

Physical Activity of Iranian Children during the Pandemic of Covid-19

Abtin Heidarzadeh¹, Romina Negari Namaghi², Gelayol Ardalan³, Seyyed Hamed Barekati⁴, Gelareh Kiani⁵, Roghayeh Salehzadeh⁶, Seyyede Azadeh Hoseini Nouri⁷, * Roksana Mirkazemi⁸

¹ Associated Professor, Department of Community and Family Medicine, School of Medicine, Medical Education Research Center, Guilan University of Medical Science and Health Services, Rasht, Iran.

² Research Department, Farzanegan Nik Andish Institute for the Development of Knowledge and Technology, Tehran, Iran.

³ Pediatrician, Head of Adolescent Youth and School Health Office Ministry of Health and Medical Education, Tehran, Iran.

⁴ Pediatrician, Child Health Expert, Ministry of Health and Medical Education, Tehran, Iran.

⁵ Assistant Professor of Pediatrics, Department of Pediatrics, School of Medicine, Isfahan University of Medical Sciences, Imam Hossein Children's Hospital, Isfahan, Iran.

⁶ Health Expert of Adolescent Youth and School Office, Deputy of Health, Guilan University of Medical Science, Rasht, Iran.

⁷ Pediatric Disease Research Center, Guilan University of Medical Sciences, Rasht, Iran.

⁸ Founder and Managing Director of Farzanegan Nik Andish Institute for the Development of Knowledge and Technology, Tehran, Iran.

Abstract

Background: During the two years of COVID-19 lockdown and its related restrictions, the level of physical activity has decreased among children. Considering the adverse effects of insufficient physical activity (PA) on the health of children and adolescents, this study was conducted with the aim of investigating the level of physical activity during the COVID-19 pandemic among children and adolescents aged 8-19 years, in Iran.

Methods: This cross-sectional study was conducted among 16,500 urban and rural students 8-19 year-old from 31 provinces across the country, during the COVID-19 pandemic in Iran. Multistage sampling was used to select the participants. Data was gathered in January 2022 using the Persian version of the PA Questionnaire (PAQ) for older children and adolescents, based on the WHO-Global School-based Student Health Survey (GSHS) questionnaire.

Results: 14893 cases were included in the study. The result of this study showed that more than half of the participants had a medium level of PA, and 32.5 had a low level of PA and only 12.6% of the participants had a high level of PA. Males and those in the age group of 14 to 19 years had significantly higher levels of PA ($P<0.05$). The regression analysis showed that for a one-year increase in age, the PA score would decrease by 0.256 times ($p=0.000$). The mean PAQ score was significantly higher among children whose parents did not have a health-related occupation or were unemployed.

Conclusion: Although the finding of this study showed controversial results considering the decrease in children's PA scores during the COVID-19 pandemic, it demonstrated a low PA level among Iranian children in general.

Key Words: Achievement goals, cheating behavior.

* Please cite this article as: Heidarzadeh A, Negari Namaghi R, Ardalan G, Barekati SH, Kiani G, Salehzadeh R, Hoseini Nouri SA, Mirkazemi R. Physical Activity of Iranian Children during the Pandemic of Covid-19. Int J Pediatr 2022; 10 (12):17058-17067. DOI: **10.22038/ijp.2022.68006.5070**

*Corresponding Author:

Roksana Mirkazemi, Founder and Managing Director of Farzanegan Nik Andish Institute for the Development of Knowledge and Technology, Tehran, Iran. Email: r.mirkazemi@gmail.com

Received date: Sep.29,2022; Accepted date: Nov.24,2022

1- INTRODUCTION

Physical activity (PA) is defined by the World Health Organization (WHO) as any type of physical movement produced by the musculoskeletal system and requires energy consumption. PA not only positively affects the health of adults, but also the health of children and adolescents (5 to 17 years) enhancing the cardiorespiratory system, muscles, and bones health. It also regulates blood pressure, blood lipids, and blood sugar, reduces the risk of insulin resistance, improves mental health, and reduces obesity (1). Studies have shown that one hour of walking or PAs such as doing house chores per day at the age of 12 can reduce the risk of developing depression at the age of 18 (2). Also, PA has positive effects on the social and cognitive development of adolescents, and improves school and college performance and physical status, positive effects which would continue into adulthood (1, 3). While PA improves psychological and mental health and well-being (4, 5), insufficient PA is associated with the onset of depressive symptoms in children (6).

According to the WHO, children and adolescents between the ages of 5 and 17 must have an average of at least 60 minutes of moderate to vigorous PA per day during a week. PA should mostly consist of aerobics and for 3 days per week, it should include muscle and bone-strengthening activities such as running and jumping (1).

However, the overall PA of children and adolescents has decreased in recent decades as they spend more time watching TV, using computers, and electronic games (7), negatively impacting their health. Various studies have confirmed that inactivity leads to weight gain and obesity (8), lack of health and well-being in adulthood (9), and adverse metabolic profiles (10). According to different studies, lack of enough PA is related to

coronary heart disease, hypertension or hyperlipidemia (11). In addition, low levels of PA could lead to obesity, and obesity is related to early pubertal growth (12).

One study has shown that PA influences body mass index (BMI) (13). Students who exercise twice a week are less likely to become overweight or obese. Also, while skipping breakfast, consuming fast food, and inactivity will lead to an increase in BMI, PA can reduce BMI as an independent factor (14).

WHO statistics demonstrate that worldwide, more than 80% of adolescents attending school do not follow the WHO's recommendations of at least one hour of PA a day. This is true for 85% of girls and 78% of boys, which shows that inactivity is more common among girls than boys. Also, evidence has shown that while the sedentary lifestyle among boys has slightly declined from 2001 to 2016, it has remained unchanged among girls (3, 15).

The physical and family environment, and social support are known as indicators of PA levels in children; however, in the past two years (16), the COVID-19 pandemic has also impacted PA levels, negatively affecting the situation. During the two years of COVID-19 lockdown and its related restrictions, the level of physical activity has decreased among children. The study conducted by Runacres et al., in 2021, showed that although during the COVID-19 pandemic, all age groups experienced a decrease in their PA level, the drop was much greater for children and adolescents. During the pandemic, screen time (TV, mobile phones, and computers) increased to about 205 minutes per day among children, accounting for 46.8% of their total inactive time (17). So, the negative physical and mental effects of insufficient PA might have affected more children, during the COVID-19 pandemic.

Considering the adverse effects of living a sedentary lifestyle and insufficient PA on the health of children and adolescents, and the considerable decrease in PA during the two years of lockdown due to the COVID-19 pandemic, it seems necessary to study the PA level during this period to design and implement necessary interventions. This study aimed to investigate the level of physical activity during the COVID-19 pandemic among children and adolescents aged 8-19 years in Iran.

2- MATERIALS AND METHODS

2-1. Study design

This cross-sectional study was conducted to assess the level of PA among children aged 8-19 years during the COVID-19 pandemic lockdown in Iran. It was done as part of a larger study for developing a national plan for adolescents' health under grant of WHO country office, APW contract number 201520726.

2-2. Sampling

The study population included 8 to 19 years old urban and rural students from 31 provinces across the country. Multistage sampling was used to select the participants. In each province, sampling was coordinated with the Medical University/Universities of that province, and the adolescent and school health unit of the Deputy for Public Health, Ministry of Health and Medical Education (MOH); and the sampling method was chosen based on the size of the student population covered by each university. Samples were chosen from all school grades (elementary, junior, and senior high school) based on the number of students in each grade. To reach the desired sample size, sampling proportionate to the population of the students was used in each province.

Each school was considered as a cluster. 10 students were chosen from each cluster to fill out the electronic questionnaire. The sample size was 500 students per province

(50 clusters), and 16,500 students from 31 provinces, (in Tehran province, 500 samples were chosen for each of the three medical universities located in this city.

2-3. Participants

14,893 students in the age range of 8-19 years, whose parents provided informed consent to participate, were finally included in the study.

2-4. Instruments

Data was gathered in January 2022 using the Persian version of the PA Questionnaire for older children and adolescents (18), based on the WHO-GSHS questionnaire. This questionnaire is a valid and reliable tool that has been used in different studies for measuring and classifying the level of PA in children and adolescents aged 8-19 years (19-21). The reliability and validity of the Persian translation of the questionnaire were assessed and approved in 2009 (22, 23).

The questionnaire investigates spare time, and times spent at physical education (PE) classes, recess, lunch (besides eating lunch), also right after school, in the evenings, weekend activity, and the weekly mean activity.

2-5. Data analysis

SPSS-22 software was used for the statistical analysis. First, the mean score for questions one and nine and the total score was calculated, and then the descriptive analysis and independent sample t-test were done. The data were categorized into three groups based on the age of the participants; 8 to 19 years, 8 to 14 years, and 14 to 19 years. Also, to investigate the influence of having parents with a health-related occupation, PA of children whose parent/s were either working for the Ministry of Health or providing health services in the private sector were compared with children whose parents had other occupations or were unemployed.

3- RESULTS

A total of 15481 participants completed the questionnaire. 62 questionnaires were excluded from the study, due to violation of the age criteria, and 470 questionnaires were excluded as they were incomplete and the PA score could not be calculated. Overall, 14893 cases were included in the study. **Table 1** shows the general characteristics of the participants. 59% of the participants were

females, and 39.5% were males. 58.7% were in the age range of 8-14 and 66.4% aged 14-19 year age group were females. 54.7% of the parents did not have a health-related job or were unemployed. This was 56.8% in the age group of 8-14 and 51.3% in the 14-19-year-old participants. The average age of the total participants was 11.77 ± 2.76 . This was 10.39 ± 1.69 for the 8-14, and 15.46 ± 1.29 for the 14-19-year-old participants.

Table-1: Characteristics of the participants

Variable	Characteristics	8-14 y	14-19 y	Overall age group
Sex	Female	5447(58.7)	2311(66.4)	8785(59.0)
	Male	3747(40.4)	1128(32.4)	5881(39.5)
	No answer	85(0.0)	44(1.1)	226(1.5)
Parents' Job	Health related	538(5.8)	213(6.1)	226(1.5)
	Unrelated to health/unemployed	5268(56.8)	1784(51.3)	8143(54.7)
	No answer	3473(37.4)	1482(42.6)	5838(39.2)

The overall PA score of the total participants was 2.72 ± 0.79 . It was 2.79 ± 0.76 for the 8-14, and 2.41 ± 0.80 for the 14-19 age groups. The average PA score was significantly higher in the 8-14 age group ($p=0.000$) (**Table 2**). More than half of the participants ($n=4806$, 54.5%) had a medium level of PA, 32.5% ($n=4806$) had a low level of PA and only 12.6% ($n=1872$) had a high level of PA (**Table 3**). The level of PA was also significantly higher in the 8-14 age group. While only 28.6% of the 8-14-year-old participants had a low level of PA, this was 49.0% for the 14-19-year-old group (**Table 3**). The regression analysis showed that for a one-year increase in age, the PA score would decrease by 0.256 times ($p=0.000$) (**Table 4**).

There was a significant difference between PAQ scores among males and females in both groups ($p<0.05$ in all groups). The mean PA score was 2.95 for males and 2.68 for females in the 8-14 age group; and

it was 2.62 for males and 2.30 for females in the 14-19 age group (**Table 2**). Males also had a higher level of physical activity, so that only 24.5% of the boys had a low PA level; however, this was 37.8% for girls. 17.8% of the boys had a high level of PA however, only 9.3% of the girls had a high PA level (**Table 3**).

The mean PAQ score was significantly higher among children whose parents did not have a health-related occupation or were unemployed ($P<0.05$). The mean score of the level of PA for children whose parents had a health-related occupation was 2.82 and was 2.60 for children with unemployed parents or with occupations unrelated to health. 42.0% of the children of parent/s with health-related occupations had low PA activity levels, while only 30.3% of children with unemployed parents or parents with occupations unrelated to health had a low PA level (**Table 4**).

Table-2: PA scores for different age groups, genders, and parental occupations

Characteristics	Physical Activity (Mean± SD)		P-value
	8-14 y	14-19 y	
Age group	2.79±0.76	2.41±0.80	0.000
Sex	Female	Male	
Overall age	2.60±0.75	2.89±0.80	0.000
8-14 y	2.68±0.73	2.95±0.77	0.000
14-19 y	2.30±0.75	2.62±0.86	0.000
Parent/s' Job	Related to Health	Not related to Health or Unemployed	P-value
Overall age	2.53±0.85	2.76±0.77	0.000
8-14 y	2.60±0.84	2.82±0.75	0.000
14-19 y	2.19±0.83	2.45±0.78	0.012

Table-3: PA level in different age, sex, and parents' job groups

Variable	Characteristics	Low	Medium	High	P-value
		N (%)			
Age group	8-14	2633(28.6)	5316 (57.5)	1262(13.7)	0.000
	14-19	1694(49.0)	1507(43.6)	258(7.5)	
Sex	Female	3269(37.8)	4626(53.0)	808(9.3)	0.000
	Male	1430(24.5)	3364(57.7)	1041(17.8)	
Parent/s' Job	Health related job	379(42.0)	429(47.6)	94(10.4)	0.000
	Unrelated health job/ unemployed	2452(30.3)	4536(56.1)	1097(13.6)	

Table-4: Regression analysis with age as the independent and PA score as the dependent variable

Variable	Standardized Coefficients Beta	T	Sig.	95.0% Confidence Interval for B	
				Lower Bound	Upper Bound
Age	-0.256	-29.959	0.000	-0.078	-0.069

To consider the effects of the possible sickness of the participant during COVID-19 pandemic on the results, a question regarding sickness in the week prior to

participation in the study was added. Overall, there was no significant difference in their PA mean score compared to other participants ($p>0.05$) (**Table 5**).

Table-5: Comparing the level of physical activities between the infected and non-infected children by COVID-19 during the pandemic

Sickness	Physical Activity	p-value
	Mean ±SD	
Yes (n=2351)	2.64±0.77	0.192
No (n=12534)	2.73±0.79	
Not-answered (n-7)	-	-

4- DISCUSSION

This study investigated PA among children and adolescents aged 8 to 19 years during the COVID-19 lockdown in Iran. The results showed an overall PA score of 2.72. Nearly one-third of children aged 9 to 14 and half of the children aged 14 to 19 had a low PA level. These findings are consistent with the results of a meta-analysis and systematic review conducted in 2020 that investigated children and adolescents' PA from 2010 to the end of 2020, and showed that a large percentage of children and adolescents in Iran do not have enough participation in PA (24).

Several studies have demonstrated that the COVID-19 pandemic has had a negative impact on PA and the increase of sedentary activity (25-29). A study conducted by Štveráková et al., in 2021, on 98 Czech children with an average age of 10.1 ± 1.47 years showed a 0.38 drop in the PA score during COVID-19 lockdown compared to the pre-pandemic period (30).

No other study was conducted in Iran using the same scale during COVID-19 pandemic; however, comparing the results of this study with previous studies conducted on children of similar age using similar tools, revealed inconsistency in the reported impact of the COVID-19 pandemic on the PA level of Iranian children.

A study conducted by Kalantari et al., in 2018, on fourth to eighth-grade students living in Mazandaran province (mean age= $11.9 \pm 1/19$), showed a total PA score of 2.67 ± 1.03 (31), which was slightly lower than the results of this study. Another study by Motamed-Gorji et al., in 2019, reported a mean score of 2 (1.8 for girls and 2.2 for boys) (32). A study conducted in Yazd (a city in Iran), in 2021, on 12-16-year-old students indicated that 29.8% had a low PA level, which is slightly higher than the findings of this

study (33). Another study conducted in Hamedan (a city in Iran) among 10-16-year-old girls, in 2017, demonstrated that, respectively, 77.2%, 84.3%, 87.5%, 91.8%, 93.5%, 98.2%, and 98.2% of 10, 11, 12, 13, 14, 15, 16-year-old girls have a low level of PA (below 3.26) (34)

However, there were other studies that demonstrated higher PA scores compared to the results of this study, for example, in the study conducted by Kalantari et al. in Mazandaran province the PA score for the boys in the 14-19 age group was 2.62. Similar results were found in a study conducted on 15–17-year-old adolescent boys in Ardabil (Iran) (PA score = 2.7 ± 1.7) (31). The result of this study showed that 24.5% of the male participants have a low level of PA. The study by Zarei et al., conducted in 2013, on 12-14-year-old male students in Sabzevar (Iran) showed a slightly lower proportion of low levels of PA (20.7%) (35).

This study showed that, overall, boys had a higher PA score compared to girls. The results of another study by Kelishadi et al., a national study conducted in 2017 among 23,183 Iranian students with a mean age of 12.55 ± 3.3 years, also showed that the proportion of girls with low PA was more than boys (36). The study of Keykhaei et al. also showed similar results (13). The study by Patnode et al. conducted in the United States in 2010 among 294 children and adolescents aged 10-17 years showed similar results; while boys engaged more in moderate-to-vigorous PA, the overall level of moderate-to-vigorous PA was less than recommended in both sexes (37).

The current study showed that, generally, the participants between the ages of 8 to 14 years had a higher PA score than those in the age range of 14 to 19 years. Results of the study by Trost et al., conducted in 2002, were also consistent with the findings of the present study, indicating that boys were more active than girls and that PA decreased as the school grade

increased; and children are more active than adolescents (38).

The results of the present study also indicated that the PA score of children whose parent/s, had a health-related occupation (working either for the Ministry of Health or providing health care services in the private sector) was lower than that of the other children. This result suggests that the parents' level of awareness about the impact of PA on their children's health does not necessarily have any influence on their children's PA level. The lower PA score might be due to higher socioeconomic status which can accommodate more screen time for the children, or more sensitivity towards observing the breakdown regulations. A study by Esmailzadeh, in 2014, showed that children with high socioeconomic status spend more time watching TV and playing video games per day; however, the difference between the PA score of these children and that of the other children was not significant (25).

5- CONCLUSION

Although this study did not show a significant reduction in PA score among children and adolescents during the COVID-19 pandemic, it demonstrated a low PA level among Iranian children in general. So, designing and implementing relevant interventions is necessary to reduce probable future health problems. In order to prevent the effects of lack of movement, health care providers should promote age-appropriate aerobic and bodybuilding exercises, especially for the vulnerable groups.

6- Ethical considerations

All participants were informed about the purpose of the study and their parents provided informed consent for participation. The data was only used for the purpose of research.

7- ACKNOWLEDGEMENT

Authors thank all participants for their participation in this study. In addition, financial support from WHO office in Iran under Grant [201520726] is gratefully acknowledged.

8- CONFLICT OF INTEREST

None.

9- FUNDING

This work was supported by the WHO office in Iran under Grant [201520726].

10- REFERENCES

1. World Health Organization (WHO). WHO guidelines on physical activity and sedentary behavior: web annex: evidence profiles. Geneva: World Health Organization; 2020. Report No.: CC BY-NC-SA 3.0 IGO.
2. Kandola A, Lewis G, Osborn DP, Stubbs B, Hayes JF. Depressive symptoms and objectively measured physical activity and sedentary behavior throughout adolescence: a prospective cohort study. *Lancet Psychiatry* 2020; 7(3): 262-71. doi: 10.1016/S2215-0366(20)30034-1.
3. World Health Organization (WHO). New WHO-led study says majority of adolescents worldwide are not sufficiently physically active, putting their current and future health at risk [Internet]. Geneva: World Health Organization; 2019. Available from: <https://www.who.int/news/item/22-11-2019-new-who-led-study-says-majority-of-adolescents-worldwide-are-not-sufficiently-physically-active-putting-their-current-and-future-health-at-risk>.
4. Okuyama J, Seto S, Fukuda Y, Funakoshi S, Amae S, Onobe J, Izumi S, Ito K, Imamura F. Mental health and physical activity among children and adolescents during the COVID-19 pandemic. *Tohoku J Exp Med* 2021; 253(3): 203-15. doi: 10.1620/tjem.253.203.

5. Wright LJ, Williams SE, Veldhuijzen van Zanten JJ. Physical activity protects against the negative impact of coronavirus fear on adolescent mental health and well-being during the COVID-19 pandemic. *Front Psychol* 2021; 12: 737. doi: 10.3389/fpsyg.2017.01280.
6. Esmaeilzadeh S. The association between depressive symptoms and physical status including physical activity, aerobic and muscular fitness tests in children. *Environ Health Prev Med* 2015; 20(6): 434-40. doi: 10.1007/s12199-015-0484-0.
7. Brodersen NH, Steptoe A, Williamson S, Wardle J. Sociodemographic, developmental, environmental, and psychological correlates of physical activity and sedentary behavior at age 11 to 12. *Ann Behav Med* 2005; 29: 2-11. doi: 10.1207/s15324796abm2901_2.
8. Caroli M, Argentieri L, Cardone M, Masi A. Role of television in childhood obesity prevention. *Int J Obes Relat Metab Disord* 2004; 28(Suppl3): 104-8. doi: 10.1038/sj.ijo.0802802.
9. Hancox RJ, Milne BJ, Poulton R. Association between child and adolescent television viewing and adult health: a longitudinal birth cohort study. *Lancet* 2004; 364: 257-262. doi: 10.1016/S0140-6736(04)16675-0.
10. Ekelund U, Brage S, Froberg K, Harro M, Anderssen SA, Sardinha LB, Riddoch C, Andersen LB. TV viewing and physical activity are independently associated with metabolic risk in children: the European Youth Heart Study. *PLoS Med* 2006; 3(12): e488. doi: 10.1371/journal.pmed.0030488.
11. Mavrovouniotis F. Inactivity in childhood and adolescence: a modern lifestyle associated with adverse health consequences. *Sport Sci. Rev.* 2012; 21(3-4):75.
12. Chung S. Growth and puberty in obese children and implications of body composition. *J Obes Metab Syndr* 2017; 26(4): 243.
13. Keykhaei F, Shahraki M, Sargolhosseinzadeh E, Shahraki T, Dashipour A. Correlation of body mass index and physical activity among 7-to 11-year children at Zahedan, Iran. *Food Nutr Bull* 2016; 37(3): 364-74. Doi:10.1016/j.metabol.2009.08.019.
14. Mushtaq MU, Gull S, Mushtaq K, Shahid U, Shad MA, Akram J. Dietary behaviors, physical activity and sedentary lifestyle associated with overweight and obesity, and their socio-demographic correlates, among Pakistani primary school children. *Int J Behav Nutr Phys Act* 2011; 8(1): 1-3. Doi: 10.1186/1479-5868-8-130.
15. Guthold R, Stevens GA, Riley LM, Bull FC. Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1.6 million participants. *Lancet Child Adolesc Health* 2020; 4(1): 23-35. doi: 10.1016/S2352-4642(19)30323-2.
16. Kargarfard M, Kelishadi R, Ziaee V, Ardalan G, Halabchi F, Mazaheri R, Poursafa P, Hayatbakhsh MR. The impact of an after-school physical activity program on health-related fitness of mother/daughter pairs: CASPIAN study. *Prev Med* 2012; 54(3-4): 219-23. doi: 10.1016/j.ypmed.2012.01.010.
17. Runacres A, Mackintosh KA, Knight RL, Sheeran L, Thatcher R, Shelley J, Shelley J, McNarry MA. Impact of the COVID-19 pandemic on sedentary time and behavior in children and adults: A systematic review and meta-analysis. *Int J Environ Res Public Health* 2021; 18(21): 11286. doi: 10.3390/ijerph182111286.
18. Kowalski KC, Crocker PR, Donen RM. The physical activity questionnaire for older children (PAQ-C) and

adolescents (PAQ-A) manual. College of Kinesiology, University of Saskatchewan 2004; 87(1): 1-38.

19. Kowalski KC, Crocker PR, Faulkner RA. Validation of the physical activity questionnaire for older children. *Pediatr Exerc Sci* 1997; 9(2): 174-86. doi: 10.1123/pes.9.2.174.

20. Moore JB, Hanes JC, Barbeau P, Gutin B, Treviño RP, Yin Z. Validation of the Physical Activity Questionnaire for Older Children in children of different races. *Pediatr Exerc Sci* 2007; 19(1): 6-19. doi: 10.1123/pes.19.1.6.

21. Wang JJ, Baranowski T, Lau WP, Chen TA, Pitkethly AJ. Validation of the physical activity questionnaire for older children (PAQ-C) among Chinese children. *Biomed Environ Sci* 2016; 29(3): 177-86. doi: 10.3967/bes2016.022.

22. Faghihimani Z, Nourian M, Nikkar AH, Farajzadegan Z, Khavariyan N, Ghatrehsamani S, Poursafa P, Kelishadi R. Validation of the Child and Adolescent International physical activity questionnaires in Iranian children and adolescents. *ARYA Atheroscler* 2010; 5(4).

23. Zameni L, Yeylaghi Ashrafi MR, Kalaji H. Psychometric features of the Persian version of the "Physical Activity of Infants" questionnaire. *Sport physiology* 2021; 11(44): 123-42.

24. Alizadeh A, Negarandeh R, Amiri FB, Yazdani Z. The study of Iranian children and adolescents' physical activity: a systematic review and meta-analysis. *Int J Adolesc Med Health* 2021; 33(3): 65-74. doi: 10.1515/ijamh-2020-0302.

25. Esmaeilzadeh S. Socioeconomic Status, Physical Activity, Physical Fitness and Sedentary Activity in 7-to 11-year-old Iranian Children. *Pertanika J Soc Sci Humanit* 2014; 22(1).

26. Sallis JF, Prochaska JJ, Taylor WC, Hill JO, Geraci JC. Correlates of physical activity in a national sample of girls and boys in grades 4 through 12. *Health Psychol* 1999; 18(4): 410. doi: 10.1037/0278-6133.18.4.410.

27. Park AH, Zhong S, Yang H, Jeong J, Lee C. Impact of COVID-19 on physical activity: A rapid review. *J Glob Health* 2022; 12. doi: 10.7189/jogh.12.05003.

28. Rossi L, Behme N, Breuer C. Physical Activity of Children and Adolescents during the COVID-19 Pandemic-A Scoping Review. *Int J Environ Res Public Health* 2021; 18(21): 11440. doi: 10.3390/ijerph182111440.

29. Velde GT, Lubrecht J, Arayess L, Loo Cv, Hesselink M, Reijnders D, Vreugdenhil A. Physical activity behavior and screen time in Dutch children during the COVID-19 pandemic: Pre-, during-and post-school closures. *Pediatric Obes* 2021; 16(9): e12779. doi: 10.1111/ijpo.12779.

30. Štveráková T, Jačisko J, Busch A, Šafářová M, Kolář P, Kobesová A. The impact of COVID-19 on Physical Activity of Czech children. *Plos One* 2021; 16(7): e0254244. doi: 10.1371/journal.pone.0254244.

31. Kalantari HA, Esmaeilzadeh S. Association between academic achievement and physical status including physical activity, aerobic and muscular fitness tests in adolescent boys. *Environ Health Prev Med* 2016; 21(1): 27-33. doi: 10.1007/s12199-015-0495-x.

32. Motamed-Gorji N, Qorbani M, Nikkho F, Asadi M, Motlagh ME, Safari O, Arefirad T, Asayesh H, Mohammadi R, Mansourian M, Kelishadi R. Association of screen time and physical activity with health-related quality of life in Iranian children and adolescents. *Health Qual Life Outcomes* 2019; 17(1): 1-1. doi: 10.1186/s12955-018-1071-z.

33. Hadianfard AM, Mozaffari-Khosravi H, Karandish M, Azhdari M. Physical activity and sedentary behaviors (screen time and homework) among overweight or obese adolescents: a cross-sectional observational study in Yazd, Iran. *BMC Pediatr* 2021; 21(1): 1-0. doi: 10.1186/s12887-021-02892-w.
34. Rostami-Moez M, Hazavehei SM, Karami M, Karimi-Shahanjarini A, Nazem F, Rezapur-Shahkolai F. Decline in physical activity among Iranian girl students aged 10 to 16 and the related factors. *Health Scope* 2017; 6(4): e62422. doi: 10.5812/jhealthscope.62422.
35. Zare M, Hamedinia MR, Haghighi A, Yarahmadi H. Relationship Physical Activity level and sedentary behaviors with diet patterns among 12-14 year-old student's boys in Sabzevar. *JSUMS* 2013; 19(4).
36. Kelishadi R, Qorbani M, Djalalinia S, Sheidaei A, Rezaei F, Arefirad T, Safiri S, Asayesh H, Motlagh ME. Physical inactivity and associated factors in Iranian children and adolescents: the Weight Disorders Survey of the CASPIAN-IV study. *J Cardiovasc Thorac Res* 2017; 9(1): 41. doi: 10.15171/jcvtr.2017.06.
37. Patnode CD, Lytle LA, Erickson DJ, Sirard JR, Barr-Anderson D, Story M. The relative influence of demographic, individual, social, and environmental factors on physical activity among boys and girls. *Int J Behav Nutr Phys Act* 2010; 7(1): 1-0. doi: 10.1186/1479-5868-7-79.
38. Trost SG, Pate RR, Sallis JF, Freedson PS, Taylor WC, Dowda M, Sirard J. Age and gender differences in objectively measured physical activity in youth. *Med Sci Sports Exerc* 2002; 34(2): 350-5. doi: 10.1097/00005768-200202000-00025.