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ASSOCIATION BETWEEN HEALTH-RELATED BEHAVIOURS AND WELL-BEING IN UNIVERSITY STUDENTS

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ABSTRACT

Background: There has been extensive research on the associations between health-related behaviours and well-being. The present study continued approach using the Well-being Process approach, the Diet and Behaviour Scale and a sample of university students. **Methods**: Three hundred and thirty-five students completed an online survey, which included the Short-Form Well-being Process Questionnaire, the Short-Form Strengths and Difficulties Scale, and the Short-Form Diet and Behaviour Scale. **Results**: Many associations were observed in univariate analyses; however, these often became non-significant when the established well-being predictors were covaried. The results confirmed the effects of the well-being process predictors. In the multivariate analyses, coffee was associated with hyperactivity and more emotional problems. Fruit and vegetable consumption was associated with greater prosocial behaviour. Junk food consumption was associated with lower positive well-being and increased hyperactivity. Consumption of tea and exercise were associated with better physical health, whereas daytime sleepiness was associated with poorer mental health. **Conclusion**: The present study confirmed the effects of established predictors of well-being. Many effects of health-related behaviours were observed in univariate analyses, but many were not significant in multivariate analyses. Associations with coffee, junk food, fruit/vegetables and tea consumption were observed. Exercise and daytime sleepiness were associated with physical health. Longitudinal research is now required as the effects of diet could reflect reverse causality.

KEYWORDS: Well-being; Strengths and Difficulties; Diet; Exercise; Sleep; University Students.

INTRODUCTION

Appropriate health-related behaviours are associated with greater well-being and better behavioural outcomes.[1,2] 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.

Two secondary analysis studies of university students[3,4] have investigated the association between HRB and well-being using the Well-being Process Questionnaire (WPQ) and Diet and Behaviour Scale (DABS). In the first study,[3] the sample consisted of students starting university; in the second study[4], they were established university students. The primary aim of this study was to examine the associations between these variables in multivariate analyses. 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 involves 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 Strengths and Difficulties Questionnaire[5] was also used to determine whether these outcomes are more sensitive than general well-being outcomes.

The present study was cross-sectional and collected data from students at Cardiff University. 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 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 can add predictors or outcomes related to the study question. Thus, additional outcome variables have been added here, namely, SDQ outcomes (conduct problems, hyperactive behaviour, emotional problems, peer problems, and prosocial behaviour). The present study utilised the psychology experimental management system (EMS) at Cardiff University to recruit participants, who were compensated with 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 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 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 previously discussed, multivariate analyses are crucial in this type of study. The following general hypothesis was 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) will be a significant predictor of well-being and SDQ outcomes after controlling for well-being predictors.

METHODS

Ethical Approval

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

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, with 53.2% of the sample being first-year students and 46.8% being second-year students. Most participants were female (male = 13.2%, female = 85.9%, others = 0.9%).

Materials

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.[6] Smith and James[7] developed a short version of the scale, which was shown to be associated with well-being outcomes. The questionnaire inquired about the consumption of healthy foods (breakfast, fruit, and vegetables) and unhealthy foods (junk meals and snacks), as well as caffeinated beverages (energy drinks, colas, coffee, and tea). It also inquired about participation in mild, moderate, and vigorous physical activity. Using a five-point Likert scale, 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 (including takeaways and 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, respondents were asked about how often they participated in exercise and answered using a four-point Likert scale (ranging 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.

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[8], based on the Demands-Resources-Individual-Effects (DRIVE) model.[9,10] The Well-being Process Questionnaire was first developed for use in occupational environments[1-28] and has been modified for students.[29-48] It has been used extensively to examine the impact of a variety of factors on well-being, along with a similar measuring instrument (the Smith Student Well-being SWELL scale).[32] The short-form WPQ (SFWPQ) was developed using the same procedures as the original measuring instrument.[7] 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 showed significant correlation with the original and extended versions.

Strengths and Difficulties Questionnaire (SDQ)

Goodman[5] 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, and the SDQ is suitable for use with adults and adolescents in various contexts. The development of the SDQ was driven by the need to address concerns regarding mental health and well-being. 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 demonstrated to discriminate between clinical and community samples effectively. The short-form SDQ uses single items for each factor. 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 its outcomes, following the concept of well-being, which encompasses both negative and positive aspects.

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. Additionally, 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 participants before consent was obtained, and a debriefing sheet was provided after the questionnaire was completed.

The study aimed to examine the associations between health-related behaviours and 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 well-being predictors included student stressors, social support, negative coping, positive coping, psychological capital, low work-life balance, flow, and low rumination, all of which were measured using 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 covariates. 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.

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 generally low, and the percentages were below 5% for each variable. To determine 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, allowing for control over all three degrees of intensity without compromising 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 (using the Enter method) were carried out for each outcome.

RESULTS

Demographic variables

Table 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 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

WPQ Variables

Tables 2 and 3 show the summary statistics for the WPQ variables.

Table 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

Table 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

Table 4 shows the descriptive statistics for the SDQ variables.

Table 4: 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

DABS Variables: The descriptive statistics for the DABS variables are shown in Table 5. The participants generally engaged in healthy lifestyles. The respondents reported high breakfast consumption, low weekly energy drink, and cola consumption. However, consumption of junk snacks was relatively high. Most students engaged in mild exercise at least three times a week.

Table 5: 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	

Univariate Analyses

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 and 7 display the predictor variables and their corresponding correlation coefficients, along with the significance levels.

Positive and Negative Well-being

Positive well-being exhibited a statistically significant and positive 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. Additionally, negative well-being exhibited a statistically significant positive correlation with student stressors, negative coping strategies, low work-life balance, and high workload. It was negatively correlated with social support, positive coping, psychological capital, and low rumination (also known as positive pondering). Moreover, the analysis revealed a significant difference in negative well-being as a function of gender F (2, 331) = 7.83, p = 0.001. A post hoc analysis was conducted to further explore this difference. 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.

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

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 strategies, low work-life balance, and excessive workload. Conversely, there was a negative correlation between hyperactive behaviour and positive coping, social support, low rumination, flow, and psychological capital.

Emotional and Peer Problems Outcomes

There were positive correlations between emotional problems and student stressors, negative coping, low work-life balance, and workload. Emotional problems had a negative correlation with social support, positive coping, psychological capacity, low rumination, and flow. Emotional problems showed the highest correlation with psychological capacity, with a coefficient of −0.574. Furthermore, peer problems were found to be statistically and positively related to student stressors and negative coping. Peer problems were negatively associated with social support, positive coping, and psychological capital.

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: 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 7: 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.*

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 8). The Pearson correlations showed that individuals with high breakfast and fruit and vegetable consumption, as well as those who engaged in regular exercise, tended to have more positive well-being. Additionally, a negative correlation was found between reduced positive well-being, junk meals, and daytime sleepiness variables. Negative well-being was only positively associated with sleepiness. Negative well-being correlated negatively with breakfast, fruit, and vegetable intake and the exercise factor. Physical health was positively and statistically significantly correlated with fruit and vegetable consumption, as well as tea consumption, and the exercise factor, and 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. Regarding the SDQ outcomes, conduct problems were positively correlated with the consumption of coffee and junk food. 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 consumption of junk meals, energy drinks, 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, as well as 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.

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. To ensure the reliability and validity of the models, the assumptions were thoroughly assessed. To avoid overfitting the models, it has been suggested to use a sample of $N > 50 + 8m$ (m is the number of independent variables). Therefore, 335 was a good sample size for the predictors analysed. Additionally, the multicollinearity assumption was assessed by calculating the variance inflation factor (VIF) and tolerance values for each predictor in the model. A VIF value of 1 indicates the minimum value of collinearity, which suggests that 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. Moreover, it is recommended 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 was met. The variables included in the multivariate analyses are shown in Tables 8, 9 and 10.

Table 8: 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
Hyperactive 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).*

Table 9: 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),	**Breakfast** (continuous), **Fruit and veg** (continuous), **Junk snacks** (continuous), **Junk meals** (continuous), **Energy drinks**	**Breakfast** (continuous), **Fruit and veg** (continuous), **Junk snacks** (continuous), **Junk meals** (continuous), **Energy drinks** (continuous), **Cola** (continuous)	**Breakfast** (continuous), **Fruit and veg** (continuous), **Junk snacks** (continuous), **Junk meals** (continuous), **Energy drinks**

	Energy drinks (continuous), **Cola** (continuous) **Coffee** (continuous) **Tea** (continuous) **Exercise** (continuous; factor score) **Sleepiness** (continuous)	(continuous), **Cola** (continuous) **Coffee** (continuous) **Tea** (continuous) **Exercise** (continuous; factor score) **Sleepiness** (continuous)	**Coffee** (continuous) **Tea** (continuous) **Exercise** (continuous; factor score) **Sleepiness** (continuous)	(continuous), **Cola** (continuous) **Coffee** (continuous) **Tea** (continuous) **Exercise** (continuous; factor score) **Sleepiness** (continuous)

Table 10: 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)

Associations between HRBs 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, R2 = 0.311). The model explained 31.1% of the variance in positive well-being. Student stressors (β= −0.208, p = 0.001) and psychological capital (β= 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 (β= 0.096, p = 0.059). Notably, the other HRB variables were not significantly associated with positive well-being.

Association between HRBs 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, R2 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 (β = 0.393, p < 0.001, β= −0.218, p < 0.001, respectively). None of the other variables were significant.

Association between HRB 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, R2 adj. = 0.198). The model explained 19.8% of the variance in physical health. There was an association between flow and increased physical health (β = 0.165, p = 0.004). Tea consumption and exercise were associated with better physical health (β = 0.107, p = 0.035), (β = 0.277, p = 0.001), respectively, while sleepiness was associated with a lower likelihood of good physical health (β = -0.119, p = 0.033), none of the other variables was significant.

Association between HRBs and Flourishing

The multiple linear regression model was significant (F [21, 313] = 19.67, p < 0.001, R2 = 0.540). The model explained 54% of the variance in flourishing. The well-being predictors showed the usual effect on flourishing. Student stressors (β = −0.110, p = 0.020), social support (β = 0.127, p = 0.006), negative coping (β = −0.105, p = 0.030), psychological capital (β = 0.0376, p = 0.001), flow (β = 0.255, p = 0.001), and low rumination (β = 0.110, p = 0.005) were good predictors of flourishing.

Association between HRBs and Conduct problems

The multiple linear regression model for conduct problems was statistically significant (F[18, 316] = 3.56, p < 0.001, R^2 adj. = 0.121), explaining 12.1% of the variance in conduct problems. The multivariate analysis results of conduct problems showed that social support (β = −0.200, p = 0.002) and daytime sleepiness (β = −0.125, p = 0.033) were associated with a lower likelihood of conduct problems.

Association between HRBs and Emotional Problems

The multiple linear regression model of emotional problems was statistically significant (F [22, 312] = 13.32, p < 0.001, R2 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 (β = −0.148, p = 0.001). High coffee consumption (β = 0.105, p = 0.015) and daytime sleepiness (β = 0.107, p = 0.025) 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 (β = 0.121, p = 0.020), negative coping (β = 0.139, p = 0.009), and psychological capital (β = −0.292, p = 0.001).

Association between HRBs 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 (β = 0.135, p = 0.005; β = 0.120, p = 0.008; β = 0.087, p = 0.045; and β = 0.092, p = 0.045, respectively). In addition, flow and positive coping showed a relationship with reduced hyperactive behaviour (β = −0.116, p = 0.016 and β = −0.104, p = 0.039, respectively).

Association between HRBs and Peer Problems

A multiple linear regression test of peer problems was statistically significant (F [21, 313] = 5.72, p < 0.001, R2 adj. = 0.229). The model explained 22.9% of the variance in peer problems. The results in the peer problems model suggest that high cola consumption (β = 0.111, p = 0.034) was 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.

Association between HRBs and Prosocial Behaviour

The model of prosocial behaviour was statistically significant (F [17, 317] = 6.34, p < 0.001, R2 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). Social support was a good predictor of prosocial behaviour (β = 0.162, p = 0.006). see Table 11 for all beta and alpha values for the predictors that were significant in the multivariate analyses.

SDQ outcomes

The significant associations between predictors, well-being, and SDQ outcomes in multiple linear regression analyses are shown in Table 11.

Table 11: 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
	Student stressors	−0.110	0.020
Flourishing	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
	Exercise	0.277	<0.001
Physical health	Tea	0.107	0.035
	Flow	0.165	0.004
	Sleepiness	-0.119	0.033
	Social support	−0.200	0.002
Conduct problems	Sleepiness	−0.125	0.033
	Student stressors	0.121	0.020
	Negative coping	0.139	0.009
	Psychological capital	−0.292	<0.001
Emotional problems	Coffee	0.105	0.015
	Exercise	−0.148	0.001
	Sleepiness	0.107	0.025
	Positive coping	−0.104	0.039
	Flow	−0.116	0.016
	Coffee	0.087	0.045
Hyperactive behaviour	Sleepiness	0.135	0.005
	Junk meals	0.120	0.008
	Exercise	0.092	0.045
	Social support	−0.258	<0.001
Peer problems	Psychological capital	−0.188	0.003
	Cola	0.111	0.034
	Gender	−0.187	<0.001
	Social support	0.162	0.006
Prosocial behaviour	Fruit and vegetables	0.141	0.010
	Sleepiness	0.247	<0.001

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

DISCUSSION

This study aimed to conduct multivariate analyses to determine the impact of health-related behaviours 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, as well as exercise and sleepiness, were associated with well-being and SDQ outcomes after controlling for established predictors of well-being. The study replicated the significant effects of the established well-being predictors, which gave greater confidence in the more novel analyses.

The univariate analysis revealed that individuals with higher breakfast, fruit, and vegetable consumption, as well as 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 associated with lower negative well-being, while sleepiness was linked to higher negative well-being. In the multivariate analyses, where established well-being predictors were controlled for, no variables from HRBs were statistically significant in models predicting positive well-being, flourishing, or negative well-being. 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, indicating a relationship between tea, exercise, and higher physical health. In contrast, sleepiness was associated with lower physical health. There were relationships between positive well-being, hyperactive behaviours, and junk food consumption, with the latter being associated with reduced positive well-being and

increased hyperactivity. This is consistent with the systematic review results.[49] Moreover, it was found that fruit and vegetable consumption was linked to increased prosocial behaviours in both the univariate and multivariate analyses. Linear regression analysis revealed that high consumption of cola was associated with an increased likelihood of experiencing peer problems; this finding was also observed in univariate analysis. Although coffee was not associated with hyperactive behaviours and emotional problems in the univariate analysis, it became significant in the multivariate analysis, indicating that high coffee consumption increases the likelihood of hyperactive behaviours and emotional problems. In univariate analyses, sleepiness was associated with emotional problems, hyperactive behaviours, and prosocial behaviours, and this association remained significant in multivariate analyses.

Limitations

One limitation of this study was that participants were recruited from a single department at a university, which may limit the generalizability of the findings to undergraduate students at other universities. Furthermore, the study's cross-sectional design prevents the establishment of causal relationships.

CONCLUSION

A strong relationship was found between the established predictor and the outcome variables of the WPQ, confirming the results of previous studies. The results also confirm the associations between HRB variables and well-being and SDQ outcomes. Furthermore, longitudinal methodology should be used to determine the underlying mechanism.

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