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ORIGINAL ARTICLE

Mental health, eating habits and physical activity levels of elite Iranian athletes during the COVID-19 pandemic

Santé mentale, habitudes alimentaires et niveau d'activité physique des athlètes iraniens de haut niveau pendant la pandémie de COVID-19

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Summary

Background. – The COVID-19 pandemic has changed life styles of millions of people worldwide. This study investigated changes in the health, physical activity levels and eating habits of elite athletes during the COVID-19 pandemic lockdown in Iran.

Methods. – Three hundred and eighty three 383 (248 female and 135 male) elite athletes (168.82 ± 0.07 cm; 63.92 ± 7.42 kg; the body mass index (BMI): 22.3 ± 0.78 kg/m²) participated in this study. The International Physical Activity Questionnaire (IPAQ), Depression Anxiety Stress Scales (DASS-21) and the Impact of Event Scale-Revised (IES-R) study tools were used to measure

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levels of physical activity and mental health status, respectively. The Emotional Eater Questionnaire (EEQ) was used to assess food consumption related to emotion. Pearson and Spearman correlation analysis test were used in data analysis.

Results. – Levels of depression and stress were mild and moderate, while levels of anxiety were severe and very severe in most elite athletes. There were levels of low emotional eating by elite athletes during the COVID-19 pandemic. Physical activity levels were negatively correlated with psychological mood measures ($P \leq 0.05$), while there were positive correlations between emotional eating behaviours and psychological mood measures (moderate correlation; $P \leq 0.01$) and light physical activity levels (weak correlation; $P \leq 0.05$).

Conclusion. – This study provides the first preliminary evidence showing that the COVID-19 lockdown conditions negatively influenced the eating habits and levels of physical activity and mental health in elite athletes. Regular high intensity physical activity as health strategy in elite athletes and the general population remains a strategy to improve overall health during the COVID-19 pandemic. Additionally, these findings suggest the need to devise strategies to improve the life styles of elite athletes during pandemics such as the Covid-19 pandemic.

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MOTS CLÉS

Habitudes
alimentaires ;
Pandémie COVID-19 ;
Confinement ;
Athlètes élités ;
Santé Mentale

Résumé

Contexte. – La pandémie de COVID-19 a changé les modes de vie de millions de personnes dans le monde. Cette étude a examiné certains indicateurs de bonne santé, les niveaux d'activité physique et les habitudes alimentaires d'athlètes Elite iraniens pendant le confinement lié à la pandémie de COVID-19.

Méthodes. – Trois cent quatre vingt trois (248 femmes et 135 hommes) athlètes élités ($168,82 \pm 0,07$ cm; $63,92 \pm 7,42$ kg; indice de masse corporelle (IMC): $22,3 \pm 0,78$ kg/m²) ont participé à cette étude. Le questionnaire international sur l'activité physique (IPAQ), l'échelle DASS-21 (Depression Anxiety Stress Scales) et les scores de l'auto-questionnaire Impact of Event Scale-Revised (IES-R) ont été utilisés pour mesurer les niveaux respectifs d'activité physique et de l'état de santé mentale. L'Emotional Eater Questionnaire (EEQ) a été utilisé pour évaluer les altérations de la prise alimentaire liées à l'émotion. Le test d'analyse de corrélation de Pearson et Spearman a été utilisé pour l'analyse des données.

Résultats. – Les niveaux de dépression et de stress étaient légers et modérés, tandis que les niveaux d'anxiété étaient sévères à très sévères chez la plupart des athlètes élités. Il y avait des niveaux de faible alimentation d'origine émotionnelle chez ces athlètes pendant la pandémie de COVID-19. Les niveaux d'activité physique étaient corrélés négativement avec les mesures de l'humeur psychologique ($p \leq 0,05$), tandis qu'il y avait des corrélations positives entre les comportements alimentaires émotionnels et les mesures de l'humeur psychologique (corrélation modérée; $p \leq 0,01$) et les niveaux d'activité physique légère (faible corrélation; $p \leq 0,05$).

Conclusion. – Cette étude apporte une preuve préliminaire que les conditions de confinement liées au COVID-19 ont influencé négativement les habitudes alimentaires et les niveaux d'activité physique et de santé mentale chez des athlètes élités. L'activité physique régulière à haute intensité aussi bien chez les athlètes élités que pour la population générale reste une stratégie pour améliorer la santé globale pendant la pandémie de COVID-19. De plus, ces résultats suggèrent la nécessité de concevoir des stratégies pour améliorer les styles de vie des athlètes élités lors de pandémies, telles que celle de Covid-19.

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1. Introduction

There are many reports of the negative psychological impacts related to the COVID-19 pandemic [1–4], where restrictions such as home confinement negatively affected eating habits and levels of physical activity [2,5]. Good mental health is an important component of public health as it can reduce the risk of depression, obesity and cardiovascular disease [6,7]. Epidemiological studies suggest that adherence to healthy dietary patterns is associated with a reduced risk of mental diseases [8,9].

Elite athletes must retain appropriate healthy habits so as to remain competitive. Therefore, it is necessary to consider possible changes in their nutrition, psychological status, and levels of physical activity, to strengthen their performance. Home confinement and social distancing due to the COVID-19 pandemic reduced sporting engagements interactions (e.g., The 2020 Olympics and Paralympics were postponed for a year due to the coronavirus pandemic). In addition to disrupting training activities of athletes, the lockdowns also reduced income levels and motivation of elite athletes, and could lead to psychological disorders [2,10]. To the best of

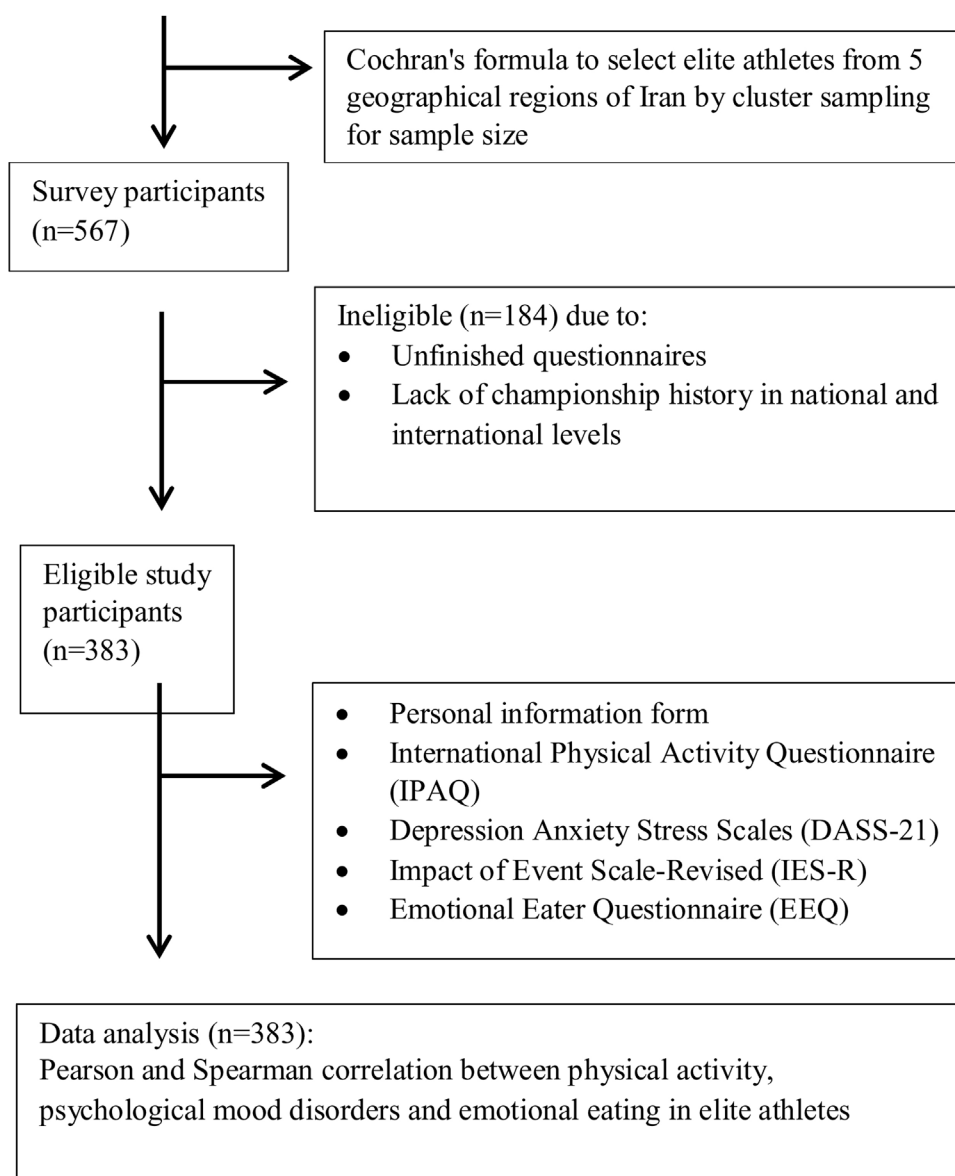


Figure 1 Flowchart of the study.

our knowledge, little is known about psychological effects of the COVID-19 pandemic lockdown in elite athletes. Home confinement related to the COVID-19 pandemic have led to lower scores in cognitive flexibility [11], while also leading to financial distress among elite athletes. Emotional eating describes the propensity to eat in response to positive and negative emotions and is a frequent eating disorder during the COVID-19 pandemic lockdown [12].

The mechanisms involved during emotional eating are not well understood. Some studies indicate that obese individuals are more emotionally reactive and more likely to overeat compared to healthy-weight people [13,14]. Emotional eating in elite athletes should be better studied due to changes in the psychological status, dietary habits and physical condition of athletes during the COVID-19 pandemic. The objective of our study was to monitor the mental, dietary emotions and physical condition of elite athletes during the COVID-19 pandemic lockdown, and to investigate the relationship between COVID-19-induced changes in mental

health, physical activity levels and eating habits in a group of elite Iranian athletes.

2. Methods

2.1. Participants

The Cochran formula was used to determine the sample size for this study [15]. We recruited 383 elite athletes to participate in the study based on cluster random sampling, using the following eligibility criteria: if they had competed in national and international athletic competitions, either individual event or in a team event. We distributed 567 questionnaires in the northern, southern, western, eastern and central parts of Iran. The inclusion criteria were used to recruit 383 elite athletes. A flowchart of the study, including study subject recruitment and data collection, is depicted in Fig. 1.

Table 1 Scoring scale for DASS-21^a.

	Depression	Anxiety	Stress
Normal	0–9	0–7	0–14
Mild and Moderate	10–20	8–14	15–25
Severe and Very severe	≥21	≥15	≥26

^aFrom Abdel Wahed and Khamis Hassan (2017) [24].

2.2. Instrument

A demographic questionnaire (gender, age, height, weight, history of activity in sports, physical activity levels, history of coronary disease and residence) was applied. The International Physical Activity Questionnaire (IPAQ) containing 7 questions was used to measure levels of physical activity. The validity and reliability of the IPAQ questionnaire has been confirmed in other studies [16,17].

The mental health status of athletes were measured using the Depression Anxiety Stress Scales (DASS-21) and the Impact of Event Scale-Revised (IES-R). The DASS-21 assesses general psychological distress in three domains of depressive mood, anxiety and perceptions of stress [18]. Based on DASS-21 norms, a total score of 32 represents elevated levels of general psychological distress, while a score of 10–12 on the depressive mood domain represents probable depression, and a score of 8 on the anxiety domain represents a probable anxiety disorder (Table 1). The internal reliability and validity of these assessment tools have been validated elsewhere [18].

The Impact of Events Scale-Revised (IES-R), a 22-item self-report questionnaire, was used to measure trauma-related distress on a 5-point scale ranging from 0 (not at all) to 4 (extremely likely) for subscales of avoidance (e.g. avoidance of feelings or situations), intrusion (e.g. intrusive distressing thoughts, nightmares), and hyper arousal (e.g. anger, irritability, hyper vigilance). Domains are scored by determining mean item scores [2,5]. High scores indicate increased distress, and the psychometric properties including reliability and validity have been validated elsewhere [19].

The Emotional Eater Questionnaire (EEQ), consisting of 14 scores based on a Likert scale with 5 options from “Strongly Agree” to “Strongly Disagree”, was used to measure emotional eating, where questions 12 to 4 were scored in reverse. The average score of these 14 questions is considered as a measure of emotional eating. A higher EEQ score suggests healthier eating patterns. The Cronbach alpha coefficients obtained was 0.76, indicating acceptable internal stability of this instrument [20].

2.3. Statistical analysis

Data were analysed using the SPSS v21.0 software (SPSS Inc., Chicago, IL). Data were presented as mean ± SD in the table. The data were analysed using Pearson and Spearman correlation. Significant difference was set at $P \leq 0.05$.

Table 2 Sociodemographic characteristics of the elite athletes.

Characteristics	Number (%)
Age groups	
15–20 years	71 (18.54)
20–25 years	90 (23.50)
25–30 years	78 (20.37)
30–35 years	144 (37.59)
Mean age ± SD	24.99 ± 11.21
Gender	
Males	135 (36.03)
Female	248 (63.97)
History of sports activities	
Less than 3 years	89 (23.24)
3–5 years	117 (30.55)
5–7 years	68 (17.75)
7–10 years	84 (21.93)
More than 10 years	25 (6.53)
Athletic events	
Individual	146 (38.12)
Team	237 (61.88)
Current activity levels	
Less than 5 hours/week	75 (19.58)
5–10 hours/week	152 (39.69)
10–15 hours/week	115 (30.03)
15–20 hours/week	40 (10.44)
More than 20 hours/week	1 (0.26)
History of Covid-19 infections	
Infected	179 (46.74)
Not experiencing Covid-19 symptoms	204 (53.26)
Location	
Urban	338 (88.25)
Rural	45 (11.75)

3. Results

The socio-demographic characteristics of the elite athletes are summarized in Table 2. A total of 383 volunteers (36.03% males; 63.97% females) aged between 15–35 years old participated in the study. The average height of the participants was 168.82 ± 0.07 cm, the average weight and body mass index (BMI) were 63.92 ± 7.42 kg and 22.3 ± 0.78 kg/m², respectively. The majority of participants competed in individual sporting events (Karate, Wrestling, Cycling, Taekwondo, Swimming, Tennis Table, Badminton) (61.88%) while the remainder (38.12%) engaged in team sports (Volleyball, Football, Basketball, Handball, Futsal).

The rates of activity levels, depression, anxiety stress, intrusion, avoidance, hyper arousal and emotional eating among study participants is shown in Table 3, which also summarizes levels (minutes per week) and intensities (light, moderate and vigorous) of physical activity in elite athletes during the COVID-19 pandemic (Table 3).

Measures of mood disorders such as depression and stress were mild and moderate, respectively, whereas anxiety levels were severe and very severe in most elite athletes (Table 3). Additionally, levels of post-traumatic stress disorders (intrusion, avoidance and hyper arousal) were lower

Table 3 Scales and subscales of research variables of the elite athletes.

Scale	Subscale	Number (%) or Score	
IPAQ	Vigorous activities		
	Mean ± SD	520.57 ± 237.232	
	Moderate activities		
	Mean ± SD	555.35 ± 364.49	
	Light activities		
	Mean ± SD	383.66 ± 279.226	
IPAQ total score (min/week)	Mean ± SD	1459.58 ± 503.97	
DASS	Depression		
	Normal	7 (1.83)	
	Mild and moderate	328 (85.64)	
	Severe and very severe	48 (12.53)	
	Mean ± SD	16.07 ± 4.79	
	Anxiety		
	Normal	0 (0)	
	Mild and moderate	136 (35.51)	
	Severe and very severe	247 (64.49)	
	Mean ± SD	15.31 ± 2.80	
	Stress		
	Normal	0 (0)	
	Mild and moderate	230 (60.05)	
	Severe and very severe	153 (39.95)	
Mean ± SD	14.02 ± 3.57		
DASS total score (0–126)	Mean ± SD	45.39 ± 9.07	
IES-R	Intrusion		
	Mean ± SD	1.44 ± 0.41	
	Avoidance		
	Mean ± SD	1.30 ± 0.29	
	Hyper arousal		
	Mean ± SD	1.35 ± 0.30	
IES-R total score (0–88)	Mean ± SD	29.99 ± 6.01	
EEQ	Non-emotional eater	0 (0)	
	Low emotional eater	271 (70.76)	
	Emotional eater	77 (20.10)	
	Very emotional eater	35 (9.14)	
	EEQ total score (0–56)	Mean ± SD	25.76 ± 10.64

IPAQ: International Physical Activity Questionnaire; DASS: Depression, Anxiety and Stress Scale; IES-R: Impact of Event Scale-Revised; EEQ: Emotional Eater Questionnaire.

and considered to be moderate. Levels of emotional eating were considered as low in elite athletes the COVID-19 pandemic (Table 3).

The correlations of total IPAQ scores with mood disorders scales and subscales are shown in Table 4. Vigorous activities correlated negatively with scores of depression, anxiety, stress, DASS total score ($P < 0.01$) and positively with hyperarousal ($P < 0.01$). There were also positive correlations between light activities and depression,

anxiety, stress, DASS, intrusion, avoidance, hyperarousal, IES-R ($P < 0.01$). Negative correlations were recorded between IPAQ total scores and psychological mood disorders subscales of depression, anxiety, stress, DASS, intrusion, avoidance, hyperarousal and IES-R ($P < 0.01$) (Table 4).

The correlations of EEQ, DASS, IES-R scores with mood disorders scales and subscales are listed in Table 5. There was a positive correlation between emotional eating and depression, anxiety, stress and DASS ($P < 0.01$). Moreover, there was a weak but positive correlation between very emotional eating and depression, anxiety, stress and DASS ($P = < 0.05$).

The correlation between scales and subscales of physical activity and EEQ are shown in Table 6. Light activities were positively correlated with emotional eating, very emotional eating and EEQ total scores ($P = < 0.05$).

4. Discussion

The coronavirus disease (COVID-19) pandemic negatively impacted both physical and mental health worldwide [10,21]. Our findings suggest that levels of depression and stress were mild and moderate during the pandemic lockdown, while anxiety levels were severe and very severe in elite athletes. In addition, more intense physical activity was performed during the lockdown conditions, with lower rates of depression, likely related to the antidepressant effects of vigorous physical activity [22].

One mechanism by which vigorous exercise reduces depression is by modulating hippocampus plasticity. For example, vigorous exercise can promote neuroplasticity and facilitate the function of the hippocampus to alleviate cognitive malfunction in depressed individuals, suggesting that the anti-depressive effects of vigorous exercise could be due to hippocampal neurogenesis [23]. On the other hand, our results indicate that rates of post-traumatic stress symptoms related to the COVID-19 pandemic (including intrusion, avoidance and hyper arousal) were unaffected in elite athletes.

Our study indicates that there was a positive correlation between emotional eating and other mood disorders such as depression, anxiety and stress. In fact, our study suggests that elite athletes with light levels of physical activity in lockdown condition were more likely to exhibit stronger overeating behaviours. Emotional eating can occur in response to a range of negative emotions such as anger, depression, psychological stress, anxiety, anger, and loneliness [12]. Mood and emotions affect food choices and diet, and the reverse can also occur whereby diet affects mood and emotions [12,23]. Since, elite athletes often engage in strenuous exercise activities, with the decline of these activities in the pandemic, they are suddenly challenged with stressful conditions, which ultimately exacerbates factors such as eating disorders and mood disorders. Among other factors that can be effective in continuation of this situation is their uncertainty toward their future and sports programs.

4.1. Limitations

Our study has some limitations: (1) we recruited a limited number of elite athletes from one country (Iran), (2) we did

Table 4 The relationship between activity levels and psychological mood disorders scales.

IPAQ	Depression	Anxiety	Stress	DASS	Intrusion	Avoidance	Hyper arousal	IES-R
Vigorous activities	-0.40 ^a	-0.43 ^b	-0.48 ^a	-0.52 ^a	0.06	0.10	0.26 ^a	0.02
Moderate activities	-0.18	-0.09	0.05	0.09	-0.08	-0.11	0.14	-0.04
Light activities	0.36 ^a	0.33 ^a	0.31 ^a	0.39 ^a	0.48 ^a	0.43 ^a	0.33 ^a	0.52 ^a
IPAQ total score	-0.34 ^a	-0.27 ^a	-0.44 ^a	-0.32 ^a	-0.19 ^a	0.16 ^a	0.17 ^a	0.21 ^a

Values are expressed based on the correlation coefficient *r*; Strength of correlation coefficients: 0 to 0.2: very weak, 0.2 to 0.4: weak, 0.4 to 0.6: moderate association and 0 to -0.2: very weak, -0.2 to -0.4: weak, -0.4 to -0.6: moderate no-association.

^a Correlation is significant at the 0.01 level (2-tailed).

^b Correlation is significant at the 0.05 level (2-tailed).

Table 5 The relationship between emotional eating scale and the psychological mood disorders scales.

EEQ	Depression	Anxiety	Stress	DASS	Intrusion	Avoidance	Hyperarousal	IES-R
Non-emotional eater	-0.04	-0.05	0.06	0.02	0.03	0.06	0.14	0.10
Low emotional eater	0.14	0.34	0.29	0.19	0.08	0.07	0.07	0.05
Emotional eater	0.55 ^a	0.77 ^a	0.61 ^a	0.45 ^b	0.09	0.19	0.21	0.15
Very emotional eater	0.24 ^b	0.20 ^b	0.18 ^b	0.27 ^b	-0.14	0.05	0.14	0.11
EEQ total score	0.22 ^b	0.33 ^b	0.34 ^b	0.38 ^b	0.03	0.03	0.01	0.03

Values are expressed based on correlation coefficient *r*; Strength of correlation coefficients (0 to 0.2: very weak, 0.2 to 0.4: weak, 0.4 to 0.6: moderate, 0.6 to 0.8 strong association and 0 to -0.2: very weak, -0.2 to -0.4: weak, -0.4 to -0.6: moderate, -0.6 to -0.8 Strong no- association).

^a Correlation is significant at the 0.01 level (2-tailed).

^b Correlation is significant at the 0.05 level (2-tailed).

Table 6 Correlation of emotional eating scales and activity scales.

EEQ	Vigorous activities	Moderate activities	Light activities	IPAQ
Non-emotional eater	-0.05	0.11	0.23	0.07
Low emotional eater	0.14	0.14	0.15	0.08
Emotional eater	-0.18	0.08	0.41 ^a	-0.18 ^a
Very emotional eater	-0.19	-0.04	0.33 ^a	-0.23 ^a
EEQ total score	-0.02	-0.04	0.11 ^a	-0.01

Values are expressed based on correlation coefficient *r*; Strength of correlation coefficients (0 to 0.2: very weak, 0.2 to 0.4: weak, 0.4 to 0.6: moderate association and 0 to -0.2: very weak, -0.2 to -0.4: weak, -0.4 to -0.6: moderate no- association). Explain abbreviations (EEQ, IPAQ). **Correlation significant at the 0.01 level (2-tailed).

^a Correlation significant at the 0.05 level (2-tailed).

not quantify biomarkers available for some of the behaviours we monitored, e.g. cortisol levels and stress [24], exercise makers [11], adipokines [14]. The unequal gender distribution of participants was an important limitation of our study.

5. Conclusions

Our study shows that engaging in physical activity was correlated with healthier eating habits during the COVID-19 pandemic. The overall findings of this study were that performing strenuous physical activity during a pandemic had a positive effect on the psychological state of athletes compared to low-intensity physical activity that had negative psychological consequences (depression, stress and anxiety). The low physical activity levels of elite athletes was associated with adverse psychological states and eating disorders. We report that elite athletes with lower levels of

physical activity are more likely to experience subjective distress caused by traumatic events (avoidance, intrusion, hyperarousal). In general, regular high intensity as a health strategy in elite athletes remains a means of improving overall health during the COVID-19 pandemic.

Disclosure of interest

The authors declare that they have no competing interest.

Ethical Approval

The research was approved by the local Ethics Committee of the Imam Khomeini International University (Ref. no. 17629).

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Informed Consent

All participants provided written informed consent.

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