

The exercise dependence at the time of COVID-19 pandemic: The role of psychological stress among adolescents

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ABSTRACT

The outbreak of COVID-19 disease caused not only unprecedented concerns about public health but also critic stress-related disorders, especially in the younger population. Several studies have found a close connection between psychological stress and exercise dependence, resulting from coping strategies such as excessive perfectionism in controlling external factors, performance, controlling food intake, weight, and body image. Moderate amounts of exercise have been demonstrated to reduce psychological distress. Thus, the aim of the present study has been to analyse the relationship between psychological stress and exercise dependence symptoms in adolescent, concerning the COVID-19 period. Participants were 50 adolescents (aged 15-17) who trained twice a week for 90 minutes per session. They were randomly assigned to participate in either a highly controlled and supervised recreational physical activity program associated with theoretical lessons that were intended to provide information regarding nutritional education (EG; n = 25) or a waitlist control group (CG; n = 25). The physical activity program involved: joint mobility exercises, low-to-moderate intensity aerobic exercise, team-building activities, exercise stations, cardio workout. At baseline and after intervention programs we administered the Exercise Dependence Scale-21, a 21-items scale designed to assess exercise dependence symptoms, and the Perceived Stress Scale that measures the level at which situations in life are perceived as stressful ($p < .01$). The findings have suggested that after a 12-week recreational physical activity and food re-education, adolescents felt a greater sensation of psycho-physical well-being and that this phenomenon was closely linked to an improvement of the symptoms of exercise dependence.

Keywords: Physical activity; Aerobic exercise; Eating disorders; Psychological stress; Recreational sport activity.

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INTRODUCTION

In the last ten years we have seen an unheard change in the world we used to know. Technology has radically developed modifying every single individual's habit and lifestyle. Nevertheless, there is an aspect that maybe is still intact. In an always evolving world, sport has managed to carve out an important place in everyone's life. This is to testify that physical activity is life: we move even when we sleep, and every interpersonal relationship is sparked by movement (Latino, Greco, Fischetti, & Cataldi, 2019).

Despite this, a large part of the population does not realize the importance of physical activity in an age in which most of the time is spent behind a desk and people cannot make time for themselves to take care of their body's wellness (Latino, Fischetti, & Colella, 2020). Thus, training is important and good for physical and mental health, but to what extent? As mentioned above, sport has always been considered a fundamental element not only for athletes but also for normal people that play sports in order to reach a physical and psychological benefit as the only purpose (Latino, Cataldi, Fischetti, 2021). From so long ago, scientific research highlighted the usefulness of a constant physical activity in many areas, especially regarding the risks' reduction of cardiovascular diseases or cancer (Cataldi, Latino, Greco, & Fischetti, 2019; Fischetti, Cataldi, & Latino, 2020; Fischetti, F., Greco, G., Cataldi, Minoia, Loseto, & Guarini, 2019; Piccinno, & Colella, 2017).

Thus, on the one hand many studies have tried to identify the causes of the development of this addiction, on the other most of the cases are still unknown and few studies were focused on targeted interventions in this population (Hausenblas, & Symons Downs, 2000; Hausenblas, Schreiber, & Smoliga, 2017; Berczik, et al., 2012).

Unlike athletes who have a sporting goal or an individual who just wants to keep fit, the ones who show this addiction use sport only to compensate their psychological needs. Individuals with low self-confidence often find in sport a social recognition, because being sporty is seen as "cool" by the society and this is used to enhance one's body. Other people with physical activity addiction show a fake perception of their bodies, considering themselves as too fat or too thin, trying to offset this conviction with an extreme training that can only cause damages to health (Macfarlane, Owens, & Cruz, 2016). The most affected seem to be those who practice running, cycling and bodybuilding (Berczik, et al., 2012).

Relying on a good information about it, athletes are aware that they must give their body time to regenerate and rest; on the contrary, those who show addiction tend to ignore pain, disease and tiredness (Petit, & Lejoyeux, 2013). These last mentioned are related with sleep disorders, muscle fatigue, headaches, and loss of appetite. On a psychological level, in these individuals' mind, skipping a single workout means an abstinence situation that can cause nervousness, restlessness, difficulty in sleeping, depression and irritability. Considering some cases, devoting to assiduous trainings leads to neglect family and friends or even quarrels with the partner. The ones who are addicted to this are really obsessed with sport performances and control of some natural aspects of life like sleep, weight, humour, self-confidence. These individuals have an innate tendency to control everything, and this often degenerates in addiction to physical activity (de la Vega, Almendros, Barquín, Boros, Demetrovics, & Szabo, 2020).

Physical exercise addiction is often underestimated. Risks are not only ignored but practicing as much sport as possible is also supposed to be good. This thought is not correct at all and that is why this addiction can be linked to other psychological pathologies (such as bulimia and anorexia) (Márquez, & de la Vega, 2015). More than 3millions of people in Italy fight against eating disorders and particularly in Italy some published

studies and research show a prevalence of 0.2-0.8% of anorexia and a 1-5% one for bulimia, as much as in other countries. A high percentage of food psychopathologies are presumably linked to sports practice (Freire, da Silva Paulo, da Silva, Batista, Alves, & do Nascimento Junior, 2020). In fact, athletes are exposed to a greater socio-cultural pressure than the rest of the population. The stress they are subjected to, especially for the advanced ones, could be the triggering factor of the previously described pathologies (Simón Grima, Estrada-Marcén, & Montero-Marín, 2019).

The outbreak of COVID-19 disease caused not only unprecedented concerns about public health but also critic stress-related disorders, especially in the younger population (Cataldi et al., 2021). In this uncertain and stressful time adolescents have the necessity to master the situation, adopting a changed focus, as well as escaping from stress. This difficulty is expressed for example by taking control in other life areas, such as in became exercise addiction (Raiola, Aliberti, Esposito, Altavilla, D'Isanto, & D'Elia, 2020).

Therefore, the aim of the present work was to investigate the effects of a physical activity intervention on exercise dependence among adolescent at the time of COVID-19 pandemic basing on the assumption that a moderate and supervised recreational exercise program and information about a healthy nutrition could improve psychological stress also following a brief intervention.

METHODOLOGY

We used a randomized controlled study design to assess the relationship between psychological stress and exercise dependence symptoms in adolescent, concerning the COVID-19 period.

The study consisted of 12 weeks of aerobic exercises characterized by fun elements associated with theoretical lessons that were intended to provide information regarding nutritional education. The intervention was performed for 90 minutes 2 days per week in the evening from 3.00 pm to 4.30 pm on Tuesday and Thursday. The evaluation regarded 36 lessons monitoring the participants at the 1st and 12th week, respectively. Measurements were administered 2 days before training (pre-test) and directly after training (post-test). In order to allow statistically meaningful comparisons between different types of activities, the subjects were classified as participants in activities that shared similar characteristics.

Participants

50 adolescents were recruited from 4 gyms located in the town of Lecce (Italy) with an age range of 15-17 years (M age = 16.13, SD = ± 0.74).

Participation in the research study was voluntary and all each person attending a gym located in that area were eligible to participate in this study. Inclusion criteria were the following: participants had to be reported for exercise dependence syndrome, to be able of completing a moderate intensity aerobic exercise session, current attending local gym, and able to abstain from all physical activity outside the parameters of the study protocol during test days. From the study were excluded any person with an orthopaedic condition limiting their ability to perform exercises, and those unable to abstain from all physical activity outside the confines of the study protocol on the testing days.

Fifty subjects fulfilled the inclusion criteria and were invited to participate in the study. They were randomly assigned to participate in either a highly controlled and supervised recreational physical activity program associated with theoretical lessons that were intended to provide information regarding nutritional education (EG; n = 25) or a waitlist control group (CG; n = 25). The researchers ensured the anonymity of the

participants, and all parents of all participants provided their written informed consent before the study. The study was conducted from September 2020 to October 2020. The research was conducted based on the Declaration of Helsinki.

Measures

Exercise Dependence Scale (EDS-R)

Exercise Dependence Scale (Hausenblas & Downs, 2002) is a 21-item Likert-type scale that assesses the extent (1 = Never to 6 = Always) to which the respondent exhibits characteristics of exercise dependence.

The instrument has seven subscales (Tolerance, Withdrawal, Continuance, Lack of Control, Reduction in Other Activities, Time, and Intention Effects) based on the DSM-IV criteria for substance dependence and a total score. In this study we used the Italian validation (Costa, Cuzzocrea, Hausenblas, Larcan, & Oliva, 2012). It required approximately 5 minutes to be completed. The scoring was calculated summing up the scores of each item. Higher scores indicate more symptoms of exercise dependence.

Perceived Stress Scale (PSS)

The Perceived Stress Scale is well-established self-report scale measuring the perception of stress. It is a measure of the “degree to which situations in one’s life are appraised as stressful” (Cohen, Kamarck, Mermelstein, 1983). The scale includes a number of queries about current levels of experienced stress. It required approximately 5 minutes to be completed. The scoring was calculated summing up the scores of each item, but it required to reverse scores for questions 4, 5, 7, and 8.

Exercise training intervention

The physical activity program involved different group of physical activities, such as joint mobility exercises, low-to-moderate intensity aerobic exercise, team-building activities, exercise stations, cardio workout. Activities with fun elements were the most preferred context. Each round of exercise session included 10-minute warm-up, moderate physical activity main session, and 10-minute cool-down. Warm-up included the following exercises: marching in place, wide toe touch, leg swings, arm swings, half jacks, chest expansions, torso rotation, alt back expansions, shoulder rotations, hops on the spots, single-leg hops, hip rotations, walking jacks, hip circles, walking knee hugs, side shuffles. On the contrary, cool-down exercises consisted in a sequence of static stretching exercises which involved: glute stretch, standing quad stretch, piriformis stretch, side bench stretch, arm-cross shoulder stretch, overhead triceps stretch, lower back stretch, abdominal stretch, lunge with spinal twist, butterfly stretch, seated shoulder squeeze, child pose, *breathing exercises*. It was important for muscle relaxation and the improvement of joint range of motion.

Statistical analysis

We carried out statistical analyses using IBM SPSS version 25.0 (IBM, Armonk, NY, USA). We presented data as group mean (*M*) values and standard deviations (*SD*) and checked for assumptions of normality (i.e., Shapiro-Wilk test) and homogeneity of variances (i.e., Levene test) in the data distributions. We used an independent sample *t*-test to evaluate group differences at baseline and a two-way ANOVA (group (experimental/control) × time (pre/post-intervention), with repeated measures on the time dimension, was conducted to examine the effect of the Multilateral Training on all dependent variables. When ‘Group x Time’ interactions reached significance, group-specific post hoc tests (i.e., paired *t*-tests) were conducted to identify the significant comparisons. Partial eta squared (η^2_p) was used to estimate the magnitude of the significant ‘Time x Group’ interaction and interpreted using the following criteria: small ($\eta^2_p < 0.06$), medium ($0.06 \leq \eta^2_p < 0.14$), large ($\eta^2_p \geq 0.14$). Effect sizes for the pairwise comparisons were determined by Cohen’s *d* and

interpreted as small ($0.20 \leq d < 0.50$), moderate ($0.50 \leq d < 0.79$) and large ($d \geq 0.80$) (Cohen, 1992). Statistical significance was set at $p < .05$.

RESULTS

No injuries were resulting from neither training program, nor all subjects received the treatment conditions as allocated.

The experimental and control groups did not differ significantly at baseline in age, anthropometric characteristics, as well as in psychological measures ($p > .05$) (Table 1). Pre- and post-intervention results for all dependent measures are presented in Table 1.

Table 1. Changes in exercise addiction and perceived stress after a 12-week physical activity program.

	Experimental Group (n = 15)			Control Group (n = 15)		
	Baseline	Post-test	Δ	Baseline	Post-test	Δ
Exercise Dependence Scale (EDS-R)	111.12 (7.54)	100.92 (7.19) †*	-10.2 (4.96)	112 (7.56)	113.52 (7.67)	1.52 (2.12)
Perceived Stress Scale (PSS)	30 (3.62)	20.04 (3.91) †*	-5.96 (2.74)	30 (3.62)	33.08 (3.10)	3.08 (2.01)

Note: values are presented as mean (\pm SD); Δ : pre- to post-training changes; †Significant 'Group x Time' interaction: significant effect of the intervention ($p < .001$). *Significantly different from pre-test ($p < .001$).

Exercise Dependence Scale (EDS-R)

Statistical analysis revealed significant 'Time x Group' interaction for *Exercise Dependence Scale (EDS-R)* ($F_{1,48} = 117.69$, $p < .001$, $\eta^2_p = 0.71$, large effect size). The post-hoc analysis revealed a significant improvement in the score for this variable ($t = 10.26$, $p < .001$, $d = 2.05$, large effect size) in the intervention group. No significant changes were found for the control group ($p > .05$).

Perceived Stress Scale (PSS)

Statistical analysis revealed significant 'Time x Group' interaction for *Perceived Stress Scale (PSS)*.

($F_{1,48} = 170.96$, $p < .001$, $\eta^2_p = 0.78$, large effect size). The post-hoc analysis revealed a significant improvement in the score for this psychological variable ($t = 10.85$, $p < .001$, $d = 2.17$, large effect size) in the intervention group. No significant changes were found for the control group ($p > .05$).

DISCUSSION

The aim of this study was to investigate the relationship between psychological stress and exercise dependence symptoms in adolescent, concerning the COVID-19 period. Participants in this study trained twice a week for 90 minutes per session and were involved in highly controlled and supervised recreational physical activity program associated with theoretical lessons that were intended to provide information regarding nutritional education.

The results of this research indicate that an intervention aimed at the practice of physical exercise in adolescents during the pandemic period was effective in reducing exercise addiction and also reducing the stress syndrome. A strong correlation emerged between the reduction in perceived psychological stress,

obtained at Perceived Stress Scale, and the decrease in the score of the Exercise Dependence Scale. Probably, this result was the direct consequence of an intervention based heavily on enjoyment (Pereira, et al., 2021). Therefore, we assumed that the recreational purpose of the intervention played a key role in reducing the perception of stress. Furthermore, we felt that the idea of combining supervised and controlled physical activity in moderate quantities with a nutrition education information program was crucial to help participants become more aware of the urgent need to reflect on their own health, especially in a period in which the pandemic has radically changed people's habits (Lim, 2021).

In connection with what was found in this study, the finding was in line with previous studies displaying a close correlation between psychological stress and exercise dependence, resulting from an excessive need in controlling external factors, performance, food intake, weight, and body image (Robertson, Duffy, Newman, Prieto Bravo, Ates, & Sharpe, 2021). Moderate amounts of exercise have been demonstrated to reduce psychological distress, and depressive symptoms, to improve mental health, and consequently exercise addiction (Garber et al., 2011). Indeed, it is well known that reward and motivation circuits belonging to brain's limbic system are responsible of self-regulation and endogenous stress processing (Ma, Ma, Wang, Liu, Chen, & Yang, 2017). Physical activity and physical exercise can reduce psychological distress by activating endogenous opiates and stimulating pleasure's induction (Crombie, Brellenthin, Hillard, & Koltyn, 2018). On the contrary, for some athletes, constant training and obsessive repetition of gesture can evolve in a compulsive way causing a physical exercise addiction. Some individuals need to fill a mental or even an emotional void and, in this case, sport or exercise is the goal (Morano, Robazza, Ruiz, Cataldi, Fischetti, & Bortoli, 2020). For these athletes, sport often acts as a drug, which is to say a remedy against physical and psychological pain. Several studies demonstrated a greater addiction to physical exercise and a higher anxiety about social judgement and physical appearance among these sportsmen (Saeed, Cunningham, & Bloch, 2019).

Besides, we assumed that the correlations found in this work could be also the direct consequence of the negative impact that COVID-19 pandemic has exerted on individuals, especially in the younger population. The outbreak of COVID-19 disease caused not only unprecedented concerns about public health but also critic stress-related disorders (Bonavolontà, Cataldi, Maci, & Fischetti, 2020). This uncontrollable pandemic has placed many of people in front of several challenges that were perceived as stressful, overwhelming, and cause of strong emotions. In response to this unprecedented situation, many of us searched a way to escape through the adoption of excessive perfectionism in controlling certain areas of life, such as body image, food intake, as well as physical activity. However, this need for control brought to a stressor overload (Fischetti, Latino, Cataldi, & Greco, 2020; Latino, Fischetti, Cataldi, Monacis, Colella, 2021).

Despite the contribution that this work intends to bring in literature, some limitations were present. Main limitation was related to the small sample size ($N = 50$) generated to the difficulties in recruiting adolescents to participate in this study during the COVID-19 pandemic. A second limitation concerned the fact that we did not evaluate the long-term effects of exercise. Lastly, we assumed that the present study could be replicated and expanded through emotional assessment methods, such as enjoyment as well as other neuroscientific methods. These approaches are necessary to investigate the involvement of the limbic structures which regulate the neurocognitive response of the emotions, as is proved by other scientific work in this field (Stork, Kwan, Gibala, & Martin Ginis, 2015; Vella, Taylor, & Drummer, 2017). However, findings of this work could provide important indications for future studies. In fact, the strengths were represented by the beneficent approach that this simple and effective program could bring.

Therefore, the present findings expand previous research by showing that high levels of psychological distress and eating disorders are co-existent in individuals with a high risk for developing exercise dependence.

CONCLUSIONS

This study has highlighted a close connection between psychological stress and exercise dependence, resulting from excessive perfectionism in controlling external factors, performance, controlling food intake, weight, and body image. The COVID-19 pandemic, due to its unprecedented scale and unique response strategies, has had a critical impact on both adolescents' psychological and physical health.

Therefore, this research suggests that a moderate, recreational, and highly controlled amount of exercise is an effective intervention able to reduce psychological distress and, as its direct consequence, the symptoms of exercise dependence. Moreover, it is a vehicle to promote a range of outcomes important to adolescents' qualitative growth, in order to address adolescents to back to practice physical exercise in a good way. Future research should be directed to verify the optimal type, intensity, level, frequency, and duration of physical activity, as well as its effects on gender and age.

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