

The risk of exercise addiction mediates the relationship between social media use and mental health indices among young Iranians

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ABSTRACT

Exposure to social media can motivate some individuals' desire to be thinner and to attain an ideal body shape. This may also motivate a minority of individuals to engage in extreme exercise. Moreover, both problematic social media use and problematic exercise can have detrimental effects on mental health. A community sample of Iranian adolescents ($n = 562$; mean age = 14.95 years [$SD \pm 1.70$]; 62.5% female) and young adults ($n = 745$; mean age = 26.19 years [$SD \pm 7.42$]; 60.5% female) participated in an online survey designed to evaluate the mediating role of exercise addiction in the relationship between problematic social media use and mental health consequences. Results indicated that 2.7% of adolescents and 4.4% of young adults were at risk for exercise addiction. After controlling for age, gender, body mass index (BMI), and educational attainment level, the results indicated that problematic social media use significantly predicted exercise addiction. Among both adolescents and adults, exercise addiction significantly mediated the association between problematic social media use and mental health consequences including psychological distress ($\beta_s = 0.06-0.12$), insomnia ($\beta_s = 0.07-0.09$), body image concern ($\beta_s = 0.19-0.10$), and compulsive eating ($\beta_s = 0.06-0.07$). Given that exercise addiction mediated the relationship between problematic social media use and mental health consequences, it is recommended that public health campaigns are needed for Iranian adolescents and young adults to raise their awareness about the potentially detrimental health consequences in relation to problematic social media use and exercise addiction. The findings suggest a need for an additional cross-cultural study examining the effect of social media on exercise addiction, in order to gain a more comprehensive understanding to help in terms of prevention and intervention for adolescents and emerging adults both in and outside of Iran.

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1. Introduction

At a time when many individuals, particularly adolescents and young adults, spend their lives immersed in the world of social media, the risk of addiction (Kircaburun et al., 2020; Tunc-Aksan & Akbay, 2019) or compulsive engagement (Van den Eijnden et al., 2016) among a minority of individuals has become a growing concern. Andreassen and Pallesen (2014) defined addictive social media use as *“being overly concerned about online activities, driven by an uncontrollable motivation to perform the behavior, and devoting so much time and effort to it that it impairs other important life areas”* (p.4054). It has also been claimed that addictive use features a number of core common components (i.e., tolerance, salience, mood modification, relapse, withdrawal, and conflict) (Griffiths & Kuss, 2017). According to a Pew Research Center (2021), 72% of American adults under the age of 30 years use social media

daily, and the prevalence of problematic social media use ranges from 4.5% to 24% (Bányai et al., 2017; Kuss & Griffiths, 2011; Lenhart et al., 2015).

There is a substantial body of literature on the relationship between social media use and a variety of mental health outcomes, including – but not limited to – body image concern and body dissatisfaction (Ahadzadeh et al., 2017; Grabe et al., 2008; Rodgers & Melioli, 2016; Ryding & Kuss, 2020; Santarossa & Woodruff, 2017; Yurdagül, et al., 2021), eating problems (Imperatori et al., 2021; Rodgers & Melioli, 2016; Rodgers et al., 2013; Santarossa & Woodruff, 2017; Smith et al., 2013), psychological distress (Chen et al., 2020; 2021; Keles et al., 2020; Korkmazer et al., 2022; Lin et al., 2020; Wong et al., 2020; Yurdagül et al., 2021), and sleep disturbances (Bhat et al., 2018; Sadagheyani & Tatari, 2021; Lin et al., 2020; 2021; Malaeb et al., 2021; Wong et al., 2020).

To date, a number of studies have been conducted examining the effect of various social media platforms on physical activities, particularly fitness and appearance (e.g., Boepple et al., 2016; Hofstetter et al., 1995; Taveras et al., 2004). For example, one trend in online media is fitness inspiration (“fitspiration”) websites that promote a fit and healthy lifestyle through exercise and nutrition (Boepple et al., 2016). This type of media is well-known for motivating individuals to engage in extreme exercise (Trott et al., 2020; Boepple et al., 2016; Cataldo et al., 2021; Raggatt et al., 2018). Exposure to social media sources, particularly those that contain images (i.e., personal profiles), encourages individuals to compare their appearance with other users, which is necessary for dieting, becoming thinner, and fulfilling a person’s ideal body image, which may result in lower body image (Kim & Chock, 2015; Kleemans et al., 2018; Rounsefell et al., 2019; Tiggemann, & Miller, 2010). It may also motivate a minority of individuals to engage in extreme exercise (which for some, may result in exercise addiction). For instance, Trott et al. (2020) observed that using social media is a significant predictor for high exercise addiction among health club users with eating disorders. Holland and Tiggemann

(2017) found that those females who often share fitspiration-related posts, have higher levels of drive for thinness, bulimia, muscularity, and excessive exercise. Moreover, they also reported that among these women, excessive exercise was associated with eating disorders. They explained that this type of social media activity results in the desire to exercise. For some, this exercise can become problematic when trying to attain a socially ideal appearance, rather than exercising for health. These findings help explain why exercise addiction is associated with body image concerns because individuals compare their own bodies to idealized figures they see on social media (images which are often a non-real, edited, filtered and/or photo-shopped representation). Such individuals believe that by increasing their physical activity, they will conform to the social media standards, but this is unlikely to happen for most individuals (Tiggemann et al., 2020).

Exercise addiction has been defined as a desire for excessive physical activity that is manifested by an uncontrollable and maladaptive pattern of exercise that can result in physiological symptoms and psychological distress (e.g., Grandi et al., 2011; Guidi et al., 2009; Hausenblas & Downs, 2002; Kun et al., 2021; Lichtenstein, Nielsen, et al., 2018; Magee et al., 2016). It is associated with eating disturbances (Godoy-Izquierdo et al., 2021; Gori et al., 2021; Bamber et al., 2000), and frequently occurs in conjunction with eating disorders (Alcaraz-Ibáñez et al., 2020; Simon-Grima et al., 2018; Weinstein & Weinstein, 2014). However, exercise addiction may also be a manifestation of eating disorders as it is nearly 3.5 times more prevalent (i.e., comorbid) among individuals with eating disorders than among individuals without eating disorders (Trott, Jackson, et al., 2021). It is consistent with research showing the prevalence of exercise addiction among individuals with eating disorders (60.2%) is over twice as high in comparison to individuals with no eating disorders (24.7%) among health club users (Trott, Yang, et al., 2020).

Exercise addiction can also have a detrimental effect on sleep (Mayolas-Pi et al., 2017). In fact, Veale (1995) included insomnia as a withdrawal symptom in the context of exercise addiction criteria. The first studies investigating exercise addiction also reported this. Baekeland (1970) examined a sample of regular exercisers across two phases (i.e., first in days they had usual exercise and second after a one-month exercise deprivation period). Baekeland observed a high level of anxiety following exercise deprivation, which resulted in altered sleep patterns and sleep disturbances. Recent research also indicates a positive association between exercise addiction and insomnia, which may be explained by increased cortisol levels (Torstveit et al., 2019), resistance to rest, and dehydration (Peake, 2019).

It should also be noted the majority of studies on exercise addiction and problematic social media use have been conducted in western cultures. Therefore, the present study is important for examining potentially valuable empirical insights, and a deeper understanding of exercise addiction in a non-Western culture (i.e., Iran). The problem of body image and body dissatisfaction among young Iranians also highlights the importance of studying problematic social media use and exercise addiction, given that exposure to physical appearance ideals in social media “may” motivate some individuals to exercise to achieve the ideal body shape. According to a recent systematic review synthesizing 44 papers published in Iran, Shoraka et al. (2019) reported that the prevalence of body dissatisfaction was 30% among young men and 60% among young women, 40-75% among adolescents, 50% among elementary schoolgirls, and 30% among elementary schoolboys. A growing proportion of young men are dissatisfied with their bodies. Increased interest in physical fitness is a major contributor to males’ body dissatisfaction. Iranian males are less pressured than Iranian females to conform to their gender-related ideal physical appearance (i.e., being muscular and athletic for males and being thin for females; Shoraka et al., 2019). Young males favour a mix of body and strength in line with western and their traditional cultures. The influence of

western beauty standards that promote thin women as the perfect example, and the traditional roles of women, particularly in oriental civilizations, can heighten women's sensitivity of body image and related difficulties. In Iran, this practice has increased in recent years. Globalization, the rise in the level of education, and the creation of new employment positions have made women more prominent in society than in the past, but they are still expected to maintain their traditional and familial roles, such as being elegant and beautiful (Shoraka et al., 2019).

Therefore, the present study may provide insight regarding important cultural differences in this context. There are substantial cultural variations between Western and Eastern nations, including attitudes toward behavior, personality, and manner of life in general (Wang, 2007). Iran is also a relatively young nation, with 40% of its 80 million inhabitants' population between the ages of 30 and 64 years (The Islamic Republic News Agency, 2022b). A recent meta-analysis reviewing published studies in Iran, estimated that approximately 25% of the population is affected by a mental disorder (Taheri Mirghaed et al., 2022), with a recent meta-analysis in Iran reporting a considerable prevalence (22%) of eating disorders (for a review, see Hashemi et al., 2022).

In Iran, according to the last report in 2019, there are only 6,000 licenced psychologists providing mental health services for the eighty-millions population of Iran (The Fars News Agency, 2022). In addition, these resources are not dispersed uniformly across the nation, are prohibitively expensive, and are not covered by health insurance (The Islamic Republic News Agency, 2022a).

The majority of Iranians (78%) use at least one social media application, according to Iranian Students Polling Agency (2022) (i.e., *WhatsApp*, *Instagram*, *Telegram*, *Facebook*, and/or *Twitter*). With the rapid growth of habitual social media use, particularly among the younger generation, and the medium's emphasis on appearance through user comparisons,

(highlighting content related to ideal physical appearance), some adolescents and young adults have become more concerned with their body shape and self-presentation, increasing their risk of developing negative mental outcomes.

According to a recent review by Szabo et al. (2019), six hypotheses have been proposed to explain exercise addiction including the (i) sympathetic arousal hypothesis (after training, a decreased resting heart rate may generate relaxation and pleasant engagement in routine exercise.), (ii) affect regulation hypothesis (exercise contributes to increases in positive affect, improvements in mood state, and reductions in negative affect), (iii) thermogenic regulation hypothesis (physical exercise raises body temperature, which is connected with decreased anxiety, enhanced relaxation, and plays as a positive reinforcer of more exercise), (iv) catecholamine hypothesis (by increasing catecholamines, exercise alters central catecholaminergic activity, which has distinct psychological benefits, such as on cognitive performance), (v) endorphin hypothesis (this relates to the ‘runner's high’ phenomenon, a happy feeling state associated with a positive self-image, a sense of energy, a sense of control, and a sense of accomplishment that is reported after a specific amount of intense exercise; here, increased exercise may contribute to increased endorphin release), and, (vi) cognitive appraisal hypothesis (exercising as a means of stress management and experiencing psychological comfort after exercise).

The present authors’ conceptualization of the links between problematic social media use, exercise addiction, and mental health consequences is grounded in the cognitive appraisal hypothesis of exercise addiction based on negative reinforced behavior (Szabo, 1995). Here, some exercisers engage in physical activity to escape their emotional distress (caused by content related to ideal physical appearance). They engage in physical activity to alleviate stress. Once an individual begins using exercise to cope with adversity (of being far from the ideal physical appearance), they become dependent on a sort of exercise since each session

produces the desired psychological effect (“*I’m getting closer to the ideal shape*”). Consequently, the individual experiences a type of psychological relief following exercise.

When exercise is restricted for some reason, the exerciser loses their coping mechanism. The lack of exercise produces the opposite impact (i.e., negative psychological feelings such as irritation, guilt, anxiety, lethargy, etc.). These sensations are collectively referred to as withdrawal symptoms resulting from a lack of or reduction in physical activity. The avoidance of these symptoms serves as a negative reinforcer for physical activity (Szabo, 1995). Also, the reported psychological alleviation may be an indication of affect and mood states improvement, as well as increases in body temperature, endorphin, and catecholamine levels, and a reduction in sympathetic arousal.

As social media platforms can be key factors in encouraging individuals to sustain regular exercise, the present study examined whether exercise addiction mediates the relationship between problematic social media use and negative mental health consequences. It was hypothesized that if problematic social media use encourages individuals with a poor body image to exercise, problematic exercise may in turn result in detrimental health consequences such as eating problems, psychological distress, and sleep problems. To enhance the internal validity of the study, individuals’ age, gender, educational level, and body mass index (BMI) were controlled for in the mediation model. Moreover, it is of utility to investigate the prevalence of exercise addiction among Iranian adolescents and young adults based on the cut-off values of exercise addiction inventories (adolescent and adult versions).

2. Method

2.1. Participants and procedure

The present study collected data using an online survey. Participants were recruited through advertisements on popular social media apps (*WhatsApp, Instagram, Telegram, Facebook, and Twitter*) in Iran, according to the Iranian Students Polling Agency (ISPA.ir, 2022). A total of

1464 individuals initially participated in the study (including 635 adolescents, who were aged 13-18 years). The shared post contained an invitation message, inclusion criteria, purpose of the study, and a link to the survey. Participants were informed about the confidentiality of their information to the researcher and the right to leave the study at any time without penalty. Eligible participants included those aged 13 years or older and were provided with an informed consent form (including parental consent for those participants under 18 years). The survey included bespoke questions and validated psychometric scales. Those aged under 18 years completed adolescent versions of scales if available (e.g., the youth version of the exercise addiction Inventory as opposed to the adult version). Therefore, adolescents and young adults' data were analyzed separately. Two additional items were added to detect careless responders. This resulted in the removal of 157 participants from the analysis. In total, data from 562 adolescents (mean age = 14.95 years [SD±1.70]; 62.5% female) and 745 young adults (mean age = 26.19 years [SD±7.42]; 60.5% female) were included in the final analysis. The present study was conducted in accordance with the 1989 Helsinki Declaration and was approved by the institutional review board.

2.2. Measures

2.2.1. Socio-demographic variables

In relation to demographic features, participants were asked to provide their age, gender, educational level, weight, and height. This information is presented in Table 1.

2.2.2. Bergen Social Media Addiction Scale (BSMAS)

The BSMAS (Andreassen et al., 2016; Persian version: Lin et al., 2017) is a unidimensional scale comprising six items used to assess the risk of problematic social media use. Items (e.g., “Felt an urge to use social media more and more”) are rated on a five-point scale from 1 (*very rarely*) to 5 (*very often*). The BSMAS total score ranges from 6-30, and high scores indicate high likelihood of the risk of problematic social media use. Bányai et al. (2017) have suggested

19 as a cutoff score for being at risk of problematic social media use. The internal consistency (α) in the present study was .77.

2.2.3. Exercise Addiction Inventory (EAI)

The EAI (Terry et al., 2004; Persian version: Akbari et al., 2022) is a unidimensional scale comprising 6 items used to assess the risk of exercise addiction. Items (e.g., “*I use exercise as a way of changing my mood*”) are rated on a five-point scale from 1 (*strongly disagree*) to 5 (*strongly agree*). The EAI total score ranges from 6-30. Scores equal to or greater than 24 may be predictive of exercise addiction risk. In the present study, this scale was used for participants who were aged 18 years or older. The internal consistency (α) in the present study was .714.

2.2.4. Exercise Addiction Inventory- Youth Version (EAI-Y)

The EAI-Y (Lichtenstein, Griffiths et al., 2018; Persian version: Akbari et al., 2022) is a unidimensional scale comprising six items that is used to assess the risk of exercise addiction among adolescents. Items (e.g., “*I have conflicts with family or friends because I exercise so much*”) are rated on a five-point scale from 1 (*strongly disagree*) to 5 (*strongly agree*). The EAI-Y total score ranges from 6-30. Scores equal to or greater than 24 may be predictive of exercise addiction risk. In the present study, this scale was used for participants who were aged under 18 years. The internal consistency (α) in the present study was .718.

2.2.5. Body Image Concern Inventory (BICI; Littleton et al., 2005)

The BICI (Littleton et al., 2005; Persian version: Pooravari et al., 2014) comprises 19 items that assess dysmorphic concerns. Items are rated on a five-point scale from 1 (*never*) to 5 (*always*). It comprises two subscales: (i) dissatisfaction and shame about one’s appearance, and checking deficits (12 items; e.g., “*I am ashamed of some part of my body*”), and (ii) interference with social function because of appearance concerns (seven items; e.g., “*I have missed social activities because of my appearance*”). The BICI total score ranges from 19-95,

and high scores indicate higher levels of dissatisfaction with one's appearance. The internal consistency (α) in the present study was .92.

2.2.6. *Compulsive Eating Scale (CES)*

The CES (Kagan & Squires, 1984; Persian version: Mostafavi et al., 2016) comprises eight items, assessing the failure to control individuals' eating behavior. Items are rated on a five-point scale: never (1), once or twice a year (2), once a month (3), once a week (4), and more than once a week (5). It comprises two subscales: (i) overeating (e.g., "*Eating so much that stomach hurts*"), and (ii) eating when not hungry (e.g., "*Eating because of feeling lonely*"). The CES total score ranges from 8-40, and high scores indicate more severe eating disorders. The internal consistency (α) in the present study was .82.

2.2.7. *Depression Anxiety Stress Scale-21 (DASS-21)*

The DASS-21 (Lovibond & Lovibond, 1995; Persian version: Asghari et al., 2008; Sahebi et al., 2005) comprises 21 items and is used to assess negative symptoms of depression, anxiety, and stress during the past week. Items are rated on a four-point scale from 0 (*Did not apply to me at all*) to 3 (*Applied to me very much, or most of the time*). It comprises three seven-item subscales: (i) depression (e.g., "*I felt I wasn't worth much as a person*"), (ii) anxiety (e.g., "*I experienced trembling [e.g., in the hands]*"), and (iii) stress (e.g., "*I found it difficult to relax*"). The DASS-21 total score ranges from 0-63, and high scores indicate higher levels of depression, anxiety, or stress. The internal consistency (α) in the present study was .93.

2.2.8. *Insomnia Severity Index (ISI)*

The ISI (Morin, 1993; Persian version: Yazdi et al., 2012) comprises seven items and is used to assess insomnia symptoms and consequences during the two past weeks (including the severity of problems related to sleep-onset, sleep maintenance and early morning awakening, satisfaction with sleep pattern, interference with daily functioning, noticeability of impairment attributed to the sleep problems, and level of distress caused by the sleep problems. Items (e.g.,

“How worried/distressed are you about your current sleep problems?”) are rated on a five-point scale from 0 to 4. The ISI total score ranges from 0-28, and high scores indicate higher levels of insomnia severity. The internal consistency (α) in the present study was .82.

2.3. Data analysis

Data were analyzed using SPSS and Amos version 28. Descriptive data were calculated using frequencies and percentages for nominal/binary variables and means and standard deviations for numeric variables. To test the mediating effect of exercise addiction in relationship between problematic social media use and mental health outcomes (i.e., insomnia, anxiety, depression, stress, body image concern, and compulsive eating) among both adolescent and young adult groups, structural equation modeling (SEM) with full information maximum likelihood (FIML) was conducted on the data. A two-step process of modeling was used (Byrne, 2001). In the first step, confirmatory factor analysis (CFA) was conducted to examine the measurement model. In the second step, SEM was conducted and adjusted for age, gender, education, BMI. The indirect associations were tested using a bias-corrected bootstrap confidence interval with 10,000 bootstrap samples. Several indices were used for assessing the model fit: (CFI; Bentler, 1990), Tucker-Lewis index (TLI; Tucker & Lewis, 1973), standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA; Joreskog & Sorbom, 1981). Model fit is accepted if CFI and TLI > 0.9 and SRMR and RMSEA < 0.08 (Hu & Bentler, 1999). Multigroup analysis was conducted to test structural invariance between male and female participants among both adolescents and young adults. Invariance is confirmed if the CFI difference (Δ CFI) is <0.01 (Byrne, 2016).

3. Results

Results indicated that the prevalence of the risk for exercise addiction was 2.7% and 4.4% for young adults. There were no significant differences between adolescents and young adults in the proportion of individuals who were risk for exercise addiction ($Q = 2.74, df = 1, p = 0.10$).

The results of the intercorrelations between study variables for both groups (i.e., adolescent and young adult groups) is reported in Table 2. The strongest correlation was found between psychological distress and body image concern among adolescents ($r = .64$) while the strongest correlation among young adults was between exercise addiction and compulsive eating ($r = .60$).

Tables 3 and 4 summarize the result of mediation effect of exercise addiction in the relationship between problematic social media use and mental health for adolescents and young adults. As Table 3 shows, there was a direct effect of problematic social media use on exercise addiction ($\beta = 0.657$, 95% CI = 0.585–0.744), insomnia ($\beta = 0.422$, 95% CI = 0.325–0.529), anxiety ($\beta = 0.248$, 95% CI = 0.183–0.318), depression ($\beta = 0.315$, 95% CI = 0.236–0.397), stress ($\beta = 0.364$, 95% CI = 0.276–0.439), body image concern ($\beta = 0.794$, 95% CI = 0.508–1.087) and compulsive eating ($\beta = 0.305$, 95% CI = 0.168–0.406). Exercise addiction was found to be a significant mediator in the relationship between problematic social media use and all mental health outcomes (Table 3). The model fit was found to be acceptable: $\chi^2(15) = 113.168$, $p < .01$, RMSEA = .046, SRMR = .050, NNFI = .946, and CFI = .959.

Table 4 shows the mediating effects of exercise addiction in relationship between problematic social media use and mental health among young adults. There was a direct effect of problematic social media use on exercise addiction ($\beta = 0.701$, 95% CI = 0.631–0.759), insomnia ($\beta = 0.366$, 95% CI = 0.239–0.455), anxiety ($\beta = 0.237$, 95% CI = 0.182–0.307), depression ($\beta = 0.256$, 95% CI = 0.170–0.351), stress ($\beta = 0.318$, 95% CI = 0.247–0.405), body image concern ($\beta = 1.067$, 95% CI = 0.749–1.344) and compulsive eating ($\beta = 0.295$, 95% CI = 0.152–0.416). Exercise addiction was found to be a significant mediator in relationship between problematic social media use and all mental health outcomes among young adults (Table 4). The model fit was satisfactory $\chi^2(15) = 105.945$, $p < .01$, RMSEA = .044, SRMR = .048, NNFI = .950, and CFI = .960. All structural models showed invariance ($\Delta CFI < 0.01$)

between male and female participants (Table 5). Additionally, Figure 1 shows the results of the analysis in the study's model.

4. Discussion

The purpose of the present study was to examine the mediating role of exercise addiction in the relationship between problematic social media use and mental health outcomes among Iranian adolescents and adults.

Results indicated that 2.7% of adolescents and 4.4% of young adults were at risk for exercise addiction. However, this was not statistically significant. The prevalence range of individuals at risk for exercise addiction in our general sample in the present study was greater than 0.5% reported from the general population as assessed using the Exercise Addiction Inventory in a nationally representative study (Mónok et al., 2012) but somewhat similar to that among exercisers (3.2%) in the same study. The prevalence of exercise addiction will also vary based on the type of exercise engaged in (Di Lodovico et al., 2019) and the severity of eating disorder (if any) (Trott, Jackson, et al., 2021).

The significant associations found in the present study were consistent with findings from previous studies which have shown significant relationships between social media and body image concern (Ahadzadeh et al., 2017; Grabe et al., 2008; Rodgers & Melioli, 2016; Ryding & Kuss, 2020; Santarossa & Woodruff, 2017; Yurdagül et al., 2021), eating problems (Imperator et al., 2021; Rodgers & Melioli, 2016; Rodgers et al., 2013; Santarossa & Woodruff, 2017; Smith et al., 2013), psychological distress (Chen et al., 2020; 2021; Keles et al., 2020; Korkmazer et al., 2022; Lin et al., 2020; Wong et al., 2020; Yurdagül et al., 2021), and sleep disturbances (Bhat et al., 2018; Sadagheyani & Tatari, 2021; Lin et al., 2020; 2021; Malaeb et al., 2021; Wong et al., 2020).

This was also true for the association between exercise addiction and body image concerns (Babalou & Salehian, 2019), psychological distress (Hausenblas & Downs, 2002;

Magee et al., 2016; Kun et al., 2021; Nielsen et al., 2018), eating problems (Godoy-Izquierdo et al., 2021; Gori et al., 2021; Weinstein & Weinstein, 2014; Simon-Grima et al., 2018), and sleep disturbances (Mayolas-Pi et al., 2017). Moreover, the positive association between exercise addiction and problematic social media use was consistent with previous findings in the literature (e.g., Trott, et al., 2020).

The findings showed the mediating role of exercise addiction in the variables evaluated among both adolescents (boys and girls) and adults (men and women), even after age and educational level were controlled for. This suggests that irrespective of gender or age, problematic social media use may result in an amplified desire for physical activity as a way of meeting media-imposed standards of beauty, power, and success (De Sousa Silva et al., 2018). The results are supportive of the cognitive appraisal hypothesis (Szabo, 1995). Consequently, some exercisers engage in physical activity to avoid experiencing negative emotions (caused by content related to ideal physical appearance, whereas some people may participate in physical activity as a means of relieving stress. Once a person begins using exercise as a means of overcoming adversity (e.g., of being far from the ideal physical look), they get dependent on a specific type of exercise since each session generates the intended psychological effect (*"I'm getting closer to the perfect shape"*). The individual receives a form of psychological relief as a result of exercise. When physical activity is restricted, the exerciser loses a coping mechanism, and therefore might be more prone to mental distress.

In the following paragraphs, an attempt is made to explain the mediating role of exercise addiction in the relationship between problematic social media use and the studied variables.

Psychological distress. While it is obvious that exercise helps keep the body healthy and looking good, the model tested in the present study demonstrated that over-exercise is associated with psychological distress. There might be two reasons for this. First, even with excessive exercise, individuals are unlikely to end up looking like social media models

especially as the images seen are often manipulated and edited, and not representative of reality (Tiggemann & Anderberg, 2020). Second, problematic exercise itself can negatively affect an individual's physical and mental health. From a psychological perspective it can lead to pain, anxiety, depression, and impairment in social life (Lichtenstein et al., 2017), and from a physiological perspective it can lead to physical injuries, irreversible health consequences, and (in extreme cases) mortality (Cumella, 2005). The interplay of the aforementioned factors appears to amplify the negative effects on mental health.

Insomnia. Increased time spent on social media, particularly in bed, is associated with sleep disturbance (Bhat et al., 2018). Therefore, the mediating role of exercise addiction may be due to increased time spent on reaching the desired body shape (Taveras et al., 2004) or increased motivation to continue exercising to obtain intended body shape (Boepple et al., 2016; Cataldo et al., 2021; Raggatt et al., 2018). Additionally, from exercise addiction to insomnia, a physiological explanation could be a higher cortisol level (Torstveit et al., 2019), maladaptation to training load, resistance to rest, dehydration, and increased body temperature as a result of inadequate recovery following exercise (Peake, 2019).

Compulsive eating. A physiological perspective may help to explain the mediating role of exercise addiction in the relationship between problematic social media use and compulsive eating. Individuals with higher exercise dependency exhibit a more pronounced energy deficiency, lower blood glucose, and higher cortisol levels which may make individuals more prone to more eating (Torstveit et al., 2019). Also, a psychological explanation could be eating disorders co-occurring (Padín et al., 2021) because individuals with problematic eating feel compelled to stop eating and exercise more when confronted with social media standards, which may lead to more eating and, again, more distress due to not resembling or achieving social media's prescribed standards.

Body image concerns. The reason for exercise addiction's mediating role in the relationship between problematic social media use and body image concerns could be that such individuals are comparing their reality to idealized body shape on social media, which are often a non-real and best-edited representation (Tiggemann et al., 2020). They expect that by increasing their exercise, they will conform to social media's prescribed standards.

Clinical implications

Clinicians who are dealing with clients who are exercising excessively and demonstrating psychological distress, insomnia, compulsive eating, and body image concerns may want to consider whether social media use is fueling this problematic behavior. If the answer is yes, such clients must understand that reality differs from what is displayed on social media. In order to do this, social media literacy may be one way to begin the intervention. For example, McLean et al. (2017) demonstrated that providing a social media literacy intervention called "The Boost Body Confidence and Social Media Savvy Intervention", protected clients (101 adolescent girls; $M_{\text{age}} = 13.13$ years, $SD = 0.33$) from the antecedents of problematic social media use. The intervention aimed to (i) increase media literacy relating to the influential and targeted nature of advertising on social media, (ii) critique digitally manipulated images on social media, (iii) reduce appearance comparisons with social media images, (iv) develop resilience to upward comparisons on social media, (v) reduce frequency of peer appearance-related commenting on social media, and (vi) reduce focus on and importance of appearance in social media interactions. The intervention successfully reduced eating disorders caused by social media environments among teenage girls. Such an intervention may also be beneficial for those with exercise addiction.

Given that excessive exercise is often a maladaptive coping mechanism, it would also be beneficial to familiarize clients with the idea of psychological flexibility and its components. Such clients may appreciate that what they see on social media is not always real given that

individuals tend to post their best-edited photos. Individuals need to accept their body shape for what it is so that they can practice psychological flexibility. First, clients should learn about their value system and what is important. Then they should learn how not to avoid experiencing emotional distress from not being perfect and ideal. Then, they need to learn how to harness the experienced distress (Akbari, Seydavi et al., 2021).

Limitations and future directions

Despite the relatively large sample size, the use of well-established psychometric instruments, and testing for measurement invariance, the findings of the present study should be viewed in the context of their limitations. The cross-sectional nature of the design means that causality between any of the variables examined could not be determined. Second, self-report assessments may lead to the possibility of recall bias. Third, convenience sampling, the absence of clinical interviews, and the overrepresentation of females may have reduced the generalizability of the findings. Given that data were obtained during the COVID-19 pandemic in Iran and that people's distress was elevated (Akbari et al., 2022b), the estimated prevalence of exercise addiction may be confounded or inflated by this issue, requiring caution in interpreting and generalizing the findings.

However, the findings lay the ground for further research. Future research may wish to replicate the tested model among athletes and to employ clinical interviews with a more gender-balanced sample. The tested model should be replicated among individuals with and without eating problems who have an exercise addiction to see if social media use has a robust effect on exercise addiction irrespective of problematic eating. While testing the model, it would be worthwhile investigating the moderating influence of psychological flexibility, time spent on social media, fitness inspiration from social media, and social media literacy in the association between exercise addiction and mental health outcomes.

Conclusion

Given that exercise addiction mediated the relationship between problematic social media use and mental health consequences among adolescents and young adults, it is recommended that public health campaigns are needed for Iranian adolescents and young adults to raise their awareness about the potentially detrimental health consequences in relation to problematic social media use and exercise addiction. In addition, the findings suggest a need for further research in other cultures on the effects of problematic social media use on exercise addiction, which will help provide a more comprehensive understanding of the underlying causes, thereby aiding in the development of prevention and intervention strategies for health practitioners and therapists. However, the findings may only be applicable to the Iranians and may not be fully applicable to individuals from Western, Educated, Industrialized, Rich, and Democratic (WEIRD) nations (Henrich et al., 2010).

Moreover, the findings may have implications for countries with similar demographics to Iran, where the majority of the population is young (40% are aged from 30 to 64 years), body dissatisfaction and body image problems are on the rise (Shoraka et al., 2019), and the majority of people utilize social media, with *Instagram* being among the most popular platforms (Iranian Students Polling Agency, 2022). *Instagram*, an application that offers photographs and videos, may be a more powerful facilitator of exercise addiction than application like *Twitter* (which tends to be more text-based). *Instagram* use could expose young people to ideal physical appearance by fitspiration-related posts (Holland & Tiggemann, 2017) or by images that may trigger individuals to compare their appearance with other users, which is necessary for dieting, becoming thinner, and fulfilling an individual's ideal body image which may result in poorer body image (Kim & Chock, 2015; Kleemans et al., 2008; Rounsefell et al., 2019; Tiggemann, & Miller, 2010). Based on the present study, researchers in other countries could perhaps use the findings in the development of prevention programs to help make vulnerable individuals

more aware of the potential relationship between social media use and exercise addiction among adolescents and emerging adults.

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Informed Consent

Informed consent was obtained from all participants in the study.

Data availability

The datasets generated during and/or analysed for the present study are available from the corresponding author on reasonable request.

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Figure 1: The study's model.

Note. The path from problematic social media use to exercise addiction is direct, while the other paths are indirect. Adults and adolescents are denoted by the number preceding parenthesis and by the number within parenthesis, respectively.

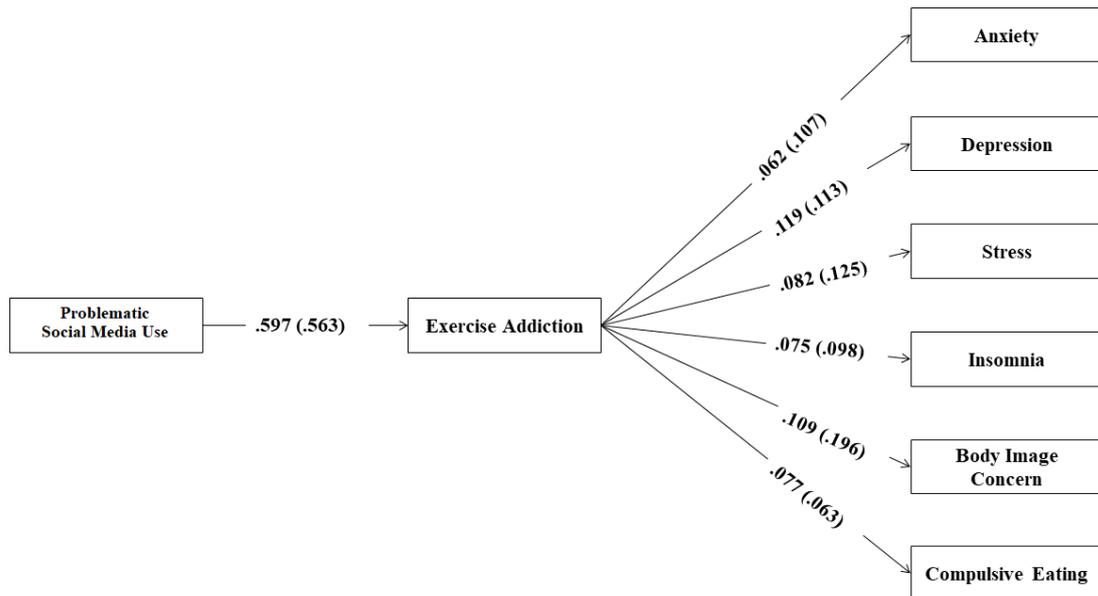


Table 1. Characteristics of the study participants (N=1307)

	Adolescents (n=562) Mean (\pm SD) or n (%)	Young adults (n= 745) Mean (\pm SD) or n (%)
Age (in years)	14.95 (\pm 1.70)	26.19 (\pm 7.42)
Gender (male)	211 (37.5)	294 (39.5)
Educational status		
<i>First high school</i>	362 (64.4)	-
<i>Second high school</i>	200 (35.6)	27 (3.6)
<i>Diploma</i>	-	34 (4.6)
<i>Bachelor</i>	-	495 (66.4)
<i>Master and PhD</i>	-	189 (25.4)
Weight	59.10 (\pm 15.18)	62.27 (\pm 14.96)
Height	165.53 (\pm 9.87)	169.58 (\pm 11.60)
BMI	21.42 (\pm 4.52)	23.59 (\pm 7.88)
Exercise addiction prevalence		
<i>At-risk (\geq24)</i>	15 (2.7)	33 (4.4)
<i>Symptomatic individual (13-23)</i>	488 (86.8)	611 (82)
<i>Asymptomatic individual (0-12)</i>	59 (10.5)	33 (4.4)

Table 2. Pearson correlation matrix of the variables of interest

Variables	Mean (SD)	<i>r</i> (for adolescents)						<i>r</i> (for young adults)						Mean (SD)
		1.	2.	3.	4.	5.	6.	1.	2.	3.	4.	5.	6.	
1. Psychological distress ^a	19.62 (7.20)	--	.55	.24	.63	.60	.48	--	.44	.37	.54	.54	.38	20.68 (10.21)
2. Problematic social media use ^b	14.12 (5.06)		--	.56	.47	.51	.36		--	.60	.43	.38	.29	16.32 (4.72)
3. Exercise addiction ^c	16.79 (4.97)			--	.25	.29	.19			--	.38	.31	.60	16.58 (5.18)
4. Body image concern ^d	40.69 (7.84)				--	.42	.36				--	.37	.39	46.77 (15.63)
5. Insomnia ^e	7.08 (4.16)					--	.37					--	.34	10.14 (5.68)
6. Compulsive eating ^f	11.97 (5.20)						--						--	13.99 (6.25)

^a Assessed using the Depression, Anxiety, Stress Scale-21

^b Assessed using the Bergen Social Media Addiction Scale

^c Assessed using the Exercise Addiction Inventory/Exercise Addiction Inventory-Youth Version

^d Assessed using the Body Image Concern Inventory

^e Assessed using the Insomnia Severity Index

^f Assessed using the Compulsive Eating Scale

Note: All *p*-values < 0.01

Table 3. Model that tested mediated effect of exercise addiction for adolescents

	Stand. Coeff.	Unstand. Coeff.	SE or (Bootstrapping SE)	t-value or (Bootstrapping LLCI)	p-value or (Bootstrapping ULCI)
Total effect of problematic social media use on outcomes					
Anxiety	0.460	0.324	0.031	10.45	0.004
Depression	0.476	0.413	0.037	11.16	0.005
Stress	0.548	0.472	0.034	13.88	0.003
Insomnia	0.513	0.522	0.046	11.35	0.005
Body image concern	0.468	1.364	0.117	11.66	0.006
Compulsive eating	0.359	0.370	0.046	8.04	0.004
Direct effect of problematic social media use on exercise addiction	0.563	0.657	0.039	16.85	0.002
Indirect effect of problematic social media use on outcomes					
Anxiety	0.107	0.076	(0.022)	(0.038)	(0.122)
Depression	0.113	0.098	(0.025)	(0.054)	(0.160)
Stress	0.125	0.108	(0.025)	(0.068)	(0.168)
Insomnia	0.098	0.100	(0.025)	(0.056)	(0.157)
Body image concern	0.196	0.570	(0.097)	(0.400)	(0.769)
Compulsive eating	0.063	0.065	(0.032)	(0.006)	(0.132)

Note: Age, gender, BMI, and education were adjusted for the model

Unstand. Coeff.=unstandardized coefficient

Stand. Coeff. = Standardized coefficient

LLCI=lower limit in 95% confidence interval

ULCI=upper limit in 95% confidence interval

Table 4. Model that tested mediated effect of exercise addiction for young adults

	Stand. Coeff.	Unstand. Coeff.	SE or (Bootstrapping SE)	t-value or (Bootstrapping LLCI)	p-value or (Bootstrapping ULCI)
Total effect of problematic social media use on outcomes					
Anxiety	0.374	0.284	0.029	9.79	0.004
Depression	0.383	0.370	0.036	10.28	0.006
Stress	0.417	0.395	0.035	11.29	0.009
Insomnia	0.379	0.456	0.044	10.36	0.015
Body image concern	0.431	1.428	0.116	12.31	0.020
Compulsive eating	0.290	0.401	0.048	8.35	0.011
Direct effect of problematic social media use on exercise addiction	0.597	0.701	0.034	20.62	0.018
Indirect effect of problematic social media use on outcomes					
Anxiety	0.062	0.047	(0.020)	(0.008)	(0.088)
Depression	0.119	0.115	(0.031)	(0.061)	(0.178)
Stress	0.082	0.077	(0.025)	(0.030)	(0.132)
Insomnia	0.075	0.090	(0.034)	(0.027)	(0.166)
Body image concern	0.109	0.361	(0.103)	(0.146)	(0.545)
Compulsive eating	0.077	0.106	(0.044)	(0.035)	(0.208)

Note: Age, gender, BMI, and education were adjusted for the model

Unstand. Coeff.= unstandardized coefficient

Stand. Coeff. = Standardized coefficient

LLCI=lower limit in 95% confidence interval

ULCI=upper limit in 95% confidence interval

Table 5. Invariance evaluation across gender through multigroup structural equation modeling for adolescents and young adults

Model and comparisons	Fit statistics						
	X ² (df)	$\Delta\chi^2$ (Δ df)	CFI	Δ CFI	TLI	Δ TLI	RMSEA
Adolescents							
M1: Unconstrained	108.87 (30)*	-	0.945	-	0.941	-	0.068
M2: Structural weights	113.92 (43)*	5.05 (13)	0.953	0.008	0.950	0.009	0.061
M3: Structural Covariances	129.90 (44)*	5.98 (1)*	0.949	- 0.004	0.947	- 0.003	0.062
M4: Structural Residuals	131.68 (51)*	9.78 (7)	0.954	0.005	0.950	0.003	0.060
Young adults							
M1: Unconstrained	136.84 (30)*	-	0.939	-	0.926	-	0.072
M2: Structural weights	145.28 (43)*	8.44 (13)	0.942	0.003	0.931	0.005	0.069
M3: Structural Covariances	152.60 (44)*	7.32 (1)*	0.933	- 0.009	0.923	-0.008	0.070
M4: Structural Residuals	169.85 (51)*	24.57 (7)*	0.943	0.01	0.932	0.009	0.066

* $p < 0.05$. CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation.