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Impact of COVID-19 Lockdown on Physical Activity and Lifestyles of Male and Female Athletes Varying in Discipline, Level and Nationality

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Abstract

The COVID-19 pandemic has significantly reduced physical activity levels in the general population. This study seeks to examine the impact of pandemic-related lockdowns on physical activity among athletes, comparing individuals across different performance levels and countries. A cross-sectional study was employed. Between 5 and 15 April 2020, they were administered the International Physical Activity Questionnaire (IPAQ) and the Short-Form General Health Questionnaire (SF-12) (including SF-12 Physical and Mental Component Summary subscores [PCS and MCS respectively]). Before the lockdown, women had higher energy expenditure (AEE) and physical component scores (PCS) compared to men, while mental component scores MCS were higher for men than for women. During a lockdown, total activity time (TAT) and AEE decreased significantly for all athletes, sitting time increased, and quality of life worsened. TAT, AEE, and PCS became similar between sexes during lockdown, but women had lower MCS at low activity levels, except for high-level female athletes, who showed similar MCS to males. In conclusion, the COVID-19 lockdown negatively impacted athletes' Total activity time, activity energy expenditure, and quality of life were greater among low-level athletes, particularly females.

Keywords: *health, athletes, pandemic, IPAQ, SF-12*

Introduction

As a preventive measure, more than a third of the world's population found themselves under full or partial lockdown for several weeks during the COVID-19 pandemic.

Polero et al. (2020) conducted a study on physical activity (PA) recommendations during the pandemic, including data from 29 articles that discussed PA patterns. Though they noted that there was a lack of consensus and that recommendations made were not suitable for all people, the authors found that PA in the form of aerobic, strength, flexibility, and balance exercises was widely recommended.

Various studies have considered different groups, in-

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cluding youth, older individuals, and people with certain diseases. For example, Tornaghi et al. (2021) considered PA levels during the pandemic among youth in northwestern Lombardy. Their results show that, in general, the lockdown had a clearly negative impact on physical activity among the young population, which was already inactive to moderately active. Only highly active students (>2.520 MET-min/wk) increased PA during (3467.48±55.85 MET-min/wk) and after (3515.73±65.75 MET-min/wk) lockdown, relative to their baseline (3151.43±42.41 MET-min/wk). Physical activity helps protect against age-related decline in physical performance and boosts biological functions while aging has no impact (Cefis et al., 2025).

Among recreational athletes, Martin et al. (2021) found that the negative impact of COVID-19 restrictions on PA was greater for females, those engaged in winter or team sports, individuals aged 18 to 39, and low-resilient copers. Yet the number of days of exercise per week increased, as did recourse to online workouts, home gym exercise, and fitness apps.

Others have studied the effects on higher-level athletes. Fikenzer et al. (2021) considered the impact of lockdowns on endurance capacity among elite handball players. They observed a reduction in this capacity in the absence of team training, despite a home-based strength and endurance program. Font et al. (2021), who also studied elite handball players, detected moderate blood lactate increases post-lockdown right after submaximal shuttle run tests, but no changes in jump performance.

Lockdown effects on youth soccer players were investigated by Pucsok et al. (2021). They found that agility, speed, and explosive power did not change under home-based conditions, but it was challenging for participants to increase endurance capacities relative to their pre-pandemic baseline. However, Rampinini et al. (2021) concluded that home-based training was effective in improving aerobic fitness among soccer players, but did not allow players to maintain the levels of power exhibited during their competitive period.

Certain international studies, relying on surveys, conducted in larger populations of athletes playing various sports. Izzicupo et al. (2021) gathered data on 467 high-school (21.9%) and university (78.1%) student athletes (57% males, 43% females) from 11 countries, competing in 49 different sports at regional (17.5%), national (43.3%), and international (39.2%) levels. Respondents reduced their time spent on sports and academics but continued to lead active lifestyles during the lockdown (Izzicupo et al., 2021). Students who participated in sports in nations that experienced widespread outbreaks were more likely to train at home, devote time to their studies, and receive encouragement from their coaches but were less likely to receive it from their teachers. They find individual sports athletes trained more and were more likely to have their coaches back them up, athletes at an international level trained the most and were the most supported by their coaches. While college students were more inclined to explore multiple vocations (i.e., athletics and higher education) to cope with the COVID-19 situation, high school students got greater support from their coaches and teachers (Izzicupo et al., 2021).

Pillay et al. (2020) examined the effects of lockdowns on 692 elite and semi-elite athletes and found they preferred sedentary to active behavior during their leisure time. They also noted altered sleep patterns (79%; $p<0.0001$), excessive consumption of carbohydrates (76% [males, 73%; females, 80%]; $p<0.0001$), feelings of depression (52%), and a need for motivation to remain active (55%). The authors concluded that COVID-19 had physical, nutritional, and psychological consequences that may have compromised general health and the safe resumption of athletics.

As most of the studies of the impact of COVID-19 lockdowns on athletes have only considered small populations and particular regions, sports, skills, and athletic levels, we chose to focus on male and female athletes, and at various levels of activity intensity. Therefore, the present study reports on the impact of COVID-19 lockdown on physical activity and quality of life of male and female athletes varying in discipline, level, and nationality from 10 countries.

Methods

Population

A total of 941 athletes (682 men 29±10 years, 259 women 25±9 years), all under lockdown at home (March to May 2020), responded to our survey. They hailed from 10 countries: Jordan (30%), Saudi Arabia (19%), Oman (12%), Palestine (10%), Kuwait (7%), France (7%), Algeria (6%), Thailand (5%), Bahrain (3%), and Iraq (1%). Athletes participating at different levels and in various sports were studied: "low-level" athletes practiced in clubs, at a local or regional level (n=727, 242 women 25±9, 485 men 29±10 years) while "high-level" athletes practiced at the national or international level (n=214, 155 men 28±11 years, 59 women 23±9). All agreed to participate and were informed that their data would remain confidential. All athletes included did not present any pathology.

During the confinement period, all athletes have received an e-mail link allowing them to access questionnaires. These allowed us to evaluate the status of each athlete before confinement and also the effect of confinement on the parameters monitored.

This study was reviewed and approved by the Research Ethics Committee (REC) of the Department of Physical and Health Education at Al-Ahliyya Amman University (Decision No. 1/11-2019/2020). All participants provided written informed consent to participate in the study and to allow their anonymized data to be used for research and publication purposes. The study complied with the institutional committee's ethical standards and followed the principles outlined in the Declaration of Helsinki.

Study design

We administered the International Physical Activity Questionnaire (IPAQ) and 12-Item Short Form Survey (SF-12) to study participants - from sports clubs, federations, and universities in 10 countries - before and during COVID-19 lockdown.

IPAQ

The International Physical Activity Questionnaire (IPAQ) is designed for international use, to provide comparable PA estimates (Craig et al. 2003). We selected the short version, which considers PA over the preceding week (Craig et al., 2003). Participants independently completed

online versions in Arabic, English, French, or Thai. The unit used to score the IPAQ was the metabolic equivalent of task (MET), where 1 MET is the amount of energy expended at rest. Walking corresponded to 3.3 METs, moderate intensity exercise is equivalent to 4 METs, and intensity vigorous exercise amounts to 8 METs.

SF-12

The Short-Form General Health Questionnaire (SF-12) (Ware et al., 1996) is a 12-item subset of the 36-item SF-36 survey (Ware & Sherbourne, 1992). As for the IPAQ, online versions in Arabic, English, French, and Thai were independently completed by participants. The SF-12 yields Physical Component Summary (PCS) and Mental Component Summary (MCS) sub-scores, while the total score is a measure of quality of life.

Data analysis

We used R statistical software (version 4.2; R Foundation for Statistical Computing, Vienna, Austria) to analyze our data, which are presented as means with standard deviations. For all statistical analyses, the significance level was $p<0.05$.

A linear mixed-models approach (R nlme package) with repeated-measures ANOVAs was applied to evaluate correlations between lockdown (before vs. during), sex, and athletes' levels (low vs. high). Post-hoc analyses were performed using simultaneous tests for general linear hypotheses (R emmeans package) with Bonferroni corrections.

Results

Effect of lockdown on body weight and BMI

There was no observable effect on weight or BMI (Figure 1) in male or female athletes, regardless of their levels.

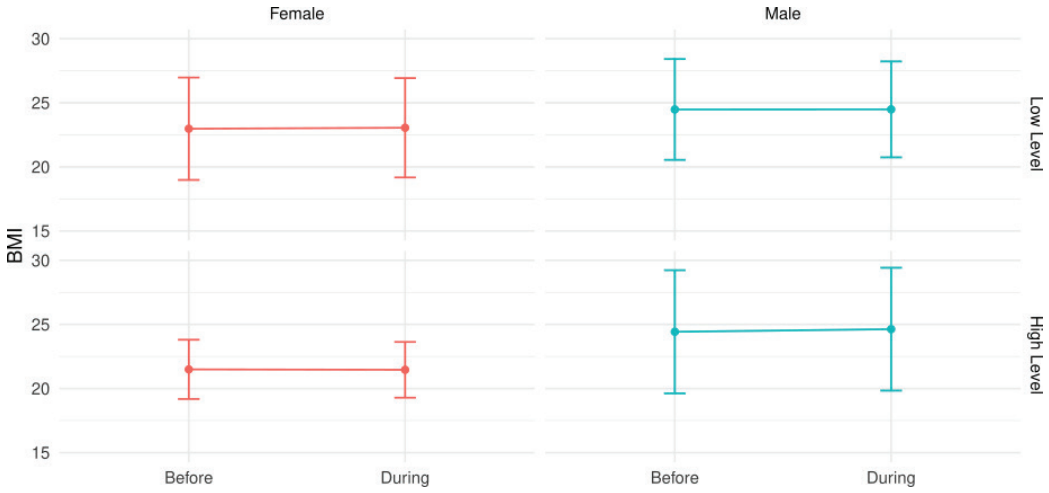

FIGURE 1. Effect of lockdown on athletes' BMI.

Note. Data for 941 athletes (682 men and 259 women), presented as means and standard deviations, and analyzed through repeated-measures ANOVA with 3 factors: period (before or during lockdown), sex, and level (low-level: athletes practicing in clubs at a local or regional level; high-level: athletes practicing at a national or international level). Regardless of sex or athletic level, no difference was detected between periods.

Total activity time (TAT) decreased for all athletes (205±228 vs. 160±251 min/wk). Before lockdown, TAT was longer for women than men ($p<0.01$) though this difference only concerned low-level athletes—while it was similar for both sexes during lockdown (Figure 2A). There was no significant differences between women and men for high level athletes though.

Before lockdown, in the male population, low-level athletes trained less than high-level ones ($p<0.001$), but no such difference was detected during lockdown. TAT for female athletes did not differ across levels either before or during lockdown.

AEE also diminished (from 4,537±3,718 MET-min/wk to 3,181±2,875 MET-min/wk), for both men and women. Before lockdown, there was again a difference between sexes that only concerned low-level athletes, with women expending more energy ($p<0.001$). Among males, before lockdown, EE was higher for high-level athletes than for low-level ones ($p<0.001$). During lockdown, however, EE was similar between levels (Figure 2B).

Sitting Time

Time spent sitting increased for both men and women during lockdown reaching 5.53±3,43 vs. 8.11±4.20 and 4.92±3,24 vs. 7.22±3.63 hours/day for men and women, respectively, but was higher for men compared with women before ($p<0.05$) as well as during ($p<0.01$) lockdown. This difference between sexes only concerned low-level athletes: sitting time did not differ between sexes before or during lockdown within the high-level population (Figure 2C).

Quality of Life Score

Total SF-12 scores, measuring quality of life, fell during lockdown (from 38.96±4.86 to 35.17±5.72, $p<0.001$) for both men and women. However, during lockdown, though only among low-level athletes, these scores were lower for women than men (34.6±5.9 vs. 35.4±5.6, $p<0.01$). High-level athletic activity among women thus tended to preserve quality of life.

Physical Component Summary (PCS) sub-scores

For low- and high-level athletes combined, women's pre-lockdown SF-12 PCSs were slightly higher than men's (+3.5%, $p<0.001$). These sub-scores fell during lockdown (from 17.1±2.4 to 15.6±2.7). Among high-level athletes alone, women's PCSs surpassed men's before (+6.5%, $p<0.01$), it was also the case among low level athletes ($p<0.05$), during lockdown there are no significant difference between men and women anymore for both levels (Figure 3B).

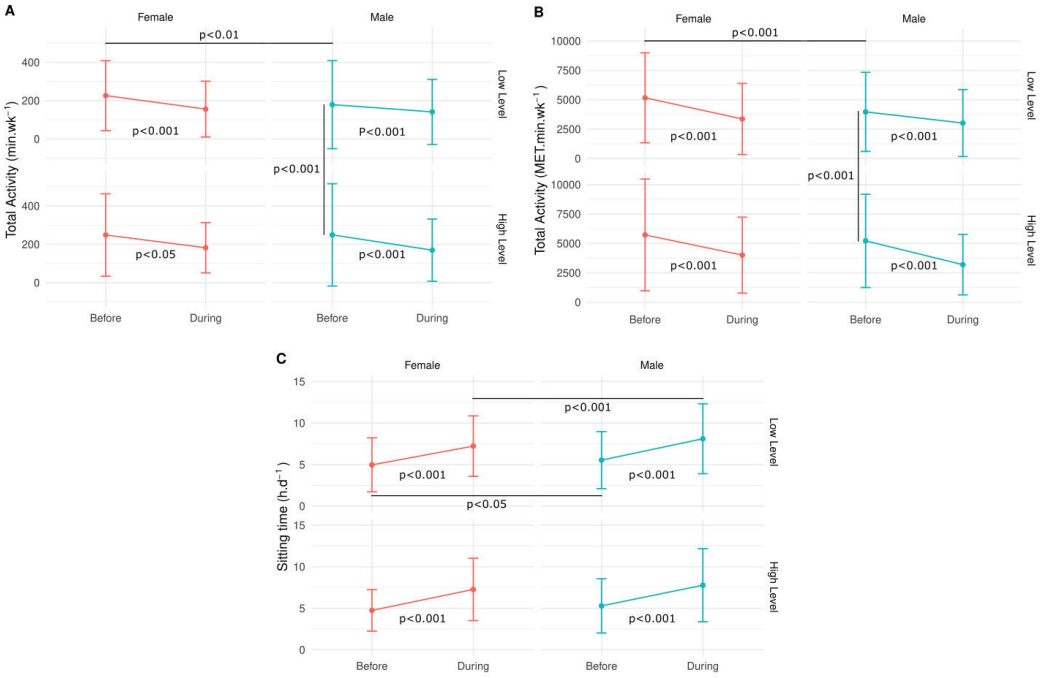

FIGURE 2. Effects of lockdown on (A) Total Activity Time (TAT), (B) Activity Energy Expenditure (AEE) and (C) Sitting Time, stratified by athletic level.

Note. Data for 941 athletes (682 men, of which 155 were high-level athletes; and 259 women, of which 59 were high-level athletes) collected using International Physical Activity Questionnaire, presented as means and standard deviations, and analyzed through repeated-measures ANOVA with 3 factors: period (before or during lockdown), sex, and level (low-level: athletes practicing in clubs at a local or regional level; high-level: athletes practicing at a national or international level).

Mental Component Summary (MCS) subscores

Overall, SF-12 MCSs dropped during lockdown (from 21.9±3.3 to 19.6±3.9, p<0.001), for all participants. MCSs among low-level athletes alone, during lockdown, were higher for men than for women (p<0.001). For women, high-level activity buoyed MCSs (p<0.05), just as was noted for quality of life (Figure 3C).

Apart from what is described above, we found no other

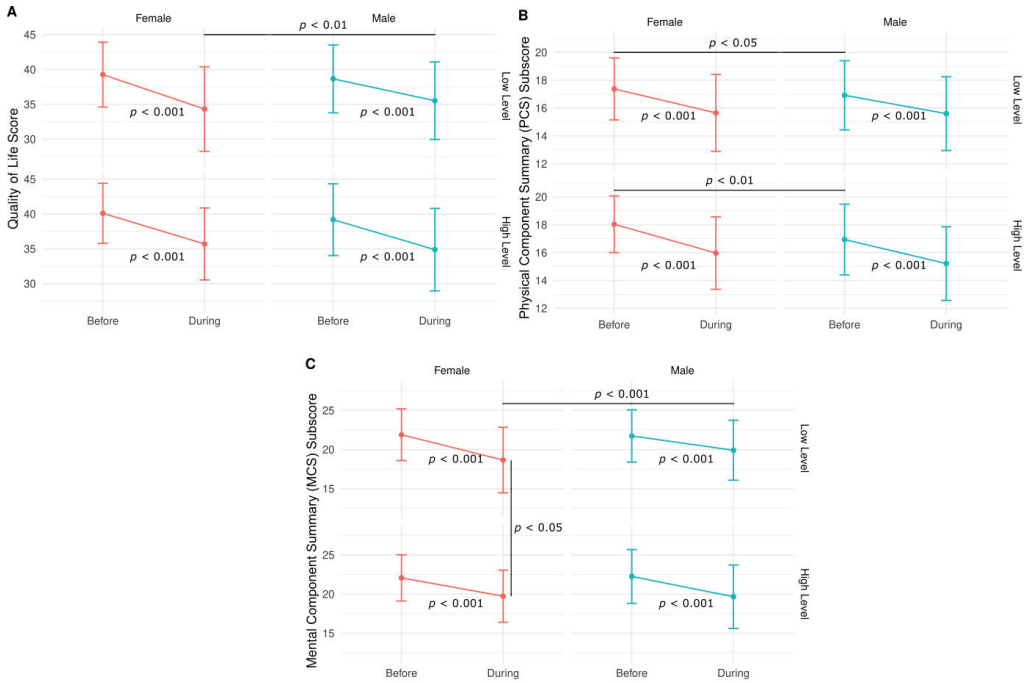

FIGURE 3. Effect of lockdown on (A) Quality of Life Score, (B) Physical Component Summary (PCS) subscore, and (C) Mental Component Summary (MCS) subscore, stratified by athletic level.

Note. Data for 941 athletes (682 men, of which 155 were high-level athletes; and 259 women, of which 59 were high-level athletes) collected using 12-Item Short Form Survey (SF-12), presented as means and standard deviations, and analyzed through repeated-measures ANOVA with 3 factors: period (before or during lockdown), sex, and level (low-level: athletes practicing in clubs at a local or regional level; high-level: athletes practicing at a national or international level).

differences when varying the groups studied (e.g. Female/Male, ...), and no correlation was found between the parameters studied except a correlation between height and mass (data not shown).

Discussion

The aim of this study was to determine the effects of COVID-19 lockdowns on physical activity and quality of life among athletes of different levels from 10 countries. There were no observed effects on body weight, regardless of athlete sex or level. Before lockdown, among low-level athletes, TAT and AEE was higher for women than for men, though there was no longer any difference during lockdown. During lockdown, TAT and AEE decreased for all athletes but did not differ between sexes at either athletic level. In general, PCSs fell during lockdown, with women scoring slightly higher than males before lockdown in both the low-level and high-level athlete subpopulations, but not anymore during lockdown.

Sitting time increased for low-level athletes during lockdown. Within this low-level athlete subpopulation, men spent more time seated than women did, both before and during lockdown. For high-level athletes, however, there was no difference in sitting time between the sexes.

Quality of life and MCSs were impacted during the lockdown in all subgroups, especially low-level female athletes. However, these variables were less severely affected among high-level female athletes.

Most studies focus on athletes practicing the same sport, or even on the same team of athletes; others have included larger populations (Pillay et al., 2020; Rampinini et al., 2021); but none have considered athletic levels of activity as did the present study. Yet results often differ by the level of activity or the sex of the athlete.

We did not observe any effect of the lockdown on BMI or body weight in either male or female athletes. Other studies have reported weight gain, as among Egyptian soccer players (Nassar et al., 2021). Needless to say that many studies have observed gains in body weight during the pandemic among the general population (Bonfanti et al., 2023; Chang et al., 2021).

In the current study, TAT was shortened for all athletes during the lockdown. Other authors have reported the similar finding. In Martin et al. (2021) study, when training frequency increased among recreational athletes, overall activity time did not. Considering student athletes, Izzicupo et al. (2021) noted a reduction in the time dedicated to sport and academics, although subjects still maintained active lifestyles. Additionally, Bourdas and Zacharakis (2020) observed a negative impact on overall PA during lockdown.

Among the low-level athletes in the present study, pre-lockdown TAT was longer for women than for men, though the gap was closed during lockdown. On the contrary, Martin et al. (2021) found that lockdown was negatively impacted women activity more than men, at the recreational level. In our study, low-level male athletes trained less than high-level male athletes before lockdown, but this difference did not carry over into the lockdown period as women's TAT was similar between low and high athletic levels.

AEE (MET-min/wk) also decreased for all athletes in our study. Washif et al. (2022) stated that "during lockdown, more than 50% of the athletes were unable to maintain prelockdown intensity during strength, endurance, speed, and/or plyometric training, change-of-direction, and technical training. The number of athletes who trained at the same frequency during lockdown was reduced by ~20% to 30%". Furthermore, just as reported by Gjaka et al. (2021), women expended more than men prior to the lockdown. Such findings were observed among our subgroup of low-level athletes. Also, before lockdown AEE was greater among high-level male athletes compared with low-level male athletes, though there was no difference during lockdown period.

Like Gjaka et al. (2021), we found that sitting time increased during lockdown. This was true for both men and women in our study. Additionally, within the low-level athlete subgroup, men spent more time sitting than women both before and during lockdown.

Quality of life score worsened during lockdown for athletes of both sexes. Ferreira et al. (2021) reported lower quality of life for women, relative to men, during lockdown. In the present study, quality of life score under lockdown was lower for women only within the subgroup of low-level male and female athletes. High-level athletic practice apparently conferred an advantage to women in terms of quality of life.

MCSs also fell during lockdown for our subjects. Baumann et al. (2021) state that "impaired mental health," defined by an MCS below the first quartile, was more common among women in their study. However, women's MCSs in our study were only lower than men's within the low-level athlete population and solely during lockdown. In addition, high-level female athletes had higher lockdown MCSs than low-level female athletes. As with quality of life, high-level athletic activity appeared to lessen the decline in MCSs.

It is interesting to note that most participants in the current study came from Jordan, as there were over twice as many men as women, and only 23% of the subjects were high-level athletes. Most studies of the impact that COVID-19 lockdowns used surveys similar to what we used in our current study, but McCarthy et al. (2021) employed a smartphone tracking app to compare exercise before, during, and after lockdown. Through this approach, the authors were able to collect data from a large number of people (5,395 individuals). Such an app may be of value for ensuring study data are more representative of the wider population.

This study relied on self-reported data and a cross-sectional design, limiting the accuracy and generalizability of the findings. Sport-specific impacts were not analyzed, and subgroup sizes were small. Future research should use longitudinal data, analyze sport-specific responses, examine sex differences, and evaluate the long-term effectiveness of the online and home-based training programs. Additionally, it's essential to consider the lockdown health impacts, especially in master athletes/aging population such as hospitalized individuals.

Conclusions

As revealed in previous studies, COVID-19 lockdown negatively impacted athletes' Total activity time, activity energy expenditure, and quality of life. This impact was apparently greater among low-level athletes, particularly females. High-level athletes of either sex were more likely to pursue high-intensity training at a high frequency. Among women, being a high-level athlete appeared to lessen the decline in one's MCS and quality of life.

In addition, to pursue training during lockdown and maintain activity levels, some athletes resort to online work-

outs, fitness apps, and home-gym exercise (Baumann et al., 2021; Djemai et al., 2022). Pucsok et al. (2021) observed that a home-based exercise program effectively preserved speed, agility, and explosive power. Font et al. (2021) reported that a structured home-based training program for top-level handball players, during lockdown, preserved lower-limb explosive strength but not aerobic capacity. With autonomous practice becoming ever more common among athletes, further investigation into the efficacy of home-based programs, mobile apps, distance coaching, and other solutions would be of interest.

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Conflict of interest

The authors report no conflict of interest.

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