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Physical Education and Gender Differences in Physical Activity, Sedentary Behavior Related to Academic Success of Science-Related Courses for Children in the State of Qatar

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Featured Application: The aim of this study was to determine gender effects regarding anthropometric, physical activity and academic performance for schoolchildren in Qatar. Relevant gender differences were only observed for peak height velocity, academic performance (Science, Arabic) and vigorous activities. The parameters from the three different dimensions were not in relation with each other.

Abstract: Background: This cross-sectional study examined gender differences in physical activity (PA), body mass index, sedentary behavior (SB), and academic performance (AP) in school-aged children in Qatar. **Methods:** Fifty-two schoolchildren (age: 11.9 ± 0.6 years) were assigned to gender-adjusted groups (female; n = 29). AP was calculated using the grade point averages (GPA) in Mathematics, Science, and Arabic. Additionally, the Short Form of the International Physical Activity Questionnaire (IPAQ) was utilized. **Results:** Four parameters (peak height velocity [PHV], science, Arabic, vigorous PA) showed relevant gender effects ($p < 0.05$ and $\eta_p^2 > 0.10$). The largest gender effect was calculated for PHV ($p < 0.001$, $\eta_p^2 = 0.45$). PHV was markedly higher for males (1.65 ± 0.90) than for females (0.36 ± 0.37). Females showed a higher performance level in science (82.9 ± 8.61 vs. 77.0 ± 8.76) and Arabic (80.9 ± 8.25 vs. 73.0 ± 8.22). A significant gender difference ($p = 0.002$, $\eta_p^2 = 0.18$) was evident for vigorous MET-minutes/week (males: 1318 ± 932 vs. females: 646 ± 525). In conclusion, males exhibited the greatest amount of moderate and vigorous PA. Females spent the greatest time sitting. Arabic was different by gender, and science AP was dependent upon gender. **Conclusions:** These data suggest subjects in middle school are sensitive to gender, but not necessarily influenced by PA or SB at this age. Encouraging a school-based program and an after-school health club characterized by gender sensitive strategies consisting of a health class and physical education curriculum support the unique needs, interests of academic performance, and motor skills to improving health related fitness for girls compared to boys.

Keywords: physical activity; anthropometrics; academic achievement; sedentary; schoolchildren

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1. Introduction

Physical activity (PA) is considered as any body movement resulting in a significant increase in energy expenditure, above basal [1]. PA displayed though many forms, and is strongly influenced by cultural heritage. Total PA is calculated from its frequency, duration, and intensity. Despite benefits of PA on health and wellbeing being widely known [2] PA levels globally have declined worldwide, for reasons such as increased use of entertainment technology [3].

Physical activity has wide-ranging benefits for children's physical and mental health [4]. Conversely, sedentary behavior (SB) exerts negative health consequences [5]. Advocates often emphasize the significance of engaging in PA for enhancement of academic achievement. Proponents suggest incorporating frequent sessions of PA during the school day to improve attention and learning, as stated by Hermassi et al. [6]. For children and teenagers, increasing PA levels and limiting SB can lead to several health advantages. Regularly high levels of PA and less SB is related to improved cognitive function, positive physical outcomes, and favorable mental health [7–9].

Previous studies [2] around the globe have reported gender differences for PA with lower participation seen in females [10]. Socioecological factors at the individual level (such as body mass, fitness, male preferences for higher intensity activities, or perceived competence), familial level (such as gender roles, living conditions, parental support, or family structure), community level (such as community sport), school level (such as opportunities for students to be physically active during school breaks), and environmental level (such as climate or geography) are all thought to contribute to this gender gap [11].

It has been reported in a systematic review that physical inactivity among Arab children and adolescents is high [12]. However, prevalence of physical inactivity, defined in Global School-based Student Health Surveys as <60 min per day on 5 or more days during the past seven days, is very high, with a low of 65% in Lebanon and a high of 91% in Egypt. Similarly, high levels of inactivity (>60%) except in KSA (45%) and Tunisia (29%), with smaller studies showing a wide variation within and among countries. In addition, overall, the prevalence of inactivity was higher among male and female adolescents.

Obesity [13,14], poor metabolic health [15,16], and worse psychosocial health in children [5] have all been linked to voluminous SB. In a comprehensive, population-based survey, it was found that Americans between the ages of 8 and 18 years of age sat down for 10.7 h on average each day (11.2 h for boys and 10.3 h for girls). TV viewing, video game playing, and music listening were among these activities [17]. Additionally, longitudinal data indicate that the prevalence of SB in children has grown over time [18]. As childhood behavior patterns are likely to continue into adolescence and adulthood, this is cause for concern [19].

A rise in habits like the use of mobile devices may be partially responsible for recent rises in SB in children and adolescents [19]. However, TV viewing has dominated the majority of studies looking at SB in children and teenagers [5], most likely because mobile device ownership has just recently become widespread. As a result, significant SBs that add to overall sedentary time have not been taken into account in studies.

Recent research has started to discover associations between physical performance, academic attainment, and cognitive performance, suggesting PA is not only coincidentally associated with cognitive function [20–22]. Moreover, global data suggest students at various levels of education exhibit gender difference in academic performance, with females generally outperforming males [23,24]. Ahrenfeldt et al. [25] reported gender differences exist in cognitive functioning and academic performance. Girls were likely to be more adaptive to learning in different environments. However, in a study conducted among secondary school students in Kenya, Wangu [26] observed more males passed the course than females. Conversely, Goni et al. [27] did not observe a significant gender difference in academic performance in college students.

However, in Arab countries, the gap is larger in favor of girls. Hence, girls achieve slightly better in mathematics, moderately higher in science, and substantially higher in reading [28–30]. This gender gap was confirmed by two studies that explored the gender differences in mathematics and science achievement for students in the last grade of high school over a 10-year period in The United Arab Emirates. In both studies, girls outperformed boys in mathematics and sciences [31,32].

Males and females may engage in divergent PA and SB, and as such may experience different health consequences. Thus, PA and SB and academic performance, split by gender is a noteworthy and important topic. The general objective of this study was to identify

PA, SB, and academic performance in school students stratified by gender. In detail, we hypothesized a priori that males would exhibit greater PA, less SB, and greater academic performance in school-aged children in Qatar. The second specific hypothesis was, that an association between PA and academic attainment would exist.

2. Materials and Methods

2.1. Study Design

The study design was a cross sectional survey. A total of Fifty-two participants were selected for the study by convenience sampling was used to select participants from a single urban school in the Doha Community (Qatar) on the basis of inclusion and exclusion criteria.

2.1.1. Participants

Fifty two healthy schoolchildren (29 female) were recruited after the QU-IRB approval (age: 11.9 ± 0.6 years; body mass: 50.0 ± 16.7 kg; height: 1.57 ± 0.09 m; body mass index (BMI): 20.0 ± 5.5 kg/m^2; Table 1). Female and male children were recruited during the period of 10 October 2021 and 10 December 2021 from a single school in a Doha Community (Qatar) by convenience sampling. The requirement that all participants be enrolled in physical education in middle school. However, middle-school schools in Qatar offer two compulsory lessons of physical education weekly.

Table 1. Comparison of anthropometric parameters depending on gender. Values are given as mean ± SD. Relevant differences ($p < 0.05$ and $\eta_p{}^2 > 0.10$) and maxima marked in bold.

Parameters	Male (n = 23)	Female (n = 29)	Variance Analysis	
			p	$\eta_p{}^2$
Age (years)	11.9 ± 0.69	**12.0 ± 0.54**	0.447	0.01
Height (m)	1.55 ± 0.09	**1.59 ± 0.08**	0.060	0.07
Seat height (cm)	117 ± 7.44	**121 ± 3.66**	0.029	0.09
Arm span (cm)	152 ± 9.80	**155 ± 9.24**	0.304	0.02
Body mass (kg)	45.1 ± 15.4	**53.8 ± 16.9**	0.062	0.07
BMI (kg/m^2)	18.5 ± 4.78	**21.1 ± 5.86**	0.092	0.06
Peak Height Velocity (PHV)	**1.65 ± 0.90**	0.36 ± 0.57	**<0.001**	**0.45**

SD-standard deviation; BMI-Body Mass Index.

2.1.2. Ethics

The ethical institutional review board of Qatar University (QU-IRB 1542-FBA/21- Date of approval: 20 May 2021 and renewed on 18 June 202) and the Ministry of Education and Higher Education of Qatar (REF: 18/2021) approved this longitudinal study, which adhered to the Declaration of Helsinki. The school senior management team, parents, and the school were informed of the study's background and objectives. Prior to the start of the trial, participants and/or guardians submitted written informed consent or assent. A permission form and information sheet outlining the study's goals were given to participants' parents or legal guardians. Sixty-five percent of participants who received papers completed the permission form and met the eligibility requirements. The protocols and the participants' freedom to leave the experiment were explained to the participants, their guardians, and any applicable teachers.

2.1.3. Inclusion and Exclusion Criteria

Exclusion criteria: If a participant fitted any of the following, they were excluded: (1) a psychiatric condition; (2) taking medication (such as antidepressants or drugs that impact the nervous system); and (3) not provided a completed informed permission form.

Inclusion criteria: Participants were eligible to participate if they (1) provided written informed parental or guardian consent, (2) were in a good health, had no contraindications

for physical activity, (3) had no physical limitations to exercise, and (4) were in age range of 10–13 years.

2.2. Experimental Design and Procedure

Measurements included anthropometric data (height, sitting height, arm span, body mass, BMI). The children filled out a PA questionnaire based on 7-day experience for only three intensities: moderate, vigorous, and walking out of physical performance during the testing processes. The AP was evaluated through school records of grades point average of Arabic, Mathematics and Science of the first semester.

After having received consent from the parents/guardians of children, two qualified researchers recorded and conducted field tests with the support of the physical education teacher of the school during the period of 10 October 2021 and 10 December 2021. Data collection took place between 08:00 and 10:00 h each day during the physical education sessions adopted by the schedule of the schools, in an indoor sports court with constant environmental conditions (temperature average: 28–29 °C; relative humidity: 65%). The requirement is that all participants be enrolled in physical education in middle school. Middle-school schools in Qatar provide two compulsory lessons of physical education weekly. The school involved in the study adhered to the active school policies outlined by the Ministry of Education and Higher Education in Doha. As per this policy, students were expected to have two 50-min physical education lessons each week, along with engaging in PA both in the classroom and during recess.

During all process of assessment and based on Qatar Sate back-to-school plans after COVID-19 concerns, we adopted the measures, instructions and policies and health protection adopted by the Ministry of Education and Higher Education and Ministry of Health in Qatar State during the data collection in the first semester of academic years 2021–2022.

2.2.1. Anthropometry

Body mass (model TBF 105; Tanita Corporation of America, Inc., Arlington Heights, IL, USA) and height (Holtain stadiometer, Crosswell, Crymych, Pembrokeshire, UK) were measured to the nearest 0.1 kg and 0.1 cm, respectively. BMI was computed as follows: body mass (kg) × square of height (m^2).

2.2.2. Predicted Maturity Offset

The following two novel gender -specific equations were applied [33] to forecast participants' maturity offset: Boys: Maturity offset (years) = −8.128741 + (0.0070346 (age sitting height)), Girls: Maturity offset (years) = −7.709133 + (0.0042232 (age stature)).

2.2.3. Physical Activity Questionnaire

We chose the International Physical Activity Questionnaire Short Form (IPAQ-SF) to investigate the PA level of children [34]. It has been confirmed that the IPAQ-SF is reliable and valid among a variety of demographics [35]. The reliability and validity of IPAQ-SF have been verified under different backgrounds in different countries [35], and it has been used to estimate the PA level of children and adolescents [36]. A recent study has used the IPAQ-SF to estimate the PA levels in children and elementary middle schools aged from 7–18 years [34]. The data are expressed in Metabolic Equivalent of Task-minutes per day (MET-min/day), which was used to calculate the daily amount of time spent in PA out of physical performance related sport practice during the assessment processes. PA was divided into three intensities using the IPAQ-SF scoring technique [34]: moderate (4 METs), vigorous (8 METs), and walking (3.3 METs) [37,38]. Both sitting duration and total PA (the sum of the three intensities) were computed in order to estimate SB.

2.2.4. Academic Performance

Academic achievement was determined using participants' grades (%) in Arabic, Mathematics, and Science from the first semester of the 2021–2022 academic year in addition

to their actual Grade Point Average (GPA) evaluation. Students graded through three assessment (oral exam, written examination, final exam) and their final grade calculated from theses assessment using a grade Weighting of each assessment. However, the reason for only including science and mathematics was due to our interest in courses of science-related subjects. It has been reported that the academic achievement depends on academic subject, with fitness being particularly beneficial for subjects having stronger reliance on executive cognition, such as mathematics and science-related subjects [39]. Concerning the choice of the ''Arabic language'', researchers have found a strong relationship between language and learning and its positive impact on different academic subjects [40].

2.2.5. Statistical Analysis

The normality of the data distribution was verified with the Shapiro–Wilk test. Homogeneity of variances were checked for all variables using by the Levene-Test. Descriptive statistics are reported as mean ± standard deviation. Differences in anthropometric, academic performance and physical activity parameters between males and females were tested using Kruskal-Wallis H test and Mann-Whitney-U test for post-hoc testing, as the data were not normally distributed. Furthermore, we performed an analysis of variance (ANOVA), with gender (female vs. male) as between-subject factor, and academic performance parameters as the within-subject factor in order to evaluate longitudinal differences. The threshold for statistical significance and relevance was set at $\alpha < 0.05$ and $\eta_p^2 > 0.10$.

A power calculation (nQuery Advisor 4.0; Statistical Solutions, Saugus, MA, USA) was performed using previous data [6]. Based on the main parameter Science, a *t*-test for independent groups, a mean difference of 7.4 (pooled SD: 8.00; d = 0.89), an α level of 5%, and a power of 80%, a sample size of 21 participants in each group was necessary [41].

Effect size (Cohen's d) was calculated for each pairwise comparison [42], and interpreted as trivial (<0.20), small (≥0.20–0.49), moderate (≥0.50–0.79), and large (≥0.80) [43]. Relationships between variables were analyzed with Spearman's product-moment correlation (r) and interpreted as negligible (<0.1), weak (0.1–0.4), moderate (0.4–0.7), strong (0.7–0.9), and very strong (>0.9) [43]. A correlation of $r^2 > 0.5$ (explained variance > 50%) was considered relevant and marked in bold. Regarding the sample size of n = 52, the critical value for the product moment correlation based on a two-sided *t*-test and a = 5% is r = 0.273 [44]. Statistical analyses were completed with SPSS (version 28.0, SPSS Inc., Chicago, IL, USA).

3. Results

3.1. Normal Distribution and Variance Homogeneity

The variables height ($p = 0.278$) and arm span ($p = 0.458$) showed a normal distribution. Regarding variance homogeneity, two parameters (age: $p = 0.041$; vigorous MET: $p = 0.004$) were not homogeneous in variance. Otherwise, all *p*-values were higher than 0.077 (Arabic) indicating that variances from all other variables were not significantly heterogeneous.

3.2. Variance Analysis

3.2.1. Anthropometric Data

All anthropometric parameters (height: $p = 0.060$, weight: $p = 0.062$, BMI: $p = 0.092$, seated height: $p = 0.992$, arm span: $p = 0.259$) were not different between male and female subjects. Only on a descriptive level, female subjects showed larger values in all parameters (exception: seat height).

3.2.2. Academic Performance Data

Regarding academic parameters, we found a significant time effect (Mathematics), interaction effect (Science), and gender effect (Arabic; Table 2). The largest difference and reduction of performance was calculated for females in Mathematics (d = −0.72). A different development over the time was observed for Science. While male performance decreased (d = −0.44), female performance increased slightly (d = 0.21). The gender effect

regarding Arabic reflect the lower performance level by males compared with female subjects at both examinations. For males, we found a decrease of performance for all three school subjects over the time.

Table 2. Comparison of academic performance parameters depending on gender and time. Values are given as mean ± SD. Relevant differences ($p < 0.05$ and $\eta_p^2 > 0.10$) and academic performance maxima marked in bold.

Parameters	Male (n = 23)	Female (n = 29)	Variance Analysis	
			p	η_p^2
Mathematics	**82.2 ± 8.64**	75.9 ± 16.8	0.108	0.05
Science	77.0 ± 8.76	**82.9 ± 8.61**	**0.017**	**0.11**
Arabic	73.0 ± 8.22	**80.9 ± 8.25**	**0.001**	**0.19**

3.2.3. Physical Activity

The group of male subjects showed the largest amount of energy expenditure during moderate (395 ± 352 MET-minutes/week), and vigorous (1318 ± 932 MET-minutes/week) activities (Table 3). Regarding walking energy expenditure, male subjects also displayed the largest values (547 ± 413 MET-minutes/week).

Table 3. Comparison of physical activity parameters depending on gender. Values are given as mean ± SD. Relevant differences ($p < 0.05$ and $\eta_p^2 > 0.10$) and maxima marked in bold.

Parameters	Male (n = 23)	Female (n = 29)	Variance Analysis	
			p	η_p^2
Vigorous physical activities				
Days/week (d)	**3.09 ± 1.76**	2.10 ± 1.18	0.020	0.10
Minutes/week (min)	**47.8 ± 20.0**	36.9 ± 22.4	0.073	0.06
MET-minutes/week	**1318 ± 932**	646 ± 525	**0.002**	**0.18**
Moderate physical activities				
Days/week (d)	2.22 ± 1.51	**2.38 ± 1.32**	0.682	0.01
Minutes/week (min)	**40.0 ± 19.1**	36.9 ± 20.6	0.579	0.01
MET-minutes/week	**395 ± 352**	363 ± 301	0.725	0.01
Walking				
Days/walk for at least 10 min (d)	**3.96 ± 1.85**	3.10 ± 1.93	0.113	0.05
Minutes per walking days (min)	**39.1 ± 19.8**	32.4 ± 19.2	0.222	0.03
MET-minutes/week	**547 ± 413**	368 ± 343	0.093	0.06
Sitting				
Hours per weekday (h)	3.17 ± 2.23	**4.45 ± 2.71**	0.075	0.06

Female participants spent the largest amount of time sitting (4.45 ± 2.71 h per week) compared to male subjects (3.17 ± 2.23 h per week). The difference between genders only reached the $p < 0.05$ level for vigorous MET-minutes/week ($p = 0.002$).

3.3. Relationships between Several Parameters and Dimensions

No meaningful (r > 0.5) product-moment-correlations were observed between parameters from different dimensions (anthropometric vs. academic performance vs. physical activity).

4. Discussion

In this study, male subjects exhibited the greatest amount of energy expenditure especially during vigorous activities and showed a markedly larger PHV than females. Female participants were more powerful in science and arabic and spent the largest amount of time sedentary. In all parameters mentioned, gender differences reached the relevance level ($p < 0.05$ and $\eta_p^2 > 0.10$). The parameters of different dimensions (anthropometric vs. PA vs. AP) did not show any relevant relationship with each other.

It should be highlighted in this context that individuals of the same gender might report relatively substantial changeability in the timing of biological maturation, resulting in late and early matures, which may reflect a difference in PA factors.

4.1. Physical Activity

Physical activity comprised a wide range of activities one can complete during their free time. Such activities can be organized (e.g., undertaking a training program), or free (e.g., walking, bicycle riding, dancing). Despite the health genic effects of PA to health and wellbeing PA has declined globally in children [45]. In the present study, males showed the largest amount of PA such as walking, and moderate and vigorous PA. Females spent the largest amount of time sitting compared to males. However, this gender difference only reached the $p < 0.05$ level for vigorous MET-minutes/week.

The lower physical activity among girls compared to boys of similar age has been well documented among several populations in Europe [46,47], the United States [48], and Australia [49]. Whereas results from these reports suggest that differences among the PA of boys and girls are seen at all ages, our data showed that physical activity among boys and girls were similar in age 5 children. However, when it comes to older children, our results correspond to those of other studies: greater activity was seen among age 9 boys than among age 9 girls. The wide difference in moderate to vigorous physical activity (MVPA) among age 9 boys and girls is a cause for concern and suggests that greater declines in a girl's physical activity may occur with maturity.

There are major variations in the prevalence of physical inactivity across regions and among countries. In the Arab region, alarming predictions have been made in light of very unfavorable combinations of risk factors related to body mass index, its determinants including physical activity, and its health consequences. Recent data from a self-administered questionnaire show that approximately 75% of school children in Qatar do not meet the daily recommended PA level [50]. Moreover, about 55% of children spend prolonged periods on sedentary activities such as watching TV and playing video games [50]. The available Qatari data show that there is gender difference in PA practices, with girls engaging in less PA than boys. Studies from Gulf Cooperation Council (GCC) countries [51] show that school children meeting 60 min MVPA/day is lower among girls (4 to 39%) than boys (44 to 71%). Although no data exist on changes in PA by age in the GCC area, longitudinal studies show that MVPA consistently declines each year among school children in Western countries [52,53].

In addition, the levels of inactivity, in Arabic word among adolescents vary greatly in the region, as a function of many factors. However, many studies have documented low levels of physical activity among adolescents in Arab settings, particularly among girls [54,55]. It shows that the percentages of adolescents who are sufficiently active ranges from a high of one-third for boys in Oman, to less than 5% for girls in Egypt, with most at about 20% for boys and around 10–15% for girls. Similarly striking low levels and gender differences are found in other countries. A study in Al-Ahsa city in Saudi Arabia found that 49% percent of males and 5% of females are physically active for 60 min per day every day [56]. The multi-country Arab Teens Lifestyle Study found that almost half of the adolescent boys and about three-quarters of the girls aged 14–19 in both Saudi Arabia and Kuwait did not meet daily physical activity guidelines [54,55].

Farmer et al. [57] reported that among six-year-old children both genders spent the largest part of leisure time in moderate to vigorous PA. However, more boys engaged in moderate to vigorous PA compared to girls at home and at school. Nevertheless, more girls were involved in PA-related classes and lessons out of school. Smpokos et al. [58] indicated that the moderate to vigorous PA was also significantly higher in Greek boys than Greek girls (age range: 5.9–7.6 years). Other research has reported that girls have lower level of self-perceptions of their physical abilities than boys. This fact explains why girls also present lower levels of PA amusement, especially as they age [59,60].

Therefore, girls consistently fall below PA threshold guidelines [59] and are less likely to engage in moderate to vigorous PA. Gender -related PA divergences increase as they approach adolescence [61] with age-related declines most prominent among females [62,63]. In this context, the studies explored the percentage of PA levels during school hours that analyzed their results separately by gender showed that boys spent between 5% [53] and 22% [64] of their school hours in MVPA, whereas this percentage for girls ranged from 3% [53] to 22% [64]. In secondary schools, adolescents spent between 4% [65] and 6% [66] of school hours in MVPA. Boys spent from 4% [67] to 8% [68] of their school hours in MVPA, whereas girls spent between 3% [69] and 6% [68] of their school time in MVPA. Therefore, it is imperative to emphasize the importance of, and promote PA in young children, to ensure lifelong healthy PA habits.

4.2. Sedentary Behavior

The presented results demonstrate females spent the largest amount of time sitting compared with males which is in accordance with other studies [70,71]. Boys were more physically active than girls, according to previous studies, and there was a consistent relationship between gender and objectively assessed SB in children and adolescents [70,72].

Zimmo et al. [51] reported that in Qatar during a six-hour school day, the average duration in sedentary time was 194.8 ± 38 min. This is relatively high when compared to a study that found in a seven-hour school day, children can spend between 150 and 200 min in sedentary activities [73]. This difference is a cause for concern and signifies the need to re-evaluate the non-PE classes, in which children are more likely to be sedentary.

Comparative surveys about sitting time in Arab countries indicate that between one-quarter and more than one-third of adolescents aged 13–15 spend more than 3 h a day sitting—watching TV, playing computer games, talking with friends or doing other sedentary activities [74]. A study on the number of hours Saudi adolescents aged 14–19 spend sitting, watching TV and playing computer games every day found a mean of 5.27 h/day among males and 6.6 h/day among females [54]. Another study among adolescents from Al-Ahsa, Saudi Arabia, found that male adolescents (aged 15–17) spent 4.99 h/day on sedentary activity, while females (aged 13–17) spent 5.78 h/day [56].

According to the most current Canadian Health Measures Survey (CHMS) cycle (2016–2017), young males were significantly less sedentary than young females. With the exception of the 2007–2009 (CHMS) cycle, this change was not noticeable in earlier cycles [75]. This tendency is troubling because early-life gender differences in remuneration continue into later childhood and beyond [63].

Evidence from a systematic review reported inconsistent gender effects for screen time in young children [70,76,77]. Based on the summation of time consumed in screen behaviors (i.e., video games, computer, television), our data showed that young boys exhibited more screen time than girls [77]. More recent data indicated that the gender differences in screen time may be decreasing but augmented by additional types of SB [75].

Boys recorded viewing more TV than girls, according to data from the HBSC between 2001 and 2009 [78]. However, data from the National Health and Nutrition Examination Survey from 2007 to 2012 showed no discernible difference in TV viewing across the genders [79]. Prince et al.'s [75] observation that girls engaged in more leisure reading and boys played more video games per day (boys: 0.35–2.68 vs. girls: 0.09–2.15 h/day) suggests that there are various sorts of SB for boys and girls.

However, as these studies pre-date the smartphone proliferation, it is unlikely these screen times are reflective of the type of screen time in 2023. Considering type of SB, those with greater household education or higher education reported more leisure reading and passive travel. Thus, although females may spend more time in SB, if more of it is reading, this has positive health outcomes (e.g., mental health, mental wellbeing, cognitive function, language development) which may outweigh (or at least attenuate) the negative effects of SB. That being said, whilst females may spend more time reading, the data of Prince et al. [75] suggest this is only ~20 min more per day. Data from the present study

suggest females are sedentary over an hour more than males. Thus, this greater reading time unlikely makes amends for the time difference in SB.

4.3. Academic Performance

Findings on gender differences in academic achievement are mixed. For instance, the Trends in International Mathematics and Science Study (TIMSS), which more than 40 countries take part in every four years, presented its findings in science and math in three categories. The first category is countries in which male students outperformed female students (including Hungary, Chile, Hong Kong SAR, Italy, and the United States), the second is countries in which female students outperformed male students (including Bahrain, Kuwait, Oman, and Jordan), and the last category is countries in which no significant differences were found between male and female students (including Japan, Lithuania, New Zealand, Georgia, Sweden, and Singapore) [29].

Other studies using different approaches (e.g., single-gender versus co-educational schooling) documented similar findings in favor of males [80,81] and females [82–84]. It is apparent in these studies that, although they have significant differences, the achievement differences between the two sexes have been argued through the lenses of social or biological perspectives to assert that one sex is better than the other in some subjects (e.g., reading for females and science and math for males) [85,86]. As each country has its own education system and teaching arrangement, it is essential, in this study, to briefly present Saudi Arabia and its education system and teaching arrangement.

Various studies have reported gender differences in school achievement, with females typically performing better [87,88]. In the German census, more females than males exist in secondary school, but more males than females exist in lower secondary school. Consequently, more females pass the qualification for university entrance, although more males complete the certificate of lower secondary school [88]. Despite the known population differences, reasons for gender differences in school attainment have not been clarified yet but are likely multi-factorial. Self-regulation and motivation, in addition to cognitive ability (such as intellect [89,90]), are positively correlated with academic success [91,92]. In accordance with these findings, earlier studies have demonstrated that particular aspects of behavioral or self-regulation may help explain gender differences [87,93]. However, these earlier researches did not take into account the broader notion of self-regulation because they solely looked at behavior regulation. Both behavior regulation and emotion regulation are included in the idea of self-regulation, and both are linked to children's academic success [94,95]. Consequently, it is crucial to understand the emotion regulation and contribution of behavior to gender differences in academic school achievement.

4.4. Limitations

Limitations of the present study are our lack of biological maturity assessment as relative growth spurts may influence PA and SB. Similarly, relative growth spurts, the short duration of intervention (two months), previous knowledge of the content of the subjects, repetition of pupils, extracurricular activities related to these subjects could influence academic achievement. These could be reasons for confuse associations between PA and academic performance. A second limitation is the self-reporting nature of PA monitoring, and future investigations may wish to utilize objectively measured PA using technological advances [96,97]. Furthermore, using MET thresholds does not account for different physical performance levels of the participants. For example, a moderate MET of 4 could be detraining for one participant but approaching maximal aerobic capacity for another.

In addition, the physical activity was measured during the October-November months in Qatar when the average outdoor temperature and humidity is 28–29 °C. We expected hot weather to be a barrier; therefore, more studies of longitudinal design are needed to determine seasonal variation and patterns in physical activity among school children. An additional limitation to this study is that we only collected school-time physical activity.

This was done in order to avoid low compliance and loss of activity monitors. The compliance on valid wear-time physical activity is lower in children of this age group, and there is an additional risk of the device being lost. Finally, we recruited a convenience sample from one middle school in Qatar. Consequently, results are not necessarily valid in other ages or other countries.

5. Conclusions

This study determined gender differences in PA, SB, BMI, and academic performance in school-aged children in Qatar. Males exhibited the greatest amount of moderate and vigorous PA (although only reaching $p < 0.05$ and $\eta_p^2 > 0.10$ for vigorous MET-minutes/week). Females spent the greatest time sitting. Arabic was different by gender, and Science displayed a change over time dependent upon gender. No relationships were noted between PA and SB and academic performance. These data suggest subjects in middle school are sensitive to gender, but not necessarily influence by PA or SB at this age. Multi-sectoral efforts are needed, including collaborations among ministries of health, sports, youth and education, as well as wider collaborations that involve sectors such as transport, environment and urban planning.

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