

Effects of Physical Activity on Adiposity in Children: The Mediating Role of Self-Esteem and Body-Image

Tayebeh Baniasadi ¹, Sheida Ranjbari ², Sedigheh Khajeaflatoon Mofrad ³, Abolfazl Neshati⁴, * Amir Dana ⁵

¹ Visiting Scholar, Indiana University, School of Public Health, Department of Kinesiology, USA.

² Department of Physical Education, Urmia Branch, Islamic Azad University, Urmia, Iran.

³ Department of Physical Education, Farhangian University, Gorgan, Iran.

⁴ Department of Physical Education, Marand Branch, Islamic Azad University, Marand, Iran.

⁵ Department of Physical Education and Sport Sciences, Tabriz Branch, Islamic Azad University, Tabriz, Iran.

Abstract

Background: Although the impact of physical activity on controlling or reducing obesity has been well documented, the components that can affect this relationship have not been well defined. Hence, the current study aimed at examining the relationship between physical activity and adiposity in children with a consideration of self-esteem and body-image as mediators.

Methods: This study followed a descriptive-correlational design. In Total, 384 children (average age of 7.67 ± 0.82 years) from Gorgan, Iran, in 2022 participated in this study. Physical Activity Behavior in Leisure-Time Scale, Rosenberg Self-Esteem Scale, and Multidimensional Body-Self Relations Questionnaire–Appearance Scales were used for assessing Physical activity, self-esteem, and body-image, respectively. BMI was calculated for assessing adiposity. Structural equation modeling was implemented for analyzing the collected data.

Results: Our sample had relatively low levels of physical activity and boys had higher levels of physical activity than girls (3.48 vs. 2.04 days/weeks, respectively, $t=5.79$, $P<0.001$). Physical activity had inversely affected BMI ($T=-7.769$). Moreover, Physical activity positively affected self-esteem ($T=6.967$) and body-image ($T=4.740$). Finally, self-esteem and body-image significantly mediated the association between physical activity and BMI ($P<0.001$).

Conclusion: Overall, self-esteem and body-image can be considered as psychological predictors of obesity. In addition, physical activity and obesity are critical concerns about children. Accordingly, it is necessary to adopt appropriate strategies for enhancing active lifestyle among this population.

Key Words: Body-image, Children, Obesity, Physical activity, Self-esteem.

* Please cite this article as: Baniasadi T, Ranjbari S, Khajeaflatoon Mofrad S, Neshati A, Dana A. Effects of Physical Activity on Adiposity in Children: The Mediating Role of Self-Esteem and Body-Image. Int J Pediatr 2022; 10(12):17172-17181. DOI: **10.22038/ijp.2022.67562.5043**

*Corresponding Author:

Amir Dana, Department of Physical Education and Sport Sciences, Tabriz Branch, Islamic Azad University, Tabriz, Iran. Email: amirdana@iaut.ac.ir

Received date: Sep.02,2022; Accepted date:Dec.13,2022

1- INTRODUCTION

Adiposity simply refers to the fact or condition of having much or too much fatty tissue in the body. It is also a condition of being severely overweight or obese (1-3). It has been shown that obesity is associated with increased risks of cardio-metabolic disorders (4-5). In addition, several studies have shown a trend in global increase of overweight and obesity in childhood and adolescence (6-8). This has caused the World Health Organization and various institutions in the field of health to give a serious warning to the health of children and adolescents (6). Therefore, there is a serious need to quickly detect obesity in early years of childhood and also to find strategies to reduce the level of obesity in children.

As a potential strategy, participating in physical activity may control the level of adiposity in children and adolescents. It's been constantly proven that ordinary physical interest has many fitness advantages which include preventing persistent illnesses and untimely deaths, enhancing physical and intellectual fitness, and growing quality of life (9-17). As a result, the World health organization (WHO) offers hints for all age groups on the amount of physical activity and sedentary conduct. In the case of children, WHO hints advocate that children and young people in elderly 6-17 years need to engage at least in 60 minutes of daily mild-to-full physical pastime throughout the week (18). Similarly, they need to restrict the quantity of sedentary time, especially the amount of recreational screen time (18). In addition, numerous studies have shown that better stages of physical activity act in opposition to adiposity in school-elderly children and teenagers (19-30). However, previous research has continually verified that only 20-25% of girls and 35-40% of boys comply with WHO's recommendations of 60 minutes of daily bodily interest (31-35); and are,

therefore, at risk for inactivity and its negative consequences. Thus, it is necessary to consistently measure the level of physical activity and adiposity among children as well as the association between physical activity and adiposity. Therefore, the first aim of this study was to investigate the association between physical activity and adiposity among children.

Although the effects of physical activity on controlling or reducing obesity have been well documented (19-30), the components that can affect this relationship have not been well defined. For example, psychological components that can mediate the relationship between physical activity and obesity have not been investigated. In fact, it has been shown that self-esteem and body-image can be psychological components that may predict the obesity process (36-40). Previous studies have shown that poorer self-esteem and body image may contribute to gaining weight and tending to be obese in children and adults (36-40). The causal nature of such relationships has not been well recognized. In fact, it is not clear whether psychological problems lead to being overweight, whether overweight leads to psychological problems, or whether they have reciprocal relationships. A recent review (38) concluded that depressed individuals, in particular adolescent women, have been much more likely to broaden weight problems. Another review supported an association among depressive symptoms and overweight (41). On the other hand, it has been shown that participating in regular physical activities leads to better perceived self-esteem and body-image (42-45). However, the mediating role of self-esteem and body-image in the relationship between physical activity and adiposity has not been investigated. Therefore, this study aimed at investigating the relationship between physical activity and

adiposity in children with a consideration of self-esteem and body-image as mediators.

2- METHODS

2-1. Participants

We applied a descriptive-correlational design. 384 children (167 girls) attending primary schools of Gorgan, Iran, in 2022 attended this study (mean age of 7.67 ± 0.82 years). The statistical sample was selected based on a convenience sampling method. Inclusion criteria encompassed all primary school students with no physical or mental disabilities. Any health problems which disrupted our study were among the exclusion criteria.

2-2. Measures

2-2.1. Physical activity

Physical activity was measured using the Physical Activity Behavior in Leisure-Time Scale (11), including three questions scored based on an eight-point Likert scale from zero days (0) to seven days (7). In the present research, 10 experts confirmed the validity of the Persian version of the scale (CVI=0.92, CVR= 0.94); and Cronbach's alpha coefficient was calculated as 0.88.

2-2.2. Self-esteem

We used the Rosenberg Self-Esteem Scale (46) to evaluate the teenagers' self-esteem. The survey consisted of 10 four-point Likert questions with scores ranging from strongly disagree (0) to strongly agree (3). In the present research, 10 experts confirmed the validity of the Persian version of the scale (CVI=0.88, CVR= 0.90); and Cronbach's alpha coefficient was 0.85.

2-2.3. Body-image

Short form of Multidimensional Body-Self Relations Questionnaire–Appearance Scales (MBSRQ-AS) (47) was used for evaluating body image. The MBSRQ is a self-report inventory that assesses peoples' attitudes towards different aspects of body

image. The MBSRQ-AS is a 34-item scored on a 5-point scale from 1 (Definitely disagree) to 5 (Definitely agree). In the present research, 10 experts confirmed the validity of the Persian version of the scale (CVI=0.90, CVR= 0.92); and its Cronbach's alpha coefficient was estimated as 0.90.

2-2.4. Obesity

We calculated body mass index (BMI) for assessing the level of obesity in children. To this end, we assessed height and weight of children using standard instruments. Height was measured to the nearest 0.1 cm and weight was measured to the nearest 0.1 kg. Then, the standard formula, weight (kg) divided by height (m^2), was used to calculate BMI.

2-3. Data analysis

We analyzed the data using SPSS Software version 26 and SmartPLS version 2.0. Descriptive analyses were used to calculate means and standard deviations. Normality of data was measured using Kolmogorov-Smirnov test. Independent t test was used to calculate gender differences. Pearson correlation test was used to measure associations between variables. Finally, we used structural equation modeling to investigate the structural associations between variables. Significant levels were considered at the alpha level of 0.05.

3- RESULTS

3-1. Demographic data

Table 1 presents demographic characteristics (including age, height, and weight) of our sample. A total of 384 participants (167 girls) participated in the present study. Mean ages of boys and girls were 7.61 ± 0.86 and 7.71 ± 0.80 , respectively. Independent t tests showed no significant difference between boys and girls, in regard to age ($t=0.68$, $P>0.05$). Moreover, boys were significantly higher than girls (116.33 vs. 109.49 cm,

respectively, $t=3.14$, $P<0.01$). Finally, the average weight of the boys was significantly higher than that of the girls

(30.99 vs. 28.02 kg, respectively, $t=4.88$, $P<0.001$).

Table-1: Demographic data

Variables		Mean \pm SD
Age (years)	Boy (n=217)	7.61 \pm 0.86
	Girl (n=167)	7.71 \pm 0.80
	Total (n=384)	7.67 \pm 0.82
Height (cm)	Boy (n=217)	116.33 \pm 11.25
	Girl (n=167)	109.49 \pm 9.07
	Total (n=384)	112.88 \pm 10.96
Weight (kg)	Boy (n=217)	30.99 \pm 6.69
	Girl (n=167)	28.02 \pm 6.99
	Total (n=384)	29.96 \pm 6.75

3-2. Descriptive data and gender differences

Table 2 shows the means and standard deviations of research variables, as well as the results of gender differences. First, it should be noted that all research variables were normally distributed (all $P>0.05$). Descriptive data showed that boys had significantly higher levels of physical activity than girls (3.48 vs. 2.04 days/week, respectively, $t=5.79$, $P<0.001$).

In addition, BMI of boys and girls was almost identical with no significant difference (18.54 vs. 18.33 kg/m², respectively, $t=0.87$, $P>0.05$). Moreover, the boys enjoyed a significantly higher self-esteem in comparison to girls (13.85 vs. 11.68, respectively, $t=4.63$, $P<0.001$). Finally, the girls perceived their body-image significantly better than boys (3.53 vs. 2.62, respectively, $t=3.93$, $P<0.001$).

Table-2: Descriptive data and gender differences

Variables		Mean \pm SD	Gender Differences
Physical activity	Boy(n=217)	3.84 \pm 0.93	$t = 5.79$ $P < 0.001$
	Girl(n=167)	2.04 \pm 1.08	
	Total(n=384)	2.96 \pm 0.98	
BMI	Boy(n=217)	18.54 \pm 2.56	$t = 0.87$ $P > 0.05$
	Girl(n=167)	18.33 \pm 2.06	
	Total(n=384)	18.42 \pm 2.32	
Self-esteem	Boy(n=217)	13.85 \pm 3.98	$t = 4.63$ $P < 0.001$
	Girl(n=167)	11.68 \pm 2.93	
	Total(n=384)	12.69 \pm 3.53	
Body-image	Boy(n=217)	2.62 \pm 1.21	$t = 3.93$ $P < 0.001$
	Girl(n=167)	3.53 \pm 1.19	
	Total(n=384)	3.01 \pm 1.21	

3-3. Bidirectional associations

Table 3 shows the results of bidirectional associations between research variables.

As it is observed, there are significant relationships between: 1) physical activity and BMI ($P<0.001$), 2) physical activity and self-esteem ($P<0.001$), 3) physical

activity and body-image ($P < 0.001$), 4) self-esteem and BMI ($P < 0.001$), 5) body-image and BMI ($P < 0.001$), and 6) self-esteem and body-image ($P < 0.001$).

3-4. Structural equation modeling

Table 4 and **Figure 1** show the results of structural equation modeling. The results demonstrated that: 1) physical activity inversely influenced BMI ($T = -7.769$), 2) physical activity positively influenced self-esteem ($T = 6.967$), 3) physical activity

positively influenced body-image ($T = 4.740$), 4) self-esteem inversely influenced BMI ($T = -6.064$), 5) body-image inversely influenced BMI ($T = -4.903$), and 6) self-esteem positively influenced body-image ($T = 5.937$). Finally, self-esteem and body-image significantly mediated the association between physical activity and BMI ($P < 0.001$). Results of evaluating fitness of data showed that our model has a good fit ($GOF = 0.92$).

Table-4: Results of structural equation modeling

No.	Path	β	T-value
1	Physical activity => BMI	0.549	-7.769
2	Peer Physical activity => Self-esteem	0.510	6.967
3	Physical activity => Body-image	0.395	4.740
4	Self-esteem => BMI	0.498	-6.064
5	Body-image => BMI	0.356	-4.903
6	Self-esteem => Body-image	0.502	5.937
		Z	P-value
7	Physical activity => Self-esteem => BMI	5.964	$P < 0.001$
8	Physical activity => Body-image => BMI	6.731	$P < 0.001$

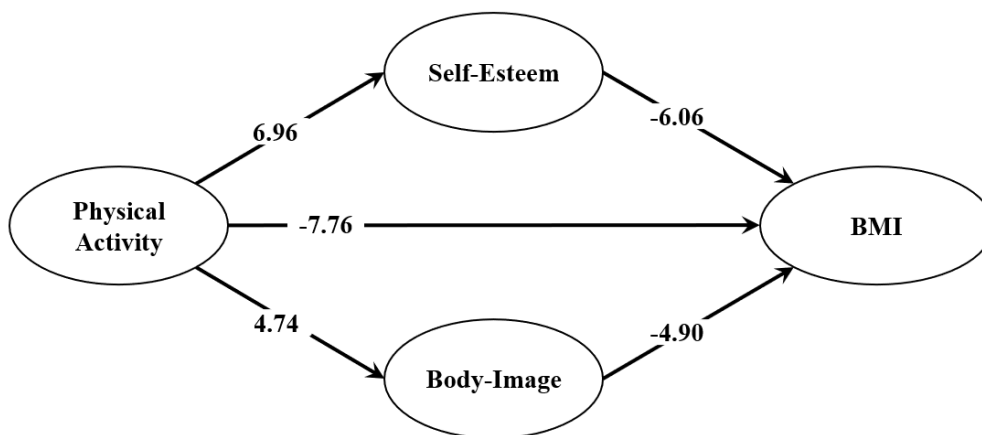


Fig. 1: Structural equation modeling

4- DISCUSSION

Although the effects of physical activity on controlling or reducing obesity have been well documented (19-30), the components that can affect this relationship have not been well defined.

For example, psychological components that can mediate the relationship between physical activity and obesity have not been investigated. Hence, the current study aimed to examine the relationship between physical activity and adiposity in children

with a consideration of self-esteem and body-image as mediators.

Regarding physical activity, we found that, overall, the children's physical activity level was very low. This findings is consistent with those of the previous studies (31-35), displaying that kids do not have sufficient physical hobbies. This indicates that these youngsters need special attention and appropriate strategies that help them to increase their degree of physical pastime. Regarding gender-related differences in physical activities, we determined that male adolescents engaged significantly more in physical interests than their female counterparts. Several studies, using self-report questionnaires or accelerometer measurements have consistently shown that there are significant differences between male and female school-children in physical activity, suggesting that boys are significantly more active than girls (11, 13). Those findings imply that techniques for increasing physical activities amongst youngsters have to put special emphasis on girls. It is asserted that the lower physical activity among girls can be explained through fewer opportunities for physical activities and sports at school, parental support, lower participation in organized sports activities, and gender-specific socialization in terms of sports and movement (11, 13, 24).

Regarding adiposity, the results showed that BMI of our sample was in the normal range. In addition, BMI of boys and girls was almost identical with no significant differences. Furthermore, physical activity had significant inverse effects on the level of obesity of children indicating that those children who participated more in physical activities had lower BMI levels and those with less participation in physical activities experienced higher levels of BMI. This finding is in line with those of previous research (19-30) who emphasized regular physical hobby as a first-rate factor of

fitness and of a healthful way of life for maintaining the functions of the body, and additionally as one of the factors preventing weight problems, indicating that bodily interest has controlling effect on the BMI of children. These results confirm that besides the circle of relatives therapy related to diet change, the bodily pastime is one of the most important factors in childhood obesity prevention and management (19-30).

Regarding psychological predictors of obesity in children, our findings revealed that both self-esteem and body-image acted as significant mediators in the relationship between physical activity and obesity. They were found to have significant inverse effects on the BMI of children. This may confirm that self-esteem and body-image can be considered as psychological determinants of obesity. If children have high levels of self-esteem and body-image, they would experience less BMI and vice versa. Previous studies have shown that poorer self-esteem and body image may contribute to gaining weight and tending to be obese in children and adults (36-40). The causal nature of such relationships has not been, yet, well recognized. In fact, it is not clear whether psychological problems lead to being overweight, whether being overweight leads to psychological problems, or whether they have a reciprocal relationship. Further research is needed to explore the causal relationships between self-esteem, body-image, and obesity in children and youth.

4-1. Limitations of the study

A limitation to this study is that we used self-report questionnaires to identify the degree of the participants' physical activity that is restricted via self-reporting bias. Furthermore, we used a pretty small sample size. Similar studies with large sample sizes should be conducted to increase the reliability of the findings.

5- CONCLUSIONS

Among the main findings of this study, it can be noted that our children had low levels of physical activity, where boys engaged significantly more in physical activities than girls. These findings indicate that strategies to increase physical activities among children should put special emphasis on girls. Moreover, physical activity was related to lower levels of BMI, indicating that physical activity has a controlling effect on the BMI of children. Finally, self-esteem and body-image acted as significant mediators in the relationship between physical activity and obesity, confirming that self-esteem and body-image can be considered as psychological determinants of obesity. Overall, these findings indicate that physical activity and obesity are vital worries in regard to kids. Therefore, it is of paramount importance to apply appropriate techniques to enhance an energetic lifestyle amongst this population.

6- ACKNOWLEDGMENTS

We are grateful to all students and their parents who helped us in this study.

7- REFERENCES

1. Ipsen, D.H.; Tveden-Nyborg, P.; Lykkesfeldt, J. Dyslipidemia: Obese or Not Obese—That Is Not the Question. *Curr. Obes. Rep.* 2016, 5, 405–412.
2. Vekic, J.; Zeljkovic, A.; Stefanovic, A.; Jelic-Ivanovic, Z.; Spasojevic-Kalimanovska, V. Obesity and Dyslipidemia. *Metabolism* 2019, 92, 71–81.
3. Pygeyre, M.; Meyre, D. Monogenetic Obesity. In *Pediatric Obesity: Etiology, Pathogenesis and Treatment (Contemporary Endocrinology)*, 2nd ed.; Freemark, S.M., Robert, C., Atkins, V., Eds.; Springer International Publishing: Bern, Switzerland, 2018; pp. 135–152.
4. Gupta, P.P.; Fonarow, G.C.; Horwich, T.B. Obesity and the Obesity Paradox in Heart Failure. *CJC* 2015, 31, 195–202.
5. Yousefi, R.; Mottaghi, A.; Saidpour, A. Spirulina Platensis Effectively Ameliorates Anthropometric Measurements and Obesity-Related Metabolic Disorders in Obese or Overweight Healthy Individuals: A Randomized Controlled Trial. *Complement. Ther. Med.* 2018, 40, 106–112.
6. Vignerová, J.; Humeníková, L.; Brabec, M.; Riedlová, J. Long-Term Changes in Body Weight, BMI and Adiposity Rebound among Children and Adolescents in the Czech Republic. *Econ. Hum. Biol.* 2007, 5, 409–425.
7. WHO. Report of the Commission on Ending Childhood Obesity. 2016. <http://www.who.int/end-childhood-obesity/en/>. Accessed 29 Jan 2016.
8. LeMura LM, Maziekas MT. Factors that alter body fat, body mass, and fat free mass in pediatric obesity. *Med Sci Sports Exerc.* 2002; 34:487–96.
9. Yaali R, Naeimi Kia M, Gholami A. Effect of weight transfer training on static and dynamic balance of older women. *Res Sport Manage Mot Behav.* 2018; 8(16):47-59.
10. Naeimikia M, Izanloo Z, Gholami A, Ahar S. The Effect of task training with increased cognitive load on the traits related to balance in elderly males. *J Geriatr Nurs.* 2018; 4(3):43-53.
11. Gholidahaneh MG, Ghorbani S, Esfahaninia A. Effects of Basic Psychological Needs Satisfaction in the Physical Education on Leisure-Time Physical Activity Behavior of Primary School Students: Mediating Role of Autonomous Motivation. *Int J Sch Health.* 2020; 7(2):46-53.
12. Dana A, Christodoulides E. The Effects of a Period of Selected Physical

Activity on Improving Manipulative and Locomotors Skills of Children with Neuropsychological Learning Disabilities. *Journal of Rehabilitation Sciences & Research*. 2020; 7(1):25-30.

13. Ghorbani S, Afshari M, Eckelt M, Dana A, Bund A. Associations between Physical Activity and Mental Health in Iranian Adolescents during the COVID-19 Pandemic: An Accelerometer-Based Study. *Children*. 2021; 8(11):1022.

14. Baniasadi T, Ranjbari S, Dana A, Mofrad SK. Objectively-Measured Physical Activity and Health-Related Quality of Life among Children with High and Low Socioeconomic Status. In 15th Conference OF Baltic Society of Sport Sciences. 2022 Apr 28 (p. 119).

15. Naeimikia M, Gholami A. Effect of Physical Activity on the Level of Perceived Mental Pressure during Home Quarantine due to Coronavirus Outbreak. *The Scientific Journal of Rehabilitation Medicine*. 2020; 9(3):217-224. Doi:10.22037/jrm.2020.114158.2503.

16. Abdoshahi M, Gholami A, Naeimikia M. The correlation of Autonomy Support with Intrinsic Motivation, Anxiety, and Intention to Do Physical Activities in Children. *International Journal of Pediatrics*. 2022; 10(3):15623-15629. Doi:10.22038/IJP.2022.63021.4810.

17. Gholami A, Rostami S. Effect of a Fun Virtual Purposeful Active Play Program on Children's Physical Fitness during Home Quarantine due to the Outbreak of Covid-19. *Motor Behavior*. 2021; 13(44):171-190. Doi:10.22089/mbj.2021.10913.1980.

18. World Health Organization. WHO guidelines on physical activity and sedentary behavior. World Health Organization. <https://apps.who.int/iris/handle/10665/336656>. License: CC BY-NC-SA 3.0 IGO. 2020.

19. Jimenez-Pavon D, Kelly J, Reilly JJ. Associations between objectively

measured habitual physical activity and adiposity in children and adolescents: systematic review. *Int J Pediatr Obes*. 2010; 5:3-18.

20. Remmers T, Sleddens EF, Gubbels JS, de Vries SI, Mommers M, Penders J, Kremers SPJ, Thijs C. Relationship between physical activity and the development of body mass index in children. *Med Sci Sports Exerc*. 2014; 46:177-84.

21. Gholami A, Abani Arani M, Ghasemi A, Ghafari B. The Effect of Selected Rainbow Parachute Games on Motor and Social Development of Preschool Children. *Motor Behavior*. 2016; 8(24):189-204. doi: 10.22089/mbj.2016.791.

22. Naeimikia M, Gholami A, Najafzadeh F. Effect of Participation in a Course of Recreational Sports Activity on the Self-Efficacy and Resilience of the Physical Education Teachers. *Sports Psychology*. 2021; 1400(1):51-62. doi: 10.52547/mbsp.6.1.51.

23. Mohammad Gholinejad P, Hojjati H, Ghorbani S. The Effect of Aerobic Exercise on Body Composition and Muscle Strength of Female Students at Elementary Schools of Ali Abad Katoul in 2018. *Int J School Health*, 2019; 6(4): 27-33.

24. Ghorbani S, Rezaeeshirazi R, Shakki M, Noohpisheh S, Farzanegi P. The role of BMI, physical activity and the use of electronic devices in the status of trunk abnormalities in male adolescents. *J Gorgan Univ Med Sci*. 2020; 22(3):129-136.

25. Espana-Romero V, Mitchell JA, O'Neil JP, Pate R. Objectively measured sedentary time, physical activity and markers of body fat in preschool children. *Pediatr Exerc Sc*. 2013; 25:154-63.

26. Janz KF, Levy SM, Burns TL, Torner JC, Willing MD, Warren DDS. Fatness,

- physical activity, and television viewing in children during the adiposity rebound period: the Iowa bone development study. *Prev Med.* 2002; 35: 563–71.
27. Jago R, Baranowski T, Baranowski JC, Thompson D, Greaves KA. BMI from 3–6 y of age is predicted by TV viewing and physical activity, not diet. *Int J Obes (Lond).* 2005; 29:557–64.
28. Heelan KA, Eisenmann JC. Physical activity, media time, and body composition in young children. *J Phys Act Health.* 2006; 2:200–9.
29. Al-Hazzaa HM, Al-Rasheedi AA. Adiposity and physical activity levels among preschool children in Jeddah, Saudi Arabia. *Saudi Med J.* 2007; 28:766–73.
30. Leppanen MH, Nystrom CD, Henriksson P, Pomeroy J, Ruiz JR, Ortega FB, Cadenas-Sánchez C, Löf M. Physical activity intensity, sedentary behavior, body composition and physical fitness in 4-year-old children: results from the ministop trial. *Int J Obes.* 2016; 40:1126–33.
31. Dana A, Ranjbari S, Baniasadi T, Mofrad SK. Effects of a Competence-Based Intervention in Physical Education on enhancing students' physical activity level: An Accelerometer-Based Study. In 15th Conference OF Baltic Society of Sport Sciences. 2022 Apr 28 (p. 27).
32. Dana A, Nodeh H, Salehian M, Mokari Saei S, Sarvari S. Smartphone Usage Status, Sleep Pattern, Health-Related Quality of Life, and Physical Activity among Adolescents from before to during the COVID-19 Confinement: A Cross-Sectional Study. *Int J School Health.* 2021.
33. Mohammadi H, Nafei H, Baniasadi T, Chaharbaghi Z. Accelerometer-Based Physical Activity and Health-Related Quality of Life in Children with ADHD. *Int J Pediatr.* 2022; 10(7): 16362-16369. Doi: 10.22038/ijp.2022.63699.4847.
34. Hashemi Motlagh S, Baniasadi T, Chaharbaghi Z, Moradi L. The Effects of Socioeconomic Status on Physical Activity in Children: Mediating Role of Motivation. *Int J Pediatr.* 2022. Doi: 10.22038/ijp.2022.63421.4834.
35. Sheikh M, Bay N, Ghorbani S, Esfahaninia A. Effects of Peers on Motivation and Physical Activity Behavior of Adolescent Students: An Investigation of Trans-Contextual Model. *Int J School Health.* 2021; 8(1):47-54.
36. Inledon E, Wake M, Hay M. Psychological predictors of adiposity: systematic review of longitudinal studies. *Int J Pediatr Obes.* 2011 Jun; 6(2-2):e1-11.
37. Wardle J, Cooke L. The impact of obesity on psychological well-being. *Best Pract Res Clin Endocrinol Metab.* 2005; 19(3):421–40.
38. Zimetkin AJ, Zoon CK, Klein HW, Munson S. Psychiatric aspects of child and adolescent obesity: a review of the past 10 years. *J Am Acad Child Adolesc Psychiatry.* 2004; 43:134–50.
39. Hebebrand J, Herpertz-Dahlmann B. Psychological and psychiatric aspects of pediatric obesity. *Child Adolesc Psychiatry Clin N Am.* 2009; 18:49–65.
40. Neumark-Sztainer D, Goeden C, Story M, Wall M. Associations between body satisfaction and physical activity in adolescents: Implications for programs aimed at preventing a broad spectrum of weight-related disorders. *Eat Disord.* 2004; 12(2):125–37.
41. Parsons TJ, Power C, Logan S, Summerbell CD. Childhood predictors of adult obesity: A systematic review. *Int J Obes Relat Metab Disord.* 1999; 23 Suppl 8:S1–107.
42. Kołło, H.; Guskowska, M.; Mazur, J.; Dzińska, A. Self-efficacy, self-esteem and body image as psychological

determinants of 15-year-old adolescents' physical activity levels. *Hum. Mov.* 2012, 13, 264–270.

43. Vani, M. F., Murray, R. M., & Sabiston, C. M. (2021). Body image and physical activity. In Z. Zenko & L. Jones (Eds.), *Essentials of exercise and sport psychology: An open access textbook* (pp. 150–175). Society for Transparency, Openness, and Replication in Kinesiology. <https://doi.org/10.51224/B1007>.

44. Zamani Sani SH, Fathirezaie Z, Brand S, Pühse U, Holsboer-Trachsler E, Gerber M, Talepasand S. Physical activity and self-esteem: testing direct and indirect relationships associated with psychological and physical mechanisms. *Neuropsychiatr Dis Treat.* 2016; 12:2617-2625.

45. Gaddad P, Pemde HK, Basu S, Dhankar M, Rajendran S. Relationship of physical activity with body image, self-esteem, sedentary lifestyle, body mass index and eating attitude in adolescents: A cross-sectional observational study. *J Family Med Prim Care.* 2018 Jul-Aug; 7(4):775-779.

46. Rosenberg M. *Society and the Adolescent Self-Image*. Princeton, NJ: Princeton University Press. 1965.

47. Cash, T.F. Multidimensional body-self relations questionnaire (MBSRQ). In T. Wade (Ed.), *Encyclopedia of feeding and eating disorders* (pp. 978-981). Singapore: Springer. 2015.