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Original Article

Effects of a Pilates Training Intervention on Mental Health, Adiposity and Self-Perceived Body-Image of Obese Children

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Abstract

Introduction: Given the increasing mechanization and digitalization of all areas of society and the significant rates of obesity among adolescents, coupled with their hesitance to engage in physical and sporting activities, it is crucial to identify strategies aimed at reducing excess weight and enhancing associated health factors.
Objective: The aim of this research was to investigate the impact of a physical activity intervention on the mental health, body fat levels, and self-perceived body image of adolescents classified as obese.
Methods: This study adopted a semi-experimental methodology with a practical objective, implementing a pre-test and post-test framework alongside a control group. The participants were obese male students aged between 15 and 18 years. The sample was divided into two groups: the experimental group and the control group, each comprising 22 students. The training program was executed over eight weeks, with three sessions per week designated for the experimental group. Assessments of mental health, adiposity, and body image were conducted using standardized tests. Data analysis was performed utilizing both paired and independent sample t-tests.
Results: The findings reveal that there were no notable differences in any demographic variables during the pretest phase ($p>0.05$). Additionally, the pretest results showed no significant disparities between groups concerning the research variables ($p>0.05$). In contrast, the analysis conducted at the conclusion of the eight-week period revealed significant differences across all assessed parameters, which included mental health, adiposity as indicated by BMI, and self-perceived body image ($p<0.001$).
Conclusion: The findings of this research suggest that individuals who are overweight or obese should engage in regular physical activities, such as Pilates, to enhance their physical and mental health.

Keywords: Pilates, Obesity, Mental Wellbeing, Body Image, Adolescents

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1. Introduction

Obesity is a chronic condition that arises from an unhealthy lifestyle and poses significant challenges to the health and treatment systems (1). It predominantly manifests during childhood and adolescence. The rising incidence of obesity and overweight among teenagers is attributed to various factors, including lifestyle changes, urbanization, the consumption of high-fat and high-carbohydrate foods, and a lack of physical activity (2,3). Additionally, the rise in activities such as residing in apartments, watching television, and engaging in computer gaming has led to an increase in obesity among this age group (3,4). This issue is recognized as a significant public health challenge. As per the World Health Organization's 2018 statistics, over 2 billion individuals globally are classified as overweight, with more than 650 million of these individuals being obese (5). Specifically, among children aged 5 to 19, over 340 million are affected by obesity and overweight conditions (6). Projections indicate that by 2022, more than 390 million children and adolescents in this age group will be overweight, including approximately 160 million who will be classified as obese (6). The sustainable development goals set forth by the United Nations in 2015 emphasize the importance of preventing and managing non-communicable diseases (1,5). Childhood and adolescent overweight and obesity are associated with serious health consequences that may extend into adulthood. Recognized as a major risk factor for non-communicable diseases, obesity negatively affects overall health and reduces life expectancy. Alarmingly, the incidence of obesity in children and adolescents is on the rise (7,8).

The prevalence of obesity in children and adolescents has become a prominent public health issue in many countries around the globe. Although obesity rates may have plateaued in some regions, there is a notable increase in the number of overweight and obese young individuals in low- and middle-income nations when compared to those in high-income countries (9). For instance, many Asian nations are transitioning from traditional lifestyles to more Westernized ways of living, as well as shifting from traditional industries to mechanized production (10).

This industrialization is accompanied by changes in dietary patterns, with traditional vegetable and carbohydrate-rich diets being replaced by high-fat diets, contributing to the rise in overweight and obesity rates (9,11). Obesity and overweight conditions are among the most common health challenges faced by children and adolescents. The early development of obesity considerably increases the likelihood of experiencing diabetes, hypertension, chronic kidney diseases, and a range of non-communicable diseases, including mental health issues, in later stages of life (12,13). Furthermore, obesity can adversely impact adolescents' health, their access to educational opportunities, and their overall quality of life. Additionally, obesity in teenagers is linked to diminished mental health, lower self-esteem, feelings of sadness and loneliness, increased anger, and engagement in risky behaviors (14,15).

Mental health is a critical human requirement that plays a vital role in sustainable development (16). According to the World Health Organization, in 2019, around 301 million people, which includes 58 million children and adolescents, experienced mental health disorders (17). In contemporary society, the subject of mental health has garnered significant attention from psychiatrists, psychologists, and various behavioral and social scientists. It is an intricate discipline that enables individuals to adapt to their surroundings and make more advantageous decisions in addressing challenges by fostering appropriate mental and emotional strategies (18). Persistent psychological pressures can undermine a person's ability to remain joyful, resilient, and capable of fulfilling social obligations. Mental disorders represent a critical and substantial aspect of the overall disease burden. Notable mental disorders include depression, anxiety, stress, bipolar disorder, and developmental conditions such as autism and phobias (16,17,19). Overweight and obesity are significantly associated with mental health disorders, particularly among adolescent girls (20,21). The early phase of adolescence is recognized as a distinctive period, characterized by its proximity to the transition from childhood and the onset of puberty, which can present various challenges. This transition effectively separates childhood from adolescence (20,22). During this period, a child's self-esteem often diminishes, while their social awareness tends to increase. Such transformations in cognitive abilities, perceptions, and interpersonal relationships compel adolescents to confront different issues than those experienced in childhood. Numerous prominent theories in developmental psychology have focused on the early years of adolescence, both directly and indirectly (22,23). In the context of education, this life stage corresponds to the guidance course or the initial years of secondary school. This phase is considered a high-risk period, making it crucial to monitor adolescents to support their mental health.

A crucial psychological aspect associated with obesity is the notion of body image. Body image pertains to how individuals perceive the dimensions and proportions of their bodies, shaped by their own thoughts, emotions, and the perceptions of others regarding their appearance. This concept is complex, integrating physiological, psychological, and sociocultural factors. In recent years, there has been a marked rise in scholarly research dedicated to the study of body perception. The mental image pertains to the internal visualization a person holds regarding their physical appearance (25,26). Essentially, it encompasses both the positive and negative emotions associated with one's body shape and size. A negative self-image can result in body dissatisfaction and feelings of unattractiveness, potentially leading to an excessive focus on specific body parts, which may impair functionality. While the mental image of the body is a complex construct, it is frequently characterized by aspects of physical appearance, such as size, shape, and overall look (27). Misinterpretation of this mental image can result in both physical and psychological issues, collectively referred to as “body image.” The self-perception that individuals hold is fundamentally shaped by their attitudes and feelings towards their own bodies. This mental image begins to develop at birth and evolves as a person matures through various life stages (26-28). A negative self-image can result in body dissatisfaction and a sense of unattractiveness, often leading to an excessive focus on specific body parts. Misinterpretation of one’s mental image can contribute to both physical and psychological issues, manifesting as depression and eating disorders. In adolescents, this misunderstanding may elevate the probability of participating in detrimental behaviors, such as restrictive dieting, which can result in insufficient nutritional consumption. The widespread occurrence of body dissatisfaction is alarming, as it correlates with psychological conditions like low self-esteem, depression, and anxiety (29,30). Furthermore, dissatisfaction with one’s appearance can result in social incompatibility and eating disorders. Disturbances in body image may also trigger a range of issues, including loss of appetite, mental exhaustion, fluctuating weight, sleep disturbances, low energy levels, anxiety, and unwarranted feelings of guilt and self-blame, all of which are indicative of broader health concerns (26,28,29).

Given the increasing mechanization and digitalization of all areas of society and the significant rates of obesity among adolescents, coupled with their hesitance to engage in physical and sporting activities, it is crucial to identify strategies aimed at reducing excess weight and enhancing associated health factors. Given the beneficial impacts of exercise and physical activity on both physical and mental well-being, this study focused on Pilates as a potential meditative practice that may influence various research variables in obese children. Pilates emphasizes the importance of movement control, body alignment, and breath regulation. Known as Contrology, Pilates aims to establish a perfect balance among the body, mind, and spirit. Practitioners of Pilates first gain comprehensive control over their bodies through targeted movements, subsequently achieving a natural equilibrium through the consistent repetition of exercises in a gradual yet progressive manner. This form of exercise is acknowledged by medical professionals as a distinctive approach to physical fitness, integrating muscle strengthening, stretching, and breathing techniques to enhance core stability and restore muscular balance. In contrast to conventional resistance training, which typically focuses on individual muscle groups, Pilates adopts a holistic perspective that necessitates the simultaneous activation and coordination of multiple muscle groups. Recent studies suggest that Pilates is suitable for people across all age groups, body types, and fitness levels. However, additional research is necessary to

determine the impact of Pilates on the mental health and obesity of children. Therefore, this study aims to examine the effects of a Pilates training program on the mental health, body fat, and self-perceived body image of adolescents with obesity.

2. Methods

2.1. Participants

This study employed a semi-experimental design with a practical application, incorporating a pre-test and post-test framework alongside a control group. The focus was on obese male students aged 15 to 18 years in 2023. Following the identification of eligible candidates, four schools were randomly selected, resulting in the inclusion of 44 obese students whose body mass index (BMI) was at or above the 95th percentile. These participants were subsequently divided into two groups: the experimental group and the control group, each comprising 22 students. It is noteworthy that the number of participants in both groups diminished during the course of the study due to factors such as lack of motivation, relocation, absence of parental consent, and inconsistent attendance at training sessions. Before the implementation of the research procedures, the objectives and methodology of the study were thoroughly communicated to both the participants and their parents. Discussions focused on the challenges and issues associated with childhood obesity, highlighting the critical role of parental engagement in its management. Written consent was secured from the parents of the participating students. Following this, the students underwent a comprehensive health assessment conducted by a qualified physician, resulting in the issuance of a health certificate and a medical clearance for physical activity. The study participants exhibited a BMI exceeding 28 kg/m^2, had not participated in regular physical exercise for the preceding six months, and had no documented history of cardiovascular, inflammatory, or joint disorders. Furthermore, individuals were excluded from the study if they demonstrated irregular involvement in sports, were taking specific medications or supplements, or were smokers. Enrollment in the research was contingent upon the selection and signing of a written consent form. Throughout this process, the confidentiality of participants' information was guaranteed, and they were made aware of their right to withdraw from the study at any point should they decide to discontinue their involvement.

2.2 Measurements

2.2.1. Adiposity

The assessment of obesity levels in children was conducted through the calculation of BMI. For this purpose, we measured the height and weight of the children utilizing standardized instruments. Height was recorded with an accuracy of 0.1 cm, while weight was measured to the nearest 0.1 kg. Subsequently, BMI was computed using the standard formula, which involves dividing weight in kilograms by the square of height in meters.

2.2.2. Mental Health

In this study, the tool utilized for data measurement and collection is the 28-item Goldberg Questionnaire (GHQ) (31). This instrument was developed to identify non-psychotic mental disorders, which is extensively employed for diagnosing mild mental disorders and screening psychological disorders (non-psychosis) in various treatment settings. The 28-item questionnaire, created by Goldberg and Hiller in 1972, features a four-point scale comprising not at all", "no more than usual", "rather more than usual" and "much more than usual". In the current study, the Persian version of the scale was validated by nine experts, yielding a CVI of 0.92 and a CVR of 0.90. Additionally, the Cronbach's alpha coefficient for the scale was calculated to be 0.93.

2.2.3. Body-image

The Multidimensional Body-Self Relations Questionnaire–Appearance Scales (MBSRQ-AS) was employed to assess body image in this study (32). This self-report inventory evaluates individuals' perceptions and attitudes regarding various dimensions of body image. The MBSRQ-AS consists of 34 items rated on a 5-point Likert scale, ranging from 1 (Definitely disagree) to 5 (Definitely agree). In the current research, the validity of the Persian adaptation of the scale was affirmed by nine experts, yielding a CVI of 0.92 and a CVR of 0.94. Additionally, the scale demonstrated a high level of internal consistency, with a Cronbach's alpha coefficient of 0.94.

2.3. Procedure

The research commenced with the necessary coordination with the Education Department followed by obtaining permission to proceed. A briefing session was subsequently held to present the research objectives, methodologies, and the implementation of interventions to both students and their parents. Following this, written consent was obtained from the parents, and the pre-test assessed mental health, adiposity, and self-perceived body image. The participants in the experimental group engaged in a Pilates training regimen that emphasized core muscle development, as well as control, precision, fluidity of movement, and proper breathing techniques. This program was conducted over a period of eight weeks, with three training sessions each week for both the experimental group. Each session comprised three warm-up segments lasting 10 minutes, followed by the primary Pilates exercises and concluding with a 5-minute cool-down. The initial training duration was set at 60 minutes, maintaining an intensity level of 50 to 55% of the reserve heart rate, consisting of one set of 10 repetitions. By the end of the eight weeks, the training duration increased to 75 minutes, with an intensity of 65 to 70% of the reserve heart rate, incorporating four sets of 12 repetitions. The intensity was progressively elevated by 5% every two weeks, with exercises including leg lifts with upper body twists, the hundred exercise, single leg raises, lying side bends, cobra stretches, dart movements, and star exercises. The exercise intensity was tailored to each participant's reserve heart rate. A post-test was conducted under the same conditions as the pre-test to compare the intervention's effects, with results analyzed between the groups. The control group refrained from

participating in any sports activities during this timeframe.

2.4. Statistical Analysis

In this study, the mean and standard deviation (SD) were employed to characterize the research variables. To assess the normality of the data distribution, the Shapiro-Wilk test was conducted. A paired t-test was utilized to compare the pre-test and post-test results within each group. Additionally, an independent t-test was applied to compare the data between the two groups. A significance level of 0.05 was established for the analyses. Data analysis was performed using SPSS version 26.

3. Results

3.1. Demographic Data

The baseline demographic attributes of all participants, including age (years), height (cm), weight (kg), and BMI (kg/m^2), were recorded (see Table 1). The analysis reveals that there were no statistically significant differences in any of the demographic variables at the pretest stage (all p>0.05).

Table 1. Demographic Data of the Experimental and Control Groups in the Baseline.

	Pilates	Control	t-Value	P-Value
Age (Years)	16.58 ± 0.24	16.61 ± 0.39	0.685	0.496
Height (Cm)	161.84 ± 4.47	162.86 ± 3.10	-0.158	0.964
Weight (Kg)	74.75 ± 7.88	75.85 ± 7.88	1.036	0.251
BMI (Kg/m^2)	28.5 ± 1.43	28.6 ± 1.52	0.225	0.759

3.2. Pretest vs. Posttest in the Pilates Group

Within the Pilates group, significant enhancements were observed through within-group comparisons concerning mental health, adiposity (specifically BMI), and self-perceived body image, as detailed in Table 2. The findings demonstrate that all outcome measures exhibited significant improvement in the experimental group. The computed p-value for each outcome measure was determined to be below the critical threshold of 0.05.

Table 2. Comparison of Pre-test and Post-test Scores in the Pilates Group.

	Pre-test	Post-test	t-Value	P-Value
Mental Health	42.48 ± 5.44	35.69 ± 3.55	12.88	<0.001
BMI	28.5 ± 1.43	27.6 ± 1.28	4.141	<0.001
Body Image	2.39 ± 0.36	3.10 ± 0.47	-2.146	0.017

3.3. Pretest vs. Posttest in the Control Group

In the control group, there were no significant differences observed between the pretest and posttest across all research variables, which included mental health, adiposity measures (specifically BMI), and self-perceived body image, as illustrated in Table 3. The p-values calculated for all outcome measures exceeded the critical threshold of 0.05.

Table 3. Comparison of Pretest and Post-test Scores in the Control Group.

	Pre-test	Post-test	t-Value	P-Value
Mental Health	41.65 ± 4.95	42.03 ± 4.88	0.857	0.387
BMI	28.6 ± 1.52	28.7 ± 1.33	1.205	0.212
Body Image	2.41 ± 0.30	2.42 ± 0.35	-0.177	0.877

3.4. Comparison of the Pilates and Control Groups

The analysis conducted at the conclusion of the eight-week intervention revealed notable disparities among the groups concerning all assessed parameters, which encompassed mental health, adiposity as indicated by BMI, and self-perceived body image. These findings are detailed in Table 4. The data suggest that participants in the Pilates group exhibited a greater degree of improvement compared to those in the control group across all measured parameters. This implies that Pilates training is a beneficial method for promoting both physical and mental well-being in obese adolescents.

Table 4. Comparison of the Pilates and Control Groups.

	Mean Difference Pilates	Mean Difference Control	t-Value	P-Value
Mental Health	-6.79	0.38	13.054	<0.001
BMI	-0.9	0.1	6.854	<0.001
Body Image	0.31	0.01	10.325	<0.001

4. Discussion

The ongoing trends of mechanization and digitalization across various sectors of society, alongside the alarming prevalence of obesity among adolescents and their reluctance to participate in physical activities, underscore the necessity of developing effective strategies to mitigate excess weight and improve related health outcomes. Consequently, this research was conducted to investigate the impact of a Pilates training program on the mental health, body fat levels, and self-perceived body image of obese adolescents. The findings reveal that participants in the Pilates group demonstrated significantly greater improvements across all measured parameters compared to the control group, indicating that Pilates training is a viable method for

promoting both physical and mental well-being in obese adolescents. These results corroborate those observed in earlier research (33-38).

Engaging in Pilates can enhance both physical and mental well-being, which may contribute to alleviating symptoms of depression, anxiety, and sleep disorders. This improvement can empower individuals to fulfill their responsibilities more effectively, make informed decisions, and experience a heightened sense of satisfaction and productivity in their work, ultimately leading to an enhanced quality of life (34,35). Furthermore, consistent physical activity fosters various psychological benefits, including increased self-esteem, a stronger sense of self-efficacy, and a more positive self-perception. It also promotes skill acquisition, self-confidence, social support, and improvements in physical performance, balance, strength, and flexibility, all of which contribute to overall health enhancement. Low concentrations of noradrenaline have been linked to mood disorders, suggesting that physical exercise may exert an antidepressant effect by promoting the synthesis of noradrenaline (35,36,37). Furthermore, engaging in physical activity activates brain serine/threonine protein kinase, a key player in cognitive and emotional regulation, which may enhance mental well-being by alleviating stress, anxiety, and depressive symptoms. Additionally, exercise boosts the functioning of both serotonergic and adrenergic systems in the brain, thereby providing an antidepressant effect comparable to that of selective serotonin reuptake inhibitors (38).

The current research has revealed several significant findings, one of which is that the experimental group experienced greater changes in average BMI than the control group. Weight reduction has the potential to greatly enhance quality of life and alleviate mental health issues linked to obesity (39). Given the strong negative correlation between body dissatisfaction and physical well-being, it appears that weight loss achieved through Pilates exercises may serve as a valid rationale for enhancing quality of life and promoting better mental health among obese boys (7,9). Pilates exercises consist of a sequence of focused movements that activate both physical and mental faculties, thereby improving strength, endurance, and flexibility. As these physical attributes develop, the risk of obesity is reduced.

The results of the present study demonstrate that an eight-week Pilates training regimen leads to significant enhancements in the body image of individuals in the experimental group relative to those in the control group. These findings suggest that engaging in physical activities such as Pilates enhances an individual's physical capabilities and fitness levels, while also transforming the perception and evaluation of one's abilities (24). This transformation contributes to an increase in self-esteem and fosters a more positive body image. To elucidate these results, it can be noted that during the practice of exercises like Pilates and tai chi, the functions of stabilizing, moving, and contracting muscles are continuously altered. This variation in muscle function can significantly enhance strength, as the exercises encourage muscles that have been consistently contracted or inactive to become more dynamic and robust (25,26). Pilates incorporates movements that positively influence breathing, nerve relaxation, flexibility, strength, and endurance, all aimed at promoting both physical and mental well-being. Furthermore, focusing on breathing and muscle contractions during Pilates enhances cognitive concentration and mindfulness (26). By strengthening the body and alleviating negative thoughts, individuals can improve their body image, thereby mitigating the decline in self-confidence and feelings of inadequacy often associated with muscle inactivity, weight gain, and imbalances in body composition.

A significant feature of the current research is the focus on obese adolescents as participants, a group that has been relatively underrepresented in previous studies. Nonetheless, the research encountered specific limitations, notably its exclusive focus on obese male adolescents. Consequently, the findings cannot be extrapolated to obese female adolescents. It is therefore recommended that future investigations address these limitations and explore the impact of Pilates exercises on both the physical and psychological health of obese teenage girls.

4.1. Conclusion

The results of the current study indicate that the mental health status of overweight male adolescents is significantly lower than that of their peers with normal weight. Engaging in a Pilates training program has the potential to enhance mental health among overweight individuals. Moreover, Pilates exercises can have a beneficial effect on the body image of obese adolescents. Therefore, it is recommended that overweight or obese individuals consistently engage in physical activities such as Pilates to promote improvements in both their physical and mental health. It is also suggested that Pilates be incorporated into the fitness programs of sports clubs and the physical education curricula in schools. Furthermore, these exercises should be delivered in a thorough academic and scientific manner, avoiding the influence of trendy marketing that often overshadows their true benefits. The researcher also highlights the necessity for additional research across various age demographics, particularly examining the relationship between diet and joint pain.

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Footnotes

Authors' Contribution: This study was carried out solely by the corresponding author.

Conflicts of Interest

Non to declare.

Data Availability: The data that support the findings of this study are openly available upon request from the corresponding author.

Ethical Approval: The author confirms that all steps and requirements of this study comply with ethical guidelines. Participants were informed about the characteristics of the study and gave written informed consent.

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