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The Impact of Parental Socioeconomic Status and Physical Activity on Motor Competence of Children with ADHD

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Abstract

Background: Previous studies have shown that parental socioeconomic status directly affects the participation of children in physical activities and consequently the improvement in their motor competencies. Nevertheless, this issue has been less studied in children with ADHD. Therefore, the present study was designed to investigate the associations between parental socioeconomic status and motor competence considering physical activity as a mediator.

Methods: The present study followed a descriptive-correlational approach using structural equation modeling (SEM). The statistical population of the study included 86 male students diagnosed with ADHD (mean age of 8.36±1.07) who attended in a special school in Tehran. Short-Form Bruininks-Oseretsky Battery, Parental Socioeconomic Status Scale, and Physical Activity Questionnaire for Children were used for data collection. Pearson correlation test and structural equation modelling were used for investigating the relationships between the research variables.

Results: The mean BMI of the participants was 16.9±1.84, placing the BMI-for-age at the 70-percentile indicating that they have healthy weights. Children in this study were in the lower-average level of motor competence (e.g., balance, upper limb coordination, and strength), their parents were mostly at medium level of socioeconomic status, and the physical activity level of the children was lower than average (M=2.23). In addition, parental socioeconomic status positively affected motor competence (T=6.862) and physical activity (T=5.151), and physical activity positively impacted motor competence (T=5.593).

Conclusion: Low amounts of physical activity in our sample make it necessary to find out appropriate factors and strategies to enhance it in children with ADHD. According to our findings, education and income of parents along with the children's participation in physical activity may be critical concerns for their health.

Key Words: ADHD, Children, Motor competence, Physical activity, Socioeconomic status.

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1- INTRODUCTION

Attention Deficit/Hyperactivity Disorder (ADHD) is a common neurodevelopmental disorder in children that can persist into adolescence and adulthood. Research has shown that children with ADHD have cognitive problems such as attention deficit, impulsiveness, hyperactivity, educational difficulties, and problems with motor skills execution. Research has shown that children with ADHD have poorer motor competence than normally developed children (1-6). For example, it has been shown that up to 50% of children with ADHD show difficulties in executing fine and gross motor skills such as handwriting, balance, coordination, and gait, which probably are related to the atrophy in their cerebellum (1-2). Regarding the mechanism underlying motor difficulties in children with ADHD, research has proposed that disorders related to motor processing, motor regulation problems, and motor preparation problems may lead to poor execution of motor skills in children with ADHD (4-6).

Due to the poorer motor competence in children with ADHD than in typically developing children, it is necessary to find out the factors affecting motor competence among children with ADHD. A possible factor that may impact the motor competence of children is socioeconomic status of parents. Indeed, several studies have proven that socioeconomic status of parents plays a major role in motor, cognitive, and social developments of children (7-13). As such, some studies have shown that children with higher parental socioeconomic status had better motor competencies compared to those with lower parental socioeconomic status (10-13). However, effects of parental socioeconomic status on motor competencies among children with ADHD has received less attention in the literature. Therefore, the primary aim of this study was to examine the associations between parental socioeconomic status and motor competence in children with ADHD.

In addition, research on typically developed children has shown that higher amount of physical activity resulted in better motor competence (14-19). Moreover, it has been shown that higher parental socioeconomic status is positively associated with the participation of children in physical activities (20-23). Thus, physical activity may act as a mediator in the association between parental socioeconomic status and motor competence in children. However, this issue has been less studied in children with ADHD. Physical activity refers to any activity or movement of the body that is caused by the contraction and expansion of skeletal muscles and expends energy. Physical activity can include walking, running, and weight lifting, picking leaves off the floor, car washing, and house cleaning, or even gardening. Numerous studies confirmed the benefits of participating in regular physical activities among various age categories, including children (24-28). As such, it has been demonstrated that participating in regular physical activity improves physical and mental health components including strengthening bones and muscles, recuing chronic illnesses and premature deaths, increasing quality of life, and enhancing memory functions (24-28). In addition, some evidence has shown that participating in intense physical activity may enhance brain structure and functioning in children with ADHD (29-31). Thus, it might be used as an intervention for improving motor function (i.e., motor competence) of children with ADHD. Nevertheless, as mentioned earlier, this issue has been received less attention in the literature. Hence, the second purpose of this study was to examine the direct associations between physical activity and motor competence in

children with ADHD; and we included physical activity as a mediator in the relationship between parental socioeconomic status and motor competence in children with ADHD. In total, the present study was designed to investigate the associations between parental socioeconomic status and motor competence with a consideration to physical activity as a mediator. Based on the findings of previous studies, we hypothesized that higher parental socioeconomic status will lead to higher motor competence in children with ADHD. Moreover, it was hypothesized that physical activity will act as a mediator in the associations between parental socioeconomic status and motor competence in children with ADHD.

2- METHODS

The present study followed a descriptive-correlational approach using structural equation modelling.

2-1. Participants

The statistical population of this study included 86 male students diagnosed with ADHD (mean age of 8.36±1.07) who attended in a special school in Tehran.

2-2. Instruments

Motor competence was measured using the short form of the Bruininks-Oseretsky test (BOT-2) (32). This test is a set of reference (product-based) norm tests that assess the motor competence of people aged 4 to 21 years. The short form of this test includes eight tests and 14 sub-tests, which include four sub-tests of gross motor skills (running speed and agility, balance, two-way coordination and strength), three sub-tests of fine motor skills (reaction speed, motor vision control and upper limb speed and agility), and a subtest measuring both motor skills (upper limb coordination). In this study, we used selected subtests including balance, upper limb coordination, and strength. In the BOT-2 short form, the participants receive a raw score, which is transformed to a point score. This point score is further transformed to a standard score, which considers age and sex. Bruininks and Oseretsky (32) estimated the alpha cronbach's reliability of this test as 0.78. The reliability coefficient of this test for Iranian children is reported to be 0.80 (33). Parental socioeconomic status including parents' education level and household income was measured using the scale developed by (34). Education of parents was categorized into low (score 1), medium (score 2), and high (score 3) levels. Annual household income was also divided into low (score 1), medium (score 2), and high (score 3) levels. In the present study, Cronbach's α coefficient of this scale was 0.89. In addition, physical activity was measured using Physical Activity Questionnaire for Children (PAQ-C) (35). The PAQ-C is a self-administered, 7-day recall instrument with nine items, each scored on a 5-point scale from zero to five. In the present study, Cronbach's α coefficient of this questionnaire was 0.90.

2-3. Data Analysis

Descriptive statistics including mean and standard deviation were used to describe the research variables. Kolmogorov-Smirnov test was used to check the normality of research data. Pearson correlation test and structural equation modelling were also used for investigating the relationships between the research variables.

3- RESULTS

Table 1 shows the demographic data of the participants including age, height, weight, and body mass index (BMI). Most importantly, BMI of the participants is 16.9, placing the BMI-for-age at the 70-percentile indicating that they have healthy weights.

Table-1: Mean and standard deviation of demographic variables

Age (year)	Height (cm)	Weight (kg)	BMI
8.36±1.07	128.67±5.72	27.95±4.82	16.9±1.84

Moreover, the mean and standard deviation of the research variables are presented in **Table 2**. Regarding the motor competence, it can be stated that children in this study were in the lower-average level of motor competence (e.g., balance, upper limb coordination, and strength). Regarding parental socioeconomic status, we found that most of students were at medium level of socioeconomic status (M=1.62). Regarding the physical activity, it should be noted physical activity level of children in this study was lower than average (M=2.23). Results of Kolmogorov-Smirnov test showed that our data were normally distributed (all P>0.05).

Table-2: Mean and standard deviation of research variables

Motor Competence			Socioeconomic Status		Physical Activity
Balance	Coordination	Strength	Education	Income	
8.12±3.51	6.49±2.72	7.33±4.19	1.92±0.67	1.31±0.77	2.23±1.84

Results of Pearson correlation test showed that there were significant direct associations between parental socioeconomic status, motor competence (r=0.594, P<0.001), and physical activity (r=0.420, P<0.001). In addition, physical activity was significantly correlated with motor competence (r=0.470, P<0.001).

Furthermore, results of structural equation modelling confirmed correlational findings, where parental socioeconomic status has positively affected motor competence (T=6.862) and physical activity (T=5.151) In addition, physical activity has positively affected motor competence (T=5.593). The conceptual model of the present study is presented in **Fig. 1**. Finally, the results of model fit showed very good fit for the research model (RMSEA=0.06).

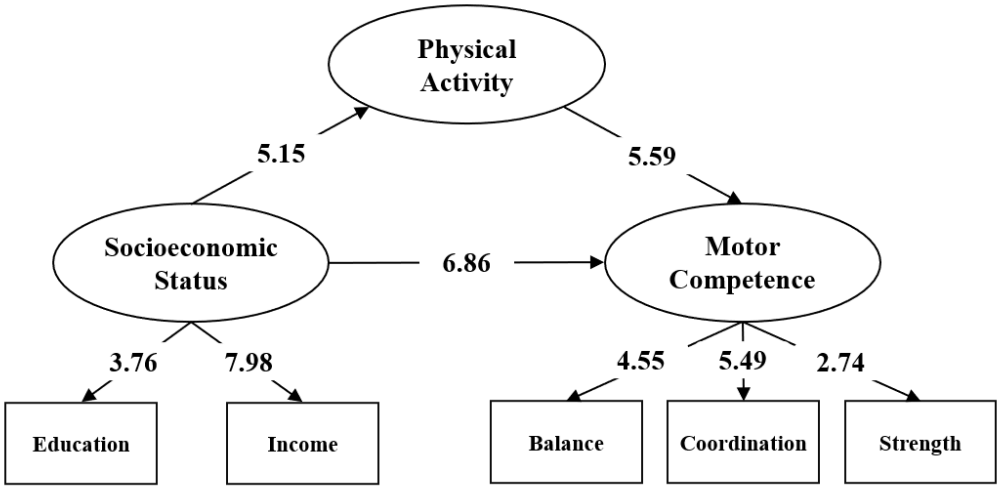

Fig. 1: Conceptual model of the study

4- DISCUSSION

Previous studies have shown that parental socioeconomic status directly affects the participation of children in physical activities and consequently the improvement in their motor competencies. Nevertheless, this issue has been less studied among children with ADHD. Therefore, the present study was designed to investigate the associations between parental socioeconomic status and motor competence with a consideration to physical activity as a mediator. Here, we hypothesized that higher parental socioeconomic status will lead to higher motor competence in children with ADHD. Moreover, it was hypothesized that physical activity will act as a mediator in the associations between parental socioeconomic status and motor competence in children with ADHD. First of all, we found that the children in this study did much less physical activities than the levels recommended by the WHO (i.e., 60 minutes of MVPA indicated that a child with ADHD has a low level of physical activity per week). These results are in line with those of previous studies (29-31) indicating low levels of physical activity in children with ADHD. Given the numerous benefits of regular physical activity (24-28), there is a need to explore strategies and to adopt appropriate intervention exercises in order to increase participation in physical activity and exercise among children with ADHD. In the meantime, strategies to create and increase motivation in children with ADHD to participate regularly in physical activity can be of particular importance. In addition, motor competencies of children with ADHD (e.g., balance, coordination, and strength) were lower than average. These results are also in accordance with previous findings (1-6) indicating that children with ADHD are at risk of poor motor execution. Hence, there is a need to find and implement strategies and interventions to enhance the level of motor competencies in children with ADHD.

Regarding parental socioeconomic status, we found that children whose parents have higher educational and financial conditions have better motor competencies compared to those with lower parental socioeconomic status. The present findings confirm our hypothesis and previous findings on typically developing children (7-13). These findings extend the results of previous studies and highlight the positive effects of parental educational and financial status on the level of motor functions of children with ADHD (10-13). To find out how parental socioeconomic status affect motor competencies in children, we included physical activity as a possible mediator in the associations between parental socioeconomic status and motor competences in children with ADHD. As expected, we found that higher level of parental socioeconomic status has resulted in higher amounts of physical activity in children with ADHD, which confirms our hypothesis and previous findings on typically developing children (7-13). In addition, physical activity acted as a significant mediator in the association between parental socioeconomic status and motor competence in children with ADHD. These findings have novelties, as previous studies have not considered physical activity as a mediator. These findings, also, support the ecological systems theory (34), which holds that children's sports participation is affected by a series of environmental systems around the person, such as parental socioeconomic status, parental support, peer support, and school sports facilities (34). Participating in physical activity increases the physical fitness (mainly muscular fitness) of children. Having better muscular fitness may result in better performance in motor functions. Therefore, it can be suggested that children who are more physically active have

higher physical fitness, which leads to better performance in motor skills.

4-1. Strengths and limitations of the study

As strength of this study, we included ADHD as a popular disability in children into the study, which made it possible to bring out novel findings on the effects of parental socioeconomic status, physical activity, and motor competencies in childhood. However, a relatively small sample size may be a limitation for this study which makes it necessary to use larger samples in future studies.

5- CONCLUSION

By using a cross-sectional study, we showed that children with ADHD engage in low amount of physical activity which deprives them from positive benefits of regular physical activity. Hence, finding and implementing strategies and interventions to enhance the level of physical activity in children with ADHD is essential. In addition, level of motor competencies was low in children with ADHD, where those with higher levels of parental socioeconomic status and physical activity had better motor competencies. In summary, our findings confirm that education and income of parents along with the ADHD children's participation in physical activity may be critical concerns for their health.

6- REFERENCES

1. Farran EK, Bowler A, Souza HD, Mayall L, Karmiloff-Smith A, Sumner E, Brady D, Hill EL. Is the Motor Impairment in Attention Deficit Hyperactivity Disorder (ADHD) a Co-Occurring Deficit or a Phenotypic Characteristic? Adv Neurodev Disord. 2020; 4:2532270.

2. Pila-Nemutandani GR, Pillay BJ, Meyer A. Gross motor skills in children with attention deficit hyperactivity disorder. S Afr J Occup Ther. 2018; 48(3): 19-23.

3. Pila-Nemutandani RG, Pillay BJ, Meyer A. Gender and hand dominance on fine motor skills among Grade 1–7 learners with attention-deficit hyperactivity disorder. S Afr J Psychol. 2020; 50(1):92-102.

4. Pan CY, Tsai CL, Chu CH, Sung MC, Huang CY, Ma WY. Effects of Physical Exercise Intervention on Motor Skills and Executive Functions in Children with ADHD: A Pilot Study. J Atten Disord. 2019; 23(4):384-397.

5. Rosa Neto F, Goulardins JB, Rigoli D, Piek JP, Oliveira JA. Motor development of children with attention deficit hyperactivity disorder. Braz J Psychiatry. 2015; 37(3):228-34.

6. Verret C, Gardiner P, Béliveau L. Fitness level and gross motor performance of children with attention-deficit hyperactivity disorder. Adapt Phys Activ Q. 2010; 27(4):337-51.

7. Gosselin V, Leone M, Laberge S. Socioeconomic and gender-based disparities in the motor competence of school-age children. J Sports Sci. 2021; 39:341-50.

8. VandenDriessche JB, Vaeyens R, Vandorpe B, Lenoir M, Lefevre J, Philippaerts RM. Variation in sport participation, fitness and motor coordination with socioeconomic status among Flemish children. Pediatric Exerc Sci. 2012; 24:113-28.

9. Africa E, Stryp OV, Musálek M. The Influence of Cultural Experiences on the Associations between Socio-Economic Status and Motor Performance as Well as Body Fat Percentage of Grade One Learners in Cape Town, South Africa. Int J Environ Res Public Health. 2021; 19(1):121.

10. Hairol MI, Nordin N, P'ng J, SharanjeetKaur S, Narayanasamy S, Mohd-Ali M, Ahmad M, Kadar M. Association between reduced visual-motor

integration performance and socioeconomic factors among preschool children in Malaysia: A cross-sectional study. PLoS ONE. 2021; 16(3):e0246846.

11. Aiman S, Yusof SM, Abd Kadir Z, Sabturani N, editors. The relationship between socioeconomic status and fine motor skills among six-year-old preschool children. Proceedings of the 2nd International Colloquium on Sports Science, Exercise, Engineering and Technology. 2016: Springer.

12. Barrodi sedehi AA, Ghasemi A, Kashi A, Azimzadeh E. The relationship of the development of motor skills and socioeconomic status of family with BMI of children with autism disorder. Pedagogy Phys Cult Sports. 2021; 25(3):160-4.

13. Morley D, Till K, Ogilvie P, Turner G. Influences of gender and socioeconomic status on the motor proficiency of children in the UK. Hum Mov Sci. 2015; 44:150-6.

14. King-Dowling S, Proudfoot NA, Cairney J, Timmons BW. Motor Competence, Physical Activity, and Fitness across Early Childhood. Med Sci Sports Exerc. 2020; 52(11):2342-8.

15. Schmutz EA, Leeger-Aschmann CS, Kakebeeke TH, Zysset AE, Messerli-Bürgy N, Stülb K, Arhab A, Meyer AH, Munsch S, Puder JJ, Jenni OG, Kriemler S. Motor Competence and Physical Activity in Early Childhood: Stability and Relationship. Front Public Health. 2020; 8:39.

16. Melby PS, Elsborg P, Nielsen G, Lima RA, Bentsen P, Andersen LB. Exploring the importance of diversified physical activities in early childhood for later motor competence and physical activity level: a seven-year longitudinal study. BMC Public Health. 2021; 21:1492.

17. Loprinzi PD, Davis RE, Fu YC. Early motor skill competence as a mediator of child and adult physical activity. Prev Med Rep. 2015; 2:833-8.

18. Gao Z, Wen X, Fu Y, Lee JE, Zeng N. Motor Skill Competence Matters in Promoting Physical Activity and Health. Biomed Res Int. 2021; 24:9786368.

19. Rittsteiger L, Hinz T, Oriwol D, Wäsche H, Santos-Hövener C, Woll A. Sports participation of children and adolescents in Germany: disentangling the influence of parental socioeconomic status. BMC Public Health. 2021; 21:1446.

20. Donnelly S, Buchan DS, McLellan G, Arthur R. The Effects of Socioeconomic Status on Parent and Child Moderate-to-Vigorous Physical Activity and Body Mass Index. Res Q Exerc Sport. 2021; 28:1-11.

21. Xia M, Hu P, Zhou Y. How parental socioeconomic status contribute to children's sports participation in China: A cross-sectional study. J Community Psychol. 2020; 48(8):2625-2643.

22. George AM, da Silva JA, Bandeira ADS, Filho VCB, Rohr LE, Lopes ADS, Silva KSD. Association between socio-economic status and physical activity is mediated by social support in Brazilian students. J Sports Sci. 2019; 37(5):500-506.

23. Sumimoto Y, Yanagita M, Miyamatsu N, Okuda N, Nishi N, Nakamura Y, Nakamura K, Miyagawa N, Miyachi M, Kadota A, Ohkubo T, Okamura T, Ueshima H, Okayama A, Miura K, for NIPPON DATA2010 Research Group. Association between socioeconomic status and physical inactivity in a general Japanese population: NIPPON DATA 2010. PLoS ONE. 2021; 16(7):e0254706.

24. Naeimikia M, Gholami A. Effect of Physical Activity on the Level of Perceived Mental Pressure during Home Quarantine due to Coronavirus Outbreak. Sci J Rehabil Med. 2020; 9(3):217-224.

25. 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. Mot Behav. 2021; 13(44):171-190.

26. 1. Naeimikia M, Gholami A. Effect of Physical Activity on the Level of Perceived Mental Pressure during Home Quarantine due to Coronavirus Outbreak. Sci J Rehabil Med. 2020; 9(3):217-4.

27. Malm C, Jakobsson J, Isaksson A. Physical Activity and Sports-Related Health Benefits: A Review with Insight into the Public Health of Sweden. Sports. 2019; 7(5):127.

28. Schwartz J, Rhodes R, Bredin S, Oh P, Warburton D. Effectiveness of Approaches to Increase Physical Activity Behavior to Prevent Chronic Disease in Adults: A Brief Commentary. J Clin Med. 2019; 8(3):295.

29. Sun W, Yu M, Zhou X. Effects of physical exercise on attention deficit and other major symptoms in children with ADHD: A meta-analysis. Psychiatry Res. 2022;311:114509.

30. Christiansen L, Beck MM, Bilenberg N, Wienecke J, Astrup A, Lundbye-Jensen J. Effects of Exercise on Cognitive Performance in Children and Adolescents with ADHD: Potential Mechanisms and Evidence-based Recommendations. J Clin Med. 2019; 8(6):841.

31. Benzing V, Chang YK, Schmidt M. Acute Physical Activity Enhances Executive Functions in Children with ADHD. Sci Rep. 2018; 8:12382.

32. Bruininks R, Bruininks, B. Bruininks-Oseretsky Test of Motor Proficiency (2nd Ed.). Minneapolis, MN: NCS Pearson. 2005.

33. Gharaei E, Shojaei M, Daneshfar A. The validity and reliability of the Bruininks–Oseretsky Test of Motor Proficiency, Brief Form, in preschool children. Ann Appl Sport Sci. 2019; 7(2):3-12.

34. Xia M, Hu P, Zhou Y. How parental socioeconomic status contribute to children's sports participation in China: A cross-sectional study. J Community Psychol. 2020; 48(8):2625-2643.

35. Kowalski KC, Crocker RE, Donen RM. The physical activity questionnaire for older children (PAC-C) and adolescents (PAQ-A) manual saskatoon. Canada. University of Saskatchewan; 2004.