studies also varied, including confounding variables such as socioeconomic status and physical activity. Interestingly, the systematic review confirmed that the associations between nutritional factors and mental health are likely to be bidirectional – while dietary factors may influence mental health, while mental health may also affect diet and nutrition.

A systematic review found that a healthy diet is associated with lower levels of depression in children and adolescents, while an unhealthy diet is linked to higher levels of depression. Seventeen studies were included in the systematic review conducted by Wu et al. (2019), consisting of twelve cross-sectional and five longitudinal studies. The total sample size of these articles was 47,932. The review aimed to investigate the relationships between diet quality, such as healthy food, unhealthy food, and breakfast habits, and health-related quality of life in children and adolescents. It was discovered that children's and teenagers' health-related quality of life correlated with diet quality and dietary habits. It has been shown that eating a nutritious diet is associated with improved physical, emotional, and psychosocial aspects of life quality. The effect size of the meta-analysis to identify the relationship

between diet quality and health-related quality of life was measured using mean differences and odds ratios. The results showed that children and adolescents with healthy diets had significantly higher total health-related quality of life scores (mean difference = 3.45) and higher physical and psychosocial health summary scores (mean difference
= 2.77 and 3.12, respectively) than those with unhealthy diets. The odds of having a poor health-related quality of life were higher for those who ate breakfast "sometimes" (OR = 1.33) or "never" (OR = 1.56) compared to those who ate breakfast "every day". These effect sizes indicate that a healthy diet led to better health-related quality of life outcomes. However, it is essential to note that the review focused on the general population of children and adolescents and not specific diseases or conditions.

A systematic review was conducted to determine the relationship between diet and depression among adolescents. The review included 20 studies after screening 3014 articles. Only articles in English published from 1970 to April 2016 were considered. The selected articles involved healthy foods like fruits and vegetables, whole grains, fish, dairy, and cereal. Unhealthy foods such as fast or takeaway foods, sweetened beverages, snacks, and high-fat processed foods such as hamburgers, pizza, meat pies, pastries, fried food, chips, and soft drinks were also included. The results showed that there was no association between fruit and vegetable consumption and mood in the majority of the studies. However, a correlation was observed between healthy food consumption in general and a reduction in depression. Notably, the effect size was small in most of the studies, and one study specifically identified this link among females alone. In addition, no significant associations were found between a healthy diet and anxiety. In contrast, the relationship between unhealthy diets and increased depression and anxiety was significant in most of the cross-sectional studies. While no long-term association was observed in the longitudinal study, unhealthy diets did not predict increased depression three years later. Seven studies examined the relationship between fast food and mental health, with only four reporting a significant correlation. However, the effect sizes of these relationships were small—a longitudinal study aimed to identify a correlation between fast food and emotional problems. The results revealed that fast food did not predict emotional problems seven years later. Moreover, two research studies have demonstrated that eating breakfast was associated with decreased depression. In addition, the association between beverages and depression was investigated, and three studies found that high consumption of soft drinks was associated with increased depression with a small effect size. Similar results were found between caffeine and depression (Khalid et al., 2016).

Another systematic review examined the associations between diet quality and mental disorders, including depression and anxiety, in young adults aged 18–29 years. The findings suggested that emerging adulthood is critical for diet quality and mental health. The review included quantitative articles published between 2009 and 2019, with 16 studies meeting the inclusion criteria. The studies used various methods to assess diet quality, such as food frequency questionnaires, 24-hour recalls, and diet quality indices. Mental health outcomes were measured using scales for depression, anxiety, and general psychological health. The findings of this systematic review were associations between higher diet quality and lower levels of depression, anxiety, stress, negative affect, and suicidal ideation, as well as better psychological health. Although the results were inconsistent, some studies did not find an association between unhealthy diets, depression, stress, and anxiety. What was of interest to the current review is that there was an association between sweets and increased positive effects. However, they noted that the methodological quality of the included studies was generally weak (Collins, Dash, Allender, Jacka, & Hoare, 2022).

Moreover, a systematic review by Solomou, Logue, Reilly, and Perez-Algorta (2023) examined the associations between diet quality and mental health outcomes among university students. The authors systematically searched four databases (PubMed, Scopus, PsycINFO, and CINAHL) for articles published up to December 2020. The quality of the included studies was assessed using the Newcastle–Ottawa Scale (NOS) for observational studies. A total of 44 studies met the inclusion criteria and were included in the review. Moreover, the studies were conducted in various countries, mainly from the United States, Australia, and Europe. Most studies used a cross-sectional design, with only a few longitudinal studies. Diet quality was assessed using various methods, including the Healthy Eating Index (HEI), the Mediterranean Diet Score (MDS), and factor-analysis-derived dietary patterns. Mental health outcomes were measured using validated questionnaires such as the Depression Anxiety Stress Scale (DASS), the Centre for Epidemiologic Studies Depression Scale (CES-D), and the Short Form-36 (SF-36). Most included studies found significant associations between higher diet quality and better mental health outcomes in university students. Students who adhered to healthier dietary patterns, characterised by higher intakes of fruits, vegetables, whole grains, and fish, tended to have lower levels of depression, anxiety, and stress, as well as better well-being and quality of life. Conversely, unhealthy dietary patterns, high in processed foods, sugar, and saturated fats, were associated with poorer mental health outcomes. However, some studies found no association between diet quality and mental health and well-being (Solomou et al., 2023).

3.7.2 Healthy Food

In order to investigate the relationship between mental health and fruit and vegetable consumption among adolescents, a systematic review of observational studies was conducted by (Głąbska, Guzek, Groele, & Gutkowska, 2020). The systematic review included 17 studies covering 181,000 adolescents. The databases used to collect the article were PubMed and Web of Science, as well as reference lists. The results showed that most studies included in the review found an association between fruit and vegetable consumption and improved mental health among adolescents (Głąbska et al., 2020). However, a study conducted among adolescents in sub-Saharan Africa showed that high fruit and vegetable consumption was associated with a high risk of depression, anxiety, and loneliness (Arat, 2017; Głąbska et al., 2020).

3.7.3 Junk Food

Malmir et al. (2023) used a systematic review method to investigate a broader range of junk food items among adolescents. The purpose of the systematic review and meta-analysis was to examine the relationship between junk food consumption and negative well-being outcomes such as depression, stress, anxiety, sleep dissatisfaction, and happiness in young people. The review included 17 studies involving more than 200,000 people. The findings revealed that junk food consumption, including sweet drinks, snacks, and junk food, was associated with an increased risk of depression and stress. The odds ratio for depression was 1.62 (95% CI = 1.35–1.95), and for stress was 1.34 (95% CI = 1.16–1.54). A similar relationship was discovered between junk food and anxiety and sleep dissatisfaction (odds ratio: 1.24; 95% CI = 1.03–1.50 for anxiety and 1.17; 95% CI = 1.05–1.30 for sleep dissatisfaction). Moreover, a negative relationship was discovered between junk food and happiness (odds ratio: 0.83; 95 per cent CI: 0.75-0.92) (Malmir et al., 2023).

Moreover, to assess the association between junk food and mental health problems, Hafizurrachman and Hartono (2021) performed meta-analyses. They searched for relevant articles published between 2010 and 2020 in the PubMed and ScienceDirect databases. The inclusion criteria for selecting articles were the availability of full-text original articles and the use of keywords related to junk food and mental health. Seven of the 5,079 article that were met relevant requirements of the inclusion criteria. The correlation coefficient of meta-analyses between junk food consumption and mental health problems was 0.11 (95% CI = 0.09–0.14). It was noted that all seven research studies that were included in the systematic review consistently revealed an association between junk food and mental health. However, as shown in the results of the previous systematic review, the effect size was small.

Table 3.1 Key features of eligible systematic reviews and meta-analyses included in the study.

No.	Author, year	The type of the review	Study design	Samples	Number of studies (Number of participants)	Country of study	Effect size
1	O'neil et al. (2014)	Systematic review	Cross-sectional, and longitudinal studies	Children and adolescents	Nine studies (Approx. 35,000)	Australia (n=4) United States (n=1) United Kingdom (n=1) Canada (n=1) China (n=1) Germany (n=1)	N/A
2	Khalid et al. (2016)	Systematic review	17 cross-sectional studies 3 longitudinal studies	Children and adolescents	20 studies (110,857)	United States (n=4) Australia (n=4) United Kingdom (n=2) Canada (n=2) Germany (n=1) Norway (n=2) Spain (n=1) China (n=1) Malaysia (n=1) Pakistan (n=1) Iran (n=1)	N/A
3	Solomou et al. (2023)	Systematic review	Cross-sectional studies Longitudinal studies	University students	44 studies	United States (n=9) Spain (n=5) Canada (n=4) United Kingdom (n=3) Japan (n=3) Iran (n=3)	Most of the effect size was small to moderate.

						Various countries (n=3) Chile (n=2) Finland (n=2) Australia (n=1) China (n=1) France (n=1) Turkey (n=1) UAE (n=1) Saudi Arabia (n=1) Italy (n=1) Lebanon (n=1) Puerto-Rico (n=1) Poland (n=1)	
4	Collins et al. (2022)	Systematic review	N/A	Emerging adulthood (18–29 years)	16 studies (17,823)	United States (n=5) Australia/New Zealand (n=3) Canada (n=2) China (n=2) Japan (n=1) Mexico (n=1) Puerto Rico (n=1) Iran (n=1)	The effect size of diet on depression was small. Diet and other mental health effect sizes were small. Diet and anxiety effect sizes were moderate.
5	Wu et al. (2019)	Systematic review and meta-analyses	12 cross-sectional studies 5 longitudinal studies	8 studies for adolescents 9 studies for children	17 studies (47,932)	Australia (n=4) Japan (n=3) United States (n=2) Canada (n=2) Greece (n=2) United Kingdom (n=1) Spain (n=1)	Healthy food had a significantly higher total HRQoL score (pooled mean difference = 3.45, 95% CI = 2.40, 4.50, P < 0.0001). Total mean difference of the healthy diet group

						Switzerland (n=1) Various countries (n=1)	versus the unhealthy diet group 3.12, 95% CI = 1.32, 4.92, *P* < 0.001 for psychosocial health; total mean difference = 2.77, 95% CI = 1.10, 4.44, *P* < 0.01 for physical health. Children who ate breakfast ‘sometimes’ or ‘never’ had higher odds of having poor HRQoL than children who ate breakfast ‘every day’ (OR = 1.33, 95% CI = 1.05, 1.68, *P* < 0.05 for ‘sometimes’ group; OR = 1.56, 95% CI = 1.19, 2.04, *P* < 0.01 for the ‘never’ group).
6	Głąbska et al. (2020)	Systematic review	N/A	Adolescents (11–18) years	17 studies (181,954)	United Kingdom (n=3) South Korea (n=3) Spain (n=1) China (n=1) Japan (n=1) Western Australia (n=2) Australia (n=2) Iceland (n=1)	N/A

						Iran (n=1) Ghana (n=1) Botswana, Kenya, the Seychelles, Uganda, the United Republic of Tanzania, Zambia (n=1)	
7	Malmir et al. (2023)	Systematic review and meta-analyses	14 cross-sectional studies 2 cohort studies 1 case–control study	16 studies of adolescents 1 study of children	17 studies (263,303)	United States (n=3) Korea (n=2) Iran (n=2) South Korea (n=2) United Kingdom (n=1) India (n=1) Spain (n=1) Pakistan (n=1) Lithuania (n=1) Karnataka (n=1) Indonesia (n=1) Australia (n=1)	According to meta-analysis: The impact of junk food on depression overall pooled OR (1.62, 95% CI = 1.35–1.95). Junk food on stress overall pooled OR (1.34, 95% CI = 1.16–1.54). Junk food on anxiety overall pooled OR (1.24, 95% CI = 1.03–1.50). Junk food on happiness overall pooled OR (0.83, 95% CI = 0.75–0.92).
8	Hafizurrachman & Hartono, (2021)	Systematic review and meta-analyses	7 cross-sectional studies	Adolescents	7 studies (213,394)	United Kingdom (n=2) Norway (n=1) Korea (n=1) China (n=1) Iran (n=1) Various countries (n=1)	According to the meta-analysis, the correlation coefficient demonstrated a small relationship between junk food consumption and

							symptoms of mental health problems (0.11, 95% CI = 0.09-0.14).

Table 3.2 Main findings, assessment used, variables of interest, and outcomes of the included systematic reviews and meta-analyses.

No.	Author, year	Aim of the systematic review	Diet variables of interest	Dietary tools (survey/questionnaire)	Outcomes/ variables	Well-being assessments	Results
1	O'neil et al. (2014)	To determine the effect of diet patterns on mental health among children and adolescents	**Healthy food** (higher intake of nutrient-dense foods, including vegetables, salads, fruits, fish, and other food groups known to be healthful) **Unhealthy patterns** (higher intake of foods with increased saturated fat, refined carbohydrates, and processed food products)	FFQ Harvard Youth/Adolescent Questionnaire (YAQ-FFQ) CSIRO FFQ Dietary questionnaire The question "Do you eat a healthy diet?"	**Internalising disorders** (depression, low mood, depressive symptoms, emotional problems, and anxiety)	Strengths and Difficulties Questionnaire (SDQ) Emotional Functioning subscale (PedsQL) Health records of physician-diagnosed internalizing disorders (ICD-9) Frequency of feeling depressed or distressed in the past 30 d Internalizing subscale of CBCL SMFQ DSRS (Chinese version)	The results illustrated a consistency between unhealthy food consumption and poor mental health outcomes, while there was no consistency between healthy food consumption and better mental health outcomes.
2	Khalid et al. (2016)	To focus on the relationships	Healthy diets Unhealthy diets	FFQ YAQ, FFQ	**Internalising disorders**	CBCL SDQ	The results showed a consistency

		between food patterns and depression among young people	Fast food Snacks Soft drinks Caffeine	CSIRO FFQ Dietary questionnaires Dichotomised question: “Do you eat a healthy diet?” Three-day food diary Frequency of consumption of junk food, sweets, beverages, fast foods and salty snacks Frequency of consumption of sweet food and drinks Energy (kcal) consumed after an overnight fast Eating Behaviour Questionnaire Frequency of fruit and vegetable consumption Frequency of carbonated drink and fast food consumption	Depression Anxiety Mood Emotional problems	SMFQ DSRS CES-DC PedsQL ICD-9/10 DASS-21 EAS EuroQoL for youth Beck Depression Inventory (II) Frequency of depression or ‘stress’ in the past 30 days Kandel and Davies’ 6-item scale Anxiety and suicidal ideation were measured using 1 item each Questions on depression, insomnia confusion, anxiety, and aggression	between unhealthy food consumption and poor mental health outcomes, while there was no consistency between healthy food consumption and better mental health outcomes
3	Solomou et al. (2023)	To investigate the effect of diet quality on mental health among university students	Diet quality Diet pattern	FFQ DII DASH E-DII HEI DQS EMA REAP-S DSQ PREDIMED	Depression Anxiety Stress General mental well-being Academic stress	DASS-21 PANAS ZSRDS BDI CES-D PHQ-9 Clinical screening Centers for Disease Control and Prevention’s Healthy Days Measure Anxiety tool	Most of the studies that were included to identify an association between a healthy diet and mental health outcomes revealed a positive correlation between students’ healthy

				SWFL KIDMED MEDAS 3-day food record 24-hour dietary recall Diet history questionnaire Customary intake frequency Three items from the Family Transitions Project survey One-item dietary preference Posteriori self-reported diet General estimating equations of dietary quality Dietary questionnaire Dietary guideline adherence index Questionnaire about dietary behaviour Dietary assessment Anonymous 7-day record of foods		GAD-7 Centers for Disease Control and Prevention Healthy Days Measure Stress tool 27-item stress questionnaire (stress) PSS PSS-10 5-item emotional distress scale Assessment of self-reported health complaints (22 items) SWEMWBS WEMEBS Oxford Happiness Questionnaire GHQ-12 K-6 SHS QoL single-item tool SWLS Academic stress tool Validated Scale of Academic Stress Self-concept tool AF-5 CDRS PTSD tool B7ISQ PCL-S	diets and improved mental health, including reduced levels of stress, anxiety, and depression

4	Collins et al. (2022)	To identify the relationship between diet quality and mental health	Diet quality Healthy food Unhealthy food	FFQ DHQ Dietary questionnaires Food diary Diet Quality Index Healthy Eating Index (HEI) HPLP-II Nutrition Scale Self-report item/s	Depression Anxiety Stress Psychological health Positive affect Negative affect	CES-D GHQ-12 SHMS Depressed Mood Scale Self-report item/s (stress) Cohen Perceived Stress Scale STAI Self-report diary CDC Healthy Days Measure SDS and SAS DASS-42 Stress Scale	The majority of the results found associations between a higher healthy diet and decreased depression, anxiety, and stress symptoms, as well as increased psychological health. However, some of the results did not find an association between an unhealthy diet and mental health problems
5	Wu et al. (2019)	To investigate the relationships that exist between a healthy diet and health-related quality of life in children and adolescents	**Healthy food** (fruits, vegetables, dairy food) **Unhealthy food** (fat, fast foods) **Eating breakfast** (never, sometimes, every day)	MD FFQ DQI-I Frequency of breakfast and snack consumption Household Food Security	**Health-related quality of life** Physical health Psychological health	Paediatric Quality of Life Inventory (PedsQL 4.0) KIDSCREEN-27 KIDSCREEN-10 EQ-5D-Y Japanese COOP Charts Child Health Utility 9D (CHU9D) EQ-5D index Assessment of Quality of Life-6D	The meta-analyses' results showed an association between healthy food and quality of life among children and adolescents
6	Głąbska et al. (2020)	To analyse various observational studies to	Fruit and vegetable intake	MDS FFQ KIDMED	Mental health	SDQ. PedsQL. SMFQ.	The review found a positive association between the

		determine whether there is a positive relationship between fruit and vegetable consumption and mental health outcomes in adolescents		Self-administered food frequency questionnaire Question about number of portions Questions about the frequency of engaging in dietary behaviours Question about frequency of consumption 14-item dietary questionnaire to assess the healthy and unhealthy diet scores		The Subjective Happiness Scale (SHS) The KIDSCREEN-52. BDI-II. Korean version of the Beck Depression Inventory (K-BDI). Rosenberg Self-Esteem Scale. Beck Depression Inventory for Youth (BDI-Y). Youth Self Report (YSR). Center for Epidemiologic Studies Depression scale (CES-D). Child Behavior Checklist (CBCL/4-18). Moods and Feelings Questionnaire (MFQ). Chinese version of the Depression Self-rating Scale for Children (DSRS). Chinese version of the Screen Scale for Child Anxiety Related Emotional Disorders (SCARED).	intake of fruit and vegetable products and mental health in adolescents. Specifically, green vegetables, yellow vegetables, and fresh fruit were particularly beneficial for general mental health
7	Malmir et al. (2023)	To investigate the relationship between eating unhealthy food and psychological distress among	**Junk food** **Sweet drinks** (fruit-flavoured drinks, sweetened coffee, fruit drinks, sugared coffee and tea, energy drinks, Coca-Cola, beverages, soft	FFQ Junk food questionnaire Food labels	Depression Anxiety Stress Sleep dissatisfaction Happiness	Questionnaire (GSHS) Self-made questionnaire IES-R Cohen's PSS (0–40) PROMIS sleep disturbance measure and sleep impairment measure (0–40) MDS (5–25)	The result of meta-analyses revealed that there was a positive association between junk food consumption and depression, anxiety, stress, and sleep

		children and adolescents	drinks, lemonade, and soda) **Sweet snacks** (sweetened desserts, fatty/sweet products, ice cream, chocolate, artificial sweeteners, dessert, candy, biscuits and pastries, cakes, pie/cookies, bakery wares, etc.) **Junk food and snacks** (fast food, fried foods, fried potato, crisps, salty snacks, hamburgers)			Children's Depression Inventory (0–54) Beck Depression Inventory (0–63) Depression anxiety stress scales 21 GASC SMFQ SDQ Kandel scores Self-administered questionnaire	problems. On the other hand, there was a negative association between junk food consumption and positive well-being.
8	Hafizurrachman & Hartono, (2021)	To determine the effects of eating junk food on mental health outcomes	Junk food	N/A	Mental health	N/A	Junk food consumption was associated with an increase in mental health problems, although the effect size of the meta-analysis was small.

FFQ: Food Frequency Questionnaire, **DII**: Diet Inflammatory Score, **DASH:** Dietary Approaches to Stop Hypertension Score, **E-DII:** Energy-Adjusted Dietary Inflammatory Index, **HEI:** Healthy Eating Index, **DQS:** Diet Quality Score, **DSQ:** Dietary Screener Questionnaire, **EMA:** Ecological Momentary Assessment, **REAP-S:** Rapid Eating and Activity Assessment for Patients—Short Version, **SWFL:** Satisfaction with Food-Related Life Scale, **KIDMED:** Mediterranean Diet Quality Index for Children and Teenagers, **MD:** Mediterranean Diet, **PREDIMED:** PREvención con DIeta Mediterranean Questionnaire, **CBCL:** Child Behaviour Checklist, **SDQ:** Strengths and Difficulties Questionnaire, **SMFQ:** Short Mood

& Feelings Questionnaire, **DSRS:** Depression Self-Rating Scale for Children, **CES-DC:** Centre for Epidemiologic Studies Depression Scale for Children, **CES-D:** Centre for Epidemiological Studies—Depression Scale, **PedsQL:** Paediatric Quality of Life, **ICD-9/10:** International Classification of Disease, **DASS:** Depression Anxiety & Stress Scale, **DQI-I:** Diet Quality Index—International, **MDS:** Mediterranean Diet Score, **GSHS:** Global School-Based Health Survey, **IES-R;** Impact of Event Scale—Revised, **PSS:** Perceived Stress Scale, **PROMIS:** Patient-Reported Outcomes Measurement Information System, **MDS:** Modified Depression Scale, **GASC:** General Anxiety Scale for Children, **EAS:** Emotionality Activity and Sociability Questionnaire, **CSIRO:** Commonwealth Scientific and Research Organisation, **YAQ:** Youth and Adolescent Questionnaire, **HPLP-II:** Health-Promoting Lifestyle Profile, **DHQ:** Diet History Questionnaire, **SAS:** Self-Rating Anxiety Scale, **SDS:** Self-Rating Depression Scale, **CDC:** Centres for Disease Control and Prevention, **GHQ-12:**12-Item General Health Questionnaire, **STAI:** State–Trait Anxiety Inventory, **SHMS:** Sub-Health Measurement Scale, **CSIRO**: Commonwealth Scientific and Industrial Research Organization, **ZSRDS:** Zung Self-Rating Depression Scale, **PANAS:** Positive and Negative Affect Scale, **BDI:** Beck Depression Inventory, **PHQ-9:** Patient Health Questionnaire, **SWEMWBS:** Warwick–Edinburgh Mental Well-being Scale—Short Version, **K-6:** Kessler-6 Psychological Distress Scale, **SHS:** Subjective Happiness Scale, **SWLS:** Satisfaction with Life Scale, **AF-5:** Five-Factor Self-Concept Questionnaire, **CDRS:** Connor–Davidson Resilience Scale, **B7ISQ:** Breslau's 7-Item Screening Questionnaire, **PCL-5:** Post-Traumatic Stress Checklist, **SMFQ:** Short Mood and Feelings Questionnaire, **CBCL:** Child Behavior Checklist, **DSRS:** Depression Self-Rating Scale for Children.

3.8 Discussion

Eight systematic reviews of observational studies were found in this umbrella review to identify the most recent data on the relationship between diets and health and well-being outcomes. It was found that most systematic review results were consistent in terms of the influence of junk food, such as fast food, unhealthy snacks, and sweets, which were correlated with an increase in mental health problems and negative well-being and health outcomes. For example, junk food consumption is associated with a higher likelihood of experiencing depression and anxiety (Collins et al., 2022; Khalid et al., 2016; Malmir et al., 2023; Solomou et al., 2023), stress (Malmir et al., 2023; Solomou et al., 2023), sleep dissatisfaction, and decreased happiness (Malmir et al., 2023). Other studies further supported this (Hafizurrachman & Hartono, 2021; O'neil et al., 2014; Wu et al., 2019). It was found that high consumption of unhealthy food was associated with poorer well-being, physical health, and mental health. In contrast, most results found that the relationship between healthy diets and well-being was inconsistent. For example, in six studies examining the relationship between healthy diets and increased mental health, only three found a significant relationship (O'neil et al., 2014). In a systematic review conducted by (Khalid et al., 2016), the relationship between depression and healthy food consumption was investigated in eight studies, and a significant correlation between healthy food and reduced depression was reported in five studies. However, the effect sizes varied from minor to moderate. In addition, the results of studies that examined the influence between fruit and vegetables and mood were not significant, suggesting no relationship between fruit and vegetable consumption and well-being (Collins et al., 2022; Khalid et al., 2016). Although the systematic review conducted by (Głąbska et al., 2020) found a relationship between fruits and vegetables and mental health outcomes in most studies that were included in the review; they confirmed that the studies that found no significant relationship between fruit and vegetable consumption and mental health may have been due to indirect effects where fruits and vegetables affect BMI, which, in turn, affects mental health. Some studies emphasised the gender differences in the consumption of certain foods that had an impact on well-being and behavioural outcomes; for example, Głąbska et al. (2020) found a relationship between healthy food consumption and reduced depression among females but not males, which confirmed the decision to consider gender and BMI as confounding factors in the multivariate analyses.

Contrastingly, the consumption of soft drinks or sugar-sweetened drinks was found to correlate with a high risk of depression (Khalid et al., 2016; Malmir et al., 2023), stress, sleep problems, and poor well-being (Malmir et al., 2023). In addition, of four studies examining the influence of sweet consumption on increased depression, three found a positive association (Khalid et al., 2016). Other reviews, however, have examined sweets and found that sweet consumption was associated with increased positive affect among people in emerging adulthood (Collins et al., 2022).

Although the current umbrella review provides helpful information on the current evidence related to diet and mental health in adolescents and emerging adults, most of the studies were cross-sectional, an approach that does not provide evidence of causality. Most of the studies used univariate analyses to assess the outcomes rather than a holistic approach to measure well-being and mental health (i.e., including the established predictors of well-being) to obtain a more accurate estimate of the effect of diet on health and well-being outcomes. Therefore, to bridge this gap, the next chapter will assess the association between health-related behaviours and well-being in university and secondary students using a holistic approach, including the established predictors of well-being through multivariate analyses.

3.9 Conclusion

The umbrella literature review presented in this chapter provides a comprehensive review of existing research exploring the association between diet and psychological and physical well-being among adolescents and university students. It was observed that most unhealthy foods or low-quality diets were associated with increased negative well-being outcomes such as depression, anxiety, stress, and emotional problems. In contrast, healthy food or a good diet was associated with positive affect. At the same time, some studies found no association between diet and well-being, especially between healthy diets such as high fruit and vegetable consumption and positive well-being. The umbrella review suggests that diet may play a role in the mental health of emerging adults, but the evidence base is still limited. It has emphasised the need for further high-quality research to better understand the relationships between diet and mental health outcomes in this age group. The following chapter describes published secondary analyses of university and secondary school students. These studies investigated the relationship between health-related behaviours and well-being using multivariate analyses. They included established predictors of well-being to determine whether the relationships between diet, exercise, sleep, and well-being remained significant when the well-being predictors were covaried.

Chapter 4: Secondary Analyses of Associations between Health-Related Behaviours and Well-being among University and Secondary School Students

4.1 Introduction

The umbrella review revealed several vital associations between diet, well-being, and mental health outcomes; however, most previous studies did not use a holistic approach to measure well-being or mental health outcomes. Thus, the secondary analysis studies presented in this chapter aim to address this gap by examining health-related behaviours and well-being outcomes among university students using well-being predictors as confounding factors. Secondary data analysis has become an increasingly common approach, especially for research on health issues. This approach has helped enhance the understanding of health and well-being issues in many populations because the information can be obtained easily and quickly. In addition, secondary analysis helps apply the data to a new research question and explore a different approach to the original question, such as extracting a specific category from the original sample to use as the research question. Moreover, the analysis of existing data can be used to evaluate the instruments employed in the main study (Cheng & Phillips, 2014). Therefore, this chapter aimed to investigate the association between HRBs and well-being and academic outcomes through existing data, as was carried out in Richards (2016).

The chapter contains three secondary analysis studies, which have been published in the following articles. Executive summaries are given before each paper.

4.2 Overview of the Secondary Analyses

As mentioned in the umbrella review, there is relevant literature on the effects of diet, well-being, and behavioural outcomes among adolescents and young adults. However, the studies did not measure the various dimensions of well-being to provide a comprehensive picture of the impact of diet on well-being outcomes. Therefore, there is a significant need for comprehensive studies that address the relationships between diet and well-being for adolescents and university students. Investigating this topic will fill the research gap and increase the understanding of the association between diet and well-being among different populations. This chapter summarises the secondary analyses conducted in this study to examine associations between health-related behaviours and well-being outcomes in different populations. The current chapter is divided into two subsections. The first and second summarises the results of secondary analyses conducted among university students using the well-being process model. In addition, the third summarises secondary analyses conducted among secondary students with special educational needs. In the following section, secondary analysis studies

4.3 Associations between Diet, Other Health-Related Behaviours, Well-being and Physical Health: A Survey of Students About to Start University[2].

Almobayed, S. & Smith, A.P. (2023). Associations between diet, other health-related behaviours, well-being and physical health: A survey of students about to start university. *European Journal of Pharmaceutical and Medical Research*, 10(7), 44–49.

4.3.1 The Summary of The Study

Aim: The study aimed to examine the associations between health-related behaviours as independent variables including the consumption of healthy diets, junk food, cola and energy drinks, alcohol, and water, as well as exercise, smoking, sleep. And well-being as outcomes (i.e., physical health, positive well-being, negative well-being) among students about to start university. The focus was on understanding how these factors interrelate and impact the health and well-being outcomes after controlling for the established predictors of well-being, including stressors, social support, negative coping, positive personality, open personality, agreeable personality, conscientiousness, and introversion, using the well-being process model, which involves a holistic approach to measuring well-being.

Tools: The Well-being Process Questionnaire (WPQ) assessed positive and negative well-being, physical health, and established predictors. The survey also collected data on health-related behaviours, such as diet, sleep, smoking, and alcohol consumption, through the Diets and Behaviours Scale (DABS).

Design: A cross-sectional study surveyed 193 students about to begin their university education. The data utilised in this study was obtained through a secondary source.

[2] Published paper.

Results: In the univariate analyses, two Pearson correlations were conducted. The first correlation matrix was between health-related behaviour factors and well-being outcomes. The results showed negative correlations between the low consumption of a healthy diet, decreased physical exercise, and positive well-being. In contrast, a low healthy diet and low exercise exhibited a positive association with negative well-being. It appeared that not smoking was positively correlated with physical health.

Moreover, low cola, energy drink consumption, and good sleep appeared to be positively associated with positive well-being and physical health. However, opposing results were found between low cola and energy drink consumption, good sleep, and negative well-being. The second Pearson correlation was conducted between well-being predictors and well-being outcomes. The results showed that most well-being predictors were statistically significantly associated with positive well-being, negative well- being, and physical health.

In the multivariate analyses, three multiple linear regressions were conducted to examine the effect of health-related behaviour variables and well-being outcomes after controlling for the predictors of well-being. The first multiple regression model was conducted for positive well-being. It was found that health-related behaviour variables were no longer significant. Similar results were found for the negative well-being multiple linear regression model; no statistical significance was found among health-related behaviour factors when adjusted for well-being predictors. In the physical health multiple linear regression model in which well-being predictors were controlled, no exercise was observed to be correlated with lower levels of physical health. Low smoking compared to high smoking was found to be positively associated with physical health (Almobayed & Smith, 2023c). A copy of the paper is presented below, and the permission is provided in Appendix E.

4.3.2 Introduction

The present study aimed to examine associations between diet, other health-related behaviours (sleep and exercise), and the well-being of students immediately prior to starting university. Our previous study (Smith & James, 2023) examined this topic in a sample of secondary school students covering most of the year groups. The present study used an older sample but considered a period when the students lived at home (the six months before university). Diet and other health-related behaviours were measured using the Diet and Behaviour Scale (Richards et al., 2015). This was developed to examine associations between diet and academic attainment and conduct a survey of secondary school students in Cornish academies (Almobayed & Smith, 2023a; Richards et al., 2015; Richards & Smith, 2015; Richards & Smith, 2016; Richards & Smith, 2016; Smith & Richards, 2018). Well-being was measured using the Student Well-being Process Questionnaire (WPQ) (Williams et al., 2017; Williams & Smith, 2012), which has been extensively used with both school and university students (Alharbi & Smith, 2019; Alheneidi & Smith, 2020; Bowen & Smith, 2019; Howells & Smith, 2019; Nor & Smith, 2019; Omosehin & Smith, 2019a, 2019b; A. et al., 2018; Smith & Firman, 2020; Smith & James, 2021; G. et al., 2021; Williams & Smith, 2018; Williams & A. P. Smith, 2018). The WPQ was based on the Demands, Resources and Individual Effects (DRIVE) model (Mark-Margrove & Smith, 2022; Richards, 2016) and has negative predictor variables (e.g. exposure to stressors; negative coping style) and positive predictors (e.g. psychological capital; social support and positive coping). The outcome measures cover positive well-being (happiness, life satisfaction and positive affect) and negative well-being (e.g. stress, fatigue, anxiety and depression). Our previous study showed significant associations between diet, sleep, exercise and well-being outcomes. However, the DABs scores also correlated with many WPQ predictor variables. When the established predictors of well-being were included in the analyses, many of the associations between the DABS scores and the well-being outcomes were no longer significant. However, some associations remained significant. Positive well-being was associated with greater fruit and vegetable consumption and lower fast food/takeaway consumption. The present study used a similar methodology to our earlier study, the main difference being the older sample. Other differences were the inclusion of smoking and alcohol consumption in the questionnaire. Also, the original Student WPQ and DABS scales were used here, whereas our earlier study used shortened versions. It was predicted that associations between the DABS scores and the well-being outcomes would be observed in the univariate analyses. It was predicted that many of these associations would no longer be significant when established predictors of well-being were included in the analyses.

4.3.3 Materials and Methods

The study was carried out with the approval of the Ethics Committee, School of Psychology, Cardiff University and with the informed consent of the participants.

Participants: The participants were 193 psychology students (170 female; mean age = 19.4 years, range = 18-45 years) starting their university course.

Materials: The questionnaire contained the Diet and Behaviours Scale and Student Well-being Process Questionnaire. In addition, questions were asked about lifestyle (hours of sleep, smoking and alcohol consumption). The questions covered the six months before coming to university.

Statistical Analyses: Factor scores for healthy and junk food, exercise, alcohol and energy drinks/cola were used in the analyses. Initial univariate analyses examined the association between health-related behaviours (healthy food, junk food, energy drinks and cola, sleep, water intake, smoking, alcohol, and exercise) and well-being predictors (negative affectivity, open, agreeable, conscientious, positive personality, negative coping, social support) and outcome variables (positive well-being factor score, negative well-being factor score and physical health). Next, three separate regression models were carried out with positive well-being, negative well-being and physical health as outcomes. The predictor variables were health-related behaviours and established well-being predictors. The analyses examined the model's goodness of fit and the predictors' significance. The presence of multicollinearity among the model's independent variables could be a serious issue, so the variance inflation factor (VIF) technique was used to detect the presence of multicollinearity.

4.3.4 Results

4.3.4.1 Univariate analyses of associations between health-related behaviours predictors and the outcomes

The independent variables low energy drinks and cola, exercise, and sleep significantly correlated with outcomes. Likewise, the association of low healthy food was significant for all dependent variables except physical health. In addition, the relationship between low smoking and negative well-being and physical health was significant at ($p= .050$, $p= .005$), respectively. In contrast, there was no association between the outcomes and the other HRB variables. The correlation matrix for the health-related behaviours variables and the well-being outcomes are summarised in (Table 4.1).

4.3.4.2 Univariate analyses of associations WPQ predictors and the outcomes

The correlation matrix with positive well-being as a dependent variable significantly correlated with all the WPQ predictor variables. The negative well-being variable significantly correlated with most predictor variables except for open personality and conscientiousness. Moreover, physical health was associated with negative affectivity, agreeable and positive personality, negative coping, and social support. The correlation matrix for the WPQ variables and the dependent variables are summarised in Table 4.2.

Table 4.1 Correlation matrix of outcomes and health-related behaviours predictors.

Predictors	Positive well-being		Negative well-being		Physical health	
Correlation	**r**	**p**	**r**	**P**	**r**	**p**
Low healthy diet	-.258	.001	.234**	.001	-.073	.316
Low junk meals	.044	.545	-.041	.575	.094	.197
Low-energy drinks & cola	.208	.004	-.148	.040	.209**	.004
High water intake	.029	.695	-.059	.420	.049	.504
Low smoking	.119	.099	.141	.050	.201**	.005
Low exercise	-.293	.001	.231**	.001	-.304**	.000
Long sleep	.196	.007	-.157*	.030	.150*	.039
High Alcohol	-0.027	.706	-.059	.414	-.039	.587
Differences	**t**	**p**	**t**	**p**	**t**	**p**
Smoker v Non-smoker	-1.66	.099	1.97	.050	-2.82	.005

Table 4.2 Correlation matrix of outcomes and WPQ predictors.

Predictors	Positive well-being		Negative well-being		Physical health	
	r	**p**	**r**	**P**	**r**	**p**
Negative affectivity	-.760**	.000	.811**	.000	-.390**	.000
Open Personality	.267**	.000	-.102	.164	.097	.185
Agreeable Personality	.323**	.000	-.172*	.018	.164*	.024
Conscientiousness	.160*	.028	-.033	.648	.070	.336
Introversion	-.430**	.000	.440**	.000	-.127	.082
Positive personality	.810**	.000	-.725**	.000	.513**	.000

Negative coping	-.497**	.000	.516**	.000	-.325**	.000
Social support	.539**	.000	-.476**	.000	.364**	.000

The HRBs were also correlated with the WPQ predictors. High alcohol consumption was associated with low conscientiousness and a disagreeable personality. Smoking was associated with negative affectivity. Hours of sleep were positively correlated with positive personality and negatively correlated with negative coping and negative affectivity. Low energy drink/cola consumption was positively associated with a positive and agreeable personality and negatively associated with negative coping and introversion. A low healthy diet was positively associated with negative coping, introversion and negative affectivity. It was negatively associated with positive, agreeable and open personalities. Low exercise was positively associated with introversion, negative affectivity and negative coping. It was negatively associated with social support and positive, agreeable and open personalities. Low junk food and water consumption were not associated with any psychosocial predictors. The shared variance between the HRBs and established well-being predictors meant that both sets of variables should be included in well-being and health outcomes analyses.

4.3.4.3 Multivariate analysis of predictors and positive well-being

The linear regression results with positive well-being as an outcome and the predictors were statistically significant, F [16, 166] = 34.79, $p < .001$, R2 = .770. The model explained 77% of the variance of positive well-being. This indicates a significant relationship between most WPQ variables and positive well-being except introversion, open personality, and negative coping. In contrast, no significant relationships existed between the HRB predictors and positive well-being (see Table 4.3).

Table 4.3 Multivariate analysis of predictors of positive well-being.

Model	B	S.E.	Beta	t	Sig.
Social support	.143	.046	.143	3.101	.002
Negative coping	.014	.048	.014	.290	.772
Negative affectivity	-.137	.025	-.314	-5.401	.000
Positive personality	.475	.060	.466	7.963	.000
Introversion	.004	.018	.009	.200	.842
Conscientiousness	.056	.020	.110	2.751	.007

Agreeable Personality	.074	.028	.111	2.637	.009
Open Personality	-.006	.025	-.010	-.242	.809
High Alcohol	.021	.041	.021	.509	.611
Low Exercise	-.051	.041	-.050	-1.229	.221
Low Smoking	-.016	.134	-.005	-.117	.907
Hours of sleep	.030	.044	.027	.685	.494
Low-energy drinks & cola	.020	.043	.020	.456	.649
High water	-.026	.025	-.041	-1.036	.302
Low junk meals	-.014	.042	-.014	-.340	.734
Low healthy diet	-.079	.042	-.078	-1.859	.065

4.3.4.4 Multivariate analysis of predictors and negative well-being

The linear regression model of negative well-being was statistically significant, F[16, 166] = 29.28, $p < .001$, R2 = .738. It explained 73% of the variance in negative well-being. The WPQ variables were good predictors of negative well-being except for introversion, conscientiousness, agreeable personality, and social support. In contrast, there was no relationship between HRB predictors and negative well-being (see Table 4.4).

Table 4.4 Multivariate analysis of predictors of negative well-being

Model	B	Std. Error	Beta	t	Sig.
Social support	-.070	.049	-.071	-1.436	.153
Negative coping	.130	.051	.132	2.566	.011
Negative affectivity	.230	.027	.532	8.571	.000
Positive personality	-.265	.063	-.262	-4.200	.000
Introversion	.007	.019	.018	.371	.711
Conscientiousness	.003	.022	.005	.127	.899
Agreeable Personality	.000	.030	.000	.008	.994
Open Personality	.063	.026	.108	2.374	.019
High Alcohol	-.074	.044	-.076	-1.698	.091
Low Exercise	-.009	.044	-.009	-.214	.831
Low Smoking	-.050	.142	-.016	-.355	.723
Hours of sleep	-.020	.046	-.018	-.425	.672
Low-energy drinks & cola	.026	.045	.027	.578	.564
High water consumption	.020	.026	.032	.747	.456
Low junk meals	.019	.044	.018	.418	.677
Low healthy diet	.057	.045	.057	1.281	.202

4.3.4.5 Multivariate analysis of predictors and physical health

The results of the linear regression model for physical health and the predictors were statistically significant, F[16, 166] = 6.82, p < .001, R2 = .397; the model explained 39% of the variance in physical health. Social support, positive personality, and introversion variables were good predictors of physical health. Regarding HRB variables, there were associations between low exercise, smoking, and poor physical health see Table 4.5.

Table 4.5 Multivariate analysis of predictors of physical health.

Model	B	Std. Error	Beta	t	Sig.
Social support	.337	.130	.192	2.581	.011
Negative coping	-.081	.136	-.046	-.596	.552
Negative affectivity	.053	.072	.070	.745	.458
Positive personality	.870	.168	.491	5.172	.000
Introversion	.153	.051	.218	2.981	.003
Conscientiousness	.022	.058	.025	.388	.698
Agreeable Personality	.065	.079	.057	.829	.408
Open Personality	-.095	.070	-.093	-1.351	.178
High Alcohol	.127	.116	.074	1.090	.277
Low Exercise	-.282	.117	-.161	-2.413	.017
Low Smoking	.876	.378	.157	2.319	.022
Hours of sleep	.108	.124	.055	.873	.384
Low-energy drinks & cola	.102	.121	.059	.838	.403
High water consumption	-.027	.070	-.025	-.385	.701
Low junk food	.162	.118	.092	1.369	.173
Low healthy diet	.043	.120	.025	.363	.717

4.3.5 Discussion

A previous study examined the associations between health-related behaviours and the well-being of secondary school students. Initial univariate analyses showed significant correlations between HRBs and well-being, with positive HRBs (good sleep, healthy diet and regular exercise) associated with positive well-being and negative HRBs associated with negative well-being. Established psychosocial predictors of well-being were also significantly associated with HRBs and well-being outcomes. When these established predictors were included with the HRBs in regressions examining associations with outcomes, few HRBs remained significant.

A very similar profile of results was obtained in the present study. Here, the sample was older and probably had more control over their diet and other HRBs. Slightly different measuring instruments were also used in the present study. The study with secondary students used the short-form versions of the WPQ and DABS. The present study used the original longer versions of these questionnaires and included HRBs relevant for an older sample (smoking and alcohol consumption). Despite these differences, the results were very similar, with initial univariate analyses showing associations between HRBs and well-being and health outcomes, with these associations being no longer significant when established predictors of well-being were included in the regressions. Again, the established predictors of well-being had significant effects, which gives confidence in the HRB results. In addition, established associations between smoking, exercise, and physical health were significant, indicating confidence in the HRB results.

The present study has some limitations. The sample was mainly female and attended a single university to study Psychology, which has been identified as a potential problem in previous research on this topic (Richards, 2016). Further research is now required to determine whether HRBs influence the well-being of university students, who often have a poor diet, do not get enough sleep, and may neglect appropriate exercise.

4.3.6 Conclusion

An online survey examined the association between HRBs and well-being. HRBs were correlated with well-being outcomes, but these associations were no longer significant when established predictors of well-being were included in the analyses. The established predictors of well-being showed their usual significant effects, and smoking and exercise were associated with physical health. Replicating these established effects gives one confidence in the novel HRB/well-being results. Further research must determine whether these results are observed with university students and older adults.

4.4 Associations Between Diet, Other Health-related Behaviours, Well-being and General health: A survey of university students[3].

Almobayed, S. & Smith, A.P. (2023). Associations between diet, other health-related behaviours, well-being and general health: A survey of university students. *World Journal of Pharmaceutical and Medical Research*, 9(8), 19–25.

4.4.1 The Summary of The Study

Aims: This study's purpose was to determine the associations between diet, other HRBs, well-being, and general health among university students. It was similar to the previous secondary analysis study, but the main difference was that the sample consisted of students who had been at university.

Tools: The original DABS was used to measure health-related behavioural factors. In addition, the WPQ was used to measure well-being predictors and outcomes.

Design: The methodology employed in this study was similar to that of the earlier study of university students before starting their education at university. It was cross-sectional. The individuals recruited for the study were undergraduates at Cardiff University. The overall sample size included 552 people. The health-related behaviour factors included the consumption of energy drinks, coffee, tea, cola, junk food, healthy food, sleep, alcohol, and smoking habits. The established predictors of well-being included student stressors, negative coping, positive personality, and social support. The outcomes under investigation were negative and positive well-being and general health.

Results: The Pearson correlation showed a positive relationship between negative well-being and the consumption of cola, energy drinks, tea, and coffee. This result suggests that increased consumption of these items was associated with poorer well-being among students. In contrast, the association between negative well-being and more sleep was negative. Although the established predictors of well-being were controlled for in the multivariate analysis, the relationship between long sleep and negative well- being persisted when linear regression was used. However, the other health-related behaviour factors were no longer statistically significant in the multivariate analysis.

[3] Published paper.

The univariate analysis found an association between positive well-being, more sleep, and energy drinks. However, the linear regression models showed that the associations between health-related behaviours and positive well-being were not significant.

In the general health analyses, there were associations between sleep and healthy food, junk food, and cola consumption in the univariate analyses. However, the linear regression model showed no significant associations with physical health except for sleep. This result indicated that good sleep is associated with better physical health (Almobayed & Smith, 2023b). A copy of the paper is presented below, and the permission is provided in Appendix F.

4.4.2 Introduction

The present research aimed to examine associations between health-related behaviours (HRBs: diet, sleep, smoking and alcohol consumption) and the well-being and health of university students. Our previous research examined this topic in a sample of secondary school students (Smith & James, 2023) and students just starting university (Almobayed & Smith, 2023c). The present study continued this line of research using a sample of university students. Diet was measured using the Diet and Behaviour Scale (Richards et al., 2015), which was developed in order to research diet, academic attainment and conduct in secondary school students in Cornish academies (Almobayed & A. Smith, 2023a; Richards, Millward, et al., 2015; Richards & Smith, 2015; Richards & Smith, 2016; Richards & Smith, 2016; Smith & Richards, 2018). Well-being was measured using the Student Well-being Process Questionnaire (WPQ) (G. M. Williams, H. Pendlebury, K. Thomas, & A. P. Smith, 2017; G. M. Williams & Smith, 2012) which has been used in studies of secondary school and university students (Alharbi & Smith, 2019; Alheneidi & Smith, 2020; Bowen & Smith, 2019; Howells & Smith, 2019; Nor & Smith, 2019; Omosehin & Smith, 2019a, 2019b; A. Smith, Garcha, & James, 2023; A. Smith, Smith, & Jelley, 2018; Smith & Firman, 2020; Smith & James, 2021; Williams et al., 2021; G. Williams & A. Smith, 2018; G. Williams & A. P. Smith, 2018). The WPQ was developed from the Demands, Resources and Individual Effects (DRIVE) model (Mark-Margrove & Smith, 2008, 2022) and had predictor variables associated with negative outcomes (e.g. exposure to stressors; negative coping style) and predictors of positive outcomes (e.g.

psychological capital and social support). Positive well-being (happiness, life satisfaction and positive affect) and negative well-being (e.g. stress, fatigue, anxiety and depression) were measured.

Our previous studies (Almobayed & Smith, 2023c; Richards, Malthouse, & Smith, 2015) found significant associations between diet, sleep, exercise and well-being. However, the DABs scores were also correlated with the established WPQ predictor variables. When the established predictors of well-being were in the regression model, many of the associations seen in univariate analyses were not significant. However, some associations were still significant. Positive well-being was associated with lower consumption of fast food/takeaways and with more frequent fruit and vegetable consumption. The present study used a methodology that was like our previous studies, the main difference being that the sample consisted of university students. Other differences were the inclusion of smoking and frequency and amount of alcohol consumption in the questionnaire. Both sleep duration and quality of sleep were also recorded. Also, the original Student WPQ and the diet part of the DABS were used here, whereas the study with secondary school students used shortened versions. It was predicted that the established psychosocial predictors of well-being would be associated with the outcomes. It was also predicted that associations between the health-related behaviour scores and the well-being outcomes would be found in the univariate analyses. It was also predicted that many of these associations would not be significant when the established predictors of well-being and health were included in the analyses.

4.4.3 Materials and Methods

The study was carried out with the approval of the Ethics Committee, School of Psychology, Cardiff University and with the informed consent of the participants.

Participants

The participants selected for this study were undergraduate students at Cardiff University. The total sample consisted of five hundred and fifty-two students, 23% male, who were between 18 and 45 years old (M= 20, SD= 3.16). The majority of these students (79%) had previously attended state schools (see Table 4.6). The students were given course credits or paid for their participation.

Materials

Data for the study were collected using an online survey presented on the Qualtrics platform. Questions about diet came from DABs. The Student Well-being Process Questionnaire was used to measure the predictors of positive and negative well-being and general health. Other questions provided demographic information (e.g. gender, age, type of high school attended, the status of current degree, whether it was a first or second degree and BMI). In terms of lifestyle, two questions were asked about sleep (sleep duration and sleep quality). In order to measure alcohol consumption, two questions were asked (how many days per week and how many units of alcohol per week were consumed). There was also a question about smoking.

Table 4.6 The descriptive analysis of demographic variables.

First or second degree		**First degree**	**Second degree**	**Total**	
	N (%)	497 (90%)	55 (10%)	552 (100%)	
Type of secondary school		**Private/paid**	**state**	**Total**	
	N (%)	116 (21%)	436 (79%)	552 (100%)	
Smoking		**yes**	**No**	**Total**	
	N (%)	73 (13.2%)	479 (86.8%)	552 (100%)	
Age	N	**Max.**	**Min.**	**Mean**	**SD**
	552	45	18	20	3.16
BMI	552	52.44	13.19	22.92	3.91

Statistical analyses

Factor scores were used for the diet, sleep and alcohol measures. Correlations were calculated to examine associations between the established well-being predictors and well-being and health outcomes. Similarly, correlations were computed to examine associations between health-related behaviours and the outcomes and established predictors. Then, three separate regression models were tested for each dependent variable, the model's goodness of fit was examined, and the significant associations were determined. Since the number of independent variables was large, the presence of multicollinearity among the dependent variables of the model could have been a severe problem. Therefore, the variance inflation factor (VIF) technique was used to detect the presence of multicollinearity. The significance of each test was based on the respective p-values being below the significance level ($p < 0.05$).

4.4.4. Results

4.4.4.1 Correlations between health-related behaviours predictors and the outcomes

The results of the correlation matrix between the Student Well-being Process predictors and the outcomes revealed significant correlations, which are shown in Table (4.7). Table (4.8) shows the correlations between health-related behaviours and the outcomes. There was a positive correlation between good sleep and positive well-being and general health. There was a negative correlation between good sleep and negative well-being. In addition, there was a positive association between negative well-being and higher consumption of energy drinks, cola, tea, and coffee. Good physical health was associated with more frequent consumption of healthy food and better sleep. A negative relationship was found between general health and higher junk food and cola. The correlations between the Student Well-being Process predictors and health-related behaviours are shown in Table (4.9). Sleep has a significant correlation with all the WPQ predictors. It was found that there was a negative correlation between social support and junk food and energy drink consumption. There were positive associations between negative well-being and energy drink, cola, tea, and coffee consumption.

Table 4.7 Correlation matrix between WPQ predictors and the outcomes.

Predictors	Positive well-being		Negative well-being		General Health	
	r	p	r	p	r	p
Student stressors	-.367	<.001	.452	<.001	-.210	<.001
Social support	.338	<.001	-.232	<.001	.114	.009
Positive personality	.820	<.001	-.666	<.001	.279	<.001
Negative coping	-.430	<.001	.514**	<.001	-.213	<.001

Table 4.8 Correlation matrix of health-related behaviours and outcomes.

Variables	Positive well-being		Negative well-being		General Health	
	r	p	r	P	r	p
Healthy food	.058	.173	-.026	.546	.132	.002
Junk food	-.001	.985	.069	.105	-.125	.003
Cola	-.070	.101	.096	.023	-.084	.049
Energy drink	-.102	.016	.114	.007	.036	.404
Coffee	-.033	.434	.083	.050	.008	.860
Tea	-.028	.515	.102	.016	-.056	.190
Sleep	.321	<.001	-.372	<.001	.314	<.001
Alcohol	.001	.974	-.048	.263	-.059	.168

Table 4.9 Correlation matrix of WPQ predictors and health-related behaviours.

Variables	Student stressor		Social support		Positive personality		Negative coping	
	r	p	r	P	r	p	r	p
Healthy food	-.061	.161	.020	.642	.042	.336	-.019	.668
Junk food	.061	.165	-.133	.002	.016	.709	.032	.470
Cola	.011	.809	-.054	.216	-.069	.115	-.017	.705
Energy drink	.048	.269	-.176	<.001	-.051	.242	.059	.177
Coffee	-.020	.653	-.023	.595	.014	.750	-.032	.470
tea	.030	.486	-.029	.507	-.032	.464	.112	.011
Sleep	-.207	<.001	.093	.032	.310	<.001	-.203	<.001
Alcohol	.022	.613	.003	.937	-.060	.174	.045	.305

4.4.4.2 Multivariate analysis of predictors and positive well-being

A hierarchical regression was performed to investigate associations between the HRB predictors of positive well-being after controlling for the influence of demographic data and well-being predictors. Demographic data were entered in Step 1 and accounted for 4% of the variance in positive well-being. However, WPQ predictors were entered in Step 2 and accounted for 47% of the variance in positive well-being. In step 3, the

HRB predictors increased the total variance explained by the model to 48%, $F[16, 459] = 26.219$, $p < .001$, $R^2 = .480$. Social support, positive personality, negative coping, and student stressors were good predictors of positive well-being. In contrast, there were no significant relationships between the HRB predictors and positive well-being (see Table 4.10).

Table 4.10 Multivariate Analysis of predictors of positive well-being.

Model		B	Std. Error	Beta	t	Sig.
1	**Age**	-.035	.046	-.036	-.764	.445
	BMI	.019	.046	.019	.412	.680
	Smoking	.071	.067	.049	1.058	.291
	Secondary school type	-.021	.056	-.017	-.378	.705
2	**Age**	-.029	.034	-.029	-.843	.400
	BMI	.025	.034	.025	.730	.466
	Smoking	.001	.050	.001	.028	.977
	Secondary school type	.068	.041	.056	1.642	.101
	Student stressors	-.111	.036	-.111	-3.047	.002
	Social support	.105	.035	.106	2.991	.003
	Positive personality	.571	.037	.573	15.471	.000
	Negative coping	-.098	.037	-.098	-2.677	.008
3	**Age**	-.031	.036	-.031	-.871	.384
	BMI	.025	.034	.025	.740	.460
	Smoke (1=smoker, 2 = non-smoker)	.002	.050	.001	.037	.970
	State secondary school	.066	.041	.055	1.606	.109
	Student stressors	-.105	.037	-.105	-2.856	.004
	Social support	.105	.036	.106	2.963	.003
	Positive personality	.567	.038	.569	15.021	.000
	Negative coping	-.094	.037	-.094	-2.538	.011
	High Junk food	-.025	.034	-.025	-.734	.463
	High Healthy	.061	.034	.061	1.792	.074

	High Energy drinks	.012	.037	.012	.321	.749
	High Coffee	-.008	.036	-.008	-.223	.824
	High Tea	.047	.035	.047	1.345	.179
	High Cola	.008	.035	.008	.216	.829
	Good sleep	.041	.036	.041	1.122	.262
	High alcohol	.040	.035	.040	1.125	.261

4.4.4.3 Multivariate analysis of predictors and negative well-being

A hierarchical regression was performed to examine HRB predictors of negative well-being after controlling for the influence of demographic data and well-being predictors. In step 1, demographic data were entered, accounting for 2.4% of the variance in negative well-being. In comparison, well-being predictors were entered in Step 2 and accounted for 41.4% of the variance in negative well-being. In step 3, the HRB predictors increased the total variance explained by the model to 44.2%, F[16, 454] = 22.439, $p < .001$, R2 = .442. All of the established well-being predictors were significant, apart from social support. Smoking was also associated with greater negative well-being. Poor sleep was associated with negative well-being, as was less frequent consumption of alcohol.

Table 4.11 Multivariate Analysis of predictors of negative well-being.

Model		B	Std. Error	Beta	t	Sig.
1	Age	.022	.046	.022	.470	.638
	BMI	.017	.046	.017	.368	.713
	Smoking	-.169	.067	-.116	-2.520	.012
	Secondary school type	.120	.055	.099	2.164	.031
2	Age	.022	.036	.022	.603	.547
	BMI	.010	.036	.010	.277	.782
	Smoking	-.098	.052	-.067	-1.861	.063
	Secondary school type	.047	.043	.039	1.089	.277
	Student stressors	.176	.038	.176	4.604	.000
	Social support	-.038	.037	-.038	-1.018	.309

	Positive personality	-.464	.039	-.464	-11.928	.000
	Negative coping	.166	.039	.165	4.291	.000
3	**Age**	.012	.037	.012	.337	.737
	BMI	.028	.035	.028	.783	.434
	Smoke (1=smoker, 2 = non-smoker)	-.114	.052	-.078	-2.172	.030
	State secondary school	.046	.043	.038	1.069	.285
	Student stressors	.157	.038	.157	4.116	.000
	Social support	-.035	.037	-.035	-.951	.342
	Positive personality	-.459	.039	-.459	-11.696	.000
	Negative coping	.146	.038	.145	3.797	.000
	High Junk food	.015	.036	.015	.426	.671
	High Healthy Diet	.051	.035	.051	1.453	.147
	High Energy drinks	.010	.039	.010	.250	.803
	High Coffee	.046	.037	.046	1.243	.214
	High Tea	.005	.036	.005	.141	.888
	High Cola	-.018	.037	-.018	-.501	.616
	Good Sleep	-.115	.038	-.114	-3.030	.003
	High Alcohol	-.112	.037	-.112	-3.042	.002

4.4.4.4 Multivariate analysis of predictors and general health

Hierarchical regression was performed to investigate the HRB predictors of general health after controlling for the influence of demographic and well-being factors. Demographics were entered in step 1 and accounted for 0.02% of the variance in general health, whereas predictors of well-being were entered in step 2 and accounted for approximately 8% of the variance in general health. In step 3, the HRB predictors increased the total variance explained by the model to 10%, F[12, 467] = 4.320, p <.001, R2 = .100. Positive personality and good sleep significantly predicted general health (see Table 4.12).

Table 4.12 Multivariate analysis of predictors of general health.

Model		B	Std. Error	Beta	t	Sig.
1	**Age**	.094	.044	.097	2.116	.035
	BMI	-.059	.044	-.061	-1.337	.182
	Low Smoking	.135	.065	.095	2.079	.038
	Secondary school type	-.051	.053	-.044	-.959	.338
2	**Age**	.095	.043	.098	2.185	.029
	BMI	-.061	.043	-.062	-1.407	.160
	Low Smoking	.108	.064	.076	1.693	.091
	Secondary school type	-.026	.053	-.022	-.486	.627
	Student stressors	-.093	.046	-.096	-2.009	.045
	Social support	.013	.045	.013	.288	.774
	Positive personality	.174	.047	.179	3.704	.000
	Negative coping	-.027	.047	-.028	-.581	.561
3	**Age**	.075	.045	.077	1.663	.097
	BMI	-.066	.043	-.068	-1.525	.128
	Smoking (1=smoker, 2=non-smoker)	.096	.064	.067	1.496	.135
	Secondary school	-.024	.052	-.020	-.454	.650
	Student stressors	-.074	.046	-.076	-1.595	.111
	Social support	.008	.045	.008	.183	.855
	Positive personality	.156	.048	.160	3.250	.001
	Negative coping	-.018	.047	-.018	-.383	.702
	High Junk food	-.064	.043	-.066	-1.469	.143
	High healthy diet	.045	.043	.046	1.042	.298
	High Energy drinks	.001	.047	.001	.028	.978
	High Coffee	.008	.045	.008	.174	.862
	High Tea	-.014	.044	-.015	-.324	.746
	High Cola	-.002	.045	-.002	-.035	.972
	Good Sleep	.120	.046	.123	2.616	.009
	High Alcohol	.019	.045	.019	.414	.679

4.4.5 Discussion

The first feature of the present results was the replication of established psychosocial predictors of well-being. Four predictors were examined. Two (positive personality and social support) were predicted to have positive associations with positive well-being and negative associations with negative well-being. These predictions were confirmed, and the predictors were also positively associated with general health. Two predictors (student stressors and negative coping) were predicted to show the opposite pattern of results, and the results confirmed these predictions. The replication of these established effects gives one greater confidence in the more novel aspects of the results. A previous study (Smith & James, 2023) with secondary students examined the associations between health-related behaviours and well-being. Significant correlations between HRBs and well-being were found, with positive well-being showing correlations with good sleep, healthy diet and regular exercise. In contrast, negative well-being was associated with negative HRBS. Established predictors of well-being were associated with both well-being outcomes and HRBs. Regressions that included established psychosocial predictors showed that few of the HRBs remained significant predictors of outcomes. Very similar results were obtained in a study where students provided information about the six months prior to starting university. In addition, established associations between smoking, exercise and health were significant, which also gives confidence in the HRB results observed in the study.

The present study extended the research to university students who have more control over their HRBs. The results showed a similar pattern to the previous studies. The correlations identified associations between HRBs and well-being and health outcomes. However, regressions that included the established predictors showed that many of the effects of the HRBs were no longer significant. The more robust effects were those of a good sleeping pattern, alcohol consumption, and smoking.

The present study had some limitations. The sample was mainly female, and more research on possible gender differences is required. This has been identified as a potential problem in previous studies on this topic (Richards, 2016). The study was also cross-sectional and longitudinal studies are required to provide a better indication of causality. Intervention studies are also required to identify underlying mechanisms and assess the practical importance of these associations.

4.4.6 Conclusion

An online survey examined the association between HRBs, well-being and general health. HRBs were correlated with well-being and health outcomes, but these associations were often not significant when established predictors of well-being were included in the regressions. The established predictors of well-being showed their usual significant effects, and good sleep, alcohol consumption and smoking were associated with well-being and general health. The replication of established effects gives one confidence in the more novel HRB/well-being results. Further research is now required to determine whether these results are observed with other samples. The underlying mechanisms and practical importance of these effects also require further investigation.

4.5 Association between Health-Related Behaviours and Well-being and Academic Performance among Secondary School Students with Special Educational Needs.

Almobayed, S. & Smith, A.P. (2023). Associations between health-related behaviours, well-being, and academic performance of secondary school students with special educational needs: A secondary analysis. *Recent Advances in Nutrition*, 3(1), 1-17. In: *A special issue on "Nutritional assessment and management of children and adolescents diagnosed with chronic conditions".*

4.5.1 The Summary of The Study

Aim: This study aimed to determine the associations between health-related behaviours and well-being, as well as behavioural and academic outcomes, among secondary school students with special educational needs (SEN) using secondary analyses.

Tools: The Diet and Behaviour Scale (DABS) was used to measure diet and lifestyle factors, including physical activity and sleep.

Design: The study utilised data from the Cornish Academies Project, conducting secondary analyses to investigate the relationships between health-related behaviour factors (i.e., healthy food, junk food, total weekly caffeine, coffee, tea, energy drinks, cola, sleep, attendance, and exercise) and the dependent variables were physical health, attainment, and behavioural outcome. In addition, three more dependent variables were added at the second time point (stress, anxiety, and depression). The sample consisted of 308 secondary school students with special educational needs, mostly ADHD and autism (mean age 13.5 years, SD 1.44 years) from three academies in Cornwall, United Kingdom. The study employed a longitudinal design with data collected at two time points, six months apart.

Statistical analysis: The variables were cross-tabulated to examine the relationships between the predictors and the outcomes, and the significance of the association between them was tested using chi-square correlation. In the multivariate analysis, three separate logistic regression models were constructed for the dependent variables (general health, attainment, behavioural outcomes) and health-related behaviour factors controlling for demographic variables for Time 1 (T1). A similar method was used for the multivariate analysis of the Time 2 (T2) data. Six Binary logistic regression models were tested to examine the effect of health-related behavioural factors as predictors controlling for demographic variables on the dependent variables from T2 (i.e., general health, attainment, behavioural outcomes, anxiety, stress, depression). For the longitudinal analyses, a cross-lagged approach was employed to investigate the effect of predictors at T1 on outcomes at T2.

Results:

1. **Univariate analysis results**

The univariate analysis showed associations between exercise, gender, healthy food, and poor general health at T1. At T2, only exercise and healthy food were associated with poor general health. These findings indicated a significant relationship between low exercise, short sleep duration, low healthy food consumption, and poor general health. In addition, females also had poorer general health compared to males. There were associations between exercise, attendance, junk food, cola, energy drinks, and low attainment at T1.

Conversely, only exercise was associated with low attainment at T2, which indicated that students with low exercise tended to have low attainment at T2. Moreover, there were correlations between gender, sleep, school year, and poor behavioural outcomes at T1. Similar results were found for T2. Poor behavioural outcomes were associated with gender, sleep, school year, total weekly caffeine, and energy drinks, which indicated that males were found to have more poor behavioural outcomes than females. Poor behavioural outcomes were observed among those with less sleep, higher weekly caffeine and energy drink consumption. The following analyses investigated the potential correlations between health-related behaviours and anxiety, depression, and stress at T2. The chi-square test indicated a significant association between anxiety and stress and a reduced duration of sleep. Furthermore, a notable correlation was observed between gender and mental health, with females exhibiting a higher propensity to report elevated levels of anxiety, despair, and stress compared to males.

2. Multivariate analysis results

The correlation between gender, sleep, healthy food, and poor general health remained statistically significant in the multivariate analysis of the T1 data. Although there was no direct correlation between junk food consumption and general health in the univariate analysis, it was discovered that consuming a significant amount of junk food was associated with an elevated risk of poor general health at T1. An association was found in the multivariate analysis between high attendance and a decreased probability of low achievement, as well as high energy drink use and an increased risk of low attainment (T1). Gender, sleep, and school year were essential factors affecting poor behavioural outcomes.

At T2, the only factor associated with poor general health was the decreased consumption of nutritious food. The multivariate analysis findings at T2 indicated a significant decrease in the probability of low achievement among individuals with a high healthy food intake and who engaged in regular physical activity. There was a notable correlation between increased sleep duration and improved behaviour at T2. High coffee consumption was positively correlated with an increased probability of negative behaviour at T2. Regarding anxiety, stress, and depression at T2, the multivariate analysis showed that, compared to men, women reported higher levels of anxiety and depression. There was a correlation between a longer sleep duration and a lower odds ratio for high anxiety at T2.

3. Longitudinal analysis results

The cross-lagging of poor general health at T2 was predicted by decreased attendance among SEN students at T1, while the high consumption of junk food predicted low attainment at T2. In addition, females at T1 were associated with high anxiety and depression at T2. The high consumption of tea at T1 was a good predictor of increased anxiety at T2 among SEN students. In contrast, the total weekly caffeine intake at T1 was related to decreased high anxiety at T2. A similar result was found between cola consumption at T1 and depression at T2. These findings most likely demonstrate reverse causation. Tea is a better option for people with mental health issues than more highly caffeinated beverages. The link between energy drinks and cola use and low anxiety and depression can be explained by the possibility that those with low anxiety tend to consume more caffeine. (Almobayed & Smith, 2023a).

A limitation of the current study is that it did not include established predictors to measure the impact on well-being and cognitive outcomes; stress, anxiety, and depression were only measured at T2. Therefore, the following chapters will consider these limitations: Chapters 6, 7, and 8 will examine the impact of health-related behaviours and ADHD/autistic traits on well-being outcomes after controlling for well-being predictors using the well-being process model as a holistic approach.

Chapter 5: Narrative Review of Dietary Behaviours, ADHD, and Autistic Traits and Well-being

5.1 Introduction

The issues of ADHD and autism of different types and classifications have been the focus of increased attention, which indicates that there is a rapid pace of development in terms of the number of people with ADHD or autism in the world and how to meet their needs. Ayano, Demelash, Gizachew, Tsegay, and Alati (2023) conducted an umbrella review of meta-analyses, including 588 studies with 3,277,590 participants from across multiple countries. The study found that ADHD is highly prevalent among children and adolescents globally. Precisely, the prevalence of ADHD was estimated at 7.6% in children aged 3–12 years, and the prevalence for adolescents aged 12–18 was slightly lower at 5.6%. In addition, a comprehensive systematic review and meta-analysis conducted by (Salari et al., 2022) aiming to determine the global prevalence of autism spectrum disorder and analyse prevalence patterns across different regions and populations. The researchers systematically reviewed studies published between 2008 and July 2021, utilising significant databases such as PubMed, Scopus, and Web of Science. A total of 74 studies encompassing 30,212,757 participants were included in the final analysis, found that the worldwide prevalence of autism was estimated at 0.6% (95% confidence interval: 0.4–1%). In Chapter 2 of this thesis, well- being and health-related behaviours were explained in terms of their definitions and theories. In this chapter, these factors will be linked with ADHD/autistic traits to investigate the impact of health-related behaviours on well-being and behavioural outcomes in people with these symptoms.

5.2 Conceptualisations of ADHD/Autistic Traits

ADHD is a prevalent neurodevelopmental disorder affecting children and adults, and may impair cognitive, social, and occupational performance (Alexander & Farrelly, 2017). Autism spectrum disorder is a neurodevelopmental condition that is defined by persistent weaknesses in social communication and social interaction, as well as repetitive patterns of behaviour, interests, or activities, and it affects individuals differently (Alnasser, 2023). Although the specific causes of ADHD and autism are not well comprehended, studies indicate that a combination of genetic, environmental, and neurological elements may play a role in their formation (Loewen et al., 2020; Pingault et al., 2015; Szatmari, 2003). Differences in behaviour, social interaction, and communication are common autistic traits. In contrast, the symptoms of impulsivity, hyperactivity, and inattention characterise ADHD. These differences can range widely in severity and manifestation, leading to the concepts of autism spectrum disorder or ADHD. Research has shown that numerous people without an official diagnosis of autism display autistic symptoms in varying degrees (Baron-Cohen et al., 2009). According to (Sasson et al., 2013), this range of characteristics points to a continuum rather than a clear division between people with and without autism. The prevailing diagnostic approach for autism is binary, classifying individuals as either having or not having the condition (Greven et al., 2018). This dichotomous perspective is bolstered by classification analyses identifying discrete categorical structures within the population. However, recent epidemiological findings have begun to challenge this classification viewpoint. These studies suggest that autism-related characteristics do not adhere strictly to conventional diagnostic boundaries; instead, they exist on a continuum that seamlessly extends into subclinical manifestations within the general population, a phenomenon referred to as the broader autism phenotype (Abu-Akel et al., 2019; Austin, 2005; Lunia & Smith, 2024). Elucidating the underlying structure of the autism spectrum holds significant implications for enhancing diagnostic methodologies, study design, and developing more accurate prognostic tools (Abu-Akel et al., 2019). At the same time, it is argued that ADHD traits are not specific to people with an ADHD diagnosis; they can also be seen in the general population, certainly to differing degrees (McLennan, 2016). Autism and ADHD traits are frequently viewed from a medical perspective that focuses on difficulties and limitations. However, recent studies support a broader understanding of autism and ADHD as normal variations of human diversity (Galvin & Richards, 2023; McLennan, 2016; Ruzich et al., 2015). The continuity between diagnosed autism and autistic traits, or diagnosed ADHD and ADHD traits, in the general population, appears to indicate that autism and ADHD are standard forms of human diversity (Greven et al., 2018). There are a limited number of studies examining this type of trait, and to examine this type of research, we investigated the relationships between health-related behaviours and ADHD/autism traits and well-being and behavioural outcomes in the general population, which are presented in Chapters 6 and 7. Then, we examined these associations in a sample of students with a prior diagnosis of ADHD/autism in a longitudinal study presented in Chapters 8 and 9.

A holistic approach considers multiple aspects of a person's well-being, whether physical, mental or emotional and can help individuals lead healthy and happy lives. The approach focuses on promoting the health and well-being of the individual rather than focusing on an illness or disorder (Frederickson & Cline, 2015). The following section discusses ADHD/autism and well-being in more detail.

5.3 ADHD/Autistic Traits and Well-being

A study by Muñoz-Cantero, Losada Puente, and Almeida (2016) examined students' quality of life. The study focused on adolescents between 12 and 19 in Spain, utilising a quantitative–descriptive methodology and following a cross-sectional design. The sample consisted of 438 pupils, of whom 145 had special educational needs, including ADHD and autism. The study examined many dimensions of well-being, such as emotional well-being, relationships with others, and physical well-being, using the Adolescent Student Quality of Life questionnaire. The sample of students with ADHD/autism exhibited lower quality of life in comparison to students who did not have these traits. A decline in physical well-being was observed among students diagnosed with ADHD and autism (Muñoz-Cantero et al., 2016). Similar findings were found in a longitudinal study by Pan and Yeh (2017), who investigated the relationship between ADHD and quality of life. The Beck scale was used to measure depression and anxiety as mediating factors. The ADHD self-rating scale (ASRS) was used to assess ADHD symptoms. A year after baseline, the WHOQOL-BREF scale was used to measure quality of life. The sample consisted of 1947 adolescents aged 15–17 years. The results showed a decrease in quality of life in adolescents with high ADHD scores. It also confirmed the significant impact of depression and anxiety on the quality of life of those with ADHD (Pan & Yeh, 2017). Although it was a longitudinal study and used a multivariate approach, it did not include factors that provide a comprehensive well-being profile. However, Ogg, Bateman, Dedrick, and Suldo (2016) explored the association between ADHD symptoms and life satisfaction in a sample of 183 students between sixth and eighth grade in the United States aged between 11 and 14 years, who completed the Students' Life Satisfaction Scale (SLSS) and ADHD Student Self-Rating Scale. A cross-sectional approach was used. The students' results showed a negative correlation between inattention and hyperactivity in general and life satisfaction. In contrast, the findings obtained from the teachers indicated an association between life satisfaction and inattention only. However, there were differences between the scales reported by teachers and students. The limitations of this study are that it only examined one dimension of well-being – life satisfaction – and, therefore, does not provide a comprehensive explanation of well-being (Ogg et al., 2016). In addition, the study conducted by Peasgood et al. (2016) aimed to identify the role of ADHD in the quality of life of children. The sample consisted of 467 adolescents with ADHD in a cross-sectional study. The results showed a decrease in quality of life and happiness as well as fewer sleep hours for children with ADHD compared with children without ADHD. Although these children reported having poor sleep, they did not feel more fatigued. The study provided a sufficient number of samples and several variables such as life satisfaction, social aspects, and sleep. However, it was a cross-sectional study in which causality between variables could not be established. In contrast, a cross-sectional study conducted by Okada et al. (2016) examined the influence of positive and negative affect on a sample of children with ADHD. The researchers gave the PANAS-C to 1094 participants. There was a total of 80 children diagnosed with ADHD alone, 284 children diagnosed with ADHD along with other disorders, and 730 children who did not have ADHD. Children with ADHD experienced higher positive affect compared to the other groups (Okado et al., 2016). Although the study sample was large, fewer children with ADHD were included compared to the overall sample size. This may lead to limited results and difficulty in generalisation.

5.4 Health-Related Behaviours and ADHD/Autistic Traits

5.4.1 Health-Related Behaviours and ADHD

Research studies have suggested that diet influences individuals with ADHD. Research has mainly examined the connection between nutrition and hyperactivity traits in the past four decades. Park et al. (2012) aimed to explore a broader range of dietary behaviours among nearly 1,000 children with ADHD and learning disabilities using a cross-sectional design. Nonetheless, based on the observed associations, the authors suggest that it is possible to assume that a well-balanced diet, regular meals, and an adequate intake of dairy and vegetables (as opposed to an unhealthy diet consisting of a high intake of sweet desserts, fried food, and salt) might be responsible for a lower level of behavioural issues and problems with learning and attention. In other words, interventions encouraging healthy eating habits might contribute to fewer issues associated with the disorder (Park et al., 2012). Similar findings were obtained by Del-Ponte, Quinte, Cruz, Grellert, and Santos (2019), who conducted a systematic literature review and meta-analysis to determine the association between food intake patterns and symptoms of ADHD in children and adolescents. A total of 14 observational studies were included in the investigation. The results of the meta-analysis revealed a negative association between the consumption of healthy food and ADHD symptoms, with an odds ratio (OR) of 0.65 and a 95% confidence interval (CI) of 0.44-0.97. However, the consumption of unhealthy foods was positively associated with a higher probability of experiencing ADHD symptoms, with an OR of 1.41 and a 95% CI of 1.15-1.74 (Del-Ponte et al., 2019). Both Park et al. (2012) and Del-Ponte et al. (2019) emphasise the need to conduct longitudinal studies to understand the nature of the relationship between diet and ADHD and to consider other variables that influence eating behaviours when designing the analyses.

Children with ADHD often experience sleep disturbances. Maladaptive sleep patterns cause daytime sleepiness and fatigue due to increased sleep deficiency. However, interventions targeting sleep disturbances might contribute to the overall well-being of people with ADHD (Lycett, Sciberras, Hiscock, & Mensah, 2016). It is posited that adolescents with ADHD usually have two or three symptoms of insomnia compared to their non-ADHD peers. A large population-based study based on responses from nearly 10,000 adolescents with ADHD supported such findings (Hysing, Lundervold, Posserud, & Sivertsen, 2016). It was found that people with ADHD experience a range of sleep disturbances, such as shorter duration of sleep, longer sleep latency, nighttime waking, significant sleep deficiency, and insomnia.

Subsequently, investigations into diet and ADHD have broadened to encompass other health-related behaviours such as eating patterns, physical activity, and sleep (Pelsser, Frankena, Toorman, & Rodrigues Pereira, 2017; Pingault et al., 2015). Recent evidence suggests that diet and lifestyle changes may help manage ADHD symptoms. A study found that decreased ADHD symptoms were associated with higher levels of exercise and greater fruit and vegetable consumption. The study also found that sugary drinks were connected to more severe ADHD symptoms. Although the study included most HRB components, it was cross-sectional and did not evaluate how HRB affects the well-being of people with ADHD (van Egmond-Fröhlich, Weghuber, & de Zwaan, 2012).

5.4.2 Health-Related Behaviours and Autism

Recent developments in the field of autism have focused on various aspects, including determining the impact of health-related behaviours and autism traits. Studies have shown that individuals with autistic symptoms and poor-quality diets, including the consumption of junk food and sugary beverages, have a high prevalence of the condition (Panossian et al., 2021).

Moreover, children and adolescents with autistic spectrum disorder often experience inappropriate sleep patterns. Gunes et al. (2019) examined the factors associated with sleep issues, including bedtime resistance and nighttime waking. The results indicate that there is no association between ASD and sleep difficulties (Gunes, Ekinci, Feyzioglu, Ekinci, & Kalinlis, 2019). However, McCallum et al. (2019) established that sleep disruptions are prevalent in all psychiatric disorders and are intensified by the presence of comorbidities (McCallum & 2019). In addition, adolescents with ASD are less likely to engage in sufficient amounts of physical activity (Mangerud, Bjerkeset, Lydersen, & Indredavik, 2014). Children with ASD, particularly girls, are significantly less active compared to adolescents from the non-clinical population, and the levels of activity are much lower while at school and during weekdays (Memari et al., 2013).

5.5 Bidirectional Relationship between Diet and ADHD/Autism

The previous section discussed how several studies have identified connections between unhealthy dietary habits (characterised by a high intake of processed foods, sugar, and unhealthy fats) and a higher likelihood or occurrence of ADHD/autistic symptoms. In contrast, dietary patterns that are considered healthy and consist of a high intake of fruits and vegetables have been linked to a reduction in the development of ADHD/autistic symptoms. However, the direction of this relationship remains ambiguous. A study conducted in the Netherlands examined the relationship between ADHD symptoms and diet quality in children. The findings revealed that exhibiting more ADHD symptoms at the age of 6 was associated with a reduction in diet quality consumption at the age of 8. However, the study did not find any evidence to suggest that diet quality at the age of 8 predicted ADHD symptoms at the age of 10 (Mian et al., 2019). Furthermore, it was found that individuals with autism were more likely to consume low-quality diets (Harris et al., 2022). These findings suggest that the symptoms of ADHD and autism may result in individuals making less healthy eating choices rather than a bad diet being the cause of ADHD/autism. It appears that the observed correlation between ADHD, autism, and low diet quality might be bidirectional, as individuals with ADHD may exhibit poor dietary decision-making due to impulsivity or inadequate self-control while also potentially experiencing an increase in symptoms as a result of the impact of these foods (Lange et al., 2023). In addition, autistic traits can also lead people to consume a poor-quality diet (Harris et al., 2022).

5.6 ADHD/Autistic Traits and Holistic Well-being

Some recent studies have been conducted using a holistic approach, with two studies measuring well-being and ADHD/autism traits. The first study was conducted among secondary school students from Wales, including a sample of 155 participants. The participants were asked about their well-being and behavioural outcomes through an online survey using the Well-being Process Questionnaire and the Strengths and Difficulties Questionnaire. The results of univariate analyses showed that there were associations between ADHD/autism traits and most well-being and behavioural outcomes. When including established predictors of well-being in the multivariate analyses, most associations between ADHD and autism traits and well-being outcomes were no longer significant. Despite this, some associations remained significant, such as autism traits being correlated with conduct problems, hyperactive behaviour, and decreased prosocial behaviour, and ADHD traits being only associated with increased hyperactive behaviour (Andrew Smith et al., 2023).

A second cross-sectional study was undertaken to explore the potential relationship between autistic and ADHD traits and university students' well-being and SDQ outcomes. The focus was on understanding how these traits impact well-being outcomes such as anxiety and depression, as well as the SDQ outcomes. Four hundred and thirty students from Cardiff University completed an online survey. The results of the study were similar to those of the previous study. In the univariate analysis, ADHD and autism traits were significantly correlated with most of the well-being and SDQ outcomes. Regression analyses showed that the effects of autistic and ADHD traits were mainly restricted to SDQ outcomes but not well-being outcomes.

For example, there were positive associations between ADHD traits, hyperactivity, and conduct problems. In addition, there were positive associations between autistic traits, hyperactive behaviour, and peer problems. A combined-effects approach was used to measure the effect of ADHD, autism traits, anxiety, and depression in a single factor. The combined factor appeared to be associated with most well-being and SDQ outcomes even after controlling for the established well-being predictors. There were associations between the combined factor score and positive and negative well-being, physical health, conduct, hyperactive behaviour, and peer problems. Prosocial behaviour did not significantly correlate with the combined score (Garcha & Smith, 2023). Although both studies (Garcha & Smith, 2023; Andrew Smith et al., 2023) used a holistic approach to assess well-being outcomes, they did not include HRB variables to evaluate their impact on ADHD/autism traits and well-being outcomes.

5.7 Discussion

The current review provided literature on two topics. The first was the association between ADHD/autistic traits and health-related behaviours. This review found that unhealthy foods such as highly processed foods, fast food, sugary beverages, sweets, and salty snacks play a significant role in increasing ADHD and autistic symptoms. Healthy diets such as fruits, vegetables, whole grains, and milk products were found to be associated with reduced ADHD and autism symptoms. It was observed that adherence to appropriate healthy behaviours, such as increased healthy food consumption, reduced junk food consumption, good sleep duration, and exercise, was associated with lower ADHD/autism symptoms. Moreover, there were associations between sleep problems, ADHD, and autism traits. However, the results were inconsistent; no association was found between sleep problems and autism traits.

The second part of the review investigated the relationship between ADHD/autistic traits and well-being. There was an association between ADHD/autistic traits, reduced positive well-being, physical health, life satisfaction, and quality of life, and increased anxiety and depression among this population. In addition, there was a lack of sleep duration among a sample of people with ADHD. However, the results were inconsistent. Research involving university and secondary students revealed no association between ADHD/autism traits and well-being outcomes when controlling for well-being predictors. However, there were significant associations between

ADHD/autistic traits and SDQ outcomes (hyperactivity, conduct problems, and prosocial behaviour).

5.8 Conclusion

The review of associations between ADHD/autism and well-being indicated several studies that predicted well-being. However, no study has examined the relationship between healthy behaviours, ADHD/autistic traits, and well-being among adolescents using a holistic approach. Therefore, further studies are needed on this population. With this in mind, the following chapters describe empirical studies examining the association between health-related behaviours, ADHD/autistic traits, and the well-being of university and secondary school students.

Chapter 6: Association between Health-Related Behaviours, Well-being, and ADHD/Autistic Traits in University Students

6.1 Introduction

The previous chapter summarised the latest research on the association between diet and well-being, focusing on young people with ADHD and autism. It was observed that adolescents with ADHD and autism traits are more dissatisfied with their quality of life (Muñoz-Cantero et al., 2016; Pan & Yeh, 2017), and appropriate health-related behaviours are associated with greater well-being and better behavioural outcomes (Park et al., 2012). Some studies have investigated the association between health-related behaviours and well-being in participants with ADHD and autism. However, as discussed in the previous review chapters, the impact of diet and other health behaviours on well-being has rarely been analysed using a multivariate method, with most studies taking a univariate approach and considering dietary variables in isolation. In addition, well-being should be considered multi-dimensional, but most studies do not control for established predictors of well-being when investigating other variables.

Chapter 3 summarised two secondary analysis studies of university students and investigated the association between HRB and well-being. In the first study, the sample was starting university; in the second study, they were established university students. However, these studies did not assess the associations between health-related behaviours, well-being, ADHD traits, and autistic traits. In addition, Chapter 3 also included a secondary analysis to examine whether health-related behaviours were associated with the well-being and academic performance of students with SEN. The measures of well-being used in that study were restricted to stress, anxiety, and depression and did not control for established predictors of well-being outcomes. Thus, the primary aim of this study was to examine the associations between these variables in multivariate analyses. However, it uses the WPQ to examine associations with diet and well-being and ADHD/autistic traits and well-being.

This study used measuring instruments identical to those used in the previous secondary analyses, which is important because both the WPQ and DABS measuring instruments have been shortened to allow the addition of extra variables to surveys. This change has involved the addition of variables that can extend the concept of well-being (e.g., predictors such as flow and rumination and outcomes such as flourishing). The outcomes that represent essential features of ADHD and autistic traits, measured by the Strengths and Difficulties Questionnaire, have also been used to determine whether these are more sensitive than general well-being outcomes.

6.2 Overview of the Present Study

The present study was cross-sectional and collected data from Cardiff University students. In order to create a multivariate model, multiple dietary variables (breakfast, fruit and vegetables, junk snacks, junk meals, energy drinks, cola, coffee, and tea) and other health-related behaviours (exercise and sleepiness) were assessed. In addition, the study considered the predictors of well-being as confounding variables (student stressors, social support, positive coping, negative coping, psychological capital, work–life balance, workload, rumination, and flow). The model used two more variables to examine the impact of ADHD and autistic traits (total score of ADHD and total score of autistic traits). The outcomes were positive well-being, negative well-being, physical health, and flourishing. One of the most essential features of the well-being process model is that it could add predictors or outcomes related to the study question. Thus, additional outcome variables have been added that are essential when examining ADHD/autistic traits, namely, SDQ outcomes (conduct problems, hyperactive behaviour, emotional problems, peer problems, and prosocial behaviour). The present study used the psychology experimental management system (EMS) at Cardiff University to recruit participants who were given credits for completing the survey. The data were extracted as an SPSS file from Qualtrics, and IBM SPSS 29 was used for analyses.

A univariate analysis was conducted to examine the following hypotheses about the relationships between HRB factors, ADHD/autism traits, and well-being outcomes:

1. There will be significant correlations between the frequency of health-related behaviours (consumption of breakfast, fruit and veg, junk snacks, junk meals, cola, energy drinks, coffee, and tea; exercise; and sleepiness) and well-being and SDQ outcomes.
2. There will be significant correlations between ADHD traits, autism traits, and well-being and SDQ outcomes.

3. There will be significant correlations between the well-being predictors (student stressors, social support, negative coping, positive coping, psychological capital, work–life balance, workload, sleepiness, flow, rumination) and well-being and SDQ outcomes.

As discussed earlier, multivariate analyses are essential in this type of study. The following general hypotheses were tested:

1. The frequency of health-related behaviours (consumption of breakfast, fruit and veg, junk snacks, junk meals, cola, energy drinks, coffee, and tea; exercise), ADHD traits, and autism traits will be significant predictors of well-being and SDQ outcomes after controlling for well-being predictors.
2. Interaction analyses will test whether ADHD and autistic traits moderate the significant associations of health-related behaviours, well-being, and SDQ outcomes in multivariate analyses.

6.3 Methods

6.3.1 Ethical Approval

This study was approved by Cardiff University's School of Psychology Ethics Committee (ethical number: EC1610114608GRA).

6.3.2 Participants

The original analysis was to be conducted by utilising the information on various variables for the 342 students. However, the sample analysed was reduced to 335 students due to missing data. The participants were psychology students, 53.2% of the sample being first-year and 46.8% second-year students. Most participants were female (male = 13.2%, female = 85.9%, others = 0.9%).

6.3.3 Materials

The complete survey is provided in Appendix A.

6.3.3.1 Short-Form Diet and Behaviour Scale (DABS)

The Diet and Behaviour Scale (DABS) is a 29-item questionnaire designed to evaluate the intake of prevalent dietary variables, with a particular emphasis on foods and beverages currently of particular concern due to their potential impact on behaviour (Richards, 2016). Smith and James (2023) developed a short version of the scale, which was shown to be associated with well-being outcomes. The questionnaire asked about the consumption of healthy foods (breakfast, fruit and vegetables), unhealthy foods (junk meals and snacks), and caffeinated beverages (energy drinks, colas, coffee, and tea). It also asked about participation in mild, moderate, and vigorous exercise. Using a five-point Likert scale, the participants were asked about the frequency of their consumption of breakfast, fruit and vegetables, junk snacks such as chocolate, crisps, and sweets, and junk food such as takeaways or fast food. The following four items assessed the typical amount of beverages consumed (cups/cans per week) for energy drinks, colas, coffee, and tea. In the final part of the survey, the respondents were asked about how often they took part in exercise and answered using a four-point Likert scale (from a week or more to never). Moreover, to control for the impact of BMI, the participants were asked about their weight and height to calculate their BMI.

6.3.3.2 Short-Form WPQ (SFWPQ)

The Student Well-being Process Questionnaire (Student WPQ) is a comprehensive instrument designed to evaluate the well-being of university students (Gary M Williams et al., 2017). The Well-being Process Questionnaire was first developed for use in occupational environments and has been modified for students (G. M. Williams & Smith, 2012). The short-form WPQ (SFWPQ) was developed using the same procedures as the original measuring instrument. Two significant changes were made to the WPQ. First, new predictors (flow, rumination, workload, work-life balance) and outcomes (flourishing) were added to the questionnaire. Secondly, single-item versions were used instead of the multi-item versions of the original questionnaire. This applied to all the predictors (stressors, social support, psychological capital, positive and negative coping) and the outcomes (positive and negative well-being). The short questions significantly correlated with the original, extended versions (Smith, under production).

6.3.3.3 Strengths and Difficulties Questionnaire (SDQ)

Goodman developed the Strengths and Difficulties Questionnaire (SDQ) to measure children’s social, emotional, and behavioural difficulties. It has been found to have good reliability and validity (Goodman, 1997; Goodman, 2001). However, the SDQ is suitable for use with adults and adolescents in various contexts (Brann et al., 2018). The development of the SDQ was driven by the need to address mental health and well-being concerns (McCrystal & McAloney, 2010), particularly in people with

ADHD/autism symptoms (Russell et al., 2013). Research suggests that the SDQ can help measure outcomes typical of autism and ADHD. Russell, Rodgers, and Ford (2013) found that all SDQ subscales were strongly associated with autism and ADHD, indicating that the SDQ can be a predictor of these conditions. Similarly, Demopoulos, Hopkins, and Davis (2013) also reported the similarities in social cognitive profiles between children with autism and ADHD, suggesting that the SDQ can be a valuable measure for both conditions.

The SDQ's five-factor structure includes conduct problems, emotional problems, hyperactivity/inattention behaviour, prosocial behaviour, and peer problems, each comprising five items: emotional symptoms, which measure emotional distress (e.g., anxiety, depression); conduct problems, which assess behavioural issues related to aggression, rule-breaking, or defiance; hyperactivity/inattention behaviours, which focuses on attention difficulties and hyperactive behaviour; peer relationship problems, which evaluates difficulties in social interactions with peers; and prosocial behaviour, which examines positive social behaviours (e.g., kindness, cooperation). It has been shown to effectively discriminate between clinical and community samples (Essau et al., 2012; Goodman, 2001; Truman et al., 2003). The items are based on a three-point Likert scale ranging from untrue to undoubtedly true. The total score is calculated by summing the scores for each scale, ranging from 0 to 10 for each scale. It is common in research to only use the first four scales that measure difficulties (conduct problems, hyperactive behaviour, emotional problems, and peer problems). At the same time, this study considers the fifth scale of prosocial behaviour and outcomes to follow the concept of well-being, which has two sides: negative and positive.

6.3.3.4 Autism Spectrum Quotient (AQ-10)

The Autism Spectrum Quotient test was developed by Baron-Cohen et al. (2001) as a self-administered instrument to assess traits associated with autism spectrum disorder in adults and adolescents. The AQ-10 was developed as a brief version of the original AQ comprising 50 items to provide a more time-efficient alternative while still capturing essential features indicative of ASD (Allison et al., 2012). The test has since been widely used in various studies to assess an individual on the autism–normality continuum and measure autistic traits in clinical and nonclinical populations (Baron-

Cohen et al., 2001; Ruzich et al., 2015). Hence, it was used in this research as a tool to measure autistic traits.

The AQ-10 consists of 10 items, each addressing specific behaviours or characteristics associated with autistic traits. Respondents rate the extent to which they identify with each statement on a four-level Likert scale, ranging from ‘definitely agree’ to ‘definitely disagree’. Scores on the AQ-10 are summed to provide a total score reflecting the level of autistic traits. Scores range from 0 to 10, with scores of 6 and over suggesting a more significant presence of autistic traits.

6.3.3.5 ADHD Self-Report Scale (ASRS)

The World Health Organization (WHO) developed the Adult ADHD Self-Report Scale (ASRS) in collaboration with researchers to create a reliable tool for assessing adult ADHD symptoms (Kessler et al., 2005). It has been updated for DSM-IV criteria (Kessler et al., 2005) and is effective in distinguishing ADHD traits from non-ADHD traits in adults (Dunlop, Wu, & Helms, 2018). However, it is a valid and reliable screening instrument for ADHD in adults and adolescents, reporting satisfactory internal consistency and good test-retest reliability (Green et al., 2018; Hines, King, & Curry, 2012). The ASRS is particularly useful in identifying adult ADHD, which can be challenging due to its co-occurrence with other psychiatric disorders (Gillig, Gentile, & Atiq, 2004). It is commonly used due to its effectiveness, ease of use, and short administration time in general and clinical populations (Hines et al., 2012), which suggests that the ASRS is a robust tool for identifying adult ADHD traits.

The ASRS Symptom Checklist comprises 18 questions that capture various aspects of ADHD symptoms, including inattention and hyperactivity/impulsivity. Respondents on a five-point rating system indicate how frequently these symptoms have occurred within the last six months, ranging from ‘never’ to ‘very often’. However, the first six questions of the ASRS screener can be used to screen for ADHD traits Kessler et al. (2005) and Kessler et al. (2007) found that the six-question ASRS screener outperformed the full 18-question ASRS in sensitivity, specificity, and total classification accuracy. Accordingly, the six questions were used in this study to measure ADHD traits. Scores range from 0 to 6, a score of 4 or higher on these six questions suggests a more significant presence of ADHD traits.

6.3.4 Design and Procedure

The study was cross-sectional; potential participants responded to an internal advertisement in the Experimental Management System (EMS), and those who expressed interest received a link to a Qualtrics online survey. The survey was then analysed using IBM SPSS 29 to obtain accurate estimates for the hypothesis under investigation. The survey took approximately 20 minutes to complete. In addition, the participants received course credit as a reward for their involvement. Informed consent was obtained within the questionnaire, and participants could only continue beyond the consent page if they agreed. The participants were advised to skip any questions they did not wish to answer. An information sheet was provided to the participants before consent was obtained, and a debriefing sheet was provided after the questionnaire.

The study aimed to examine the associations between health-related behaviours as main predictors: the consumption of breakfast, fruit and vegetables, junk snacks, junk meals, energy drinks, cola, coffee, and tea; sleepiness; and exercise. All HRB variables were taken from the DABS scale except for sleepiness, obtained from the WPQ. The total scores for ADHD traits were taken from the ASRS questionnaire. The total scores for autistic traits were taken from the AQ questionnaire. The well-being predictors were student stressors, social support, negative coping, positive coping, psychological capital, low work-life balance, flow, and low rumination; these were taken from the WPQ and used as covariates. It should be noted that not all established predictors were included as covariates in each regression model. Essentially, each of the covariates that were significantly or marginally associated (i.e., $p < 0.1$) for the outcome in the hypotheses were entered as covariate (Richards, 2016); Tables 6.1 and 6.2 show the control variables included in each outcome. The outcome variables from the WPQ were positive well-being, negative well-being, flourishing, and physical health. The other outcome variables were taken from the SDQ: conduct problems, hyperactive behaviour, emotional problems, peer problems, and prosocial behaviour.

6.3.5 Statistical Analysis

The descriptive statistics were computed using the continuous variables' mean and standard deviation as descriptive measures and percentages for category variables.

Missing data were low in general, and the percentages were below 5% for each variable. Except for weight, they were 7% and were replaced by the mean. For normality data testing, skewness and kurtosis tests were conducted on the variables and total scores of the ADHD/autistic trait questionnaires. According to Kim (2013), if the variables fall between −2 and +2 for skewness tests, a kurtosis of +7 is sufficient to demonstrate normality in samples larger than 300 (Kim, 2013).

For the purpose of determining the covariates for each outcome, a correlation matrix (Pearson) was constructed for the continuous variables, an independent sample T-test for nominal variables, and a one-way between-subjects analysis of variance (ANOVA) for categorical variables. All control variables that exhibited significant or marginally significant ($p < 0.1$) correlations with the dependent variable were inserted as covariates in the multivariate analyses. A factor analysis was conducted with an eigenvalue of 1.00, and the principal component method and variable rotation of the factor (varimax rotation) on the three exercise items (vigorous, moderately energetic, and mildly energetic) were used to obtain a single-factor response. The objective was to include a single variable in the multivariate analyses, enabling control over all three degrees of intensity without decreasing statistical power.

In the initial univariate analyses, a correlation matrix (Pearson) was conducted to determine the relationship between the main predictors (HRB variables) and the well-being and SDQ outcome variables. Then, multiple linear regression analyses (Enter) were carried out for each outcome. Moreover, interaction analyses were conducted to investigate whether the statistically significant effects of health-related behaviour variables on well-being and SDQ outcomes identified in the multivariate analyses varied depending on ADHD/autistic traits.

6.4 Results

6.4.1 Descriptive analyses

6.4.1.1 Demographic variables

Table 6.1 shows the summary statistics for the sample (N=335). The participants were mainly female and evenly distributed across the first and second years of study.

Table 6.1 Descriptive analysis of demographic variables.

Demographic Variables	Values
University year N (%)	
First year	153 (45.7%)
Second year	180 (53.7%)
Total	333 (99.4%)
Gender N (%)	
Male	43 (12.8%)
Female	287 (85.7%)
Other	4 (1.2%)
Total	334 (99.7%)
BMI	
Min.	15.60
Max.	58.50
Mean	22.73
Standard deviation	4.79

6.4.1.2 WPQ Variables

Tables 6.2 and 6.3 show the summary statistics for the WPQ variables. These results show that the full range of rating scales was used. However, the WPQ variables seem to have the highest mean for sleepiness, workload, and student stressors.

Table 6.2 Descriptive analysis of established predictors of well-being.

Predictors	Min.	Max.	Mean	SD	N
Student stressors	1	10	6.84	2.045	335
Social support	1	10	6.73	2.100	335
Positive coping	1	10	6.73	1.930	335
Negative coping	1	10	5.96	2.184	335
Psychological capital	1	10	5.81	1.957	335
Low work-life balance	1	10	6.80	2.155	335
High workload	1	10	7.12	1.887	334
Sleepiness	1	10	7.13	1.983	334
Flow	1	10	5.45	1.729	333
Low rumination	1	10	4.43	2.032	330

Note: *Variables taken from the WPQ.*

Table 6.3 Descriptive analysis of well-being outcomes.

Outcomes	Min.	Max.	Mean	SD	N
Positive well-being	1	10	6.03	1.991	335
Negative well-being	1	10	6.26	2.138	335
Physical health	1	10	6.21	1.773	333
Flourishing	1	10	5.22	1.812	333

Note: *Variables taken from the WPQ.*

6.4.1.3 DABS Variables

The descriptive statistics for the DABS variables are shown in Table 6.4. The participants generally engaged in healthy lifestyles. The respondents reported high breakfast, low weekly energy drinks, and cola consumption. However, junk snack consumption was relatively high. Most students engaged in mild exercise three times a week or more. A factor analysis of the exercise variables revealed one factor; the initial eigenvalue was 1.514, and the extracted factor accounted for 50.46% of the variance. The factor loadings (without rotation) were calculated as follows: moderate exercise, 0.801; vigorous exercise, 0.794; and mild exercise, 0.491.

Table 6.4 Descriptive analysis of DABS variables.

Food variables	**N**	**Never**	**Once a month**	**Once or twice a week**	**Most days (3–6)**	**Every day**
Breakfast	334	22 (6.6%)	24 (7.2%)	77 (23%)	103 (30.7%)	108 (32.2%)
Fruit and veg	334	19 (5.7%)	34 (10.1%)	113 (33.7%)	149 (44.5%)	19 (5.7%)
Junk snacks	334	3 (0.9%)	13 (3.9%)	89 (26.6%)	157 (46.9%)	72 (21.5%)
Junk meals	334	8 (2.4%)	129 (38.5%)	179 (53.4%)	16 (4.8%)	2 (0.6%)
Exercise	**N**	**Never/ hardly ever**	**One to three times a month**	**Once or twice a week**	**Three times a week or more**	
Mild	327	4 (1.2%)	10 (3.0%)	34 (10.1%)	279 (83.3%)	
Moderate	320	69 (20.6%)	79 (23.6%)	107 (31.9%)	65 (19.4%)	
Vigorous	320	125 (37.3%)	78 (23.3%)	67 (20.0%)	50 (14.9%)	
Weekly caffeine (cups per week)	**N**	**Min.**	**Max.**	**Mean**	**SD**	

Energy drinks	333	0	14	0.60	1.661
Cola	334	0	20	1.26	2.523
Coffee	334	0	25	3.72	4.636
Tea	334	0	50	5.21	7.260

6.4.1.4 ADHD and AQ-10 Scales

Table 6.5 shows the total scores for the ASRS for ADHD traits and the AQ-10 scale to measure autistic traits. In Table 6.6, a score of 4 or above on the ADHD scale means the person is at risk of ADHD. One hundred thirty-two students (39.4% of the sample) fell into this category. People with a score of six and above on the AQ-10 are at risk of autism. Fifty students (14.9%) fell into this category. The following analyses used the total ADHD/autistic trait scores and did not categorise the participants based on the cut-off scores.

Table 6.5 Descriptive analysis of ADHD and autism questionnaires (total scores).

ADHD/Autism	Total scores	Min.	Max.	Mean	SD	N
Total score: Autism	0-10	0	10	3.31	1.94	330
Total score: ADHD	0-6	0	6	2.98	1.61	333

Table 6.6 Descriptive analysis of ADHD and autism questionnaires (cut-off score).

ADHD/Autism	Type of scores	N (%)	Total N (%)
Autism	No autism (0-5)	280 (83.6%)	330 (98.5%)
	Autism traits (6-10)	50 (14.9%)	
ADHD	No ADHD (0-3)	201 (60.0%)	333 (99.4%)
	ADHD traits (4–6)	132 (39.4%)	

6.4.1.5 SDQ Scores

With regard to the SDQ scores, the prosocial behaviour score had the highest average of the sub-scales (m = 8.2, SD = 1.68), followed by emotional problems and hyperactive behaviour (emotional problems: m = 5.36, SD = 2.44; hyperactivity: m = 5.02, SD = 2.21) Poor conduct had the lowest average (m =1.74, SD = 1.39), as shown in Table 6.7.

Table 6.7 Descriptive analysis of SDQ outcomes questionnaire.

SDQ Outcomes	Total scores	Min.	Max.	Mean	SD	Total
Conduct problems	0–10	0	9	1.74	1.39	331
Hyperactive behaviour	0–10	0	10	5.02	2.21	333
Emotional problems	0–10	0	10	5.36	2.44	328
Peer problems	0–10	0	8	2.28	1.57	332
Prosocial behaviour	0–10	3	10	8.21	1.68	333

6.4.2 Univariate Analyses

6.4.2.1 Correlations between Covariate Variables and Outcomes

The following section presents the relationship between the predictor variables and outcomes: positive well-being, negative well-being, flourishing, physical health, conduct problems, hyperactive behaviour, emotional problems, peer problems, and prosocial behaviour. Furthermore, these correlations were used to identify specific predictor variables with correlations in order to include them in the multivariate analysis's outcome models. Tables 6.8 and 6.9 show the predictor variables and outcomes' correlation coefficients and significance levels.

6.4.2.1.1 Positive and Negative Well-being

Positive well-being showed a positive and statistically significant correlation with positive coping, social support, flow, and psychological capital. At the same time, there were negative correlations between positive well-being and negative coping, student stressors, high workload, and low work-life balance. In addition, negative well-being displayed a positive and statistically significant correlation with student stressors, negative coping, low work-life balance, and high workload. It was negatively correlated with social support, positive coping, psychological capital, and low rumination (positive pondering). Moreover, the analysis revealed a significant difference in negative well-being among the sex groups: $F(2, 331) = 7.83$, $p = 0.001$. A post hoc analysis was performed to explore the differences between the sex groups further. The results of the Tukey HSD post hoc test indicated that males were significantly lower in terms of negative well-being ($M = 5.26$, $SD = 1.97$) than females ($M = 6.39$, $SD = 2.11$) and others ($M = 8.50$, $SD = 1.29$), with p-values of 0.003 and 0.009, respectively. No significant difference was observed between the females and others.

6.4.2.1.2 Physical Health and Flourishing

Physical health was positively associated with positive coping, social support, flow, and psychological capital. It was negatively correlated with student stressors and negative coping. Moreover, there was a significant difference between physical health and sex groups ($F(2, 329) = 3.21$, $p = 0.042$). The Tukey HSD post hoc test results indicated that males were significantly more physically healthy ($M = 6.35$, $SD = 2.01$) than others ($M = 4.25$, $SD = 2.75$), with a p-value of .036. Given the small number of participants in the 'other' group, this result must be treated cautiously. No significant difference was observed between the females and males.

Flourishing had a positive and statistically significant correlation with social support, positive coping, psychological capital, flow, and low rumination. In addition, a negative correlation was observed between flourishing and student stressors, negative coping, low work-life balance, and high workload.

6.4.2.1.3 Conduct Problems and Hyperactive Behaviour

Conduct problems correlated negatively with social support, positive coping, psychological capital, and flow. Moreover, hyperactivity was positively correlated with student stressors, negative coping, low work-life balance, and workload. Notably, the correlation between hyperactivity and negative coping was the strongest among all variables, with a coefficient of 0.345. Conversely, there was a negative correlation between hyperactive behaviour and positive coping, social support, low rumination, flow, and psychological capital. Notably, the correlation between hyperactivity, flow, and positive coping was the strongest among all variables, with coefficients of −0.370 and −0.350, respectively.

6.4.2.1.4 Emotional and Peer Problems Outcomes

There were positive correlations between emotional problems and student stressors, negative coping, low work-life balance, and workload. Notably, the correlations between emotional problems, negative coping, and student stressors were higher, with coefficients of 0.480 and 0.455, respectively. Emotional problems had a negative correlation with social support, positive coping, psychological cap, low rumination, and flow. Emotional problems showed the highest correlation with psychological cap, with a coefficient of −0.574. Furthermore, peer problems were found to be statistically and positively related to student stressors and negative coping. The peer problem, on the other hand, had a negative impact on social support, positive coping, and psychological capital.

6.4.2.1.5 Prosocial Behaviour

Flow, social support, workload, and positive coping were positively and statistically significantly correlated with prosocial behaviour. The correlations between prosocial behaviour and other predictor variables were not significant.

Table 6.8 Associations between predictor variables and well-being outcomes.

Control Variables	Positive well-being		Negative well-being		Flourishing		Physical health	
Correlation	**r**	**p**	**r**	**p**	**r**	**p**	**r**	**p**
Student stressors	**-.386**	**<.001**	**.570**	**<.001**	**-.406**	**<.001**	**-.163**	**.003**
Social support	**.270**	**<.001**	**-.198**	**<.001**	**.370**	**<.001**	**.238**	**<.001**
Positive coping	**.259**	**<.001**	**-.127**	**.021**	**.313**	**<.001**	**.228**	**<.001**
Negative coping	**-.292**	**<.001**	**.413**	**<.001**	**-.478**	**<.001**	**-.170**	**.002**
Psychological capital	**.526**	**<.001**	**-.451**	**<.001**	**.642**	**<.001**	**.271**	**<.001**
Low work-life balance	**-.170**	**.002**	**.291**	**<.001**	**-.212**	**<.001**	-.061	.266
Workload	**-.271**	**<.001**	**.371**	**<.001**	**-.323**	**<.001**	-.079	.152
Flow	**.212**	**<.001**	-.090	.101	**.474**	**<.001**	**.298**	**<.001**
Low rumination	.092	.094	**-.135**	**.014**	**.260**	**<.001**	.030	.582
BMI	-.058	.287	-.014	.797	-.064	.245	-.084	.128
Differences	**F**	**p**	**F**	**p**	**F**	**p**	**F**	**p**
Sex	0.944	0.390	**7.83**	**0.001**	0.182	0.834	**3.21**	**0.042**
School year	**T**	**p**	**T**	**p**	**T**	**p**	**T**	**p**
	-.683	0.495	-.031	0.976	-.112	.911	-1.316	.189

Note: *All correlations are Pearson's (two-tailed). p< 0.05 are displayed in bold.*

Table 6.9 Correlation between control variables and SDQ outcomes (t-test sig., two-tailed).

Control Variables	Conduct problems		Hyperactive behaviour		Emotional problems		Peer problems		Prosocial behaviour	
Correlations	**r**	**p**	**r**	**p**	**r**	**p**	**r**	**p**	**r**	**p**
Student stressors	.091	.099	**.292**	**<.001**	**.455**	**<.001**	**.230**	**<.001**	.012	.826
Social support	**-.283**	**<.001**	**-.333**	**<.001**	**-.297**	**<.001**	**-.363**	**<.001**	**.222**	**<.001**
Positive coping	**-.220**	**<.001**	**-.350**	**<.001**	**-.223**	**<.001**	**-.269**	**<.001**	**.243**	**<.001**
Negative coping	.074	.179	**.345**	**<.001**	**.480**	**<.001**	**.191**	**<.001**	.046	.402
Psychological capital	**-.109**	**.048**	**-.308**	**<.001**	**-.574**	**<.001**	**-.318**	**<.001**	-.011	.839
Low work-life balance	.062	.263	**.151**	**.006**	**.221**	**<.001**	.101	.066	-.029	.599
Workload	-.033	.545	**.192**	**<.001**	**.356**	**<.001**	.043	.438	**.136**	**.013**
Flow	**-.111**	**.043**	**-.370**	**<.001**	**-.228**	**<.001**	-.107	.053	**.147**	**.007**
Low rumination	.065	.243	**-.164**	**.003**	**-.125**	**.024**	.035	.524	-.081	.143
BMI	.032	.560	.091	.097	.020	.713	-.030	.591	.019	.732
Differences	**F**	**p**	**F**	**p**	**F**	**p**	**F**	**p**	**F**	**p**
Gender	2.42	0.090	**3.14**	**0.045**	**5.42**	**0.005**	**6.21**	**0.002**	**12.98**	**0.001**
School year	**T**	**p**	**T**	**p**	**T**	**p**	**T**	**p**	**T**	**p**
	.549	.583	**2.188**	**0.029**	-.108	.914	1.861	.064	-.847	.398

Note: *All correlations are Pearson's (two-tailed). P < 0.05 are displayed in bold.*

6.4.2.2 Correlations between ADHD/Autistic Traits and Outcomes

A Pearson correlation analysis was conducted to investigate the relationship between the ADHD/autistic scores and the outcome variables. These results are shown in Table 6.10.

Positive and negative well-being, physical health, and flourishing were significantly correlated with ADHD scores. The results showed a positive correlation between negative well-being and ADHD scores and a negative correlation between positive well-being and flourishing. In addition, there were negative relationships between physical health and ADHD/autism scores.

There were positive associations between ADHD and autism traits and peer problems, conduct problems, hyperactive behaviour, and emotional problems. Prosocial behaviour was negatively correlated with ADHD and autism scores.

Table 6.10 Correlations between ADHD and autistic trait scores and outcome variables.

Outcomes	Total scores: ADHD		Total scores: Autism	
	r	p	r	p
Positive well-being	**-.248**	**<.001**	-.068	.219
Negative well-being	**.238**	**<.001**	.027	.621
Flourishing	**-.361**	**<.001**	-.083	.133
Physical health	**-.147**	**.007**	**-.167**	**.002**
Conduct problems	**.219**	**<.001**	**.226**	**<.001**
Hyperactive behaviour	**.585**	**<.001**	**.303**	**<.001**
Emotional problems	**.339**	**<.001**	**.209**	**<.001**
Peer problems	**.214**	**<.001**	**.325**	**<.001**
Prosocial behaviour	**-.111**	**.044**	**-.257**	**<.001**

Note: *All correlations are Pearson's (two-tailed). p< 0.05 are displayed in bold.*

6.4.2.3 Associations between Health-Related Behaviours and Outcomes

A Pearson correlation analysis assessed the strength and direction of the linear relationship between HRBs and well-being and SDQ outcomes (see Table 6.11).

The Pearson correlations showed that people with a high breakfast intake, fruits and vegetables, and engaging in regular exercise tended to have more positive well-being. In addition, there was a negative correlation between positive well-being and junk meals, and daytime sleepiness variables. Negative well-being was only positively associated with sleepiness. Negative well-being correlates negatively with breakfast, fruit and vegetable intake, and the exercise factor. Physical health was positively and statistically significantly correlated with fruit and vegetable, tea consumption, and the exercise factor, and it was negatively correlated with daytime sleepiness. Flourishing showed a significant positive correlation with breakfast, fruit and vegetable consumption, as well as the exercise factor, and a negative correlation with daytime sleepiness.

With regard to the SDQ outcomes, conduct problems were positively correlated with coffee, and junk meal consumption. Emotional problems were negatively correlated with the consumption of breakfast, fruit and vegetables, and the exercise factor but positively correlated with sleepiness. Hyperactivity was found to have a positive and significant correlation with junk meal, energy drink consumption, and daytime sleepiness. Additionally, hyperactivity had a negative and statistically significant correlation with breakfast, fruit and vegetable consumption. Peer problems were positively correlated with consuming cola and negatively correlated with exercise. Prosocial behaviour was positively correlated with the frequency of consuming fruit and vegetables and sleepiness.

In summary, the univariate analyses confirmed the results of previous studies. The next question was which associations would remain significant in multivariate analyses, combining all the significant predictors.

Table 6.11 Correlations between health-related behaviours and outcomes.

Outcomes	Frequent Breakfast Consumption		Frequent Fruit and Veg Consumption		Frequent Junk Snack Consumption		Frequent Junk Meal Consumption		High Energy Drink Consumption		High Cola Consumption		High Coffee Consumption		High Tea Consumption		Frequent Exercise		Frequent Daytime Sleepiness	
	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p
Positive well-being	.136	.013	.109	.046	.035	.526	-.115	.036	-.036	.512	-.081	.140	-.005	.926	.060	.271	.209	.001	-.244	.001
Negative well-being	-.112	.041	-.122	.026	.040	.471	.077	.158	-.025	.645	.105	.056	.063	.248	-.015	.780	-.137	.012	.310	.001
Flourishing	.219	.001	.175	.001	.080	.145	-.093	.091	-.085	.123	-.077	.162	-.031	.568	.017	.756	.188	.001	-.358	.001
Physical health	.105	.055	.145	.008	-.039	.479	-.061	.263	-.035	.526	-.101	.067	.047	.397	.135	.013	.344	.001	-.228	.001
Conduct problems	-.033	.545	-.034	.535	-.025	.654	.132	.016	.012	.830	.082	.137	.116	.035	-.009	.873	-.004	.947	-.023	.683
Hyperactiv e behaviour	-.163	.003	-.177	.001	-.047	.392	.193	.001	.144	.009	.006	.920	.092	.092	.017	.753	-.008	.886	.323	.001
Emotional problems	-.146	.008	-.227	.001	-.026	.641	.024	.668	.051	.358	.098	.076	.107	.053	.032	.564	-.309	.001	.358	.001
Peer problems	-.026	.639	-.103	.061	-.040	.468	.007	.893	.070	.204	.122	.026	-.001	.992	-.024	.664	-.142	.010	.103	.060
Prosocial behaviour	-.012	.830	.152	.006	.078	.157	-.091	.098	-.008	.885	.064	.242	.043	.432	.065	.236	.038	.485	.161	.003

Note: *All correlations are Pearson's (two-tailed).*

6.4.3 Multivariate Analysis

The multiple linear regression (Enter) method was used to predict the outcomes of the multivariate analysis. One practical advantage of regression analysis is that the outcome models include the control variables. In order to ensure that the models were reliable and valid, the assumptions were assessed. To avoid overfitting the models, Tabachnick and Fidell (2013) Suggest using the $N > 50 + 8m$ (m is the number of independent variables). Therefore, 335 was a good sample size for the predictors analysed. In addition, the multicollinearity assumption was tested by calculating the variance inflation factor (VIF) and tolerance values for each predictor in the model. A VIF value of 1 shows the minimum value of collinearity, which indicates there is no multicollinearity. In practice, there is always some collinearity between the predictors. Generally, a VIF number greater than five is a concerning level of multicollinearity (James et al., 2013). Moreover, Allison (1999) recommends that a tolerance level below .40 concerns the existence of multicollinearity. The results showed that the highest VIF observed was 1.794, and the lowest tolerance value was 0.557, indicating no multicollinearity among the predictors. The homoscedasticity and normality of residuals were assessed visually using a P-P plot and a scatterplot of the standardised residuals for homoscedasticity. The results suggested that the assumption of homoscedasticity and normality of residuals were met.

Table 6.12 Variables included in the multivariable models for well-being outcomes.

Predictors	Positive well-being	Negative well-being	Physical health	Flourishing
Control variables and established predictors	**Student stressors** (continuous) **Social support** (continuous) **Positive coping** (continuous) **Negative coping** (continuous) **Psychological capital** (continuous) **Low work-life balance** (continuous) **Workload** (continuous) **Flow** (continuous) **Low rumination** (continuous)	**Sex** (categories: male, female, other) **Student stressors** (continuous) **Social support** (continuous) **Positive coping** (continuous) **Negative coping** (continuous) **Psychological capital** (continuous) **Low work-life balance** (continuous) **Workload** (continuous) **Low rumination** (continuous)	**Sex** (categories: male, female, other) **Student stressors** (continuous) **Social support** (continuous) **Positive coping** (continuous) **Negative coping** (continuous) **Psychological capital** (continuous) **Flow** (continuous)	**Student stressors** (continuous) **Social support** (continuous) **Positive coping** (continuous) **Negative coping** (continuous) **Psychological capital** (continuous) **Low work-life balance** (continuous) **Workload** (continuous) **Flow** (continuous) **Low rumination** (continuous)
HRB predictors	**Breakfast** (continuous) **Fruit and veg** (continuous) **Junk snack** (continuous) **Junk meals** (continuous) **Energy drinks** (continuous) **Cola** (continuous) **Coffee** (continuous) **Tea** (continuous) **Exercise** (continuous; factor score) **Sleepiness** (continuous)	**Breakfast** (continuous) **Fruit and veg** (continuous) **Junk snacks** (continuous) **Junk meals** (continuous) **Energy drinks** (continuous) **Cola** (continuous) **Coffee** (continuous) **Tea** (continuous) **Exercise** (continuous; factor score) **Sleepiness** (continuous)	**Breakfast** (continuous) **Fruit and veg** (continuous) **Junk snacks** (continuous) **Junk meals** (continuous) **Energy drinks** (continuous) **Cola** (continuous) **Coffee** (continuous) **Tea** (continuous) **Exercise** (continuous; factor score) **Sleepiness** (continuous)	**Breakfast** (continuous) **Fruit and veg** (continuous) **Junk snacks** (continuous) **Junk meals** (continuous) **Energy drinks** (continuous) **Cola** (continuous) **Coffee** (continuous) **Tea** (continuous) **Exercise** (continuous; factor score) **Sleepiness** (continuous)
ADHD/Autism traits	**ADHD traits** (continuous; total score of ADHD) **Autism traits** (continuous; total score of AQ)	**ADHD traits** (continuous; total score of ADHD) **Autism traits** (continuous; total score of AQ)	**ADHD traits** (continuous; total score of ADHD) **Autism traits** (continuous; total score of AQ)	**ADHD traits** (continuous; total score of ADHD) **Autism traits** (continuous; total score of AQ)

Table 6.13 Variables included in the multivariable models for SDQ outcome.

Predictors	Conduct problems	Hyperactive behaviour	Emotional problems	Peer problems	Prosocial behaviour
Control variables and established predictors of WPQ	**Sex** (male, female, other) **Student stressors** (continuous) **Social support** (continuous) **Positive coping** (continuous) **Psychological capital** (continuous) **Flow** (continuous)	**University year** (first, second) **Sex** (male, female, other) **BMI** (continuous) **Student stressors** (continuous) **Social support** (continuous) **Positive coping** (continuous) **Negative coping** (continuous) **Psychological capital** (continuous) **Low work-life balance** (continuous) **Workload** (continuous) **Flow** (continuous) **Low rumination** (continuous)	**Sex** (male, female, other) **Student stressors** (continuous) **Social support** (continuous) **Positive coping** (continuous) **Negative coping** (continuous) **Psychological capital** (continuous) **Low work-life balance** (continuous) **Workload** (continuous) **Flow** (continuous) **Low rumination** (continuous)	**University year** (first, second) **Sex** (male, female, other) **Student stressors** (continuous) **Social support** (continuous) **Positive coping** (continuous) **Negative coping** (continuous) **Psychological capital** (continuous) **Low work-life balance** (continuous) **Flow** (continuous)	**Sex** (male, female, other) **Social support** (continuous) **Positive coping** (continuous) **Workload** (continuous) **Flow** (continuous)
HRB predictors	**Breakfast** (continuous) **Fruit and veg** (continuous) **Junk snacks** (continuous) **Junk meals** (continuous) **Energy drinks** (continuous) **Cola** (continuous) **Coffee** (continuous) **Tea** (continuous) **Exercise** (continuous; factor score) **Sleepiness** (continuous)	**Breakfast** (continuous) **Fruit and veg** (continuous) **Junk snacks** (continuous) **Junk meals** (continuous) **Energy drinks** (continuous) **Cola** (continuous) **Coffee** (continuous) **Tea** (continuous) **Exercise** (continuous; factor score) **Sleepiness** (continuous)	**Breakfast** (continuous) **Fruit and veg** (continuous) **Junk snacks** (continuous) **Junk meals** (continuous) **Energy drinks** (continuous) **Cola** (continuous) **Coffee** (continuous) **Tea** (continuous) **Exercise** (continuous; factor score) **Sleepiness** (continuous)	**Breakfast** (continuous) **Fruit and veg** (continuous) **Junk snacks** (continuous) **Junk meals** (continuous) **Energy drinks** (continuous) **Cola** (continuous) **Coffee** (continuous) **Tea** (continuous) **Exercise** (continuous; factor score) **Sleepiness** (continuous)	**Breakfast** (continuous) **Fruit and veg** (continuous) **Junk snack** (continuous) **Junk meals** (continuous) **Energy drinks** (continuous) **Cola** (continuous) **Coffee** (continuous) **Tea** (continuous) **Exercise** (continuous; factor score) **Sleepiness** (continuous)
ADHD/Autism traits	**Total ADHD score** (continuous) **Total autism score** (continuous)	**Total ADHD score** (continuous) **Total autism score**(continuous)	**Total ADHD score** (continuous) **Total autism score** (continuous)	**Total ADHD score** (continuous) **Total autism score** (continuous)	**Total ADHD score** (continuous) **Total autism score** (continuous)

6.4.3.1 Association between HRBs, ADHD/Autistic Traits, and Positive Well-being

A multiple linear regression (Enter) method was used to identify the HRB factors associated with positive well-being. The model of positive well-being was statistically significant ($F [21, 313] = 8.17$, $p < 0.001$, $R^{2adj} = 0.311$). The model explained 31.1% of the variance in positive well-being. Student stressors ($\beta = -0.208$, $p = 0.001$) and psychological capital ($\beta = 0.400$, $p = 0.001$) were good predictors of positive well-being. Increased exercise was associated with higher positive well-being, although the relationship was only marginally significant ($\beta = 0.096$, $p = 0.059$). Notably, the other HRB variables, ADHD and autism trait scores, were not significantly associated with positive well-being.

6.4.3.2 Association between HRBs, ADHD/Autistic Traits, and Negative Well- being

Multiple linear regression was used to conduct multivariate analyses to identify the appropriate predictors of negative well-being. The model fit of the regression was significant ($F [21, 313] = 11.49$, $p < 0.001$, $R^{2\ adj.} = 0.397$); the model explained 39.7% of the variance in negative well-being. There was an association between negative well-being, high student stressors, and low psychological capital ($\beta = 0.393$ $p < 0.001$, $\beta = -0.218$ $p < 0.001$, respectively). None of the other variables were significant.

6.4.3.3 Association between HRBs, ADHD/Autistic Traits, and Physical Health

Multiple linear regression analyses were conducted for physical health. The model fit was statistically significant ($F [19, 315] = 5.33$, $p < 0.001$, $R^{2\ adj.} = 0.198$). The model explained 19.8% of the variance in physical health. There was an association between flow and increased physical health ($\beta = 0.165$, $p = 0.004$). Tea consumption and exercise were associated with better physical health ($\beta = 0.107$, $p = 0.035$), ($\beta = 0.277$, $p = 0.001$), respectively. While sleepiness was associated with a lower likelihood of good physical health ($\beta = -\ 0.119$, $p = 0.033$), none of the other variables was significant.

6.4.3.4 Association between HRBs, ADHD/Autistic Traits, and Flourishing

The multiple linear regression model was significant ($F [21, 313] = 19.67$, $p < 0.001$, $R^{2\ adj.} = 0.540$). The model explained 54% of the variance in flourishing. However, the HRB variables and ADHD and autism trait scores appeared to have a statistically insignificant correlation with flourishing. The well-being predictors showed the usual effect on flourishing. Therefore, student stressors ($\beta = -0.110$, $p = 0.020$), social support ($\beta = 0.127$, $p = 0.006$), negative coping ($\beta = -0.105$, $p = 0.030$), psychological capital ($\beta = 0.0376$, $p = 0.001$), flow ($\beta = 0.255$, $p = 0.001$), and low rumination ($\beta =$

0.110, p = 0.005) were good predictors of flourishing.

6.4.3.5 Association between HRBs, ADHD/Autistic Traits, and Conduct problems

The multiple linear regression model of conduct problems was statistically significant ($F [18, 316] = 3.56$, $p < 0.001$, $R^{2\ adj.} = 0.121$); the model explained 12.1% of the variance in conduct problems. This indicates that there were significant correlations between conduct problems, autistic traits and ADHD traits, although ADHD was only marginally significant ($\beta = 0.147$, $p = 0.008$ and $\beta = 0.116$, $p = 0.057$, respectively). Moreover, the multivariate analysis results of conduct problems showed that social support ($\beta = -0.200$, $p = 0.002$) and daytime sleepiness ($\beta = -0.125$, $p = 0.033$) were associated with a lower likelihood of conduct problems.

6.4.3.6 Association between HRBs, ADHD/Autistic Traits, and Emotional Problems

The multiple linear regression model of emotional problems was statistically significant ($F [22, 312] = 13.32$, $p < 0.001$, $R^{2\ adj.} = 0.448$). The model explained 44.8% of the variance in emotional problems. Exercising was associated with a lower likelihood of having emotional problems ($\beta = -0.148$, $p = 0.001$). High coffee consumption ($\beta = 0.105$, $p = 0.015$), daytime sleepiness ($\beta = 0.107$, $p = 0.025$), ADHD traits ($\beta = 0.102$, $p = 0.036$), and autistic traits ($\beta = 0.097$, $p = 0.028$) correlated with a greater risk of emotional problems. The well-being predictors that showed a significant relationship in the emotional problems model were student stressors ($\beta = 0.121$, $p = 0.020$), negative coping ($\beta = 0.139$, $p = 0.009$), and psychological capital ($\beta = -0.292$, $p = 0.001$).

6.4.3.7 Association between HRBs, ADHD/Autistic Traits, and Hyperactive Behaviour

The hyperactivity model in multiple linear regression was statistically significant ($F [24, 310] = 12.44$, $p < 0.001$, R2 adj. = 0.451). The model explained 45.1% of the variance of hyperactivity. It was found that daytime sleepiness, junk meal and coffee consumption, and exercise were associated with increased likelihood of hyperactive behaviour ($\beta = 0.135$, $p = 0.005$; $\beta = 0.120$, $p = 0.008$; $\beta = 0.087$, $p = 0.045$; and $\beta = 0.092$, $p = 0.045$, respectively). There were positive relationships between ADHD traits ($\beta = 0.373$, $p = 0.001$), autistic traits ($\beta = 0.159$, $p = 0.001$), and hyperactive behaviour. In addition, flow and positive coping showed a relationship with reduced hyperactive behaviour ($\beta = -0.116$, $p = 0.016$ and $\beta = -0.104$, $p = 0.039$, respectively).

6.4.3.8 Association between HRBs, ADHD/Autistic Traits, and Peer Problems

A multiple linear regression test of peer problems was statistically significant ($F [21, 313] = 5.72$, $p < 0.001$, $R^{2\ adj.} = 0.229$). The model explained 22.9% of the variance in peer problems. The results in the peer problems model suggest that autistic traits (β = 0.232, p = 0.001) and high cola consumption (β = 0.111, p = 0.034) were associated with increased likelihood of peer problems. Social support (β = −0.258, p = 0.001) and psychological capital (β = −0.188, p = 0.003) were associated with decreased likelihood of having peer problems.

6.4.3.9 Association between HRBs, ADHD/Autistic Traits, and Prosocial Behaviour

The model of prosocial behaviour was statistically significant (F [17, 317] = 6.34, p < 0.001, $R^{2\ adj.}$ = 0.214). The model explained 21.4% of the variance of prosocial behaviour. As in the univariate analyses, there was a positive association between prosocial behaviour and fruit and vegetable consumption (β = 0.141, p = 0.010) and daytime sleepiness (β = 0.247, p = 0.001). There was also a negative association between prosocial behaviour and autistic traits (β = −0.183, p = 0.001). Social support was a good predictor of prosocial behaviour (β = 0.162, p = 0.006); see Table 6.14 for all beta and alpha values for the predictors that were significant in the multivariate analyses.

Table 6.14 Significant associations between predictors, well-being, and SDQ outcomes in multiple linear regression analyses.

Outcomes	Predictors	Beta	p-values
Positive well-being	Student stressors	−0.208	<0.001
	Psychological capital	0.400	<0.001
Negative well-being	Student stressors	0.393	<0.001
	Psychological capital	−0.218	<0.001
Flourishing	Student stressors	−0.110	0.020
	Social support	0.127	0.006
	Negative coping	−0.105	0.030
	Psychological capital	0.376	<0.001
	Flow	0.255	<0.001
	Low rumination	0.110	0.005
Physical health	Exercise	0.277	<0.001
	Tea	0.107	0.035
	Flow	0.165	0.004
	Sleepiness	-0.119	0.033
Conduct problems	Social support	−0.200	0.002
	Sleepiness	−0.125	0.033
	Autistic traits	0.147	0.008
	Student stressors	0.121	0.020
	Negative coping	0.139	0.009

Emotional problems	Psychological capital	−0.292	<0.001
	Coffee	0.105	0.015
	Exercise	−0.148	0.001
	Sleepiness	0.107	0.025
	Autistic traits	0.097	0.028
	ADHD traits	0.102	0.036
Hyperactive behaviour	Positive coping	−0.104	0.039
	Flow	−0.116	0.016
	Coffee	0.087	0.045
	Sleepiness	0.135	0.005
	Junk meals	0.120	0.008
	Exercise	0.092	0.045
	Autistic traits	0.159	<0.001
	ADHD traits	0.373	<0.001
Peer problems	Social support	−0.258	<0.001
	Psychological capital	−0.188	0.003
	Cola	0.111	0.034
	Autistic traits	0.232	<0.001
Prosocial behaviour	Gender	−0.187	<0.001
	Social support	0.162	0.006
	Fruit and vegetables	0.141	0.010
	Sleepiness	0.247	<0.001
	Autistic traits	−0.183	<0.001

***Note:** The values of beta (β) are standardised.*

6.4.4 Interaction Analysis

An investigation into whether the associations between health-related behaviour variables, well-being, and SDQ outcomes that were found to be significant in the multivariate analysis were dependent on ADHD and autistic traits was carried out through the use of interaction analysis. The procedure for analysing these interactions was nearly identical to that used to investigate the primary impacts of the multivariate analysis (i.e., using the same control variables in the multivariate linear regression analyses) referred to in Tables 6.12 and 6.13, except the addition of the interaction terms of health-related behaviours × ADHD traits, and health-related behaviours × autistic traits to the model.

Given the number of analyses conducted, one should treat the significant results cautiously. However, three notable interactions were discovered and are shown in

Figures 6.1 to 6.3. The first interaction was between exercise and ADHD traits on physical health. Taking part in regular exercise is associated with better physical health outcomes. The second significant interaction was between ADHD traits and daytime sleepiness on prosocial behaviour outcomes. which suggests a positive relationship between daytime sleepiness and prosocial behaviours. Another significant finding was an interaction between daytime sleepiness and autistic traits on conduct behaviours. Higher conduct problems were observed in those with high autistic traits during periods of low daytime sleepiness. These interactions are complex to interpret. Given the number of analyses conducted, these interactions may be chance effects. Tables 6.15 and 6.16 contain beta values and p-values that describe the effect of the interactions between health-related behaviour variables and ADHD/autistic traits on well-being and SDQ results.

Table 6.15 Interactions between health-related behaviours and ADHD traits about well-being and SDQ outcomes.

Outcomes	Interaction terms	β	Sig
Physical health	Exercise*ADHD traits	-.304	.005
	Tea*ADHD traits	-.115	.374
	Sleepiness* ADHD traits	-.238	.322
Hyperactive behaviour	Junk meals*ADHD traits	.027	.910
	Coffee*ADHD traits	-.040	.709
	Exercise*ADHD traits	.050	.584
	Sleepiness*ADHD traits	.024	.909
Conduct problems	Sleepiness*ADHD traits	-.052	.836
Emotional problems	Coffee*ADHD traits	.147	.163
	Exercise*ADHD traits	.123	.174
	Sleepiness* ADHD traits	.046	.823
Peer problems	Cola*ADHD traits	.177	.176
Prosocial behaviour	Fruit and vegetables*ADHD traits	-.360	.073
	sleepiness*ADHD traits	.480	.049

***Note**: The beta (β) values are standardised—these are the variables of health-related behaviours in the interaction terms that were significant in the multivariate analysis.*

Table 6.16 Interactions between health-related behaviours and autism traits about well-being and SDQ outcomes.

Outcomes	Interaction terms	β	Sig
Physical health	Exercise*autism traits	-.065	.527
	Tea*autism traits	-.181	.181
	Sleepiness* autism traits	-.267	.209
Hyperactive behaviour	Junk meals*autism traits	.061	.760
	Coffee* autism traits	.070	.463
	Exercise*autism traits	.098	.274
	Sleepiness* autism traits	-.129	.477
Conduct problems	Sleepiness*autism traits	-.485	.025
Emotional problems	Coffee*autism traits	-.014	.882
	Exercise*autism traits	.070	.429
	Sleepiness*autism traits	.161	.369
Peer problems	Cola*autism traits	-.104	.394
Prosocial behaviour	Fruit and veg*autism traits	.232	.265
	Sleepiness*autism traits	.353	.089

***Note**: The values of beta (β) are standardised. The health-related behaviour variables in the interaction terms were significant in the multivariate analyses.*

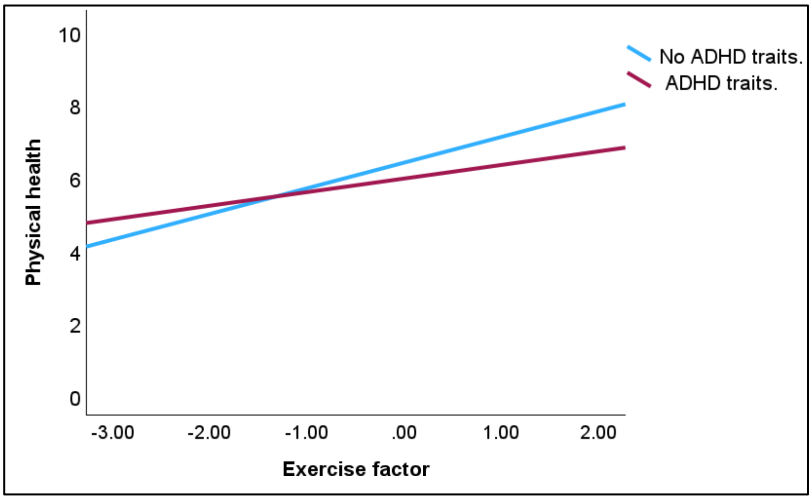

Figure 6.1 Interaction between exercise and ADHD traits on physical health.

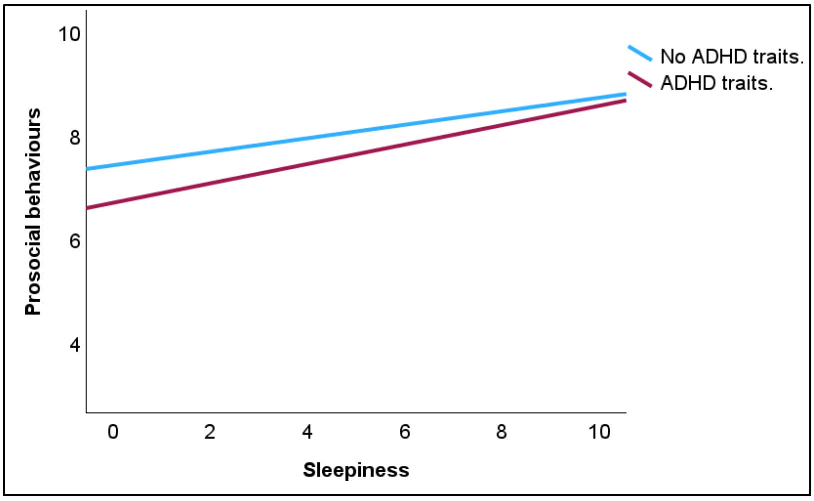

Figure 6.2 Interaction between sleepiness and ADHD traits on prosocial behaviours.

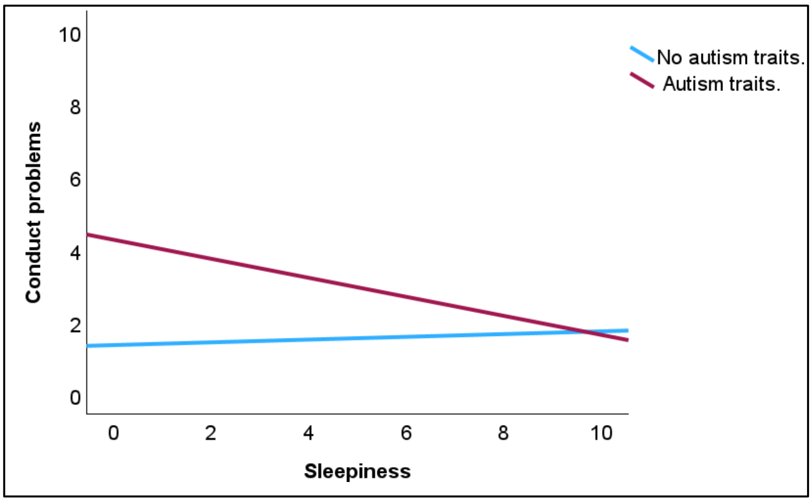

Figure 6.3 Interaction between sleepiness and autism traits on conduct problems.

6.5 Discussion

This study aimed to conduct multivariate analyses to determine the impact of health-related behaviours and ADHD/autism traits on the well-being of university students. Its specific aim was to determine whether the consumption of breakfast, fruit and vegetables, junk snacks, junk meals, energy drinks, cola, coffee, and tea; exercise; sleepiness; ADHD traits; and autism traits were predictive of well-being and SDQ outcomes after controlling for established well-being predictors (Smith & James, 2023). The study replicated the significant effects of the established well-being predictors, which gave greater confidence in the more novel analyses.

The univariate analysis showed that people with higher breakfast, fruit and vegetable consumption, and regular exercise tended to report more positive well-being and flourishing. At the same time, sleepiness was associated with lower positive well-being and flourishing. Conversely, breakfast, fruit and vegetable consumption, and exercise were linked to lower negative well-being, while sleepiness was associated with higher negative well-being. In the multivariate analyses, where established well-being predictors were controlled for, no variables from HRBs, ADHD/autism traits were statically significant in positive well-being, flourishing, and negative well-being models. In univariate analyses, fruit and vegetables, tea consumption, and exercise engagement were associated with improved physical health. Tea, exercise, and sleepiness remained significant in the multivariate regression model of physical health, which indicates a relationship between tea and exercise and higher physical health, whereas sleepiness was associated with lower physical health. There were relationships between positive well-being, hyperactive behaviours, and junk meal consumption, with the latter being associated with reducing positive well-being and increasing hyperactivity. This is consistent with the systematic review results obtained by (Hafizurrachman and Hartono, 2021). Moreover, it was found that fruit and vegetable consumption was linked to increased prosocial behaviours in both the univariate and multivariate analyses. Linear regression revealed that the high consumption of cola was associated with increased likelihood of experiencing peer problems; this finding was found in univariate as well. Although coffee was not associated with hyperactive behaviours and emotional problems in the univariate analysis, it became significant in the multivariate analysis, indicating that the high consumption of coffee increases the likelihood of hyperactive behaviours and emotional problems. This could be interpreted by relationships between ADHD/autism traits and coffee on the outcomes; a study involving 2,259 individuals from the general population investigated the relationship between ADHD traits, caffeine consumption, and well-being. Utilising the Adult ADHD Self-report Scale (ASRS) to assess ADHD traits, the study revealed that the severity of caffeine uses correlates with an increase in ADHD traits. In contrast, both caffeine uses and ADHD traits are linked to decreased well-being (Distelberg et al., 2017). In univariate analyses, sleepiness was associated with emotional problems, hyperactive behaviours, and prosocial behaviours, and it remained so in multivariate analyses.

ADHD and autistic traits showed several significant correlations in the univariate analysis. However, they were not significantly associated with well-being in the multivariate analysis, confirming results from a previous study involving university students (Garcha & Smith, 2023). The ADHD and autism scores showed significant associations with the SDQ outcomes. Those with high ADHD/autistic traits were more likely to have conduct problems, hyperactive behaviours, and emotional problems at the multivariate level. In addition, only those with high autistic traits were more likely to have peer problems and less likely to show prosocial behaviours. These results confirm that individuals with autistic traits have difficulties building friendships and avoiding and being anxious in social situations (Black et al., 2023). The associations between ADHD/autistic traits and the SDQ outcomes may reflect the SDQ measures being critical components of ADHD and autism. In addition, the well-being predictors were not strong predictors of the SDQ scores, which meant that covarying them in the SDQ analysis had less effect than when the WPQ outcomes were analysed. Few interactions were observed between ADHD/autistic traits and health-related behaviours. Given the number of analyses, one would expect certain significant effects by chance. The interpretation of some of the significant interactions was also tricky.

6.6 Limitations

One of the limitations of this study was that the participants were recruited from a single department in one university, which may limit the generalisability of the findings to undergraduate students at other universities. Furthermore, the study's cross-sectional design prevents the establishment of causal relationships. It is also important to note that the study aimed to investigate the associations between health-related behaviours, well-being, and traits of ADHD and autism. Thus, it was considered important to measure these on people with previous diagnoses of ADHD and autism. These observations, therefore, will be followed up in Chapters 7 and 8.

6.7 Conclusion

There was a strong relationship between the established predictor and the outcome variables of the WPQ, which confirmed the results of previous studies. The results also confirm HRB variables' associations with well-being and SDQ outcomes. The study did not find significant relationships between ADHD/autistic traits and well-being when established predictors were covaried, confirming previous findings. However, the ADHD/autistic trait scores were good predictors of the SDQ outcomes, confirming predictions based on previous research. More research is needed to determine whether the interactions between predictors are robust. Furthermore, longitudinal methodology should be used to determine the underlying mechanism. The following chapter will investigate the relationships between health-related behaviours, well-being, and ADHD/autistic traits in secondary students to determine whether the results obtained in the present study generalise to a sample differing in age, place of residence, and school location. Several studies have found that anxiety and depression are strongly linked to autistic and ADHD traits, and these outcomes were included in the following study.

Chapter 7: Association between Health-Related Behaviours, ADHD/Autism Traits and Well-being in Secondary Students

7.1 Introduction

Much of the Student WPQ research has involved university students (Alharbi & Smith, 2019; Alheneidi & Smith, 2020a, 2020b; Omosehin & Smith, 2019; A. P. Smith & Firman, 2019, 2020). However, there is a study with secondary school students from a school in South Wales was conducted by (Smith and James, 2023) but did not include ADHD/autism traits in the study. The Cardiff University sample and the secondary school sample differed in terms of age; gender ratio – the university sample was mainly female; socioeconomic status – the secondary school is in a deprived area in the Welsh valleys; the language used in teaching – the secondary school students are taught mainly in Welsh; residence – the secondary school students live at home. It is also essential to use different samples in research on health-related behaviours. All of the differences mentioned above may influence dietary choice and acceptability. Furthermore, university students may have other health-related behaviours (smoking, drug use, and alcohol consumption) that may be less frequent in younger students living at home. If one examines the research on diet and well-being, one finds 6,921 studies on university students (PubMed). Although less than half of the similar studies are on secondary school students (N=3,329), there is substantial research on both groups. In contrast, there are far fewer studies of ADHD traits and well-being among university and secondary school students (university: N= 39; secondary: N=14). A similar result is seen for autistic traits and well-being (university: N=95; secondary: N=27). Again, more research on these topics is being carried out using university samples.

7.2 Overview of the Chapter

The present study used a methodology similar to the previous study, with the main difference being the sample size. The participants were from a Cornish Academy based in a deprived area of the UK. Another difference was in the analysis, where the combined effects approach was used to reduce the established predictors in the WPQ to a single variable. This combined effects variable strongly predicts well-being outcomes in occupational samples (McNamara et al., 2020; A. Smith, 2021, 2022). Combined effects analyses have not yet been used with the Student WPQ; thus, the present study tested this approach. Additionally, anxiety and depression variables were added to the outcomes, as these are often co-morbid factors in ADHD and autism (Mayes et al., 2011; Rosbrook & Whittingham, 2010).

Based on the previous study, the following hypotheses were tested:

1. The usual profile of associations will be observed for the WPQ variables, with the combined predictors variable showing the strongest associations.
2. The WPQ predictors will show weaker associations with the SDQ outcomes.
3. Univariate analyses will show significant associations between health-related behaviours and outcomes. These critical effects will significantly reduce in multi-variate analyses covarying the established predictors.
4. Univariate analyses will show significant associations between ADHD/autistic traits and outcomes. These significant effects will be significantly reduced in multivariate analyses covarying the established predictors.
5. There will be little evidence of interactions between health-related behaviours and ADHD/autistic traits.

7.3 Methods

7.3.1 Ethical Approval

This study was approved by Cardiff University's School of Psychology Ethics Committee (ethical number: EC2003105988R2A).

7.3.2 Participants

The target population for this study were secondary students from a Cornish Academy secondary school. The research sample initially recruited 205 students. Five participants were excluded due to incomplete responses to the survey questions. Therefore, the final sample consisted of 200 participants. The sample comprised 41.5% male students (n=83) and 58.5% female students (n=117). In terms of the school year of the students, the sample was 58.5% for Year 8 (n=117), 32.5% for Year 9 (n=65), and 18% for Year 7 (n=18). Table 7.1 shows the school year and the characteristics of the students.

Table 7.1 Descriptive results of demographic variables.

Gender	Male N (%)	Female N (%)	Total N (%)	
	83 (41.5%)	117 (58.5%)	200	
Year of Study	7 N (%) (11-12 years)	8 N (%) (12-13 years)	9 N (%) (13-14 years)	Total
	18 (9%)	117 (58.5%)	65 (32.5%)	200

7.3.3 Materials

The tools used in this study were described in detail in Chapter 6. The short-form Diet and Behaviours Scale (Richards, Malthouse, & Smith, 2015) was used to measure health-related behaviour variables, and the short-form Student Well-being Process Questionnaire was used to assess specific aspects of established predictors and well-being outcomes (Smith & James, 2023). Two variables, anxiety and depression, were also included. As in Study 1, the Autism Spectrum Quotient was used to calculate the total scores of autistic traits. The ADHD self-report scale was used to calculate the total scores of part A for ADHD traits, and the SDQ was used to measure behavioural outcomes.

7.3.4 Study Design and Procedure

The data were collected through an online survey hosted by Qualtrics as part of an online self-report survey methodology, taking approximately 20 minutes to complete. The survey was then analysed using IBM SPSS 29 to produce precise tests of the hypotheses. The study examined cross-sectional associations between health-related behaviours: breakfast consumption, fruit and vegetables, junk snacks, junk meals, energy drinks, cola, coffee, tea, exercise, sleepiness, well-being, and SDQ outcomes. Associations between well-being and the total scores for ADHD/autistic traits were also examined. The established predictors were also covaried in analyses examining the associations between the other variables and well-being in multivariate analyses. It should be noted that the regression model did not include all of the established predictors as covariates; only the established predictors were significantly related to the outcomes. Tables 7.12 and 7.13 show the established predictors for each outcome. The outcome variables were positive well-being, negative well-being, flourishing, physical health, depression, and anxiety. These outcomes were taken from the WPQ. Other outcome variables were taken from the SDQ: conduct problems, hyperactive behaviour, emotional problems, peer problems, and prosocial behaviour.

7.3.5 Statistical Analysis

The descriptive statistics were computed using the mean and standard deviation of the continuous variables as descriptive measures and percentages for category variables. A skewness test was performed to determine the normality of the data. Based on Tabachnick and Fidell (2013), skewness values between −1.5 and +1.5 are considered normal distributions. As a result, all variables were normally distributed, except for the beverages (energy drinks, cola, coffee, and tea), which had more than +3 (positive skewness) values. With regard to missing data, all variables had less than 10% of missing data, except for some items in the AQ-10 and ASRS, which were more than 10%, so they were replaced with mean values.

Factor analysis was conducted for the three exercise items employing the same method reported in the statistical analysis section of Chapter 6 (refer to Section 6.3.5, Chapter 6), which extracted a single exercise factor. The correlation matrix (Pearson) was constructed for contentious variables, and the independent-sample t-test was constructed for nominal variables as a univariate analysis of the relationship between the predictor variables and the outcomes. To evaluatethe associations between HRB on well-being while controlling for well-being covariates and demographics, multiple linear regression analyses (Enter) were performed for each outcome.

The combined effects approach was also used with the established WPQ predictors. This method was applied in a secondary analysis study of nurses, and the findings validated the possibility of combining the established predictors from the well-being process model into a single item (Andrew Smith, 2022). The WPQ-established predictors were combined into a single score by summing the negative well-being predictors (student stressors, negative coping) and the reverse-scored positive predictors (e.g., social support, psychological capital). A new variable of combined established predictors labelled negative factor, was introduced; a high score on this variable represented a strong predictor of negative well-being.

7.4 Results

7.4.1 Descriptive Analysis

7.4.1.1 Descriptive Statistics for WPQ Variables

The WPQ questions are responded to on a scale from 1 (disagree) to 10 (strongly agree) (see Table 7.2 for descriptive statistics for the WPQ variables in Study 2). As in the previous survey, daytime sleepiness had the most considerable mean value on the scale (Study 1 = 7.13, Study 2 = 7. 30). Additionally, high workload also appeared to have a high average score (m = 6.26, SD = 2.85). Again, this was similar to Study 1 (m = 7.12, SD = 1.88). However, negative coping also had a high average (m = 6.63, SD = 2.91), as did negative well-being (m = 6.21, SD = 2.65), which was not observed in Study 1.

Table 7.2 Descriptive analysis of established predictors of well-being.

The Predictors	Min.	Max.	Mean	SD	N
Student stressors	1	10	5.96	2.97	197
Social support	1	10	4.83	2.77	198
Positive coping	1	10	4.10	2.60	196
Negative coping	1	10	6.63	2.91	197
Psychological cap	1	10	4.40	2.49	196
Work-life balance	1	10	5.93	3.08	196
High workload	1	10	6.26	2.85	194
Sleepiness	1	10	7.30	2.81	196
Flow	1	10	5.08	2.29	194
Low Rumination	1	10	4.59	2.71	194

Note: *Variables taken from WPQ.*

Table 7.3 Descriptive analysis of the outcomes of well-being.

Outcomes	Min.	Max.	Mean	SD	N
Positive well-being	1	10	5.35	2.45	199
Negative well-being	1	10	6.21	2.65	198
Anxiety	1	10	5.84	2.79	198
Depression	1	10	4.67	2.94	199
Physical health	1	10	5.53	2.49	195
Flourishing	1	10	4.67	2.17	196

Note: *Variables taken from WPQ.*

7.4.1.2 Descriptive Statistics for Health-Related Behaviour Variables

The consumption of breakfast, fruit and vegetables, junk meals, and junk snacks was measured using a five-point Likert scale ('every day', 'most days', 'once or twice a week', 'once a month', 'never'). This study sample (Study 2) had a less healthy lifestyle than the sample in the previous survey. The secondary students reported drinking more cola (m = 2.47) and energy drinks (m = 1.60) compared to university students (m = 1.26 for cola and m = 0.60 for energy drinks). Furthermore, the proportion of students who did not eat breakfast was more significant for secondary students (Study 1 = 6.6%; Study 2 = 28%). There were no significant differences in the percentages of junk food consumption across the samples in both studies. In addition, mild and moderate exercise did not appear to differ between the two samples. At the same time, it was observed that secondary students engaged in more vigorous and energetic exercise than university students (Study 1 mode [37.3%] = never; Study 2 mode [30.5%] = three times a week or more). The factor analysis of the three exercise items revealed that a single factor (exercise) was extracted. The initial eigenvalue for this factor was 1.740, and it accounted for 58.01% of the variance. The factor loadings (without rotation) were computed as follows: vigorous, 0.820; moderate, 0.804; light exercise, 0.649.

Table 7.4 Descriptive analyses of the DABS variables.

Food variables	N	Every day	Most days (3-6)	Once or twice a week	Once a month	Never
Breakfast	194	52 (26%)	35 (17.5%)	39 (19.5%)	12 (6%)	56 (28%)
Fruit and veg	194	36 (18%)	79 (39.5%)	43 (21.5%)	11 (5.5%)	25 (12.5%)
Junk snacks	193	55(27.5%)	82 (41%)	45 (22.5%)	7 (3.5%)	4 (2%)
Junk meals	193	5 (2.5%)	9 (4.5%)	56 (28%)	113 (56.5%)	10 (5%)
Exercise	**N**	**Three times a week or more**	**Once or twice a week**	**One to three times a month**	**Never/ hardly ever**	
Mild	187	130 (65%)	33 (16.5%)	9 (4.5%)	15 (7.5%)	
Moderate	186	52 (26%)	61 (30.5%)	38 (19%)	35 (17.5%)	
Vigorous	183	61 (30.5%)	45 (22.5%)	28 (14%)	49 (24.5%)	
Weekly caffeine (cups per week)	**N**	**Min.**	**Max.**	**Mean**	**SD**	
Energy drinks	183	0	28	1.61	3.28	
Cola	183	0	40	2.47	4.31	

Coffee	183	0	24	1.95	4.06
Tea	180	0	40	3.51	6.29

7.4.1.3 Descriptive Statistics for ADHD/Autistic Trait Questionnaires

Tables 7.5 and 7.6 show the questionnaire results measuring ADHD/autistic traits. The average AQ-10 score was m = 5.12 (SD = 1.44). This indicated that most students' scores were below the cutoff point for the AQ-10 scale. However, 73 students scored six or above. The average score for the ADHD questionnaire (ASRS) was 3.64 (SD = 1.49). The average score for ADHD was near the cutoff point of the scale, and 130 students scored four and above. Again, the high number of potential autism and ADHD cases suggests that the cutoff points are inappropriate.

Table 7.5 Descriptive analysis for ADHD/autistic trait questionnaires.

ADHD/Autism	Total Score	Min.	Max.	Mean	SD
Total score: Autism	0-10	2	9	5.12	1.44
Total score: ADHD	0-6	0	6	3.64	1.49

Table 7.6 Descriptive analysis of ADHD and autism questionnaires (cutoff points).

ADHD/Autism	Type of Score	N (%)	
Autism	No autism traits (0–5)	128	64%
	Autism traits (6–10)	72	36%
ADHD	No ADHD traits (0–3)	69	34.5%
	ADHD traits (4–6)	130	65%

7.4.1.4 Descriptive Statistics for SDQ Outcomes

The descriptive statistics for the SDQ variables are shown in Table 7.7. The current sample had high average scores for prosocial and hyperactivity behaviour as in the previous study. Conversely, they had low scores for conduct problems and peer problems. However, the current study found that the scores for conduct problems (m = 4.30, SD = 2.10) were higher than those in the previous study (m = 1.74, SD = 1.39). Peer problems also appeared to be higher in Study 2 (Study 1 m = 2.28, Study 2 m = 3.88). In contrast, the average prosocial score was lower in Study 2 (Study 1 m = 8.21, Study 2 m = 6.58). However, there were no differences between emotional problems and hyperactivity behaviour in either study.

Table 7.7 Descriptive analysis of SDQ outcomes.

SDQ Outcomes	Total Score	Min.	Max.	Mean	SD
Conduct problems	0–10	1	10	4.30	2.10
Hyperactivity behaviour	0–10	0	10	6.64	2.39
Emotional problems	0–10	0	10	5.81	2.73
Prosocial behaviour	0–10	0	10	6.58	2.39
Peer problems	0–10	0	9	3.88	1.80

7.4.2 Univariate Analyses

7.4.2.1 Associations between Control Variables and Outcomes

To examine the relationship between the outcomes and predictor variables (negative factors, low work-life balance, flow, and low rumination), univariate analyses were performed using Pearson's correlations for continuous variables and between-subjects t-tests and one-way ANOVA for categorised variables, see Tables (7.8 and 7.9). Those variables that showed significant correlation were included in the multivariate models of each outcome, see Tables (7.10 and 7.11). The results replicated the associations between the established predictors and the outcomes. The combined negative factor score had higher correlations than the individual variables.

Table 7.8 Relationships between control variables and SDQ outcomes.

Control Variables	Emotional problems		Conduct problems		Peer problems		Hyperactivity behaviour		Prosocial behaviour	
	r	p	r	p	r	p	r	p	r	p
Negative factor score	**.537**	**<.001**	**.339**	**<.001**	**.341**	**<.001**	**.400**	**<.001**	-.058	.412
Low work-life balance	**.212**	**.003**	.133	.062	.043	.550	.099	.165	**-.203**	**.004**
High workload	**.257**	**<.001**	.103	.149	.135	.062	**.166**	**.020**	-.019	.785
Flow	-.084	.240	**-.177**	**.013**	-.125	.083	**-.284**	**<.001**	**.233**	**<.001**
Low rumination	-.131	.067	-.121	.088	**-.154**	**.033**	-.057	.424	.095	.179
Differences	**t**	**p**	**t**	**p**	**t**	**p**	**t**	**p**	**t**	**p**
Gender	**-5.08**	**0.001**	-.448	0.655	**-2.30**	**.022**	-1.54	0.123	**-3.06**	**0.002**
School year	**F**	**p**	**F**	**p**	**F**	**p**	**F**	**p**	**F**	**p**
	.340	.712	1.856	.159	.826	.439	2.143	.120	.895	.410

Note: *All correlations are Pearson's (two-tailed). p< 0.05 are displayed in bold.*

Table 7.9 Relationships between control variables and well-being outcomes.

Control Variables	Positive well-being		Negative well-being		Physical health		Flourishing		Anxiety		Depression	
	r	p	r	p	r	p	r	p	r	p	r	p
Negative factors	**-.579**	**<.001**	**.641**	**<.001**	**-.267**	**<.001**	**-.499**	**<.001**	**.521**	**<.001**	**.605**	**<.001**
Low work-life balance	**-.140**	**.048**	**.341**	**<.001**	-.065	.369	-.108	.127	**.257**	**<.001**	**.292**	**<.001**
Workload	**-.216**	**.002**	**.400**	**<.001**	-.130	.070	**-.164**	**.020**	**.364**	**<.001**	**.342**	**<.001**
Flow	**.302**	**<.001**	-.102	.150	**.263**	**<.001**	**.419**	**<.001**	-.044	.538	**-.166**	**.019**
Low rumination	**.205**	**.004**	-.023	.744	**.215**	**.003**	**.171**	**.015**	-.096	.174	-.078	.270
Differences	**t**	**p**	**t**	**p**	**t**	**p**	**t**	**p**	**t**	**p**	**t**	**p**
Sex	**2.54**	**0.012**	**-4.37**	**0.001**	1.56	.119	.571	.569	**-4.79**	**0.001**	**-4.03**	**0.001**
School year	**F**	**p**	**F**	**p**	**F**	**p**	**F**	**p**	**F**	**p**	**F**	**p**
	.108	.898	.647	.525	.376	.687	.294	.745	.863	.423	1.146	.320

Note: *All correlations are Pearson's (two-tailed). p< 0.05 are displayed in bold.*

7.4.2.2 Associations between Total ADHD/Autistic Trait Scores and Outcomes

Pearson's correlation analysis was used to examine the relationship between ADHD/autistic traits and the outcome. The findings revealed that the ADHD/autistic trait scores and most outcome variables were significant or marginally significant (see Table 7.10).

7.4.2.2.1 Total Scores for ADHD Traits and Outcomes

ADHD scores were positively correlated with conduct behaviour, hyperactivity behaviour, emotional problems, and peer problems. In addition, there was a positive significant correlation between ADHD scores and anxiety, although the significance was marginal between ADHD scores and anxiety. Negative associations between ADHD scores and flourishing were observed, though the correlation between ADHD and flourishing was only marginally significant.

7.4.2.2.2 Total Scores for Autistic Traits and Outcomes

Autistic traits were positively correlated with emotional problems, conduct behaviour, hyperactivity behaviour, and peer problems. Moreover, autism scores were negatively correlated with positive well-being, flourishing, physical health, and prosocial behaviour. Table 7.10 illustrates the value of significance and the direction of correlation.

Table 7.10 Correlation matrix between the total scores for ADHD, autism, and outcomes.

Outcomes	Total Scores for ADHD		Total Scores for Autism	
	r	p	r	p
Positive well-being	-.120	.092	**-.140**	**.048**
Negative well-being	.113	.113	.090	.205
Anxiety	.136	.055	.116	.101
Depression	.030	.678	.014	.842
Flourishing	-.136	.055	**-.231**	**.001**
Physical health	-.128	.076	**-.187**	**<.009**
Conduct problems	**.163**	**.022**	**.187**	**.008**
Hyperactivity behaviour	**.412**	**<.001**	**.359**	**<.001**
Emotional problems	**.343**	**<.001**	**.193**	**.006**
Prosocial behaviour	.000	.995	**-.145**	**.040**
Peer problems	**.184**	**.011**	**.242**	**<.001**

Note: *All correlations are Pearson's (two-tailed). p< 0.05 are displayed in bold.*

7.4.2.3 Association between Health-Related Behaviours and Outcomes

For the univariate analyses, Pearson tests were performed to determine whether there was an association between health-related behaviours (consumption of breakfast, fruit and vegetables, junk snacks, junk meals, energy drinks, cola, coffee, and tea; exercise; sleepiness) and the outcome variables, see Table (7.11).

7.4.2.3.1 Correlations between Energy Drink, Cola, Coffee, and Tea Consumption and Outcomes

Energy drinks were found to have a positive correlation with negative well-being, anxiety, and depression and a negative correlation with positive well-being, physical health, and flourishing. Moreover, there was a negative correlation between energy drinks, cola, and prosocial behaviour. A positive association was found between coffee and negative well-being, anxiety, depression, emotional problems, and conduct problems. In addition, coffee intake was negatively correlated with positive well-being and flourishing.

7.4.2.3.2 Correlations between Breakfast, Fruit and Veg, Junk Snack, and Junk Meal Consumption and Outcomes

There was a positive correlation between breakfast and positive well-being, flourishing, and physical health. There were negative correlations between breakfast and negative well-being, depression, emotional problems, conduct problems, and hyperactivity behaviour. Fruit and vegetable consumption, on the other hand, was positively associated with physical health and prosocial behaviour and negatively associated with conduct problems. Furthermore, there was a negative relationship between infrequent junk snacks and meal consumption and anxiety but a positive relationship with positive well-being.

7.4.2.3.3 Correlations between Exercise, Sleepiness, and Outcomes

Increased exercise was found to be associated with better physical health, flourishing, and prosocial behaviour. Moreover, exercise was negatively correlated with negative well-being and conduct problems. Daytime sleepiness was positively associated with negative well-being, depression, emotional problems, and conduct and hyperactive behaviour.

Table 7.11 Correlation matrix for health-related behaviours and outcomes.

Outcomes	Breakfast		Fruit and veg		Junk snacks		Junk meals		Energy drinks		Cola		Coffee		Tea		Exercise		Sleepiness	
	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p
Positive well-being	**.227**	**.001**	-.068	.336	**.171**	**.015**	**.219**	**.002**	**-.295**	**.001**	-.064	.370	**-.242**	**.001**	.078	.272	.111	.119	-.11	.111
Negative well-being	**-.206**	**.003**	-.005	.939	-.122	.087	-.123	.083	**.199**	**.005**	.046	.519	**.254**	**.001**	.020	.779	**-.146**	**.039**	**.249**	**.001**
Anxiety	-.108	.128	.059	.403	**-.175**	**.013**	**-.149**	**.036**	**.138**	**.050**	-.004	.952	**.169**	**.017**	-.079	.269	-.082	.246	.117	.099
Depression	**-.218**	**.002**	.063	.376	-.082	.250	-.125	.077	**.183**	**.010**	.061	.390	**.228**	**.001**	-.086	.230	-.089	.210	**.164**	**.021**
Flourishing	**.345**	**.001**	.059	.404	.038	.589	.025	.721	**-.171**	**.015**	-.102	.151	**-.147**	**.038**	.123	.084	**.256**	**.001**	-.14	.055
Physical health	**.192**	**.007**	**.236**	**.001**	-.040	.581	.020	.783	**-.175**	**.014**	-.015	.836	-.119	.096	.088	.222	**.327**	**.001**	-.108	.134
Conduct problems	**-.202**	**.004**	**-.182**	**.010**	.079	.271	.063	.379	.097	.174	.078	.274	**.197**	**.005**	.132	.065	**-.168**	**.018**	**.176**	**.013**
Hyperactive behaviour	**-.300**	**.001**	-.084	.238	.052	.467	-.015	.834	.115	.106	.032	.653	.129	.070	.101	.156	-.136	.056	**.219**	**.002**
Emotional problems	**-.244**	**.001**	.047	.506	-.003	.964	-.051	.479	-.098	.170	-.087	.222	**.143**	**.045**	-.035	.622	-.126	.076	**.256**	**.001**
Prosocial behaviour	.113	.112	**.364**	**.001**	.015	.838	.042	.557	**-.262**	**.001**	**-.165**	**.020**	.061	.387	.026	.716	**.272**	**.001**	-.039	.588
Peer problems	-.118	.103	.059	.418	-.081	.261	**-.178**	**.013**	.066	.363	-.061	.401	.106	.144	-.027	.711	-.041	.572	.054	.454

Note: *All correlations are Pearson's (two-tailed). p< 0.05 are displayed in bold.*

7.4.3 Multivariate Analysis

Multiple linear regression models (Enter method) were used for the multivariate analysis for each outcome.

Table 7.12 Variables included in each well-being outcome model.

Predictors	Positive well-being	Negative well-being	Physical health	Flourishing	Anxiety	Depression
Covariate variables	Sex Negative factors Low work-life balance Workload Flow Low rumination	Sex Negative factors Low work-life balance Workload	Negative factors Flow Low rumination	Negative factors Workload Flow Low rumination	Sex Negative factors Low work-life balance Workload	Sex Negative factors Low work-life balance Workload Flow
HRB variables	Breakfast Fruit and veg Junk snacks Junk meals Energy drinks Cola Coffee Tea Exercise Sleepiness	Breakfast Fruit and veg Junk snacks Junk meals Energy drinks Cola Coffee Tea Exercise Sleepiness	Breakfast Fruit and veg Junk snacks Junk meals Energy drinks Cola Coffee Tea Exercise Sleepiness	Breakfast Fruit and veg Junk snacks Junk meals Energy drinks Cola Coffee Tea Exercise Sleepiness	Breakfast Fruit and veg Junk snacks Junk meals Energy drinks Cola Coffee Tea Exercise Sleepiness	Breakfast Fruit and veg Junk snacks Junk meals Energy drinks Cola Coffee Tea Exercise Sleepiness
ADHD/autism trait variables	Total ADHD score Total autism score	Total ADHD score Total autism score	Total ADHD score Total autism score	Total ADHD score Total autism score	Total ADHD score Total autism score	Total ADHD score Total autism score

Table 7.13 Variables included in each SDQ outcome model.

Predictors	Conduct problems	Hyperactivity behaviour	Emotional problems	Peer problems	Prosocial behaviour
Covariate variables	Negative factors Low work-life balance Flow Low rumination	Negative factors Workload Flow	Sex Negative factors Low work-life balance Workload Low rumination	Sex Negative factors Workload Flow Low rumination	Sex Low work-life balance Flow
HRB variables	Breakfast Fruit and veg Junk snacks Junk meals Energy drinks Cola Coffee Tea Exercise Sleepiness	Breakfast Fruit and veg Junk snacks Junk meals Energy drinks Cola Coffee Tea Exercise Sleepiness	Breakfast Fruit and veg Junk snacks Junk meals Energy drinks Cola Coffee Tea Exercise Sleepiness	Breakfast Fruit and veg Junk snacks Junk meals Energy drinks Cola Coffee Tea Exercise Sleepiness	Breakfast Fruit and veg Junk snacks Junk meals Energy drinks Cola Coffee Tea Exercise Sleepiness
ADHD/autism traits	Total ADHD score Total autism score	Total ADHD score Total autism score	Total ADHD score Total autism score	Total ADHD score Total autism score	Total ADHD score Total autism score

7.4.3.1 Positive and Negative Well-being Regression Models

The first multiple linear regression analysis was performed to identify the predictors of positive well-being. The model of positive well-being was statistically significant (F[18, 181] = 9.37, p = 0.001, and R2 = 0.483). The model accounted for 48.3% of the variance in positive well-being. Negative factors (β = −0.474, p = 0.001), flow (β = 0.182, p = 0.004), and energy drinks (β = −0.188, p = 0.006) were significant predictors of positive well-being.

A second multiple linear regression analysis was carried out to identify the predictors of negative well-being. The model to predict negative well-being was significant (F [16, 183] = 12.79, p = 0.001, R2 = 0.528), explaining 52.8% of the variance in negative well-being. The predictors that were significant in the negative well-being model were negative factors (β = 0.503, p = 0.001), workload (β = 0.158, p = 0.009), and coffee (β = 0.149, p = 0.007), all associated with increased negative well-being. No significant relationships existed between positive and negative well-being, ADHD scores, and autism scores.

7.4.3.2 Anxiety and Depression Regression Models

The multiple linear regression for the anxiety model was statistically significant (F [16, 183] = 7.60, p < 0.001, R2 = 0.399). The model explained about 40% of the variance in anxiety. The model showed that the variables associated with anxiety were negative factors (β = 0.383, p = 0.001), workload (β = 0.178, p = 0.009), and being female (β = 0.198, p = 0.002). Interestingly, though, there was no significant relationship between anxiety, HRB predictors, ADHD scores, and autism scores.

Another multiple linear regression was performed to investigate the predictors of depression. The model was significant (F [17, 182] = 9.81, p < 0.001, R2 = 0.478), and the model explained 47.8% of the variance in depression. The negative factor variable was a good predictor of depression (β = 0.524, p = 0.001). In addition, the results showed that high workload (β = 0.137, p = 0.031) and coffee consumption (β = 0.121, p = 0.038) were associated with depression. There were no significant associations between ADHD/autistic traits and depression.

7.4.3.3 Flourishing and Physical Health Regression Models

A multiple linear regression was used to predict flourishing. The flourishing model was statistically significant ($F [16, 183] = 8.47$ $p < 0.001$, $R2 = 0.426$); the model accounted for 42.6% of the variance in flourishing. Flow ($\beta = 0.286$, $p = 0.001$), breakfast ($\beta = 0.150$, $p = 0.017$), and tea ($\beta = 0.126$, $p = 0.032$) were associated with flourishing. The combined negative factor score was significantly associated with decreased flourishing among secondary school students ($\beta = -0.374$, $p = 0.001$). There were no associations between ADHD scores, autism scores, and flourishing.

The physical health multiple linear regression model was statistically significant ($F [15, 184] = 4.21$, $p < 0.001$, $R2 = 0.256$), and the model explained 25.6% of the variance in physical health. The results showed that physical health was associated with negative factors ($\beta = -0.159$, $p = 0.027$), flow ($\beta = 0.162$, $p = 0.023$), and low rumination ($\beta = 0.145$, $p = 0.030$). In addition, fruit and vegetable consumption ($\beta = 0.162$, $p = 0.023$) and exercise ($\beta = 0.198$, $p = 0.006$) were associated with an increased the likelihood of physical health. The ADHD/autistic trait variables were not significant in this multivariate analysis.

7.4.3.4 Conduct and Hyperactivity Behaviour Regression Models

The results of multiple linear regression to predict conduct behaviour showed that the model was statistically significant ($F [16, 183] = 3.34$, $p= 0.001$, $R2 = 0.226$) and explained 22.6% of the variance. Although the model was statistically significant, only negative factors ($\beta= 0.254$, $p = 0.001$) and coffee ($\beta = 0.188$, $p = 0.008$) were significant predictors. The model for hyperactivity was also statistically significant ($F [15, 184] = 7.62$, $p < 0.001$ $R2 = 0.383$), and the model explained 38.3% of the variance. Negative factors were a good predictor of hyperactivity ($\beta = 0.194$, $p = 0.004$). Infrequent breakfast consumption was associated with an increased likelihood of hyperactivity ($\beta = -0.147$, $p = 0.023$). In addition, there were significant associations between ADHD scores, autism scores, and hyperactivity ($\beta = 0.283$, $p = 0.001$ and $\beta = 0.187$, $p = 0.005$, respectively).

7.4.3.5 Emotional and Peer Problem Regression Models

The emotional problems multiple linear regression model was statistically significant ($F [17, 182] = 9.62$, $p = 0.001$, $R2 = 0.473$) and explained 47.3% of the variance in emotional problems. Females were more likely to have high levels of emotional problems than males (β = 0.223, p = 0.001). Interestingly, though, it was found that the frequent consumption of energy drinks was associated with fewer emotional problems (β = −0.194, p = 0.004). Negative factors (β = 0.359, p = 0.001). The ADHD score was related to emotional problems in the univariate analysis and remained significant in the multivariate analysis (β = 0.236, p = 0.001).

The model peer problems were significant (F [17, 182] = 2.69, p = 0.001, and R2 = 0.201). Negative factors (β = 0.207, p = 0.009) and autism score (β = 0.205, p = 0.009) were associated with peer problems.

7.4.3.6 Prosocial Behaviour Regression Model

Multiple linear regression was performed to investigate the predictors of prosocial behaviour. The model was significant (F [15, 184] = 5.45, p < 0.001, R2 = 0.308) and explained 30.8% of the variance in prosocial behaviour. Fruit and vegetable consumption (β = 0.248, p = 0.001). In addition, it found that the consumption of energy drinks (β = −0.214, p = 0.005) and low work-life balance (β = −0.188, p = 0.005) were associated with decreased prosocial behaviour among secondary school students. Females were more likely than males to have high prosocial behaviour (β = 0.204, p = 0.002); see Tables (7.14 and 7.15) for all beta and alpha values of the significant variables in the multivariate analyses of well-being and SDQ outcomes.

Table 7.14 Significant associations between the predictors and well-being outcomes in multiple linear regression analysis.

Outcomes	Predictors	Beta	p
Positive well-being	Negative factors	−0.474	<0.001
	Flow	0.182	0.004
	Energy drinks	−0.188	0.006
Negative well-being	Negative factors	0.503	<0.001
	Workload	0.158	0.009
	Coffee	0.149	0.007
Anxiety	Gender	0.198	0.002

	Negative factors	0.383	<0.001
	Workload	0.178	0.009
Depression	Negative factors	0.524	<0.001
	Workload	0.137	0.031
	Coffee	0.121	0.038
Flourishing	Negative factors	−0.374	<0.001
	Flow	0.286	<0.001
	Breakfast	0.150	0.017
	Tea	0.126	0.032
Physical health	Negative factors	−0.159	<0.027
	Low rumination	0.145	0.030
	Fruits and vegetables	0.162	0.023
	Exercise	0.198	<0.006

***Note**: The values of beta (β) are standardised.*

Table 7.15 Significant associations between the predictors and SDQ outcomes in multiple linear regression analysis.

The Outcomes	Predictors	Beta	p
Conduct problems	Negative factors	0.254	0.001
	Coffee	0.188	0.008
Hyperactive behaviour	Negative factors	0.194	0.004
	Breakfast	−0.147	0.023
	ADHD traits	0.283	<0.001
	Autistic traits	0.187	0.005
Emotional problems	Gender	0.223	<0.001
	Negative factors	0.359	<0.001
	Energy drinks	−0.194	0.004

	ADHD traits	0.236	<0.001
Peer problems	Negative factors	0.207	0.009
	Autistic traits	0.205	0.009
Prosocial behaviour	Gender	0.204	0.002
	Low work-life balance	−0.188	0.005
	Fruit and veg	0.248	<0.001
	Energy drinks	−0.214	0.005

***Note**: The values of beta (β) are standardised.*

7.4.4 Interaction Analysis Results

Further analyses investigated whether the associations between the significant health-related behaviour variables, well-being, and SDQ outcomes in the multivariate analyses varied according to ADHD/autistic trait scores. The method used for analysing these interactions was similar to the multivariate analysis in the multiple linear regression (i.e., using the same variables in the multivariate linear regression analyses) in addition to interaction terms. The results revealed only one significant interaction (see Tables 7.16 and 7.17). There was an interaction between breakfast consumption and ADHD traits in the analysis of hyperactivity (see Figure 7.1). Frequent breakfast consumption was associated with reduced hyperactivity in those with no ADHD traits.

Table 7.16 Interactions between health-related behaviours and ADHD traits according to well-being and SDQ outcomes.

The Outcomes	Interaction Terms	β	Sig
Positive well-being	Energy drinks*ADHD traits	-.149	.196
Negative well-being	Coffee*ADHD traits	.208	.198
Flourishing	Tea*ADHD traits	.279	.097
	Breakfast*ADHD traits	-.277	.144
Depression	Coffee*ADHD traits	.075	.665
Physical health	Fruit and vegetables*ADHD traits	-.051	.860

	Exercise*ADHD traits	.102	.642
Conduct behaviour	Coffee*ADHD traits	-.109	.601
Hyperactive behaviour	Breakfast*ADHD traits	.425	.032
Emotional problems	Energy drink*ADHD traits	.170	.145
Prosocial behaviour	Fruit and vegetables*ADHD traits	.222	.410
	Energy drinks*ADHD traits	-.037	.778

***Note**: The values of beta (β) are standardised. The health-related behaviour variables in the interaction terms were significant in the multivariate analysis.*

Table 7.17 Interactions between health-related behaviours and autism traits according to well-being and SDQ outcomes.

Outcomes	Interaction Terms	β	Sig
Positive well-being	Soft drinks*autism traits	.649	.110
Negative well-being	Coffee*autism traits	-.197	.377
Flourishing	Breakfast*autism traits	-.252	.263
	Tea*autism traits	.487	.055
Depression	Coffee*autism traits	.040	.865
Physical health	Tea*autism traits	-.236	.497
	Exercise*autism traits	-.185	.531
Conduct problems	Coffee*autism traits	-.196	.493
Hyperactive behaviour	Breakfast*autism traits	.021	.927
Emotional problems	Soft drink*autism traits	-.130	.750
Prosocial behaviour	Fruit and vegetables*autism traits	.326	.313
	Cola*autism traits	.817	.085

***Note**: The values of beta (β) are standardised. The health-related behaviour variables in the interaction terms were significant in the multivariate analysis.*

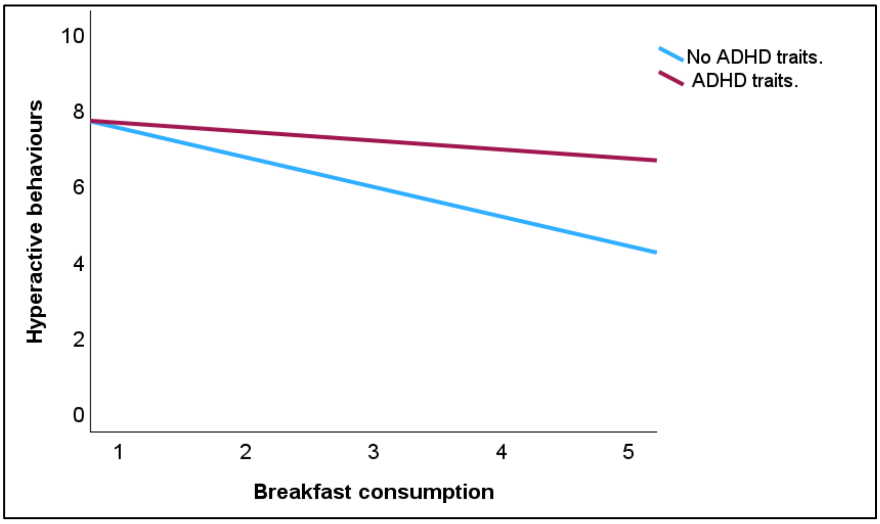

Figure 7.1 Interaction between breakfast and ADHD traits on hyperactive behaviour.

7.5 Discussion

This study investigated the associations between HRBs, ADHD/autistic traits, well-being, and SDQ outcomes for students in secondary schools. The first aim of this study was to examine the usual effect of established predictors of well-being and well-being outcomes. This was confirmed, and it was found that the combined effects negative factor score was the strongest predictor. This finding was consistent with the results of a study by Smith (2021, 2022). The combined effects negative factor was associated with all the well-being and SDQ outcomes in the multivariate analyses except for prosocial behaviour in the univariate analyses. Some of the variables in the short-form WPQ have been less extensively studied (e.g., work-life balance, workload, rumination, flow, and flourishing). A poor work-life balance was associated with decreased positive well-being and prosocial behaviour. In contrast, it was associated with increased negative well-being, anxiety, depression, and emotional problems in the univariate analyses. Like the previous study, low work-life balance was not associated with conduct problems, peer problems, or physical health. In the multivariate analyses, low work-life balance remained significant, with reduced prosocial behaviour among the secondary students. Moreover, a high workload was a good predictor of well-being outcomes and most SDQ outcomes, with a high workload being associated with decreased positive well-being and flourishing. Similar findings were reported in the university student sample. A high workload was associated with increased negative well-being, anxiety, depression, hyperactive behaviour, and emotional problems in the univariate analyses. Likewise, previous studies involving university students found similar results in terms of workload. However, in the multivariate analyses, high workload remained significantly associated with increased negative well-being, anxiety, and depression in secondary students but not in university students. Moreover, flow was a good predictor of well-being outcomes; hence, flow was associated with increased positive well-being, flourishing, physical health, and prosocial behaviour among secondary school students and decreased hyperactivity, conduct problems, and depression. These findings were similar to those reported in the previous study involving a univariate analysis of a university student sample. In a multivariate analysis, flow correlated with an increase in positive well-being and flourishing. Low negative rumination was associated with increased physical health, flourishing, positive well-being, and decreased peer problems and remained so with physical health in multivariate analyses.

The combined factor of established predictors statistically correlated with all the well-being and SDQ outcomes except for prosocial behaviour. The results were consistent, with the combined variable positively associated with adverse outcomes and negatively related to positive outcomes. Flow was a strong predictor of well-being and SDQ outcomes; most of the association found in the univariate analyses also remained significant in multivariate analyses. It appeared that high flow increased the likelihood of positive well-being and flourishing. In addition, a high workload remained significant at the multivariate analysis level – a high workload was associated with increased negative well-being, anxiety, and depression. Another finding was that females were more likely than males to report anxiety, emotional problems, and prosocial behaviour.

The second aim was to investigate the relationships among HRB variables, ADHD/autistic traits, well-being, and SDQ outcomes. The results of the univariate analysis confirmed the findings from earlier research on university and secondary school students. After adjusting for established predictors in the multivariate analyses to determine whether HRB factors, ADHD/autistic characteristics still significantly associated with the outcomes. The health-related behaviour results showed that, in the univariate analyses, an increase in coffee consumption could contribute to an increase in negative well-being, depression, anxiety, emotional problems, and conduct problems and decreased positive well-being and flourishing. This association persisted in the multivariate analyses of depression, negative well-being, and conduct problems. Breakfast was associated with increased physical health, flourishing, and positive well- being and decrease negative well-being, depression, conduct problems, hyperactivity, and emotional problems in univariate analyses. Although breakfast was associated with most of the well-being and SDQ outcomes in the univariate analyses, after controlling for well-being predictors, breakfast consumption only remained statistically significant in the analyses of flourishing and hyperactivity, with more frequent breakfast consumption being associated with an increased likelihood of flourishing and decreased likelihood of hyperactivity among secondary school students. In the univariate analyses, secondary school students' consumption of fruit and vegetables was associated with good physical health, more prosocial behaviour, and fewer conduct problems. The association between fruit and vegetable intake and prosocial behaviour and physical health remained significant in the multivariate analyses. This finding was observed in the previous study with university students; after controlling for well-being predictors, high fruit and vegetable consumption was likely to be associated with increased prosocial behaviour.

Moreover, energy drink consumption was associated with decreased positive well-being, flourishing, prosocial behaviour, and physical health and may increase negative well-being, anxiety and depression in univariate analyses. The effect of high-energy drink consumption on positive well-being and prosocial behaviours persisted after controlling for the well-being predictors in the multivariate analyses. Although the association between energy drink consumption and emotional problems was not significant in the univariate analyses, there was an association between the high consumption of energy drinks, which could reduce emotional problems among secondary students. This exciting result could be due to the bidirectional relationship between diet, well-being, and mood outcomes, with high emotional problems potentially associated with increased energy drink consumption. Previous studies have confirmed that students commonly consume caffeine-containing beverages such as energy drinks and cola to deal with stressful events (Ríos et al., 2013; Richards, 2016). Significant relationships existed between high tea consumption and flourishing, though the association between tea and flourishing was only marginally significant. This association was also observed in the multivariate analyses. The relationship between exercise and physical health was also statistically significant after adjusting for the well-being predictors in the secondary university student studies. Like the previous survey, more exercise was a good predictor of physical health in secondary and university students and in the univariate and multivariate analyses.

Higher levels of ADHD and autistic traits were associated with more conduct problems, hyperactivity, peer problems, and emotional problems. In contrast, low positive well-being, low prosocial behaviour, poor physical health, and poor flourishing were associated with autistic traits. In the multivariate analyses, after controlling for established predictors and health-related behaviours, the results revealed that individuals with high ADHD/autistic traits could have higher hyperactivity behaviours. ADHD traits were associated with increased emotional problems. At the same time, autism traits were related to peer problems in multivariate analyses. The results regarding ADHD and autistic traits were similar to those reported in the previous chapter for university students. Like in the last study, no significant associations were found between the ADHD/autistic trait scores and the well-being outcomes in the multivariate analyses. The last aim was to investigate whether the significant HRB effects in the multivariate analyses were independent or interacted with ADHD/autistic traits. Only one significant interaction existed between the HRB variables and ADHD/autistic traits (between breakfast and ADHD traits in the analysis of hyperactivity). Given the number of analyses conducted, these could be chance effects.

The results of the present study largely confirm the previous findings obtained from surveys of university students. These confirmatory results are important indicators of the extent to which results from studies using the Student WPQ generalise to other groups. No research using the present methodology has investigated the well-being of those with diagnoses of ADHD and autism. The following study will examine this issue and use mediation and moderation to provide a more detailed profile of the relationship between the variables.

7.6 Conclusion

This study examined the relationship between health-related behaviours, ADHD/autistic traits, well-being outcomes, and strengths and difficulties outcomes. The sample consisted of secondary students; prior to this study, little research had been conducted on the well-being of this age group. The results confirmed the associations between established predictors and well-being outcomes. More novel WPQ variables such as flow, high workload, work-life balance, and rumination were also shown to have significant effects. A combined negative factors score was also shown to be the strongest predictor of the outcomes. Health-related behaviours were associated with the outcomes in the univariate analyses, but the significant effects were reduced in the multivariate analyses when including the established predictors. ADHD/autistic traits were also associated with the outcomes in the univariate analyses. Significant associations were restricted to the strengths and difficulties measures in the multivariate analyses. There was little evidence of significant interactions between the health-related behaviours and ADHD/autistic traits. The following study will continue with the present approach and survey a sample of individuals with ADHD or autism diagnoses. Mediation and moderation will also provide a detailed profile of the relationships between the variables.

Chapter 8: Associations between Health-Related Behaviours and Well-being for Students with ADHD and Autism Diagnoses and Traits

8.1 Overview of the Study

Previous studies have examined ADHD and autistic traits in the general population rather than diagnosed individuals. This study compares students with previous diagnoses of ADHD/autism with those without a diagnosis. AQ10 and ADHD questionnaires were still used in this study, as it is plausible that individuals may have high scores on these measures even though no formal diagnosis has been made. This allows for comparing analyses based on criteria with those using symptom scores. Previous studies have been cross-sectional, making it difficult to identify causal mechanisms. Here, a longitudinal study was used to examine the extent to which measures taken at Time 1 (T1) can predict outcomes at Time 2 (T2). This approach removes the possibility of reverse causality, as the T2 measurements are taken after the first. The analyses reported in the earlier chapters primarily focused on the primary effects rather than considering interactions or mediating effects. This chapter rectifies this gap by examining the interactions between diet and ADHD/AQ scores and how variables may mediate the association between predictors and outcomes. The initial aim of the analyses presented in this chapter is to replicate the findings from the previous surveys at two-time points. The specific hypotheses tested are as follows:

Hypothesis 1: The usual associations between the well-being predictors and outcomes will be replicated.

Hypothesis 2: The adjusted means of well-being and SDQ outcomes for the three groups of people (i.e., those with ADHD traits, autism traits, or no ADHD/autism traits) differ after accounting for health-related behaviours and well-being predictors as confounding factors at both time points.

Hypothesis 3: The WPQ, SDQ, and DABS measures will have good test-retest reliability.

Hypothesis 4: There will be fewer significant associations between the established predictors and the SDQ outcomes.

Hypothesis 5: Associations between the ADHD/autism traits, HRB scores, and well-being outcomes will essentially become non-significant when the established well-being predictors are included in the analyses.

Hypothesis 6: Associations between the ADHD/AQ variables and the SDQ outcomes will be more robust and remain significant even when the established predictors are included in the analyses.

8.2 Methods

8.2.1 Ethical Approval

Cardiff University's School of Psychology Ethics Committee approved this study (ethical number: EC2212136676R).

8.2.2 Participants

Data were collected from the Prolific recruitment panel for three groups. The first group was students without a prior diagnosis of ADHD or autism, and the second group was students with a previous diagnosis of autism. The final group was people with a prior diagnosis of ADHD. The Prolific pre-screen selection settings were used to implement the inclusion and exclusion criteria for recruiting the participants. The inclusion criteria for the three groups were students from the United Kingdom, the United States, Australia, New Zealand, and South Africa. To select people with ADHD, the pre-screen feature was participants with a prior diagnosis of ADHD. In addition, the participants with a previous autism diagnosis were used to select the autism group. The total sample size was 300 participants (100 for each group) at T1. However, there was a decrease in the response rate during T2 three months later, in July 2023, when just 248 participants answered the survey: 92 from the no ADHD/autism group, 83 from the ADHD group, and 73 from the autism group. Table (8.1) shows the characteristics of the students. At T1, females accounted for 49% (n = 147) of the sample, and males accounted for 50.7% (n = 152). In contrast, at T2, females accounted for 50% (n = 124) and males 48.4% (n = 120). Regarding age, the average of the total sample was 27.6 (SD = 9.13) at T1; this value was similar to that for T2, with 28.4 (SD = 9.57). BMI was more significant in people with autism (M = 28.6) compared to people with ADHD (M = 26.5). At the same time, people without ADHD or autism had the lowest BMI, with an average of 24.9 at T1. It was noted that the average BMI increased to M = 30.7 among participants in the autism group and M = 26.3 among those in the no ADHD/autism group at T2. The BMI of the individuals in the ADHD group was stable (M= 26.8) at T2; see Table 8.1.

Table 8.1 Descriptive analysis of demographic variables.

Groups	N		Age Mean (SD)		BMI Mean (SD)		Gender N (%)			
							Male	Female	Male	Female
	T1	T2	T1	T2	T1	T2	T1		T2	
ADHD	100	83	28.29 (8.76)	28.17 (12.22)	26.57 (8.36)	26.82 (8.78)	47 (47%)	53 (53%)	43 (51.8%)	37 (44.6%)
Autism	100	73	27.67 (6.94)	28.75 (9.14)	28.69 (11.05)	30.78 (12.64)	49 (49%)	51 (51%)	32 (43.8%)	40 (54.8%)
No ADHD/autism	100	92	27.09 (11.25)	28.38 (7.02)	24.96 (6.08)	26.35 (8.19)	57 (57%)	42 (42%)	45 (48.9%)	47 (51.1%)
Total	300	248	27.68 (9.13)	28.42 (9.57)	26.75 (8.85)	27.83 (10.05)	152 (50.7%)	147 (49%)	120 (48.4%)	124 (50%)

8.2.3 Materials

As in previous chapters, the Student Well-being Process Questionnaire measured specific aspects of established predictors and well-being outcomes. The short-form Diet and Behaviours Scale was used to measure health-related behaviour variables. The (AQ-10) was used to calculate the total scores for autistic traits, while the ADHD self-report scale part A was used to calculate the total scores for ADHD traits. These tools were already detailed in depth in Chapter 6. This study analyses mediation and moderation; thus, the appraisal factors from the WPQ were added: life stress, life satisfaction, university stress, and university satisfaction. A scale from (1: not at all stressful) to (10: very stressful) was used to measure life stress (‘Overall, how stressful is your life?’) and university stress (‘How stressful is your university course?’). Life satisfaction (‘Overall, I am satisfied with my life’) and university satisfaction (‘Overall, I am satisfied with my university course’) were measured using a scale from (1: not at all) to (10: very much). It is worth noting that the same surveys were administered at both time points.

8.2.4 Study Design and Procedure

This study utilised a longitudinal design to examine the relationships between health behaviours and well-being over three months. The participants completed online surveys assessing healthy diet, junk food intake, caffeine consumption, physical activity, positive and negative well-being, and SDQ outcomes. All respondents completed the same questionnaire at both time points. The surveys were administered via the Prolific web-based data collection platform. Three advertisements were administered: the first was for the ADHD group, the second was for the autism group, and the third was for people with no ADHD/autism. Those who expressed interest were transferred through a link to a Qualtrics online survey. The survey was then analysed using IBM SPSS 29 to obtain accurate estimates for the hypothesis under investigation.[4]

T2 collection was done by selecting the pre-screen option on the Prolific website (including participants who participated in the previous study only). Then, Prolific sent the study invitations to eligible participants who were taking part for the first time. The surveys took approximately 20 minutes to complete, and the participants received £5 for the survey completed at T1 and another £5 for the one completed at T2. Informed consent was obtained within the questionnaire, and participants could only continue beyond the consent page if they agreed. Participants were informed that they could withdraw from the study and were advised to skip any questions they did not wish to answer. An information sheet was provided before consent was obtained, and a debriefing sheet was provided after the questionnaire.

8.2.4.1 Independent Variables

To accommodate considerable variance without reducing the statistical power of the multivariate analyses, in this study, the diet variables were (junk food, healthy diet, and total weekly caffeine). Junk snack items and junk meal items were summed to create a total junk food intake score labelled ‘junk food’ with a range of 2–10, with higher scores indicating greater junk food intake, while the mean of the junk food score was for time 1 (m= 6.28, SD= 1.46) and for time 2 (m= 6.40, SD=1.44). Moreover, the

[4] Because the participants and materials used in Chapter 8 are described in detail here, they will not be discussed again in the Methods sections of Chapter 9 that reports analyses from the same dataset.

total healthy diet score, which ranged from 2 to 10, was calculated by adding the consumption of breakfast and fruits and vegetables, with higher scores indicating a healthier diet with the mean of the healthy diet score was 1 (m= 6.72, SD= 1.79) for time and (m= 6.78, SD=1.86) for time 2. In this study, we calculated the total weekly caffeine intake instead of using energy drinks, cola, coffee, and tea variables. Caffeine consumption was assessed using items from the beverages section (energy drinks, cola, coffee, and tea), which measures the weekly cup intake. The responses were converted to milligrams of caffeine using Richards' (2016) values derived from those of Brice and Smith (2002). Energy drinks were valued at 133 mg per can, cola at 25 mg per can, coffee at 80 mg per cup, and tea at 40 mg per cup; the mean of total caffeine consumption was 956.98 mg/w (*SD* = 819.17) at time 1, and 953.67 mg/w (*SD* = 767.28) at time 2. Moreover, exercise and sleepiness were included as health-related behaviour variables and health-related covariates included BMI, sex, and well-being predictors.

Moreover, several dependent variables related to health behaviours were examined: positive well-being, flourishing, physical health, negative well-being, anxiety, depression, hyperactive behaviour, conduct problems, emotional problems, peer problems, and prosocial behaviour.

8.2.5 Statistical Analysis

Descriptive statistics were calculated for the study variables at each time point. Two exploratory factor analyses of three exercise items using the principal component method with eigenvalue one and variable rotation of the factor (varimax rotation) approaches were performed for the items to extract one single variable at T1 and T2. Pearson correlations were used to examine the cross-sectional relationships between health behaviours, well-being, and SDQ outcomes. The independent-sample t-test was used to identify differences between the nominal variable (gender) and the outcomes. Then, multiple linear regression analysis (Enter method) was performed for each outcome, controlling for the well-being predictors.

8.3 Results

8.3.1 Descriptive Analysis

8.3.1.1 Descriptive Analysis for WPQ Variables

Well-being was assessed using the WPQ, which provides a score ranging from 1 to 10. The mean positive well-being score was 6.08 (SD = 2.22) at T1 and 6.4 (SD = 2.13) at T2. The mean negative well-being score was 6.2 (SD = 2.38) at T1 and 5.6 (SD = 2.50) at T2, showing a slight increase in positive well-being and a decrease in negative well-being over the study period. Regarding established predictors of WPQ, the highest average appeared to be student stressors, low work-life balance, workload, and university stress at T1. Meanwhile, at T2, the highest averages were for workload, university stress, and positive coping (see Table 8.2). It was found that most of the WPQ factors remained relatively stable over the study period.

Table 8.2 Descriptive analysis of WPQ variables at T1 and T2.

WPQ Variables	Min. – Max.	Mean		SD		N	
		T1	T2	T1	T2	T1	T2
Positive well-being	1–10	6.08	6.43	2.22	2.13	299	248
Negative well-being	1–10	6.27	5.66	2.38	2.50	296	246
Student stressors	1–10	7.06	6.53	2.23	2.394	297	247
Social support	1–10	5.98	6.11	2.36	2.670	298	247
Positive coping	1–10	6.55	6.85	2.19	2.246	295	248
Negative coping	1–10	6.26	5.71	2.43	2.554	297	248
Psychological capital	1–10	5.95	6.52	2.18	2.213	298	248
Low work-life balance	1–10	7.03	6.63	2.35	2.487	296	246
Workload	1–10	7.08	6.80	2.20	2.323	298	246
Sleepiness	1–10	6.20	6.04	2.40	2.509	299	247
Physical health	1–10	6.11	6.01	1.97	1.972	300	245
Flow	1–10	6.02	6.13	2.02	2.035	299	246
Flourishing	1–10	5.23	5.37	2.13	2.015	299	246
Low rumination	1–10	5.20	4.98	2.26	2.261	300	246
Anxious	1–10	6.40	6.05	2.28	2.380	299	246
Life stress	1–10	6.44	6.16	2.05	2.186	296	246
University stress	1–10	6.86	6.84	2.12	2.066	296	246
Depression	1–10	5.31	4.97	2.38	2.467	299	247
Life satisfaction	1–10	5.53	5.53	2.28	2.287	297	246
University satisfaction	1–10	6.29	6.28	2.10	2.203	299	247

8.3.1.2 Descriptive Analysis for Health-Related Behaviour Variables

Health-related behaviours were measured on a five-point Likert scale regarding the self-reported frequency of eating breakfast, fruit and vegetables, junk snacks, and junk meals. The mode for junk meal consumption was "once or twice a week" at both time points (46.7% and 44.4%, respectively). However, the participants at T1 (35.7%) and T2 (35.1%) reported consuming junk snacks "most days" (3–6). The mode for breakfast consumption was "most days" (3–6) (31%) T1, while breakfast consumption at T2 was slightly high, with 29% of the participants reporting that they consumed breakfast every day. Exercise was measured using three self-reported items. The values remained relatively stable for the three exercise items at both time points. The participants reported engaging in mild physical activity "three times a week or more" at both time points (67.7% for T1 and 65.7% for T2). Notably, 54 respondents reported taking part in mild exercise "once or twice a week" at T1 and T2. The mode of moderate exercise was "never or hardly ever" (30.3% at T1 and 29.8% at T2). Similar findings were observed for vigorous exercise: "never or hardly ever" was the highest percentage at 41.7% at T1 and 41.9% at T2, see Tables (8.3 and 8.4).

With regard to the factor analysis of the three items, the results revealed that the first-factor analysis was for T1. A single factor was extracted, referred to as exercise factor T1; the initial eigenvalue for this factor was 1.588, accounting for 52.92% of the variance. The factor loadings were computed as follows: moderate, 0.826; vigorous, 0.774; mild, 0.554. The findings from the factor analysis for T2 revealed that one factor was extracted, namely, exercise factor T2; the initial eigenvalue for this factor was 1.691, accounting for 56.39% of the variance. The factor loading for moderate exercise was 0.833, vigorous exercise was 0.822, and mild exercise was 0.566. However, energy drinks and cola consumption increased at time two. In contrast, coffee and tea consumption was lower at time 2 than at time 1 (see Tables 8.3 and 8.4).

Table 8.3 Descriptive analysis for health-related behaviour at T1.

Food variables	N	Never	Once a month	Once or twice a week	Most days (3–6)	Every day
Breakfast	297	27 (9%)	14 (4.7%)	82 (27.3%)	92 (30.7%)	82 (27.3%)
Fruit and veg	296	28 (9.3%)	42 (14%)	116 (38.7%)	93 (31%)	17 (5.7%)

Junk snacks	298	7 (2.3%)	32 (10.7%)	96 (32%)	107 (35.7%)	56 (18.7%)
Junk meals	299	18 (6%)	97 (32.3%)	140 (46.7%)	40 (13.3%)	4 (1.3%)
Exercise	**N**	**Never/ hardly ever**	**One to three times a month**	**Once or twice a week**	**Three times a week or more**	
Mild	300	20 (6.7%)	23 (7.7%)	54 (18%)	203 (67.7%)	
Moderate	298	91 (30.3%)	70 (23.3%)	86 (28.7%)	51 (17%)	
Vigorous	299	125 (41.7%)	63 (21%)	66 (22%)	45 (15%)	
Weekly caffeine (cups per week)	**N**	**Min.**	**Max.**	**Mean**	**SD**	
Energy drinks	300	0	21	1.74	3.43	
Cola	298	0	25	2.80	4.04	
Coffee	299	0	50	5.66	7.28	
Tea	299	0	70	4.97	7.68	

Table 8.4 Descriptive analysis for health-related behaviour at T2.

Food variables	N	Never	Once a month	Once or twice a week	Most days (3–6)	Every day
Breakfast	246	25 (10.1%)	15 (6%)	68 (27.4%)	66 (26.6%)	72 (29%)
Fruit and veg	247	22 (8.9%)	36 (14.5%)	85 (34.3%)	82 (33.1%)	22 (8.9%)
Junk snacks	246	4 (1.6%)	24 (9.7%)	77 (31%)	87 (35.1%)	54 (21.8%)
Junk meals	247	13 (5.2%)	84 (33.9%)	110 (44.4%)	35 (14.1%)	5 (2%)
Exercise	**N**	**Never/ hardly ever**	**One to three times a month**	**Once or twice a week**	**Three times a week or more**	
Mild	247	18 (7.3%)	12 (4.8%)	54 (21.8%)	163 (65.7%)	
Moderate	245	74 (29.8%)	59 (23.8%)	66 (26.6%)	46 (18.5%)	
Vigorous	243	104 (41.9%)	52 (21%)	45 (18.1%)	42 (16.9%)	

Weekly caffeine (cups per week)	N	Min.	Max.	Mean	SD
Energy drinks	246	0	27	1.74	3.64
Cola	246	0	30	2.57	3.77
Coffee	247	0	35	5.53	6.53
Tea	247	0	50	5.43	7.90

8.3.1.3 Descriptive Statistics for ADHD and Autism Questionnaire

The average of the participant scores for the AQ-10 scores was 4.6 (SD = 2.48) at T1, and a similar average was found at T2 (M = 4.51, SD = 2.38). Furthermore, the ASRS average score (m = 3.4, SD = 1.75) was similar to that reported at T2 (M = 3.24, SD = 1.82; see Table 8.5). The average for prosocial behaviour had the highest score on the SDQ (m = 7.6, SD = 2.16), followed by emotional problems (m = 5.3, SD = 2.73) and hyperactive behaviour (m = 5.0, SD = 2.73). Conduct problems had the lowest average (m = 2.3, SD = 1.66), followed by peer problems (m = 3.7, SD = 2.07). These results are similar to those reported at T2, as shown in Table (8.7).

Table 8.5 Descriptive analysis of ADHD and autism questionnaires at T1 and T2.

ADHD/Autism Scores	Total Scores	T1				T2			
		Min.	Max.	Mean	SD	Min.	Max.	Mean	SD
Total score for ADHD	0–6	0	6	3.47	1.75	0	6	3.24	1.82
Total score for Autism	0–10	0	10	4.63	2.48	0	10	4.51	2.38

Table 8.6 Descriptive analysis of ADHD and autism questionnaires at T1 and T2 (cutoff points).

ADHD/Autism	Type	T1 N (%)	T2 N (%)
Autism	No autism traits (0–5)	195 (65%)	168 (67.7%)
	Autism traits (6–10)	98 (32.7%)	76 (30.6%)
ADHD	No ADHD traits (0–3)	140 (46.7%)	125 (50.4%)
	ADHD traits (4–6)	155 (51.7%)	119 (48%)

Table 8.7 Descriptive analysis of subscale of SDQ at T1 and T2.

SDQ Outcomes	Total scores	T1					T2				
		Min.	Max.	Mean	SD	N	Min.	Max.	Mean	SD	N
Conduct problems	0–10	0	9	2.39	1.66	300	0	8	2.31	1.62	245
Hyperactive behaviour	0–10	0	10	5.06	2.73	299	0	10	4.70	2.79	243
Emotional problems	0–10	0	10	5.33	2.73	298	0	10	5.00	2.70	239
Peer problems	0–10	0	9	3.70	2.07	300	1	10	4.89	1.70	246
Prosocial behaviour	0–10	0	10	7.67	2.16	299	1	10	7.86	2.06	246

8.3.2 Test-Retest Reliability

A test-retest reliability analysis used a correlation coefficient to assess the variables' stability over time. The same survey was administered to participants on two separate occasions, with a 3-month interval between administrations. The results showed that the outcome variables' test-retest reliability coefficients ranged from 0.804 to 0.441, indicating good to low reliability across the outcome variables (see Table 8.8). Meanwhile, the coefficients of HRB variables and ADHD and autism traits ranged from 0.762 to 0.598 (see Table 8.9). Moreover, the coefficients of controlled variables ranged from .681 to .257 (see Table 8.10). However, it is essential to note that the variables might not be stable over time. For this reason, in the next chapter, we conduct longitudinal analyses to assess the impact of independent variables at T1 on the outcome variables at T2.

Table 8.8 Test–retest reliability coefficients and descriptive statistics for the outcome variables.

Variables	Test M (SD)	Retest M (SD)	r	p
Positive well-being	6.08 (2.22)	6.43 (2.13)	.441	<.001
Negative well-being	6.27 (2.38)	5.66 (2.50)	.454	<.001
Flourishing	5.23 (2.13)	5.37 (1.97)	.559	<.001
Physical health	6.11 (1.97)	6.01 (2.38)	.673	<.001
Anxiety	6.27 (2.28)	6.05 (2.01)	.700	<.001
Depression	2.38 (2.38)	4.97 (2.46)	.643	<.001
Conduct problems	2.39 (1.66)	2.31 (1.62)	.599	<.001
Hyperactive behaviour	5.06 (2.73)	4.70 (2.79)	.777	<.001

Emotional problems	5.33 (2.73)	5.00 (2.70)	.804	<.001
Peer problems	3.70 (2.07)	4.89 (1.70)	.664	<.001
Prosocial behaviour	7.67 (2.16)	7.86 (2.06)	.748	<.001

Table 8.9 Test-retest reliability coefficients and descriptive statistics for HRB, ADHD, and autism trait variables.

Variables	Test M (SD)	Retest M (SD)	r	p
Healthy diet	6.77 (1.79)	6.78 (1.86)	.762	<.001
Junk food	6.25 (1.46)	6.40 (1.44)	.620	<.001
Total weekly caffeine (mg)	975.60 (825.42)	953.67 (767.28)	.748	<.001
Exercise	0.00 (0.989)	-0.008 (0.997)	.598	<.001
Total ADHD	4.63 (2.48)	4.51 (2.38)	.684	<.001
Total autism	3.47 (1.75)	3.24 (1.82)	.754	<.001

Table 8.10 Test–retest reliability coefficients and descriptive statistics for control variables.

Variables	Test M (SD)	Retest M (SD)	r	p
BMI	26.75 (8.85)	27.83 (10.05)	.681	<.001
Student stressors	7.06 (2.23)	6.53 (2.39)	.494	<.001
Social support	5.98 (2.36)	6.11 (2.67)	.524	<.001
Positive coping	6.55 (2.19)	6.85 (2.24)	.541	<.001
Negative coping	6.26 (2.43)	5.71 (2.55)	.482	<.001
Psychological capital	5.95 (2.18)	6.52 (2.21)	.652	<.001
Low work-life balance	7.03 (2.35)	6.63 (2.48)	.437	<.001
Sleepiness	6.20 (2.40)	6.04 (2.50)	.448	<.001
Workload	7.08 (2.20)	6.80 (2.32)	.386	<.001
Flow	6.2 (2.02)	6.13 (2.03)	.588	<.001
Low rumination	5.20 (2.26)	4.98 (2.26)	.257	<.001

8.3.3 Univariate Analysis

8.3.3.1 Associations between Control Variables and Outcomes

To examine the relationship between the outcomes and control variables using univariate analysis Pearson's correlation was performed for continuous variables and between-subjects t-tests for categorising variables for T1 and T2 (see Tables 8.11 and

8.12). The results were as expected: there were positive correlations between the covariates of low work-life balance, workload, negative coping, and student stressors and the outcomes of negative well-being, anxiety, and depression at T1 and T2; and negative correlations between social support, flow, and psychological capital and the outcomes negative well-being, anxiety, and depression at both time points. Moreover, social support, flow, positive coping, and psychological capital showed significant positive correlations with positive well-being, flourishing, and physical health at T1 and T2. Workload, negative coping, and student stressors negatively correlated with positive well-being and flourishing at both times. There was a negative correlation between low rumination and negative well-being, anxiety, and depression at T2 only. Positive correlations were found between BMI and negative well-being, anxiety, and depression at T2 only. Age was only correlated with anxiety at T1; see Table 8.11.

In addition, flow, positive coping, psychological cap, and social support were negatively correlated with hyperactive behaviour and emotional problems at both time points. In contrast, there were positive correlations between life stress and hyperactivity, conduct problems, and emotional and peer problems at T1 and T2. Moreover, psychological capital, life satisfaction, social support, and positive coping were positively correlated with prosocial behaviour at both time points. On the other hand, there was a negative correlation between negative coping and prosocial behaviour at T1 and T2 (see Table 8.12).

Table 8.11 Relationships between control variables and well-being outcomes at T1 and T2. Note: Correlations and differences are two-tailed.

Control variables		Positive well-being		Flourishing		Physical health		Negative well-being		Anxiety		Depression	
		T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2
Student stressors	**r**	-.441	-.456	-.332	-.360	-.137	-.268	.675	.649	.585	.529	.539	.554
	p	<.001	<.001	<.001	<.001	.018	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Social support	**r**	.374	.459	.458	.469	.256	.279	-.284	-.254	-.351	-.226	-.371	-.404
	p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Negative coping	**r**	-.335	-.305	-.359	-.317	-.193	-.317	.448	.417	.460	.497	.437	.514
	p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Positive coping	**r**	.280	.343	.392	.326	.261	.258	-.239	-.115	-.234	-.136	-.256	-.299
	p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	.072	<.001	.034	<.001	<.001
Psychological capital	**r**	.574	.496	.644	.545	.365	.431	-.460	-.444	-.482	-.417	-.524	-.464
	p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Work–life balance	**r**	-.105	-.083	-.165	-.177	-.037	-.169	.278	.225	.265	.343	.209	.300
	p	.073	.196	.004	.005	.524	.008	<.001	<.001	<.001	<.001	<.001	<.001
Workload	**r**	-.210	-.246	-.149	-.256	-.047	-.157	.318	.348	.320	.395	.256	.318
	p	<.001	<.001	.010	<.001	.419	.014	<.001	<.001	<.001	<.001	<.001	<.001
Sleepiness	**r**	-.269	-.192	-.274	-.397	-.206	-.329	.329	.427	.418	.416	.390	.439
	p	<.001	.002	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Flow	**r**	.302	.311	.539	.462	.306	.305	-.224	-.322	-.134	-.261	-.190	-.213
	p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	.020	<.001	<.001	<.001
Low rumination	**r**	.236	.204	.320	.238	.089	.239	-.108	-.142	-.025	-.169	-.075	-.129
	p	<.001	.001	<.001	<.001	.123	<.001	.063	.027	.665	.008	.195	.044

Life stress	**r**	-.328	-.237	-.205	-.238	-.102	-.284	.442	.423	.498	.553	.523	.512
	p	<.001	<.001	<.001	<.001	.081	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Life satisfaction	**r**	.577	.439	.690	.656	.345	.394	-.443	-.494	-.417	-.412	-.547	-.521
	p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Age	**r**	-.036	-.063	-.026	-.049	-.055	-.031	-.082	.040	-.177	-.078	-.073	-.086
	p	.536	.327	.648	.442	.344	.629	.158	.536	.002	.226	.206	.180
BMI	**r**	-.093	-.011	-.116	-.111	-.211	-.253	.075	.132	.079	.154	.077	.142
	p	.110	.862	.047	.086	<.001	<.001	.199	.040	.177	.016	.189	.026
Differences													
Gender	**t**	.096	-.336	.381	**-.122**	**.804**	**2.019**	-1.84	-2.28	-2.88	-3.49	-1.06	-1.36
	p	.923	.737	.704	**.903**	**.422**	**.045**	.066	.023	.004	.001	.289	.175

Table 8.12 Relationships between control variables and well-being and SDQ outcomes at T1 and T2. ***Note:*** *Correlations are two-tailed.*

Control variables		**Conduct problems**		**Hyperactive behaviour**		**Emotional problems**		**Peer problems**		**Prosocial behaviour**	
		T1	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**
Student stressors	**r**	.106	.110	.291	.371	.476	.544	.323	.277	-.053	-.036
	p	.069	.088	<.001	<.001	<.001	<.001	<.001	<.001	.360	.570
Social support	**r**	-.100	-.219	-.269	-.223	-.333	-.300	-.469	-.411	.214	.204
	p	.083	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	.001
Positive coping	**r**	-.170	-.199	-.232	-.234	-.283	-.231	-.342	-.274	.210	.288
	p	.003	.002	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Negative coping	**r**	.099	.180	.374	.376	.512	.558	.400	.313	-.119	-.232

	p	.090	.005	<.001	<.001	<.001	<.001	<.001	<.001	.040	<.001
Psychological capital	**r**	-.072	-.122	-.409	-.439	-.504	-.543	-.404	-.347	.228	.305
	p	.214	.057	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Work–life balance	**r**	.042	.077	.248	.296	.248	.317	.068	.096	.049	.050
	p	.473	.229	<.001	<.001	<.001	<.001	.244	.136	.401	.436
Workload	**r**	.169	.110	.268	.276	.298	.324	.096	.069	-.024	-.015
	p	.003	.086	<.001	<.001	<.001	<.001	.098	.279	.682	.811
Sleepiness	**r**	.058	.086	.323	.344	.408	.417	.143	.223	-.064	-.039
	p	.321	.182	<.001	<.001	<.001	<.001	.013	<.001	.271	.544
Flow	**r**	-.149	-.176	-.380	-.432	-.187	-.263	-.116	-.085	.187	.071
	p	.010	.006	<.001	<.001	.001	<.001	.045	.187	.001	.271
Low rumination	**r**	-.008	-.073	-.207	-.121	-.112	-.164	-.128	-.092	.077	.096
	p	.890	.258	<.001	.061	.054	.011	.027	.152	.185	.135
Life stress	**r**	.213	.224	.274	.370	.449	.439	.186	.137	-.091	-.015
	p	<.001	<.001	<.001	<.001	<.001	<.001	.001	.032	.123	.819
Life satisfaction	**r**	-.068	-.188	-.415	-.370	-.407	-.444	-.378	-.413	.188	.179
	p	.245	.003	<.001	<.001	<.001	<.001	<.001	<.001	.001	.005
Age	**r**	-.025	-.093	-.041	-.071	-.087	-.090	.113	.047	.002	-.023
	p	.660	.149	.479	.274	.134	.165	.051	.460	.968	.721
BMI	**r**	-.033	.120	.048	.089	.119	.131	.092	.100	.069	.041
	p	.570	.063	.415	.169	.042	.044	.115	.120	.240	.520
Differences											
Gender	**t**	-.243	-1.597	.864	-.005	-4.529	-5.542	-1.942	-1.139	-.053	-.795
	p	.808	0.112	.388	.996	.001	0.001	.053	.256	0.958	0.427

8.3.3.2 Associations between ADHD and Autism and Outcomes

Pearson correlation analysis was used to investigate the relationship between total ADHD and autism scores and the outcome variables. The findings revealed that the values of the total score of ADHD, autism, and most outcome variables were significant, demonstrating the efficacy of the ADHD and autism traits tests and their ability to deal with various outcome variables in this study.

8.3.3.2.1 ADHD scores and outcomes

The total ADHD scores were positively correlated with negative well-being, anxiety, depression, hyperactive behaviour, peer problems, conduct problems, and emotional problems at T1 and T2. Conversely, a negative association between ADHD scores and positive well-being, flourishing, physical health, and prosocial behaviour was observed at both time points (see Table 8.13). Similar results were found in the dichotomised cutoff point scores (see Table 8.14).

8.3.3.2.2 Autism scores and outcomes

The total autism scores were positively correlated with negative well-being, anxiety, depression, emotional problems, peer problems, hyperactive behaviours, and conduct problems, anxiety, and depression at T1 and T2. Moreover, negative correlations were observed between autism and positive well-being, flourishing, physical health, and prosocial behaviour at both time points (see Table 8.13). Table 8.14 illustrates the values of significance and the differences between people who scored above and under the cutoff point, which is 5.

Table 8.13 Correlation matrix between the total score for ADHD, autism, and outcomes at T1 and T2.

Outcomes	T1				T2			
	ADHD score		Autism score		ADHD score		Autism score	
	r	p	r	p	r	p	r	p
Positive well-being	-.221	<.001	-.245	<.001	-.219	<.001	-.202	.002
Flourishing	-.374	<.001	-.284	<.001	-.248	<.001	-.256	<.001
Physical health	-.257	<.001	-.299	<.001	-.206	.001	-.294	<.001
Negative well-being	.299	<.001	.190	<.001	.367	<.001	.372	<.001
Anxiety	.318	<.001	.292	<.001	.393	<.001	.377	<.001
Depression	.281	<.001	.258	<.001	.301	<.001	.293	<.001
Conduct problems	.129	.027	.132	.024	.179	.005	.165	.010
Hyperactive behaviour	.667	<.001	.480	<.001	.695	<.001	.535	<.001

Emotional problems	.348	<.001	.346	<.001	.442	<.001	.454	<.001
Peer problems	.189	.001	.398	<.001	.060	.349	.293	<.001
Prosocial behaviour	-.146	.012	-.356	<.001	-.207	.001	-.289	<.001

Note: *All correlations are Pearson's (two-tailed).*

Table 8.14 Scores for ADHD, autism, and the outcomes (cutoff points) at T1 and T2.

Outcomes	**T1**				**T2**			
	ADHD traits		**Autism traits**		**ADHD traits**		**Autism traits**	
	t	**p**	**t**	**p**	**t**	**p**	**t**	**p**
Positive well-being	-3.468	<.001	-3.42	<.001	-2.904	.004	-2.363	.019
Flourishing	-6.743	<.001	-3.21	<.001	-3.951	<.001	-3.201	.002
Physical health	-3.095	.002	-3.92	<.001	-2.936	.004	-3.561	<.001
Negative well-being	4.22	<.001	1.92	.056	5.77	<.001	5.93	<.001
Anxiety	4.57	<.001	3.39	<.001	4.86	<.001	5.82	<.001
Depression	4.40	<.001	3.12	<.001	3.63	<.001	3.85	<.001
Conduct problems	1.268	.206	2.14	.033	3.369	<.001	1.654	.099
Hyperactive behaviour	11.75	<.001	6.48	<.001	11.26	<.001	7.850	<.001
Emotional problems	4.968	<.001	4.12	<.001	5.562	<.001	6.364	<.001
Peer problems	2.410	.017	6.00	<.001	.130	.897	3.580	<.001
Prosocial behaviour	-2.37	0.018	-6.08	<.001	-2.47	0.014	-2.95	0.003

8.3.3.3 Association between Health-Related Behaviours and Outcomes

For the univariate analyses, Pearson's tests were performed to determine whether there was an association between health-related behaviours (healthy diet, junk food, total weekly caffeine intake, exercise, and sleepiness) and the outcome variables (see Tables 8.15 and 8.16).

Total weekly caffeine intake was found to have a positive correlation with negative outcomes (i.e., negative well-being, anxiety, depression, hyperactive behaviour, and emotional problems) at T1. While at T2, correlations were found between total weekly caffeine intake and depression and hyperactive behaviour. Similarly, junk food had a positive correlation with anxiety, hyperactive behaviour, and emotional problems at both time points and a negative correlation with physical health at T1 and T2. Exercise, on the other hand, was positively associated with positive well-being, flourishing, and physical health at T1 and T2, and negatively associated with anxiety, depression, hyperactive behaviour, peer problems, and emotional problems at both time points. Moreover, a positive association was found between sleepiness and hyperactive behaviour, negative well-being, anxiety, depression, emotional problems, and peer problems at T1 and T2. It was also negatively associated with positive well-being, flourishing, and physical health. The next section discusses the objective which was whether there is a significant difference in well-being and SDQ outcomes across the different groups after controlling for the confounding variables.

Table 8.15 Correlation between health-related behaviours and outcomes at T1.

Outcomes	Healthy food		Junk food		Weekly caffeine		Exercise		Sleepiness	
	T1		T1		T1		T1		T1	
	r	p	r	p	r	p	r	p	r	p
Positive well-being	.195	<.001	-.030	.612	-.211	<.001	.210	<.001	-.269	<.001
Flourishing	.194	<.001	-.046	.427	-.232	<.001	.193	<.001	-.274	<.001
Physical health	.325	<.001	-.213	<.001	-.109	.061	.427	<.001	-.206	<.001
Negative well-being	-.100	.090	.027	.649	.162	.006	-.080	.172	.329	<.001
Anxiety	-.151	.010	.147	.011	.134	.021	-.131	.023	.418	<.001
Depression	-.177	.002	.044	.451	.183	.002	-.139	.016	.390	<.001
Conduct behaviour	-.144	.013	-.009	.875	.038	.513	-.035	.548	.058	.321
Hyperactive behaviour	-.271	<.001	.151	.009	.129	.027	-.143	.013	.323	<.001
Emotional problems	-.224	<.001	.185	.001	.185	.001	-.236	<.001	.408	<.001
Peer problems	-.176	.003	.077	.185	.052	.377	-.266	<.001	.143	.013
Prosocial behaviour	.188	.001	-.133	.022	-.087	.135	.086	.138	-.064	.271

Note*: All correlations are Pearson's (two-tailed).*

Table 8.16 Correlation between health-related behaviours and outcomes at T2.

Outcomes	Healthy food		Junk food		Weekly caffeine		Exercise		Sleepiness	
	T2		T2		T2		T2		T2	
	r	p	r	p	r	p	r	p	r	p
Positive well-being	.040	.531	-.110	.086	-.158	.013	.134	.034	-.192	.002
Flourishing	.051	.424	-.045	.484	-.164	.010	.219	<.001	-.397	<.001
Physical health	.290	<.001	-.175	.006	-.189	.003	.445	<.001	-.329	<.001

Negative well-being	-.110	.086	.170	.008	.094	.143	-.133	.038	.427	<.001
Anxiety	-.113	.079	.231	<.001	-.023	.725	-.283	<.001	.416	<.001
Depression	-.095	.137	.169	.008	.149	.019	-.229	<.001	.439	<.001
Conduct problems	-.136	.034	-.026	.684	.083	.200	-.064	.320	.086	.182
Hyperactive behaviour	-.272	<.001	.240	<.001	.176	.006	-.168	.009	.344	<.001
Emotional problems	-.146	.024	.192	.003	.077	.237	-.300	<.001	.417	<.001
Peer problems	-.070	.276	-.031	.624	.095	.140	-.213	<.001	.223	<.001
Prosocial behaviour	.055	.389	-.003	.967	-.126	.049	.037	.562	-.039	.544

Note: *All correlations are Pearson's (two-tailed).*

8.3.4 Differences between Autism, ADHD, and No Diagnosis Groups

A multivariate analysis of covariance (MANCOVA) was conducted to examine the effects of groups (i.e., no ADHD/autism group, ADHD group, autism group) on well-being and SDQ outcomes separately as dependent variables while controlling for gender, BMI, health-related behaviour variables (i.e., healthy diet, junk food, total weekly caffeine intake, exercise, and sleepiness), and establish predictors of well-being (i.e., student stressors, social support, positive coping, negative coping, psychological capital, flow, and rumination) at T1 and T2. In order to perform the MANCOVA, equality of covariance matrices were performed using Box's test. The results showed that the p-values were more than 0.05 at T1 and below 0.05 at T2, which indicates that the assumption was met at T1 but not at T2; however, the results should be interpreted with caution. Thus, to resolve this violation assumption, the alpha value was reduced to 0.01, and Pillai's trace was used at T2 only; this is preferred for analyses with unequal sample sizes rather than Wilks' Lambda, because it is more resilient to violations of the homogeneity of variance (Alharbi, 2020). Moreover, ηp^2 was used as the estimated effect size for F.

The results of the well-being outcomes revealed that the multivariate test showed no significant differences among the groups in terms of the dependent variables at T1 and T2 (Wilks' Lambda = 0.943, FF (12, 472) = 1.174, pp = 0.299, $\eta\eta pp^2$ = 0.029 at T1; Pillai's Trace = 0.066, F (12, 406) = 1.149, p = 0.318, ηp^2 = 0.033 at T2). Conversely, the MANCOVA test results for the SDQ outcomes showed that there were significant differences among groups in terms of the combined dependent variables at T1 and T2 (Wilks' Lambda = 0.819, FF (10, 474) = 4.98, pp = 0.001, $\eta\eta pp^2$ = 0.095 at T1; Pillai's Trace = 0.235, F (10, 394) = 5.255, p = 0.001, ηp^2= 0.0118 at T2). The between-subjects effects illustrated that there were significant differences between the groups in terms of hyperactive behaviour at both time points (F (2, 241) = 18.65, p < 0.001, partial $\eta\eta pp^2$ = 0.134 at T1; F (2,200) = 19.15, p < 0.001, partial $\eta\eta pp^2$ = 0.161 at T2). Emotional problems also exhibited significant differences among groups at T1 and T2, indicating the reliability of these results (F (2, 241) = 4.27, p < 0.015, partial $\eta\eta pp^2$ = 0.034 at T1; F (2, 200) = 7.46, p < 0.001, partial $\eta\eta pp^2$ = 0.069, respectively), see Tables (8.17 and 8.18). In addition, pairwise comparisons were conducted to explore the significant effects of hyperactive behaviour and emotional problems further. The results revealed that hyperactive behaviour was significantly higher for individuals with ADHD traits compared to those without ADHD/autism traits, with a mean difference of 2.00 (SE = 0.335, p = 0.001, 95% CI [1.19, 2.81]) at T1 and 1.643 (SE = 0.348, p = 0.001, 95% CI [0.610, 2.67]) at T2. Similar results were found in individuals with autism traits: hyperactive behaviour was significantly higher for individuals with autism traits compared to those without autism/ADHD traits, with a mean difference of 1.433 (SE = 0.345, p = 0.001, 95% CI [0.602, 2.26]) at T1, and 1.993 (SE = 0.344, p = 0.001, 95% CI [0.969, 3.01]) at T2. However, there were no differences between the ADHD group and the autism group (see Table 8.19). The emotional problems variable was significantly higher for individuals with autism traits compared to those without ADHD/autism traits at both time points, with a mean difference of 0.910 (SE = 0.327, p = 0.018, 95% CI [0.121, 1.69]) at T1, and 1.231 (SE = 0.319, p = 0.001, 95% CI [0.283, 2.17]) at T2. However, there were no differences between the ADHD/autism traits group and the ADHD group; in addition, no differences were found between people with ADHD traits and people with autism traits in terms of emotional and peer problems (see Table 8.19).

Table 8.17 MANCOVA of SDQ outcomes at T1. Descriptive statistics and F-tests comparing ADHD, autism, and no ADHD/autism groups.

Dependent Variables	**Groups**	**Mean**	**SD**	**Mean Adj**	**SE**	**F**	**P**	**Partial Eta squared η**

Conduct problems	No ADHD	2.22	1.657	2.317	.182	.071	.931	.001
	ADHD	2.44	1.559	2.327	.175			
	Autism	2.38	1.639	2.407	.181			
Hyperactive behaviour	No ADHD	3.44	2.432	3.909	.238	18.652	<.001	.134
	ADHD	6.24	2.084	5.913	.228			
	Autism	5.48	2.815	5.342	.236			
Emotional problems	No ADHD	4.25	2.554	4.749	.226	4.279	.015	.034
	ADHD	5.52	2.676	5.457	.217			
	Autism	6.09	2.738	5.659	.224			
Peer problems	No ADHD	3.29	1.889	3.476	.196	2.393	.094	.019
	ADHD	3.56	2.056	3.617	.188			
	Autism	4.30	2.234	4.066	.194			
Prosocial behaviour	No ADHD	8.24	2.147	8.096	.239	2.648	.073	.022
	ADHD	7.63	2.197	7.676	.229			
	Autism	7.21	2.213	7.298	.237			

Table 8.18 MANCOVA of SDQ outcomes for T2. Descriptive statistics and F-tests comparing ADHD, autism, and no ADHD/autism groups.

Dependent Variables	**Groups**	**Mean**	**SD**	**Mean $_{Adj}$**	**SE**	**F**	**P**	**Partial Eta squared η**
Conduct problems	No ADHD	1.88	1.263	1.933	.181	2.363	.097	.023
	ADHD	2.40	1.715	2.374	.198			
	Autism	2.54	1.812	2.500	.195			
Hyperactive behaviour	No ADHD	2.89	2.295	3.509	.227	19.152	<.001	.161
	ADHD	5.60	2.303	5.152	.249			
	Autism	5.81	2.642	5.501	.245			
Emotional problems	No ADHD	3.71	2.397	4.361	.210	7.468	<.001	.069
	ADHD	5.04	2.489	4.899	.230			
	Autism	6.23	2.734	5.591	.227			
Peer problems	No ADHD	4.63	1.386	4.875	.173	1.891	.154	.019
	ADHD	4.57	1.819	4.543	.190			
	Autism	5.33	1.763	5.057	.187			
Prosocial behaviour	No ADHD	8.40	1.981	8.246	.227	2.542	.081	.025
	ADHD	7.90	1.819	7.911	.249			
	Autism	7.30	2.277	7.472	.245			

Table 8.19 Bonferroni post hoc comparisons of hyperactive behaviour and emotional problem scores for ADHD, autism, no ADHD/autism groups.

Outcomes	Group type		T1			T2		
			Mean diff	SE	Sig	Mean diff	SE	Sig
Hyperactive behaviour	ADHD	No ADHD/autism	**2.004**	**.335**	**<.001**	**1.643**	**.348**	**<.001**
	Autism	No ADHD/autism	**1.433**	**.345**	**<.001**	**1.993**	**.344**	**<.001**
	ADHD	Autism	.571	.333	.262	-.349	.352	.964
Emotional problems	ADHD	No ADHD/autism	.708	.318	.081	.539	.322	.288
	Autism	No ADHD/autism	**.910**	**.327**	**.018**	**1.231**	**.319**	**<.001**
	Autism	ADHD	.202	.316	1.00	.692	.325	.104

8.3.5 Multivariate Regression Analyses

For the multivariate analyses, a multiple linear regression model (Enter method) was run for each outcome at T1 and T2. The following control variables were included in all multivariate analyses conducted in the current study (BMI, gender, student stressors, social support, positive coping, negative coping, psychological capital, low work–life balance, sleepiness, flow, and rumination). Moreover, HRB variables (healthy diet, junk food, total weekly caffeine intake, exercise, and sleepiness), ADHD scores, and autism scores were added as well. The assumptions were assessed to ensure that the linear regression models were reliable and valid. To avoid overfitting the models, Tabachnick and Fidell (2013) suggest using the formula N > 50 + 8(m) (m is the number of independent variables). Therefore, 300 was a good sample size for the predictors analysed. The multicollinearity assumption was tested by calculating variance inflation factor (VIF) and tolerance values for each predictor in the model. The VIF values were between 1.023 and 2.151 – less than 5, which is the accepted VIF value (James, Witten, Hastie, & Tibshirani, 2013). However, the tolerance values were between 0.465 and 0.978, indicating no evidence of problematic multicollinearity among the predictors Allison (1999). Moreover, the homoscedasticity and normality of residuals were assessed visually using a P-P plot for normality and a scatterplot of the standardised residuals for homoscedasticity, and the results suggest that the assumption of homoscedasticity and normality of residuals were met.

8.3.5.1 Positive Well-being, Flourishing, and Physical Health Regression Models

The first linear regression analysis was conducted to determine the significant predictors of positive well-being. Gender, BMI, student stressors, social support, positive coping, negative coping, psychological capital, low work–life balance, and flow were the covariate predictors entered in the regression model. The positive well-being models were statistically significant at T1 and T2, with F [18, 281] = 12.08, p = 0.001, and R^{adj} = 0.400; F [18, 229] = 10.40, p = 0.001, and R^{adj} = 0.407, respectively. The model accounted for 40% of the variance in positive well-being at T1 and T2. This suggests that there is a positive association between psychological capital and positive well-being at both time points. In addition, high student stressors correlated with decreased positive well-being at T1 and T2. The flow and social support were associated with positive well-being at T2 only. Moreover, the HRB variables (healthy diet, junk food, total weekly caffeine intake, exercise, and sleepiness) were included in the model, in addition to ADHD and autism traits, giving the ADHD trait and autism trait total scores. The health-related behaviour factors, ADHD, and autism scores were not significant predictors in the model; the full results are shown in Table 8.20.

Table 8.20 Multiple linear regression between health-related behaviours, ADHD and autism trait scores, and positive well-being outcome at T1 and T2. ***Note:*** *Beta (β) values are standardised.*

Positive Well-being						
T1				**T2**		
R^2	.436			**R^2**		.450
R adjusted	.400			**R adjusted**		.407
F	12.08			**F**		10.40
F Sig	.001			**F Sig**		0.001
Predictors	**β**	**t**	**Sig**	**β**	**t**	**Sig**
BMI	-.046	-.971	.332	.007	.137	.891
Gender	.075	1.590	.113	.076	1.367	.173
Student stressors	-.211	-3.765	<.001	-.314	-4.861	<.001
Social support	.105	1.911	.057	.183	2.739	.007
Positive coping	-.060	-1.038	.300	.024	.368	.713
Negative coping	-.017	-.279	.780	.001	.018	.986
Psychological capital	.371	6.129	<.001	.337	4.957	<.001
Low work–life balance	.051	.969	.333	.143	2.296	.023
Workload	-.106	-1.859	.064	-.113	-1.716	.088
Flow	.101	1.924	.055	.142	2.454	.015
Low rumination	.056	1.118	.264	.011	.208	.836

Healthy diet	.080	1.592	.112	-.047	-.884	.377
Junk food	.071	1.459	.146	-.070	-1.314	.190
Total weekly caffeine	-.073	-1.557	.121	-.051	-.993	.322
Exercise	.076	1.549	.122	.010	.182	.856
Sleepiness	-.013	-.234	.815	.076	1.276	.203
Total ADHD	.041	.715	.475	-.005	-.085	.932
Total autism	-.008	-.146	.884	.087	1.386	.167

The flourishing multiple linear regression models of T1 and T2 were statistically significant (F [18, 281] = 22.561, p = 0.001, R^{adj} = 0.565 T1, and F [18, 229] = 13.56, p = 0.001, R^{adj} = 0.478) at T2. The models explained 56.5% of flourishing at T1 and 47.8% at T2. High social support, psychological capital, and flow were linked to a greater likelihood of flourishing. These findings were observed at both time points. High weekly caffeine intake and ADHD traits correlated with lower flourishing at T1; these findings were not observed at T2. In addition, there was a negative correlation between sleepiness and flourishing at T2 only (see Table 8.21).

Table 8.21 Multiple linear regression between health-related behaviours, ADHD and autism trait scores, and flourishing outcome at T1 and T2. ***Note:*** *Beta (β) values are standardised.*

Flourishing						
T1				**T2**		
R^2	.591			**R^2**		.519
R adjusted	.565			**R adjusted**		.478
F	22.561			**F**		13.56
F Sig	.001			**F Sig**		.001
Predictors	**β**	**t**	**Sig**	**β**	**t**	**Sig**
BMI	-.050	-1.22	.222	-.061	-1.252	.212
Sex	.005	.133	.894	.083	1.592	.113
Student stressors	-.039	-.810	.419	-.076	-1.259	.209
Social support	.123	2.620	.009	.246	3.926	<.001
Positive coping	.037	.748	.455	-.080	-1.292	.198
Negative coping	-.040	-.774	.440	.042	.713	.477
Psychological capital	.374	7.25	<.001	.370	5.797	<.001
Low work–life balance	-.036	-.801	.424	.014	.234	.815
Workload	-.010	-.200	.842	-.114	-1.858	.065
Flow	.320	7.13	<.001	.272	5.029	<.001
Low rumination	.045	1.07	.283	-.013	-.254	.800
Healthy diet	.024	.563	.574	-.074	-1.464	.144
Junk food	.072	1.75	.081	.006	.112	.911

Total weekly caffeine	-.085	-2.13	.034	-.073	-1.517	.131
Exercise	.013	.320	.749	.040	.757	.450
Sleepiness	.022	.475	.635	-.188	-3.387	<.001
Total ADHD	-.122	-2.50	.013	.065	1.086	.279
Total autism	.025	.535	.593	.080	1.353	.177

Moreover, the results of the multiple linear regression to predict physical health were also statistically significant at T1 and T2 ($F [18, 281] = 9.42$, $p < 0.001$, $R^{adj} = 0.336$; $F [18, 229] = 9.224$, $p < 0.001$, $R^{adj} = 0.375$, respectively). The model explained about 33% of the variance at T1 and 37.5% at T2. The covariate predictors' psychological capital was associated with a higher likelihood of physical health at both time points. High BMI was linked to lower physical health at T1 and T2. Flow was related to physical health only at T1. Eating healthy food and regular exercise were correlated with a greater likelihood of physical health at both time points, while ADHD and autism scores showed no significant associations (see Table 8.22).

Table 8.22 Multiple linear regression between health-related behaviours, ADHD and autism trait scores, and physical health outcome at T1 and T2. ***Note:*** *Beta (β) values are standardised.*

Physical health						
T1				**T2**		
R^2	.376			**R^2**		.420
R adjusted	.336			**R adjusted**		.375
F	9.42			**F**		9.224
F Sig	.001			**F Sig**		.001
Predictors	**β**	**t**	**Sig**	**β**	**t**	**Sig**
BMI	-.129	-2.56	.011	-.163	-3.044	.003
Sex	.011	.230	.818	-.018	-.309	.758
Student stressors	.032	.546	.585	-.080	-1.212	.227
Social support	.056	.973	.331	.010	.150	.881
Positive coping	.034	.569	.570	.025	.373	.709
Negative coping	.083	1.28	.199	.017	.259	.796
Psychological capital	.190	2.98	.003	.241	3.452	<.001
Low work–life balance	.036	.643	.521	.008	.129	.897
Workload	.002	.034	.973	-.004	-.054	.957
Flow	.137	2.47	.014	.089	1.510	.132
Low rumination	-.081	-1.54	.124	.052	.921	.358
Healthy diet	.145	2.749	.006	.150	2.731	.007
Junk food	-.086	-1.69	.091	-.056	-1.030	.304
Total weekly caffeine	-.017	-.346	.729	-.124	-2.354	.019

Exercise	.302	5.83	<.001	.260	4.514	<.001
Sleepiness	-.038	-.669	.504	-.084	-1.377	.170
Total ADHD	-.084	-1.39	.165	.073	1.113	.267
Total autism	-.068	-1.19	.233	-.020	-.307	.759

8.3.5.2 Negative Well-being, Anxiety, and Depression Regression Models

Linear regression analyses were carried out to identify the predictors of negative well-being at T1 and T2. The first model to predict negative well-being at T1 was significant (F [18, 281] = 18.26, p = 0.001, and R^{adj} = 0.510). The model to predict negative well-being at T2 was significant as well (F [18, 229] = 16.18, p = 0.001, and R^{adj} =.525), explaining 51% of the variance in the negative well-being at T1 and 52.5% of the variance at T2. Negative well-being was predicted by increased student stressors and decreased psychological capital at T1 and T2. In addition, high BMI was found to be associated with an increase in negative well-being at T2. However, this association was not found at T1. Negative coping was positively correlated with negative well-being at T1 only. No associations were found between health-related behaviour predictors or ADHD, autism traits and negative well-being. See Table 8.23 for full details.

Table 8.23 Multiple linear regression between health-related behaviours, ADHD, and autism traits, and negative well-being outcome for T1 and T2. ***Note:*** *Beta (β) values are standardised.*

Negative Well-being						
T1				T2		
R^2	.539			**R^2**		.560
R adjusted	.510			**R adjusted**		.525
F	18.26			**F**		16.18
F Sig	.001			**F Sig**		.001
Predictors	**β**	**t**	**Sig**	**β**	**t**	**Sig**
BMI	.057	1.31	.188	.104	2.23	.027
Sex	.031	.726	.469	.012	.247	.805
Student stressors	.512	10.09	<.001	.519	8.97	<.001
Social support	.012	.247	.805	.036	.596	.552
Positive coping	-.002	-.034	.973	.103	1.74	.082
Negative coping	.127	2.30	.022	.090	1.58	.116
Psychological capital	-.216	-3.93	<.001	-.215	-3.53	<.001
Low work–life balance	.092	1.92	.055	-.084	-1.50	.133
Workload	.008	.164	.870	.029	.489	.625
Flow	-.092	-1.92	.055	-.141	-2.73	.007

Low rumination	.068	1.51	.130	-.010	-.203	.839
Healthy diet	.042	.931	.353	.012	.252	.801
Junk food	-.072	-1.65	.100	.007	.142	.887
Total weekly caffeine	.015	.356	.722	.008	.178	.859
Exercise	.031	.700	.484	.064	1.26	.206
Sleepiness	-.017	-.346	.730	.084	1.57	.116
Total ADHD	.071	1.36	.173	.053	.921	.358
Total autism	-.062	-1.26	.206	.036	.636	.526

Moreover, the linear regression models of anxiety were statistically significant at T1 and T2 ($F [18, 281] = 16.01$, $p = 0.001$, and $R^{adj} = 0.475$ at T1 and $F [18, 229] = 12.50$, $p = 0.001$, and $R^{adj} = 0.456$ at T2). The model explained 47.5% of the variance in anxiety at T1 and 45.6% at T2. The model showed that anxiety was associated with psychological capital at both time points. There was a positive association between negative coping, student stressors, and anxiety at T1 and T2. Moreover, social support was associated with lower anxiety at T1. It noticed that total weekly caffeine intake was linked to a reduced likelihood of anxiety at time 2, but not time 1. whereas there was no significant relationship between anxiety and ADHD and autism scores. For the beta values and p-values in the multiple linear analyses between the predictors, anxiety, and depression, see Table 8.26.

In addition, linear regression models were used to investigate the predictors of depression. Model T1 was significant ($F [18, 281] = 13.36$, $p = 0.001$, and $R^{adj} = 0.427$) and the model explained 42.7% of the variance in depression at T1. The second model was also significant ($F [18, 229] = 13.54$, $p = 0.001$, and $R^{adj} = 0.478$); the model explained 47.8% of the variance in depression at T2. The results showed that at T1 and T2, there were positive relationships between negative coping, student stressors, and depression. It was found that the established predictor of psychological capital was associated with decreased depression at both time points. Moreover, depression was predicted by increasing sleepiness during the day. As in previous results, no relationship between ADHD, autism scores and depression were observed (see Table 8.25).

Table 8.24 Multiple linear regression between health-related behaviour, ADHD and autism trait scores, and anxiety outcome for T1 and T2. ***Note:*** *Beta (β) values are standardised.*

Anxiety						
T1				**T2**		
R^2	.506			**R^2**		.496
R adjusted	.475			**R^2 adjusted**		.456
F	16.01			**F**		12.50
F Sig	.001			**F Sig**		**.001**
Predictors	**β**	**t**	**Sig**	**β**	**t**	**Sig**
BMI	.016	.365	.716	.072	1.450	.148
Gender	.061	1.382	.168	.042	.788	.432
Student stressors	.337	6.421	<.001	.276	4.457	<.001
Social support	-.113	-2.19	.029	.023	.353	.724
Positive coping	.046	.859	.391	.082	1.301	.195
Negative coping	.114	1.991	.047	.200	3.299	.001
Psychological capital	-.259	-4.55	<.001	-.169	-2.589	.010
Low work–life balance	.082	1.657	.099	.030	.501	.617
Workload	.035	.656	.512	.077	1.230	.220
Flow	.030	.616	.538	-.053	-.956	.340
Rumination	.137	2.951	.003	-.024	-.452	.651
Healthy diet	-.007	-.150	.881	.066	1.285	.200
Junk food	.068	1.496	.136	.080	1.574	.117
Total weekly caffeine	-.022	-.503	.615	-.108	-2.187	.030
Exercise	.020	.440	.661	-.097	-1.803	.073
Sleepiness	.099	1.966	.050	.049	.864	.388
Total ADHD	.043	.796	.427	.082	1.344	.180
Total autism	.031	.611	.542	.069	1.140	.255

Table 8.25 Multiple linear regression between health-related behaviours, ADHD and autism trait scores, and depression outcomes for T1 and T2. Note: Beta (β) values are standardised.

Depression			
T1		**T2**	
R^2	.461	**R^2**	.516
R adjusted	.427	**R adjusted**	.478
F	13.36	**F**	13.54
F Sig	.001	**F Sig**	.001

Predictors	β	t	Sig	β	t	Sig
BMI	.029	.623	.534	.078	1.598	.111
Gender	-.030	-.654	.514	-.082	-1.579	.116
Student stressors	.295	5.372	<.001	.346	5.707	<.001
Social support	-.114	-2.128	.034	-.075	-1.203	.230
Positive coping	.068	1.215	.225	-.039	-.636	.525
Negative coping	.123	2.055	.041	.209	3.512	<.001
Psychological capital	-.300	-5.067	<.001	-.207	-3.237	.001
Low work–life balance	.048	.928	.354	.107	1.825	.069
Workload	.023	.411	.681	-.057	-.919	.359
Flow	-.019	-.362	.718	.023	.434	.665
Low rumination	.088	1.818	.070	.053	1.030	.304
Healthy diet	-.058	-1.190	.235	.069	1.371	.172
Junk food	-.045	-.944	.346	.025	.491	.624
Total weekly caffeine	.028	.614	.540	.075	1.551	.122
Exercise	.005	.114	.909	-.052	-.984	.326
Sleepiness	.101	1.920	.056	.160	2.881	.004
Total ADHD	.008	.144	.886	.007	.118	.906
Total autism	.008	.153	.879	-.070	-1.196	.233

8.3.5.3 Conduct Problems and Hyperactive Behaviour Regression Models

Multiple linear regression models were used at both time points to determine the effects of the predictors on hyperactive behaviour. The results showed that the T1 model was statistically significant ($F [18, 281] = 19.99$, $p = 0.001$, and $R^{2\ adj} = 0.533$), and the model accounted for approximately 53% of the hyperactive behaviour at T1. In addition, the T2 model was also significant ($F [18, 229] = 20.08$, $p = 0.001$, and $R^{adj} = 0.582$); this model accounted for 58.2% of the hyperactive behaviour. Flow appeared to be associated with a decrease in the likelihood of hyperactive behaviour at T1 and T2. A relationship was observed between student stressors and increased hyperactive behaviour at T2, but not at T1. A healthy diet was associated with a decreased likelihood of hyperactive behaviour at T1. However, this association were not observed at T2. Along with a healthy diet, ADHD traits and autism traits were found to be associated with an increased likelihood of hyperactive behaviour at both time points (see Table 8.26).

Although, the multiple linear regression model for conduct problems at T1 was insignificant ($F [18, 281] = 1.52$ $p < 0.081$, $R^{adj} = 0.031$), the regression model at T2 was significant (F [18, 229] = 2.00 p < 0.001, R^{adj} = 0.010), only gender was substantial at T2 (see Table 8.27).

Table 8.26 Multiple linear regression between health-related behaviours, ADHD and autism trait scores, and hyperactive behaviour outcome at T1 and T2. ***Note:*** *Beta (β) values are standardised.*

Hyperactive Behaviour						
T1				**T2**		
R^2	.561			**R^2**		.612
R adjusted	.533			**R adjusted**		.582
F	19.94			**F**		20.08
F Sig	.001			**F Sig**		.001
Predictors	**β**	**t**	**Sig**	**β**	**t**	**Sig**
BMI	-.032	-.757	.450	.005	.108	.914
Gender	-.079	-1.899	.059	-.049	-1.056	.292
Student stressors	-.008	-.163	.870	.147	2.703	.007
Social support	-.035	-.717	.474	.055	.981	.328
Positive coping	.077	1.513	.131	-.081	-1.461	.145
Negative coping	.061	1.135	.257	.023	.434	.665
Psychological capital	-.149	-2.781	.006	-.103	-1.811	.071
Low work–life balance	.053	1.137	.256	.044	.844	.399
Workload	.033	.648	.518	-.073	-1.322	.187
Flow	-.150	-3.228	.001	-.156	-3.220	.001
Low rumination	-.022	-.498	.619	.026	.563	.574
Healthy diet	-.088	-1.983	.048	-.072	-1.594	.112
Junk food	-.022	-.506	.613	.072	1.603	.110
Total weekly caffeine	-.001	-.024	.981	.041	.952	.342
Exercise	-.002	-.053	.958	.013	.270	.787
Sleepiness	.040	.842	.401	-.027	-.548	.584
Total ADHD	.441	8.761	<.001	.464	8.672	<.001
Total autism	.166	3.465	<.001	.169	3.201	.002

Table 8.27 Multiple linear regression between health-related behaviours, ADHD and autism trait scores, and conduct problems at T1 and T2. ***Note:*** *Beta (β) values are standardised.*

Conduct problems			
T1		**T2**	
R^2	.089	**R^2**	.136
R adjusted	.031	**R adjusted**	.068
F	1.52	**F**	2.00

F Sig	.081			F Sig		.010
Predictors	**β**	**t**	**Sig**	**β**	**t**	**Sig**
BMI	-.035	-.583	.560	.099	1.525	.129
Gender	.029	.476	.634	.158	2.275	.024
Student stressors	.018	.254	.800	.004	.048	.962
Social support	-.023	-.325	.745	-.125	-1.492	.137
Positive coping	-.110	-1.512	.132	-.133	-1.614	.108
Negative coping	-.019	-.250	.803	.046	.581	.562
Psychological capital	.044	.576	.565	.114	1.334	.184
Low work–life balance	-.084	-1.253	.211	-.049	-.621	.535
Workload	.172	2.376	.018	.033	.401	.689
Flow	-.136	-2.040	.042	-.116	-1.609	.109
Low rumination	.068	1.070	.286	.001	.020	.984
Healthy diet	-.087	-1.369	.172	-.113	-1.681	.094
Junk food	-.063	-1.025	.306	-.086	-1.292	.198
Total weekly caffeine	.019	.320	.749	.018	.285	.776
Exercise	.028	.446	.656	.077	1.089	.277
Sleepiness	-.032	-.464	.643	-.052	-.701	.484
Total ADHD	.036	.498	.619	.092	1.156	.249
Total autism	.071	1.032	.303	.084	1.068	.286

8.3.5.4 Emotional Problem and Peer Problem Regression Models

The model was statistically significant in terms of the linear regression results to predict emotional problems at both time points ($F [18, 281] = 14.66$, $p = 0.001$, and $R^{adj} = 0.451$; $F [18, 229] = 17.17$, $p = 0.001$, and $R^{adj} = 0.541$, respectively). Females reported significantly higher emotional problems than males at T1 and T2. The established predictors of psychological capital, student stressors, and negative coping were significant at both time points. In addition, high ADHD traits correlated with an increased likelihood of emotional problems at T2 but not at time 1, (see Table 8.28).

The linear regression models of peer problems were significant at both time points ($F [18, 281] = 11.15$, $p < 0.001$ $R^{adj} = 0.379$; $F [18, 229] = 4.58$, $p < 0.001$, $R^{adj} = 0.223$, respectively). The models explained about 38% of the variance in peer problems at T1 and 22.3% at T2. Social support was associated with fewer peer problems at T1 and T2. Negative coping and student stressors were linked to a greater likelihood of peer problems at T1 only, while exercise and sleepiness were associated with fewer peer problems, though the effect was only observed at T1. The findings revealed that autism traits positively correlated with peer problems at both time points. The full results are shown in Table 8.29.

Table 8.28 Multiple linear regression between health-related behaviours, ADHD and autism trait scores, and emotional problems for T1 and T2. ***Note:*** *Beta (β) values are standardised*.

Emotional Problems						
T1				**T2**		
R^2	.484			**R^2**		.574
R adjusted	.451			**R adjusted**		.541
F	14.66			**F**		17.17
F Sig	.001			**F Sig**		.001
Predictors	**β**	**t**	**Sig**	**β**	**t**	**Sig**
BMI	.023	.506	.613	.037	.816	.415
Gender	.158	3.489	<.001	.193	3.974	<.001
Student stressors	.158	2.941	.004	.262	4.602	<.001
Social support	-.075	-1.435	.152	.023	.393	.695
Positive coping	.034	.624	.533	-.003	-.060	.952
Negative coping	.193	3.310	.001	.220	3.951	<.001
Psychological capital	-.242	-4.180	<.001	-.245	-4.099	<.001
Low work–life balance	.076	1.497	.135	.021	.382	.703
Workload	.030	.547	.585	-.035	-.602	.548
Flow	-.003	-.066	.947	-.032	-.630	.529
Low rumination	.064	1.341	.181	.032	.652	.515
Healthy diet	-.068	-1.419	.157	.014	.294	.769
Junk food	.068	1.478	.141	.037	.793	.429
Total weekly caffeine	.040	.887	.376	-.015	-.331	.741
Exercise	-.047	-.997	.320	-.061	-1.231	.220
Sleepiness	.076	1.481	.140	.022	.412	.681
Total ADHD	.056	1.022	.308	.134	2.392	.018
Total autism	.050	.960	.338	.081	1.461	.145

Table 8.29 Multiple linear regression between health-related behaviours, ADHD and autism trait scores, and peer problems at T1 and T2. ***Note:*** *Beta (β) values are standardised.*

Peer Problems			
T1		**T2**	
R^2	.417	**R^2**	.286
R adjusted	.379	**R adjusted**	.223
F	11.15	**F**	4.581
F Sig	.001	**F Sig**	.001

Predictors	β	t	Sig	β	t	Sig
BMI	-.011	-.228	.820	.053	.855	.394
Gender	.032	.667	.506	-.010	-.144	.885
Student stressors	.150	2.634	.009	.131	1.660	.098
Social support	-.323	-5.791	<.001	-.260	-3.197	.002
Positive coping	-.026	-.440	.660	-.016	-.201	.841
Negative coping	.194	3.126	.002	.144	1.903	.058
Psychological capital	-.074	-1.207	.229	-.078	-.954	.341
Low work–life balance	.014	.269	.788	.024	.310	.757
Workload	-.062	-1.073	.284	-.067	-.846	.398
Flow	.066	1.242	.215	.022	.315	.753
Low rumination	-.015	-.297	.767	.001	.011	.991
Healthy diet	-.015	-.291	.771	.008	.130	.897
Junk food	.019	.376	.707	-.083	-1.305	.193
Total weekly caffeine	-.058	-1.207	.228	.016	.258	.797
Exercise	-.134	-2.682	.008	-.095	-1.399	.163
Sleepiness	-.124	-2.274	.024	.007	.097	.923
Total ADHD	-.075	-1.284	.200	-.111	-1.424	.156
Total autism	.264	4.784	<.001	.161	2.134	.034

8.3.5.5 Prosocial Behaviour Regression Model

The prosocial behaviour linear regression model for T1 was statistically significant (F [18, 281] = 4.27, p = 0.001, R^{adj} = 0.165). The model explained 16.5% of the prosocial behaviour. It was found that high BMI and social support increase the likelihood of prosocial behaviour at T1. The model of prosocial behaviour at T2 was also statistically significant (F [18, 229] = 3.43, p = 0.001, and R^{adj} = 0.151). The model explained approximately 15% of the prosocial behaviour at T2. It was found that positive coping was correlated with prosocial behaviour at T2, although these correlations were not observed at T1. Furthermore, it appeared that autism traits were negatively associated with prosocial behaviour at both time points. There were no relationships between health-related behaviour factors and prosocial behaviour in the multivariate analyses (see Table 8.30).

Table 8.30 Multiple linear regression between health-related behaviour factors, ADHD and autism trait scores, and prosocial behaviour for T1 and T2. ***Note:*** *Beta (β) values are standardised.*

Prosocial Behaviour						
T1				**T2**		
R^2	.215			**R^2**		.212
R adjusted	.165			**R adjusted**		.151
F	4.27			**F**		3.43
F Sig	.001			**F Sig**		.001
Predictors	**β**	**t**	**Sig**	**β**	**t**	**Sig**
BMI	**.157**	**2.791**	**.006**	.088	1.409	.160
Gender	-.014	-.245	.807	.036	.549	.583
Student stressors	.070	1.057	.292	.062	.805	.422
Social support	**.136**	**2.092**	**.037**	.015	.192	.848
Positive coping	.044	.650	.516	**.176**	**2.235**	**.026**
Negative coping	.025	.341	.733	-.138	-1.822	.070
Psychological capital	.071	.995	.321	.113	1.393	.165
Low work–life balance	.107	1.709	.089	.111	1.495	.136
Workload	-.017	-.256	.798	.021	.272	.786
Flow	.090	1.452	.148	-.077	-1.115	.266
Low rumination	-.016	-.269	.788	.043	.654	.514
Healthy diet	.110	1.861	.064	.003	.040	.968
Junk food	-.087	-1.519	.130	.015	.235	.815
Total weekly caffeine	-.032	-.572	.568	-.035	-.567	.571
Exercise	-.034	-.593	.554	-.012	-.173	.863
Sleepiness	.027	.427	.670	.107	1.508	.133
Total ADHD	.041	.612	.541	-.142	-1.858	.064
Total autism	**-.315**	**-4.924**	**<.001**	**-.194**	**-2.589**	**.010**

8.6 Discussion

In this study, we investigated the associations between health-related behaviours, ADHD and autism scores, well-being, and SDQ outcomes in groups of students with and without a prior diagnosis of ADHD or autism. The first aim of this study was to examine the relationship between HRB variables, ADHD scores, autism scores, and outcomes, and then to find to what extent HRB variables and ADHD and autism scores predict outcomes when controlling for established predictors for students with a previous diagnosis of ADHD and autism. As in previous studies, the well-being process model was used as the theoretical framework. In addition to adopting a multivariate approach, most prior research examined associations between HRBs and well-being in people with ADHD and autism using univariate analysis. A significant advantage of including established predictors as covariates is that substantial effects of established predictors represent the replication of previous findings and provide greater confidence in the important effects of ADHD/autism and health-related behaviours. As a result, HRBs, ADHD scores, autism scores, and established variables were used as predictors. Meanwhile, the well-being and SDQ variables were the outcomes. The two significant differences from the previous studies reported in this thesis were the comparison with individuals with prior diagnosed and the use of a longitudinal design.

8.6.1 Diagnosed Groups

To explore the comparison between the three groups (i.e., no ADHD/autism group, ADHD group, and autism group) on well-being and SDQ outcomes, multivariate analysis of covariance (MANCOVA) analyses was conducted with groups as independent variables, well-being and SDQ outcomes as dependent variables, and gender, BMI, health-related behaviours, and established predictors as covariates for T1 and T2. No differences were found among the three groups regarding well-being outcomes. In contrast, there were differences between the groups for the SDQ outcomes; hyperactivity and emotional problems. The no ADHD/autism group had lower hyperactivity scores than the ADHD and autism groups. However, the difference in hyperactivity between the ADHD group and the autism group was not significant. These results are consistent with the findings from the previous literature. Emotional problems were also significantly different between the groups: those with autism had more emotional problems than those in the no ADHD/no autism group. This finding was not observed among people with ADHD.

8.6.2 Associations between Established Predictors and Outcomes

Most of the established predictors were associated with the outcomes at the univariate analysis level. As might be expected, the negative outcomes were associated with increased levels of student stressors and negative coping strategies, decreased levels of social support, and psychological capital. Conversely, positive outcomes were associated with increased levels of social support, positive personality traits, and positive coping strategies. All well-being and SDQ outcomes, except prosocial behaviour and conduct problems, were associated with student stressors, psychological capital, negative coping, positive coping, and social support at both time points. These results confirm those of the previous studies using the Well-being Process Questionnaire. In the univariate analysis, poor work–life balance, high workload, and life stress were positively related to negative well-being, anxiety, depression, emotional problems, and hyperactive behaviour and negatively associated with positive well-being and flourishing at both time points. Conversely, low rumination, life satisfaction, and flow were positively related to positive well-being and flourishing.

In the multivariate analysis, some of the established predictors remained significant. For example, increased psychological capital was associated with increased positive well-being, and physical health at both time points. Similar findings were found for flow and social support with positive well-being at T2. In addition, increased psychological capital, flow, and social support were associated with increased flourishing at both time points. This confirms the earlier observations in Chapter 6, which showed that psychological capital and flow might help increase university students' positive well-being and flourishing. In addition, in the multivariate analysis, there were significant associations between the established predictors of student stressors and negative well-being, anxiety, depression, and emotional problems at both time points. These results confirm those reported in Chapters 6 and 7, where stressors appeared to increase negative well-being and emotional problems among university and secondary students and were associated with increased anxiety and depression among secondary students. Moreover, the results showed that student stressors could contribute to decrease positive well-being at both time points, and increased hyperactive behaviour at T2; this finding was not observed at T1. However, the results from previous chapters supported the idea that student stressors are associated with low positive well-being and flourishing. Negative coping was related to increases in anxiety and depression at T1 and T2. There was a consistent relationship between negative coping and emotions at both time points and with peer problems and negative well-being at T1. This is consistent with the university students' survey results described in Chapter 6, which found a positive relationship between emotional problems and negative coping in multivariate analyses. The positive relationship between negative well-being and negative coping was consistent with the study of university students. Females were more likely than males to have emotional problems. A similar finding was found in previous chapters among secondary students.

8.6.3 Associations between ADHD/Autistic Traits and Outcomes

In the univariate analyses, ADHD and autism scores were consistently associated with well-being and SDQ outcomes at both time points. For example, these scores were associated with lower positive well-being, flourishing, physical health, and prosocial behaviour, as well as high negative well-being, anxiety, depression, conduct problems, hyperactive behaviour, peer problems, and emotional problems. In the multivariate analyses, after adjusting for established predictors and health-related behaviour, the results showed similar finding of previous chapters, ADHD/autism traits were not associated with well-being outcomes except for ADHD traits related to reduced flourishing at T1, this finding was not observed at T2. While, the ADHD and autism scores remained significantly associated with some SDQ outcomes. ADHD and autism traits were associated with increased hyperactivity at both times. The results also showed that autistic traits were associated with increased peer problems and decreased prosocial behaviour. These results were found at both time points. The results described in the previous chapters indicated similar associations between ADHD traits, autism traits, and hyperactivity among university and secondary students. In addition, autistic traits were associated with peer problems in the university and secondary student surveys, while decreased prosocial behaviour was associated with autism traits among university students, but not secondary students. In previous literature studies of an association between ADHD and autism traits and well-being, the SDQ outcomes showed the same results. For example, after controlling for established predictors, Garcha et al. (2023) found that ADHD/autistic traits were positively associated with hyperactive behaviour among university and secondary school students; at the same time, they reported that autistic traits were positively related to peer problems among university students and low prosocial behaviour among secondary students (Garcha & Smith, 2023; Andrew Smith et al., 2023).

8.6.4 Associations between HRBs and Outcomes

Several studies reported a relationship between HRBs and well-being and ADHD and autism traits. Hence, one of the aims of this study was to determine whether HRB, ADHD, and autism scores could predict outcomes when established predictors were controlled in a multivariate analysis. The results showed that, in univariate analysis, an increase in weekly caffeine consumption was associated with an increase in negative well-being, anxiety, depression, emotional problems, and hyperactive behaviour at T1 and depression and hyperactive behaviour at T2, in addition to reduced positive well-being and flourishing at T1 and T2.It was found that the association between weekly caffeine intake and the reduction in flourishing persisted in multivariate analyses after controlling for established predictors at T1. However, this effect did not appear in the multivariate analysis at T2. Although there was no association between weekly caffeine intake and anxiety at T2 in the univariate analysis, it was found in the multivariate analysis. Weekly caffeine consumption might reduce the likelihood of anxiety at time 2 but not at time 1. A possible explanation is that low-anxious individuals might consume more caffeine, which could indicate reverse causality. Another interpretation previous studies confirm the association between coffee consumption and improved mental health outcomes among adults (Nouri-Majd et al., 2022).

In the univariate analyses, healthy diet consumption was found to help reduce hyperactive behaviour, conduct problems, and emotional problems and contribute to increased physical health at both time points. However, the influence of healthy diets on physical health remained significant in multivariate analyses at T1 and T2 and on hyperactive behaviour at T1 only after controlling for established predictors. These results confirmed that a healthy diet could reduce hyperactive behaviour and increase physical health (Pinto et al., 2022).

In addition to healthy food consumption, high exercise was associated with decreased anxiety, depression, hyperactive behaviour, emotional problems, and peer problems, and increased positive well-being, flourishing, and physical health according to the univariate analyses at T1 and T2. However, in the multivariate analyses, exercise was associated with most of the well-being and SDQ outcomes at both time points. the relationships that were observed between exercise and high levels of physical health at T1 and T2; confirm the findings of (Penedo & Dahn, 2005). Moreover, it appeared that exercise was related to reduced peer problems, and this remained significant in the multivariate analysis at T1 but not at T2.

Sleepiness was positively associated with depression in the univariate analyses at both time points and remained so in the multivariate analysis at T2 but not at T1. This finding was not unexpected, since, in the previous study, sleep problems were already associated with increased negative well-being after controlling for established predictors. However, although there were associations between HRB variables and positive well-being, negative well-being, emotional problems, and prosocial behaviour at both time points in the univariate analyses, in the multiple regression analyses, no significant relationships were found between HRB measures and these outcome variables at either time point.

Although univariate analyses showed associations between HRBs, depression, hyperactive behaviour, and peer problems at both time points, the multivariate analyses did not find any association between HRB and depression at T1. In addition, there was no association between HRB variables and peer problems and hyperactive behaviour at T2.

8.7 Conclusion

The results are consistent with previous chapters on university and secondary student populations. Although the HRBs were significant in univariate analyses, most of the HRBs became no longer significant after being adjusted for controlling variables. This suggests that while HRBs are correlated to well-being and SDQ outcomes in univariate analyses, they often have less predictive power when other well-being predictors are taken into account. Moreover, similar to previous chapters, ADHD/autism traits were significant with SDQ outcomes but not well-being outcomes. The present analyses considered some of the hypotheses outlined in the Introduction section. The next chapter presents the cross-lagged analyses examining whether the predictors at T1 are associated with the outcomes at T2. Following this, the possible interactions and mediating effects of certain variables are discussed.

Chapter 9: Longitudinal Analyses, Mediation, and Interaction Analyses of Students with Diagnosed ADHD and Autism

9.1 Overview of the Chapter

This chapter aims to provide a deeper understanding of the study results described in the previous chapter. The current chapter has three main aims. The first is to investigate the longitudinal influence of health-related behaviours and well-being predictors on the well-being and SDQ outcomes. The second is to examine the interaction terms and determine whether the effect of diet variables on well-being and SDQ outcomes changes depending on the presence of ADHD and autism traits. The final aim is to identify the indirect relationships between diet variables and well-being outcomes through mediation analyses, with the diet variables without other health-related variables being included in the moderation and mediation analysis.

9.2 Methods

The same dataset and study design were employed in this study as those described in Chapter 8. For a more comprehensive description of the data collection process and sample characteristics, please refer to Section 8.2 in Chapter 8.

9.2.1 Statistical Analyses

Three analysis approaches were used: cross-lagged analysis, interaction analysis, and mediation analysis. The cross-lagged analysis investigates the potential causal nature of the relationships between predictors at time 1 and well-being and SDQ outcomes at time 2 three months later, using multiple linear regression (Enter model) methods. The covariates included in the cross-lagged models are the same as in the cross-sectional analyses of well-being and SDQ outcomes in Chapter 8 (i.e., BMI, gender, student stressors, social support, positive coping, negative coping, psychological capital, low work–life balance, workload, low rumination, and flow). These covariant variables were included in each multivariate cross-lagged analysis conducted in this study, and all covariates were measured at T1. The second statistical approach is interaction analyses. Interaction analyses were performed to investigate whether cross-sectional associations between diet variables and well-being outcomes are moderated by ADHD and autism traits. The final approach used is to estimate the indirect effect of diet behaviours on well-being through the hypothesised mediator (e.g., ADHD traits). Mediation is tested using the PROCESS macro for SPSS (Hayes, 2017). The significance of the indirect effect is assessed using bootstrapping with 5,000 resamples and 95% confidence intervals (CI) for model 4. The indirect effect is considered statistically significant if the CI does not include zero. The following section describes the first aim of the current chapter, namely, cross-lagged analyses to examine associations between predictors at T1 and the outcomes of T2.

9.3 Results

9.3.1 Cross-Lagged Analysis

A cross-lagged analysis was performed to determine whether the predictors at T1 were related to outcomes at T2. This part of the study was divided into two parts. The first part investigated the effect of health-related behaviours, ADHD, and autism traits at T1 on the well-being outcomes at T2 in univariate cross-legged, and after controlling for well-being predictors in multivariate cross-lagged analyses. The second part investigated the association between health-related behaviours, ADHD, and autism traits at T1 on SDQ outcomes at T2 in univariate and multivariate cross-lagged analyses.

9.3.1.1 Cross-Lagged Analysis of Health-Related Behaviours and Well-being Outcomes

The univariate cross-lagged analysis results were similar to the cross-sectional results in the previous chapter. There were statistically significant positive correlations between ADHD traits and autism traits at T1 and negative well-being, anxiety, and depression at T2, and the effect size ranged between 240 and 319. Negative correlations were observed between ADHD traits and autism traits at T1 and positive well-being, flourishing, and physical health at T2. Total weekly caffeine consumption at T1 was associated with decreased positive well-being and flourishing and increased depression at T2. Moreover, there were positive associations between exercise at T1 and physical health, positive well-being, and flourishing at T2. Negative associations were observed between exercise at T1 and anxiety and depression at T2. It was found that junk food consumption at T1 was associated with increased anxiety at T2. There were positive associations between sleepiness at T1 and negative well-being, anxiety, and depression at T2 (see Table 9.1).

In the multivariate cross-lagged analysis and after controlling for the covariant variables, most of the significant associations disappeared. However, the association between exercise at T1 and positive well-being and physical health at T2 remained significant. As observed in the univariate cross-lagging, junk food consumption at T1 was associated with increased anxiety at T2. A healthy diet at T1 was a good predictor of physical health at T2. Social support at T1 was associated with increased positive well-being and flourishing, and decreased depression at T2. In addition, psychological capital at T1 was associated with positive well-being, flourishing, and physical health at T2. While, psychological capital at T1 was associated with decreased negative well-being, anxiety, and depression at T2. Moreover, a significant effect was observed between student stressors at T1 and negative well-being, anxiety, and depression at T2. Flow at T1 was associated with increased flourishing at T2. There were no significant associations between ADHD, autism traits, and well-being outcomes at T2 in the multivariate analyses (see Tables 9.2 and 9.3).

Table 9.1 Univariate cross-lagged associations between HRBs, ADHD, autism traits, and well-being outcomes. ***Note:*** Pearson's matrix (two-tailed) is used for all correlations.

Predictors	Positive well-being T2		Flourishing T2		Physical health T2		Negative well-being T2		Anxiety T2		Depression T2	
	r	p	r	p	r	p	r	p	r	p	r	p
BMI T1	-.078	.223	-.216	.001	-.254	.001	.158	.013	.180	.005	.132	.038
Sex T1	-.002	.970	-.010	.871	-.162	.011	.161	.012	.229	.001	.107	.093
Student stressors T1	-.215	.001	-.168	.008	-.177	.006	.362	.001	.433	.001	.402	.001
Social support T1	.331	.001	.498	.001	.260	.001	-.335	.001	-.341	.001	-.404	.001
Positive coping T1	.268	.001	.354	.001	.312	.001	-.189	.003	-.227	.001	-.317	.001
Negative coping T1	-.257	.001	-.297	.001	-.275	.001	.301	.001	.396	.001	.370	.001
Psychological capital T1	.396	.001	.484	.001	.373	.001	-.397	.001	-.449	.001	-.472	.001
Low work–life balance T1	-.034	.596	-.080	.215	-.087	.177	.208	.001	.224	.001	.175	.006
Workload T1	-.132	.039	-.044	.489	-.123	.055	.185	.004	.226	.001	.236	.001

Flow T1	.192	.002	.307	.001	.211	.001	-.165	.010	-.175	.006	-.154	.015
Low ruminationT1	.084	.190	.171	.007	.081	.206	-.022	.729	-.099	.123	-.069	.277
Total weekly caffeine T1	-.148	.020	-.148	.021	-.101	.118	.097	.131	.076	.236	.157	.014
Healthy diet T1	.112	.081	.115	.074	.365	.001	-.061	.347	-.068	.295	-.118	.067
Junk food T1	-.034	.600	-.068	.294	-.159	.014	.074	.248	.218	.001	.106	.099
Exercise T1	.230	.001	.230	.001	.473	.001	-.123	.054	-.199	.002	-.142	.026
Sleepiness T1	-.218	.001	-.256	.001	-.231	.001	.228	.001	.317	.001	.350	.001
ADHD T1	-.259	.001	-.330	.001	-.215	.001	.316	.001	.303	.001	.240	.001
Autism T1	-.270	.001	-.268	.001	-.320	.001	.319	.001	.303	.001	.261	.001

Table 9.2 Multivariate cross-lagged associations between health-related behaviours and well-being outcomes. ***Note:*** *The values of beta (β) are standardised.*

The predictors	Negative well-being T2		Anxiety T2		Depression T2	
	β	p	β	p	β	p
BMI T1	.072	.233	.083	.143	.058	.322
Sex T1	.088	.139	**.113**	**.042**	.019	.742
Student stressors T1	**.209**	**.005**	**.233**	**<.001**	**.144**	**.045**
Social support T1	-.135	.056	-.109	.100	**-.163**	**.018**
Positive coping T1	.028	.697	.016	.809	-.066	.350
Negative coping T1	.029	.699	.097	.172	.032	.669
Psychological capital T1	**-.172**	**.024**	**-.205**	**.004**	**-.236**	**.001**
Low work–life balance T1	.095	.148	.094	.125	.032	.610
Workload T1	-.044	.556	-.033	.639	.073	.314
Flow T1	-.059	.376	-.011	.856	-.010	.877
Rumination T1	**.128**	**.039**	.072	.217	.082	.174
Healthy diet T1	.082	.197	.120	.046	.019	.758
Junk food T1	-.003	.955	**.143**	**.012**	.045	.447
Total weekly caffeine T1	-.032	.587	-.074	.173	.023	.685
Exercise T1	-.024	.701	-.074	.210	.000	.998
Sleepiness T1	-.037	.579	.013	.836	.101	.125
ADHD traits T1	.136	.060	.083	.217	-.019	.788
Autism traits T1	.121	.072	.054	.393	.038	.565

The model fit	F = 5.48, p <.001 R^2 =.301	F = 8.12, p <.001 R^2 =.390	F = 6.56, p <.001 R^2 =.340

Table 9.3 Multivariate cross-lagged associations between health-related behaviours and well-being outcomes. Note: The values of beta (β) are standardised.

The predictors	Positive well-being T2		Flourishing T2		Physical health T2	
	β	**p**	**β**	**p**	**β**	**p**
BMI T1	-.019	.760	**-.121**	**.032**	**-.186**	**.001**
Sex T1	.048	.436	.043	.435	-.064	.246
Student stressors T1	-.015	.847	.098	.152	.062	.362
Social support T1	**.150**	**.042**	**.313**	**<.001**	.044	.499
Positive coping T1	.038	.614	.038	.576	.065	.332
Negative coping T1	.013	.869	-.021	.763	.013	.857
Psychological capital T1	**.202**	**.011**	**.215**	**.002**	**.177**	**.012**
Low work–life balance T1	.097	.153	.015	.803	.033	.579
Academic stress T1	-.112	.152	-.013	.849	-.128	.064
Flow T1	.071	.308	**.150**	**.016**	.070	.256
Low rumination T1	-.058	.368	-.026	.651	-.070	.219
Healthy diet T1	-.027	.690	-.050	.400	**.180**	**.002**
Junk food T1	.042	.506	.005	.927	.003	.951
Total weekly caffeine T1	-.045	.455	-.014	.792	.010	.855
Exercise T1	**.145**	**.028**	.098	.096	**.323**	**<.001**
Sleepiness T1	-.011	.872	-.033	.602	-.029	.646
ADHD traits T1	-.088	.240	-.112	.094	.039	.555
Autism traits T1	-.068	.332	-.020	.753	-.094	.130
The model fit	F = 4.01, p <.001 R^2 =.240		F = 8.37, p <.001 R^2 =.397		F = 8.63, p <.001 R^2 =.404	

9.3.1.2 Cross-Lagged Analysis of Health-Related Behaviours and SDQ Outcomes

In the univariate cross-lagged analysis results, there was a positive association between junk food, total weekly caffeine consumption, sleepiness at T1, and hyperactive behaviour and emotional problems at T2. Total weekly caffeine intake and junk food at T1 were negatively associated with prosocial behaviour at T2. Autistic traits at T1 was positively associated with hyperactive behaviour, emotional problems, conduct problems, and peer problems at T2. While ADHD traits was correlated with hyperactive behaviours and emotional problems. ADHD and autism traits T1 were negatively associated with prosocial behaviour at T2 (see Table 9.4).

In the multivariate analyses, most of the correlations observed in the univariate cross-lagged analysis disappeared after controlling for the covariates. ADHD and autistic traits at T1 remained significantly associated with hyperactive behaviour at T2 (B = 0.436, p = 0.002 and B = 0.111, p = 0.048, respectively). It was observed that autistic traits at T1 were positively associated with conduct, emotional, and peer problems and negatively related to prosocial behaviour at T2. It was observed that psychological capital at T1 was negatively associated with hyperactive behaviour and emotional problems and positively associated with prosocial behaviour at T2. In addition, negative coping at T1 was associated with increased emotional problems at T2. Flow at T1 was associated with decreased hyperactive behaviour at T2 (see Table 9.5). It was observed that high student stressors at T1 were associated with emotional problems at T2.

The following section moves on to the second aim of the current chapter, which examines whether the effect of diet variables is dependent on ADHD and autistic traits by analysing the interaction between diet variables and ADHD and autistic traits on well-being and SDQ outcomes at T1 and T2.

Table 9.4 Univariate cross-lagged associations between HRBs, ADHD, autism traits, and SDQ outcomes. ***Note:*** Pearson's matrix (two-tailed) is used for all correlations.

The predictors	Conduct problems T2		Hyperactive behaviour T2		Emotional problems T2		Peer problems T2		Prosocial behaviour T2	
	r	p	r	p	r	p	r	p	r	p
BMI T1	.103	.109	.177	.006	.174	.001	.014	.832	-.173	.007
Sex T1	.117	.068	.015	.815	.360	.001	.272	.001	-.372	.001
Student stressors T1	.072	.264	.298	.001	.441	.021	.104	.104	-.181	.005
Social support T1	-.188	.003	-.293	.001	-.353	.014	-.077	.236	.068	.292
Positive coping T1	-.160	.013	-.291	.001	-.276	.004	-.007	.919	-.138	.031
Negative coping T1	.097	.131	.384	.001	.496	.001	-.216	.001	.122	.056
Psychological capital T1	-.054	.402	-.459	.001	-.533	.001	.100	.119	-.079	.219
Low work life balance T1	.056	.384	.208	.001	.170	.009	.091	.158	.075	.245

Workload T1	.091	.158	.220	.001	.231	.001	.024	.710	-.010	.875
Flow T1	-.082	.200	-.374	.001	-.154	.017	.021	.745	.124	.053
RuminationT1	.041	.520	-.184	.004	-.162	.012	-.047	.465	.039	.538
Total weekly caffeine T1	.035	.589	.176	.006	.150	.021	.104	.104	-.181	.005
Healthy diets T1	-.133	.039	-.222	.001	-.161	.014	-.077	.236	.068	.292
Junk food T1	.080	.214	.163	.012	.185	.004	-.007	.919	-.138	.031
Exercise T1	-.041	.525	-.156	.015	-.250	.001	-.216	.001	.122	.056
Sleepiness T1	.100	.119	.350	.001	.389	.001	.100	.119	-.079	.219
ADHD T1	.112	.082	.645	.001	.365	.001	.014	.832	-.173	.007
Autism T1	.205	.001	.444	.001	.398	.001	.272	.001	-.372	.001

Table 9.5 Multivariate cross-lagged associations between health-related behaviours and SDQ outcomes. ***Note:*** *The values of beta (β) are standardised.*

The predictors	Conduct problems T2		Hyperactive behaviour T2		Emotional problems T2		Peer problems T2		Prosocial behaviour T2	
	β	p	β	p	β	p	β	p	β	p
BMI T1	.066	.331	.053	.295	.021	.684	.009	.888	**.164**	**.011**
Sex T1	.112	.094	-.020	.680	**.265**	**<.001**	.041	.498	.048	.444
Student stressors T1	-.053	.521	.038	.531	**.147**	**.020**	.108	.148	.033	.672
Social support T1	-.177	.027	.015	.792	-.049	.413	**-.295**	**<.001**	.061	.411
Positive coping T1	-.072	.376	-.021	.729	.008	.895	.066	.373	.029	.704
Negative coping T1	-.017	.838	.025	.698	**.172**	**.008**	.135	.080	.032	.686
Psychological capital T1	.125	.142	**-.185**	**.004**	**-.239**	**<.001**	-.099	.197	**.171**	**.034**
Low work–life balance T1	-.023	.751	.044	.419	.019	.729	.089	.180	.106	.127
Academic stress T1	.082	.329	-.013	.832	-.044	.490	-.097	.202	.001	.992
Flow T1	-.092	.220	**-.142**	**.011**	.045	.424	.109	.109	.044	.537
Low rumination T1	.094	.180	.012	.821	-.008	.873	-.005	.937	-.043	.515
Healthy diet T1	-.061	.400	-.021	.698	.003	.953	-.007	.919	-.009	.891
Junk food T1	.022	.744	-.018	.715	.038	.466	-.026	.670	-.093	.151
Total weekly caffeine T1	.001	.988	.031	.517	-.007	.882	.005	.934	-.100	.105
Exercise T1	.050	.479	.010	.851	-.050	.351	-.125	.052	.017	.799
Sleepiness T1	.044	.561	.048	.388	.053	.354	-.087	.206	.053	.457

ADHD traits T1	-.050	.534	**.436**	**<.001**	.112	.067	**-.190**	**.010**	-.013	.866
Autism traits T1	**.183**	**.016**	**.111**	**.048**	**.123**	**.032**	**.222**	**.001**	**-.297**	**<.001**
The model fit	F = 1.61, p <.057 R^2 =.113		F = 13.64, p <.001 R^2 =.517		F = 12.52, p <.001 R^2 =.496		F = 4.96, p <.001 R^2 =.281		F = 3.53, p <.001 R^2 =.217	

9.3.2 Interactions between Diet and ADHD/Autistic Traits in Relation to Well-being and SDQ Outcomes

Interaction analyses were conducted to investigate whether the cross-sectional relationship between the diet variables and well-being and SDQ outcomes introduced in this study were moderated by ADHD and autistic traits. The interaction terms of diet and ADHD/autistic traits were added to the model. The procedure was identical to that which was utilised to examine the main effects in the cross-sectional multivariate analyses (i.e., using the same control variables in the linear regression analyses), so the covariates were the same as in the cross-sectional analyses of well-being and SDQ outcomes in Chapter 8 (refer to Section 8.3.5). The results revealed that there was a significant interaction between the effect of junk food and ADHD traits on positive well-being at T1: high junk food intake associated with reduced positive well-being for those with high ADHD traits at T1, but not for those with no ADHD traits (see Figure 9.1). A similar finding was observed between junk food and autistic traits on flourishing at T1 as well: high junk food intake associated with reduced flourishing for those with autistic traits, but not for those with no autistic traits (see Figure 9.2). The interaction between the consumption of caffeine and autistic traits was significant, with high weekly caffeine consumption associated with an increase in anxiety at T1 for people with no autistic traits but not for people with autistic traits (see Figure 9.3). A significant interaction was found between junk food consumption and autistic traits on depression at T1; the results revealed that high junk food consumption was associated with increased depression for people with autistic traits, but not for people without autistic traits at T1 only (Figure 9.4). Junk food was associated with reduced prosocial behaviour for people with no autistic traits at T1 (see Figure 9.5).

The interaction results at T2 revealed that high junk food consumption was associated with reduced physical health for those with ADHD traits, but not those without such traits (see Figure 9.6). The impact of junk food consumption and ADHD traits on negative well-being and emotional problems at T2 indicated that high junk food intake was associated with increased negative well-being and emotional problems in those with ADHD traits, but not in those without ADHD traits (see Figures 9.7 and 9.8). The interactions among total caffeine consumption, autistic traits, and conduct problems showed that high caffeine consumption was associated with increased conduct problems at T2 (see Figure 9.10). The interactions among total caffeine consumption, autistic traits, and emotional problems showed that high caffeine consumption was associated with increased emotional problems at T2 for those with no autistic traits, but not for people with autistic traits (see Figure 9.9). The beta values and p-values describing the results of the interactions between the diet variables and ADHD and autistic traits are shown in Tables 9.6 and 9.7.

Mediation analyses will be examined in the following section to examine the indirect relationship between diet and ADHD/autistic traits and well-being.

Table 9.6 Interactions among healthy diet, junk food, total weekly caffeine, and ADHD traits in relation to well-being and SDQ outcomes. Note: The values of beta (β) are standardised.

Outcomes	**Interaction terms**	**T1**			**T2**		
		β	**T**	**Sig**	**β**	**T**	Sig
Positive well-being	Healthy diet*ADHD traits	.036	.217	.829	-.049	-.194	.846
	Junk food*ADHD traits	-.779	-3.10	.002	-.351	-1.26	.209
	Weekly caffeine* ADHD	.116	.822	.412	.212	1.250	.213
Flourishing	Healthy diet*ADHD traits	.032	.226	.822	-.195	-.819	.414
	Junk food*ADHD traits	.127	.592	.555	-.441	-1.68	.093
	Weekly caffeine* ADHD	-.181	-1.49	.136	.200	1.255	.211
Physical health	Healthy diet*ADHD	.263	1.501	.134	-.110	-.423	.673
	Junk food*ADHD	-.304	-1.13	.257	-.617	-2.16	.031
	Weekly caffeine* ADHD	-.153	-1.01	.310	-.079	-.454	.650
Negative well-being	Healthy diet*ADHD traits	-.039	-.258	.796	-.206	-.915	.361
	Junk food*ADHD traits	.436	1.905	.058	.711	2.890	.004
	Weekly caffeine*ADHD traits	-.096	-.747	.455	-.079	-.528	.598
Anxiety	Healthy diet*ADHD traits	-.028	-.183	.855	-.197	-.806	.421
	Junk food*ADHD traits	.103	.436	.663	.299	1.120	.264

	Weekly caffeine* ADHD traits	-.004	-.030	.976	-.035	-.213	.831
Depression	Healthy diet*ADHD traits	.132	.811	.418	-.275	-1.16	.246
	Junk food*ADHD traits	-.258	-1.03	.301	.187	.720	.472
	Weekly caffeine* ADHD	-.049	-.352	.725	-.224	-1.42	.157
Hyperactive behaviour	Healthy diet*ADHD traits	.006	.042	.967	-.247	-1.15	.249
	Junk food*ADHD traits	.387	1.724	.086	.168	.721	.472
	Weekly caffeine* ADHD traits	-.001	-.010	.992	.019	.134	.894
Conduct problems	Healthy diet*ADHD traits	.182	.858	.392	.248	.786	.433
	Junk food*ADHD traits	.160	.494	.622	.512	1.484	.139
	Weekly caffeine* ADHD traits	-.039	-.213	.832	.297	1.411	.160
Emotional problems	Healthy diet*ADHD traits	-.022	-.135	.893	-.132	-.600	.549
	Junk food*ADHD traits	.159	.651	.516	.520	2.153	.032
	Weekly caffeine* ADHD traits	-.212	-1.54	.123	-.032	-.216	.829
Peer problems	Healthy diet*ADHD traits	-.057	-.334	.739	-.234	-.812	.418
	Junk food*ADHD traits	.133	.513	.608	.590	1.875	.062
	Weekly caffeine* ADHD traits	-.060	-.413	.680	-.093	-.486	.627
Prosocial behaviour	Healthy diet*ADHD traits	-.023	-.117	.907	-.301	-.986	.325
	Junk food*ADHD traits	-.248	-.828	.408	.083	.247	.805
	Weekly caffeine* ADHD	-.015	-.089	.929	.103	.508	.612

Table 9.7 Interactions among healthy diet, junk food, total weekly caffeine, and autism traits in relation to well-being and SDQ outcomes. Note: The values of beta (β) are standardised.

Outcomes	**Interaction terms**	**T1**			**T2**		
		β	**t**	**Sig**	**β**	**t**	**Sig**
Positive well-being	Healthy diet*autism traits	-.167	-1.08	.281	-.023	-.096	.924
	Junk food*autism traits	.195	.698	.486	.100	.312	.755
	Weekly caffeine* autism traits	.075	.572	.568	.109	.648	.517
Flourishing	Healthy diet*autism traits	-.074	-.561	.576	.161	.729	.467

	Junk food*autism traits	-.635	-2.65	.009	.339	1.128	.261
	Weekly caffeine* autism traits	.041	.365	.716	-.053	-.340	.735
Physical health	Healthy diet*autism traits	-.117	-.713	.476	-.149	-.615	.539
	Junk food*autism traits	.251	.844	.399	.283	.864	.388
	Weekly caffeine* autism traits	-.024	-.172	.863	.093	.544	.587
Negative well-being	Healthy diet*autism traits	.131	.930	.353	.036	.171	.864
	Junk food*autism traits	.275	1.080	.281	-.365	-1.28	.199
	Weekly caffeine* autism traits	.094	.784	.434	-.065	-.435	.664
Anxiety	Healthy diet*autism traits	.013	.089	.929	.139	.614	.540
	Junk food*autism traits	.238	.901	.368	-.209	-.680	.497
	Weekly caffeine* autism traits	-.285	-2.29	.022	-.149	-.926	.356
Depression	Healthy diet*autism traits	-.058	-.377	.707	.360	1.636	.103
	Junk food*autism traits	.554	2.002	.046	.198	.663	.508
	Weekly caffeine* autism traits	-.100	-.770	.442	-.052	-.330	.742
Hyperactive behaviour	Healthy diet*autism traits	.066	.474	.636	-.021	-.107	.915
	Junk food*autism traits	.101	.402	.688	.239	.889	.375
	Weekly caffeine* autism traits	-.083	-.708	.480	-.167	-1.18	.237
Conduct problems	Healthy diet*autism traits	.003	.013	.990	-.457	-1.56	.120
	Junk food*autism traits	.234	.651	.516	-.258	-.648	.517
	Weekly caffeine* autism traits	-.297	-1.75	.080	-.451	-2.16	.031
Emotional problems	Healthy diet*autism traits	.073	.483	.629	.033	.162	.871
	Junk food*autism traits	.127	.465	.642	-.094	-.339	.735
	Weekly caffeine* autism traits	.093	.731	.465	-.292	-2.00	.046
Peer problems	Healthy diet*autism traits	.004	.026	.980	.347	1.298	.196
	Junk food*autism traits	.097	.337	.737	.042	.115	.908
	Weekly caffeine* autism traits	-.208	-1.53	.126	-.065	-.343	.732

Prosocial behaviour	Healthy diet*autism traits	-.086	-.464	.643	.314	1.107	.270
	Junk food*autism traits	.779	2.334	.020	.438	1.136	.257
	Weekly caffeine* autism traits	.032	.207	.836	-.017	-.083	.934

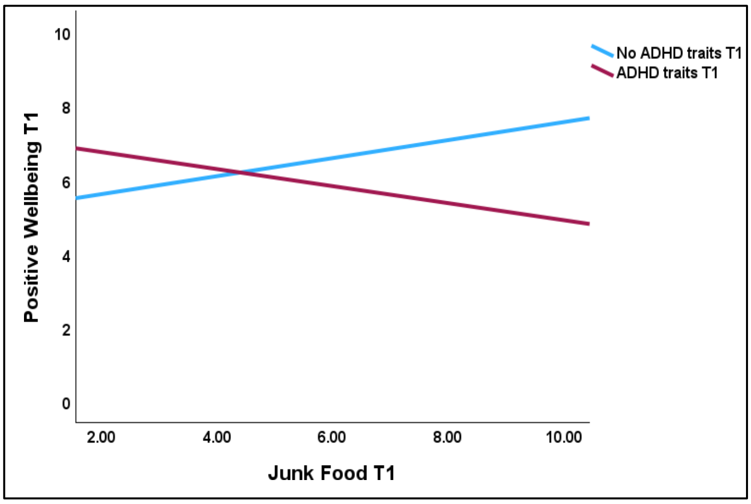

Figure 9.1 Interactions between junk food and ADHD traits predicting positive well-being at T1.

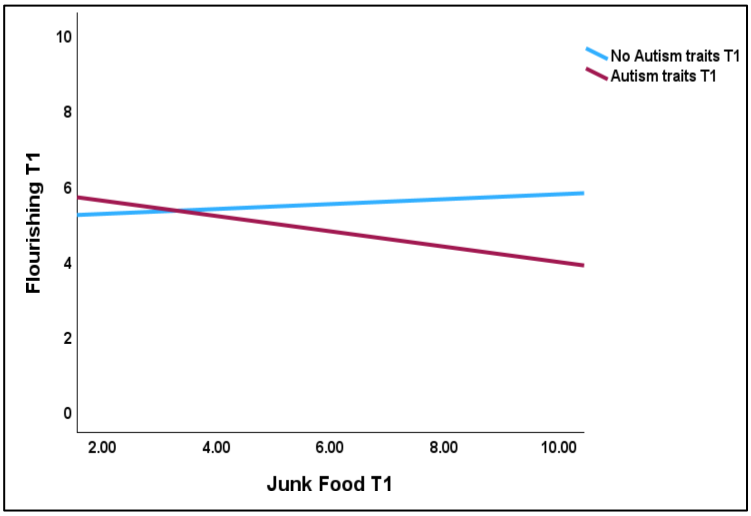

Figure 9.2 Interactions between junk food and autism traits predicting flourishing at T1.

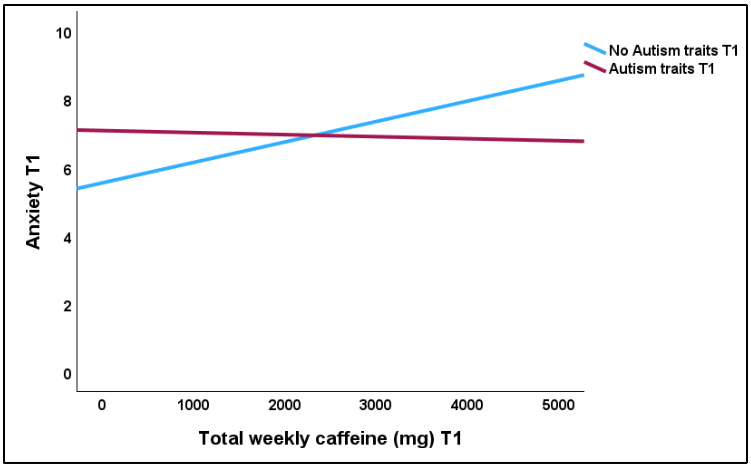

Figure 9.3 Interactions between weekly caffeine intake and autism traits predicting anxiety at T1.

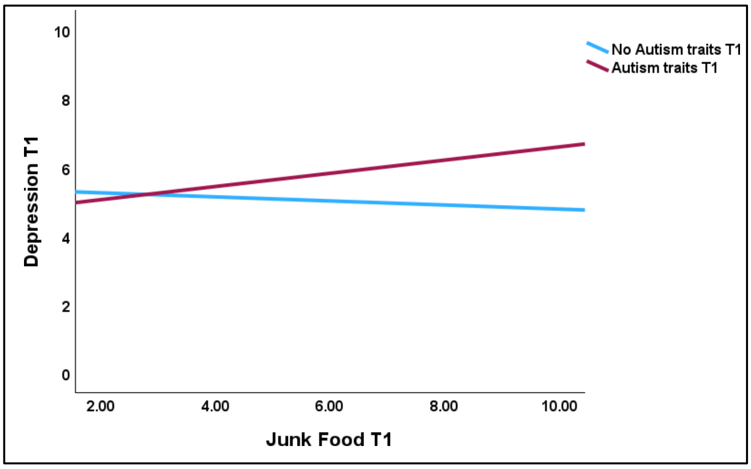

Figure 9.4 Interactions between junk food and autism traits predicting depression at T1.

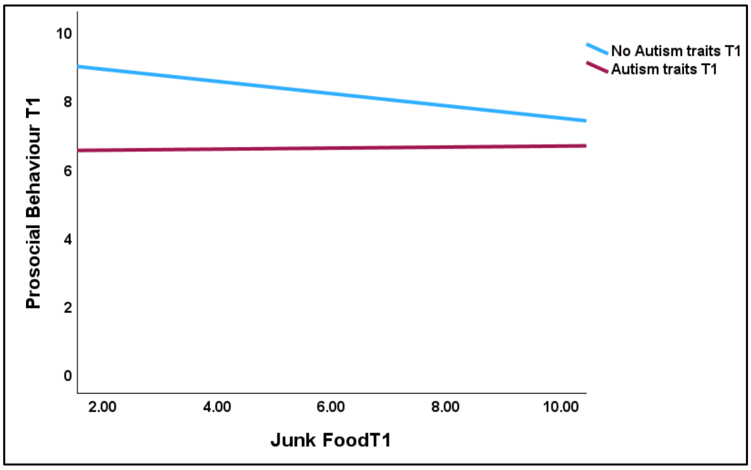

Figure 9.5 Interactions between junk food and autism traits predicting prosocial behaviour at T1.

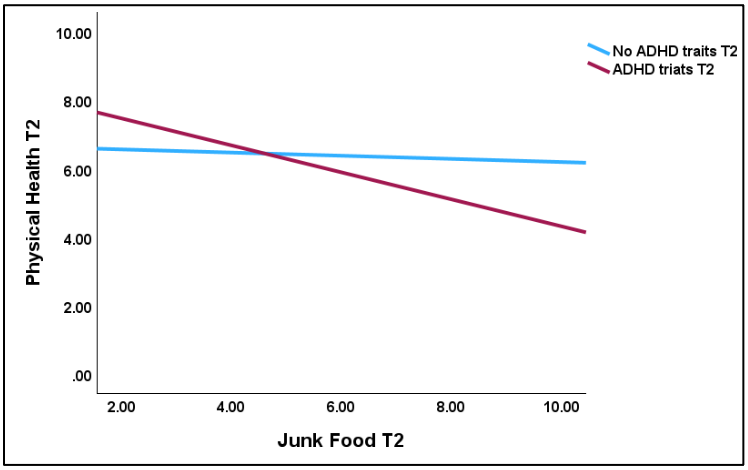

Figure 9.6 Interactions between junk food and ADHD traits predicting physical health at T2.

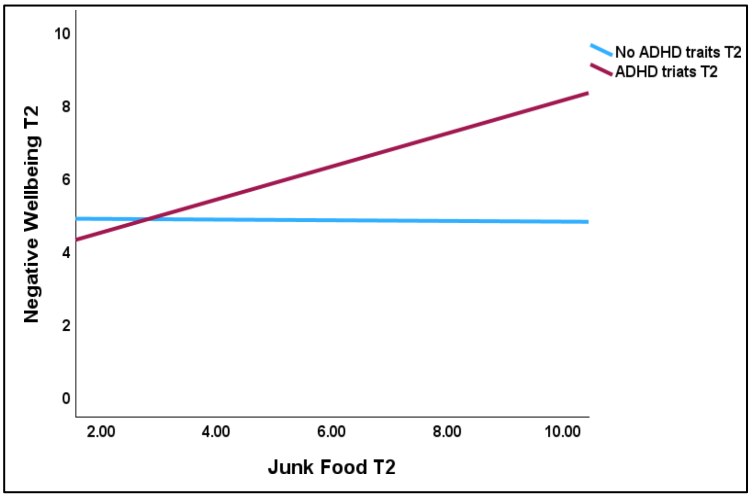

Figure 9.7 Interactions between junk food and ADHD traits predicting negative well-being at T2.

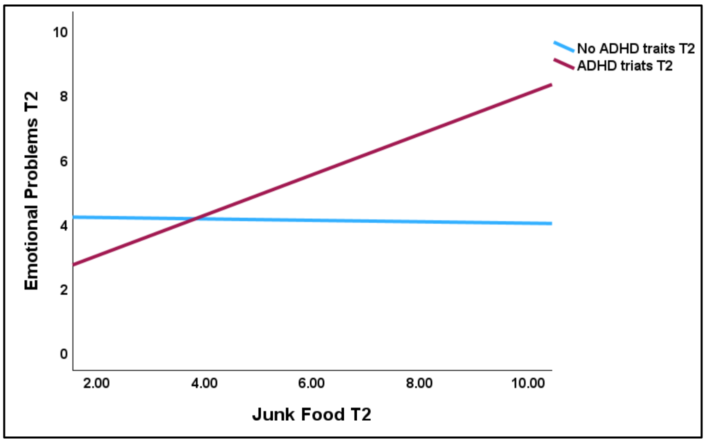

Figure 9.8 Interactions between junk food and ADHD traits predicting emotional problems at T2.

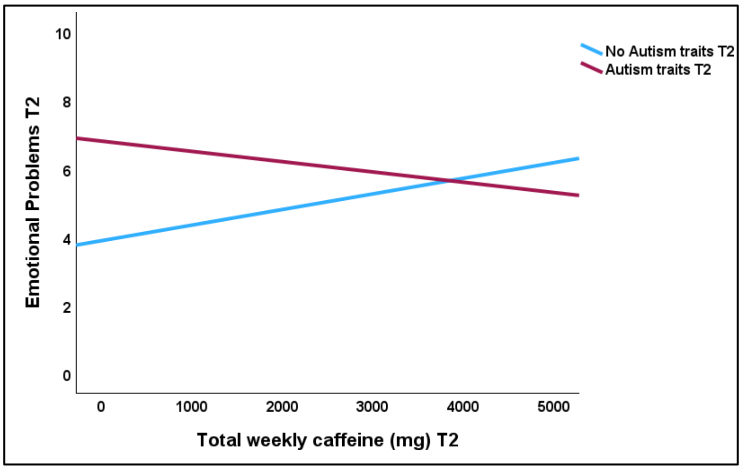

Figure 9.9 Interactions between weekly caffeine intake and autism traits predicting emotional problems at T2.

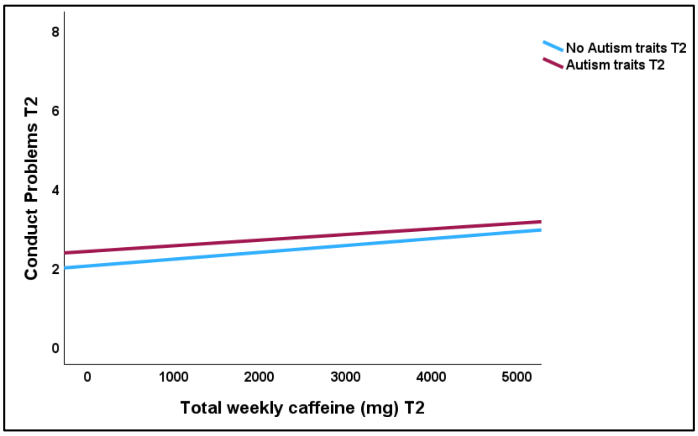

Figure 9.10 Interactions between weekly caffeine intake and autism traits predicting conduct problems at T2.

9.3.3 Mediation Analyses

Mediation analyses were conducted using the PROCESS macro for SPSS to examine the usual effect of the DRIVE model, which perceived stress and life satisfaction as appraisal mediators between individual differences, personal resources, and well-being outcomes. The DRIVE model considers the impact of subjective appraisals of the stress events. The model added cognitive appraisals, such as perceived job stress and life satisfaction, as mediators in the association between work, individual characteristics and well-being outcomes. In order to show the subjective appraisal process equivalent to the appraisal stages of the DRIVE model Mark and Smith (Mark-Margrove & Smith, 2008, 2022) suggested that emotional perceptions, including perceived job stress, control the association between work and individual characteristics and well-being outcomes. Therefore, if a stressor event is not viewed as stressful, it will not have an impact on results (Nelson & Smith, 2024). A university student study showed an indirect effect between course demands and negative well-being outcomes through perceived stress, while the direct relationship between course demand and negative well-being was not significant (Alharbi, 2020). Thus, the study supports the mediating role of perceived stress. Based on above the first mediation analysis was between psychological capital and positive well-being, with life satisfaction as a mediator. The second was between student stressors and negative well-being, with stress as a mediator.

In addition, the indirect effect of ADHD traits on well-being through eating behaviours will be examined. It appeared from the literature review in Chapter 5 that the relationship between diet and ADHD/autistic traits tends to be complex and potentially bidirectional. While observational studies consistently show an association between poorer diet quality and ADHD, the direction of this relationship is not entirely clear. There is some evidence that ADHD symptoms may drive poorer dietary habits rather than vice versa, suggesting a bidirectional relationship (Harris et al., 2022; Lange et al., 2023; Mian et al., 2019). However, intervention studies also support the effect of diet on ADHD symptoms, at least in some individuals. More research is needed to fully elucidate the complex interplay between diet and ADHD and determine the extent to which this relationship is bidirectional. Thus, the mediation analyses were conducted in two different ways. First, diet variables were set as mediators between

ADHD/autistic traits and well-being outcomes. Second, ADHD/autistic traits were set as mediators between dietary variables and well-being outcomes.

Before examining diet and ADHD/autistic traits, established mediators in the well-being process model were examined.

9.3.3.1 Life Satisfaction as a Mediator between Psychological Capital and Positive Well-being Outcome at T1 and T2

Psychological capital positively influenced positive well-being through perceived life satisfaction at both time points (ab: β = 0.217, 95% CI = 0.137 to 0.301 at T1; ab: β = 0.129, 95% CI = 0.045 to 0.212 at T2) Furthermore, independent of these mechanisms, there was a direct relationship between psychological capital and positive well-being at both time points (see Figures 9.11 and 9.12).

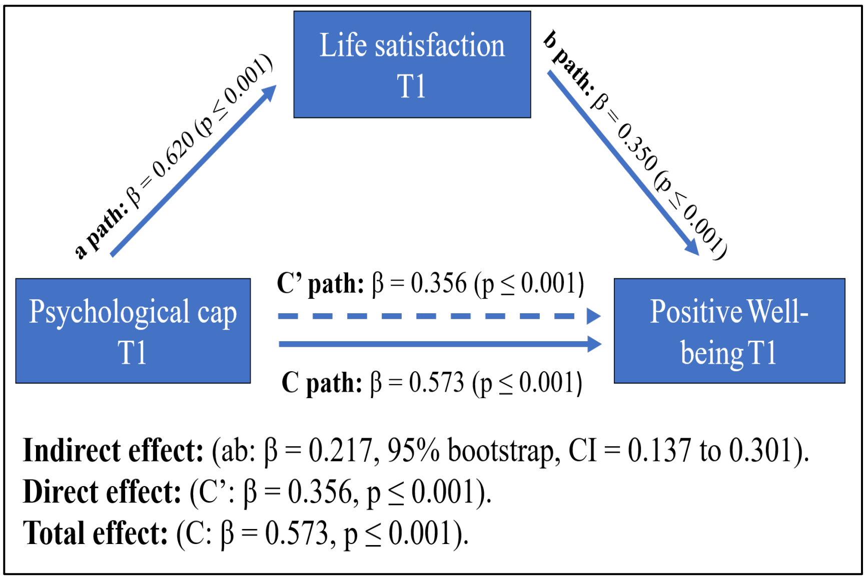

Figure 9.11 Life satisfaction as a mediator between psychological cap and positive well-being outcome at T1.

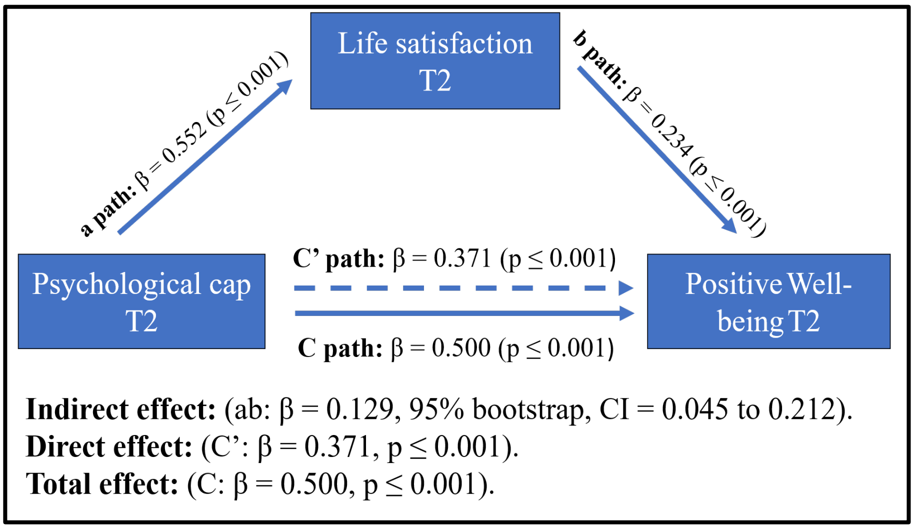

Figure 9.12 Life satisfaction as a mediator between psychological cap and positive well-being outcome at T2.

9.3.3.2 Life Stress as a Mediator between Student Stressors and Negative Well-being Outcome at T1 and T2

Mediation analyses were conducted to examine the influence of life stress as a mediator between student stressors and negative well-being at T1 and T2. The results showed that student stressors positively influenced negative well-being through perceived stress (ab: β= 0.072, 95% CI= 0.022 to 0.124) at T1. In contrast, there was no indirect effect between student stressors and negative well-being by life stress at T2 (ab: β= 0.052, 95% CI = −0.002 to 0.121). Furthermore, independent of these mechanisms, there was a direct relationship between student stressors and negative well-being at both time points (see Figures 9.13 and 9.14). The next section examines mediation using the diet and ADHD/autistic trait variables.

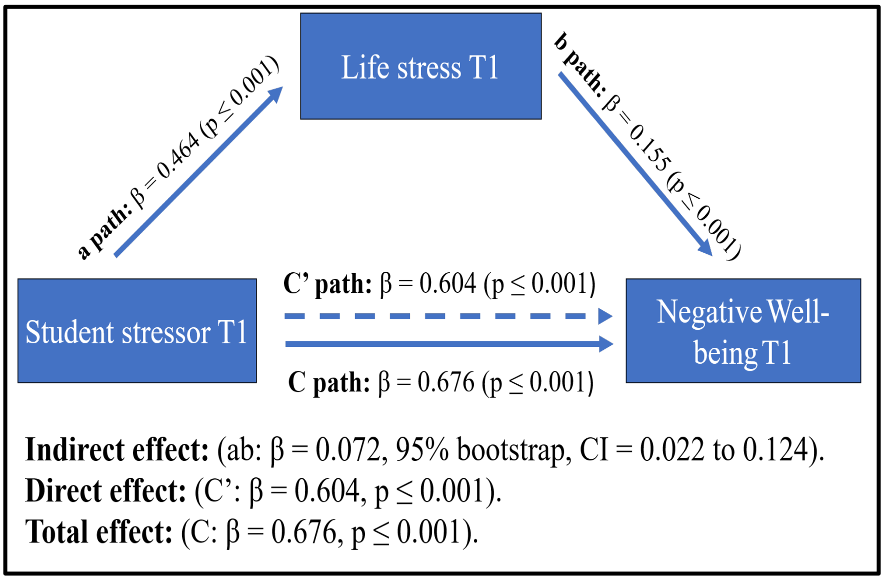

Figure 9.13 Life stress as a mediator between student stressors and negative well-being outcome at T1.

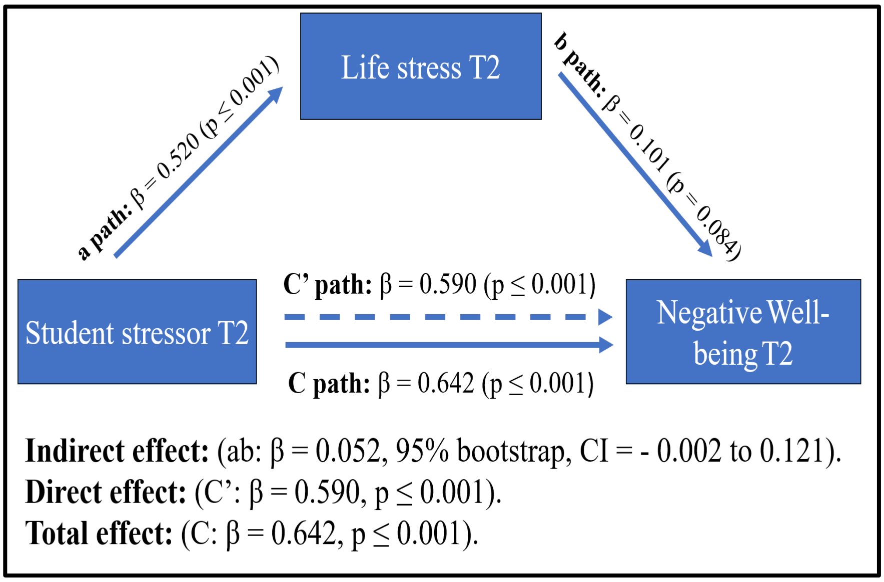

Figure 9.14 Life stress as a mediator between student stressors and negative well-being outcome at T2.

9.3.3.3 Diet Variables as a Mediators between ADHD/Autism Traits and Well-being Outcomes

9.3.3.3.1 ADHD and autism traits as predictors and positive well-being as outcome at T1 and T2

Mediation analyses were performed with ADHD traits and autistic traits as predictors and positive well-being as an outcome. The first mediator was healthy diet, and the second mediator was total weekly caffeine. BMI and gender were included as covariates. The mediation model (see Figure 9.15) showed that ADHD traits at T1 were significantly associated with reduced healthy diet behaviours at that time (a: $\beta = -0.225$, $p \leq 0.001$), and healthy diet behaviours at T1 were significantly associated with higher positive well-being (b: $\beta = 0.162$, $p \leq 0.006$). The total effect of ADHD traits on positive well-being at T1 was significant (c: $\beta = -0.216$, $p \leq 0.001$). The direct and indirect effect of ADHD traits on positive well-being at T1 were significant (c': $\beta = -0.180$, $p \leq 0.002$), (ab: $\beta = -0.036$, 95% CI= -0.075 to -0.006), this suggests that ADHD traits decreased positive well-being through reduced healthy food consumption indicating partial mediation. In contrast, although the total effect of ADHD and positive well-being at T2 was significant (C: $\beta = -0.226$, $p \leq 0.001$), a healthy diet at T2 was not a mediator between ADHD traits and positive well-being at that time because the indirect effect between ADHD traits, positive well-being, and healthy diet consumption as mediators was insignificant at T2 (ab: $\beta = 0.005$, CI = −0.027 to 0.034), (see Figure 9.16).

The result of the mediation analysis for autistic traits (predictor), healthy diet (mediator), and positive well-being at T1 (outcome) showed that there was a significant association between autistic traits at T1 and a healthy diet at T1 (a: $\beta = -0.189$; $p < 0.001$), and, further, a positive significant association between healthy diet consumption at T1 and positive well-being (b: $\beta = 0.148$, $p < 0.012$). However, the direct effect also showed a significant association between autistic traits and positive well-being, indicating that autistic traits partially reduced positive well-being (C': $\beta = -0.215$, $p \leq 0.001$) through reduced healthy diet consumption at T1 (ab: $\beta = -0.028$, 95% CI= -0.065 to -0.003). While autistic traits did not mediate the effect of healthy diet on positive well-being at T2 (ab: $\beta = -0.001$, CI = −0.029 to 0.027). While, there was a direct relationship between autistic traits and positive well-being (C': $\beta = -0.209$, $p \leq 0.001$; see Figure 9.18).

The mediation model of total weekly caffeine as a mediator between ADHD traits and positive well-being at T1 indicated that ADHD traits had an insignificant indirect effect on positive well-being through the impact of weekly caffeine consumption at both time points (see Figures 9.19 and 9.20). While, the direct effects were significant at both time points (c': $\beta = -0.194$, $p = 0.001$ and c': $\beta = -0.208$, $p = 0.001$, respectively), which indicated direct relationships between ADHD traits and reducing positive well-being.

There was a significant indirect association between autistic traits and positive well-being through total weekly caffeine at T2 (ab: β = −0.223, CI = −0.051 to −0.001). As can be seen in Figure 9.21, people with autistic traits had higher weekly caffeine consumption (a: β= 0.147, p = 0.013), and high weekly caffeine consumption was negatively associated with positive well-being (b: β= −0.169, p = 0.004). A confidence interval for the indirect effect was (ab: β= −0.0223, CI = −0.051 to −0.001). In addition, the direct impact was also significant (c': β = −0.204, p = 0.001), which indicates partial mediation between autistic traits and positive well-being through weekly caffeine consumption at T1. In contrast, the indirect effect between autistic traits and positive well-being through weekly caffeine consumption at T2 was insignificant (ab: β = −0.017, CI = −0.050 to 0.003). However, the direct effects were significant between autism traits and positive well-being at T2. Figure 9.21 and 9.22 displays the standardised regression coefficients for the mediation models at both time points.

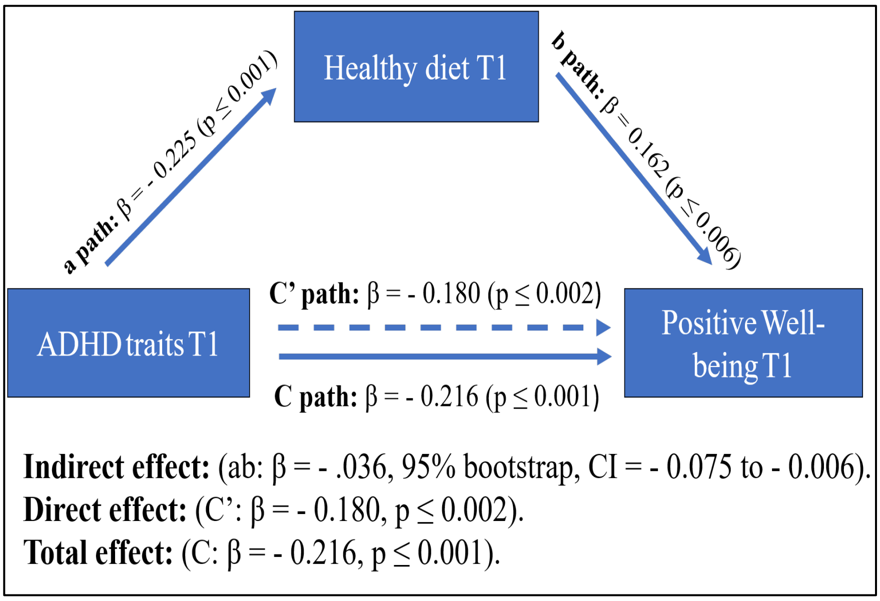

Figure 9.15 Healthy diet as a mediator between ADHD traits and positive well-being at T1.

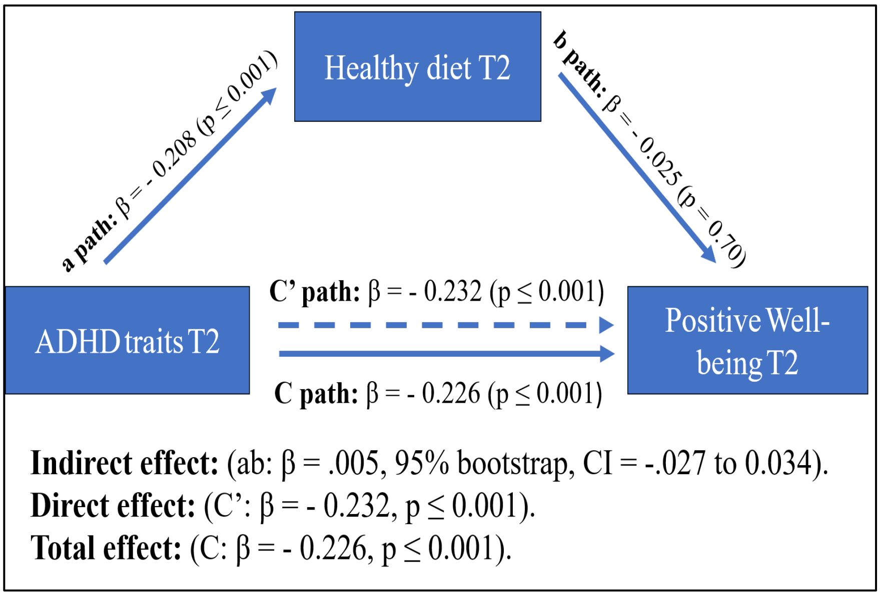

Figure 9.16 Healthy diet as a mediator between ADHD traits and positive well-being at T2.

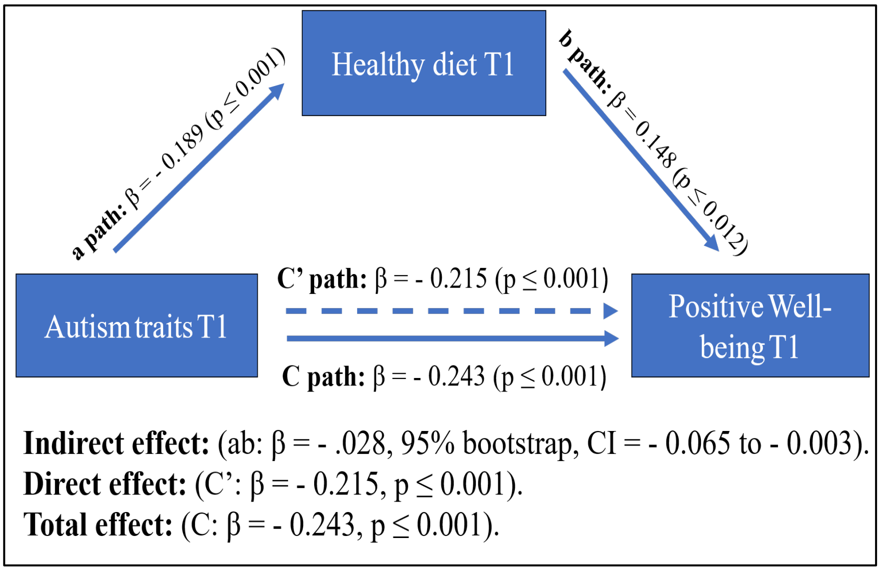

Figure 9.17 Healthy diet as a mediator between autism traits and positive well-being at T1.

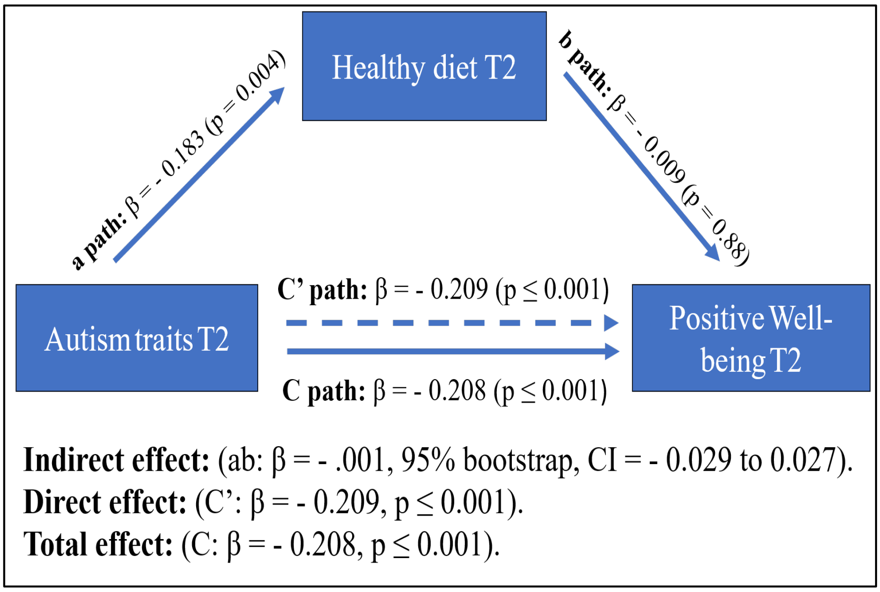

Figure 9.18 Healthy diet as a mediator between autism traits and positive well-being at T2**.**

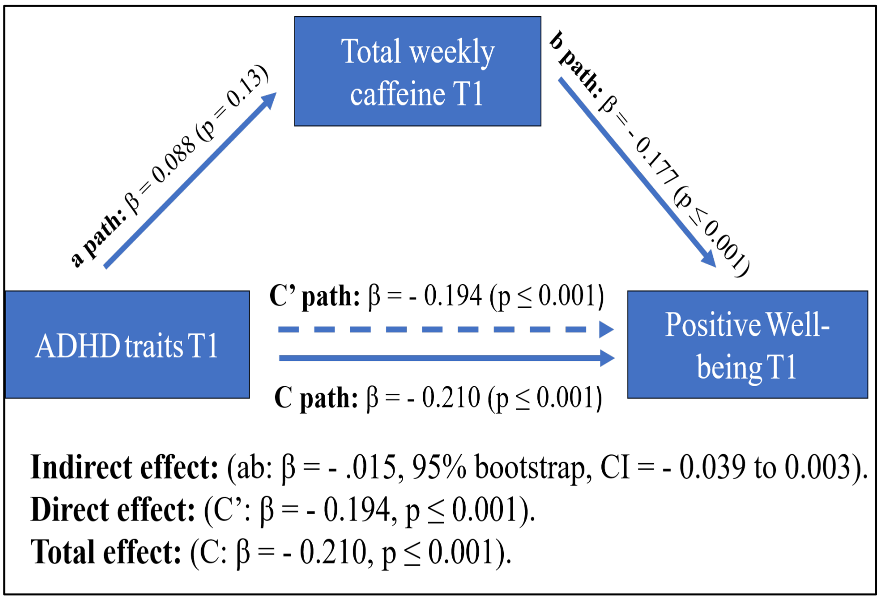

Figure 9.19 Weekly caffeine intake as a mediator between ADHD traits and positive well-being at T1.

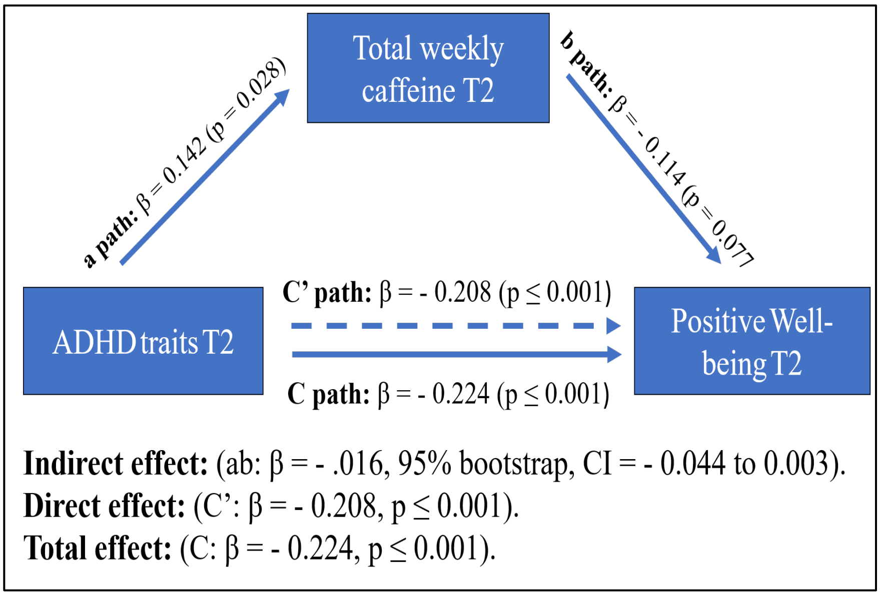

Figure 9.20 Weekly caffeine intake as a mediator between ADHD traits and positive well-being at T2.

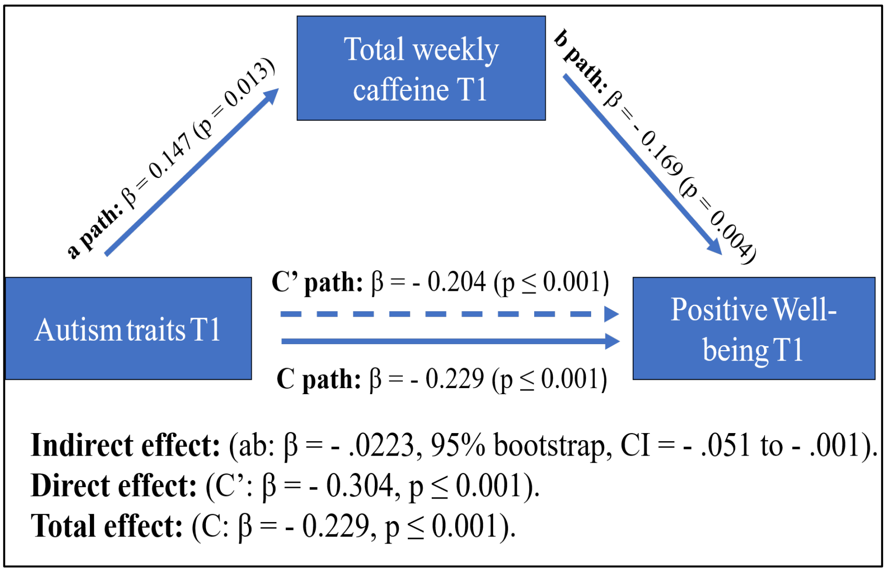

Figure 9.21 Weekly caffeine intake as a mediator between autism traits and positive well-being at T1.

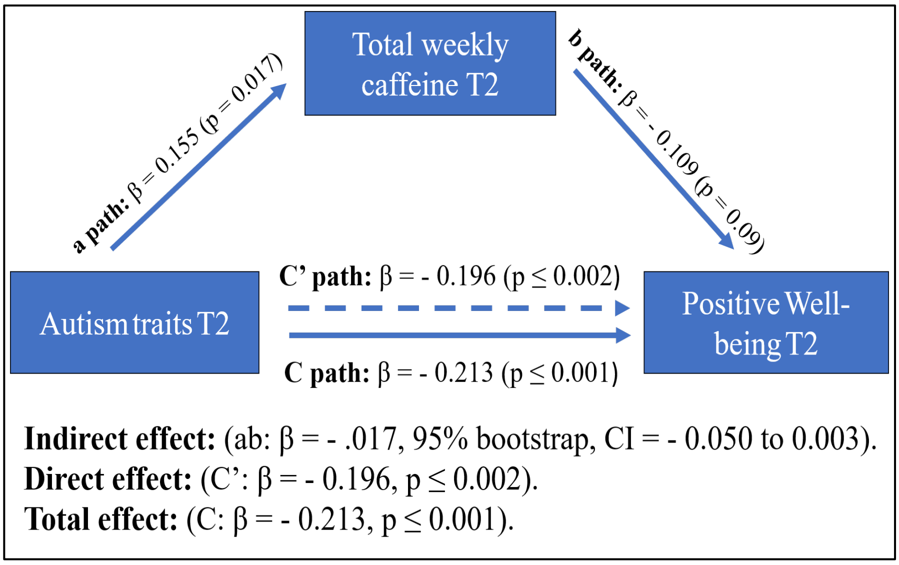

Figure 9.22 Weekly caffeine intake as a mediator between autism traits and positive well-being at T2.

9.3.3.3.2 ADHD and autistic traits as predictors and negative well-being as the outcome at T1 and T2

Mediation analyses were performed with ADHD traits and autistic traits as predictors and negative well-being as the outcome. The first mediator was junk food and the second mediator was total weekly caffeine intake. BMI and gender were included as covariates. The results indicated that ADHD traits were significant predictors of junk food consumption at both time points, autism traits at time 2 only, indicating people with ADHD traits and autistic traits having higher levels of junk food consumption. However, junk food consumption did not significantly predict negative well-being at either time point. The total effects of ADHD and autism traits on negative well-being were significant at both times, showing the direct effect of ADHD/autistic traits on negative well-being at both times, indicating that individuals with ADHD/autistic traits may tend to have higher negative well-being. While, the indirect effect of these traits on negative well-being through junk food was not statistically significant at both time points, as the confidence interval contained zero. These results show that junk food does not mediate the relationship between ADHD/autism traits, and negative well-being in this sample (see Figures from 9.23 and 9.24).

The mediation models between ADHD/autistic traits and negative well-being through weekly caffeine consumption at both time points were examined (see Figures 9.25 and 9.26). The results indicated that the total effect of ADHD/autistic traits on negative well-being were significant at both time points. The direct effects of ADHD/autistic traits on negative well-being were significant at both time points; however, the indirect effects between ADHD/autism traits on negative well-being through weekly caffeine were not statistically significant at either time point. These results show that the relationship between ADHD/autism traits and negative well-being is not mediated by total weekly caffeine intake at either time point.

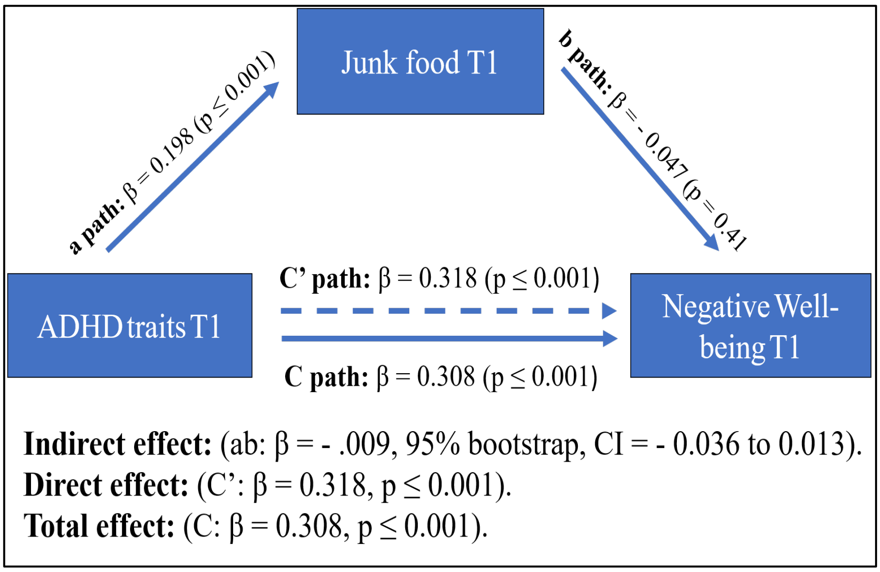

Figure 9.23 Junk food as a mediator between ADHD traits and negative well-being at T1.

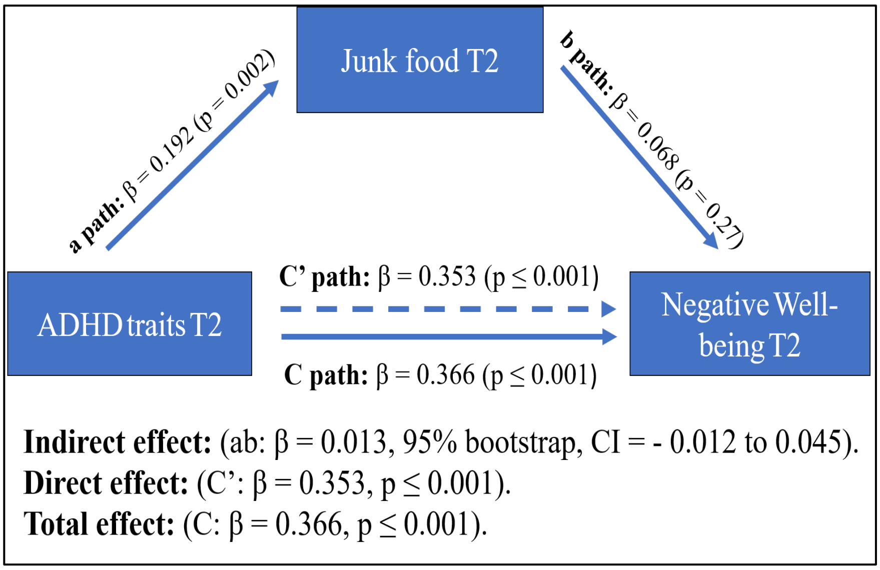

Figure 9.24 Junk food as a mediator between ADHD traits and negative well-being at T2.

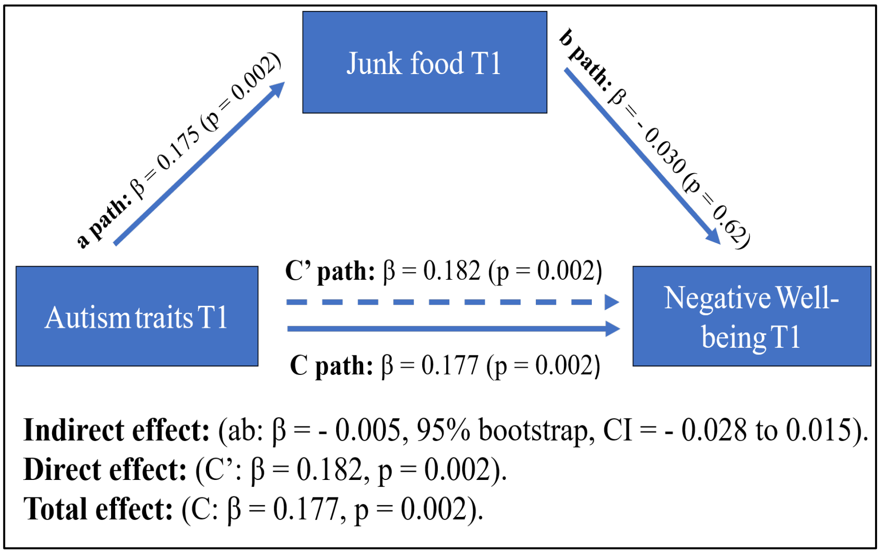

Figure 9.25 Junk food as a mediator between autism traits and negative well-being at T1.

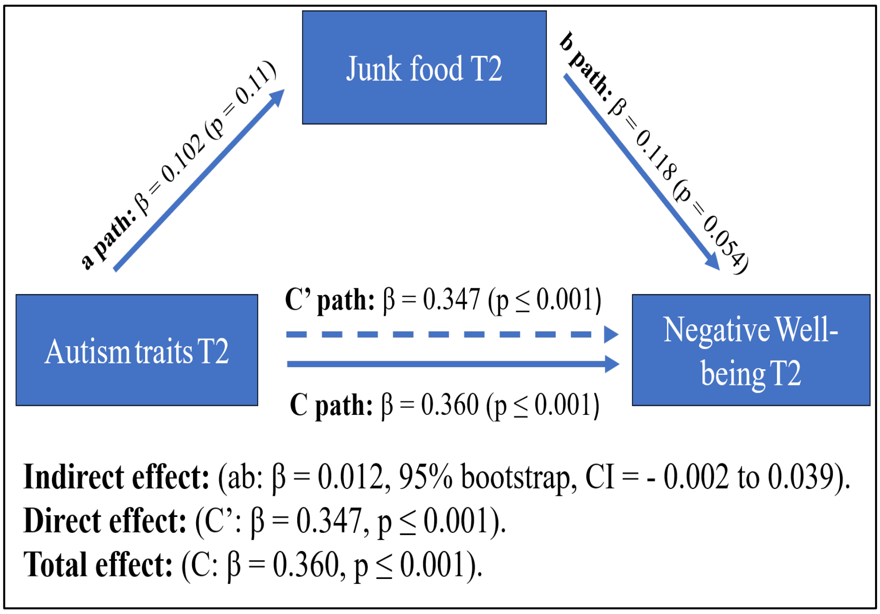

Figure 9.26 Junk food as a mediator between autism traits and negative well-being at T2.

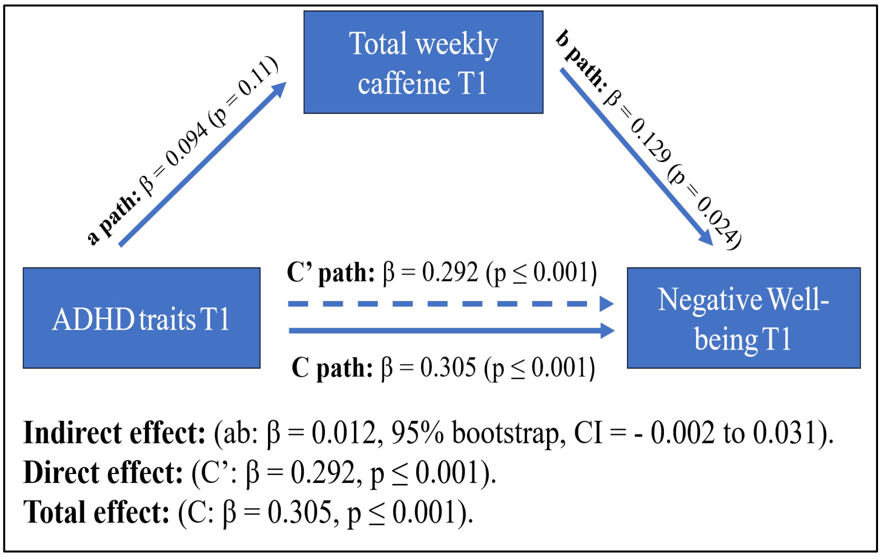

Figure 9.27 Weekly caffeine intake as a mediator between ADHD traits and negative well-being at T1.

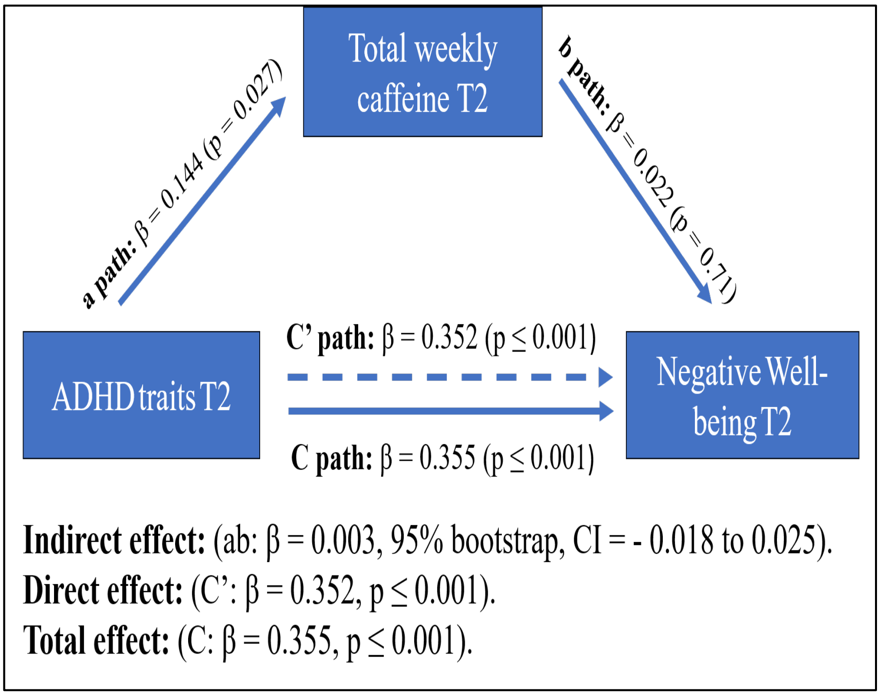

Figure 9.28 Weekly caffeine intake as a mediator between ADHD traits and negative well-being at T2.

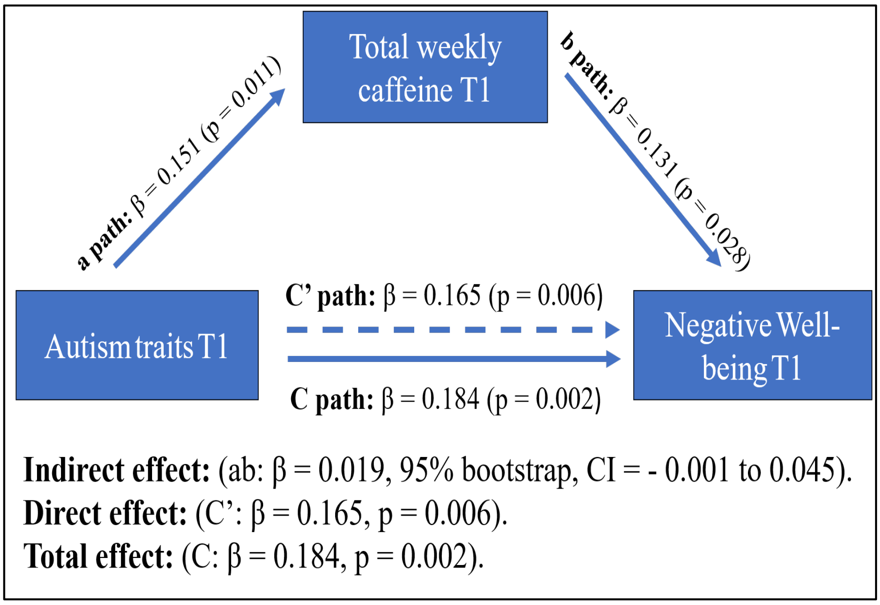

Figure 9.29 Weekly caffeine intake as a mediator between autism traits and negative well-being at T1.

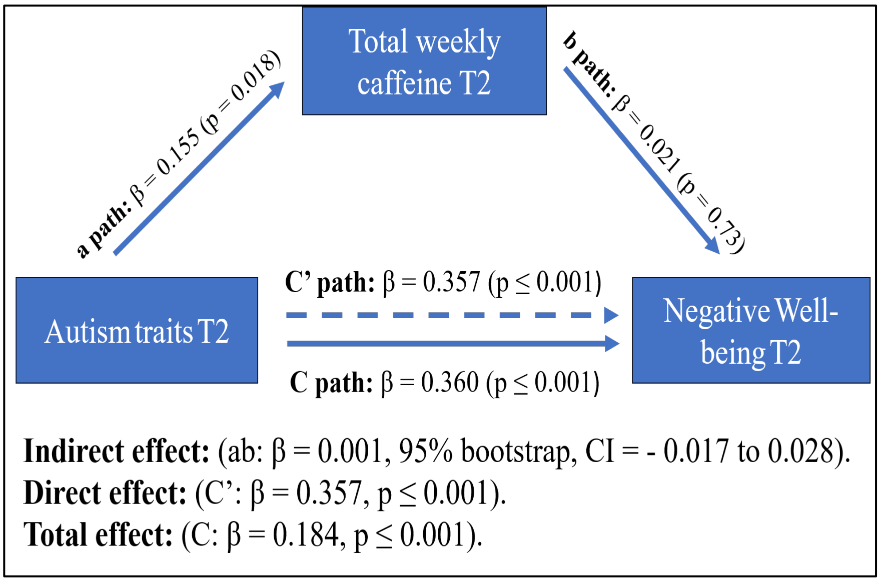

Figure 9.30 Weekly caffeine intake as a mediator between autism traits and negative well-being at T2.

9.3.3.4 ADHD and Autism Traits as Mediators between Diet Variables and Well-being Outcomes

9.3.3.4.1 Healthy diet and total weekly caffeine as predictors and positive well-being as an outcome

Mediation analyses were performed with healthy diet and total weekly caffeine as predictors and positive well-being as an outcome. The first mediator was ADHD traits and the second was autistic traits. BMI and gender were included as covariates. The mediation model between a healthy diet and positive well-being through ADHD and autistic traits at both time points was tested using model 4 path analysis in the PROCESS macro for SPSS (Hayes, 2017) with 5,000 bootstrapped samples and a 95% confidence interval. The results indicated that ADHD traits significantly indirectly affected the relationships between positive well-being and healthy diets at time 1 and time 2 (ab: β = 0.030, CI = 0.003 to 0.62) T time 1, and (ab: β = 0.030, CI = 0.003 to 0.62) at time 2, (see Figures 9.31 and 9.32). In addition, the indirect association between healthy diet and positive well-being through autistic traits at T2 was significant (ab: β = 0.030, CI = 0.003 to 0.62), but not at time 2. As can be seen in Figure 9.31, with a healthy diet being associated with lower autistic traits (a: β= −0.196, p = 0.001), and higher autistic traits being negatively associated with positive well-being (b: β= −0.154, p = 0.019). The indirect effect between healthy diet and positive well-being through autistic traits was non-significant at T2 (ab: β = 0.027, CI = −0.003 to 0.068).

In contrast, the mediation model linking total weekly caffeine and positive well-being through ADHD and autistic traits at both time points revealed that the indirect standardised coefficient between weekly caffeine and positive well-being through ADHD and autism traits was statistically non-significant at time 1 and time 2, (see Figures 9.33 and 9.34).

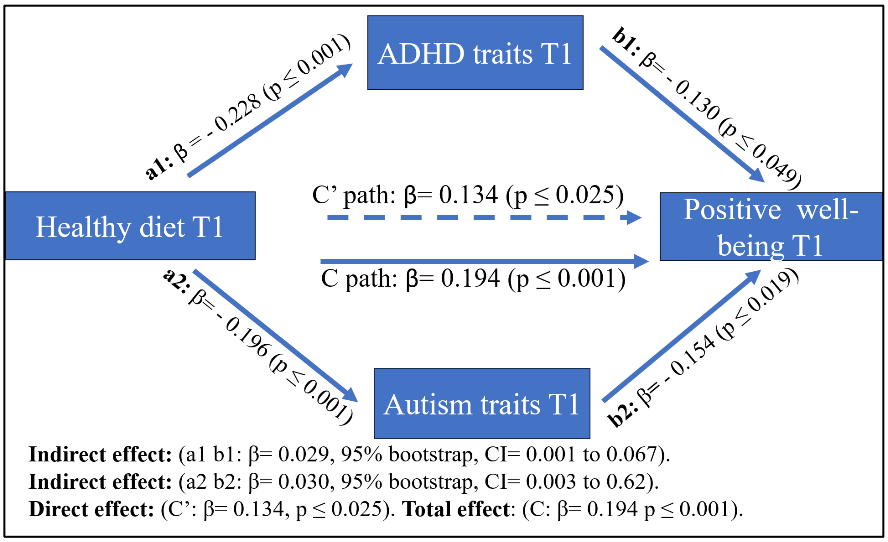

Figure 9.31 ADHD, and autism traits as mediators between healthy diet and positive well-being at T1.

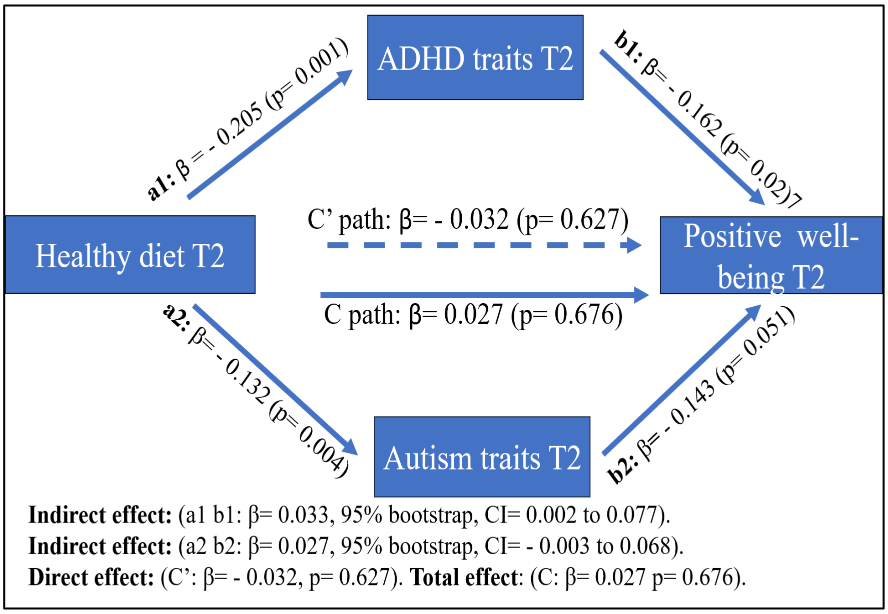

Figure 9.32 ADHD and autism traits as mediators between healthy diet and positive well-being at T2.

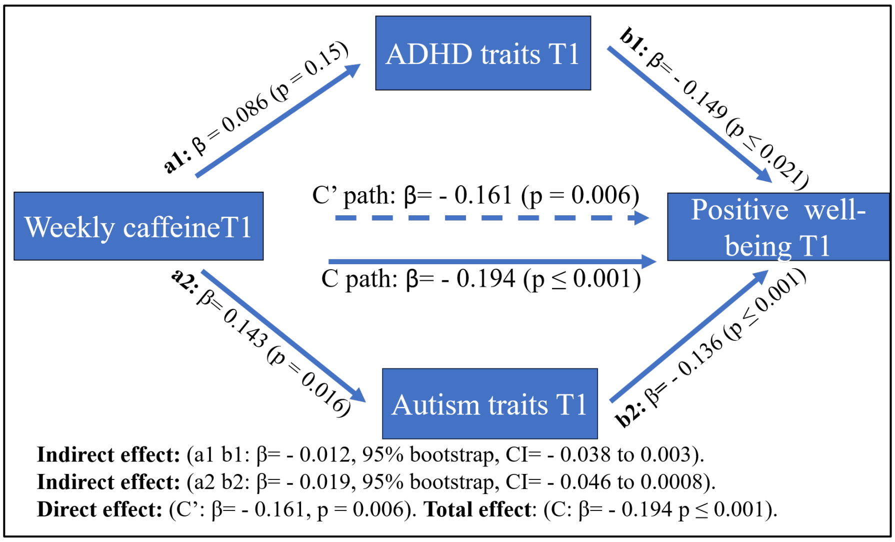

Figure 9.33 ADHD and autism traits as mediators between weekly caffeine and positive well-being at T1.

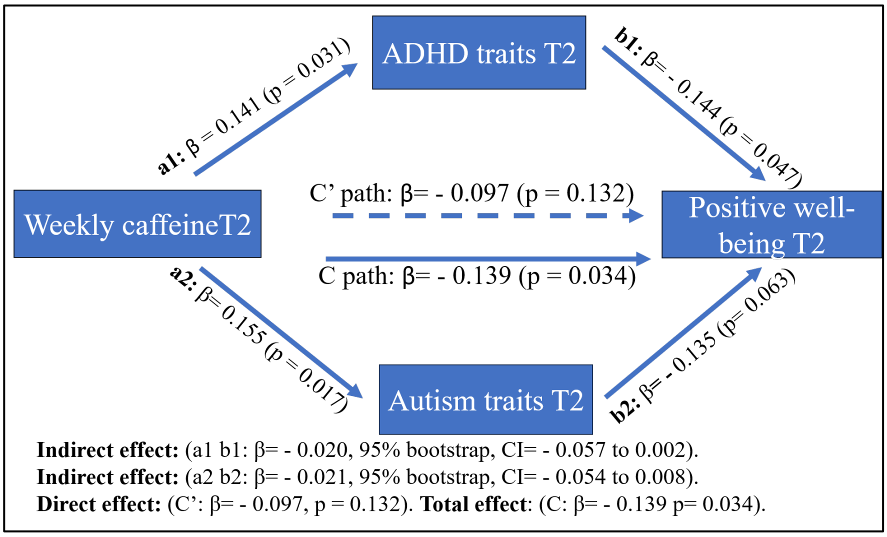

Figure 9.34 ADHD and autism traits as mediators between weekly caffeine intake and positive well-being at T2.

9.3.3.4.2 Junk food and total weekly caffeine as predictors and negative well-being as outcome

Mediation analyses were performed for junk food and total weekly caffeine as predictors and negative well-being as the outcome. The first mediator was ADHD traits and the second was autistic traits. BMI and gender were included as covariates. Mediation analyses were performed with junk food as the predictor and negative well-being as the outcome. The first mediator was ADHD traits and the second was autistic traits at both time points. BMI and gender were included as covariates. The mediation model (Figure 9.35) showed that junk food consumption was significantly associated with higher ADHD traits at both time points (a1: $\beta = 0.213$, $p \leq 0.001$ and a1: $\beta = 0.186$, $p = 0.004$, respectively), and ADHD traits were significantly associated with higher negative well-being at both times (b1: $\beta = 0.301$, $p \leq 0.001$, b1: $\beta = 0.255$, $p \leq 0.001$, respectively). Moreover, the indirect effect between junk food and negative well-being through ADHD traits was significant at both time points, showing that high junk food consumption was associated with higher ADHD traits, which may related to increase negative well-being at both time points (see Figures 9.35 and 9.36). In contrast, the mediating relationship between junk food consumption and negative well-being through autistic traits at T1 and T2 was not observed.

The results showed that the mediation model of ADHD and autistic traits as a mediator between total weekly caffeine intake and negative well-being at T1 indicated that weekly caffeine intake had an insignificant indirect effect on negative well-being through ADHD and autism traits at T1 (Figure 9.37). In contrast, there were significant indirect associations between weekly caffeine intake and negative well-being through ADHD/autistic traits at T2 (a1 b1: β = 0.036, CI = 0.001 to 0.080 and a2 b2: β = 0.038, CI = 0.001 to 0.079). As can be seen in Figure (9.38), weekly caffeine consumption was associated with higher ADHD/autistic traits (a1: β= 0.142, p = 0.030; a2: β = 254, p = 0.001), and ADHD/autistic traits were positively associated with negative well-being (b1: β= 0.155, p = 0.017 and b2: β = 0.245, p = 0.001). There was no evidence that weekly caffeine consumption directly impacts negative well-being independent of this mediation process because the direct effect was not significant (C': β= 0.003, p = 0.954) at time 2.

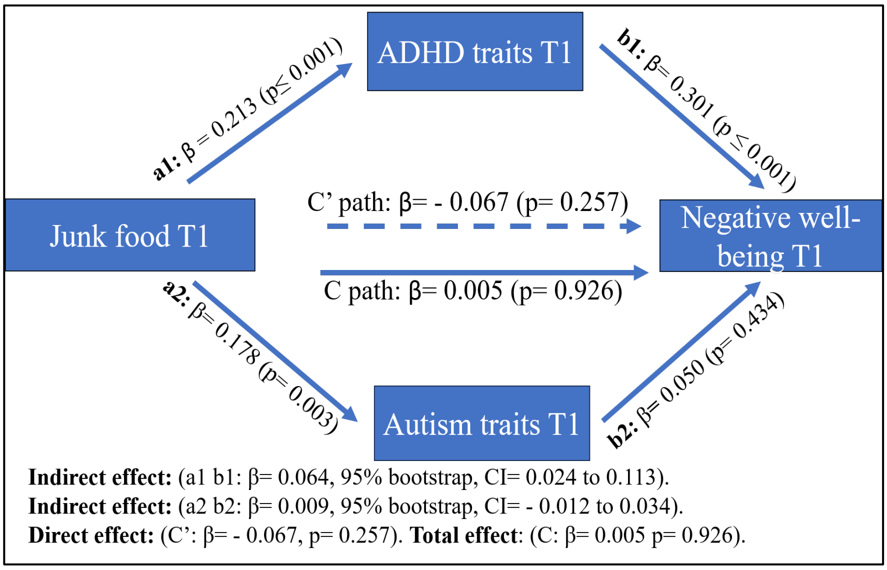

Figure 9.35 ADHD and autism traits as mediators between junk food and negative well-being at T1.

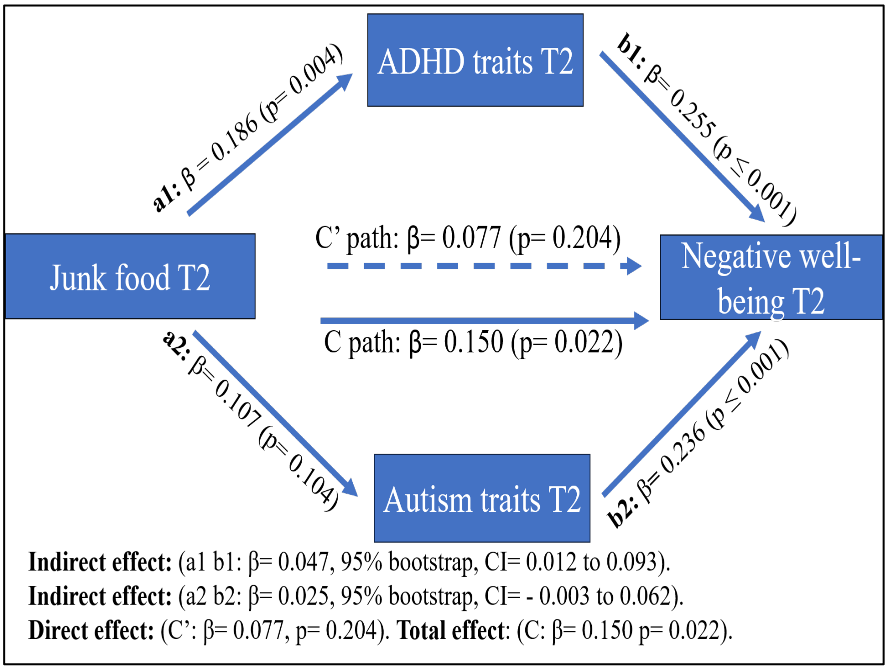

Figure 9.36 ADHD and autism traits as mediators between junk food and negative well-being at T2.

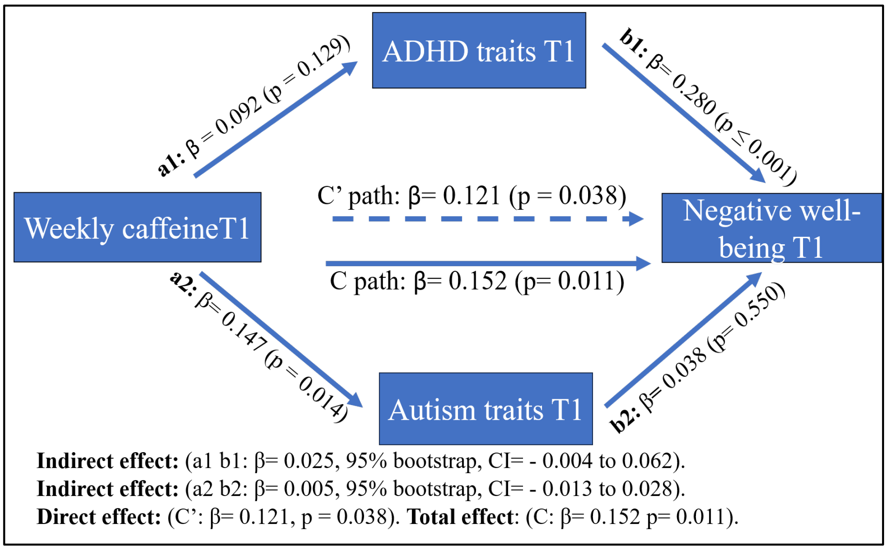

Figure 9.37 ADHD and autism traits as mediators between weekly caffeine and negative well-being at T1.

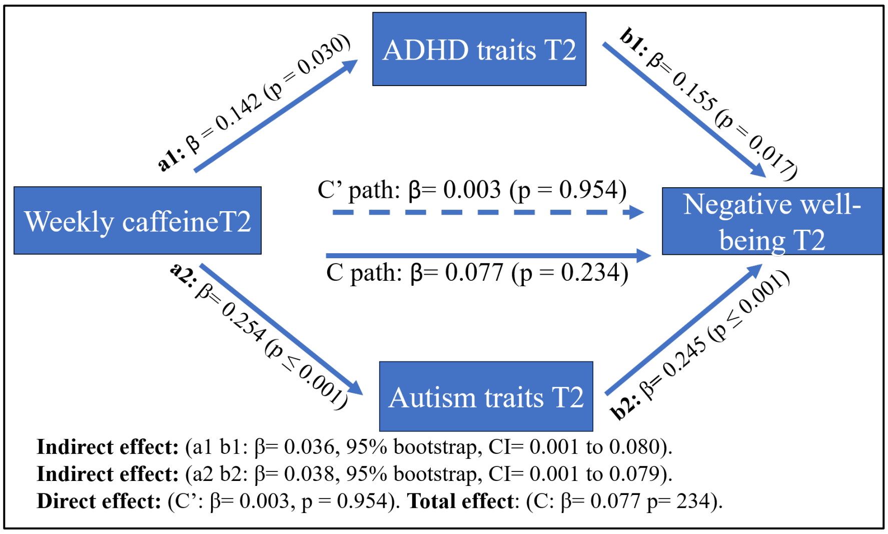

Figure 9.38 ADHD and autism traits as mediators between weekly caffeine and negative well-being at T2.

9.4 Discussion

The first aim of this chapter was to investigate the influence of health-related behaviours and well-being predictors measured at T1 on well-being and SDQ outcomes measured at T2. The longitudinal multivariate analyses, controlling for established predictors, gender, and BMI, revealed that exercise was associated with increased positive well-being and physical health, which is consist with results found (Costigan et al., 2019). There was a relationship between a healthy diet and improved physical health as well. In addition, high junk food consumption was associated with increased anxiety. This result is consistent with previous studies. Moreover, increased hyperactive behaviour has been observed among individuals with ADHD traits**.** People with ADHD traits also had low peer problems. Hyperactivity, emotional problems, conduct problems, and peer problems were predicted by increased autistic characteristics. Moreover, individuals with higher autistic traits at T1 tended to show lower prosocial behaviour at T2.

The second aim was to investigate the interaction between the diet variables, and ADHD and autistic traits on well-being and SDQ outcomes. These analyses aimed to examine whether the effect of diet variables on the well-being and SDQ outcomes changed depending on the presence of ADHD and autistic traits. The analyses found that there was an interaction between junk food and ADHD traits in the positive well-being analysis which indicated that the relationship between junk food consumption and positive well-being varied according to ADHD traits, with high junk food consumption being associated with lower positive well-being among people with ADHD traits. This finding was observed at T1, but not at T2. A similar finding was found between junk food and autistic traits in the flourishing analysis at T1 only, indicating that people with autistic traits who consume large amounts of junk food tend to experience decreased flourishing. Moreover, the interaction between total weekly caffeine intake and autism traits reflected increased anxiety at T1 for people with no autistic traits. It was found that the interaction between junk food and autistic traits, reflecting increased depression for people with autism traits, occurred only at T1. There was a significant interaction between junk food and ADHD traits, reflecting decreased physical health and increased negative well-being at T2 only. However, there were no other reliable interactions between ADHD and autistic traits and the remaining diet variables on well-being outcomes. There was a significant interaction between junk food and autistic traits in the analysis of emotional problems at T2, but this was not observed at T1. However, total weekly caffeine was associated with decreased emotional problems for people with autistic traits at T2 and increased conduct problems at the same time point. Interestingly, these interactions found among people with prior diagnoses of ADHD/autism were not found in previous chapters that involved studies with the general population.

The mediation analyses showed a significant indirect effect between psychological capital and positive well-being mediated by life satisfaction at both time points, which suggests that psychological capital could increase positive well-being through perceived life satisfaction, although the mediation between psychological cap and positive well-being through life satisfaction at time 1 and time 2 were partially mediations because the direct effect between psychological cap and positive well-being were significant as well. In addition, there were indirect effects between student stressors and negative well-being mediated by perceived stress at T1 only.

The final aim was to identify the indirect relationships between diet variables and well-being outcomes through mediation analyses. The indirect effect of ADHD traits on positive well-being through healthy diet consumption was significant at T1 only. A similar indirect effect was found when analysing the effects of autistic traits on positive well-being through healthy diet consumption at T1, but not at time 2. These findings illustrate that ADHD traits and autistic traits are associated with reduced healthy diet consumption, which may be associated with decreased positive well-being. When a healthy diet was the predictor and ADHD and autistic traits were mediators of positive well-being, it was found that there was a significant indirect effect between healthy diets and positive well-being through and ADHD and autistic traits: at T1 for autism traits, and at both time points for ADHD traits. These findings confirm previous indications of a potential bidirectional association between diet and ADHD and autistic traits (Harris et al., 2022; Lange et al., 2023; Mian et al., 2019). Another significant indirect effect was found between autism traits and positive well-being through weekly caffeine consumption, which indicated that autistic traits were associated with reduced positive well-being through increased total weekly caffeine consumption; this finding was only observed at T1. Thus, the result suggests that autism traits are related to a decrease in positive well-being through high caffeine consumption. Another finding showed that junk food consumption was associated with increased ADHD traits, which, in turn, may contribute to increased negative well-being. These findings were more robust as they were found at both time points. Moreover, weekly caffeine consumption was associated with increased negative well-being through ADHD/autistic traits at T2.

9.5 Conclusion

This analysis study included cross-lagged, interactions, and mediation analyses. The cross-lagged results were consistent with previous research, which found that most of the relationships between HRBs were no longer significant after controlling for well-being predictors. However, it is observed that the ADHD/autism traits time 1 were significant with SDQ outcomes time 2, but not well-being outcomes, which confirmed the SDQ was more sensitive with ADHD/autism traits compared to well-being outcomes. Moreover, it was found that there were more significant interactions between diet and ADHD/autism on well-being and SDQ outcomes among this population. In regard to mediation analyses, the results revealed the potential of bidirectional relationships between healthy diet and ADHD/autism traits on positive well-being.

Chapter 10: Conclusions

10.1 General Discussion

The Wellbeing Process Model was a framework for the thesis. It is a comprehensive framework that considers multiple factors influencing an individual's well-being by integrating positive and negative components, individual characteristics, appraisals, and outcomes. The established predictors of the model are stressors, social supports, coping strategies, personality traits, and cognitive appraisals, which influence positive outcomes such as happiness and negative outcomes such as anxiety and depression. The basic assumptions of the models are that negative factors and personal characteristics predict negative outcomes. In contrast, positive outcomes were mainly predicted by positive factors. The results of the current thesis confirmed the established predictors of well-being outcomes. Positive well-being was predicted by high psychological cap, social support, positive coping, and low stressors. Negative outcomes were driven by high stressors, negative coping, low social support, and low psychological cap. These findings align with the WPQ model of wellbeing introduced earlier, which emphasises that negative established factors and personal characteristics predict negative outcomes. In contrast, positive outcomes were mainly predicted by positive factors (e.g., enhancing social support, reducing negative coping) can improve well-being outcomes. The findings of this thesis support the previous literature review by showing that psychological cap, social support, and coping strategies play a crucial role in well-being assessment. This contributes to the broader literature by determining the importance of these factors for well-being.

In addition, WPQ model is a flexible framework, it acknowledges the multifaceted nature of well-being, influenced by a combination of factors. It has been widely used to understand the factors influencing well-being, allow researchers to add new variables and test whether they contribute additional predictive power beyond established predictors. Therefore, health-related behaviour variables have been added as predictors and SDQ as outcomes.

Mediation analyses investigating the links between health-related behaviours, ADHD/autistic traits, and well-being outcomes revealed that the indirect effect of ADHD traits on positive well-being via healthy diet consumption was significant only at Time 1. A comparable indirect effect was observed for autistic traits influencing positive well-being through a healthy diet at T1, but this effect did not persist at Time 2. These results suggest that both ADHD and autistic traits are related to lower levels of healthy diet consumption, which may, in turn, contribute to reduced positive well-being. When a healthy diet was considered as the predictor and ADHD and autistic traits served as mediators for positive well-being, a significant indirect relationship was found: for autistic traits at T1, and for ADHD traits at both T1 and T2. These findings align with previous research, indicating a potential bidirectional relationship between diet and ADHD/autistic traits (Harris et al., 2022; Lange et al., 2023; Mian et al., 2019). Worth mentioning that the observed associations may be influenced by an unmeasured variable.

Wellbeing is multi-dimensional, with positive and negative predictors and outcomes needing assessment. A holistic and flexible framework for assessing wellbeing contribute to the identification of key factors that can be included to improve well-being among students. New variables (health-related behaviours) can enhance the model's predictive power if they show significant effects.

The literature review in this thesis suggested that a healthy diet, fruit and vegetable consumption, and regular breakfast consumption may contribute to enhancing health outcomes and improving mood among adolescents and young adults (Głąbska et al., 2020; Solomou et al., 2023). However, there is also evidence that there was no association between healthy food and mental health outcomes among adolescents (Khalid et al., 2016; O'neil et al., 2014). Previous literature reviews supported the view that there is a consistent association between junk food consumption and mental health outcomes, with high junk food consumption contributing to increased mental health problems (Hafizurrachman & Hartono, 2021; Malmir et al., 2023). However, limited associations have been found between caffeine consumption and well-being outcomes. Evidence from a systematic review indicated that caffeine consumption enhances mental health outcomes, reduces anxiety, and increases relaxation (Ikar & Sable, 2023). Another finding from an umbrella review suggested that three to four cups of coffee per day were associated with improved health outcomes, but that greater consumption may lead to harm (Poole et al., 2017). A study conducted by Qureshi, Stampfer, Kubzansky, and Trudel-Fitzgerald (2022) found an association between coffee and psychological well-being, with high coffee consumption (four or more cups per day) might be related to reduced happiness. In contrast, there was no relationship between moderate coffee consumption (one to three cups per day) and happiness. However, these previous studies were conducted with adults and did not consider whether individual differences and lifestyle could influence the effect of caffeine.

A considerable number of studies have examined the associations between ADHD/autistic traits and SDQ outcomes. A study conducted by Stern et al. (2020) confirms the association between ADHD traits and emotional problems among adolescents and young adults. A similar result was found among adolescents and young adults with autism; which is there are associations between emotional and behavioural problems and autistic traits (Pisula et al., 2017). A systematic review examining the association between autism and peer problems found that individuals with autism suffer more peer problems and face difficulties in creating friendships (Cresswell, Hinch, & Cage, 2019).

The previous chapters investigated the impact of health-related behaviours, especially diet and ADHD and autism traits, on well-being and SDQ outcomes in young people while controlling for well-being predictors. The findings provide valuable insights into the associations between HRBs, ADHD, and autistic traits and well-being outcomes for adolescents and young adults.

10.1.1 Association between HRB and Well-being Outcomes

Our results revealed that HRB factors significantly influenced student well-being outcomes in most univariate analyses. However, after accounting for the established predictors of well-being, most of the significance in the univariate analyses disappeared in multivariate analyses. However, some HRBs associations remained significant, such as those between a healthy diet and physical health; it was found that a healthy diet was associated with physical health among students with previous ADHD/autism diagnoses at T1 and T2. This effect also remained significant in the cross-lagged analyses: healthy diet consumption at T1 was associated with better physical health at T2 among students with previous ADHD/autism diagnoses. In addition, high fruit and vegetable consumption was associated with increased physical health among secondary school students. These results are consistent with the conclusions from an umbrella review conducted by Angelino et al. (2019). Another finding was observed among secondary students: high breakfast and tea consumption was associated with increased flourishing. This result is supported by recent research by Lange, Nakamura, Lange, and Zhao (2022) which found that tea helps to reduce stress and enhances positive mood. Tea consumption was also associated with better physical health among university students, consistent with the results found (Khan & Mukhtar, 2013). Junk food consumption was associated with increased anxiety in the cross-lagged analyses. In addition, energy drink consumption was associated with low positive well-being among secondary students; these finding reflect those of Richards and Smith (2016), who also found energy drink consumption could increase mental health problems among secondary students. It was observed that high coffee consumption was associated with increased depression and negative well-being among secondary students, this finding was also reported in previous literature, which found that high coffee consumption was associated with increased anxiety and depression among secondary student population (Richards & Smith, 2015). High weekly caffeine consumption was also associated with reduced flourishing at T1 and physical health at T2 in the survey of students with previous diagnoses of ADHD/autism. Similar finding was found in a study conducted by Qureshi et al. (2022) that high coffee consumption might be related to reduced happiness. In analyses conducted in earlier chapters, it was observed that exercise was associated with enhanced physical health. Sleepiness was associated with increased anxiety and depression and reduced flourishing among students previously diagnosed with ADHD/autism.

10.1.2 Association between HRBs and SDQ Outcomes

The results of the analysis of SDQ outcomes after controlling for established predictors showed that healthy diets was related to reduced hyperactivity among students with previous diagnoses of ADHD/autism. A similar result was observed among secondary students regarding breakfast and hyperactivity, suggesting that increased breakfast consumption was related to reduced hyperactivity. Moreover, fruit and vegetable consumption was associated with increased prosocial behaviours among university and secondary students. Meanwhile, junk food was associated with increased hyperactivity among university students, and high cola consumption was associated with increased peer problems in this population, which is consistent with the results found (Suglia, Solnick, & Hemenway, 2013), but the sample was among the child population. Weekly caffeine consumption was also associated with reduced prosocial behaviours among students with previous diagnoses of ADHD/autism. A similar finding among secondary students suggested that increased soft drink consumption was associated with reduced prosocial behaviours. Coffee consumption increases conduct problems in secondary students and causes emotional and hyperactive behaviours in university students. It appeared that exercise was associated with reduced emotional problems in university students and peer problems in students with previous diagnoses of ADHD/autism. In addition, it was observed that exercise was associated with increased prosocial behaviours in cross-lagged analysis. Sleepiness was associated with increased emotional problems and hyperactivity in university students.

Consuming a healthy diet and avoiding junk food to increase positive well-being and decrease negative well-being aligns with previous research highlighting the benefits of following healthy behaviours such as exercise, a healthy diet, and good sleep for well-being and SDQ outcomes (Johnson & Smith, 2020). This approach may enhance students' ability to increase positive well-being and reduce behavioural issues such as hyperactivity, peer problems, and emotional problems.

10.1.3 Association between ADHD/Autism traits and Well-being and SDQ Outcomes

The results revealed that most ADHD/autism traits were associated with well-being and SDQ outcomes in the univariate analyses. In the multivariate analyses, when adding HRB variables and controlling for established predictors, the ADHD/autism traits were no longer significant with regard to well-being outcomes, except for ADHD and flourishing, with high ADHD traits decreasing flourishing at T1 only in students with previous diagnoses of ADHD/autism. These results align with those of previous studies by (Garcha & Smith, 2023; A. Smith et al., 2023) which also found that ADHD/autistic traits were not associated with well-being outcomes but were with SDQ outcomes. After controlling for established predictors, the multivariate analyses of SDQ outcomes showed that ADHD/autism traits were significantly associated with most SDQ outcomes. It was found that ADHD/autism traits were associated with increased conduct problems among university students. Moreover, ADHD traits were associated with hyperactivity and emotional problems in secondary school and university students, and university students with previous diagnoses of ADHD at both time points. A similar finding was observed for autism traits, which were associated with increased hyperactivity and emotional problems for university and secondary students. There was also an association between autistic traits and high hyperactivity behaviours among students with previous diagnoses of ADHD/autism at both time points. It was observed that high autistic traits were associated with high peer problems for secondary school and university students and university students with previous diagnoses of ADHD/autism at both time points; this association remained significant in the cross-lagged analysis, This finding supports evidence from a systematic review observations (Cresswell, Hinch, & Cage, 2019) that examining the association between autism and peer problems found that individuals with autism suffer more peer problems and face difficulties in creating friendships. High autistic traits were associated with low prosocial behaviours in university students and university students with previous diagnoses of ADHD/autism at both time points and in the cross-lagged analysis as well. Previous studies have also confirmed this association between high autistic traits and low prosocial behaviours (Oerlemans, Rommelse, Buitelaar, & Hartman, 2018).

10.2 Implications

The current results indicate that health-related behaviours could be important for enhancing well-being and behavioural outcomes. These health-related behaviours could involve maintaining a balanced diet, exercising regularly, and getting enough sleep. It is crucial for healthcare providers and carers to collaborate in the development of strategies that encourage healthy habits and resolve any difficulties that may arise in maintaining a healthy lifestyle for university and secondary students, in addition to individuals with ADHD and autism traits. Furthermore, social workers and the parents of adolescents could encourage healthy dietary habits, because adolescents are influenced by factors such as social interaction during mealtimes, the location of the meal, and the presence of family members. Thus, the parents of adolescents significantly influence the comprehension and understanding of diet and nutritional consumption. It is imperative to encourage healthy practices in childhood to establish a proper diet later in life, as parents significantly impact how adolescents perceive and understand nutrition. Promoting and establishing opportunities for healthy behaviours can protect against the development of future physical and mental health issues in students. Therefore, social workers could have the ability to develop strategies that help to maintain a healthy lifestyle.

The research also highlighted the significance of well-being predictors, including low psychological capital, lack of social support, student stressors, and negative coping, which may decrease students' quality of life. These predictors have more robust effects than health-related behaviours. Consequently, practitioners may want to concentrate on students with ADHD/autism traits and try to enhance their well-being by utilising self-efficacy and coping skills. In summary, the current study indicates that student stressors, a lack of social support, negative coping, and low psychological capital are relevant to health impairment and well-being. Thus, a practical strategy for student counsellors would be to increase awareness of the potentially detrimental effects of these factors to enhance students' well-being.

10.3 Limitations of the Study and Recommendations

While this research provides valuable insights into relationships between health-related behaviours, ADHD/autism traits, and well-being, it is important to acknowledge several limitations that may affect the interpretation and generalisability of the findings.

The study samples predominantly comprised adolescent and young adult students, which may not represent the broader population, such as younger children or those not in university education. Future research should aim to replicate these findings with larger, more diverse samples. Although this thesis included a longitudinal study, the duration between the first and second studies was short. Thus, further longitudinal research is needed to determine the directionality and potential causal mechanisms underlying these relationships. In addition, the reliance on self-reported measures for key variables introduces the possibility of response bias and social desirability effects. Moreover, it is important to acknowledge that the observed results may be affected by underlying factors that are unmeasured. Future studies could benefit from incorporating objective measures or multi-informant approaches to corroborate self-reported data. Despite these limitations, this research's findings provide important insights for future research into relationships between health-related behaviours, ADHD/autism traits, well-being, and SDQ outcomes.

10.3 Contribution to Knowledge

This research provides a valuable contribution to the investigation of the impact of health-related behaviours on well-being and behavioural outcomes in the educational environment. Although health-related behaviour factors were associated with well-being and SDQ outcomes, their impact was significantly decreased when well-being predictors were taken into account. However, certain health-related behaviours continued to be significant even after controlling for these predictors, which confirms the possible importance of the increased consumption of healthy food, promotion of a healthy lifestyle, and limiting unhealthy food consumption to support the well-being of students.

10.4 Conclusion

The thesis comprised consecutive studies, each contributing uniquely to our understanding of the factors influencing well-being among general students and students with ADHD/autism. Collectively, these studies employed both theory-driven and data-driven approaches, integrating the Wellbeing Process Model with empirical findings to advance knowledge in this area.

The first study examined the associations between health-related behaviours and well-being among university students before starting university study in secondary analyses, confirming that positive lifestyle factors such as regular exercise and no smoking are linked to higher physical health.

The second study extended these findings by examining the relationships between health-related behaviours and wellbeing in different university student populations, revealing that good sleep and alcohol are associated with lower negative wellbeing. Moreover, smoking was associated with high negative well-being. The results suggest that good sleep is associated with increased general health. Due to the literature on autistic and ADHD traits is largely absent. This led to a data-driven approach, which added ADHD/autistic traits as predictors to examine the association between health, health-related behaviours and wellbeing and behavioural outcomes.

Study 3 explored potential associations between health-related behaviours, ADHD/autism traits and well-being, and behavioural outcomes after controlling for established predictors in university students. The results of this study showed that most of the health-related behaviours and ADHD/autism traits were no longer significant after controlling for well-being predictors, except for exercise was associated with high physical health. In addition, ADHD/autism traits were associated with behaviour outcomes even when adjusted for well-being predictors, but not well-being outcomes. This suggests that the SDQ was more sensitive to ADHD/autism traits compared to well-being outcomes.

Study 4, building on the previous results, it is predicted that there is no association between health-related behaviours, ADHD/autistic traits and well-being and behaviour outcomes for secondary school students after controlling for combined well-being predictors in one factor, finding that the relationship between HRBs and well-being was stronger than previous study. For example, coffee was associated with decreased positive well-being, increased negative well-being and depression. Fruit and vegetables correlated with high physical health, while tea and breakfast increased flourishing. Similar to the previous study, the ADHD/autism traits were associated with SDQ outcomes.

The final study utilised a longitudinal design to examine the predictive factors of HRBs, ADHD/autism traits and wellbeing and behavioural outcomes for students with a prior diagnosis of ADHD/autism. The findings demonstrated that a healthy diet was associated with high physical health at times 1 and 2. Total weekly caffeine was associated with reduced flourishing at T1 and physical health at T2. Moreover, in cross-lag exercise, Time 1 significantly predicted positive well-being at Time 2 among individuals with prior diagnoses of ADHD and autistic traits. This study introduced mediation analyses, showing that healthy diet consumption mediated the relationship between ADHD and autism traits and positive well-being. At the same time, ADHD and autism traits mediated the relationship between a healthy diet and positive well-being. This suggests that a potential bidirectional relationship exists between diet and ADHD/autism traits.

These studies provide a comprehensive understanding of the relationships between health behaviours, ADHD/autistic traits and well-being. The results confirm that some of the health-related behaviours, such as exercise is good predictor of well-being outcomes. Future research should continue to explore these relationships in more diverse populations, consider the multidimensional nature of wellbeing, including established predictors when assessing for wellbeing, and consider the bidirectional nature of diet and ADHD/autism.

The main findings of the thesis are as follows:

- Novel empirical studies confirmed the established predictors of well-being. These psychosocial predictors were often not related to SDQ outcomes.
- Univariate analyses associated health-related behaviour variables with well-being and SDQ outcomes. However, most variables were no longer significant when established predictors were controlled for in multivariate analyses.

- Although most HRB variables in the multivariate analyses disappeared when controlling for established predictors, some remained significant.
- ADHD/autism traits were significant in the SDQ outcomes analysis, but not in analysis of well-being outcomes.
- The significant HRBs results with well-being and SDQ were similar across the various samples.
- There was little evidence of interactions between HRBs and ADHD/autism traits with regard to well-being and SDQ outcomes.
- Evidence of mediation was obtained, but these analyses did not adjust for the established predictors.

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Appendices

Appendix A: Full survey.

1. **University year.** Which university year are you in?

2. **Gender.** Gender.
   - Male
   - Female.
   - Other.

A.1 WPQ questionnaire: Short form

Please answer the following questions about how you have felt and behaved in the last 6 weeks.

3. **Positive well-being.** I have been experiencing positive feelings (e.g. feeling happy, satisfied with life, in good spirits; feeling good about relaxations; being able to relax; and feeling energetic and interested).

   Disagree strongly 1 2 3 4 5 6 7 8 9 10 Agree Strongly.

4. **Negative well-being.** I have been experiencing negative feelings (e.g. feeling stressed; feeling anxious or depressed; feeling physically or mentally tired; and feeling emotionally drained).
   Disagree strongly 1 2 3 4 5 6 7 8 9 10 Agree Strongly

5. **Anxiety.** To what extent have been feeling anxious.
   Not at all 1 2 3 4 5 6 7 8 9 10 very much so

6. **Depression.** To what extent have been feeling depressed.

   Not at all 1 2 3 4 5 6 7 8 9 10 very much so

7. **Student stressors.** I have had stressful experiences (e.g., time pressure; academic dissatisfaction; loneliness; and friendship problems).

   Disagree strongly 1 2 3 4 5 6 7 8 9 10 Agree Strongly

8. **Social support.** I feel that I have the social support I need (e.g. people to talk to, support for financial needs, friendship, and someone to discuss problems with).

Disagree strongly 1 2 3 4 5 6 7 8 9 10 Agree Strongly

9. **Positive Coping.** When I'm in a stressful situation I try and solve the problem or look for support from others.

Disagree strongly 1 2 3 4 5 6 7 8 9 10 Agree Strongly

10. **Negative Coping.** When I am in a stressful situation I blame myself, or wish for things to improve, or avoid the problem.

Disagree strongly 1 2 3 4 5 6 7 8 9 10 Agree Strongly

11. **Psychological Capital.** I am optimistic, confident in my ability to solve problems and I am generally satisfied with myself.

Disagree strongly 1 2 3 4 5 6 7 8 9 10 Agree Strongly

12. **Work-Life balance.** Does life outside of school interfere with your school work, and school interferes with other aspects of your life?

Not at all 1 2 3 4 5 6 7 8 9 10 Definitely Yes

13. **Academic stress.** Do you have a high workload that makes you feel stressed and could affect how efficiently you do your work?

Not at all 1 2 3 4 5 6 7 8 9 10 Definitely Yes

14. **Sleepiness.** How often do you feel sleepy during the day?

Never 1 2 3 4 5 6 7 8 9 10 All the time

15. **Physical health.** In general how would you rate your physical health?

Extremely poor 1 2 3 4 5 6 7 8 9 10 Extremely good

16. **Flow.** To what extent do you feel immersed in your academic work and have full involvement and engagement in your studies?

Not at all 1 2 3 4 5 6 7 8 9 10 Very much so

17. **Flourishing.** To what extent do you feel you are thriving or flourishing (e.g. being successful, feeling that life is going well, and having a sense of belonging)?

Not at all 1 2 3 4 5 6 7 8 9 10 Very much so

18. **Rumination.** If you think about school work in your free time does it have a negative effect (e.g. makes you tense and troubled) or does it help to solve problems?

Negative effect 1 2 3 4 5 6 7 8 9 10 Positive effect.

A.2 DABS questionnaire: Short form

19. **Breakfast.** How often did you eat breakfast? (Please tick one box.)

Every day	Most days (3-6)	Once or twice a week	Once a month	Never
□1	□2	□3	□4	□5

20. **Fruit and Veg.** How often did you eat 5 pieces of fruit or vegetables?

Every day	Most days (3-6)	Once or twice a week	Once a month	Never
□1	□2	□3	□4	□5

21. **Junk snacks.** How often did you eat snacks like chocolate, crisps and sweets?

Every day	Most days (3-6)	Once or twice a week	Once a month	Never
□1	□2	□3	□4	□5

22. **Junk meals.** How often did you eat take-aways or fast-food?

Every day	Most days (3-6)	Once or twice a week	Once a month	Never
□1	□2	□3	□4	□5

The next set of questions ask about how much you eat and drink (Put 0 if you don't eat or drink that product)

23. Energy drinks _______ cans a week.
24. Colas ________cans a week.
25. Coffee _______cups a week.
26. Tea______ cups a week.

Finally, some questions about other things that influence your health.

27. What is your weight? __________
28. What is your height? ___________

29. How often do you take part in sports or other types of physical exercise: (Please tick ONE box per category)

	3 times a week or more	Once or twice a week	About once to three times a month	Never/ hardly ever
A) Mildly energetic (e.g. walking)	~ 1	~ 2	~ 3	~ 4
B) Moderately energetic (e.g. dancing, cycling, leisurely swimming)	~ 1	~ 2	~ 3	~ 4
c) Vigorous (e.g. running, hard swimming, tennis, squash, aerobics)	~ 1	~ 2	~ 3	~ 4

A.3 ADHD self-report questionnaire

Please answer the questions below, rating yourself on each of the criteria shown using the scale on the right side of the page. As you answer each question, mark in the box that best describes how you have felt and conducted yourself over the past 6 months:

	Never	Rarely	Sometimes	Often	Very Often
1. How often do you have trouble wrapping up the final details of a project once the challenging parts have been done?					
2. How often do you have difficulty getting things in order when you have to do a task that requires organization?					
3. How often do you have problems remembering appointments or obligations?					
4. When you have a task that requires a lot of thought, how often do you avoid or delay getting started?					
5. How often do you fidget or squirm with your hands or feet when you have to sit down for a long time?					
6. How often do you feel overly active and compelled to do things, like you were driven by a motor?					

A.4 AQ-10 questionnaire

	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
1. I often notice small sounds when others do not.				
2. I usually concentrate more on the whole picture, rather than the small details.				
3. I find it easy to do more than one thing at once.				
4. If there is an interruption, I can switch back to what I was doing very quickly.				
5. I find it easy to 'read between the lines' when someone is talking to me.				
6. I know how to tell if someone listening to me is getting bored.				
7. When I'm reading a story, I find it difficult to work out the characters' intentions.				
8. I like to collect information about categories of things (e.g. types of car, types of bird, types of train, types of plant etc).				

9. I find it easy to work out what someone is thinking or feeling just by looking at their face.
10. I find it difficult to work out people's intentions.

A.5 SDQ questionnaire

For each item, please mark the box for Not True, Somewhat True or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain. Please give your answers on the basis of how things have been for you over the last six months.

	Not True	Somewhat True	Certainly True
Conduct behaviours			
1. I get very angry and often lose my temper			
2. I am generally willing to do what other people want			
3. I fight a lot. I can make other people do what I want			
4. I am often accused of lying or cheating			
5. I take things that are not mine from home, work or elsewhere			
Hyperactive paviours			
6. I am restless, I find it hard to sit down for long			
7. I am constantly fidgeting or squirming			
8. I am easily distracted, I find it difficult to concentrate			
9. I think before I do things			
10. I finish the work I'm doing. My attention is good			
Emotional problems			
11. I get a lot of headaches, stomach-aches or sickness			
12. I worry a lot			
13. I am often unhappy, depressed or tearful			
14. I am nervous in new situations. I easily lose confidence			
15. I have many fears, I am easily scared			

Peer problems

16. I would rather be alone than with other people

17. I have at least one good friend

18. Other people generally like me

19. Other people pick on me or bully me

20. I get along better with older people than with people of my own age

Prosocial behaviours

21. I try to be nice to other people. I care about their feelings

22. I usually share with others, for example food or drink

23. I am helpful if someone is hurt, upset or feeling ill

24. I am kind to children

25. I often offer to help others (family members, friends, colleagues)

Appendix B: Full results of multivariate analyses in Chapter 6

Positive Well-being

Table B1 Multiple linear regression between predictors and positive well-being outcome

Predictors	β	t	p
Student stressors	-.208	-3.604	<.001
Social support	.055	.979	.328
Positive Coping	.085	1.515	.131
Negative Coping	.088	1.498	.135
Psychological Cap	.400	6.643	<.001
Low Work Life balance	.025	.461	.645
Academic stress	-.074	-1.258	.209
Flow	.016	.295	.768
Rumination	-.014	-.295	.768
Breakfast	.017	.328	.743
Fruit and veg	-.066	-1.288	.199
Junk snack	-.007	-.155	.877
Junk meals	-.084	-1.706	.089
Energy Drinks	.031	.627	.531
Colas	-.003	-.061	.951
Coffee	.006	.135	.893
Tea	.038	.803	.422
Exercise factor	.096	1.895	.059
Sleepiness	-.023	-.432	.666
Total ADHD	-.031	-.582	.561
Total autism	.065	1.346	.179

Note: *Beta (β) values are standardised.*

Negative Well-being

Table B2 Multiple linear regression between predictors and negative well-being outcome.

Predictors	β	t	p
Sex	-.040	-.878	.380
Student stressors	.393	7.289	<.001
Social support	-.002	-.042	.966
Positive Coping	.016	.301	.764
Negative Coping	.094	1.702	.090
Psychological Cap	-.218	-3.876	<.001

Low Work Life balance	.052	1.026	.306
Academic stress	.043	.779	.436
Rumination	-.026	-.581	.561
Breakfast	-.047	-.958	.339
Fruit and veg	-.008	-.173	.863
Junk snack	.082	1.839	.067
Junk meals	.034	.740	.460
Energy Drinks	-.080	-1.757	.080
Colas	.044	.965	.335
Coffee	.033	.747	.456
Tea	.009	.212	.832
Exercise factor	.016	.332	.740
Sleepiness	.055	1.116	.265
Total ADHD	.018	.359	.720
Total autism	-.077	-1.682	.094

***Note**: Beta (β) values are standardised.*

Flourishing

Table B3 Multiple linear regression between predictors and flourishing outcome.

Predictors	**β**	**t**	**p**
Student stressors	-.110	-2.344	.020
Social support	.127	2.762	.006
Positive Coping	-.014	-.314	.754
Negative Coping	-.105	-2.186	.030
Psychological Cap	.376	7.646	<.001
Low Work Life balance	.033	.756	.450
Academic stress	-.079	-1.649	.100
Flow	.255	5.881	<.001
Rumination	.110	2.808	.005
Breakfast	.037	.871	.385
Fruit and veg	-.037	-.881	.379
Junk snack	.018	.465	.642
Junk meals	-.019	-.468	.640
Energy Drinks	.031	.779	.437
Colas	.019	.469	.639
Coffee	-.013	-.336	.737

Tea	.004	.092	.927
Exercise factor	-.001	-.033	.974
Sleepiness	-.069	-1.592	.112
Total ADHD	-.011	-.249	.803
Total autism	.068	1.731	.084

***Note**: Beta (β) values are standardised.*

Physical health

Table B4 Multiple linear regression between predictors and physical health outcome.

Predictors	**β**	**t**	**p**
Sex	-.004	-.078	.938
Student stressors	-.015	-.258	.797
Social support	.084	1.400	.162
Positive Coping	.068	1.133	.258
Negative Coping	.025	.393	.694
Psychological Cap	.079	1.222	.223
Flow	.165	2.920	.004
Breakfast	-.058	-1.041	.299
Fruit and veg	-.027	-.487	.626
Junk snack	-.023	-.439	.661
Junk meals	-.018	-.340	.734
Energy Drinks	.014	.259	.796
Colas	-.029	-.558	.578
Coffee	.031	.614	.540
Tea	.107	2.118	.035
Exercise factor	.277	5.073	<.001
Sleepiness	-.119	-2.143	.033
Total ADHD	.008	.139	.890
Total autism	-.047	-.887	.376

***Note**: Beta (β) values are standardised.*

Conduct problems

Table B5 Multiple linear regression between predictors and conduct problems outcome.

Predictors	**β**	**t**	**p**
Sex	.060	1.103	.271
Student stressors	.020	.331	.741
Social support	-.200	-3.183	.002

Positive Coping	-.081	-1.285	.200
Psychological Cap	.005	.086	.932
Flow	-.002	-.036	.972
Breakfast	.023	.389	.697
Fruit and veg	.006	.109	.913
Junk snack	-.039	-.719	.473
Junk meals	.071	1.276	.203
Energy Drinks	-.073	-1.339	.182
Colas	.083	1.509	.132
Coffee	.094	1.763	.079
Tea	.029	.547	.585
Exercise factor	.025	.442	.659
Sleepiness	-.125	-2.146	.033
Total ADHD	.116	1.912	.057
Total autism	.147	2.663	.008

***Note**: Beta (β) values are standardised.*

Hyperactive Behaviour

Table B6 Multiple linear regression between predictors and hyperactive behaviours outcome.

Predictors	β	t	p
Sex	-.024	-.549	.583
University year	-.059	-1.330	.184
BMI	.064	1.521	.129
Student stressors	.049	.950	.343
Social support	-.014	-.281	.779
Positive Coping	-.104	-2.073	.039
Negative coping	.068	1.280	.202
Psychological Cap	.038	.704	.482
Low work life balance	-.001	-.013	.989
Workload	.028	.524	.600
Flow	-.116	-2.431	.016
Rumination	-.055	-1.277	.203
Breakfast	-.008	-.171	.864
Fruit and veg	-.065	-1.410	.160

Junk snack	-.006	-.135	.893
Junk meals	.120	2.680	.008
Energy Drinks	.009	.198	.843
Colas	-.077	-1.747	.082
Coffee	.087	2.016	.045
Tea	.037	.868	.386
Exercise factor	.092	2.013	.045
Sleepiness	.135	2.839	.005
Total ADHD	.373	7.670	<.001
Total autism	.159	3.631	<.001

Note: *Beta (β) values are standardised.*

Emotional Problems

Table B7 Multiple linear regression between predictors and emotional problems outcome.

Predictors	**β**	**t**	**p**
Sex	-.078	-1.797	.073
Student stressors	.121	2.345	.020
Social support	-.070	-1.385	.167
Positive Coping	.050	.987	.324
Negative coping	.139	2.633	.009
Psychological Cap	-.292	-5.407	<.001
Low work life balance	-.004	-.084	.933
Workload	.074	1.401	.162
Flow	.016	.341	.733
Rumination	.019	.435	.664
Breakfast	.028	.590	.556
Fruit and veg	-.081	-1.746	.082
Junk snack	.008	.176	.860
Junk meals	-.019	-.423	.673
Energy Drinks	-.044	-1.008	.314
Colas	.022	.504	.614
Coffee	.105	2.455	.015
Tea	.046	1.092	.276
Exercise factor	-.148	-3.255	.001
Sleepiness	.107	2.252	.025
Total ADHD	.102	2.106	.036

Total autism	.097	2.208	.028

***Note**: Beta (β) values are standardised.*

Peer Problems

Table B8 Multiple linear regression between predictors and peer problems outcome.

Predictors	β	t	p
Sex	.057	1.113	.267
University year	-.031	-.606	.545
Student stressors	.090	1.502	.134
Social support	-.258	-4.386	<.001
Positive Coping	-.052	-.869	.385
Negative coping	-.026	-.419	.675
Psychological Cap	-.188	-2.957	.003
Low work life balance	.013	.235	.815
Flow	.072	1.301	.194
Breakfast	.065	1.179	.239
Fruit and veg	-.005	-.099	.921
Junk snack	-.050	-.984	.326
Junk meals	-.082	-1.550	.122
Energy Drinks	.006	.121	.904
Colas	.111	2.130	.034
Coffee	-.035	-.685	.494
Tea	.008	.157	.875
Exercise factor	-.043	-.802	.423
Sleepiness	-.078	-1.420	.157
Total ADHD	.030	.524	.600
Total autism	.232	4.486	<.001

***Note**: Beta (β) values are standardised.*

Prosocial Behaviour

Table B9 Multiple linear regression between predictors and prosocial behaviours outcome.

Predictors	β	t	p
Sex	-.187	-3.647	<.001
Social support	.162	2.750	.006
Positive Coping	.109	1.869	.063
Workload	.072	1.337	.182
Flow	.089	1.613	.108

Breakfast	-.045	-.820	.413
Fruit and veg	.141	2.577	.010
Junk snack	.075	1.472	.142
Junk meals	-.002	-.034	.973
Energy Drinks	.029	.569	.570
Colas	.060	1.153	.250
Coffee	.036	.723	.470
Tea	.024	.484	.628
Exercise factor	-.006	-.116	.908
Sleepiness	.247	4.436	<.001
Total ADHD	-.007	-.129	.897
Total autism	-.183	-3.525	<.001

***Note**: Beta (β) values are standardised.*

Appendix C: Full results of multivariate analyses in Chapter 7

Positive Well-being

Table C1 Multiple linear regression between predictors and positive well-being outcome.

Predictors	β	t	p
Sex	-.030	-.495	.621
Negative affect	-.474	-7.337	<.001
Low work life balance	.008	.127	.899
Workload	-.042	-.660	.510
Flow	.182	2.955	.004
Rumination	.062	1.099	.273
Breakfast	.009	.149	.882
Fruit and veg	-.099	-1.631	.105
Junk snack	.096	1.589	.114
Junk meals	.093	1.560	.120
Energy Drinks	-.188	-2.807	.006
Colas	.040	.601	.548
Coffee	-.103	-1.787	.076
Tea	.043	.760	.448
Exercise factor	.007	.108	.914
Sleepiness	-.008	-.127	.899
Total ADHD	.054	.895	.372
Total autism	-.038	-.612	.542

Note*: Beta (β) values are standardised.*

Negative Well-being

Table C2 Multiple linear regression between predictors and negative well-being outcome.

Predictors		β	t	p
Sex		.111	1.968	.051
Negative affect		.503	8.320	<.001
Low work life balance		.097	1.615	.108
Workload		.158	2.636	.009
Breakfast		.033	.578	.564
Fruit and veg		.042	.740	.460
Junk snack		-.050	-.898	.371
Junk meals		-.021	-.377	.707

Energy Drinks		.094	1.495	.137
Colas		-.033	-.517	.606
Coffee		.149	2.743	.007
Tea		.020	.384	.701
Exercise factor		-.071	-1.233	.219
Sleepiness		.053	.946	.346
Total ADHD		-.034	-.598	.551
Total autism		-.003	-.055	.956

Note: *Beta (β) values are standardised.*

Flourishing

Table C3 Multiple linear regression between predictors and flourishing outcome.

Predictors	β	t	p
Negative affect	-.374	-5.727	<.001
Workload	-.027	-.445	.657
Flow	.286	4.440	<.001
Rumination	.037	.622	.535
Breakfast	.150	2.414	.017
Fruit and veg	-.058	-.922	.358
Junk snack	.037	.582	.561
Junk meals	-.041	-.663	.508
Energy Drinks	.010	.144	.886
Colas	-.027	-.386	.700
Coffee	-.048	-.794	.428
Tea	.126	2.159	.032
Exercise factor	.101	1.597	.112
Sleepiness	-.023	-.382	.703
Total ADHD	.044	.702	.484
Total autism	-.057	-.880	.380

Note: *Beta (β) values are standardised.*

Physical Health

Table C4 Multiple linear regression between predictors and physical health outcome.

Predictors	β	t	p
Negative affect	-.159	-2.229	.027
Flow	.073	1.009	.314

Rumination	.145	2.184	.030
Breakfast	.044	.622	.535
Fruit and veg	.162	2.288	.023
Junk snack	-.066	-.929	.354
Junk meals	-.011	-.162	.872
Energy Drinks	-.138	-1.748	.082
Colas	.130	1.647	.101
Coffee	-.075	-1.096	.274
Tea	.117	1.762	.080
Exercise factor	.198	2.770	.006
Sleepiness	.002	.029	.977
Total ADHD	-.035	-.486	.627
Total autism	-.022	-.304	.761

***Note**: Beta (β) values are standardised.*

Anxiety

Table C5 Multiple linear regression between predictors and anxiety outcome.

Predictors	β	t	p
Sex	.198	3.104	.002
Negative affect	.383	5.612	<.001
Low work life balance	.071	1.052	.294
Workload	.178	2.642	.009
Breakfast	.103	1.621	.107
Fruit and veg	.052	.801	.424
Junk snack	-.102	-1.619	.107
Junk meals	-.029	-.453	.651
Energy Drinks	.075	1.066	.288
Colas	-.018	-.249	.804
Coffee	.095	1.559	.121
Tea	-.054	-.899	.370
Exercise factor	-.047	-.732	.465
Sleepiness	-.043	-.684	.495
Total ADHD	.007	.110	.913
Total autism	.073	1.098	.273

***Note**: Beta (β) values are standardised.*

Depression

Table C6 Multiple linear regression between predictors and depression outcome.

Predictors	β	t	p
Sex	.071	1.193	.234
Negative affect	.524	8.151	<.001
Low work life balance	.089	1.406	.162
Workload	.137	2.169	.031
Flow	-.086	-1.412	.160
Breakfast	-.028	-.462	.645
Fruit and veg	.085	1.393	.165
Junk snack	.000	-.001	.999
Junk meals	-.020	-.345	.730
Energy Drinks	.056	.843	.400
Colas	-.020	-.303	.762
Coffee	.121	2.094	.038
Tea	-.088	-1.564	.120
Exercise factor	-.025	-.412	.681
Sleepiness	-.011	-.183	.855
Total ADHD	-.097	-1.608	.109
Total autism	-.089	-1.428	.155

***Note**: Beta (β) values are standardised.*

Conduct Problems

Table C7 Multiple linear regression between predictors and conduct problems outcome.

Predictors	β	t	p
Negative affect	.254	3.354	<.001
Low work life balance	-.016	-.229	.819
Flow	-.007	-.101	.920
Rumination	-.068	-.991	.323
Breakfast	-.053	-.742	.459
Fruit and veg	-.111	-1.526	.129
Junk snack	.083	1.141	.255
Junk meals	.065	.907	.366
Energy Drinks	-.010	-.124	.901
Colas	.056	.689	.492
Coffee	.188	2.695	.008

Tea	.084	1.234	.219
Exercise factor	-.033	-.449	.654
Sleepiness	.051	.714	.476
Total ADHD	.098	1.341	.182
Total autism	.054	.719	.473

***Note**: Beta (β) values are standardised.*

Hyperactive Behaviour

Table C8 Multiple linear regression between predictors and hyperactive behaviours outcome.

Predictors	β	t	p
Negative affect	.194	2.883	.004
Workload	.006	.099	.921
Flow	-.101	-1.527	.128
Breakfast	-.147	-2.291	.023
Fruit and veg	.037	.579	.563
Junk snack	.084	1.290	.199
Junk meals	-.006	-.098	.922
Energy Drinks	.041	.570	.569
Colas	.023	.321	.748
Coffee	.093	1.490	.138
Tea	.085	1.408	.161
Exercise factor	.028	.432	.666
Sleepiness	.119	1.868	.063
Total ADHD	.283	4.367	<.001
Total autism	.187	2.841	.005

***Note**: Beta (β) values are standardised.*

Emotional Problems

Table C9 Multiple linear regression between predictors and emotional problems outcome.

Predictors	β	t	p
Sex	.223	3.715	<.001
Negative affect	.359	5.553	<.001
Low work life balance	-.004	-.070	.944
Workload	.080	1.270	.206
Rumination	-.078	-1.391	.166
Breakfast	-.082	-1.372	.172
Fruit and veg	.083	1.361	.175

Junk snack	.072	1.214	.226
Junk meals	.046	.764	.446
Energy Drinks	-.194	-2.919	.004
Colas	.012	.175	.861
Coffee	.112	1.936	.054
Tea	-.035	-.616	.538
Exercise factor	-.054	-.894	.372
Sleepiness	.106	1.788	.075
Total ADHD	.236	3.928	<.001
Total autism	.027	.432	.666

***Note**: Beta (β) values are standardised.*

Peer Problems

Table C10 Multiple linear regression between predictors and peer problems outcome.

Predictors	**β**	**t**	**p**
Gender	.123	1.670	.097
Negative affect	.207	2.625	.009
Workload	.027	.373	.710
Flow	-.027	-.358	.721
Rumination	-.070	-1.000	.319
Breakfast	.006	.075	.941
Fruit and veg	.065	.868	.387
Junk snack	-.018	-.245	.807
Junk meals	-.115	-1.559	.121
Energy Drinks	.054	.650	.516
Colas	-.036	-.431	.667
Coffee	.052	.727	.468
Tea	.013	.192	.848
Exercise factor	.012	.161	.873
Sleepiness	-.009	-.126	.900
Total ADHD	.051	.682	.496
Total autism	.205	2.629	.009

***Note**: Beta (β) values are standardised.*

Prosocial Behaviour

Table C11 Multiple linear regression between predictors and prosocial behaviours outcome.

Predictors	β	t	p
Sex	.204	3.067	.002
Low work life balance	-.188	-2.846	.005
Flow	.111	1.604	.110
Breakfast	.022	.318	.751
Fruit and veg	.248	3.565	<.001
Junk snack	.066	.954	.341
Junk meals	.106	1.583	.115
Energy Drinks	-.214	-2.823	.005
Colas	.029	.371	.711
Coffee	.108	1.637	.103
Tea	.055	.857	.392
Exercise factor	.135	1.954	.052
Sleepiness	.047	.697	.486
Total ADHD	.097	1.421	.157
Total autism	-.052	-.750	.454

***Note**: Beta (β) values are standardised.*

Appendix D: Summary of significant HRBs in multivariate analyses among primary empirical studies in the thesis.

Table D1 Summary of significant HRBs in multivariate analyses among primary empirical studies in the thesis.

Predictors	Outcomes	Population	Notes
Fruit and vegetables	(+) prosocial behaviours	University students. Secondary students.	
	(+) physical health	Secondary students.	
Breakfast	(+) flourishing (-) hyperactive behaviours	Secondary students.	
Health diet	(+) physical health	Students with previous diagnoses of ADHD/autism traits at T1 & T2. Cross-lagged analyses.	
	(-) hyperactive behaviours	Students with previous diagnoses of ADHD/autism traits at T1.	
Junk meals	(+) hyperactive behaviours	University students.	
Junk food	(+) anxiety	Cross-lagged analysis.	
Cola	(+) peer problems	University students	
Energy drinks	(-) positive well-being. (-) emotional problems. (-) prosocial behaviours.	Secondary students.	
Total weekly caffeine	(-) flourishing	Students with previous diagnoses of ADHD/autism traits at T1.	
	(-) physical health (-) anxiety.	Students with previous diagnoses of ADHD/autism traits at T2.	

	(-) prosocial behaviours	Cross-lagged analysis.	
Coffee	(+) Emotional problems (+) Hyperactive behaviours	University students	
	(+) Negative well-being (+) Depression (+) Conduct problems	Secondary students	
Tea	(+) flourishing	Secondary students	
	(+) physical health	University students.	
Exercise	+ physical health	University students. Secondary students. Students with previous diagnoses of ADHD/autism traits at T1 &T2. Cross-lagged analysis.	
	(+) positive well-being	Cross-lagged analyses.	
	(+) hyperactive behaviours (-) emotional problems	University students.	
	(-) peer problems	Students with previous diagnoses of ADHD/autism traits at T1.	
Sleepiness	(-) conduct problems (+) emotional problems (+) hyperactive behaviours (+) prosocial behaviours (-) physical health	University students.	

	(-) peer problems (+) anxiety	Students with previous diagnoses of ADHD/autism traits at T1.	
	(-) flourishing (+) depression	Students with previous diagnoses of ADHD/autism traits at T2.	
ADHD/autism traits	(+) conduct problems	University students	
	(+) hyperactive behaviours	University students Secondary students Students with previous diagnoses of ADHD/autism traits at both time points. Cross-lagged analyses.	
	(+) emotional problems	University students	
ADHD traits	(+) emotional problems	Secondary students Students with previous diagnoses of ADHD/autism traits at both time points.	
	(-) flourishing	Students with previous diagnoses of ADHD/autism traits T1.	
	(-) peer problems	Cross-lagged analysis.	
Autism traits	(+) conduct problems	Cross-lagged analysis.	
	(+) emotional problems	Cross-lagged analysis.	
	(+) peer problems	University students Secondary students Students with previous diagnoses of ADHD/autism traits at both time points. Cross-lagged analyses.	

	(-) prosocial behaviours	University students. Students with previous diagnoses of ADHD/autism traits at both time points. Cross-lagged analyses.	

Appendix E: Permission to include a copy of the published paper in the thesis

The article is: Associations between Diet, Other Health-Related Behaviours, Well-being and Physical health: A Survey of Students About to Start University.

Almobayed, S. & Smith, A.P. (2023). Associations between diet, other health-related behaviours, well-being and physical health: A survey of students about to start university. *European Journal of Pharmaceutical and Medical Research*, 10(7), 44-49.

On Thu, Aug 15, 2024 at 8:12 PM Andrew Smith <SmithAP@cardiff.ac.uk<mailto:SmithAP@cardiff.ac.uk>> wrote:

Dear Editor,

I am writing to ask permission for my PhD student, Shikah Almobayed, to put a copy of our published paper (shown below) in her PhD thesis. I would be most grateful if you could e-mail your confirmation as soon as possible.

Almobayed, S. & Smith, A.P. (2023). Associations between diet, other health-related behaviours, well-being and physical health: A survey of students about to start university. European Journal of Pharmaceutical and Medical Research, 10 (7), 44-49.

Best regards,

Andy

Professor Andy Smith,
Director,
Centre for Occupational and Health Psychology,
School of Psychology, Cardiff University,
63 Park Place, Cardiff CF10 3AS, UK
Tel: +44 2920874757
Fax: +44 2920874758

From: EJPMR Journal <editor@ejpmr.com>
Sent: 16 August 2024 02:21
To: Andrew Smith
Subject: Re: Putting a copy of a paper in a PhD thesis

Dear Professor Andy Smith,

You can use your article for your thesis,

EJPMR do not have any Objection.

Appendix F: Permission to include a copy of the published paper in the thesis

The article is: Associations Between Diet, Other Health related Behaviours, Well-being and General health: A survey of university students.

Almobayed, S. & Smith, A.P. (2023). Associations between diet, other health-related behaviours, well-being and general health: A survey of university students. *World Journal of Pharmaceutical and Medical Research*, 9(8), 19-25.

On Thu, Aug 15, 2024 at 8:09 PM Andrew Smith
<SmithAP@cardiff.ac.uk<mailto:SmithAP@cardiff.ac.uk>> wrote:
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Director,
Centre for Occupational and Health Psychology,
School of Psychology, Cardiff University,
63 Park Place, Cardiff CF10 3AS, UK
Tel: +44 2920874757
Fax: +44 2920874758

From: wjpr journal <editor.wjpr@gmail.com>

Sent: 16 August 2024 02:04

To: Andrew Smith

Subject: Re: Putting a copy of a paper in a PhD thesis

Dear Professor Andy Smith,

You can use your article for your thesis,

WJPR do not have any Objection.

Appendix G: Permission to include a copy of the published paper in the thesis

The article is: Association between Health-Related Behaviours and Well-being and Academic Performance among Secondary School Students with Special Educational Needs.

Almobayed, S. & Smith, A.P. (2023). Associations between health-related behaviours, well-being, and academic performance of secondary school students with special educational needs: A secondary analysis. Recent Advances in Nutrition, 3(1), 1-17. In: A special issue on “Nutritional assessment and management of children and adolescents diagnosed with chronic conditions”.

On Thu, Aug 15, 2024 at 10:37 PM Andrew Smith
<SmithAP@cardiff.ac.uk<mailto:SmithAP@cardiff.ac.uk>> wrote:
Dear Editor,

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Almobayed, S. & Smith, A.P. (2023). Associations between health-related behaviours, well-being, and academic performance of secondary school students with special educational need: A secondary analysis. Recent Progress in Nutrition, 3 (1), 1-17. doi:10.21926/rpn.2301005
In: A special issue on “Nutritional assessment and management of children and adolescents diagnosed with chronic conditions”.

Best regards,

Andy

From: rpn rpn <rpn@lidsen.com>
Sent: 16 August 2024 02:51
To: Andrew Smith
Subject: Re: For the attention of the Editor

Dear Prof. Dr. Smith,

Thank you for your email.

Actually, articles published in Recent Progress in Nutrition will be under the Creative Commons Attribution (CC BY 4.0) License and the copyright is retained by the author(s) (https://eur03.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.lidsen.com%2Fjournals%2Frpn%2Frpn-copyright-license&data=05%7C02%7CAlmobayedS%40cardiff.ac.uk%7Cd8e7e7b1dd3e48215b6c08dcbdcef549%7Cbdb74b3095684856bdbf06759778fcbc%7C1%7C0%7C638593943781736400%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C0%7C%7C%7C&sdata=g%2BkT%2Fn5LrfWWv5WuRKCTo1ywUdq%2BwraydGvvUlo0qXw%3D&reserved=0<https://eur03.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.lidsen.com%2Fjournals%2Frpn%2Frpn-copyright-license&data=05%7C02%7CSmithAP%40cardiff.ac.uk%7C4748b32855d141e7c47e08dcbd9607e8%7Cbdb74b3095684856bdbf06759778fcbc%7C1%7C0%7C638593699273994036%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C0%7C%7C%7C&sdata=zURN3%2B4Utk%2BKArivvXQw2jd8t4s%2Ftls4kIY1KHo%2FG08%3D&reserved=0>). So you can be free to use the published article in the PhD thesis as long as the original source of this article is properly cited.

Best regards,
Jessy Wang