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## RESEARCH ARTICLE

### Physical Activity at Home During the COVID-19 Pandemic in the Two Most-affected Cities in Saudi Arabia

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#### Abstract:

#### Background:

During the COVID-19 pandemic, sufficient physical activity has had a positive effect on physical and mental health. This study aimed to assess levels of physical activity among Saudi participants before and during the COVID-19 pandemic.

#### Methods:

The study included 244 young and middle-aged Saudi adults (154 males, 90 females), (mean age  $\pm$  SD, 33.8  $\pm$  7.7 years). All subjects completed an online self-report questionnaire to determine their physical activity levels over the last 7 days. Paired *t*-tests were used to determine if there were significant differences in the total MET-minutes/week of physical activity (*i.e.*, insufficiently active and sufficiently active) between different variables of physical activity-related social contexts.

#### Results:

A significant decrease (57.1%) in the time spent performing physical activity before and during the COVID-19 lockdown was observed. No significant difference in total MET-min/week of physical activity before and during the lockdown was observed for the participants who participated in physical activity with a personal trainer (before = 2207  $\pm$  389.3 MET-min/week; during = 2077  $\pm$  201.5 MET-min/week). However, results indicated significant decreases in physical activity for participants who performed physical activity alone (59%), with family (61.6%), with friends (62%), or with groups (61.3%).

#### Conclusion:

The results of this study showed a significant decrease in the amount of time spent in physical activity levels during the COVID-19 lockdown than before the lockdown period. These findings may have implications for the essential development of public health initiatives that aim to increase physical activity levels during the pandemic. This study adds to the knowledge base by showing how people during the COVID-19 lockdown have more time to be physically active at home; nevertheless, this study indicates that participants are insufficiently physically active.

**Keywords:** Coronavirus, IPAQ, Public health interventions, Social contexts, Subjective assessment, Lockdown.

#### Article History

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## 1. INTRODUCTION

Coronavirus disease 2019 (COVID-19) belongs to a family of viruses that usually cause acute respiratory tract illnesses, for example, the common cold [1 - 3]. The virus was first observed toward the end of December 2019 in the city of Wuhan, China. At the beginning of 2020, the World Health Organization became alarmed at the spread of this virus and, on January 30, 2020, declared COVID-19 to be a public health

emergency of international concern. Shortly after, on March 11, 2020, it was declared a global pandemic [4].

The first case of COVID-19 was detected in the Kingdom of Saudi Arabia (KSA) on March 2, 2020. Its potential to spread rapidly among the public meant there was a large risk of an immediate outbreak. The KSA was among the leading countries to carry out several strategies to help delay the spread of the disease. These strategies included suspending events with super-spreader potential, such as city festivals and a massive cultural celebration. Progressive and speedy action was taken by the KSA government to suspend all visits to Mecca (the holy mosque) and Medina. On April 2, 2020, the

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KSA authorities imposed a 24-hour curfew on the cities of Mecca and Medina, with limited exceptions for safety and life. All schools and universities were also closed, international and domestic flights were suspended, and attendance at workplaces in all government and private sector businesses was prohibited. In addition, all malls, markets, restaurants, and gatherings on beaches were forbidden [5]. The KSA also suspended sporting activities, events, and competitions, including those at private sports halls and centers [6]. As of May 12, 2020, the KSA had 39,048 recorded cases of COVID-19, with 11,457 recoveries and 246 deaths. The highest rate of cases has been recorded in Mecca (8,854) and Medina (6,281).

The strategies listed above are intended to help reduce the spread of COVID 19 and are expected to prove effective. These restrictions have forced people to stay at home, disrupting their daily routines, including regular physical activity. Many international organizations and ministries of health in numerous countries have highlighted how staying at home could increase the amount of time spent in sedentary activities and decrease the amount of time spent performing regular physical activities. To maintain adequate health and avoid physiological and psychological health risks in these circumstances, individuals should maintain the daily level of physical activity required to produce health benefits.

Recently, several studies have indicated that performing regular physical activity at home produces strong beneficial effects in reducing the risk of upper respiratory tract infections and might help the immune system function better [7]. A study review by Nieman and Wentz [8] showed that regular physical activity improved immune regulation; thus, the study highlighted the relationship between moderate-intensity physical activity (walking program ~45 min/day, 5 days/week) and a decreased risk of different illnesses [8]. A recent study that used a self-reported questionnaire measured the relationship between changes in physical activity, sedentary behaviors, and physical health during the COVID-19 pandemic in France and Switzerland, finding that adults who increased their leisure-related physical activity (walking and moderate physical activity) during lockdown improved their physical health [9].

There are many possibilities and challenges with regard to performing regular physical activity at home during the COVID-19 lockdown, compared with activities outside of the house, which are usually more available, involve group participants or a personal trainer, and access to more facilities and infrastructure to achieve moderate-to-vigorous intensity physical activity [10, 11]. It is, therefore, essential to find ways to engage all individuals in regular physical activity inside the home to improve their health.

From the beginning of the epidemic to the time of writing this paper, there have been a massive number of recommendations, instructions, and consultations made through TV shows, social media, conferences, seminars, workshops, athletic coaches, specialists, scientific papers, videos, and health apps, encouraging people to participate in regular physical activity at home during the lockdown [12, 13]. The present study aimed to explore the amount of time people spend engaged in daily physical activity at home during the

lockdown by examining differences in adults' levels of physical activity before and during the COVID-19 pandemic. It was hypothesized that participants spend less time performing regular physical activity during the COVID-19 lockdown than before the lockdown period.

## 2. MATERIALS AND METHODS

### 2.1. Participants

Participants were individuals living in Mecca and Medina. A convenience sample was recruited through e-mail invitations and on social media sites (Twitter, Telegram, and WhatsApp groups) to answer a short online questionnaire (about 10 mins). The online questionnaire was launched on April 9, 2020, a week after the KSA authorities imposed a 24-hour curfew on the cities of Mecca and Medina. The last participant to submit the questionnaire did so on April 25, 2020.

Two hundred and forty-four young and middle-aged adults (154 males, 90 females), aged between 18 and 50 years (mean age  $\pm$  SD,  $33.8 \pm 7.7$  years), were recruited to participate in this study. Body mass index (BMI) was calculated as weight (in kilograms) divided by squared height (in meters) (mean BMI  $\pm$  SD,  $27.8 \pm 6.0$  range 17.5–41 kg·m<sup>-2</sup>).

### 2.2. Measurements

The online questionnaire consisted of 18 multiple-choice questions divided into 4 parts:

- The first part involved general demographic information, including gender, age, height, weight, and administrative regions in Mecca or Medina.
- The second part concerned health information, including health status and satisfaction with the lifestyle.
- The third part focused on physical activity and physical location before the COVID-19 lockdown. Physical activity was assessed using the short version of the International Physical Activity Questionnaire (IPAQ). The IPAQ is scored by using the Metabolic Equivalent of Task (MET) method, in which different activities and levels of intensity are assigned different MET estimates. This form contains objective questions about the frequency (days per week), duration (hours/minutes), and level of intensity (vigorous, moderate) of physical activity during the last 7 days [14]. In this study, the weekly total physical activity (MET-minutes/week) was calculated, meanwhile, based on the guidelines for data processing and analyses of the IPAQ scoring protocol [15]. Then, the total MET-minutes/week was considered according to the American College of Sports Medicine guidelines: insufficiently active (participants who reported a physical activity level of 1–499 MET-minutes/week) and sufficiently active (participants who reported a physical activity level  $\geq$  500 MET-minutes/week) [16]. The activity-related social contexts “in which physical activity occurred” were assessed using 5 response options: alone, with family, with friends, with groups (but not an organized program), and with a personal trainer (as an organized program).
- The fourth part was focused on physical activity and physical location during the COVID-19 lockdown, and a

similar technique of measuring physical activity as used in the third part (total MET-minutes/week).

### 2.3. Statistical Analyses

All statistical analyses were carried out via SPSS statistical software, version 26.0 for Windows (IBM SPSS Inc., Chicago, IL). Descriptive data were expressed as means and standard deviations (95% confidence intervals). Paired *t*-tests were used to determine if there were significant differences in the total MET-minutes/week of physical activity (*i.e.*, insufficiently active and sufficiently active) in different variables of physical activity-related social contexts. For cases of significance on the paired *t*-tests, effect sizes for mean differences were expressed as Cohen's *d* (difference in means divided by the standard deviation of the difference) and interpreted as small, moderate, or large based on 0.2, 0.5, and 0.8, respectively [17].

## 3. RESULTS

Participant characteristics are illustrated in Table 1. Frequency values indicate that there were more males ( $n = 154$ ) than females ( $n = 99$ ). Participants' age ranged from 18 to 52 years, with a mean age of 33.8 years. The mean BMI was  $28.2 \pm 5.6$  for males and  $27.3 \pm 6.6$  for females. The participants' distribution showed that the largest number of participants were from Mecca (73.4.5%); and 26.6% were from Medina. Most participants (87%) reported no symptoms of health-related issues; 5% reported symptoms of diabetes and high blood pressure. Nearly 79% of the participants were very satisfied or somewhat satisfied with their lifestyle; while 27% were dissatisfied.

The physical activity-related social contexts "in which physical activity occurred" are displayed in Table 2. Females were more likely than males to prefer performing physical activities with family (19% and 5.8%, respectively). Males and females both reported performing physical activities alone (69.5% and 69%, respectively). 13% of males reported participating in physical activity with groups compared to 11.1% of females. Performing physical activity with a personal trainer was less frequently reported in activity-related social contexts: 2% of males and females. There were no significant differences in physical activity domains among the activity-related social contexts, in which physical activity occurred by gender.

Differences between before and during the COVID-19 lockdown in the total MET-min/week of physical activity (*i.e.*,

insufficiently active and sufficiently active) are illustrated in Table 3. Paired-sample *t*-tests indicated a significant decrease in the total MET-min/week from before to during the COVID-19 lockdown for overall participants. Initially, total amount of physical activity was  $903 \pm 755.6$  MET-min/week; and during lockdown, it dropped to  $387 \pm 397.8$  MET-min/week ( $t [243] = 12.8, p < 0.001$ ), with a large effect size ( $d = 0.89$ ). For males, there was a significant decrease (58.1%) in physical activity performed before ( $951 \pm 740.5$  MET-min/week) and during the COVID-19 lockdown ( $398 \pm 413.1$  MET-min/week), ( $t [243] = 10.6, p < 0.001$ ), with a large effect size ( $d = 0.96$ ). For females, there was a significant decrease (55%) in physical activity performed before ( $818 \pm 777.5$  MET-min/week) and during the COVID-19 lockdown ( $368 \pm 369.9$  MET-min/week), ( $t [243] = 6.4, p < 0.01$ ), with a moderate effect size ( $d = 0.78$ ).

Mean MET-min/week for overall physical activity among the activity-related physical, social contexts "in which physical activity occurred" before and during the COVID-19 lockdown is illustrated in Fig. (1). All participants experienced a statistically significant decline in the total MET-min/week spent performing physical activity before and during the lockdown in most of the activity-related social contexts. Results indicated a significant decrease (59%) in the total MET-min/week of physical activity performed alone before ( $880 \pm 752.0$  MET-min/week) and during the lockdown ( $361 \pm 330.1$  MET-min/week), ( $t [168] = 10.6, p < 0.001$ ), with a large effect size ( $d = 0.98$ ). There was a significant decrease (61.6%) in the total MET-min/week of physical activity performed with family before ( $728 \pm 678.8$  MET-min/week) and during the lockdown ( $279 \pm 215.4$  MET-min/week), ( $t [25] = 3.5, p < 0.01$ ), with a large effect size ( $d = 1.08$ ). Results showed a significant decrease (62%) in the total MET-min/week of physical activity performed with friends before ( $815 \pm 546.3$  MET-min/week) and during the lockdown ( $310 \pm 204.0$  MET-min/week), ( $t [16] = 4.1, p < 0.01$ ), with a large effect size ( $d = 1.35$ ). There was a significant reduction (61.3%) in the total MET-min/week of physical activity performed with friends before ( $1020 \pm 806.6$  MET-min/week) and during the lockdown ( $394 \pm 352.5$  MET-min/week), ( $t [26] = 4.5, p < 0.001$ ), with a large effect size ( $d = 1.08$ ). No significant difference in total MET-min/week of physical activity performed before or during the lockdown was observed for participants who participated in physical activity with a personal trainer (before =  $2207 \pm 389.3$  MET-min/week; during =  $2077 \pm 201.5$  MET-min/week), ( $t [4] = 0.57, p = 0.59$ ).

**Table 1. Demographics of the study population (mean  $\pm$  SD), ( $n = 244$ ).**

	Male	Female	Overall
Age (years)	( $n = 154$ ) $34.0 \pm 8.1$	( $n = 90$ ) $33.7 \pm 7.3$	( $n = 244$ ) $33.8 \pm 7.7$
18-25 years	( $n = 29$ ) $22.1 \pm 1.8$	( $n = 15$ ) $22.6 \pm 1.4$	( $n = 44$ ) $22.3 \pm 1.7$
26-35 years	( $n = 66$ ) $31.6 \pm 2.4$	( $n = 40$ ) $31.5 \pm 2.8$	( $n = 106$ ) $31.6 \pm 2.5$
36-45 years	( $n = 42$ ) $40.3 \pm 3.1$	( $n = 32$ ) $40.1 \pm 2.7$	( $n = 74$ ) $40.2 \pm 3.0$
>46 years	( $n = 17$ ) $47.3 \pm 1.6$	( $n = 3$ ) $49.6 \pm 0.6$	( $n = 20$ ) $27.7 \pm 1.8$
Height (cm)	( $n = 154$ ) $173.2 \pm 7.4$	( $n = 90$ ) $158.7 \pm 7.0$	( $n = 244$ ) $167.8 \pm 10.0$
Weight (kg)	( $n = 154$ ) $84.5 \pm 18.1$	( $n = 90$ ) $69.0 \pm 18.0$	( $n = 244$ ) $78.8 \pm 19.5$

(Table 1) contd.....

	Male	Female	Overall
BMI (kg·m <sup>-2</sup> )	(n = 154) 28.2 ± 5.6	(n = 90) 27.3 ± 6.6	(n = 244) 27.8 ± 6.0
Administrative regions in KSA (%)			
Makkah region	(n = 105) 68.2%	(n = 74) 82.2%	(n = 179) 73.4%
Madinah region	(n = 49) 31.8%	(n = 16) 17.8%	(n = 65) 26.6%
Health Status (%)	(n = 137) 64%	(n = 75) 53%	(n = 212) 87%
No symptoms			
Diabetes	(n = 8) 66%	(n = 4) 33%	(n = 12) 5%
High blood pressure	(n = 3) 27%	(n = 8) 72%	(n = 11) 5%
Others	(n = 6) 66%	(n = 3) 33%	(n = 9) 3%
Satisfaction with Lifestyle (%)			
Bit of both/very dissatisfied	(n = 33) 64%	(n = 18) 35%	(n = 51) 21%
Very satisfied/ somewhat satisfied	(n = 121) 64%	(n = 72) 37%	(n = 193) 79%

Table 2. Differences and frequency of reported physical activity domains among the activity-related social contexts “in which physical activity occurred.” (n = 244).

Physical Activity domains	Overall	Male	Female	t	p - value
Social Contexts (%)					
Alone	(n =169) 69.3%	(n =107) 69.5%	(n =62) 69%	2.25	p < 0.224
With Family	(n =26) 10.7%	(n =9) 5.8%	(n =17) 19.0%	0.19	p < 0.575
With Friends	(n =17) 7.0%	(n =15) 9.7%	(n =2) 2.2%	0.44	p < 0.161
With Groups	(n =27) 11.1%	(n =20) 13.0%	(n =7) 7.8%	1.78	p < 0.423
With Personal Trainer	(n =5) 2.0%	(n =3) 1.9%	(n =2) 2.2%	1.90	p < 0.648

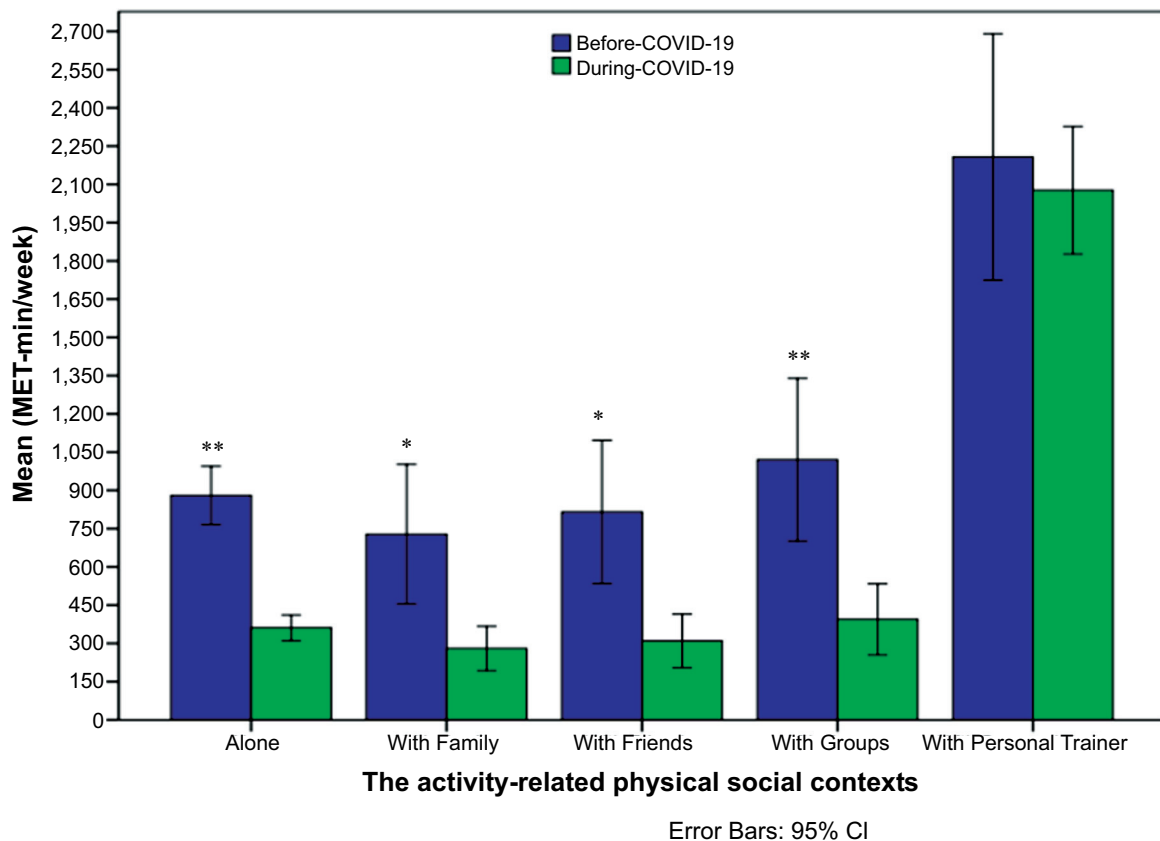


Fig. (1). Mean MET-min/week for overall physical activity among the activity-related physical social contexts “in which physical activity occurred” before-during COVID-19 lockdown. \*\* (p < .001), \* (p < .05).

**Table 3. Before/during the COVID-19 lockdown: differences in the total MET-minutes/week (mean  $\pm$  SD).**

		Physical Activity (MET-minutes/week)				
		Before-COVID-19	During-COVID-19	<i>t</i>	<i>p</i> - value	Cohen
<b>Overall</b>		( <i>n</i> = 244) 903 $\pm$ 755.6	( <i>n</i> = 244) 387 $\pm$ 397.8	12.8	<i>p</i> < 0.001	<i>d</i> = 0.89
<b>Sex</b>	Male	( <i>n</i> = 154) 951 $\pm$ 740.5	( <i>n</i> = 154) 398 $\pm$ 413.1	11.3	<i>p</i> < 0.001	<i>d</i> = 0.96
	Female	( <i>n</i> = 90) 818 $\pm$ 777.5	( <i>n</i> = 90) 368 $\pm$ 369.9	6.4	<i>p</i> < 0.01	<i>d</i> = 0.78

A Cohen *d* value of **0.8** or greater indicates a large effect size.

#### 4. DISCUSSION

The findings of the present study support the hypothesis that participants have spent less time performing regular physical activity during the COVID-19 lockdown than before. The findings of the present study suggest that on a weekly average, approximately 57.1% of participants decreased their total MET-min/week of physical activity. The result is consistent with the findings of a recent study by Cheval *et al.* [9] who studied 273 adults, using a self-reported physical activity questionnaire that collected data before and during the COVID-19 pandemic in France and Switzerland. The researchers found that there was a statistically significant decrease in the amount of time spent performing physical activity (-15 min/day, *p* < 0.001) [9].

Another study evaluated the physical activity levels of 12,107 participants living in 31 regions in China during the initial period of the COVID-19 lockdown, using a short version of the IPAQ [18]. The findings showed that nearly 60% of participants were insufficiently active, indicating more than twice the global prevalence of insufficient physical activity.

Somewhat similar findings were revealed in a report by a smart-watch company that estimated the impact of COVID-19 on physical activity around the world by analyzing step counts in various countries [19]. Results indicated a 12% reduction in physical activity levels in the KSA as of March 22, 2020, compared to the same week the previous year. However, these results contradict those of previous research that indicates that many people fail to meet sufficient physical activity recommendations (*i.e.*, ~150 minutes per week) because of a lack of time to perform physical activities due to other life requirements, such as educational, family responsibilities, and career. The present study adds to the knowledge base by showing how people have more time to be physically active at home during the COVID-19 lockdown; nevertheless, the previous studies cited above indicate that people are insufficiently physically active.

According to the literature, one of the most influential factors on people's choice and engagement in different aspects of physical activity is the social context. When people are with their friends or family, they are more likely to be involved in physical activity. During the COVID-19 lockdown, staying at home has disrupted routine daily activities, including physical activity-related social contexts. The present study investigated how lockdown and staying at home have affected the level of physical activity of individuals who participated in physical activity-related social contexts before the COVID-19 lockdown. The findings of this study indicate that all participants who participated in physical activity alone, with family, with friends, or with groups experienced a statistically

significant decline during the COVID-19 lockdown, becoming insufficiently physically active when compared to before the lockdown. These results are not surprising and support the hypothesis that social isolation during a lockdown may lead to reduced levels of physical activity caused by lack of space at home, lack of exercise equipment, and poor mental and physical health [12, 20 - 22].

Unexpectedly, this investigation found no significant difference between the total MET-min/week of physical activity (sufficiently active) of participants who participated in physical activity with a personal trainer before or during the lockdown. This result is in line with those of earlier literature that found that participation in physical activity with a personal trainer provides regularly structured and supervised exercise opportunities that may promote autonomous physical activity engagement anywhere [23]. In the present study, variables of exercise behavior that could affect intrinsic motivation, which is more predictive of long-term exercise adherence across a range of personal trainers, were not measured [24]. Indeed, it appeared that those participants who performed physical activity with a personal trainer had knowledge about "what kind of exercises they have to do", awareness of the benefits of being physically active, and a daily exercise schedule, or they may have had direct contact with their trainer to perform everyday activities at home during the lockdown period.

The amount of insufficient physical activity (375  $\pm$  363.8 MET-min/week) during the lockdown, as shown in the results, affects the endorsement of public health recommendations concerning physical activity for adults (*i.e.*, all adults should accumulate ~150 minutes per week) [25]. In general, there is a clear consensus that regular physical activity is related to a general reduction in the risk of respiratory tract infections, which are a considerable risk during the COVID-19 pandemic period. In light of this evidence, Hong Kong's influenza epidemic has been studied since 1997, by Wong and colleagues, who examined the relationship between regular physical activity and influenza-associated mortality [26, 27]. They found that individuals who engaged in sufficient physical activity (low to moderate-intensity physical activity) had a significantly reduced risk of death compared to individuals who did not participate in physical activity [27].

Increasing the levels of physical activity during the COVID-19 outbreak will not only help avoid respiratory tract infections but also motivate individuals to take charge of their behavior to improve their overall health-related quality of life. Recently, a study examined the relationship between depression/health-related quality of life and levels of physical activity in 3,947 Vietnamese adults who were suspected of having COVID-19 symptoms [28]. Results indicated that

Vietnamese adults who had more physical activity had a significantly lower likelihood of depression and a significantly higher health-related quality of life score.

The present study investigated participants' level of physical activity before and during the COVID-19 lockdown and analyzed the physical activity-related social context variables. However, this study had several limitations. The IPAQ, which was used to measure the sufficiency of physical activity in the current study, relies on participants' ability to interpret questions and provide accurate responses. To address this, responses were verified by the author and the assistant team. The online questionnaire used in this study also limited respondents to those who could access the Internet. To address this, the researcher made an effort to obtain diversity and demographical representation within the participant group by seeking participants through e-mail invitations and different social media sites. Future studies should include larger sample sizes and different administrative regions in the KSA.

## CONCLUSION

The discussion of the results of this study provides meaningful information to enhance the understanding of individuals' physical activity levels during the COVID-19 pandemic in the KSA. A significant decrease (57.1%) was found between the time spent participating in physical activity before ( $903 \pm 755.6$  MET-min/week) and during ( $387 \pm 397.8$  MET-min/week) the COVID-19 lockdown ( $p < 0.001$ ). These findings may have implications for the essential development of public health initiatives aimed at increasing physical activity levels during the COVID-19 pandemic. This study adds to the knowledge base by showing that people have more time to be physically active at home during the COVID-19 lockdown; nevertheless, this study indicates that participants were insufficiently physically active. Given that regular physical activity has been shown to have physical and mental health benefits, more research, including accurate measurements with larger sample sizes, is needed to increase the evidence base.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by the Officer of Graduate Studies and Scientific Research at the College of Education, Umm Al-Qura University, Saudi Arabia on 25/03/2020, reference number 41260.

## HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

## CONSENT FOR PUBLICATION

Written informed consent was obtained from each participant prior to the study.

## AVAILABILITY OF DATA AND MATERIALS

The data that support the findings of this study are

available from the corresponding author, [F.A.B], upon reasonable request.

## FUNDING

None.

## CONFLICT OF INTEREST

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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