

# Influence of individual and family factors on physical activity among Saudi girls: a cross-sectional study

Manal Alharbi

From the Department of Maternity and Child Health Nursing, College of Nursing, King Saud University, Riyadh, Saudi Arabia

**Correspondence:** Dr. Manal Alharbi · Department of Maternity and Child Health Nursing, College of Nursing, King Saud University, Riyadh 11422, Saudi Arabia · T: +966 118058533 · maalwahbi@ksu.edu.sa · ORCID: <http://orcid.org/0000-0001-6630-7476>

**Citation:** Alharbi M. Influence of individual and family factors on physical activity among Saudi girls: a cross-sectional study. *Ann Saudi Med* 2019; 39(1): 13-21. DOI: 10.5144/0256-4947.2019.13

**Received:** August 1, 2018

**Accepted:** January 5, 2019

**Published:** January 31, 2019

**Copyright:** Copyright © 2018, Annals of Saudi Medicine, Saudi Arabia. This is an open access article under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND). The details of which can be accessed at <http://creativecommons.org/licenses/by-nc-nd/4.0/>

**Funding:** Deanship of Scientific Research at King Saud University, Research Project No. NFG-7-18-02-40.

**BACKGROUND:** Physical inactivity is a major public health problem and one of the main causes of noncommunicable diseases among children. The physical activity (PA) of children has been studied extensively in other countries, but not in Saudi Arabia, most especially among school-based girls.

**OBJECTIVES:** Assess the PA among older Saudi girls (10–15 years old) and determine the influence of various personal and family factors on PA.

**DESIGN:** Descriptive, cross-sectional study.

**SETTING:** Primary and middle schools in Riyadh, Saudi Arabia.

**SUBJECTS AND METHODS:** Using a multi-stage stratified sampling technique, school girls were surveyed using the Physical Activity Questionnaire for Older Children (PAQ-C). Personal and familial factors that influenced PA levels were assessed by multiple regression analysis.

**MAIN OUTCOME MEASURES:** PA levels of Saudi school girls.

**SAMPLE SIZE:** 464 girls.

**RESULTS:** The mean (SD) score of the respondents in the PAQ-C was 2.63 (0.57, range=1.27-4.24). The majority of the older children reported a moderate level of PA in the last seven days (73.5%), whereas 22.4% and 4.1% of them reported low and high levels of PA, respectively. Employment status of the parents and monthly family income were significant factors that influenced the PA of children.

**CONCLUSIONS:** The findings reiterate the significance of improving the PA of school girls and the critical role of the family in improving children's PA. Multisectoral coordination between schools, health agencies, families, and other concerned agencies to plan and implement interventions should help increase the PA of school girls.

**LIMITATIONS:** The use of self-report may have introduced some levels of social desirability bias. The study was only conducted in a single city.

**CONFLICT OF INTEREST:** None.

Physical activity (PA) is a positive health behavior that can take several forms. PA is critical in children for physical growth and development. PA has also been associated with the psychological and social development of children through social interaction and integration.<sup>1</sup> Previous studies have reported an association with spending more than 2 hours on media and physical inactivity in children.<sup>2,3</sup> A national cross-sectional study of 8568 9-year-old Irish children affirmed that the risk of being overweight and obese was low in children with low sedentary behaviors and high PA.<sup>4</sup> Another study on Asian school-age children and adolescents revealed low PA levels with limited of standardized and viable measurement tools.<sup>5</sup> Cooper and colleagues measured PA and sedentary time patterns in children and reported a 4.2% decrease in PA with each additional year of age.<sup>6</sup> A systematic review and meta-analysis to identify the relationship between sedentary behavior and PA in young people found a negative association between sedentary behaviors and PA.<sup>7</sup> Together, these studies have provided important insights into the PA of children.

Almost 30% of the population of Saudi Arabia is less than 15 years of age, and little is known about PA at these ages.<sup>8</sup> Children tend not meet the physical activity guidelines set by WHO. Previous studies using the Physical Activity Questionnaire for Older Children (PAQ-C) tool showed a moderate PA level among school age children.<sup>9,10</sup> However, data are lacking on PA levels among school girls aged between 10 and 15 years in Saudi Arabia. The Saudi Vision 2030 (<https://vision2030.gov.sa/en>) requires a vibrant, active society that engages and empowers more women to be more physically fit and active. Hence, more research is required to assess PA among school girls and determine the personal and family factors that influence PA. Numerous studies have attempted to explain these factors.<sup>11,12</sup> Children who engage in sports are more likely to have a high PA level.<sup>13,14</sup> Research has investigated PA, but little is known of the personal and family factors that influence PA among children, especially girls.<sup>6</sup> A number of studies have postulated gender disparities in organized sports participation as a significant factor, with boys participating more than girls.<sup>15</sup> Also studies have shown an association between higher levels of PA in children in households without a car and having a television in the child's bedroom.<sup>13,16</sup> Collectively, these studies suggest variation in PA appears to be determined by personal and family circumstances rather than the wider environment. Building an active, strong, and healthy society by promoting PA as a part of girls growth and development and by empowering educa-

tional, cultural, and entertainment in the physical education within schools is important. Therefore, the present study attempts to assess PA among Saudi girls from age 10 to 15 years old and determine the influence of various personal and family factors on PA.

## SUBJECTS AND METHODS

This descriptive, cross-sectional study was carried out in April 2018 in Riyadh City, Saudi Arabia. Of the total population of 616764 girls in general education,<sup>16</sup> participants were selected from 437828 girls in the primary and middle schools using a multi-stage stratified sampling technique. The inclusion criteria for the sample were that participants be school girls aged between 10 and 15 years in primary and middle schools who were free of any chronic disease that prevented any PA. The study excluded those who were out of age range and absent or could not complete the questionnaire for any reason.

The sampling frame included a selection of schools stratified from the total population of students in the five educational regions stratified by middle/primary grades. The total number of governmental schools were 291 middle and 453 primary schools. The first three schools from middle and primary schools were selected from the sampling frame (three middle and three primary schools). One class from each of three grades was chosen, with an average number of students per class equal to or above 22. Classes were selected randomly, one from each grade (grades 4, 5, and 6) in the three primary schools and grades 1, 2, and 3 from the three middle schools. With the Raosoft online sample size calculator, the required sample size for this study was 384 for the population size of 437828 (margin of error=5.0%, confidence level=95.0%). Hence, 18 classes were selected from the six selected schools. Since all students in each class were recruited with an assumed average of 22 students per class, the required sample size of 400 was achieved from the selected classes. The sample was increased to 484 to compensate for dropouts. Data collection was performed from April to May 2018 at the targeted classrooms to explain the study to students. The students were subsequently instructed to put the answered questionnaire together with the signed informed consent in the envelope and seal it themselves before placing in drop boxes in different places in the school.

In a two-part questionnaire, the first part was a researcher-constructed Arabic form for personal and family variables. Personal variables included educational stage (primary or middle), age (10-15 years old), membership in sports club (yes or no), total hours spent

on TV and other electronic devices a day (two hours or less or more than two hours), and whether a favorite hobby required kinetic activities. The total media time was categorized according to American Academy of Paediatricians recommendations.<sup>6</sup> Family variables included parents' employment status (employed or unemployed), parents' educational attainment (no education, middle, secondary, or university graduate and above), monthly family income (less than 2500 USD, 2500–5000 USD, or greater than 5500 USD), type of family (nuclear [father, mother, children less than five], nuclear [father, mother, children more than five], or extended family), rank in the family (first, second, third, and fourth and above), and whether they had siblings. The second part was the PAQ, which assessed the participants' PA level. The PAQ has nine items that are used to recall 7-day PA. The PAQ-C is administered once to compute an activity score but is not intended to estimate metabolic-equivalent expenditure.<sup>17</sup> A high score indicates high levels of PA.<sup>18</sup> The scores were also categorized as low ( $\leq 2.3$ ), moderate (2.4–3.7), and high ( $\geq 3.8$ ) levels of PA. The PAQ-C is a valid instrument to assess moderate-to-vigorous PA in children.<sup>19</sup> The reliability and validity of the PAQ-C were evaluated in the original study, and subsequent studies all showed strong internal consistency (Cronbach's alpha above 0.70).<sup>19–22</sup> A pilot study was conducted to check content validity wording, the clarity of the questionnaire, and the testing of the sampling and recruitment strategy with a convenience sample of 20 students. This sample size was adequate for the pilot testing based on suggestions in the literature (10 to 30 samples).<sup>23</sup> The validation procedures suggested by the World Health Organization (WHO, 2018) were employed.<sup>24</sup> The steps included forward translation by an independent bilingual native Arabic and proficient English-speaking translator; validation by a panel of bilingual experts; backward translation by an independent bilingual native English- and proficient Arabic-speaking translator. Validation by a panel of experts with five members who rated the content validity of the tool as adequate (item-level content validity index=1, scale-level content validity index=1). Moreover, students commented that the items were straight to the point and were simple to comprehend. The internal consistency-reliability of the translated scale was 0.80. Therefore, the scale was considered ready for use.

The study protocol was reviewed and approved by the Sub-Committee of Humanities Faculties of Bioethics Research at the research institute of King Saud University. Permission to conduct the study was obtained from the principals of the participating schools. The principles of ethics, such as respect for persons,

beneficence, and justice, were considered in this study. Thus, the parents of participants were requested to sign an informed consent.

Statistical tests were conducted using IBM SPSS version 22.0 (Armonk, NY: IBM). Frequency counts and percentages are presented for personal and family variables. Mean and standard deviation were calculated to assess the PA of the respondents. Independent sample t-test and one-way analysis of variance were conducted to inspect the associations between variables. Multiple linear regression was performed to examine the influence of the personal and family variables on the PA levels of the respondents. *P* values less than .05 were considered significant.

## RESULTS

### *Personal and family characteristics*

From the 484 questionnaires distributed, 464 were retrieved and included in the analysis for a 95.9% response rate. Forty-five percent of the respondents were in primary school and 55.0% were in the middle school (**Table 1**). Most children were 10–12 years and 13–15 years of age. The majority of the respondents were not a member of a sport club, but most had a favorite hobby that involved kinetic activities. More than half of the children spent more than two hours a day with TV and electronic devices, while less than half spent two hours or less in the same activities. In terms of family factors, the majority of their mothers were employed, while almost all of their fathers were employed. Most of the mothers and fathers were university graduates or higher. Most of the respondents had a monthly family income of >2,500 USD. The majority of the children belonged to a small nuclear family and had siblings.

### *Association of personal and family characteristics with physical activity levels*

The mean score of the respondents in the PAQ-C was 2.63 (SD=0.57, range=1.27–4.24). The majority of the older children reported a moderate level of PA in the last seven days (73.5%), while 22.4% and 4.1% of them reported low and high levels of PA, respectively. Children in primary school had significantly higher levels of PA compared with children in the middle school (**Table 2**). Children aged 10–12 years reported significantly higher levels of PA than children aged 13–15 years. Furthermore, children who spent two hours or less a day in TV and electronic devices were significantly more active than children who spent two hours or more in the same activities.

Children with mothers who were not working re-

**Table 1.** Personal and family characteristics of the respondents (n=464).

Variables	n	%
<b>Personal factors</b>		
Educational stage		
Primary school	209	45.0
Middle school	255	55.0
Age		
10-12 years	214	46.1
13-15 years	250	53.9
Membership in sports club		
No	377	81.3
Yes	87	18.8
Total hour spent with TV or electronic device a day		
Two hours and less	216	46.6
More than two hours	248	53.4
Favorite hobby requires kinetic activities		
No	122	26.3
Yes	342	73.7
<b>Family factors</b>		
Mother's employment status		
Unemployed	257	55.4
Employed	207	44.6
Mother's educational attainment		
No education	54	11.6
Intermediate	30	6.5
Secondary	77	16.6
University graduated and above	303	65.3
Father's employment status		
Unemployed	23	5.0
Employed	441	95.0

**Table 1 (cont).** Personal and family characteristics of the respondents (n=464).

Variables	n	%
Father's educational attainment		
No education	16	3.4
Intermediate	7	1.5
Secondary	40	8.6
University graduated and above	401	86.4
Monthly family income		
Less than 10000 SR	73	15.7
10000-19000 SR	207	44.6
20000 SR and more	184	39.7
Type of family		
Nuclear (small family)	192	41.4
Nuclear (large family)	258	55.6
Extended family	14	3.0
Rank in the family		
First	90	19.4
Second	85	18.3
Third	91	19.6
Fourth and above	198	42.7
Have siblings		
No	17	3.7
Yes	447	96.3

ported higher levels of PA than children with employed mothers ( $P<.001$ ) (**Table 3**). Similarly, children with unemployed fathers were physically more active than children with employed fathers ( $P<.001$ ). The levels of PA also varied significantly by family monthly income ( $P<.001$ ). Multiple comparisons revealed that children belonging to families with less 10,000 SR monthly income were physically more active than children belonging to families with 10,000–19,000 SR ( $P<.001$ ) and 20000 SR and more ( $P<.001$ ) monthly income.

#### *Influence of personal and family factors on physical activity levels*

The significant personal and family factors in the bivariate analyses were considered predictor variables in a standard multiple linear regression to predict the PA of the respondents. The regression model was sub-

stantial ( $F [7, 456]=13.19, P<.001$ ) and accounted for approximately 15.6% ( $R^2=0.168$ ; adjusted  $R^2=0.156$ ) of the variance in the PA scores. Parent employment status and family financial status significantly predicted the PA levels of the respondents in this study (**Table 4**). Specifically, girls who had an unemployed mother and father reported significantly higher levels of PA compared with girls with parents who were working. Furthermore, Saudi girls belonging to a family with a monthly income of 10000 SR–19000 SR and 20000 SR and more had lower PA scores than girls belonging to a family with a monthly income of less than 10000 SR.

## DISCUSSION

This study assessed the PA levels of Saudi girls in primary and middle schools. It also examined the influence of personal and family factors on the activity levels of the participants. The reported PA level of the respondents was within the moderate level with a mean (SD) score of 2.63 (0.57). This finding is lower compared with the reported PA levels of girls from Spain (mean=3.26, SD=0.56;) and Italy (mean=2.93, SD=0.66) using the same tool. By contrast, the current finding is higher than that reported in China (mean=2.56, SD=0.66).<sup>20,25,26</sup> The moderate level of PA may be explained by several factors. The activity levels of Saudi children have been purported to be decreasing in recent decades.<sup>27</sup> The prevalence of obesity among Saudi children, which was shown to be a negative effect of inactivity among children, is increasing at an alarming rate.<sup>28</sup> Furthermore, most Saudi children, especially the girls, travel to and from the school via private cars and school buses.<sup>27</sup> A previous study reported that children had low walking times per week and that girls had significantly less total walking per week than males.<sup>29</sup> A sedentary lifestyle, with many hours consumed with TV and electronic devices, as revealed by the personal factors of the children in this study, is also prevalent among Saudi children, which may have also caused lower levels of PA. Moreover, the Saudi environment, with inadequate facilities for PA (e.g., sports grounds and parks), and the desert climate, are not conducive for PA.<sup>29</sup>

Some of the personal variables were associated with the level of PA. Specifically, students in primary school aged 10–12 years were more physically active compared with students in middle school aged 13–15 years. Similar results were reported in a study conducted among school-based children in China, where children in lower stages of education were more likely to meet the recommendation for moderate-to-vigorous PA than children in the higher stages of education.<sup>30</sup> Previous studies in Canada confirmed that as the age

**Table 2.** Association between individual factors and physical activity levels of Saudi children (n=464).

Variables			Statistical test	P
<b>Educational stage</b>				
Primary school	2.72	0.60	t=2.97	<b>.003</b>
Middle school	2.56	0.53		
<b>Age</b>				
10–12 years	2.72	0.59	t=3.05	<b>.002</b>
13–15 years	2.56	0.54		
<b>Membership in sports club</b>				
No	2.63	0.56	t=0.26	.793
Yes	2.61	0.60		
<b>Total hour spent with TV or electronic device a day</b>				
Two hours and less	2.70	0.60	t=2.50	<b>.013</b>
More than two hours	2.57	0.53		
<b>Favorite hobby requires kinetic activities</b>				
No	2.60	0.56	t = -0.77	.444
Yes	2.64	0.57		

Data are mean (SD) scores on the PAC-Q

increases, participation in active play, as well as PA, decreases.<sup>31</sup> The same study argued that the decline in PA as children aged was related to biological maturity.<sup>31</sup> Furthermore, the present findings suggest that children who had many hours spent watching TV and using electronic devices seemed to be more inactive compared with children with less exposure. This is somewhat logical as children who spend lesser time on these activities have more time to spend in more active activities, such as sports and play. Activities such as watching TV and using electronic devices require minimal to no activity. The use of electronic devices and involvement in other sedentary behaviors are common among children. For instance, a study conducted among children in Washington, USA reported that approximately 40% of the study sample were solitary and sedentary every day.<sup>32</sup> The same study reported that high use of electronic media and having a TV in the child's room were associated with a higher frequency of sedentary behaviors. Thus, research supports the hypothesis that

**Table 3.** Association between family factors and physical activity levels of Saudi children (n=464).

Variables	Mean	SD	Statistical test	P
<b>Mother's employment status</b>				
Unemployed	2.75	0.59	t=5.49	<b>&lt;.001</b>
Employed	2.47	0.50		
<b>Mother's educational attainment</b>				
No education	2.70	0.55	F=0.38	.767
Intermediate	2.67	0.67		
Secondary	2.62	0.56		
University graduated and above	2.61	0.56		
<b>Father's employment status</b>				
Unemployed	3.28	0.75	t=4.25	<b>&lt;.001</b>
Employed	2.60	0.54		
<b>Father's educational attainment</b>				
No education	2.84	0.56	F=1.47	.222
Intermediate	2.62	0.63		
Secondary	2.50	0.58		
University graduated and above	2.63	0.57		
<b>Monthly family income</b>				
Less than 10000 SR (reference level)	2.99	0.60	F=20.94	<b>&lt;.001</b>
10000-19000 SR	2.62	0.53		
20000 SR and more	2.50	0.54		
<b>Type of family</b>				
Nuclear (small family)	2.63	0.57	F=0.89	.413
Nuclear (large family)	2.63	0.57		
Extended family	2.43	0.44		
<b>Rank in the family</b>				
First	2.58	0.56	F=0.42	.742
Second	2.66	0.56		
Third	2.65	0.61		
Fourth and above	2.63	0.56		
<b>Have siblings</b>				
No	2.61	0.55	t=-0.13	.899
Yes	2.63	0.57		

Data are mean (SD) scores on the PAC-Q.

**Table 4.** Personal and family factors influencing the physical activity levels of Saudi children (n=464).

Predictor variables	$\beta$	SE-b	Beta	t	P	95% CI	
						Lower	Upper
Educational stage	-0.03	0.10	-0.03	-0.36	.723	-0.23	0.16
Age	-0.08	0.10	-0.07	-0.88	.380	-0.27	0.10
Total hours spent watching TV or using electronic devices	-0.03	0.05	-0.03	-0.57	.566	-0.13	0.07
Mother's employment status	-0.22	0.05	-0.20	-4.43	<b>&lt;.001</b>	-0.32	-0.12
Father's employment status	-0.51	0.12	-0.20	-4.43	<b>&lt;.001</b>	-0.74	-0.29
Monthly family income (reference group: Less than 10000 SR)							
10000-19000 SR	-0.24	0.07	-0.21	-3.23	<b>.001</b>	-0.39	-0.09
20000 SR and more	-0.31	0.08	-0.27	-3.95	<b>&lt;.001</b>	-0.46	-0.16

The Saudi children's physical activity was the dependent variable in the multiple linear regression.  $\beta$  is the unstandardized coefficients; SE-b is the standard error. Beta is the standardized coefficient. R<sup>2</sup>=0.168; Adjusted R<sup>2</sup>=0.156.

excessive exposure to TV, electronic games, and computers increases the risk of a more sedentary life and the incidence of being overweight and obese and having reduced PA.<sup>33</sup>

In this study, PA was also significantly related to the employment status of the parents, as well as family financial status. These family factors significantly influenced the level of PA of the children. Children who had parents who were not working had higher levels of PA than children with employed parents. This scenario may be related to the time parents spend with their children, as well as their attention to their children's needs. Non-working parents have enough time to be with their children and do activities with them. By contrast, working parents are occupied with work-related activities, thereby allotting less time to be with their children. This scenario supports the claim that parents have a large effect on their child's PA. A previous study confirmed that increased parental encouragement was associated with the increased PA during school days and weekends. Further, increased parental support and engagement were associated with the children having greater physical activity.<sup>33</sup> Moreover, given their busy schedules at work, working parents, as compared with parents who stay at home, may have insufficient time to accompany their children to recreational activities. Another potential reason for this finding is that working parents may oblige their children to stay at home after school, which entails a decreased participation of children in PA and

increases the possibility of the children watching TV and using electronic devices.<sup>34,35</sup>

Children who belong to a family with lower family income tend to be more physically active than children belonging to a family with higher family income. This finding is congruent with previous studies.<sup>35,36</sup> High total yearly family income was associated with the children having low moderate-to-vigorous PA. On the other hand, parents with low income encourage their children to be more physically active compared with parents with higher income.<sup>35</sup> Furthermore, given the lack of financial resources to buy electronic devices, poorer parents tend to direct their children to use their immediate environment for playtime and other activities, which increases the children's PA. They also tend to devote more time to being directly involved in their children's PA. Conversely, parents who have a higher income can afford to buy electronic gadgets for their children. They are also more capable of sending their children to schools by private car, which further increases inactivity.<sup>36</sup>

In conclusion, this study has shown that high levels of PA are associated with being in primary school, being younger, spending fewer hours watching TV and using electronic devices, having unemployed parents, and belonging to a family with low monthly income. The results indicate that a multisectoral coordination of policy makers among schools, health sectors, families, and other concerned sectors is recommended to

plan and implement interventions to ensure an active lifestyle for school girls. Families should also be supportive and encourage their children's involvement in various activities rather than confining them inside the home. Moreover, educating parents about supportive measures, providing adequate time with the children, and using methods that help increase PA among children, may also be beneficial in improving the PA of children. The significant insights gained from this study may be of assistance in research using robust objective measures to explore the influence of personal factors, family structure and parents' attitude towards girls PA. The study should be repeated using mixed methods to define personal and family factors within the Saudi context. This work contributes to existing

knowledge of PA and provides data for specific ages, which help implement physical education programs at girls schools. Limitations of the study are the use of self-report, which may have introduced some level of social desirability bias. However, this method is the simplest way of assessing the PA of children. The study was only conducted in a single city; therefore, future studies should include other cities in the country to enhance the generalizability of the findings.

**Acknowledgment**

*The author extends her appreciation to the Deanship of Scientific Research at King Saud University for funding this work through the Research Project No. NFG-7-18-02-40.*

## REFERENCES

1. World Health Organization. Physical activity strategy for the WHO European Region 2016–2025.2016.[cited 2018 May 11]. Available from: [http://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0014/311360/Physical-activity-strategy-2016-2025.pdf?ua=1](http://www.euro.who.int/__data/assets/pdf_file/0014/311360/Physical-activity-strategy-2016-2025.pdf?ua=1).
2. Leech RM, McNaughton SA, Timperio A. The clustering of diet, physical activity and sedentary behavior in children and adolescents: a review. *Int J Behav Nutr Phys Act.* 2014;11(1):4.
3. Ngantcha M, Janssen E, Godeau E, Ehlinger V, Le-Nezet O, Beck F, et al. Revisiting Factors Associated With Screen Time Media Use: A Structural Study Among School-Aged Adolescents. *J Phys Act Health.* 2018;15(6):448-56.
4. Lane A, Harrison M, Murphy N. Screen time increases risk of overweight and obesity in active and inactive 9-year-old Irish children: a cross sectional analysis. *J Phys Act Health.* 2014;11(5):985-91.
5. Müller AM, Khoo S, Lambert R. Review of physical activity prevalence of Asian school-age children and adolescents. *Asia Pac J Public Health.* 2013;25(3):227-38.
6. Cooper AR, Goodman A, Page AS, Sherar LB, Esliger DW, van Sluijs EM, et al. Objectively measured physical activity and sedentary time in youth: the International children's accelerometry database (ICAD). *Int J Behav Nutr Phys Act.* 2015;12(1):113.
7. Pearson N, Braithwaite RE, Biddle SJ, van Sluijs EM, Atkin AJ. Associations between sedentary behaviour and physical activity in children and adolescents: a meta-analysis. *Obes Rev.* 2014;15(8):666-75.
8. Ministry of Health. Statistics book. 2017. [cited 2018 May 11]. Available from: <http://www.moh.gov.sa/ministry/statistics/book/pages/default.aspx>
9. Alhusaini AA. Physical Activity and Sedentary Behavior Relative to Body Mass Index among School Children in Saudi Arabia. *Pediatr Ther [Internet].* 2017;07(01):1–9. [cited 2018 May 11]. Available from: <https://www.omicsonline.org/open-access/physical-activity-and-sedentary-behavior-relative-to-body-mass-index-among-school-children-in-saudi-arabia-2161-0665-1000312.php?aid=85110>
10. Alahmad ME. Constraints and motivations on the participation of Saudi Arabian high school students in physical activity and sport. *Coll Sport Exerc Sci.* 2016;Doctoral t.
11. Van Sluijs EM, Kriemler S. Reflections on physical activity intervention research in young people—dos, don'ts, and critical thoughts. *Int J Behav Nutr Phys Act.* 2016;13(1):25.
12. Kirby J, Levin KA, Inchley J. Socio-environmental influences on physical activity among young people: a qualitative study. *Health Educ Res.* 2013;28(6):954-69.
13. Poulidou T, Sera F, Griffiths L, Joshi H, Geraci M, Cortina-Borja M, Law C. Environmental influences on children's physical activity. *J Epidemiol Community Health.* 2014;jech-2014.
14. Vander Ploeg KA, Kuhle S, Maximova K, McGavock J, Wu B, Veugelaers PJ. The importance of parental beliefs and support for pedometer-measured physical activity on school days and weekend days among Canadian children. *BMC Public Health.* 2013;13(1):1132.
15. Wilk P, Clark AF, Maltby A, Smith C, Tucker P, Gilliland JA. Examining individual, interpersonal, and environmental influences on children's physical activity levels. *SSM Popul Health.* 2018;4:76-85.
16. General Authority for Statistics. Population estimates for Riyadh Province. 2017. [cited 2018 March 8]. Available from: [https://www.stats.gov.sa/sites/default/files/ar-riyadh\\_0.pdf](https://www.stats.gov.sa/sites/default/files/ar-riyadh_0.pdf).
17. Moore JB, Hanes Jr 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.
18. Crocker PR, Bailey DA, Faulkner RA, Kowalski KC, McGrath R. Measuring general levels of physical activity: preliminary evidence for the Physical Activity Questionnaire for Older Children. *Med Sci Sports Exerc.* 1997;29(10):1344-9.
19. 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.
20. 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.
21. Benítez-Porres J, López-Fernández I, Raya JF, Álvarez Carnero S, Alvero-Cruz JR, Álvarez Carnero E. Reliability and Validity of the PAQ-C Questionnaire to Assess Physical Activity in Children. *J Sch Health.* 2016;86(9):677-85.
22. Gobbi E, Elliot C, Varnier M, Carraro A. Psychometric Properties of the physical activity questionnaire for older children in Italy: testing the validity among a General and clinical Pediatric Population. *PloS One.* 2016;11(5):e0156354.
23. Hill R. What sample size is "enough" in internet survey research. *Interpers Comput Technol An Electron J 21st century [Internet].* 1998;6(3–4):1–12. [cited 2018 May 11]. Available from: <http://www.reconstrue.co.nz/IPCT-J Vol 6 Robin hill SampleSize.pdf>
24. World Health Organization. Process of translation and adaptation of instruments. . [cited 2018 May 11]. Available from: [https://www.who.int/substance\\_abuse/research\\_tools/translation/en/](https://www.who.int/substance_abuse/research_tools/translation/en/)
25. Al-Hazzaa HM. Obesity and physical inactivity among Saudi children and youth: Challenges to future public health. *J Family Community Med.* 2006;13(2):53.
26. Hammad SS, Berry DC. The child obesity epidemic in Saudi Arabia: A review of the literature. *J Transcult Nurs.* 2017;28(5):505-15.
27. Al-Nakeeb Y, Lyons M, Collins P, Al-Nuaim A, Al-Hazzaa H, Duncan MJ, Nevill A. Obesity, physical activity and sedentary behavior amongst British and Saudi youth: A cross-cultural study. *Int J Environ Res Public Health.* 2012;9(4):1490-506.
28. Fan X, Cao ZB. Physical activity among Chinese school-aged children: national prevalence estimates from the 2016 Physical Activity and Fitness in China—The Youth Study. *J Sport Health Sci.* 2017;6(4):388-94.
29. Sherar LB, Esliger DW, Baxter-Jones AD, Tremblay MS. Age and gender differences in youth physical activity: does physical maturity matter?. *Med Sci Sports Exerc.* 2007;39(5):830-5.
30. Roberts JD, Rodkey L, Ray R, Knight B, Saelens BE. Electronic media time and sedentary behaviors in children: Findings from the Built Environment and Active Play Study in the Washington DC area. *Prev Med Rep.* 2017;6:149-56.
31. Martin K. Electronic overload: The impact of excessive screen use on child and adolescent health and wellbeing. Department of Sport and Recreation, Perth, Western Australia. 2011. [cited 2018 May 11]. Available from: [https://www.natureplaywa.org.au/library/1/file/Resources/research/K%20Martin%202011%20Electronic%20Overload%20DSR%20\(2\).pdf](https://www.natureplaywa.org.au/library/1/file/Resources/research/K%20Martin%202011%20Electronic%20Overload%20DSR%20(2).pdf).
32. Johansson E, Mei H, Xiu L, Svensson V, Xiong Y, Marcus C, et al. Physical activity in young children and their parents—An Early STOPP Sweden-China comparison study. *Sci Rep [Internet].* 2016;6:1–8. [cited 2018 May 11]. Available from: <http://dx.doi.org/10.1038/srep29595>
33. Lee S, Young DR, Pratt CA, Jobe JB, Chae SE, McMurray RG, et al. Effects of parents' employment status on changes in body mass index and percent body fat in adolescent girls. *Child Obes.* 2012;8(6):526-32.
34. Xu C, Quan M, Zhang H, Zhou C, Chen P. Impact of parents' physical activity on preschool children's physical activity: a cross-sectional study. *PeerJ [Internet].* 2018;6:e4405. [cited 2018 May 11]. Available from: <https://peerj.com/articles/4405>
35. Cottrell L, Zatezalo J, Bonasso A, Lattin J, Shawley S, Murphy E, et al. The relationship between children's physical activity and family income in rural settings: A cross-sectional study. *Prev Med Rep.* 2015;2:99-104.
36. Matsudo VK, Ferrari GL, Araújo TL, Oliveira LC, Mire E, Barreira TV, et al. Socio-economic status indicators, physical activity, and overweight/obesity in Brazilian children. *Rev Paul Pediatr.* 2016;34(2):162-70.