Title: Physical activity and sedentary behaviours levels of Kuwaiti adolescents: the Study of Health and Activity among Adolescents in Kuwait.

Running head: Lifestyle in Kuwaiti adolescents.

Manuscript type: Original research.

Key words: accelerometry, youth, sedentary behaviour.

Abstract

Background: There are scarce number of studies describing the lifestyle of adolescents living in Arab countries. We described physical activity (PA) and sedentary behaviours patterns among Kuwait adolescents and the associations with parental education. Methods: Cross-sectional data from 435 adolescents (201 boys) from the Study of Health and Activity among Adolescents in Kuwait (SHAAK), conducted between 2012-2013. Outcomes variables included PA (Actigraph GT1M accelerometers) and sedentary behaviours. Exposure variable was parental education. Descriptive and multiple logistic regression analysis to examine the association between parental education and outcomes variables. Results: Total sedentary time (minutes/day) was higher in girls (568.2 ± 111.6) than boys (500.0 ± 102.0), whereas boys accumulated more minutes in light, moderate and vigorous PA (all P-values≤ 0.001). In total, 3.4% of adolescents spent ≥ 60 minutes/day of moderate to vigorous PA (by accelerometry) whilst only 21% met screen-time guidelines. Low/medium maternal education was associated with a higher odds of exceeding screen-time guidelines (OR, 95% CI: 2.09, 1.09-4.02). Conclusions: Most Kuwaiti adolescents in this sample were physically inactive and exceeded screen-time guidelines. Objective PA was not socially patterned, yet an inverse association between maternal education and screen-time behaviours was found.

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1   **Introduction**

2   Lifestyle in modern industrialized societies is characterized by a pandemic of physical inactivity as well as the wide

3   use of technology-based sedentary behaviours. For example, in a large survey 80% of adolescents (13-15 years)

4   were not meeting physical activity (PA) recommendations (1 hour/day of moderate to vigorous PA intensity)[1]. In

5   addition, at least two thirds of children and adolescents exceeded 2 hours/day of screen time (TV viewing plus

6   computer use)[2] in a large pooled international study. However, there are scarce number of studies describing the

7   lifestyle of adolescents living in Arab countries. Kuwait remains one of the most affluent countries in the world

8   (ranked 5th in 2015 according to the World Bank)[3], which may enable a widespread use of diverse electronic media

9   among adolescents regardless of familial socioeconomic level.

10   Epidemiological studies in Arab countries have traditionally relied on self-reported PA and sedentary behaviours

11   questionnaires in both sexes[4-7] with the exception of one study conducted in males that included pedometers[8]. Using

12   data from 2009, Allafi et al.[5] described PA and sedentary behaviours patterns among Kuwaiti adolescents aged 14-

13   19 years. Half of the boys and three quarters of the girls did not meet physical activity recommendations, and almost

14   all students reported >2 hours/day on screen time. However, PA levels were estimated by questionnaires which

15   present well-known limitations[9].

16   Understanding the socioeconomic variation in health related behaviours in adolescents is important as it may help to

17   understand the pathways by which low socioeconomic status (SES) leads to poorer health outcomes. To our

18   knowledge no study has examined the association between PA, sedentary behaviours and SES indicators in Kuwaiti

19   adolescents. Although in high-income countries there is a consistent inverse association between SES and

20   adolescents' total screen time,[10,11] fewer studies in the literature have examined the association between SES and

21   objectively measured total sedentary time[10]. One systematic review published in 2010 concluded that higher SES

22   was associated with higher PA levels in adolescents[12]. Conversely, a recent pooled analysis of 12770 adolescents

23   from Europe, Australia, Brazil and the USA found lower levels of objectively light intensity PA and higher of total

24   sedentary time in adolescents with high SES (based on maternal education)[10]. Reasons of these equivocal findings

25   might may be explained by methodological reasons: for example, how PA was measured (questionnaires or

26   objective methods) and the choice of different SES indicators among studies (education, household income,

27   composite measures, etc).

28   Given the reduced number of published studies in Arab adolescents further studies in this region are warranted. The

29   aims of this study were to describe objectively measured PA and self-reported sedentary behaviours among Kuwaiti

30   adolescents. In addition, we examined the association between parental education and, adolescents' PA and

31   sedentary behaviours.

32

33   **Methods**

34   *Study design*

35   The Study of Health and Activity among Adolescents in Kuwait (SHAAK) was a cross-sectional study

36   targeting Kuwaiti adolescent students between 2012 and 2013. A multistage stratified sampling design with

37   proportionate sampling was used. The original sampling frame included all the governmental (intermediate and

38   secondary) schools in Kuwait. They were stratified by governorate (Hawalli, Asimah, Jahra, Farwaniya, Ahmadi

39   and Mubarak), gender and the school grades (7 to 12). In a first stage, researchers randomly selected (using a box

40   with folded papers) schools for each sex and governorate by a serial number assigned to each school. In a second

41   stage, using a similar allocation process, one class was selected from each grade (that is, three classes from each

42   intermediate school and three from each secondary one). From a total estimated population of 128,948 adolescents,

43   it was originally planned to obtain a representative sample of 1% (n=1,289).   Due to resource and time constraints,

44   data were collected from only three (Hawalli, Asimah and Jahra) of Kuwait's six governorates. From 594 students

45   invited to participate, 591 gave written informed consent (99%). For the aim of this study 435 students had valid

46   data including complete sociodemographic information and PA and sedentary behaviour measurements.

47   *Data collection*

48   Data collection took place from October 2012 through June 2013. Researchers followed one standard protocol that

49   included: a general questionnaire requesting information on socio-demographic, health-related behaviours (smoking,

50   sleep and soda drinks intake) PA and sedentary behaviours, as well as a physical examination (anthropometric

51   measurements) and the provision of PA sensors (accelerometers) to participants.

52   *Physical activity and sedentary behaviours:*

53   Physical activity measurements included both self-reported questionnaires and objective methods. The questionnaire

54   requested information about physical activity in different domains: transport (car, bus, walking, other), school

55   breaks (sitting, standing and/or walking, running and/or playing), and leisure time (type, duration and frequency per

56   week).

57   Objectively measured PA was assessed by Actigraph GT1M activity monitor (Actigraph, LLC, Pensacola, FL,

58   USA). The Actigraph is a small and lightweight device, which is attached to a belt around the waist. The Actigraph

59   monitor is a uniaxial accelerometer designed to measure change in acceleration in the vertical plane with respect to

60   time. The GT1M measures the vertical acceleration and deceleration of human motion. The detected accelerations

61   are filtered, then converted to a number (count) and subsequently summed over a specified time interval called an

62   epoch[13]. The Evenson et al.[14] cut points for adolescents were chosen as appropriate cut points for categorizing the

63   intensities of activity as sedentary ($\leq$100), light (>100), moderate ($\geq$2296) and vigorous ($\geq$4012). A number of

64   inclusion and exclusion criteria were specified to reduce the accelerometer data. First, a 20-minute count of

65   consecutive "zero" counts was used to indicate that the accelerometer was not worn. Second, days with fewer than

66   ten hours of wear time data were excluded from the analyses to account for unrepresentative days of activity[15]. Last,

67   data for any participant with at least one valid day were included in the analyses to maximise the use of the sample.

68   Participants also reported habitual daily sedentary behaviour using a self-completed questionnaire: television

69   viewing, non-active video games (games played while being seated), active video games (games eliciting light-

70   intensity activity), computer use, social networks, homework, leisure-time reading). Response options were: I do not

71   do this; one to two hours; two to three hours; or more than three hours.

72   *Parental education:*

73   A self-reported questionnaire was used to collect participant's demographic information (date of birth, gender,

74   school grade, birth order, type of and family size, number of cars in their family). Parental education level was

75   reported by the adolescents using a self-completed questionnaire that listed the following response options: illiterate,

76   read and write, intermediate, secondary, university or higher education. Because of too few answers in some

77   categories the five categories of answers were merged into: 1) Low: included read and write level and intermediate

78   level (Grades 7-9); 2) Medium: included secondary level (Grades 10-12); 3) High: at least University degree.

79   *Physical measurements*

80   Nurses were trained by researchers in measuring anthropometric measurements before the study commencement

81   date. Weight, height and waist circumference were measured in all participants.

82   Weight was measured (light clothing, emptied pockets and without shoes), to the nearest 0.1 kg using a SECA

83   (Germany) electronic scale, model 813. Height was measured (without shoes, in bare or stocked feet), to the nearest

84   0.1cm using a SECA (Germany) portable stadiometer, model 217, with adolescents standing upright.   Waist

85   circumference was measured (over light clothing), using a non-elastic flexible measuring tape (Myotape, USA).

86   Waist circumference measurements were taken midway between the tenth rib and the iliac crest, to the nearest 0.1

87   cm, with participants standing erect, arms by their sides, feet together and abdomen relaxed (at the end of

88   expiration).

89   *Ethical Approval*

90   Participants received a detailed explanation of the aim of the study and its methods. Written consent forms were

91   attached to the study questionnaire and signed by the participating students, before starting the assessment. In

92   addition, the students took home a parental consent form to be signed by their guardians. Both students and their

93   parents were free to agree or refuse to participate and/or withdraw from the study at any time, without any

94   obligation. Written consent was obtained in each participant. Ethical approval for all study procedures and

95   instruments was obtained by Kuwait Institute for Medical Specialization (Reference number: VDR/JC/505. Date:

96   April 8, 2012).

97

98   *Data handling and statistical analysis*

99   Descriptive results are expressed as, median and inter-quartile range (or mean and standard deviation) for

100   continuous variables and percentages for categorical variables. To be used in the regression model, education

101   categories were recoded into two levels: High, if parents achieved at least university studies; Low, below University

102   studies. Physical inactivity was defined as accumulating less than 60 minutes of daily moderate to vigorous physical

103   activity (MVPA)[16]. Participants in the upper quartile of objectively measured sedentary time were defined as the

104   sedentary group. Meeting screen-time guidelines was based on <120 minutes per day[17] of television viewing or/and

105   computer use or/and non-active videogames. Associations among maternal and paternal education with: screen-time,

106   TV-viewing, sedentary time (accelerometry) and physical inactivity (accelerometry) were analysed using a multiple

107 logistic regression (Odds ratio, OR and 95% confidence intervals CIs). Each continuous outcome variable was

108 recoded into binary variables: For screen-time, 0: <120 minutes per day; 1: ≥120 minutes per day; For television-

109 viewing, 0: <120 minutes per day; 1: ≥120 minutes per day; For sedentary time, 0: First and Second quartile; 1:

110 Third quartile; Physical inactivity, 0: <60 minutes of MVPA per day; 1: ≥60 minutes of MVPA per day. Data for

111 boys and girls were combined to boost the statistical power, with one model adjusting by age, sex and governorate.

112 Two-tailed statistical significance was set at the 5% level. Analysis and were carried out using SPSS version 24.0'

113 (IBM Corp, Armonk, NY, USA).

114

115 **Results**

116 *Sample characteristics*

117 Table 1 shows the descriptive characteristics of the participants, N=435 (201 boys (median age: 15.9 years), 234

118 girls (median age: 16.0)). As shown in Table 1 some statistically significant sex differences emerged (boys were

119 taller, heavier, larger waist circumference, had higher smoking prevalence and less time sleeping at the weekend,

120 and were in families with higher number of cars, than girls).

121 *Self-reported physical activity and sedentary behaviours*

122 As shown in Table 2, car was the predominant way of transport to school (in 87.6% in total participants). By sex,

123 girls reported a higher prevalence of motorized transport (car and bus) than boys whereas only boys walked to

124 school (17.4%) (P ≤0.001). In the school breaks, a higher percentage of boys reported sitting than girls, but a higher

125 percentage of boys reported be physically active than girls during leisure time (ex. Frequency of PA during school

126 days: 3 times or more, in 42.2% of boys versus 17.2% of girls).

127 For sedentary behaviours, boys played more with videogames whereas girls spent more time watching TV, using

128 computers, reading and doing homework. Most of adolescents (79%) exceeded screen-time recommendations (≥2

129 hours/day), in boys (74.6%) and girls (83.3%). Using just TV viewing, 41.4% of adolescents exceeded screen-time

130 guidelines.

131 *Objectively measured physical activity*

132   As shown in Table 3, objectively measured total sedentary time (minutes per day) was higher in girls (568.2 ±

133   111.6) than boys (500.0 ± 102.0), whereas boys accumulated more minutes in light, moderate and vigorous physical

134   activity (all P ≤0.001). In the total sample, 3.4% of adolescents met PA guidelines (≥60 minutes per day of moderate

135   to vigorous PA), being slightly higher the prevalence in boys than girls (5.6% and 1.6%, respectively).

136   *Associations among screen time, sedentary time and physical inactivity with SES status*

137   Table 4 shows the results of the multivariate logistic regression analyses. For paternal education, no associations

138   were found. For maternal education, adolescents whose mother had a low/medium level was associated with a

139   higher risk of exceeding screen-time recommendations: (OR, 95% CI: 2.09, 1.09-4.02) and screen-time guidelines

140   based solely in TV viewing: (OR, 95% CI: 1.88, 1.15-3.07). However, maternal education was not associated with

141   objectively measured PA (sedentary group defined as the third quartile, physically inactive defined as less than 60

142   minutes of MVPA (or even in further analyses when physically inactive was defined as less than 30 minutes of

143   MVPA).

144

145   **Discussion**

146   The present study examined the prevalence of PA and sedentary behaviours as well as their associations with an

147   important indicator or familial socioeconomic status (parental education) in a sample of Kuwaiti adolescents. The

148   main findings were: I) Based on the accelerometry, almost all adolescents were physically inactive (total sample:

149   97%), and boys accumulated more time in light, moderate and vigorous PA than girls. II) Most of adolescents spent

150   ≥2 hours/day of total screen-time (79%). III) Low maternal education was associated with a higher odds of

151   exceeding screen-time guidelines, but not with meeting objectively measured PA guidelines.

152   *Prevalence of physical inactivity*

153   PA differences between sexes have been consistently reported in the literature using objective measurement

154   methods[18] and also in Kuwait using PA questionnaires[5]. For example, in the latter study conducted in 2009 in

155   Kuwaiti adolescents (aged 14-19 years) 56% of boys and 24% of girls met PA recommendations[5]. However, based

156   on accelerometer data we found a substantial lower prevalence of Kuwaiti adolescents meeting with PA

157   recommendations (3% of total sample, 6% boys and 2% girls). These worrisome findings are in agreement with

158 recent data from a pooled study (n=27637, age=5-17 years) conducted in ten countries (Australia, Belgium, Brazil,

159 Denmark, Estonia, Norway, Portugal, Switzerland, UK, USA)[18] where only 9% of boys and 2% of girls met PA

160 guidelines. In addition, we observed that boys were less sedentary and more active than girls, as previously noted[18].

161 There are many possible explanations of the high prevalence of physical inactivity in Kuwait. Remarkably, we

162 found that around 90% of adolescents travelled by car to school and owned at least 3 familiar cars. There is growing

163 evidence that active school travellers are more physically active on the whole than non-active travellers[19]. It can be

164 also suggested that the extremely hot climate in Kuwait (in summer temperatures above 40ºC) and cultural norms

165 adopted in some Arab countries (example, girls are socially discriminated against participating in any kind of

166 exercise) could explain the low physical activity levels in this sample of adolescents. Nonetheless, it is important to

167 bear in mind that the very high prevalence of physical inactivity observed in this sample of Kuwaiti adolescents is

168 almost similar to previous data published in other wealthy countries[18].

169 As described in Table 3 by PA intensity levels, boys accumulated more time in light, moderate and vigorous PA

170 than girls, but the major difference was observed with light intensity PA (median values: 42 minutes/day higher in

171 boys). If higher amounts of light PA may provide health benefits in physically inactive adolescents must be

172 investigated.

173 *Prevalence of meeting screen-time guidelines*

174 A low percentage of Kuwaiti adolescents (total sample: 21%) met screen-time guidelines (TV viewing plus non-

175 active videogames plus computer use <2 hours/day). Based solely in time spent watching TV, the proportion of

176 adolescents watching less than 120 minutes/day increased (total sample: 59%), being higher than previous data

177 published in USA[20] (~40%) or Brazil[21] (~30%). In agreement with data from Westernized European countries[22], we

178 found marked differences between sexes by types of sedentary behaviour, with boys spending more time with

179 videogames whereas girls more time in academic related behaviours (reading, homeworks). Our results (girls

180 reported more time watching TV than boys) agree with the Arab Teens Lifestyle Study conducted in Kuwait in

181 2009[5], where girls also reported a higher time watching TV.

182 *Associations between socioeconomic status with physical activity and sedentary behaviours*

183   Maternal education was associated with exceeding screen-time guidelines. Our data obtained in Kuwait (a rich

184   country) are in agreement with the conclusions of a recent systematic review about socioeconomic correlates of

185   sedentary behaviour in adolescens[11]. In high-income countries a strong and consistent inverse association between

186   SES and total screen time and TV time was found[11]. Despite the role of mothers may vary given societal and cultural

187   differences among rich countries, the inverse association observed in Kuwait between maternal education and TV

188   time is identical to prior data reported in the literature. Nevertheless, paternal education was not associated with

189   sedentary behaviours. Regarding physical activity, maternal and paternal education were not associated with

190   meeting PA guidelines, in agreement with a pooled observational study that included 10 studies from Europe,

191   Australia, Brazil and the USA[10]. In other words, the dramatic low PA levels found in this sample of adolescents

192   suggest that recent changes in wealthy countries, such as wide-use of technology in leisure time and motorized

193   transport, have eroded physical activity levels across all social strata, age groups and countries.

194   *Strengths and limitations*

195   This is the first study conducted in Kuwaiti adolescents using an objective method of PA measurement, as well as

196   the association with a proxy of SES (parental education). An additional strength was the use of well-established cut-

197   points (Evenson)[14] to define the time spent at various PA intensities which may allow comparison with other large

198   international pooled studies[10,18]. As limitations, the type of accelerometer used in this study (Actigraph GT1M) have

199   a set of well-known methodological limitations. For example, they inaccurately record upper arms movements or

200   physical activity when cycling[23]. However, due to the predominant use of motorised transport in Kuwait (in our

201   study 90% of adolescents used cars for commuting to school) it can be rule out a general PA underestimation. In

202   addition, Actigraph monitors misclassify time spent in standing as sedentary, which is not sedentary behaviour[24].

203   Finally, the current study was conducted in three out of six governorates in Kuwait, which may limit the

204   generalizability of our findings for the whole population of Kuwaiti adolescents. From a public health perspective, a

205   high parental education was not advantageous in terms of increase the probability to become physically active. The

206   low number of subjects meeting PA recommendations in this study (n=12) could partially account for the lack of

207   associations found. However, null associations were also found when we defined the active group as doing a

208   minimum of 30 daily minutes of MVPA (Table 4).

209 In conclusion, in our sample of Kuwaiti adolescents almost all the adolescents were physically inactive, and

210 exceeded screen-time guidelines. PA was not socially patterned, yet for screen-time behaviours, association with

211 maternal education emerged. As a physical inactivity pandemic is affecting Kuwait, population-wide strategies (i.e.,

212 promote active ways of transport) should be implemented to boost physical activity in the population.

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225 **References**

226 1) Hallal PC, Andersen LB, Bull FC, Guthold R, Haskell W, Ekelund U; Lancet Physical Activity Series

227   Working Group. Global physical activity levels: surveillance progress, pitfalls, and prospects. *Lancet.*

228   2012; 380:247-57.

229 2) Atkin AJ, Sharp SJ, Corder K, van Sluijs EM; International Children's Accelerometry Database (ICAD)

230   Collaborators. Prevalence and correlates of screen time in youth: an international perspective. *Am J Prev*

231   *Med.* 2014;47:803-7.

232 3) "GDP per capita, PPP (current international $)", World Development Indicators database, World Bank.

233   Database updated on 16 December 2016.

234   4)   Guthold R, Cowan M, Autenrieth C, Kann L, Riley L. Physical activity and sedentary behavior among
235   schoolchildren: a 34-country comparison. *J Pediatr.* 2010;157:43-9.

236   5)   Allafi A, Al-Haifi AR, Al-Fayez MA, Al-Athari BI, Al-Ajmi FA, Al-Hazzaa HM, Musaiger AO, Ahmed F.
237   Physical activity, sedentary behaviours and dietary habits among Kuwaiti adolescents: gender differences.
238   *Public Health Nutr.* 2014;17:2045-52.

239   6)   Hajian-Tilaki K, Heidari B. Prevalences of overweight and obesity and their association with physical
240   activity pattern among Iranian adolescents aged 12-17 years. *Public Health Nutr.* 2012;15:2246-52.

241   7)   Al-Hazzaa HM, Abahussain NA, Al-Sobayel HI, Qahwaji DM, Musaiger AO. Physical activity, sedentary
242   behaviors and dietary habits among Saudi adolescents relative to age, gender and region. *Int J Behav Nutr*
243   *Phys Act.* 2011;8:140.

244   8)   Al-Hazzaa HM. Pedometer-determined physical activity among obese and non-obese 8- to 12-year-old
245   Saudi schoolboys. *J Physiol Anthropol.* 2007;26:459-65.

246   9)   Shephard RJ. Limits to the measurement of habitual physical activity by questionnaires. *Br J Sports Med.*
247   2003;37:197–206.

248   10) Sherar LB, Griffin TP, Ekelund U, Cooper AR, Esliger DW, van Sluijs EM, Bo Andersen L, Cardon G,
249   Davey R, Froberg K, Hallal PC, Janz KF, Kordas K, Kriemler S, Pate RR, Puder JJ, Sardinha LB, Timperio
250   AF, Page AS. Association between maternal education and objectively measured physical activity and
251   sedentary time in adolescents. *J Epidemiol Community Health.* 2016;70:541-8.

252   11) Mielke GI, Brown WJ, Nunes BP, Silva IC, Hallal PC. Socioeconomic Correlates of Sedentary Behavior in
253   Adolescents: Systematic Review and Meta-Analysis. *Sports Med.* 2017; 47:61-75.

254   12) Stalsberg R, Pedersen AV. Effects of socioeconomic status on the physical activity in adolescents: a
255   systematic review of the evidence. *Scand J Med Sci Sports.* 2010;20:368-83.

256   13) Toschke JA, von Kries R, Rosenfeld E, Toschke AM. Reliability of physical activity measures from
257   accelerometry among preschoolers in free-living conditions. *Clin Nutr.* 2007;26:416-20.

258   14) Evenson KR, Catellier DJ, Gill K, Ondrak KS, McMurray RG. Calibration of two objective measures of
259   physical activity for children. *J Sports Sci.* 2008;26:1557-65.

260   15) Sardinha LB, Andersen LB, Anderssen SA, Quitério AL, Ornelas R, Froberg K, Riddoch CJ, Ekelund U.
261   Objectively measured time spent sedentary is associated with insulin resistance independent of overall and
262   central body fat in 9- to 10-year-old Portuguese children. *Diabetes Care.* 2008;31:569-75.

263   16) WHO (2010). Global strategy on Diet, Physical Activity and Health. Physical activity and young people. In
264   http://www.who.int/dietphysicalactivity/factsheet_young_people/en/

265   17) American Academy of Pediatrics (AAP) Committee on Public Education. Children, adolescents, and
266   television. *Pediatrics.* 2001;107:423–6.

267   18) Cooper AR, Goodman A, Page AS, Sherar LB, Esliger DW, van Sluijs EM, Andersen LB, Anderssen S,
268   Cardon G, Davey R, Froberg K, Hallal P, Janz KF, Kordas K, Kreimler S, Pate RR, Puder JJ, Reilly JJ,
269   Salmon J, Sardinha LB, Timperio A, Ekelund U. Objectively measured physical activity and sedentary time
270   in youth: the International children's accelerometry database (ICAD). *Int J Behav Nutr Phys Act.*
271   2015;12:113.

272   19) Larouche R, Saunders TJ, Faulkner G, Colley R, Tremblay M. Associations between active school
273   transport and physical activity, body composition, and cardiovascular fitness: a systematic review of 68
274   studies. *J Phys Act Health.* 2014;11:206-27.

275   20) Eisenmann JC, Bartee RT, Smith DT, Welk GJ, Fu Q. Combined influence of physical activity and
276   television viewing on the risk of overweight in US youth. *Int J Obes (Lond).* 2008;32:613-8.

277   21) Wells JC, Hallal PC, Reichert FF, Menezes AM, Araujo CL, Victora CG. Sleep patterns and television
278   viewing in relation to obesity and blood pressure: evidence from an adolescent Brazilian birth cohort. *Int J*
279   *Obes (Lond).* 2008;32:1042-9.

280   22) Rey-López JP, Vicente-Rodriguez G, Ortega FB, Ruiz JR, Martinez-Gómez D, De Henauw S, Manios Y,
281   Molnar D, Polito A, Verloigne M, Castillo MJ, Sjöström M, De Bourdeaudhuij I, Moreno LA. Sedentary
282   patterns and media availability in European adolescents: The HELENA study. *Prev Med.* 2010;51:50-5.

283   23) Corder K, Brage S, Ekelund U. Accelerometers and pedometers: methodology and clinical application.
284   *Curr Opin Clin Nutr Metab Care.* 2007;10:597–603.

285   24) Network SBR. Letter to the Editor: Standardized use of the terms "sedentary" and "sedentary behaviours".
286   *Appl Physiol Nutr Metab.* 2012;37:540–2.

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294 Table 1. Characteristics of participants in the Study of Health and Activity among Adolescents in Kuwait
295 (SHAAK)

		Boys (n=201)	Girls (n=234)
Age (year)		15.9 (14.7-17.3)	16.0 (14.6-17.6)
Height (cm)		169.0 (168.0-171.0)***	156.0 (155.0-157.0)
Weight (kg)		70.8 (58.9-91.3)***	58.4 (46.1-67.5)
BMI (kg m^{-2})		24.4 (20.6-30.8)**	23.3 (19.1-26.9)
Waist circumference (cm)		84.0 (72.0-97.1)***	77.0 (67.6-84.5)
Maternal education level (n, %)	Low[1]	15 (7.5)	25 (10.7)
	Medium[2]	27 (13.4)	35 (15.0)
	High[3]	159 (79.1)	174 (74.4)
Paternal education level (n, %)	Low[1]	31 (15.4)	26 (11.1)
	Medium[2]	40 (19.9)	45 (19.2)
	High[3]	130 (64.7)	163 (69.7)
Number of cars (n, %)	Low[#]	20 (10.0)	41 (17.5)*
	High[§]	181 (90.0)	193 (82.5)
Smoking (currently Yes) (n, %)		25 (12.4)***	2 (0.9)
Soft-drinks (frequency) (n, %)	Low^	96 (47.8)	120 (51.3)
	High~	105 (52.2)	114 (48.7)
Sleep weekdays (hours/day)		7.5 (6.2-8.1)	7.5 (6.3-8.5)
Sleep weekend (hours/day)		9.0 (8.0-10.0)***	10.0 (9.0-10.5)

296 Continuous variables are shown as median (interquartile range) according to their distribution. n= number of
297 participants. For categorical variables, n and percentages are shown. Education level: [1]Low, read and write,
298 intermediate (Grades 7-9); [2]Medium, secondary (Grades 10-12); [3]High, at least University degree. Number of cars:
299 [#]Low, up to 2 cars. [§]High, at least 3 cars. Soft drinks: ^Low, less than 1 drink per day; ~High, at least 1 drink per
300 day. P-values for sex differences using Mann-Whitney U Test (non-parametric) or Chi-Square Test (categorical): *
301 ≤0.05; **≤0.01; ***≤0.001. The p value refers to the overall result of the Chi-Square Test describing the
302 associations of number of cars and sex

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316 Table 2. Self-reported physical activity and sedentary behaviours in adolescents:

317 the Study of Health and Activity among Adolescents in Kuwait (SHAAK study)

Physical activity domain	Boys n=201	Girls n=234	Total n=435
Transport to school			
Car (n, %)	164 (81.6)	217 (92.7)***	381 (87.6)
Bus (n, %)	0 (0)	16 (6.8)	16 (3.7)
Walking (n, %)	35 (17.4)	1 (0.4)	36 (8.3)
Other (n, %)	2 (1.0)	0 (0.0)	2 (0.5)
PA first school break			
Sitting (n, %)	84 (41.8)*	82 (35.0)	166 (38.2)
Standing and/or walking (n, %)	106 (52.7)	147 (62.8)	253 (58.2)
Running and/or playing (n, %)	11 (5.5)	5 (2.1)	16 (3.7)
PA second school break (n, %)			
Sitting (n, %)	103 (51.8)***	83 (35.5)	186 (43.0)
Standing and/or walking (n, %)	92 (45.8)	147 (62.8)	239 (55.2)
Running and/or playing (n, %)	4 (2.0)	4 (1.7)	8 (1.8)
Leisure PA school days			
Never (n, %)	33 (16.5)***	67 (28.8)	100 (23.1)
Once per week (n, %)	33 (16.5)	43 (18.5)	76 (17.5)
Twice per week (n, %)	50 (25.0)	83 (35.6)	133 (30.7)
Three times or more (n, %)	84 (42.2)	40 (17.2)	124 (28.6)
Leisure PA weekend days			
Never (n, %)	67 (33.7)***	128 (55.2)	195 (45.2)
Once per week (n, %)	67 (33.7)	53 (22.8)	120 (27.8)
Twice per week (n, %)	65 (32.7)	51 (22.0)	116 (26.9)
Leisure time Sedentary behaviour			
TV viewing			
None (n, %)	33 (16.4)	16 (6.8)***	49 (11.3)
1-2 hours (n, %)	116 (57.7)	90 (38.5)	206 (47.4)
2-3 hours (n, %)	25 (12.4)	70 (29.9)	95 (21.8)
+3 hours (n, %)	27 (13.4)	58 (24.8)	85 (19.5)
Videogames-non active			

Nothing (n, %)	89 (44.3)***	145 (62)	234 (53.8)
1-2 hours (n, %)	66 (32.8)	66 (28.2)	132 (30.3)
2-3 hours (n, %)	27 (13.4)	14 (6.0)	41 (9.4)
+3 hours (n, %)	19 (9.5)	9 (3.8)	28 (6.4)
Videogames-active			
Nothing (n, %)	151 (75.1)	161 (68.8)	312 (71.7)
1-2 hours (n, %)	35 (17.4)	49 (20.9)	84 (19.3)
2-3 hours (n, %)	8 (4.0)	18 (7.7)	26 (6.0)
+3 hours (n, %)	7 (3.5)	6 (2.6)	13 (3.0)
Computer use			
Nothing (n, %)	102 (51.3)	80 (34.5)**	182 (42.2)
1-2 hours (n, %)	72 (36.2)	106 (45.7)	178 (41.3)
2-3 hours (n, %)	12 (6.0)	31 (13.4)	43 (10.0)
+3 hours (n, %)	13 (6.5)	15 (6.5)	28 (6.5)
Social networks			
Nothing (n, %)	44 (21.9)	45 (19.5)	89 (20.6)
1-2 hours (n, %)	77 (38.3)	83 (35.9)	160 (37.0)
2-3 hours (n, %)	35 (17.4)	41 (17.7)	76 (17.6)
+3 hours (n, %)	45 (22.4)	62 (26.8)	107 (24.8)
Homework			
Nothing (n, %)	44 (21.9)	12 (5.2)	56 (12.9)
1-2 hours (n, %)	110 (54.7)	97 (41.6)	207 (47.7)
2-3 hours (n, %)	28 (13.9)	69 (29.6)***	97 (22.4)
+3 hours (n, %)	19 (9.5)	55 (23.6)	74 (17.1)
Reading			
Nothing (n, %)	151 (75.1)	130 (56.5)	281 (65.2)
1-2 hours (n, %)	42 (20.9)	72 (31.3)	114 (26.5)
2-3 hours (n, %)	8 (4.0)	25 (10.9)***	33 (7.7)
+3 hours (n, %)	0 (0.0)	3 (1.3)	3 (0.7)
Meeting screen-time guidelines (n, %)	51 (25.4)***	39 (16.7)	90 (20.7)
Meeting TV-time guidelines (n, %)	149 (74.1)***	106 (45.3)	255 (58.6)

318 PA: Physical activity. Screen-time guidelines based on <2 hours per day of television viewing or/and computer use
319 or/and non-active videogames[14] P-values (two sided) for sex differences: * ≤0.05; **≤0.01; ***≤0.001 using Chi
320 Square Test. The p value refers to the overall result of the chi-square with the asterisk indicating the sex with higher
321 value. Data are number of participants (n) and percentage (%).

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Table 3. Objectively measured physical activity in adolescents: the Study of Health and Activity among
Adolescents in Kuwait (SHAAK study)

PA intensity level			
	Boys (n=162)	Girls (n=189)	Total (n=351)
Sedentary (min/day) x±sd	500.0 ± 102.0	568.2 ± 111.6***	536.7 ± 112.4
Median (IR)	492.2 (431.4-565.4)	567.3 (489.7-635.0)	532.7 (456.7-610.1)
Light (min/day)	306.7 (244.7-370.8)**	262.0 (220.0-323.9)	276.00 (229.5-347.0)
Moderate (min/day)	16.1 (9.0-26.9)***	8.2 (4.4-14.7)	12.0 (5.8-20.0)
Vigorous (min/day)	1.7 (0.5-4.5)***	0.67 (0.0-1.9)	1.00 (0.2-3.0)
Moderate to Vigorous (min/day)	19.0 (10.4-30.6)***	8.7 (4.8-16.7)	13.71 (6.2-23.0)
Meeting PA guidelines (n, %)	9 (5.6)*	3 (1.6)	12 (3.4)

Data are median (interquartile range, IR) or mean (± standard deviation) according to the distribution of the
variables using Evenson cut points[12]. One valid day was considered if adolescents wore at least ten hours of wearing
time. PA guidelines based on ≥60 minutes per day of moderate to vigorous PA[13]. P-values (two sided): * ≤0.05;
≤0.01; *≤0.001 using non-parametric tests, t-test and Chi-square test. PA: Physical activity.

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Table 4. Odds ratio and 95% confidence intervals for not meeting screen time guidelines, being physically inactive or sedentary by maternal and paternal education: the Study of Health and Activity among Adolescents in Kuwait (SHAAK study)

	Screen time (≥ 2hours/day)	TV viewing (≥ 2hours/day)	Sedentary (Third quartile)	Physically inactive (accelerometry)	Physically inactive alternative definition (accelerometry)
	Total (n=433)	Total (n=433)	Total (n=350)	Total (n=350)	Total (n=350)
Maternal education	OR 95% CI	OR 95% CI	OR 95% CI	OR 95% CI	OR 95% CI
High[§]	1	1	1	1	1
Low/Medium[#]	2.09 (1.09-4.02)	1.88 (1.15-3.07)	1.05 (0.60-1.85)	1.88 (0.39-9.00)	0.57 (0.28-1.15)
P-value	0.03	0.01	0.87	0.43	0.12
Paternal education	OR 95% CI	OR 95% CI	OR 95% CI	OR 95% CI	OR 95% CI
High[§]	1	1	1	1	1
Low/Medium[#]	1.19 (0.71-2.03)	1.34 (0.86-2.09)	0.94 (0.55-1.59)	1.81 (0.47-7.05)	0.81 (0.45-1.47)
P-value	0.50	0.19	0.81	0.39	0.49

Model adjusted model by age, sex and governorate. Screen-time guidelines based on <2 hours per day of television viewing or/and computer use or/and non-active videogames (reference). Physical activity guidelines: at least 60 daily minutes of moderate to vigorous PA. Alternative definition: at least 30 daily minutes of moderate to vigorous PA. [#]Low/Medium education level: read and write, intermediate, secondary level; [§]High education as having at least University studies. OR, odds ratio, CI, confidence intervals.