Original Article

Exploring change in self-reported physical activity behaviors during the coronavirus disease 2019 lockdown compared with prelockdown: A cross-sectional survey of physically active adults in Saudi Arabia

ABSTRACT

Background: The World Health Organization announced coronavirus disease 2019 (COVID-19) was a global pandemic in March 2020. Like other countries around the world, the Saudi Arabian Government imposed measures to control the spread of the virus, including lockdowns and limits on people's physical activity (PA).

Aim: The study aimed to explore changes in self-reported PA behavior during the COVID-19 lockdown compared with prelockdown among physically active adults in Saudi Arabia, and understand the barriers for those who performed less or no PA during lockdown.

Design: A cross-sectional survey.

Materials and Methods: This study included 213 physically active adults (aged 18–64 years) living in Saudi Arabia, the majority of whom were male (65.70%; *n* = 140). The researcher distributed an online version of the international PA questionnaire (short form) through social media platforms between November 5, 2021, and December 15, 2021.

Results: The study's results showed: (1) 40.8% (*n* = 87) of study participants did not perform any PA during lockdown; (2) there was a significant reduction in the frequency of all PA intensity (vigorous, moderate, and a combination of both) during lockdown compared with before; (3) there was a significant reduction in the duration of all PA intensity except for vigorous PA intensity during lockdown compared with before; (4) almost 70% (*n* = 148) of participants did not meet the international recommendation for PA during lockdown; and (5) the lack of appropriate equipment/space and closed sports infrastructure were the most significant barriers that led to participants performing less or no PA during lockdown.

Conclusion: The COVID-19 lockdown negatively impacted the PA behaviors of physically active adults in Saudi Arabia, while the majority of participants (70%) did not meet the international recommendation for PA during lockdown.

Keywords: Coronavirus, coronavirus disease 2019, exercise, lockdown, physical activity, training

مستخلص الدراسة

في مارس ٢٠٢٠ م ، أعلنت منظمة الصحة العالمية أن مرض فايروس كورونا ٢٠١٩ (كوفيد-١٩) أصبح وباءً عالميًا. وفقاً لذلك ، فرضت حكومة المملكة العربية السعودية إجراءات احترازية للسيطرة على انتشار الفايروس، بما في ذلك فرض حظر التجول مما أدى الى انخفاض في النشاط البدني.

هدف الدراسة: هدفت الدراسة إلى استكشاف التغييرات في سلوك النشاط البدني أثناء حظر التجول مقارنة بفترة ما قبل حظر التجول بين البالغين النشطين بدنيًا في المملكة العربية السعودية ، وفهم العوائق التي يواجهها أولئك الذين مارسوا نشاطًا بدنيًا أقل أو لم يمارسوا أي نشاط بدني أثناء حظر التجول.

نوع الدراسة: اتبعت هذه الدراسة الاستقصاء المقطعي المستعرض

منهجية الدراسة: تكونت عينة الدراسة من ٢١٣ شخصًا بالغًا ونشطًا بدنيًا (تتراوح

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أعمارهم بين ١٨ و ٦٤ عامًا) ، يعيشون في المملكة العربية السعودية ، وكان معظمهم من الذكور (العدد: ١٤٠ ، ٦٥.٧٠ ٪). قام الباحث بتوزيع نسخة إلكترونية من الاستبيان الدولي للنشاط البدني (نموذج قصير) عبر منصات التواصل الاجتماعي في الفترة ما بين ٥ نوفمبر و ١٥ ديسمبر للعام ٢٠٢١

نتائج الدراسة: توصلت نتائج الدراسة للآتي

١- ٤٠.٨ ٪ (العدد: ٨٧) من المشاركين في الدراسة لم يمارسوا أي نشاط بدني أثناء حظر التجول

٢- كان هناك انخفاض كبير في تكرار شدة النشاط البدني (مرتفع ومعتدل الشدة والمزيج من الاثنين معًا) أثناء حظر التجول مقارنة بما قبله.

٣- كان هناك انخفاض كبير أيضاً في مدة شدة النشاط البدني باستثناء النشاط البدني مرتفع الشدة أثناء حظر التجول مقارنة بما قبله.

٤- ما يقارب ٧٠ ٪ (العدد: ١٤٨) من المشاركين لم يتبعوا التوصيات العالمية بشأن النشاط البدني أثناء حظر التجول.

٥- عدم وجود المعدات والمساحة الكافية وإغلاق النوادي الرياضية كانت من أهم العوائق التي أدت إلى قيام المشاركين بأداء نشاط بدني أقل أو عدم القيام بأي نشاط بدني أثناء حظر التجول.

الخاتمة: أثر حظر التجول بسبب فايروس كورونا (كوفيد-١٩) سلبًا على سلوكيات النشاط البدني للبالغين النشطين بدنيًا في المملكة العربية السعودية ، في حين أن غالبية المشاركين (٧٠ ٪) لم يستوفوا التوصيات العالمية للنشاط البدني أثناء حظر التجول.

الكلمات المفتاحية: النشاط البدني ، تمرين ، تدريب ، كوفيد-١٩ ، فايروس كورونا ، حظر التجول

INTRODUCTION

On March 11, 2020, the World Health Organization (WHO) announced that coronavirus disease 2019 (COVID-19) was a global pandemic.[1] The Kingdom of Saudi Arabia (KSA) was one of the many countries affected by COVID-19 at this time, with Barwais[2] reporting that the first case was detected on March 2, 2020. The number of cases in KSA increased significantly from that point, and 10,484 cases had been reported by April 20, 2020.[3] Subsequently, KSA's Ministry of Health implemented a 3-month lockdown and curfew to limit COVID-19's spread and prevent health-care system collapse. The lockdowns began on March 23, 2020, and were divided into two stages, with outdoor exercise restrictions enforced as sports and gym facilities were closed in both stages. Although lockdowns and other limitations helped to mitigate the transmission of the virus, several scholars highlighted evidence regarding the decreased level of physical activity (PA) worldwide and in KSA.[4-6] This continued for a significant period and impacted both physically active,[7] and inactive people.[8] However, Lee *et al*.[9] highlight that regular PA is essential for people with noncommunicable diseases in particular, and Brooks *et al*.[10] suggest that increased inactivity may intensify anxiety, depression, and other psychological issues.

The WHO[11] launched a campaign called #HealthyAtHome, which was aimed to motivate people to be physically active and decrease the amount of sitting time during COVID-19 lockdowns and quarantine. PA has a positive effect on coping skills, reducing the risk of future diseases,[12] raising immunity,[13] increasing well-being, heightening sleep quality, and promoting a better quality of life.[14] Since chronic conditions are closely correlated with the severity and death rate of COVID-19, Mattioli *et al*.[15] highlight that protection, which is largely derived from PA, is pivotal. Regular PA can achieve significant effects in terms of decreased risk of acute respiratory distress syndrome, which is deemed a major reason for mortality among COVID-19 patients.[16]

To the best of this researcher's knowledge, there are no KSA-based studies that explored the change in PA behaviors during the COVID-19 lockdown among physically active adults or identified barriers to PA. This research aimed to explore the change in self-reported PA behaviors during the COVID-19 lockdown compared with prelockdown among physically active adults in KSA and understand the barriers that inhibited PA during lockdown. This study's results might guide the government and health-care professionals in KSA to more effectively maintain PA among adults during the current or future pandemics.

MATERIALS AND METHODS

Study design

A cross-sectional study was utilized. This study was approved by the School of Healthcare Sciences Research Ethics Committee on October 12, 2021 (REC820). Informed consent was provided by all study participants.

Participants and recruitment

Participants were aged between 18 and 64 years and living in Saudi Arabia and had been engaging in at least 150/min to 300/min of moderate PA per week, at least 75/min–150/min of vigorous PA per week, or an equivalent combination of both before the COVID-19 pandemic (for a minimum of 3 months). A convenience sample was recruited via social media sites, including Twitter and Facebook, to answer an anonymous electronic questionnaire that was created through Google Forms between November 5, 2021, and December 15, 2021.

Sample size

The total ideal sample size required for this study was 385. Alqahtani *et al*.[17] designed a study to determine the percentage of physically active adults in Saudi Arabia; their findings revealed that only 17.40% (n = 3,613,741) of all adults in the country were physically active. Thus, the formula developed by Rahi *et al*.[18] was followed to determine the most suitable sample size for this study:

$$S = \chi^2 \text{ NP } (1-P)/d^2 \ (N-1) + \chi^2 \ P \ (1-P)$$

S = Required sample size.

χ^2 = Table value of Chi-square for 1 degree of freedom at the desired confidence level (3.841).

N = Population size.

P = Population proportion (assumed to be 0.50 since this would provide the maximum sample size).

d = Degree of accuracy expressed as a proportion (0.05).

$$S = 3.841 \ (3{,}613{,}741 \times 0.50) \ (1-0.50)/0.50 \ (3{,}613{,}741-1) + 3.841 \times 0.50 \ (1-0.50)$$

S = 385.

The questionnaire

The short version of the International Physical Activity Questionnaire (IPAQ) was used in this study [Appendix 1], as it offers a valid and reliable outcome measure for PA,[19] it has also been shown to be valid and reliable in the Arabic version.[20] The questionnaire comprised three sections. A total of 23 questions were developed and distributed in two different languages, Arabic and English.

The first section focused on participants' demographic information relating to age, gender, weight, height, region, and years of engaging in PA. The second section assessed the IPAQ with 15 questions, classified into two segments. Part one posed questions about various PA behaviors (intensity, frequency, and duration) before lockdown, while part two asked about the respondents' situation with regard to PA behaviors during the lockdown. In the third section, participants were asked about the barriers that made them perform "less" or "no" PA during the COVID-19 lockdown.

Statistical analysis

Data analysis was carried out using IBM SPSS for Windows 10, version 27.0.1. Independent sample t-tests were used to identify the baseline characteristic differences between two independent variables (male and female). A Skewness test was used to explore the normality of the data. A Wilcoxon signed rank test (nonparametric) was used to compare the mean duration of PA before and during lockdown, as these data were not normally distributed. One sample t-test (parametric) was used to compare the mean frequency of PA before and during lockdown, as these data were normally distributed. A $P < 0.05$ was taken as statistically significant for all analyses.

RESULTS

Demographic data

A total of 316 participants completed this cross-sectional survey. After excluding those who provided unrealistic data (n = 27), incomplete data (n = 9), and people who were not physically active before lockdown (n = 67), a total of 213 participants with complete data remained for inclusion in the analysis. The majority of study participants (65.70%, n = 140) were male, with an age range between 18 and 64 years and 51.6% (n = 110) being between 18 and 29 years. Most participants (39.9%, n = 85) were found to be overweight, and about half of the respondents were from Makkah Almukarrama (46.50%) [Tables 1 and 2].

Intensity of physical activity before and during lockdown

During lockdown, 59.2% of participants (n = 126) continued to perform PA, and 40.8% (n = 87) did not perform any PA. The number of participants who engaged in vigorous PA before lockdown, 14.6% (n = 31), declined significantly to 2.8% (n = 6) during lockdown; those who performed moderate PA prelockdown decreased from 50.2% (n = 107) to 39.4% (n = 83) during lockdown [Table 3].

Table 1: Demographic data

Demographic data of study population (n=316)	
	n **(%)**
Sex	
Male	140 (65.70)
Female	73 (34.30)
Age (years)	
18–29	110 (51.60)
30–39	59 (27.70)
40–49	32 (15.00)
50–59	8 (3.80)
60–64	4 (1.90)
Weight (kg), mean±SD	75.3±16.1
Height (cm), mean±SD	167.8±8.4
BMI (mean±SD)	26.6±4.8
BMI	
Underweight (BMI <18.5 kg/m^2)	7 (3.3)
Normal weight (18.5–24.9 kg/m^2)	73 (34.3)
Overweight (25.0–29.9 kg/m^2)	85 (39.9)
Obese (BMI ≥30 kg/m^2)	48 (22.5)

BMI=Body mass index, SD=Standard deviation

Frequency and duration of vigorous physical activity before and during lockdown

During lockdown, there was a significant reduction in the number of participants who performed vigorous PA, decreasing from 31 participants to only 6. Half of these (n = 3) performed vigorous PA for between 2 and 3 days/week [Table 4].

Before lockdown, the mean frequency of vigorous PA decreased from 4.7 ± 1.3 days/week to 4.0 ± 1.5 days/week during lockdown (P < 0.001). The mean duration of vigorous PA also increased from 72.1 ± 32.5 min/day to 86.7 ± 43.2 min/day [Table 5].

The frequency and duration of moderate physical activity before and during lockdown

Before lockdown, the majority of participants (n = 46) engaged in moderate PA between 3 and 4 days/week, and this decreased to 41 participants. Before lockdown, the majority (81 of 107) of participants spent ≥60 min/day in moderate PA, while during lockdown, the majority (71 of 83) spent ≤60 min/day [Table 6]. The sample t-test indicated that the mean frequency of moderate PA reduced significantly during lockdown [P = 0.01, Table 5].

Frequency and duration of the combination of vigorous and moderate physical activity before and during lockdown

During lockdown, 16 and 13 participants engaged in a combination of vigorous and moderate PA between 3 and 4 days/week and 5 and 6 days/week, respectively [Table 7].

Table 2: Demographic data

Demographic data of study population (n=316)	
Administrative region in KSA (%)	**Percentage**
Makkah Almukarrama	46.50
Riyadh	14.10
Jazan	9.90
Almadena Almunawara	8
Aseer	5.60
Tabouk	3.80
Hail	3.80
Aljouf	2.80
Albaha	2.80

KSA=Kingdom of Saudi Arabia

Table 3: Number of participants who engaged in physical activity based on its intensity before and during lockdown

Intensity of PA	Before lockdown, n (%)	During lockdown, n (%)
Vigorous PA	31 (14.6)	6 (2.8)
Moderate PA	107 (50.2)	83 (39.4)
An equivalent combination of vigorous and moderate PA	75 (35.2)	37 (17.4)

PA=Physical activity

During lockdown, the majority of participants (20 of 37) spent ≤45 min/day engaging in vigorous-and-moderate PA, [Table 7]. Moreover, the mean frequency and duration of combined vigorous-and-moderate PA reduced significantly during lockdown (P = 0.001), (P = 0.04), respectively [Table 5].

International physical activity recommendations

Although 59.2% of participants (n = 126 of 213) continued to engage in PA during the lockdown, almost half (48.5%) of these people (n = 61 of 126) failed to meet the international recommendations for PA, as shown in Figure 1.

Barriers to physical activity

The majority of participants reported that lack of appropriate equipment/space (n = 104) and closed sports infrastructure (n = 100) were the greatest barriers to PA. The lowest barriers to PA during lockdown were lack of time and lack of awareness about the importance of PA, accounting for 31 and 30 participants, respectively [Figure 2].

DISCUSSION

The current study explores the change in self-reported PA behaviors during the COVID-19 lockdown compared with prelockdown among physically active adults in KSA and aims to understand the barriers for those who performed less or no PA during lockdown.

Physical activity intensity

The analysis identifies that the number of participants who used to perform vigorous PA and moderate PA dropped significantly from 14.6% and 50.2% before lockdown to 2.8% and 39% during lockdown, respectively. This is in agreement with a study by Maugeri *et al.*,[8] which revealed that the percentage of participants who used to engage in vigorous and moderate PA before lockdown decreased from 41.76% and 35.18% to 30.63% and 29.75% during lockdown, respectively. The reduction in the percentage of participants who engaged in vigorous PA during lockdown could be related to people's

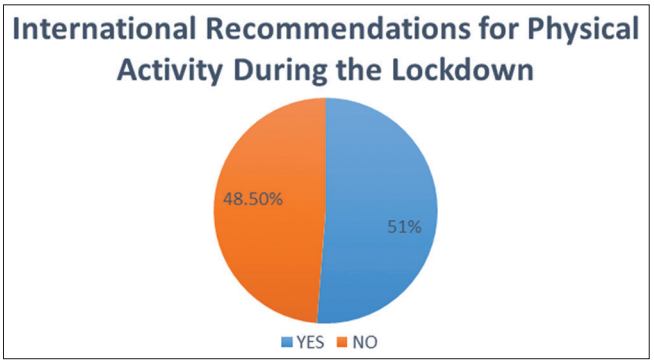

Figure 1: Percentage of participants who met the international physical activity recommendations during lockdown

Table 4: Frequency and duration of vigorous physical activity before and during lockdown

Frequency of vigorous PA per week			Duration of vigorous PA per day		
Frequency of PA per week	Before lockdown (*n*=31)	During lockdown (*n*=6)	Duration of PA per day	Before lockdown (*n*=31)	During lockdown (*n*=6)
1 day/week	0	0	30 min/day	2	0
2 days/week	1	1	40 min/day	1	0
3 days/week	5	2	45 min/day	3	0
4 days/week	7	0	50 min/day	1	0
5 days/week	11	2	60 min/day	14	4
6 days/week	4	1	90 min/day	5	0
7 days/week	3	0	120 min/day	4	1
			160 min/day	0	1
			180 min/day	1	0

PA=Physical activity

Table 5: *P* values

Variable	Before lockdown		During lockdown		*P*
	n	Mean	*n*	Mean	
Frequency of vigorous PA per week	31	4.7±1.3	6	4.0±1.5	0.001
Duration of vigorous PA per day	31	72.1±32.5	6	86.7±43.2	0.31
Frequency of moderate PA per week	107	4.3±1.5	83	3.6±1.5	0.001
Duration of moderate PA per day	107	75.1±31.1	83	49.5±25.9	0.01
Frequency of a combination of vigorous and moderate PA per week	75	4.5±1.3	37	4.1±1.6	0.001
Duration of a combination of vigorous and moderate PA per day	75	68.7±35.9	37	56.2±28.4	0.04

PA=Physical activity

Table 6: Frequency and duration of moderate physical activity before and during lockdown

Frequency of moderate PA per week			Duration of moderate PA per day		
Frequency of PA per week	Before lockdown (*n*=107)	During lockdown (*n*=83)	Duration of PA per day	Before lockdown (*n*=107)	During lockdown (*n*=83)
1 day/week	1	4	15 min/day	0	5
2 days/week	12	16	30 min/day	8	31
3 days/week	27	25	40 min/day	2	1
4 days/week	19	16	45 min/day	15	11
5 days/week	25	12	50 min/day	1	1
6 days/week	13	6	60 min/day	32	22
7 days/week	10	4	90 min/day	29	7
			120 min/day	15	5
			160 min/day	5	0

PA=Physical activity

Table 7: Frequency and duration of combined vigorous and moderate physical activity before and during lockdown

Frequency of a combination of vigorous and moderate PA			Duration of a combination of vigorous and moderate PA		
Frequency of PA per week	Before lockdown (*n*=75)	During lockdown (*n*=37)	Duration of PA per day	Before lockdown (*n*=75)	During lockdown (*n*=37)
1 day/week	0	1	15 min/day	0	1
2 days/week	6	5	30 min/day	11	11
3 days/week	10	9	40 min/day	1	1
4 days/week	20	7	45 min/day	18	7
5 days/week	25	6	60 min/day	23	9
6 days/week	6	7	90 min/day	9	5
7 days/week	8	2	120 min/day	9	3
			150 min/day	2	0
			160 min/day	2	0

lack of knowledge about how to do this at home. Teh and Aziz,[21] indicate that stair climbing for at least 10 min/day is considered vigorous PA, which is achievable for most people since stairs are found in most private homes. Exploring the

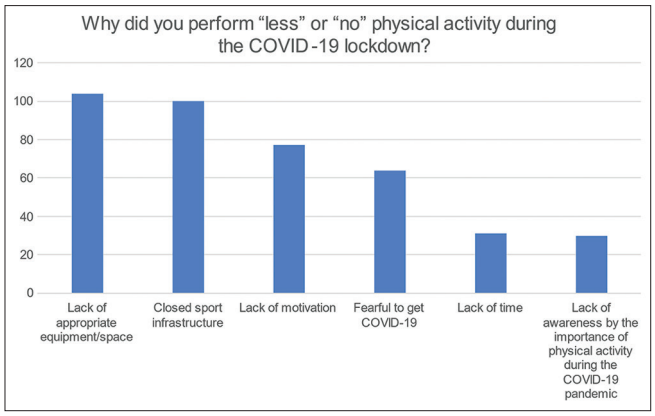

Figure 2: Barriers to physical activity during lockdown. COVID-19 = Coronavirus disease 2019

intensity of PA is crucial during the COVID-19 pandemic as it can alter the responses of the immune system.[22,23] Due to COVID-19 affecting the immune system,[24] people are taking steps to improve the ability of the immune system through PA and nutrition.[25] However, Pedersen and Hoffman-Goetz,[26] also highlight that performing a session of vigorous PA without sufficient rest can reduce cell-mediated immunity, thereby potentially increasing the risk of infection from diseases such as COVID-19. This might indicate that the decreased number of participants who engaged in vigorous PA during lockdown found in this study could be advantageous from this perspective.

Physical activity frequency and duration

Frequency and duration of vigorous physical activity

The study's results show that the mean frequency of vigorous PA before lockdown in KSA was 4.7 ± 1.3 days per week, which decreased to 4.0 ± 1.5 days per week during lockdown. Surprisingly, the mean duration of vigorous PA increased from 72.1 ± 32.5 min per day before lockdown to 86.7 ± 43.2 min per day during lockdown.

Castañeda-Babarro *et al*.'s,[27] Spanish-based study shows conflicting results, finding that the mean duration of vigorous PA decreased significantly ($P < 0.05$) from 219 ± 196 min per week before lockdown to 182 ± 184 min per week during lockdown. Castañeda-Babarro *et al*. only explored the duration of the PA per week and did not demonstrate its frequency. White *et al*.[28] indicate that both frequency and duration are considered to be a basic component of PA, and Bull *et al*.[29] advise that they are generally linked to physical health. The participants in Castañeda-Babarro *et al*.'s[27] study might have achieved the PA recommendations by engaging in PA 1 day per week, as the study did not explore the frequency of participants' PA, so it would be difficult to guarantee whether they were regularly physically active. In research into the acute physiological and metabolic changes that persist after people engage in PA, it is suggested that regular PA has more health benefits than the equivalent amount of irregular PA.

Frequency and duration of moderate physical activity

In terms of moderate PA, the mean frequency decreased significantly during lockdown in KSA compared to before lockdown (before: 4.3 ± 1.5 days per week; during: 3.6 ± 1.5 days per week; $P < 0.05$). Before lockdown, the majority (76%) of those who engaged in moderate PA spent ≥60 min per day, while during lockdown, most (86%) spent ≤60 min per day. This observation matches the findings in Bakhsh *et al*.'s[6] study, as more than half of the participants (52%) spent ≤60 min per day engaging in moderate PA during lockdown. However, Bakhsh *et al*.'s study did not compare this with similar findings before the lockdown, meaning that it would be difficult to explore how much PA changed as a result of the lockdown.

However, the mean duration of moderate PA dropped significantly from 75.1 ± 31.1 min per day before lockdown to 49.5 ± 25.9 min per day during lockdown. This finding is in agreement with Maugeri *et al*.'s[8] study, which found that the mean duration of moderate PA dropped significantly from 574 min per week before lockdown to 523.3 min per week during lockdown ($P < 0.05$). In Spain, Castañeda-Babarro *et al*.[27] also found that the mean duration of moderate PA decreased during lockdown compared with before (before: 149 ± 174 min per week; during: 145 ± 170 min per week). As lockdowns were announced and governments closed sports and leisure facilities, suspended group activities or limited time spent outdoors, a reduction in moderate PA was to be expected.

Frequency and duration of the combination of vigorous and moderate physical activity

The results of the current study have also shown that the mean frequency of combined vigorous and moderate decreased significantly from 4.5 ± 1.3 days per week before lockdown to 4.1 ± 1.6 days per week of PA during lockdown. In addition, the mean duration decreased from 68.7 ± 35.9 min per day before lockdown to 56.2 ± 28.4 min per day during lockdown. These findings do not support Lesser and Nienhuis' Canadian study,[30] which found that 40.3% of physically active participants reported increasing their vigorous to moderate PA and 37.3% reported no change in their level, meaning that the majority (77.6%) were not impacted by lockdown. However, in Canada, there were no restrictions on outdoor PA,[31] so most physically active people could maintain their level of PA. Bowler *et al*.'s[32] research found that people who engaged in outdoor PA reported more intention to continue to PA compared to those who

performed it indoors. In KSA, the 24-h curfew meant that people could not engage in outdoor PA, which might explain these different results.

International physical activity recommendations

It can be observed that 70% of the study participants (148 of 213) did not meet the international recommendations during lockdown either by performing or not performing the PA. However, Maugeri *et al*.'s[8] research in Italy reports contradictory results; although the participants reported a reduction in PA levels during lockdown compared with before, most participants (60%) followed the international recommendations for PA during lockdown. Notably, neither people in KSA nor Italy were allowed to leave home for outdoor PA. This might indicate that community awareness about the importance of maintaining the level of PA during lockdown was higher in Italy than in KSA. Furthermore, since home-based exercise was the only option to maintain PA levels during the lockdown, people in Italy might be more educated about home-based exercise choices.

Barriers to physical activity

Most reviewed studies did not identify the reasons for decreasing PA levels. The current study addressed this limitation by investigating the reasons behind not engaging or decreasing levels of PA during lockdown. Identifying barriers to PA is crucial for developing strategies to promote it.[33,34] This study's data show that lack of appropriate space or equipment and closed sports infrastructure were the most significant barriers, while lack of awareness about the importance of PA was the lowest barrier for performing less or no PA during lockdown. This might reveal that the participants lacked knowledge or skills about how to achieve weekly PA recommendations through home-based exercises during lockdown. Thus, educating people about how to maintain their level of PA at home without equipment might help to maintain the levels of PA. Chen *et al*.[4] believe that home-based exercise is an effective way to maintain the weekly PA recommendations and decrease the risk of being diagnosed with COVID-19. Constandt *et al*.[35] report that closing gyms and the absence of sporting events were the most significant barriers to PA during the lockdown, which is supported by the present study.

Limitations of the study

The major limitation of this study was that the data were collected through a self-reported questionnaire, which might have been subject to bias. The sample size was smaller than suggested, and due to a convenience sampling technique, this could have led to self-selection bias as the study obtained a small number of participants, which might limit the generalizability of results.[36]

Future research

Future research should focus on a larger sample size to facilitate the generalizability of the study results. Future research should also consider exploring PA behavior post-COVID-19 lockdown, particularly since Aarts *et al*.[37] advise that not participating in regular PA for more than 3 weeks can result in this becoming a new habit.

CONCLUSION

Based on the present findings, the COVID-19 lockdowns negatively impacted the PA behaviors of physically active adults, with 40.8% of participants not performing any PA during the lockdown. The study's participants reported that a lack of appropriate equipment and space, together with closed sports infrastructure, were the most significant barriers that resulted in them performing less or no PA during lockdown compared with before. Moreover, about 70% of study participants did not meet the international recommendations for PA during lockdown. Before the COVID-19 pandemic, the percentage of people in KSA who met the international PA recommendations was already too low, and this may have decreased further because of the COVID-19 lockdowns. The results of this study may help health-care professionals and the government in KSA to develop effective strategies to keep adults physically active during any future pandemic. Furthermore, in critical situations such as the COVID-19 pandemic or future pandemics, health professionals, including physiotherapists and doctors, and sports professionals, such as coaches, personal trainers, and instructors, should be actively engaged in ensuring that the public is aware of the benefits of maintaining PA even under lockdown circumstances. This paper recommends that any future government policies should adopt more sensitive, less restrictive approaches to curtailing PA.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. World Health Organization. Novel Coronavirus (2019-nCoV): Situation Report, 18; 2020.
2. Barwais FA. Assessing physical activity and sedentary time during the COVID-19 pandemic using self-reported measurement. Natl J Physiol Pharm Pharmacol 2020;10:1019-24.
3. Alahdal H, Basingab F, Alotaibi R. An analytical study on the awareness, attitude and practice during the COVID-19 pandemic in Riyadh, Saudi Arabia. J Infect Public Health 2020;13:1446-52.
4. Chen P, Mao L, Nassis GP, Harmer P, Ainsworth BE, Li F. Coronavirus

disease (COVID-19): The need to maintain regular physical activity while taking precautions. J Sport Health Sci 2020;9:103-4.
5. Hall G, Laddu DR, Phillips SA, Lavie CJ, Arena R. A tale of two pandemics: How will COVID-19 and global trends in physical inactivity and sedentary behavior affect one another? Prog Cardiovasc Dis 2021;64:108-10.
6. Bakhsh MA, Khawandanah J, Naaman RK, Alashmali S. The impact of COVID-19 quarantine on dietary habits and physical activity in Saudi Arabia: A cross-sectional study. BMC Public Health 2021;21:1487.
7. Giustino V, Parroco AM, Gennaro A, Musumeci G, Palma A, Battaglia G. Physical activity levels and related energy expenditure during COVID-19 quarantine among the Sicilian active population: A cross-sectional online survey study. Sustainability 2020;12:4356.
8. Maugeri G, Castrogiovanni P, Battaglia G, Pippi R, D'Agata V, Palma A, *et al.* The impact of physical activity on psychological health during COVID-19 pandemic in Italy. Heliyon 2020;6:e04315.
9. Lee PH, Macfarlane DJ, Lam TH, Stewart SM. Validity of the international physical activity questionnaire short form (IPAQ-SF): A systematic review. Int J Behav Nutr Phys Act 2011;8:115.
10. Brooks SK, Webster RK, Smith LE, Woodland L, Wessely S, Greenberg N, *et al.* The psychological impact of quarantine and how to reduce it: Rapid review of the evidence. Lancet 2020;395:912-20.
11. World Health Organization. #HealthyAtHome – Physical Activity; 2020. Available from: https://www.who.int/news-room/campaigns/connecting-the-world-to-combat-coronavirus/healthyathome/healthyathome---physical-activity. [Last accessed on 2022 Feb 18].
12. Warburton DE, Bredin SS. Health benefits of physical activity: A systematic review of current systematic reviews. Curr Opin Cardiol 2017;32:541-56.
13. da Silveira MP, da Silva Fagundes KK, Bizuti MR, Starck É, Rossi RC, de Resende E Silva DT. Physical exercise as a tool to help the immune system against COVID-19: An integrative review of the current literature. Clin Exp Med 2021;21:15-28.
14. Hammami A, Harrabi B, Mohr M, Krustrup P. Physical activity, and coronavirus disease 2019 (COVID-19): Specific recommendations for home-based physical training. Manag Sport Leis 2022;27:26-31.
15. Mattioli AV, Ballerini Puviani M, Nasi M, Farinetti A. COVID-19 pandemic: The effects of quarantine on cardiovascular risk. Eur J Clin Nutr 2020;74:852-5.
16. Yan Z, Spaulding HR. Extracellular superoxide dismutase, a molecular transducer of health benefits of exercise. Redox Biol 2020;32:101508.
17. Alqahtani BA, Alenazi AM, Alhowimel AS, Elnaggar RK. The descriptive pattern of physical activity in Saudi Arabia: Analysis of national survey data. Int Health 2021;13:232-9.
18. Rahi S, Alnaser FM, Abd Ghani M. Designing Survey Research: Recommendation for Questionnaire Development, Calculating Sample Size and Selecting Research Paradigms. Economic and Social Development: Book of Proceedings; 2019. p. 1157-69.
19. Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE, *et al.* International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc 2003;35:1381-95.
20. Helou K, El Helou N, Mahfouz M, Mahfouz Y, Salameh P, Harmouche-Karaki M. Validity and reliability of an adapted Arabic version of the long international physical activity questionnaire. BMC Public Health 2017;18:49.
21. Teh KC, Aziz AR. Heart rate, oxygen uptake, and energy cost of ascending and descending the stairs. Med Sci Sports Exerc 2002;34:695-9.
22. Nieman DC, Wentz LM. The compelling link between physical activity and the body's defense system. J Sport Health Sci 2019;8:201-17.
23. Wang M, Baker JS, Quan W, Shen S, Fekete G, Gu Y. A preventive role of exercise across the coronavirus 2 (SARS-CoV-2) pandemic. Front Physiol 2020;11:572718.
24. Thevarajan I, Nguyen TH, Koutsakos M, Druce J, Caly L, van de Sandt CE, *et al.* Breadth of concomitant immune responses prior to patient recovery: A case report of non-severe COVID-19. Nat Med 2020;26:453-5.
25. Rahmati-Ahmadabad S, Hosseini F. Exercise against SARS-CoV-2 (COVID-19): Does workout intensity matter? (A mini review of some indirect evidence related to obesity). Obes Med 2020;19:100245.
26. Pedersen BK, Hoffman-Goetz L. Exercise and the immune system: Regulation, integration, and adaptation. Physiol Rev 2000;80:1055-81.
27. Castañeda-Babarro A, Arbillaga-Etxarri A, Gutiérrez-Santamaría B, Coca A. Physical activity change during COVID-19 confinement. Int J Environ Res Public Health 2020;17:6878.
28. White SA, Croce RV, Loureiro EM, Vroman N. Effects of frequency and duration of exercise sessions on physical activity levels and adherence. Percept Mot Skills 1991;73:172-4.
29. Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, *et al.* World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med 2020;54:1451-62.
30. Lesser IA, Nienhuis CP. The impact of COVID-19 on physical activity behavior and well-being of Canadians. Int J Environ Res Public Health 2020;17:3899.
31. Canada PH. Individual and Community-Based Measures to Mitigate the Spread of COVID-19 in Canada; 2020. Available from: https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/health-professionals/public-health-measures-mitigate-covid-19.html. [Last accessed on 2022 Mar 10].
32. Bowler DE, Buyung-Ali LM, Knight TM, Pullin AS. A systematic review of evidence for the added benefits to health of exposure to natural environments. BMC Public Health 2010;10:456.
33. Barbosa JP, Farah BQ, Chehuen M, Cucato GG, Farias Júnior JC, Wolosker N, *et al.* Barriers to physical activity in patients with intermittent claudication. Int J Behav Med 2015;22:70-6.
34. Silva KS, Del Duca GF, Garcia LM, da Silva JA, Bertuol C, de Oliveira ES, *et al.* Barriers associated with frequency of leisure-time physical activity among Brazilian adults of different income strata. Scand J Med Sci Sports 2016;26:206-13.
35. Constandt B, Thibaut E, De Bosscher V, Scheerder J, Ricour M, Willem A. Exercising in times of lockdown: an analysis of the impact of COVID-19 on levels and patterns of exercise among adults in Belgium. Int J Environ Res Public Health 2020;17:4144.
36. Acharya AS, Prakash A, Saxena P, Nigam A. Sampling: Why and how of it. Indian J Med Spec 2013;4:330-3.
37. Aarts H, Paulussen T, Schaalma H. Physical exercise habit: On the conceptualization and formation of habitual health behaviours. Health Educ Res 1997;12:363-74.

APPENDIX 1 (QUESTIONNAIRE)

Questionnaire

Section 1

(Demographics)

Please tick the appropriate option or provide your own answer (s) as suits the question.

1. What is your gender?
   - Male
   - Female
   - Prefer not to say

2. What is your age range?
   - 18–29
   - 30–39
   - 40–49
   - 50–59
   - 60–64

3. What is your current weight in (kg)?
   ……

4. What is your height in (cm)?
   ……

5. What is your region?
   - Eastern
   - Riyadh
   - Alqaseem
   - Najran
   - Aseer
   - Jazan
   - Albaha
   - Makkah Almukarrama
   - Almadena Almunawara
   - Hail
   - Tabouk
   - Aljouf
   - Northern boarders

6. How long have you been physically active?
   (Physically active means that you were engaging in at least 150/min to 300/min of moderate physical activity per week, or at least 75/min to 150/min of vigorous physical activity per week, or a combination of both).
   - <1 year
   - 1–2 years
   - 3–4 years
   - 5–6 years
   - Over 6 years

Section 2

(Physical activity questionnaire)

This section consists of three parts, please tick the appropriate option or provide your own answer (s) as suits the question.

PART 1

This section contains questions that measure physical activity behaviors before the lockdown period (Before March 2020).

1. Before the lockdown, did you do vigorous physical activities, moderate physical activities or an equivalent combination of both? (Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal, like heavy lifting, digging, aerobics, fast bicycling, or running. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal, like carrying light loads, bicycling at a regular pace, or doubles tennis).
   A. Vigorous physical activity
   B. Moderate physical activity
   C. An equivalent combination of both

2. Before the lockdown, on how many days did you do vigorous physical activities? (Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal, such as heavy lifting, digging, aerobics, fast bicycling, or running)
   - No vigorous physical activities (skip this question)
   - 1 day per week
   - 2 days per week
   - 3 days per week
   - 4 days per week
   - 5 days per week
   - 6 days per week
   - Every day
   - Don't know/Not sure

3. How much time did you usually spend doing vigorous physical activities on one of those days? (If you don't know/not sure, you can skip this question. Please use the minute format only. For example: 15, 30, 45, 60, 90, 120)
   Answer:…….

4. Before the lockdown, on how many days did you do moderate physical activities? (Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal, like carrying light loads, bicycling at a regular pace, or doubles tennis)
   - No moderate physical activities (skip this question)
   - 1 day per week
   - 2 days per week
   - 3 days per week
   - 4 days per week
   - 5 days per week
   - 6 days per week
   - Every day
   - Don't know/Not sure

5. How much time did you usually spend doing moderate physical activities on one of those days? (If you don't know/not sure, you can skip this question. Please use the minute format only. For example: 15, 30, 45, 60, 90, 120)
   Answer:…….

6. Before the lockdown, on how many days, did you do an equivalent combination of vigorous- and moderate-intensity activity? moderate physical activities?
   - No equivalent combination of vigorous- and moderate-intensity activity physical activities (skip this question)
   - 1 day per week
   - 2 days per week
   - 3 days per week
   - 4 days per week
   - 5 days per week
   - 6 days per week
   - Every day
   - Don't know/Not sure

7. How much time did you usually spend doing an equivalent combination of vigorous- and moderate-intensity activity physical activities on one of those days? (If you don't know/not sure, you can skip this question. Please use the minute format only. For example: 15, 30, 45, 60, 90, 120)
   Answer:…….

PART 2

This section contains questions that measure physical activity behaviors during the lockdown period (Between March 23, 2020, and June 21, 2020).

8. During the lockdown, did you perform any moderate or vigorous physical activity? (Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal, such as heavy lifting, digging, aerobics, fast bicycling, or running. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal, like carrying light loads, bicycling at a regular pace, or doubles tennis).
   - Yes
   - No

9. During the lockdown, did you do vigorous physical activities, moderate physical activities, or an equivalent combination of both? (vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal, like heavy lifting, digging, aerobics, fast bicycling, or running. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal, like carrying light loads, bicycling at a regular pace, or doubles tennis).
   A. Vigorous physical activity
   B. Moderate physical activity
   C. An equivalent combination of both

10. During the lockdown, on how many days did you do vigorous physical activities? (Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal, like heavy lifting, digging, aerobics, fast bicycling, or running)
    - No vigorous physical activities (skip this question)
    - 1 days per week
    - 2 days per week
    - 3 days per week
    - 4 days per week
    - 5 days per week
    - 6 days per week
    - Every day
    - Don't know/Not sure

11. How much time did you usually spend doing vigorous physical activities on one of those days? (If you don't know/not sure, you can skip this question. Please use the minute format only. For example: 15, 30, 45, 60, 90, 120)
    Answer:…….

12. During the lockdown, on how many days did you do moderate physical activities? (Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal, like carrying light loads, bicycling at a regular pace, or doubles tennis)
    - No moderate physical activities (skip this question)
    - 1 day per week
    - 2 days per week
    - 3 days per week
    - 4 days per week
    - 5 days per week
    - 6 day per week
    - Every day
    - Don't know/Not sure

13. How much time did you usually spend doing moderate physical activities on one of those days? (If you don't know/not sure, you can skip this question. Please use the minute format only. For example: 15, 30, 45, 60, 90, 120)
    Answer:…….

14. During the lockdown, on how many days, did you do an equivalent combination of vigorous- and moderate-intensity activity? moderate physical activities?
    - No equivalent combination of vigorous- and moderate-intensity activity physical activities (skip this question)
    - 1 day per week
    - 2 days per week
    - 3 days per week
    - 4 days per week
    - 5 days per week
    - 6 days per week
    - Every day
    - Don't know/Not sure

15. How much time did you usually spend doing an equivalent combination of vigorous- and moderate-intensity activity physical activities on one of those days? (If you don't know/not sure, you can skip this question. Please use the minute format only. For example: 15, 30, 45, 60, 90, 120)
    Answer:…….

PART 3

16. Why did you perform "less" or "no" physical activity during the COVID-19 lockdown?
    - Lack of motivation
    - Lack of time
    - Lack of awareness of the importance of physical activity during the COVID-19 pandemic
    - Closed sport infrastructure
    - Lack of appropriate facilities/equipment/space
    - Fearful to get COVID-19
    - Other, please mention it
    - Don't know/Not sure

End of survey. Many thanks for your participation.