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Association between body image perception with demographic characteristics of physically active individuals during COVID-19 lockdown in Saudi Arabia

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Objective: This study aimed to determine the relationship between body image perception and demographic factors among physically active (men and women) during the COVID-19 lockdown in Saudi Arabia.

Methods: A descriptive cross-sectional survey was employed among physically active individuals in Saudi Arabia between June and July 2020. Eligible participants completed a 19-item self-administered questionnaire that covered three areas: demographic questions, reasons for physical activity, and role or perceptions of body image during the COVID-19 pandemic quarantine.

Results: A total of 323 physically active individuals participated in this study. The majority of the participants were female ($N=217$, 72.7%), were married (66.6%), and living in the Middle region of Saudi Arabia ($N=268$, 83%). The analysis shows that majority of the participants were dissatisfied with their current body shape. The analysis also showed a significant association between participants' educational attainment and BMI and body dissatisfaction ($p=0.001$). The strongest predictor was BMI level, recording an odds ratio (OR) of 5.99 (CI: 2.15 – 10.54, $p=0.001$) in obese and an OR of 4.55 (CI: 1.31 – 9.35, $p=0.001$) in overweight, indicating that compared with normal weight, obese and overweight participants were more likely to be dissatisfied by five and four times, respectively.

Conclusion: This study indicates that physically active individuals are greatly influenced by the confinement period. Programs that promote physical activity in their house or during lockdown may help to encourage, lessen their anxiety, and maintain their health. This may also decrease the anxiety of individuals, particularly those active ones.

KEYWORDS

body image, body image dissatisfaction, COVID-19, physically active, Saudi Arabia

Introduction

Saudi Arabia reported the first coronavirus disease 2019 (COVID-19) case on 2 March 2020. The rapid increase of COVID-19 cases and deaths has caused a global public health concern. Different countries implemented nonpharmaceutical interventions (NPIs) to mitigate the spread of COVID-19. The Ministry of Health implemented NPIs such as suspension of all classes, 14 days of isolation for travelers, mask-wearing, physical distancing, the shutdown of nonessential businesses (e.g., coffee shops, sports clubs, schools, and fitness gyms), and a nationwide curfew between 2 p.m. and 6 a.m. (1). In addition, the Islamic pilgrimage called “Umrah,” performed by thousands of Muslims in Mecca, was also suspended to contain the COVID-19 outbreak. Due to the unprecedented measures placed on people’s movements may significantly influence their habits and behaviors and consequently increase the risk of anxiety and emotional distress (2).

Several studies have expressed concern about the potential health risk for NPIs, particularly lockdown measures that increase sedentary behaviors and irregular eating patterns in the general population (3–6). In addition, collective anxiety about weight gain during the lockdown and stigmatizing media messages about the dangers of higher body weight might contribute to increased body shame and levels of disordered eating (2). A global study shows that home confinement had a negative effect on the intensity of physical activity of individuals and increased the number of sitting time (7). Other studies also revealed the negative effect of home confinement on the emotional wellbeing of individuals (8, 9).

Physical inactivity increases the risk of many chronic diseases, such as hypertension, coronary heart disease, stroke, diabetes, depression, and risk of falls (10). Previous studies have shown that proper or regular physical activity helps maintain a healthy weight, reduces the risk of developing obesity, and strengthens the immune system (10, 11). Considering the health benefits of regular physical activity, the WHO recommends that individuals, mainly adults, undertake 150–300 min of moderate-intensity, or 75–150 min of vigorous-intensity physical activity, or some equivalent combination of moderate-intensity and vigorous-intensity aerobic physical activity per week (12).

To individuals who are physically active and involved in sports disciplines and where appearance, including body shape and mass, is essential, the effects of lockdown measures can increase the level of anxiety from undertaking physical activity. Furthermore, individuals who exercise regularly can be expected to differ in the impact of NPIs because it tends to be more concerned and dissatisfied with their appearance compared with those who are physically inactive. Body image dissatisfaction is defined as negative thoughts, feelings, and perceptions about one’s body (13). Body image is a multidimensional concept of individual perception, affection, and behaviors (e.g., satisfaction or dissatisfaction with body image and evaluation of body size)

(14, 15). Body image involves different aspects, such as cognitive, emotional, social, and cultural, in addition to dissatisfaction with own body (14). A popular belief about body image is that social media and society with lean anthropometric profiles are beauty standards (16, 17). Moreover, physical activity is regarded as a critical component of a healthy lifestyle and disease prevention (18). A previous study has shown that a negative body image may work as both a motivation and a barrier to exercise participation (19).

Several studies revealed that body weight concerns and body dissatisfaction are prevalent in Arab countries, particularly among women. A survey conducted in five Arab countries (Syria, Bahrain, Jordan, Oman, and Egypt) shows that 33% of Arab women were dissatisfied with their body weight (20). In Saudi Arabia, 21.4% of men and 33.5% of women reported body image dissatisfaction (21). Another study among Saudi females attending fitness centers revealed that 87% were dissatisfied with their body image, including those of normal weight (22). Such findings may call the attention that the COVID-19 and NPIs will have negative implications for those individuals, particularly those who are physically active.

Accordingly, it is necessary to identify the perceived changes to their body image behaviors during this period considering the effects of the COVID-19 lockdown. We hypothesized that social isolation, lockdown, and quarantine in Saudi Arabia may have adversely impacted the perception of body image of physically active individuals. Thus, we aimed to assess the body dissatisfaction of physically active (men and women) during the COVID-19 lockdown in Saudi Arabia and determined the possible associated factors that can serve as a baseline for future policies and health programs.

Materials and methods

Design and participants

This descriptive cross-sectional study employed a total of 323 physically active individuals who were living in Saudi Arabia during the COVID-19 pandemic. The participants’ inclusion criteria were as follows: aged 18 years and above, Saudi nationals, physically active individuals exercising equal to or more than 150–300 min of moderate activity for 1 week, and member of a sports club. The participants were also asked to describe themselves as somehow active, amateur, and athletes for the classification of physical activity. A convenience sampling method was used due to the pandemic situation. A 5% margin of error, a confidence level of 95%, and a significance value of 0.05 were used as statistical parameters. Ethical approval for this study was approved by the King Saud University Ethics Research Committee. All participants provided informed consent prior to participating in this study.

Instrument

An instrument was developed which covered the following three areas: demographic questions, role and perception of body image, and reasons for physical activity during the COVID-19 quarantine. The demographic section includes age, sex, marital status, educational level, and body mass index (BMI). The Stunkard Figure Rating Scale (FRS) images were used to assess the perception of the body image of the participants. This questionnaire consists of two diagrams in which the first diagram ranks their actual body image based on the nine silhouette figures, while the second diagram ranks their desires to look like from the same nine figure images. A corresponding rating score of each figure is from 1 to 9, with nine representing the most obese figure and one the thinnest (23). The discrepancy between perceived and desired body image scores was calculated. Body dissatisfaction occurred when the desired silhouette was smaller than the self-evaluated and dissatisfaction with slimness when the desired shape was larger than the self-evaluated (23).

The International Physical Activity Questionnaire (IPAQ) was used to assess participants' physical activity levels. The participants were asked how often (the number of days per week) and for how long (the average time in minutes) they had been active at light, moderate, and vigorous intensities during the last 7 days. The intensities of physical activity were assigned to an average Metabolic Equivalent Time (MET) to yield MET-minutes (MET-min) per week. We based the overall MET value on the average MET value for each intensity in the MET compendium (24, 25). Light activity was 3.3 MET, moderate 4.0 MET, and vigorous 8.0 MET. All scored data were according to the IPAQ scoring protocol, version 2.0. All participants in one or more intensity levels had reported days (frequency) and time (duration) of physical activity or vice versa and were included in the analysis by summing up the frequency and duration of activity. A draft questionnaire was piloted and revised to a final survey of 19 items related to electronic survey response and demographic variables, which took approximately 15 min to complete. All the participants' responses were recorded *via* the platform of the study survey and downloaded by a trained researcher.

Data gathering procedure

All participants were recruited online through a sports club group. All eligible participants received an invitation, including a link to an online survey. The survey questionnaire includes participants' consent information, which explains the rationale for the study, and all participants' information is confidential and anonymous. All participants entered and completed the survey between June and July 2020.

Statistical analysis

Statistical analysis was performed using SPSS (version 23.0). Microsoft Excel was used for data entry, editing, and sorting. Continuous data were presented as mean and standard deviation (SD), and categorical data as frequency and percentage. The classifications of physical activity were categorized into three based on the guidelines and recommendations of the International Physical Activity Questionnaire Research Committee (IPAQ Research Committee, 2005). The proposed levels of physical activity are [i] inactive (low), [ii] minimally active (moderate), and [iii] health-enhancing physical activity, or a high active category (IPAQ Research Committee, 2005). Furthermore, the level of physical activity was dichotomized into moderate activity, which has >1,680 MET-min/week, and vigorous activity, whose MET-min/week was <1,680 (24–26). The association between body image and physical activity was examined using the chi-square test analysis. To assess the predictors associated with body dissatisfaction, we performed a multiple logistic regression model, and the odds ratios (ORs) and 95% confidence intervals (CIs) were obtained. The dependent variable was body image, and the reference category was "Satisfied". Statistical significance was set at $p < 0.05$.

Results

The composition of the study sample with age category shows that 29.1% were aged 18–24, 24.5% were aged 25–29 years, 17.3% were aged 30–34 years, 16.4% (26–30), and 12.7% were aged 40 years and above (Table 1). The majority of the participants were female ($N = 217$, 72.7%), were married (66.6%), and living in the Middle region of Saudi Arabia ($N = 268$, 83%). Sixty percent of the participants were of university education level, where a small sample had a high school/diploma (18.6%) or <high school (0.6%). Most of the respondents were amateurs ($N = 220$, 68.1%), and 26% ($N = 85$) were athletes in the club or the school. More than half of the participants had normal BMI levels ($N = 204$, 63%), 27.9% ($N = 90$) were overweight, and 9% of the participants were obese ($N = 29$). Notably, 31% of the participants had higher energy expenditure in MET-min/week of vigorous based on the 1,680 MET-min/week cutoff. The majority of the participants were dissatisfied with their current body shape or desired a smaller shape ($N = 276$, 85.5).

Table 2 displays the demographic characteristics of physically active individuals who were satisfied and dissatisfied with their body shape. The analysis shows that majority of the participants were dissatisfied and desired a smaller shape. The chi-square test analysis also indicated a significant association of participants' educational attainment and BMI with body dissatisfaction ($p = 0.001$). The proportion of physically active individuals with body dissatisfaction

TABLE 1 Demographic characteristics of the participants.

| Variable | N = 323 | % |
|--|---------|------|
| Age | | |
| 18–24 | 94 | 29.1 |
| 25–29 | 79 | 24.5 |
| 30–34 | 56 | 17.3 |
| 35–39 | 53 | 16.4 |
| 40 and above | 41 | 12.7 |
| Gender | | |
| Male | 66 | 27.3 |
| Female | 217 | 72.7 |
| Marital status | | |
| Single | 108 | 33.4 |
| Married | 215 | 66.6 |
| Educational level | | |
| <high school | 2 | 0.6 |
| High school/diploma | 60 | 18.6 |
| Bachelor's degree | 196 | 60.7 |
| High education degree | 65 | 20.1 |
| Region | | |
| Middle region | 268 | 83 |
| Eastern and Western region | 47 | 14.5 |
| Northern and Southern | 8 | 2.5 |
| Western | | |
| BMI | | |
| Normal | 204 | 63.1 |
| Overweight | 90 | 27.9 |
| Obese | 29 | 9 |
| Classification of physical activity | | |
| I am not always active | 18 | 5.6 |
| Amateur | 220 | 68.1 |
| Athletes in the club or school | 85 | 26.3 |
| Level of physical activity | | |
| METs-min/week from moderate activity < 1,680 | 222 | 68.1 |
| METs-min/week from vigorous activity > 1,680 | 103 | 31.9 |
| METs-min/week | | |
| Body dissatisfaction | | |
| Satisfied | 47 | 14.5 |
| Dissatisfied | 276 | 85.5 |

across educational attainment increased significantly (high school/diploma—77.4%, Bachelor's degree—85.7%, and Postgraduate or High education degree—92.3%, $p < 0.05$). Body dissatisfaction was also significantly associated with participants' BMI in which the majority of the participants who were overweight ($N = 65$, 72%) and obese ($N = 23$, 79.3%) were dissatisfied with their actual BMI ($p = 0.001$).

The analysis also shows that 92.2% who had normal BMI were dissatisfied or desired a smaller shape than their actual BMI ($p = 0.001$).

Multiple logistic regression was performed to assess the predictors of body dissatisfaction of physically active individuals. The model contained eight independent variables (age, gender, marital status, educational level, region, BMI level, classification of physical activity, and level of physical activity). As shown in Table 3, only one variable emerged as a significant predictor of body dissatisfaction of physically active individuals. The strongest predictor was BMI level, recording an OR of 5.99 (CI: 2.15–10.54, $p = 0.001$) in obese and an OR of 4.55 (CI: 1.3–9.35, $p = 0.001$) in overweight, indicating that compared with normal weight, obese and overweight participants were more likely to be dissatisfied by five and four times, respectively.

Discussion

This study intended to assess the body dissatisfaction of physically active (men and women) during the COVID-19 lockdown in Saudi Arabia. The analysis shows that majority of the participants were dissatisfied with their body image or desired a smaller shape. The findings were parallel with previous research among Saudi females attending fitness clubs and those adolescents in Brazil (14, 22). The less altered body image dissatisfaction of the participants was possibly driven by the concerns during a lockdown of not engaging in their usual physical activity routine. A previous study concurred that body dissatisfaction is associated with disordered eating (19). Behavior theory suggests that a common emotional response to a pandemic is an exaggerated feeling of fear or anxiety (31, 32). Therefore, these findings may support concerns that the COVID-19 lockdown is a factor in developing these complex health conditions.

Our results also highlight that educational attainment and BMI level were significantly associated with body dissatisfaction. These results confirm that body shape dissatisfaction was higher than those with higher education, as previously stated in other literature (33). With regards to body dissatisfaction between BMI levels, it was noted that the majority of participants with normal BMI levels were dissatisfied or desired a smaller shape than their actual BMI. Similar findings were found among Spanish adults and in the USA (34, 35). Our findings were also parallel to a study in Hong Kong in which the majority of the participants with normal weight status desired a leaner or slimmer body (33). The results are not surprising that a relatively high proportion of individuals with normal BMI levels misperceived their body image since our participants were physically active individuals. This mismatch could also have been perceived by the desire for an ideal body shape influenced by norms, media, and society (33). The findings indicate a signal of a feeling of distress and the development of anxiety among

TABLE 2 Association of body image dissatisfaction with demographic characteristics of the participants.

| Variable | N = 323 | Body Image | | P-value |
|--|------------|--------------------|------------------------|---------|
| | | Satisfied (N = 47) | Dissatisfied (N = 276) | |
| Age | | | | 0.568 |
| 18–29 | 173 (53.6) | 23 (13.3) | 150 (86.7) | |
| 30–39 | 109 (33.7) | 19 (82.6) | 19 (17.4) | |
| 40 and above | 41 (12.7) | 5 (87.8) | 36 (12.2) | |
| Gender | | | | 0.175 |
| Male | 66 (27.3) | 19 (17.6) | 89 (82.4) | |
| Female | 217 (72.7) | 28 (13) | 187 (87) | |
| Marital status | | | | 0.211 |
| Single | 108 (33.4) | 18 (16.7) | 90 (83.3) | |
| Married | 215 (66.6) | 29 (13.5) | 186 (86.5) | |
| Educational level | | | | 0.050 |
| High school/diploma | 62 (19.2) | 14 (22.6) | 48 (77.4) | |
| Bachelor's degree | 196 (60.7) | 28 (14.3) | 168 (85.7) | |
| High education degree | 65 (20.1) | 5 (7.7) | 60 (92.3) | |
| Region | | | | 0.091 |
| Middle region | 268 (83) | 44 (16.4) | 224 (83.6) | |
| Eastern and Western region | 47 (14.5) | 2 (4.3) | 45 (95.7) | |
| Northern and Southern Western | 8 (2.5) | 1 (12.5) | 7 (87.5) | |
| BMI | | | | 0.001 |
| Normal | 204 (63.2) | 16 (7.8) | 188 (92.2) | |
| Overweight | 90 (27.9) | 25 (27.8) | 65 (72.2) | |
| Obese | 29 (9) | 6 (20.7) | 23 (79.3) | |
| Classification of physical activity | | | | 0.094 |
| I am not always active | 18 (5.6) | 4 (22.2) | 14 (77.8) | |
| Amateur | 220 (68.1) | 32 (14.5) | 182 (85.5) | |
| Athletes in the club or school | 85 (26.3) | 11 (12.9) | 74 (87.1) | |
| Level of physical activity | | | | 0.311 |
| METs-min/week from moderate activity < 1,680 | 222 (68.1) | 34 (15.5) | 186 (84.5) | |
| METs-min/week from vigorous activity > 1,680 METs-min/week | 103 (31.9) | 13 (12.6) | 90 (87.4) | |

Chi-square tests for the differences in proportions; significance level at <0.05.

the participants. In addition, misperception of body shape is common, particularly among adolescents and adults (36–38).

Another result worth emphasizing was BMI levels as a predictor associated with the body dissatisfaction of the participants. The analysis indicated that the strongest predictor was obesity, followed by overweight participants in the BMI level. The research reflects the difference between BMI levels and body image perception of physically active individuals during the COVID-19 pandemic. These findings were consistent with previous research in Brazil (14, 17). A previous study suggests that promoting exercise needs to deemphasize weight loss and appearance for positive body image (27, 39). These findings demonstrated the importance of physical activity behavior as a potential mechanism to develop body image positivity. Considering the benefits of physical activity during quarantine and in relation to body image, it is necessary to identify ways and promote exercise during the isolation

period. Similarly, physical activity could be recommended to reduce the negative emotional effect during the periods of lockdown and quarantine (2, 28). In addition, digital health solutions such as exergames or the development of virtual coaches can allow easy and accurate interventions as well as recommendations to improve physical activity during the quarantine and pandemic (29).

The findings of this study present some limitations. First, the cross-sectional design of this study limits the causality. Second, the small sample size and the use of convenience sampling may result in bias and may not be able to generalize the entire population. However, the results are comparable with the previously conducted study. In addition, it produced information about body image perception (body dissatisfaction) and its association with the demographic characteristics of physically active individuals during the COVID-19 lockdown in Saudi Arabia.

TABLE 3 Predictors associated with body dissatisfaction among physically active individuals.

| | OR (95 % CI) | P-value |
|--|-------------------|---------|
| Variable | N = 323 | |
| Age | | 0.820 |
| 18–29 | 1 | |
| 30–39 | 1.11 (0.45–2.74) | |
| 40 and above | 0.36 (0.08–1.49) | |
| Gender | | 0.649 |
| Male | 1 | |
| Female | 0.84 (0.08–1.49) | |
| Marital status | | |
| Single | 1 | |
| Married | 1.36 (0.53–3.48) | |
| Educational level | | 0.099 |
| High school/diploma | 1 | |
| Bachelor's degree | 0.57 (0.25–1.29) | |
| High education degree | 0.26 (0.07–0.90) | |
| Region | | |
| Middle region | 1 | 0.094 |
| Eastern and Western region | 0.18 (0.04–0.84) | |
| Northern and Southern Western | 0.94 (0.09–9.30) | |
| BMI | | 0.001 |
| Normal | 1 | |
| Overweight | 4.55 (2.22–9.35) | |
| Obese | 5.99 (2.15–10.54) | |
| Classification of physical activity | | |
| I am not always active | 1 | 0.819 |
| Amateur | 0.77 (0.21–2.79) | |
| Athletes in the club or school | 0.64 (0.15–2.70) | |
| Level of physical activity | | |
| METs-min/week from moderate activity <1680 | 1 | 0.92 |
| METs-min/week from vigorous activity >1680 | 0.96 (0.45–2.20) | |

CI, confidence interval for odds ratio (OR); dependent variable "body image" and the reference category "Satisfied"; significance level at <0.05.

Conclusion

This study identified that the majority of the participants were dissatisfied with their current body shape. The analysis also found that the proportion of physically active individuals with body dissatisfaction increased significantly across educational attainment. In addition, the findings indicate a trend of increased body dissatisfaction from normal weight to overweight and then decreased likelihood of obese participants. This study indicates that confinement greatly influences physically active individuals. The findings of this study provide important insights into the effect of COVID-19 and NPIs among physically active individuals during the COVID-19 pandemic. The present results need to be interpreted with caution due to these limitations. The present findings have potential implications that could aid in developing interventions to mitigate the effect of the COVID-19 pandemic, particularly

among these individuals. We recommend programs that promote physical activity in their house or during lockdown which may help to encourage, lessen their anxiety, and maintain their health. This may also decrease the feeling of distress of physically active individuals.

Data availability statement

The data that support the findings of this study are available at the Department of Community Health Sciences, College of Applied Medical Science King Saud University, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request.

Ethics statement

Institutional Review Board Committee at King Saud University approved the study prior to enrollment in this study. The patients/participants provided their written informed consent to participate in this study.

Author contributions

MA contributed to data analysis, interpretation of results, drafting, or revising the manuscript, agreed to be accountable for all aspects of the study, and approved the final version of the manuscript.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

- Komies S, Aldahir AM, Almeahmadi M, Alghamdi SM, Alqarni A, et al. COVID-19 Outcomes in Saudi Arabia and the UK: A Tale of Two Kingdoms. *medRxiv*. (2020) 04.25.20079640. doi: 10.1101/2020.04.25.20079640
- Ozdemir F, Cansel N, Kizilay F, Guldogan E, Ucuz I, Sinanoglu B, et al. The role of physical activity on mental health and quality of life during COVID-19 outbreak: A cross-sectional study. *Eur J Integr Med*. (2020) 40:101248. doi: 10.1016/j.eujim.2020.101248
- Di Renzo L, Gualtieri P, Pivari F, Soldati L, Attinà A, Cinelli G, et al. Eating habits and lifestyle changes during COVID-19 lockdown: an Italian survey. *J Transl Med*. (2020) 18:229. doi: 10.1186/s12967-020-02399-5
- Naja F, Hamadeh R. Nutrition amid the COVID-19 pandemic: a multi-level framework for action. *Eur J Clin Nutr*. (2020) 74:1117–21. doi: 10.1038/s41430-020-0634-3
- Touyz S, Lacey H, Hay P. Eating disorders in the time of COVID-19. *J Eat Dis*. (2020) 8:19. doi: 10.1186/s40337-020-00295-3
- Weissman RS, Bauer S, Thomas JJ. Access to evidence-based care for eating disorders during the COVID-19 crisis. *Int J Eat Disord*. (2020) 53:369–76. doi: 10.1002/eat.23279
- Ammar A, Brach M, Trabelsi K, Chtourou H, Boukhris O, Masmoudi L, et al. Effects of COVID-19 home confinement on eating behaviour and physical activity: results of the ECLB-COVID19 international online survey. *Nutrients*. (2020) 12:1583. doi: 10.3390/nu12061583
- Chtourou H, Trabelsi K, H'mida C, Boukhris O, Glenn JM, Brach M, et al. Staying Physically active during the quarantine and self-isolation period for controlling and mitigating the COVID-19 pandemic: a systematic overview of the literature. *Front. Psychol*. (2020) 11:1708. doi: 10.3389/fpsyg.2020.01708
- Ammar A, Trabelsi K, Brach M, Chtourou H, Boukhris O, Masmoudi L, et al. Effects of home confinement on mental health and lifestyle behaviours during the COVID-19 outbreak: insights from the ECLB-COVID19 multicentre study. *Biol Sport*. (2021) 38:9–21. doi: 10.5114/biolsport.2020.96857
- Reiner M, Niermann C, Jekauc D, Woll A. Long-term health benefits of physical activity—a systematic review of longitudinal studies. *BMC Public Health*. (2013) 13:813. doi: 10.1186/1471-2458-13-813
- Warburton D, Bredin S. Health benefits of physical activity: a systematic review of current systematic reviews. *Curr Opin Cardiol*. (2017) 32:541–56. doi: 10.1097/HCO.0000000000000437
- World Health Organization. *Physical Activity*. (2020). Available online at: <https://bjsm.bmj.org/content/54/24/1451> (accessed January 3, 2021).
- Myers TA, Crowther JH. Social comparison as a predictor of body dissatisfaction: a meta-analytic review. *J Abnorm Psychol*. (2009) 118:683–98. doi: 10.1037/a0016763
- Miranda V, Morais NS, Faria ER, Amorim P, Marins J, Franceschini S, et al. Body Dissatisfaction, physical activity, and sedentary behavior in female adolescents. *Revista paulista de pediatria: orgao oficial da Sociedade de Pediatria de São Paulo*. (2018) 36:482–90. doi: 10.1590/1984-0462/2018;36;4:0005
- Sun W, Chen D, Wang J, Liu N, Zhang W. Physical activity and body image dissatisfaction among pregnant women: a systematic review and meta-analysis of cohort studies. *Eur J Obstet Gynecol Reprod Biol*. (2018) 229:38–44. doi: 10.1016/j.ejogrb.2018.07.021
- Frederick DA, Daniels EA, Bates ME, Tylka TL. Exposure to thin-ideal media affect most, but not all, women: results from the perceived effects of media exposure scale and open-ended responses. *Body Image*. (2017) 23:188–205. doi: 10.1016/j.bodyim.2017.10.006
- Silva L, Tucan A, Rodrigues EL, Del, R.é PV, Sanches P, Bresan D. Dissatisfaction about body image and associated factors: a study of young undergraduate students. *Einstein (São Paulo, Brazil)*. (2019) 17:eAO4642. doi: 10.31744/einstein_journal/2019AO4642
- Rahman ME, Islam MS, Bishwas MS, Moonajilin MS, Gozal D. Physical inactivity and sedentary behaviors in the Bangladeshi population during the COVID-19 pandemic: an online cross-sectional survey. *Heliyon*. (2020) 6:e05392. doi: 10.1016/j.heliyon.2020.e05392
- Robertson M, Duffy F, Newman E, Prieto Bravo C, Ates HH, Sharpe H. Exploring changes in body image, eating and exercise during the COVID-19 lockdown: a UK survey. *Appetite*. (2021) 159:105062. doi: 10.1016/j.appet.2020.105062
- Musaiger AO. Body size preferences among young women in five Arab countries: a cross-cultural study. *Int J Adolesc Med Health*. (2014) 26:417–21. doi: 10.1515/ijamh-2013-0317
- Al-Otaibi HH, Nassef SL, Raouf TA. Body shape dissatisfaction, weight status and physical activity among a sample university student in Saudi Arabia. *Food Nutr Sci*. (2013) 04:616–25. doi: 10.4236/fns.2013.46079
- Albawardi NM, AlTamimi AA, AlMarzooqi MA, Alrasheed L, Al-Hazza HM. Associations of body dissatisfaction with lifestyle behaviors and socio-demographic factors among Saudi females attending fitness centers. *Front Psychol*. (2021) 12:611472. doi: 10.3389/fpsyg.2021.611472
- Stunkard AJ, Sørensen T, Schulsinger F. Use of the Danish adoption register for the study of obesity and thinness. *Res Publ Assoc Res Nerv Ment Dis*. (1983) 60:115–20.
- Ainsworth BE, Haskell WL, Leon AS, Jacobs DR, Montoye HJ, Sallis JF, et al. Compendium of physical activities: classification of energy costs of human physical activities. *Med Sci Sports Exerc*. (1993) 25:71–80. doi: 10.1249/00005768-199301000-00011
- Ainsworth BE, Haskell WL, Whitt MC, Irwin ML, Swartz AM, Strath SJ, et al. Compendium of physical activities: an update of activity codes and MET intensities. *Med Sci Sports Exerc*. (2000) 32:S498–504. doi: 10.1097/00005768-200009001-00009
- AlMarzooqi MA. Physical activity and attitudes toward social media use of active individuals during the COVID-19 pandemic in Saudi Arabia: cross-sectional survey. *Front Psychol*. (2021) 12:707921. doi: 10.3389/fpsyg.2021.707921
- Gaddad P, Pemde HK, Basu S, Dhankar M, Rajendran S. Relationship of physical activity with body image, self esteem sedentary lifestyle, body mass index and eating attitude in adolescents: A cross-sectional observational study. *Fam Med Prim Care Rev*. (2018) 7:775–9. doi: 10.4103/jfmpc.jfmpc_114_18
- Slimani M, Paravlic A, Mbarek F, Bragazzi NL, Tod D. The relationship between physical activity and quality of life during the confinement induced by COVID-19 outbreak: a pilot study in Tunisia. *Front Psychol*. (2020) 11:1882. doi: 10.3389/fpsyg.2020.01882
- Ammar A, Bouaziz B, Trabelsi K, Glenn JM, Zmijewski P, Müller P, et al. Applying digital technology to promote active and healthy confinement lifestyle during pandemics in the elderly. *Biol Sport*. (2021) 38:391–6. doi: 10.5114/biolsport.2021.100149
- IPAQ Research Committee. *Guidelines for data processing and analysis of the International Physical Activity Questionnaire (IPAQ)-short and long forms*. (2005). Available online at: <http://www.ipaq.ki.se/scoring/~pdf> (accessed January 3, 2021).
- Bavel J, Baicker K, Boggio PS, Capraro V, Cichocka A, Cikara M, et al. Using social and behavioural science to support COVID-19 pandemic response. *Nat Human Behav*. (2020) 4:460–71. doi: 10.1038/s41562-020-0884-z
- Kwok KO, Li KK, Chan H, Yi YY, Tang A, Wei WI, et al. Community responses during early phase of COVID-19 epidemic, Hong Kong. *Emerging Infect Dis*. (2020) 26:1575–9. doi: 10.3201/eid2607.200500
- Cheung YT, Lee AM, Ho SY, Li ET, Lam TH, Fan SY, et al. Who wants a slimmer body? The relationship between body weight status, education level and body shape dissatisfaction among young adults in Hong Kong. *BMC Public Health*. (2011) 11:835. doi: 10.1186/1471-2458-11-835
- Bibili MD, Coll JL, Pich J, Pons A, Tur JA. Body image satisfaction and weight concerns among a Mediterranean adult population. *BMC Public Health*. (2017) 17:39. doi: 10.1186/s12889-016-3919-7
- Voelker DK, Reel JJ, Greenleaf C. Weight status and body image perceptions in adolescents: current perspectives. *Adolesc Health Med Ther*. (2015) 6:149–58. doi: 10.2147/AHMT.S68344
- López MI, Rodríguez Cabeo D. Body image of Spanish children and adolescents. Differences by diet and physical activity. *Atena J Sports Sci*. (2020) 2:5.
- Monteagudo, Sánchez C, Dijkstra SC, Visser M. Self-perception of body weight status in older Dutch adults. *J. Nutr. Health Aging*. (2015) 19:612–8. doi: 10.1007/s12603-015-0486-z
- Sonneville KR, Thurston IB, Milliren CE, Gooding C, Richmond TK. Weight misperception among young adults with overweight/obesity associated with disordered eating behaviors. *Int J Eat Disord*. (2016) 49:937–46. doi: 10.1002/eat.22565
- Homan KJ, Tylka TL. Appearance-based exercise motivation moderates the relationship between exercise frequency and positive body image. *Body Image*. (2014) 11:101–8. doi: 10.1016/j.bodyim.2014.01.003