

University of Nevada, Reno

**Comparison of Physical Activity between Traditional and Homeschool Elementary
School Students: a pilot study**

A thesis submitted in partial fulfillment of the requirements for the degree of Master of
Science in Kinesiology

By

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Abstract

Purpose: The purpose of this study was to examine the difference between the moderate to vigorous physical activity (MVPA) and time spent sedentary behavior (SEB) between traditional and homeschool elementary students during one school week.

Methods: There was a total of 25 participants (mean age = 8.8 ± 1.6 years; 10 girls, 15 boys), 13 traditional school students (mean age = 9.5 ± 0.7 years; 5 girls, 8 boys) who were recruited from an elementary school and a sample of 12 homeschool students (mean age = 8.1 ± 2.1 years; 5 girls, 7 boys) were also recruited. Participants were required to wear an Actigraph wGT3X-BT accelerometer (ActiGraph, Florida, USA) on their dominant wrist during each day of data collection between the time frame of 10:00am to 2:00pm. The MVPA and SEB measures were recorded using a 15s epoch at 100Hz sampling rate and was calculated using the Freedson children cut points. The data exported and averaged was calculated for time in MVPA and SEB for each participant.

Results: On average, the traditional school participants demonstrated higher levels of MVPA (MVPA average \pm SD = 64.21 ± 8.5 , $p = .508$, $t = 2.2$, $df = 23$) and lower levels of SEB (SEB average \pm SD = 23.1 ± 7.9 , $p = .968$, $t = 3.2$, $df = 23$) when compared to their homeschool counterparts levels of MVPA (MVPA average \pm SD = 56.24 ± 9.5 , $p = .508$, $t = 2.2$, $df = 23$) and SEB (SEB average \pm SD = 33.27 ± 7.9 , $p = .968$, $t = 3.2$, $df = 23$). However, there was no statistically significant difference between the MVPA and SEB of both groups. **Conclusion:** The results of this study suggest that traditional elementary students may be more physically active, as they demonstrated more time in MVPA and less time in SEB, however there was no statistically significant difference present between the two groups levels of PA.

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Introduction:

In the past three decades, the prevalence of obesity has more than doubled in children and tripled in adolescents, as data from 2015-2016 showed that 18.4% of school-aged children were classified as obese.¹ In 2019, it was estimated that 38.2 million children who were under the age of five years globally, were classified as overweight or obese.² There has been no known cause to this epidemic, but it is believed that obesity is the result of complex interactions between biological, developmental, behavioral, genetic, and environmental factors.³ These factors consist of an increase intake of energy-dense foods which are high in fat and sugars; and an decrease in physical activity due to an increase in sedentary nature.² In addition, sedentary behavior (SEB) and obesity within children has been seen to increase risk of death and cardiovascular diseases.⁴ Early childhood is essential as it provides the opportunity to establish lifestyle behaviors, such as healthy eating habits, physical activity (PA), and limited sedentary time that will promote health.⁵

Physical activity (PA) is a health-protective factor with multiple benefits for school- aged children, however, only 22% of children and adolescents living in the United States meet the recommended amount of 60 minutes of moderate to vigorous physical activity (MVPA) per day.⁶ Given the prevalence of insufficient PA among children, it is important to promote PA during the school day and it is more beneficial when it is implemented into the curriculum.⁶ Numerous studies report that when a high quality physical education program is implemented, students can learn new skills, be more confident, and gain knowledge to help increase PA.⁷ Schools are also considered to

be the most ideal settings for assisting children in PA promotion as students have access to playgrounds, fields, and can also be influenced by the teachers and faculty.^{6,8} It is important that children participate in PA as much as they can each day as PA has positive impacts on memory, cognitive function, and prevents cardiovascular disease risk factors.⁹ The relationship that PA has with children in school is important overall because it can assist them to achieve a better academic performance while also helping improve their overall physical health.^{9, 10} Students who participate more in PA are also more likely to listen better in the classroom and their on-task behavior is improved, which also means that these students face less disciplinary action from teachers.⁷ Children's play outside of the classroom, is also essential as it can lead them to have a positive mood during school hours and increase enjoyment in school.¹¹ This does raise the question if traditional or homeschool students benefit more from their schooling environment, as previous research reported that traditional school students had greater body mass index (BMI) percentages when compared to homeschool students.¹²

There are about 2 million children who are being homeschooled in the United States.¹³ Unlike traditional schools, the homeschool children are not required by some county regulations to include physical education class, PA initiatives, or fitness testing.¹³ This puts homeschooled children at risk for deficits in muscular and cardiorespiratory fitness without the time spent in PA that traditional schooling offers time.¹⁴ Homeschooled children may only rely on organized sports and physical activities outside of schooling time, to achieve the recommended levels of PA per day.¹⁵

Previous research has mixed results with analysis of PA levels between traditional and homeschool elementary students, with some studies reporting no difference and others only reporting lower levels of PA among homeschooled students.¹⁶ For example, Kabiri et al. (2017) reported that traditional school students, (n=75) of ages 8-11 years old, had greater abdominal strength and upper body strength when compared to homeschooled children, (n=75) of ages 8-11 years old.¹⁴ However, the study also reported that homeschool students had greater aerobic capacity than their traditional school counterparts.¹⁴ As traditional school students had the better fitness levels, this was in line with the study by Tribby et al. (2021) as homeschool students spent more time in SEB and demonstrated lower PA levels when compared to traditional school students.¹⁶ To the researchers' knowledge, there has been little or no research that has directly compared accelerometry data between traditional and homeschool elementary students. Therefore, the purpose of this study was to examine the difference between the MVPA and SEB, using accelerometry, between traditional and homeschool elementary students for one school week. Based on the previous literature, the researchers hypothesized that homeschool elementary students will be more physically active during the school week and record greater measures of MVPA with lower measures of SEB.^{16, 17}

Methods

Participants

There was a total of 25 participants (mean age = 8.9 ± 1.7 years; 10 girls, 16 boys), 13 were traditional elementary school students (mean age = 9.5 ± 0.7 years; 5 girls, 8 boys) recruited from a public school located in the Reno, Nevada area.

Additionally, there were 12 homeschool elementary students (mean age = 8.1 ± 2.1 years; 5 girls, 7 boys) who were recruited from families that also lived in the Reno, Nevada area.

For this study, the traditional student's inclusion criteria were (1) enrolled into a traditional elementary school and (2) were aged 5-11 years old. There were no exclusion criteria as all families were encouraged to have their children participate in the study as there were no mandatory requirements for PA collected from the students. The homeschool student's inclusion criteria were (1) homeschool elementary students (grades Kindergarten to 5th grade) and (2) were aged 5-11 years. Before the start of data collection, written consent from the parents or guardian of the participants was obtained, as well as the verbal consent from the participants, and the study was approved by the University Institutional Review Board (IRB Number: 1989822-2).

Procedures

This study required the students to wear an Actigraph wGT3X-BT accelerometer (ActiGraph, Florida, USA) on their dominant wrist during the times of 10:00am to 2:00pm for one school week (Monday – Friday). Participants that attended the traditional school were recruited from 11 families and were all students of two fourth grade classrooms from an elementary school in the Reno, Nevada area. The data collection for the traditional participants took place in early January and was completed in late January during the winter. The traditional participants were equipped with the accelerometer at 9:00am when school began, and the data collection was set through the ActiLife software to begin at 10:00am to prevent any possible collection of invalid data during the set-up

time. These accelerometers were then removed from the participants at 2:00pm and these procedures were repeated for one school week. After each day, the data was exported, and the accelerometers were reset for the following days' time frame. The homeschool participants were all recruited from six families that all lived in the Reno, Nevada area. The data collection for the home school participants started in early February and ended in early May, due to homeschool participant recruitment. The parents of the homeschool group were given the accelerometer(s) on the first day of the week (Monday) before 10:00am. The accelerometers would be set to collect data starting at 10:00am on the first day of the week and stop collecting data at 2:00pm on the last day of the week (Friday). The parents were instructed to equip the participants with accelerometers everyday just before 10:00am and remove the accelerometers at 2:00pm. The parents were reminded 10 minutes before each set time to ensure that the participants wore the accelerometers for the entire duration each day. On the last day of the school week, the accelerometers were collected at 2:00pm and the data was exported.

Measures

Physical activity: The participant's PA that was collected consisted of MVPA and SEB. The activity counts were recorded using 15s epochs at a 100Hz sampling rate and then was calculated using the Freedson Children cut points.^{18, 19} The data exported from the accelerometers of both groups consisted of the average percentage of MVPA and SEB for each day (between the hours of 10:00am to 2:00pm). Once these percentages were recorded from each participant and the week of data collection was completed, they

were averaged together collectively as a single population (traditional or homeschool) for comparison.

Data Analysis

The data collected from the accelerometers was analyzed using two independent t-tests, which were used to identify a statistically significant difference between the students' average MVPA and SEB for one school week. The students were placed into two groups, traditional and homeschool, their recorded data for the school week would be averaged together as a single percentage before being used to conduct the independent t-tests. The accelerometer data was also used to run descriptive statistics of the average percentages for comparison between the two groups of students. The alpha level was set at $\alpha = 0.05$ to test the effect of this study and the data analysis was conducted using SPSS v28.0 (IBM, Armonk, NY, USA).²⁰

Results

A total of 1 homeschool participant withdrew participation from data collection after one day and the participant's data was removed from the analysis. The final sample consisted of 25 participants (mean age = 8.8 ± 1.6 years; 10 girls, 15 boys), which were 13 traditional school students (mean age = 9.5 ± 0.7 years; 5 girls, 8 boys) and 12 homeschool students (mean age = 8.1 ± 2.1 years; 5 girls, 7 boys). Demographic information of the participants is in Table 1. Table 2 is the descriptive statistics of the data collected from the participants, which consists of the average percentages of MVPA and SEB. On average, the traditional school participants demonstrated higher time in MVPA (MVPA average \pm SD = 64.21 ± 8.5 , $p = .508$, $t = 2.2$, $df = 23$) and less time in

SEB (SEB average \pm SD = 23.1 ± 7.9 , $p = .968$, $t = 3.2$, $df = 23$) than their homeschool counterparts. However, upon conducting the two independent t-tests, no statistically significant difference was seen between the two groups' levels of PA. Figure 1 and Figure 2 compare the average percentage of MVPA and SEB of both groups of participants (Traditional average MVPA = 64.21 ± 8.5 , average SEB = 23.1 ± 7.9 and homeschool average MVPA = 56.24 ± 9.5 , average SEB = 33.27 ± 7.9).

Discussion

The purpose of this study was to examine the difference between the MVPA and SEB between traditional and homeschool elementary students for one school week. It was hypothesized that homeschool elementary students would be more physically active during the week and would demonstrate more time spent in MVPA and less time in SEB. After data analysis the researcher's hypothesis was rejected as the traditional participants demonstrated more time in MVPA and less time in SEB. The results went along with previous research by Tribby et al. (2021), as homeschool students demonstrated lower time in MVPA and more time in SEB when compared to their traditional counterparts.¹⁵ However, when compared individually, some homeschool participants did record greater amounts of MVPA when compared to some traditional participants. It was noted that the homeschool participants, which were also from the same family, were also younger when compared to the traditional participants and also had the greatest time spent in MVPA for the homeschool group.

Upon conducting the two Independent T-tests, ($p > 0.05$) there was no statistically significant difference between the groups. When further examining the data, it was

observed that although some homeschool students did demonstrate more time in MVPA, it was noted that they still also demonstrated more time in SEB when compared to traditional students. The cause of this may have been due to the traditional students having more open space inside classrooms and on school grounds, while the homeschool students were limited to inside their homes.⁸

The strength of this study includes, (1) the compliance of both groups of participants in wearing the accelerometers during the selected time frame. The weakness of this study includes, (1) the assessment of MVPA and SEB measures from both groups of participants during only one school week.

This study is not without limitations. First, the sample size of the study was very small for both groups due to limited time under the school district and recruitment from homeschool families. Therefore, the results may be difficult to generalize. Second, data collection took place during the winter and due to the weather, the students from both groups may have had limited PA performance on certain days. This also caused school delays and closures, which also delayed the data collection process. Lastly, one traditional student recruited had data collection during the week of the Smart Balanced Assessment Consortium (SBAC) state testing, this also could have limited the student's MVPA or SEB.

In the future, researchers should consider conducting data collection where the weather may not be a limiting factor in measuring MVPA for elementary students. Researchers should continue to measure and examine physical activity measures of elementary students as early childhood is essential to establish lifestyle behaviors.⁵ It is

also important to consider incentives for participation for future research as it may benefit the recruitment process and the allotted time for data collection.

Conclusions

In conclusion, traditional elementary students demonstrated more time in MVPA and less time in SEB when compared to homeschool elementary students. The results concur with previous literature that homeschool students have lower levels of physical activity measures when compared to traditional school students. The researchers also noted that based on the average percentages of MVPA from both groups, both the traditional and homeschool participants all achieved well above the recommended 60 minutes of MVPA per day within the four-hour time frame for this study. Both the traditional school and homeschool families are all encouraged to continue with their influence to assist the participants to continue to achieve this goal.

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Table 1. Demographics of Participants

Gender	Traditional School Group (n=13)	Homeschool Group (n=12)	Total (n=25)
Girl	5 (38.46)	5 (41.67)	10 (40)
Boy	8 (61.54)	7 (58.33)	15 (60)
Age (year)	9.5 ± 0.7	8.1 ± 2.1	8.8 ± 1.6

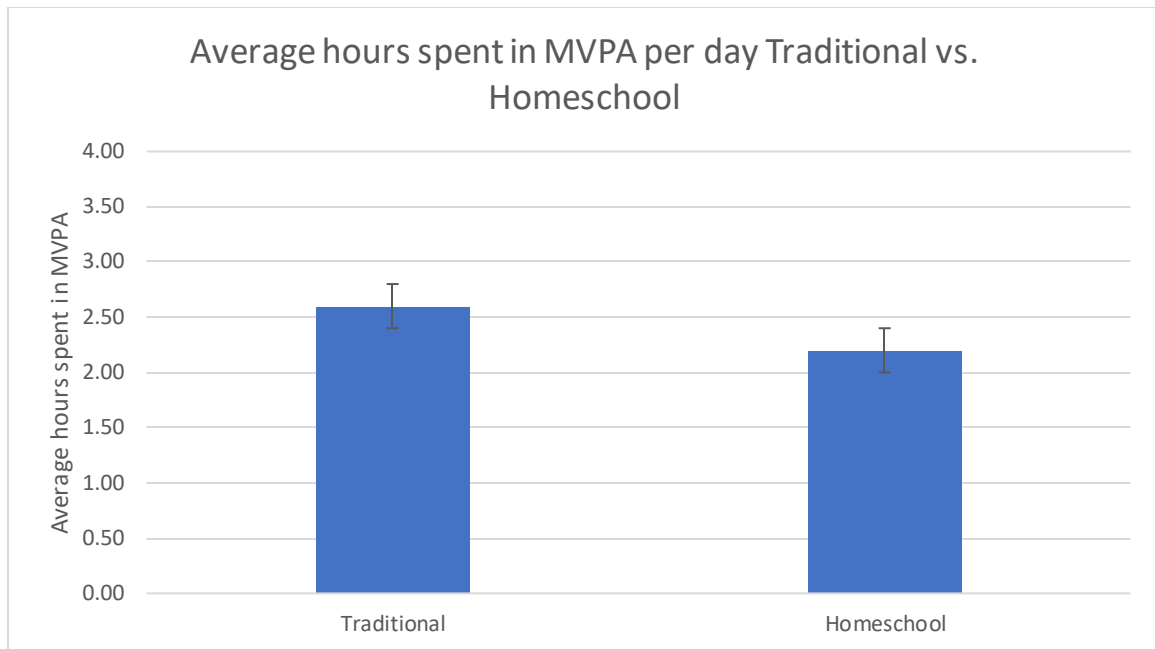
Note: Data is presented as number (%) or mean ± SD. Both groups' age ranges consisted of 5–11 years old.

Table 2. Descriptive statistics and Independent T-tests results of MVPA and SEB for traditional and homeschool participants.

PA type	Group	n	Average \pm SD	<i>p</i>	<i>t</i>	df
MVPA	Traditional	13	64.21 \pm 8.5	.508	2.2	23
	Homeschool	12	56.24 \pm 9.5			
SEB	Traditional	13	23.1 \pm 7.9	.968	3.2	23
	Homeschool	12	33.27 \pm 7.9			

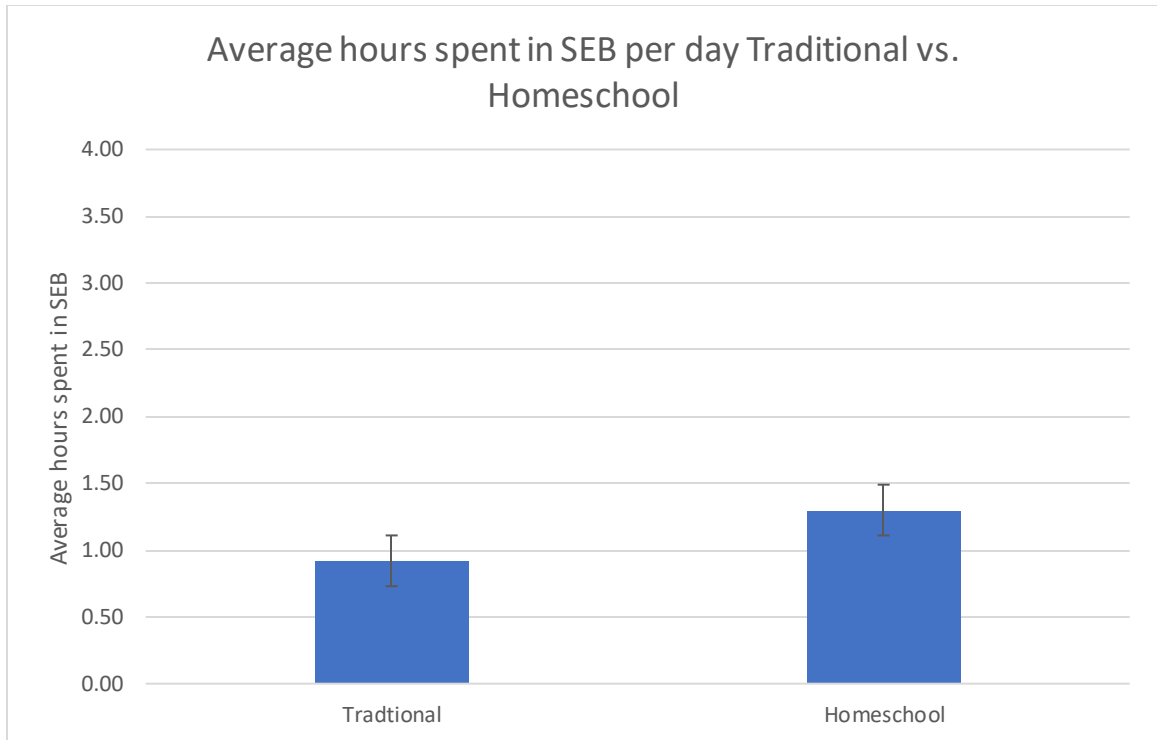
Note: MVPA= Moderate to Vigorous Physical activity, SEB= time spent sedentary behavior, Average % for 5 days (Monday – Friday) between the hours of 10:00am to 2:00pm. Statistical significance $p < 0.05$.

Figure 1. Average hours spent in MVPA for Traditional and Homeschool participants per day.



Note: Traditional participants recorded a greater average of time spent in MVPA at 2.6 hours compared to homeschool participants 2.2 hours. Light physical activity (LPA) was automatically recorded but not used in this study.

Figure 2. Average hours spent in SEB for Traditional and Homeschool participants per day.



Note: Homeschool participants recorded a greater time spent in SEB at 1.3 hours compared to traditional participants at 0.92 hours. Light physical activity (LPA) was automatically recorded but not used in this study.