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Original Article

The Associations between Physical Activity with Body-Image and Body Composition in Female Children

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Abstract

Background: Early childhood is a critical period for the development of body image (BI) and healthy body composition (BC). Understanding how physical activity (PA) influences these factors in young girls can help guide interventions that promote long-term health and well-being. This study investigated the relationship between PA, BI, and BC in female children.
Methods: This was a descriptive-correlational study. A total of 384 female children aged 10 to 12 in Ali-Abad-Katoul city, Golestan Province, Iran, in 2024 were selected through convenience sampling technique. ActiGraph accelerometer, the Body Image State Scale and the X-Scan plus-II were used for measuring PA, BI and BC, respectively. Pearson correlation was used to analyze the data.
Results: The average duration of daily moderate-to-vigorous PA (MVPA) was found to be 36.84±6.96 minutes, while the mean body mass index (BMI) was recorded at 18.00±1.35. The analysis revealed a significant positive correlation between MVPA and BI ($r=0.540$, $P<0.001$) as well as skeletal muscle mass (SMM) ($r=0.429$, $P<0.001$). Conversely, a significant negative association was observed between MVPA and both BMI ($r=-0.639$, $P<0.001$) and mass of body fat (MBF) ($r=-0.508$, $P<0.001$). Furthermore, a significant negative correlation was identified between BMI and MBF with BI ($r=-0.394$, $P<0.001$ and $r=-0.342$, $P<0.001$, respectively), while SMM exhibited a positive and significant relationship with BI ($r=0.417$, $P<0.001$).
Conclusions: This study emphasized the importance of paying attention to lifestyle, especially PA, in female children. Given the general changes in lifestyle and the increasing tendency of people to use computers and watch television more, physical inactivity is considered an important problem from a health perspective.

Keywords: Child, Female, Exercise, Obesity, Body Image

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1. Introduction

Current discussions on women's body activism emphasize a shift in how the body is perceived—from being seen merely as an object to being recognized as a subject deserving critical analysis (1). This shift has fostered a heightened sense of intimacy and agency in relation to the body, positioning it as a competitive arena among individuals. Women's fluid and evolving perceptions of their bodies have led to constant self-reflection and evaluation of body shape and form, making these concerns an integral part of daily life (2, 3). Negative body image (BI) involves dissatisfaction with one's body and the adoption of unrealistic appearance ideals that are rarely attainable. Concerns related to BI encompass an individual's perceptions, emotions, and thoughts about their own physique, typically involving judgments about body size, attractiveness, and related feelings regarding shape and weight (4). BI is recognized as a multidimensional construct, comprising a perceptual dimension (the importance placed on body and dietary habits), a cognitive dimension (beliefs and thoughts about body shape), and an affective dimension (the emotional responses individuals have toward their bodies) (1, 2, 5). Some individuals exhibit a chronic preoccupation with physical appearance, experiencing an intense and distressing fear of being perceived as unattractive, despite having a normal or even conventionally appealing appearance (5, 6). The evaluation of physical appearance can therefore be situated within the broader framework of BI, understood as a complex construct that includes perceptions of appearance, beliefs and thoughts about body shape, and behaviors related to appearance (3). Research showed that BI concerns and related dissatisfaction contribute significantly to the development of clinical disorders, including eating

disorders (1, 6, 7). Furthermore, these concerns adversely impact psychological well-being in non-clinical populations, leading to increased levels of depression, social anxiety, and lowered self-esteem (3, 4, 6, 7).

In the domain of women's health, one of the most prominent mind–body interactions identified in the literature is the relationship between obesity and overweight (8-10). There is an inverse association between obesity and factors such as emotional well-being, psychological health, and overall psychiatric status (8, 9). A range of psychiatric disorders, acute psychological stressors, and long-term psychological and personality-related difficulties can contribute to the development of obesity and overweight (10, 11). Numerous psychological factors may therefore act as primary and persistent contributors to obesity. The global prevalence of childhood overweight and obesity is increasing at an alarming rate (12-14), a trend that is particularly concerning because obesity is a major risk factor for multiple physical and mental health problems that often persist into adulthood (8-11). Children who are obese are more likely to become obese adults and consequently face a higher risk of mortality (15, 16). An important psychological component within the context of obesity is BI (17-21). Accordingly, it is essential to identify the factors and strategies that influence body composition (BC) and, in turn, BI in children, with a particular focus on girls. Participation in physical activity (PA) represents one potential factor that may affect both BC and BI.

Traditional approaches to treating BI disturbances have primarily relied on cognitive behavioral therapy and pharmacological interventions (22-24). However, the limitations of these methods-including their time demands, costs, and potential side effects- have prompted growing interest in exercise and PA as alternative or complementary strategies. Evidence suggested that demographic factors such as age, weight, and height, as well as the duration of sport participation, are significant predictors of BI perceptions. Moreover, participation in endurance-based sports has been shown to positively influence BI, particularly its physical dimension (25-28). Notably, sustained involvement in sport is often associated with reductions in body mass index (BMI), which in turn relate to changes in BI concerns and identity issues (26, 27). These findings highlighted the beneficial role of sport participation in reducing BI dissatisfaction. Accordingly, this study aimed to examine the associations between PA and both BI and BC in female children, emphasizing the importance of understanding the factors that shape these outcomes during early developmental stages.

2. Methods

2.1. Design

This was a descriptive-correlational study conducted through convenience sampling technique.

2.2. Selection and Description of Participant

The study participants were female children aged 10–12 years from Ali-Abad Katoul, Golestan Province, Iran, in 2024. Based on correlational study parameters (28) with α=0.05, β=0.05, and r=0.20, the required sample size was calculated as 319. To allow for an anticipated dropout rate of 25%, 392 participants were initially recruited. Eight participants were later excluded due to incomplete adherence to PA protocol, resulting in a final sample of 384 participants for analysis. The sample size estimation was based on PA (i.e., daily moderate-to-vigorous physical activity), with a reported mean of 49.71±22.37 (28). Participants were selected using a convenience sampling method and were required to meet the following inclusion criteria: enrollment in grades four to six, provision of parental consent, completion of all required protocols, and absence of any physical conditions that could limit participation. Parental consent was obtained prior to the data collection.

2.3. Data Collection and Measurements

2.3.1. Physical activity: The assessment of PA was conducted using an ActiGraph wGT3X-BT accelerometer. This tri-axial accelerometer captures the activity data of participants with a high degree of precision over a continuous 24-hour period for one week. In this study, moderate-to-vigorous PA (MVPA) was measured as PA variable. In this study, Cronbach's alpha coefficient was 0.94.

2.3.2. Body-image: The Body Image State Scale (29) was employed to assess children's perceptions of their BI. This scale comprises six items that evaluate the cognitive aspects of participants' views on their body shape, size, weight, attractiveness,

self-image, and their comparisons with others at a specific point in time. A scoring system with nine levels is used, where items 1, 3, and 4 receive positive scores ranging from 1 to 9, while items 2, 5, and 6 are scored in reverse from 9 to 1. In this study, the validity of this instrument has been confirmed by eight experts, yielding a Content Validity Index (CVI) of 0.90 and a Content Validity Ratio (CVR) of 0.92. The reliability of the scale was determined here using Cronbach's alpha, which yielded a coefficient of 0.92.

2.3.3. Body composition: In this study, BC was assessed using the Body Composition X-Scan Plus II device. Initially, the height of the children was recorded with a standard measuring tape, ensuring an accuracy of 0.1 cm. Subsequently, the participants were positioned on the device to obtain their weight measurements. This apparatus employs eight electrodes to transmit electrical impulses through various tissues, allowing for the calculation of BC metrics such as Body Mass Index (BMI), skeletal muscle mass (SMM), and mass of body fat (MBF) based on the velocity of the electrical signals.

2.4. Procedure

Following ethical approval, written parental consent and child assent were obtained. Participants completed a body-image questionnaire under researcher supervision, with items read aloud to ensure understanding. Anthropometric measurements, including height and weight, were collected using standardized protocols to calculate BMI. Physical activity was measured using accelerometers, with instructions provided to ensure accurate reporting. All procedures were conducted during school hours, and data were anonymized to maintain confidentiality, in accordance with the ethical standards of the Declaration of Helsinki.

2.5. Data Analysis

Descriptive statistics, including mean and standard deviation, and the Kolmogorov-Smirnov test were used to check the normal distribution of the data. One sample t test was used to compare the daily MVPA with international guideline (i.e., 60 minutes of daily MVPA). Also, Pearson correlation test was used for measuring the correlation between the research variables. The significance level is considered at the level of 0.05. SPSS version 27 was used to analyze the data.

3. Results

3.1. Demographic Data

The demographic characteristics of the participants are presented in Table 1. A total of 384 female children were included in the analysis. The mean age of the participants was 10.93±0.52 years. Additionally, the average height was 141.36±2.54 cm. The mean weight of the participants was 35.96±2.94 kg. Furthermore, the distribution of participants across various school grades was relatively uniform, with the largest proportion (42%) being in the fifth grade of primary school. Also, a significant majority of the parents (74%) had attained a college education.

3.2. Descriptive Data

The total duration of daily MVPA recorded was 36.84±6.96 minutes, which is significantly below the international recommendation (t=9.855, P<0.001).

Table 1: The demographic characteristics of the participants

	Mean	**SD**
Age (year)	10.93	0.52
Height (cm)	141.36	2.54
Weight (kg)	35.96	2.94
	n	**%**
Grade		
Primary-school grade 4	82	21%
Primary-school grade 5	163	42%
Primary-school grade 6	139	37%
Parental Education		
Diploma and below	99	26%
College	285	74%

SD: Standard Deviation

Table 2: Mean and standard deviation of the research variables

Variables	Mean	SD
MVPA (minutes per day)	36.84	6.96
Body-image	24.56	4.40
BMI	18.00	1.35
SMM	20.48	2.39
MBF	12.05	1.55

MVPA: Moderate-to-Vigorous Physical Activity; BMI: Body Mass Index; SMM: Skeletal Muscle Mass; MBF: Mass of Body Fat

Table 3: Correlations between physical activity, body image, and body composition

Variables	1	2	3	4	5
1. Physical Activity	-				
2. Body-Image	r=0.540 P<0.001	-			
3. BMI	r=-0.639 P<0.001	r=-0.394 P<0.001	-		
4. SMM	r=0.429 P<0.001	r=0.417 P<0.001	r=-0.332 P<0.001	-	
5. MBF	r=-0.508 P<0.001	r=-0.342 P<0.001	r=0.483 P<0.001	r=-0.725 P<0.001	-

BMI: Body Mass Index; SMM: Skeletal Muscle Mass; MBF: Mass of Body Fat

Additionally, the average BI score was 24.56±4.40, reflecting a level of body satisfaction that is below the medium threshold. In terms of BC, the mean BMI was found to be 18.00±1.35, indicating a healthy BMI range. Furthermore, the mean scores for SMM and MBF were 20.48±2.39 and 12.05±1.55, respectively (Table 2).

3.3. Correlations between Research Variables

The results indicated that MVPA was positively and significantly correlated with BI and SMM (both P<0.001); however, it was negatively and significantly correlated with BMI and MBF (both P<0.001). In addition, our results displayed a negative and significant correlation between BMI and MBF with BI (both P<0.001), but SMM had a positive and significant correlation with BI (P<0.001) (Table 3).

4. Discussion

The initial analysis revealed that the average daily duration of MVPA was recorded at 36.84 minutes, which falls significantly short of the international guidelines. This observation is consistent with prior research (30-33) indicating that children are not engaging in adequate PA necessary for optimal health. Given the extensive advantages linked to regular PA for children's well-being (34-40), it is crucial for health professionals to focus on the PA patterns of primary school children, particularly among girls. Therefore, it is essential to develop and implement interventions and strategies designed to enhance MVPA levels in female children.

The findings of this study indicated a significant association between PA and a more positive BI among girls. Specifically, greater engagement in PA was related to a more favorable perception of BI. These results were consistent with previous research (25-28), suggesting that participation in PA has a beneficial effect on BI, particularly in female individuals. One possible explanation is that PA acts as a catalyst for self-awareness, as individuals often become more conscious of their physical capabilities and limitations through exercise (25). By engaging in PA, individuals gain a clearer understanding of their fitness levels and physical attributes in relation to others. It is important to interpret these findings while considering the influence of potential confounding factors such as age and socio-cultural context (27). Over time, regular exercise promotes sustained participation in PA, as individuals overcome initial challenges and begin to experience positive changes in their physical condition and self-perception (26, 27).

The findings of this study regarding BC indicated that the average BMI of the sample fell within the healthy range. In line with previous studies (25, 26), greater engagement in PA was associated with a lower risk of obesity, as reflected in both BMI and body fat measures. Both

cross-sectional and longitudinal evidence has consistently shown that participation in higher-intensity PA is linked to a reduced likelihood of developing obesity (27, 28). Reductions in BMI associated with PA may be explained by changes in metabolic processes, increased energy expenditure, and improved appetite regulation (27). In addition, participation in aerobic activities promotes feelings of competence and achievement, which can enhance self-esteem and BI (25, 27). Because BI involves a complex interaction of thoughts and emotions related to physical appearance, successful weight management may contribute to more positive perceptions of the body (26, 27). As a result, individuals' beliefs about themselves across different life domains may shift over time and remain open to change.

Engaging in PA provides substantial physiological and psychological benefits, particularly in strengthening mental resilience (34, 36, 37). Exercise increases cerebral blood flow and stimulates the release of neurotransmitters that contribute to a sense of well-being. This positive experience, together with improvements in muscle development and weight regulation, enhances self-esteem and body awareness, ultimately leading to a more positive BI. Physical exercise also improves the strength and flexibility of bodily systems, promotes coordination between motor actions and cognitive processes, and increases muscular capacity and elasticity (25-28). As physical functioning improves, individuals often experience greater overall well-being and physical self-worth. Accordingly, participation in PA is associated with higher life satisfaction and self-esteem, arising from improved balance and harmony between physical form and self-perception, which in turn enhances both quality of life and BI (25, 26, 28).

4.1. Limitations

A key strength of the present study was the use of objective and precise instruments to assess PA, thereby reducing the bias commonly associated with self-reported measures. However, an important limitation was the exclusive focus on elementary school girls, which limits the generalizability of the findings to other age groups and also to opposite sex, suggesting that future research should include more diverse samples in terms of both age and sex. From a practical perspective, greater attention should be given to lifestyle factors in children and adolescents, particularly during critical developmental periods. This requires appropriate education and awareness-raising initiatives, the systematic integration of PA programs into school curricula, proper monitoring of their implementation, and the promotion of participation through organized activities and competitions, all of which can make a substantial contribution to improving individual and public health outcomes.

5. Conclusions

The results of the present study highlighted the importance of promoting a healthy lifestyle, particularly PA, among female children. In light of widespread lifestyle changes and the growing tendency to engage in sedentary activities such as computer use and television viewing, physical inactivity has emerged as a significant public health concern. Consistent with previous research, our findings demonstrated a direct association between physical inactivity and increased rates of overweight and obesity, which in turn negatively affect BI and reduce satisfaction with one's physical appearance.

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Authors' Contribution

Maosud Shakki: Substantial contributions to the conception and design of the work, acquisition, analysis, and interpretation of data for the work; drafting the work and reviewing it critically for important intellectual content. Reza Rezaeeshirazi: Contribution to the design of the work; drafting the work and reviewing it critically for important intellectual content. Neda Aghayei Bahmanbeglou: Substantial contributions to the conception and design of the work, acquisition, analysis, and interpretation of data for the work; drafting the work. Saeed Ghorbani: Substantial contributions to the conception and design of the work, acquisition, analysis, and interpretation of data for the work; reviewing the work critically for important intellectual content. All authors

approved the final version of the manuscript and agree to be accountable for all aspects of the work, ensuring that any questions related to the accuracy or integrity of any part of the study are appropriately investigated and resolved.

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Ethical Approval

The Ethics Review Board of Islamic Azad University of Aliabad Katoul city, Golestan Province, Iran approved the present study with the code of IR.IAU.AK.REC.1402.008. Also, written informed consent was obtained from the parents of children.

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