Original

A Comparison of Physical Activity Among 10-year-old Children Between Suburban Vietnam and Japan

Sumiko Kamoshita[1], Phuong Mai Nguyen[1]*, Hitomi Takeichi[2], Shigeru Yamamoto[1]

[1] *Nutrition and Food Culture Research Center, Jumonji University, Saitama, Japan*
[2] *Faculty of Home Economics, Kobe Women's University, Hyogo, Japan*

ABSTRACT Background: The prevalence of overweight and obesity among Vietnamese children is increasing. Meanwhile, Japan is one of the few developed countries with the lowest prevalence of childhood obesity in the world. The Japanese government has many policies to encourage children to be more active. Therefore, Japanese children had higher levels of physical activity compared to other countries. Purpose Evaluation and comparison of physical activity of Vietnamese and Japanese children. Methods: The 7-day and 3-day minute-by-minute activity records were used to assess the physical activity of children aged 10 years old in Hanoi suburban (Vietnam) and Tokyo suburban (Japan), respectively. Results: The physical activity level (PAL) was higher for Japanese children (1.54) than for Vietnamese children (1.42) ($p<0.001$). Time spent in moderate to vigorous physical activity in Japanese children was about 2 times longer than for Vietnamese children ($p<0.001$). Conclusion: Japanese children had higher levels of physical activity than Vietnamese children. The Government of Vietnam needs to have appropriate policies to increase the level of physical activity of Vietnamese children in order to prevent and solve the problem of obesity.
Keywords: physical activity, children, suburban, Vietnam, Japan

INTRODUCTION

In recent years, the increase in childhood obesity has been remarkable in Vietnam. According to the results of the National Nutrition Survey, Vietnam, in the decade from 2010 to 2020, the prevalence of overweight and obesity among 5-19 year olds almost doubled from 15.4% to 26.8% in urban areas and from 8.5% to 19% in rural areas (1). Meanwhile, the prevalence of overweight and obesity in Japanese children was about 11%, one of the lowest in the developed countries (2). Therefore, many countries have taken Japan as a model to compare and find solutions to overcome overweight and obesity.

The low prevalence of obesity in Japan can be explained through healthy lifestyle habits that the Japanese population have continued over time (3). The Japan Sports Association published a guideline entitled "Active Child 60 min" (4). The main target were pre-school and primary school children (Japan Sports Association 2010). Moreover, Japan has high rates (98.3%) of active transport to school among children in public school compared with other similar-income countries (5). Japan has a highly established "walking to school practice" (5).

Meanwhile, in Vietnam, the sedentary lifestyle is increasing in children (6). In addition, at present, most of the studies focus on over intake, but not many studies focus on assessing the physical activity of children. Therefore, this study was conducted with the aim of assessing and comparing the physical activity of Vietnamese and Japanese children.

*To whom correspondence should be addressed: nguyenmaiphuong2102@gmail.com

MATERIALS AND METHODS

Participants

A total of 134 children (73 boys and 61 girls) aged 10 years old at a public primary school in suburban Hanoi participated in this study. The school was selected by convenience sampling. All data were collected in October of 2020. Informed consent was obtained from the children, their guardians and teachers according to the Declaration of Helsinki, and the study protocol was approved by the Biomedical Research Ethics Committee of Hanoi Medical University (no. 355/HMUIRB).

A total of 78 children (35 boys and 43 girls) aged 10 years old at an elementary school in Tokyo suburban participated in this study. All data were collected in November of 2022. Informed consent was obtained from the children, their guardians and teachers according to the Declaration of Helsinki.

Physical activity assessments

The 7-day and 3-day minute-by-minute activity records were used in suburban Hanoi and Tokyo, respectively to assess the physical activity level. The activity record form is designed based on the template developed by Koebnick et.al. The same recording form was used in both the Vietnam and Japan surveys. Numbers 1 to 24 contain general activities, but activities that do not fit into these categories are written in numbers 25 to 28. The "Other" columns prevent bias due to the recording form. Children were instructed to record the activity by number shown in recording form and mark the start and end times for each activity (Fig 1). The recording method was explained to teachers, children and their guardians with an example of a completed physical activity form. We asked teachers and guardians to help the children to complete the activity record. When collecting the activity record form, we interviewed children to improve the accuracy of the activity record

by adding and correcting the content regarding omissions and unclear points.

Statistical analysis

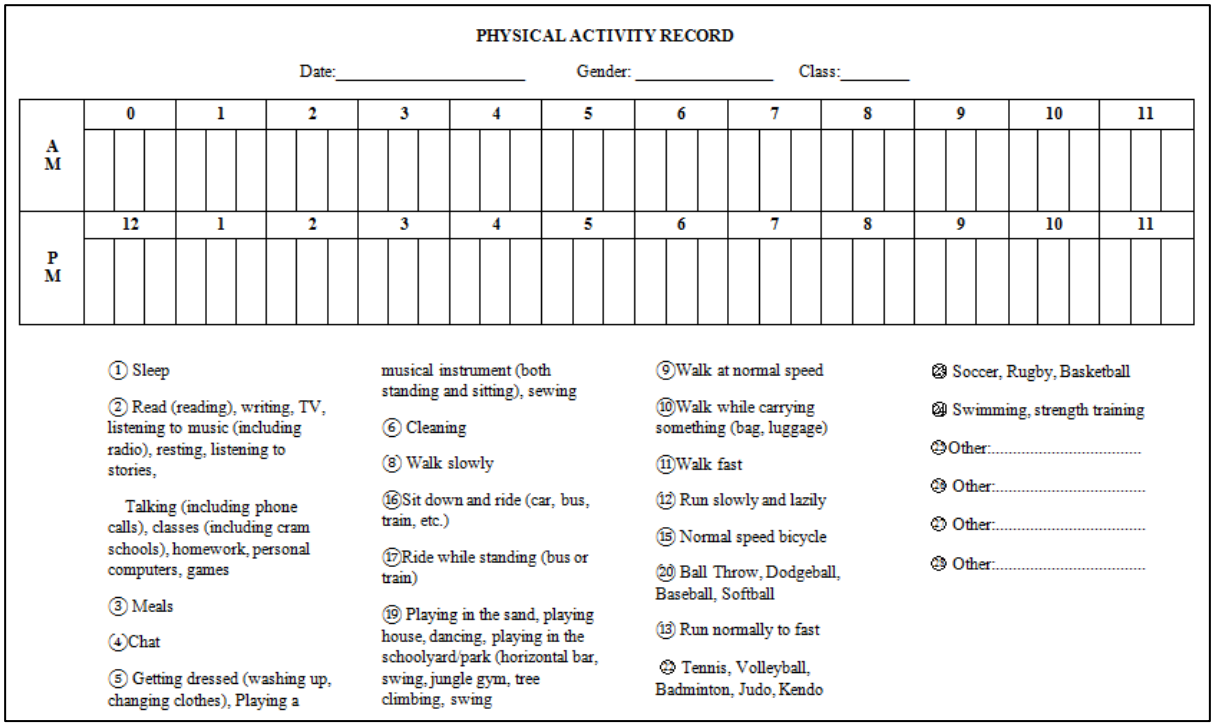
The physical activity level (PAL) was calculated based on the following formula:

PAL = Σ 24h {MET value of physical activity x time (min)} /1440 (minutes of 24 hours)

In which the MET value of physical activity was referenced from the compendium of physical activities of Ainsworth et al (7).

The time spent in each physical acitivity intensity each day was calculated using METs for each participant: average minutes spent in sedentary and light physical activity (METs< 3), moderate to vigorous physical activity (METs ≥3.0) (8), (9).

All statistical analyses were performed using SPSS software (version 26; IBM Corporation, Armonk, New York). The data were expressed as mean±SD or %. The study analyses involved comparisons between Tokyo suburban and Hanoi suburban. Differences between groups were assessed using independent t-tests and dependent t-tests for continuous data and chi-squared tests for categorical data. P values less than 0.05 were defined as a statistical difference.



PHYSICAL ACTIVITY RECORD

Date:_____ Gender: _____ Class:_____

	0	1	2	3	4	5	6	7	8	9	10	11
AM												
	12	1	2	3	4	5	6	7	8	9	10	11
PM												

① Sleep

② Read (reading), writing, TV, listening to music (including radio), resting, listening to stories,

Talking (including phone calls), classes (including cram schools), homework, personal computers, games

③ Meals

④Chat

⑤ Getting dressed (washing up, changing clothes), Playing a musical instrument (both standing and sitting), sewing

⑥ Cleaning

⑧ Walk slowly

⑯Sit down and ride (car, bus, train, etc.)

⑰Ride while standing (bus or train)

⑲ Playing in the sand, playing house, dancing, playing in the schoolyard/park (horizontal bar, swing, jungle gym, tree climbing, swing

⑨Walk at normal speed

⑩Walk while carrying something (bag, luggage)

⑪Walk fast

⑫ Run slowly and lazily

⑮ Normal speed bicycle

⑳ Ball Throw, Dodgeball, Baseball, Softball

㉑ Run normally to fast

㉒ Tennis, Volleyball, Badminton, Judo, Kendo

㉓ Soccer, Rugby, Basketball

㉔ Swimming, strength training

㉕Other:.....

㉖ Other:.....

㉗ Other:.....

㉘ Other:.....

Fig 1. Physical activity recording form

RESULTS

Figure 2 shows the comparison of PAL between Vietnamese and Japanese girls. In total, the PAL of girls in Tokyo suburban was significantly higher than those of Hanoi suburban at 1.45±0.10 and 1.40±0.12 ($p<0.05$), respectively. The PAL of girls on weekdays and weekends in Tokyo suburban was significantly higher than those of Hanoi suburban were 1.45±0.11 vs 1.41±0.09 ($p<0.05$) and 1.46±0.18 vs 1.38 ±0.15 ($p<0.05$), respectively. In overall, there was no significant differences between PAL on weekdays and weekends in both Tokyo and Hanoi suburban ($p>0.05$).

Figure 3 shows the comparison of PAL between Vietnamese and Japanese boys. In total, the PAL of boys in Tokyo suburban was significantly higher than those of Hanoi suburban at 1.69±0.15 and 1.45±0.13, respectively ($p<0.001$). The PAL of boys on weekdays and weekends in Tokyo suburban was significantly higher than those of Hanoi suburban were 1.67±0.14 vs 1.47±0.14 ($p<0.001$) and 1.74±0.29 vs 1.41±0.23 ($p<0.001$), respectively. In overall, there was no significant differences between PAL on weekdays and weekends in both Tokyo and Hanoi suburban ($p>0.05$).

Figure 4 shows the comparison of time spent on moderate and vigorous physical activity between Vietnamese and Japanese girls. In total, time spent for moderate to vigorous physical activity of girls in Tokyo suburban was significantly higher than those of Hanoi suburban at 153±59 and 85±37 min/d ($p<0.001$), respectively. Average time spent on moderate to vigorous physical activity of girls on weekdays and weekends in Tokyo suburban was significantly higher than those of Hanoi suburban were 145±62 vs 80±46 min/d ($p<0.001$) and 171±103 vs 95±62 min/d ($p<0.001$), respectively. In overall, there was no significant differences between average time spent on moderate to vigorous physical activity on weekdays and weekends in both Tokyo and Hanoi suburban ($p>0.05$).

Figure 5 shows the comparison of time spent on moderate and vigorous physical activity between Vietnamese and Japanese boys. In total, time spent for moderate to vigorous physical activity of boys in Tokyo suburban was significantly higher than those of Hanoi suburban at 175±93 and 97±43 min/d ($p<0.001$), respectively. Average time spent on moderate to vigorous physical activity of boys on weekdays and weekends in Tokyo suburban was

significantly higher than those of Hanoi suburban were 157±74 vs 99±45 min/d ($p<0.001$) and 212±192 vs 92±67 min/d ($p<0.001$), respectively. In overall, there was no significant differences in average time spent on moderate to vigorous physical activity between weekdays and weekends in both Hanoi and Tokyo suburban ($p>0.05$)

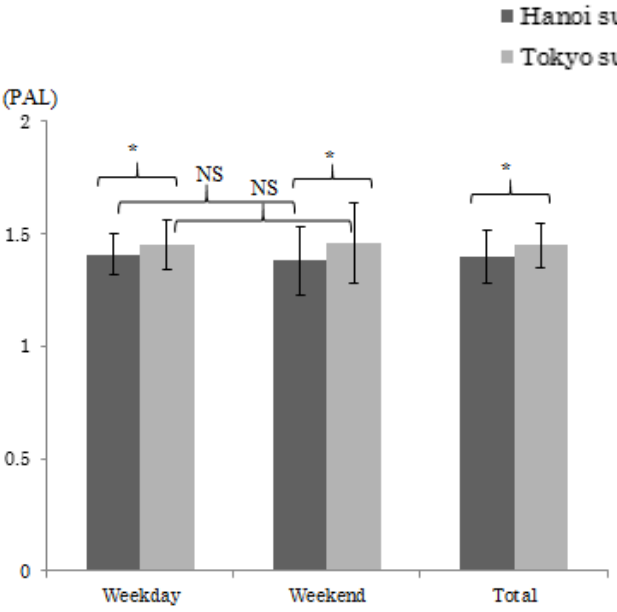


Figure 2. Comparison of PAL between Vietnamese (n=61) and Japanese girls (n=43)

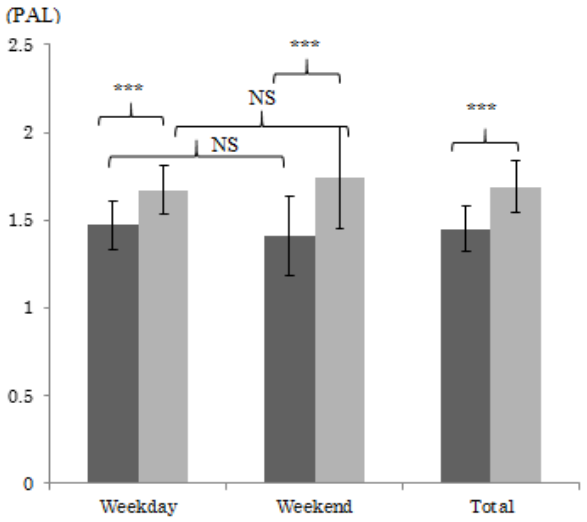


Figure 3. Comparison of PAL between Vietnamese (n=73) and Japanese boys (n=35)

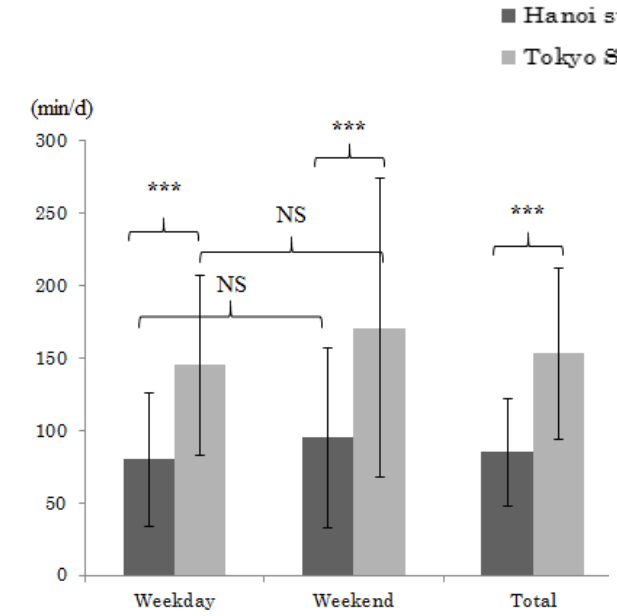


Figure 4. Comparison of time spent on moderate to vigorous physical activity between Vietnamese (n=61) and Japanese girls (n=43)

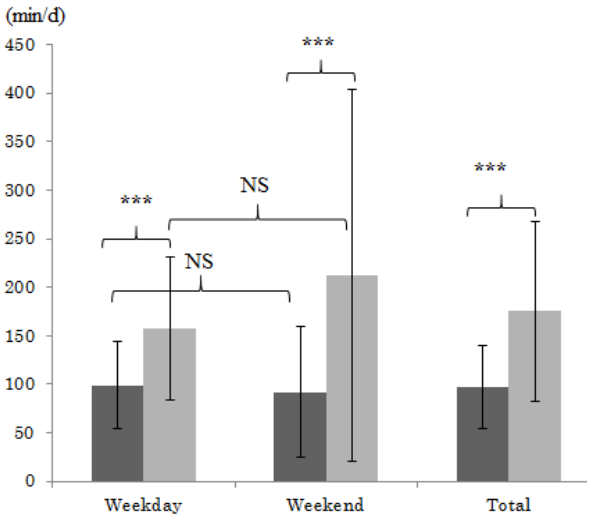


Figure 5. Comparison of time spent on moderate and vigorous physical activity between Vietnamese (n=73) and Japanese boys (n=35)

All values are mean±SD.
P-values were computed using an independent *t*-test between groups and a dependent *t*-test within group.
NS: non-significant differences and ***: significant differences at $p<0.001$.
PAL was calculated by ∑24h {MET value of physical activity x time (min)} /1440 min. It is the same as the average METs.

Table 1 compares some factors of physical activity in children aged 10 years old between Hanoi suburban and Tokyo suburban. The sleeping time of girls and boys in Hanoi suburban was significantly

longer than that in Tokyo suburban, with a difference of 67 minutes and 39 minutes, respectively ($p<0.001$). Time spent for moderate to vigorous physical activity of girls and boys in Tokyo suburban was significantly higher than those of Hanoi suburban at 153±59 vs 85±37 min/d ($p<0.001$) and 175±93 vs 97±43 min/d ($p<0.001$), respectively. 100% of children in the Tokyo suburban walked to school while about 50% of children in the Hanoi suburban walked or biked to school. The commute time from school for children in Tokyo was about 3 times longer than that of Hanoi suburban ($p<0.001$).

Table 1 Comparison of some factors of physical activity in children aged 10 years old between Hanoi suburban (N=134) and Tokyo suburban (N=78) by gender

	Girls			Boys		
	Hanoi (n=61)	**Tokyo (n=43)**	***p*-value†**	**Hanoi (n=73)**	**Tokyo (n=35)**	***p*-value†**
Sleeping time (min/d)	621±38	554±37	**<0.001**	611±49	572±56	**<0.001**
Moderate to vigorous physical activity (min/d)	85±37	153±59	**<0.001**	97±43	175±93	**<0.001**
No. of children walking or biking to school (%)	50.8	100	**<0.001**	52.1	100	**<0.001**
Time of walking or biking to school (min/d)	7±9	26±11	**<0.001**	7±8	24±9	**<0.001**

Values are mean±SD and %.

†Independent *t*-test except Chi-squared test for walking or biking to school (%). Significant difference: $p<0.05$.

DISCUSSION

The purposes of the present study was to assess and compare the physical activiy in Vietnamese and Japanese children. The physical activity level in Japanese children was higher than that of Vietnames children. The sleep time of Vietnamese children is longer than that of Japanese children. 100% of Japanese children walked to school that was 2 times higher than Vietnamese children. In particular, the time spent on moderate and vigorous physical activities of Japanese children was about 2 times higher than that of Vietnamese children.

The research period for this study was 7 days in Vietnam and 3 days in Japan. In terms of physical activity assessment, previous research has shown that with the minute-by-minute activity record method, the 7-day study period gives reliable results (10). However, in Japan, the Japanese Ministry of Education applied the physical activity record method for three non-consecutive days (11). Therefore, most of the studies on physical activity of Japanese children were conducted over a non-consecutive 3-day period and were found to be reliable. In other words, the difference in study period does not affect the results of this study. The two studies in Vietnam and Japan were all conducted around October-November of the year and in suburban area to reduce spatial and temporal errors. This allowed us to rule out differences in exercise that might be caused by season.

Regarding physical activity, the present study indicates that the level of physical activity of Tokyo children is higher than that of Hanoi children of both sexes, with a big difference especially among boys. The sleep duration of Japanese children was about 554 min/d in girls and about 572 min/d in boys. Sleeping time of girls and boys in Tokyo suburban were significantly shorter than those of Hanoi suburban at 67 and 39 min, respectively. This difference may be due to the nap habits of Vietnamese. In Vietnam, after lunch, children have about 45-60 minutes to take a nap before the afternoon class starts. In the present study, 100% of children in Tokyo suburban walked to school while the percentage of children in Hanoi suburban walked or cycled to school only about 50%. A cross-sectional study in 2020 reported that 53% of school children (aged 5-15 years) used active transport to and from school in Hanoi city (12). Promotion of active school travel (e.g., walking and cycling to/from school) may be a way to improve children's health due to its association with levels of physical activity (13). In Japan, more than 90% of children travel to school on foot, which may partly contribute to the relatively low prevalence of childhood obesity and being overweight (14). According to the 2018 Report Cards on Physical Activity for Children and Youth from 49 countries (also known as the Global Matrix 3.0) (15), Japan was highly rated as "A-" (i.e., 80–86% prevalence) for active transportation (16). Previous research has shown that active school travel was positively associated with neighborhood physical and social environments, safety, walkability, and neighborhood social interactions, and negatively associated with travel distance and car ownership (17), (18). In particular, safety has been identified as the core concept of school travel policies (19), (20), most studies have focused on traffic safety (21), (22). In the present study, the average time children walked to school about 30 minutes was an appropriate time because normally, the walking distance to school ranges between 2 and 4 kilometers for elementary school (3). In Vietnam, to increase the rate of children walking to school, it is necessary to improve the level of traffic safety as well as social security.

The difference in physical activity levels between children in Tokyo and Hanoi is mainly due to the difference in time spent on moderate to vigorous physical activities. A survey conducted in 2021 in Japan revealed that almost 55% of girls and close to 62% of boys aged between 4 and 11 years

participated in sports teams and clubs (23). Besides sports clubs, schools often also offer clubs for cultural activities, such as playing music instruments (23). In Vietnam, percentage of students who were physically active for a total of at least 60 minutes per day on all seven days during the past seven days was 13.6% (6). Additionally, for female students aged 10-11 years old showed that in 2012 only 11.9% of the grade 5 students in Ho Chi Minh City participated in active play after school (6). Time spent for moderate to vigorous physical activity of girls and boys in Tokyo suburban was significantly higher than those of Hanoi suburban at 68 min/d and 78 min/d, respectively. Consistently, the previous studies indicated that more than half of the children participated in organized sports for at least 60 minutes per day (4).

The evidence suggests that Vietnamese children had low levels of physical activity. Physical activity initiatives in Vietnamese children are largely focused on enhancing physical education in schools (24). Public health policy initiatives should focus more on community-based programs and promoting physical activity environments for children outside school settings (6). As recommended by the WHO ACTIVE toolkit, countries should focus on four policy action areas: changing the population's perception of the importance of physical activity; providing safe and well-maintained facilities and green areas for physical activity; encouraging people of all age groups to engage in regular physical activity, and to build a strong leadership and governance system to support successful policy implementation (6).

The present study has several limitations to note. In terms of physical activity, the present study was conducted in suburban areas of two big cities in Vietnam and Japan at the same time of year. However, the effects of the covid-19 pandemic may affect children's physical activity in both countries. A study to be conducted after the covid-19 pandemic is needed. In addition, the cross-sectional design used in the present study could not determine causality. Therefore, cohort studies should be conducted among Vietnamese and Japanese children in the future.

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CONFLICT OF INTEREST

The authors has no conflicts of interest to disclose.

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