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Survey on the Amount of Physical Activity and Self-Esteem of School Age Students in A Town in Japan

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Abstract

This study aimed to clarify the amount of physical activity, lifestyle, and self-esteem of elementary school students living in Aomori Prefecture Japan. The subjects were ninety-one elementary school students in the 4th to 6th grades who live in A town. The subjects were asked to fill out a questionnaire about lifestyles and self-esteem and to wear the lifestyle-related recorder Life Coder GS® (Suzuken, Japan) for a total of four days, two weekdays and two holidays. The results showed the amount of exercise such as the number of steps taken was significantly higher on weekdays than on holidays. There was no difference by gender or classification of obesity. In addition, when they go to school on foot, the number of steps and fast walking time was significantly higher than when using the bus. Screen times of holidays were significantly longer than those of weekdays. The number of steps on holidays was negatively correlated with screen time, and positively correlated with the factor of "self-assertion/self-determination" of self-esteem scale. Health promotion is needed so that the entire community, including family and friends, can develop daily physical activities.

Keywords

Physical Activity, Children, Exercise, Self-Esteem

1. Introduction

Childhood obesity is a risk factor for lifestyle-related diseases such as type 2 diabetes, hypertension, and non-alcoholic liver dysfunction [1], and it has been

suggested that childhood healthy lifestyle leads to adulthood health. Not only that, children's obesity and activity are said to be related to psychological aspects such as self-esteem and quality of life.

It is known that the proportion of obese children tends to increase from the latter half of elementary school to junior high school [2]. In addition to the relatively stable period of height growth, multiple factors such as eating habits, exercise habits [3] [4], genetic factors, environmental factors, and psychological factors influence each other [5]. Obesity during this period is also clearly at high risk of exacerbating severe obesity [6] [7]. Therefore, obesity of elementary school children must be prevented as much as possible.

By the way, school-aged children in Aomori Prefecture have a higher rate of obesity than the national average. For example, according to the 2017 School Health Statistics Survey, the national average obesity rate for 9-year-olds is 8.63%, while that for Aomori Prefecture is 12.58% [8]. In addition, Aomori Prefecture has a shorter life expectancy than the whole country [9], so improving lifestyle habits is an urgent issue. For future health, it is expected that acquiring a health-conscious lifestyle from school age will have a positive effect on long-term physical and mental health and QOL.

It is also said that obese children have low self-esteem [10] due to deterioration of body image and motor function. On the other hand, it has also been suggested that exercise has a positive effect on self-esteem [11] [12].

Therefore, in this study, we surveyed the amount of exercise, living conditions, and self-esteem of elementary school students living in Aomori Prefecture. By investigating these relationships, we aimed to obtain clues to a healthy life.

The purpose of this study is to clarify the relationship amount of physical activity and lifestyle and self-esteem of elementary school students living in Aomori Prefecture.

2. Methods

2.1. Subjects

Ninety-one elementary school students in the 4th to 6th grade in A Town, Aomori Prefecture.

Aomori Prefecture, where the subjects live, is in the northern part of Japan and has heavy snowfall in winter. Town A is a rural town with a population of about 4000, whose main industry is agriculture and fisheries. There is one public elementary school in the town.

2.2. Survey Method

The subjects were asked to wear the lifestyle-related recorder Life Coder GS® (Suzuken, Japan) for a total of four consecutive days, two weekdays and two holidays. Life Coder is a pedometer with a built-in accelerometer, which is attached to the abdomen to easily measure exercise intensity. Furthermore, information such as gender and physique, lifestyles (the way of commuting to school,

time of watching television (TV), time of playing electronic games), self-esteem were acquired by a questionnaire. Survey period was June 2018. Regarding ethical consideration, the purpose and content of the research were explained to the subjects in writing and verbally, and the consent of the parents was obtained in writing. In addition, the approval of the ethics committee of the institution to which the researcher belongs was obtained.

2.3. Survey Contents

As definition of terms, the amount of physical activity in this study is 1) number of steps, 2) dose of exercises, and 3) exercise (EX) based on the data obtained from Life Coder GS., 4) the total amount of time during which subjects exercised strongly (strong activity time).

Regarding physical activities, data obtained from Life Coder GS are number of steps per day, dose of exercise (energy consumption by exercise and walking) (kcal), exercise (EX) which is added to the Mets conversion value, 1 EX is equivalent to 20 minutes of normal walking, and 23 exercises per week are recommended for adults, activity time for each exercise intensity and strong activity time, the total of exercise time with fast walking or higher.

Concerning lifestyles and self-esteem, data obtained from the questionnaire were gender, grade, height, weight, means of go to school on weekdays, time spent watching TV or video, time spent playing electronic games by personal computer (PC), smartphone or game consoles, and self-esteem. Screen time was defined as the time spent using devices such as TV, PC, smartphones, and game consoles Regarding self-esteem, we asked for answers using a four-case method using a self-esteem measurement scale (Tokyo version) consisting of 22 items. As a subscale, it consists of 8 items of "self-evaluation/self-acceptance", 7 items of "self in a relationship", and 7 items of "self-assertion/self-determination". The higher the score means the higher the self-esteem.

2.4. Analytical Method

Data are expressed as mean ± standard deviation. To compare various parameters (number of steps per day, dose of exercise, EX and strong activity time) by gender and presence or absence of obesity, data were analyzed by unpaired t-test. Between weekdays and holidays differences in various parameters were assessed using paired t-test. The data was compared about the relationship between screen time, physical activity, and self-esteem using Pearson's correlation coefficient. $p < 0.05$ was considered significant.

3. Results

3.1. Physique

The degree of obesity was calculated using the Japanese age-specific obesity calculation formula [13] for elementary school children. 13.3% of students were classified as obese with a classification of obesity of 20% or higher (Table 1).

Table 1. Percentage of obesity.

	Normal	Mild obesity	Moderate obesity	Severe obesity
Degree of obesity	−20% - +20%	+20% - +30%	+30% - +50%	+50%
Boys (n = 39)	33	3	1	2
Girls (n = 51)	45	4	0	2

3.2. Amount of Physical Activity

This section describes the cases excluded from the analysis. Eleven children who did not have a pedometer record, those who took less than 1,500 steps on weekdays, and those who took less than 1,000 steps on holidays were excluded from the analysis because their activity may not have been measured accurately. The remaining forty-two subjects were analyzed. 11.9% of the 42 students were considered obese.

As comparison between boys and girls, the average daily number of steps for 4 days was 9,441 for boys and 10,475 for girls, and the results were slightly higher for girls in all surveyed items, but there was no significant difference.

Concerning comparison between weekdays and holidays, the average daily number of steps was 12,067 on weekdays, which was significantly higher than the 8,390 steps on holidays. The results also showed that weekday values were significantly higher than holidays in all other surveyed items.

Table 2 shows the amount of exercise on weekdays and holidays by gender.

About comparison by presence or absence of obesity, Table 3 shows a comparison of amount of physical activity between the non-obese group and obese group. The daily number of steps was 10,157 in the non-obese group and 10,756 in the obese group, showing that the number of steps, amount of exercise, EX and strong activity time were generally higher in the obese group, but there was no significant difference.

Regarding activity time by exercise intensity, Figure 1 shows a comparison of activity time by exercise intensity on weekdays and holidays. The time for fast walking was 26.5 minutes on weekdays, 16.7 minutes on holidays, and the time for jogging was 18.6 minutes on weekdays and 8.2 minutes on holidays, a significant difference. There was no difference by gender or classification of obesity.

3.3. Lifestyles

As to the way of commuting on weekdays, the most common way was by bus, with 22 people (56.4%) on the first day and 19 people (45.2%) on the second day. The number of children who went to school on foot was 8 (19.0%) on the first day and 7 (16.7%) on the second day. Comparing the amount of exercise in the case of using the bus and the case of going to school on foot, the number of steps and strong activity time were larger for those who went to school on foot, and the time for fast walking was significantly longer (p < 0.01) (Table 4).

Table 2. Amount of physical activity by gender: Difference between weekdays and holidays (Mean ± SD).

	Weekdays	Holidays	p value
Steps (/day)			
Boys (n = 10)	11,732 ± 4170	7149 ± 3166	0.039
Girls (n = 32)	12,172 ± 3028	8778 ± 3686	0.000
EX (METs × hour/day)			
Boys (n = 10)	4.2 ± 1.9	1.9 ± 1.1	0.009
Girls (n = 32)	4.2 ± 1.5	2.2 ± 1.3	0.000
Dose of exercise (kcal/day)			
Boys (n = 10)	248.9 ± 113.8	138.7 ± 80.1	0.018
Girls (n = 32)	238.7 ± 73.0	156.5 ± 76.1	0.000
Strong activity time (minutes/day)			
Boys (n = 10)	43.7 ± 18.5	21.8 ± 11.9	0.014
Girls (n = 32)	45.9 ± 16.5	29.5 ± 24.3	0.002

Table 3. Amount of exercise: Difference between non-obesity and obesity (Mean ± SD).

	Non-obesity (n = 37)	Obesity (n = 5)
Steps (/day)	10,157 ± 2800	10,757 ± 3067
EX (METs × hour/day)	3.1 ± 1.1	3.5 ± 1.6
Dose of exercise (kcal/day)	190.5 ± 66.8	242.8 ± 75.8
Strong activity time (minutes/day)	36.3 ± 14.6	38.8 ± 15.9

Table 4. Comparison by the way of commuting (Mean ± SD).

The way of commuting	On foot (n = 15)	By bus (n = 41)	p value
Steps (/day)	15,477 ± 3623	11,783 ± 4230	0.004
EX (METs × hour/day)	6.0 ± 2.3	4.0 ± 1.9	0.002
Dose of exercise (kcal/day)	304.1 ± 112.5	239.4 ± 107.4	0.054
Strong activity time (minutes/day)	66.5 ± 22.7	42.3 ± 18.5	0.000
Slowly walk time (minute/day)	74.0 ± 22.1	71.2 ± 23.5	0.693
Fast walk time (minute/day)	41.9 ± 13.4	22.8 ± 9.4	0.000
Jogging (minute/day)	24.6 ± 13.7	19.2 ± 11.9	0.152

About screen time (TV time and game time), the average was calculated for the screen time. Weekdays TV time and game time were 101.9 ± 78.8 minutes and 52.6 ± 53.0 minutes, respectively, and holidays were 112.1 ± 84.4 minutes and 77.6 ± 93.6 minutes, respectively. Holiday screen times were significantly longer than those of weekdays (p < 0.01). (Figure 2)

Regarding the self-esteem, cronbach *a*, indicates the reliability of the scale, 0.882 for 8 items of "self-evaluation/self-acceptance", 0.848 for 7 items of "self in a relationship", and 0.874 for 7 items of "self-assertion/self-determination". The average per item is 3.15 ± 0.42 for boys and 3.09 ± 0.77 for girls in "self-evaluation/self-acceptance", 3.18 ± 0.60 for boys and 3.40 ± 0.60 for girls in "self in relationships", "self-assertion/self-determination" was 3.31 ± 0.42 for boys and 3.13 ± 0.74 for girls, showing no significant difference between boys and girls.

As for relationship between amount of exercise, living conditions, and self-esteem, the correlation coefficient between the number of steps on weekdays/holidays, the TV and game time on weekdays/holidays, and self-esteem was calculated.
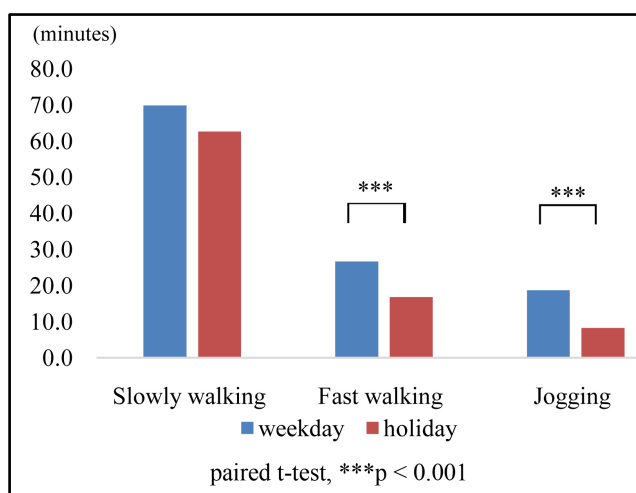

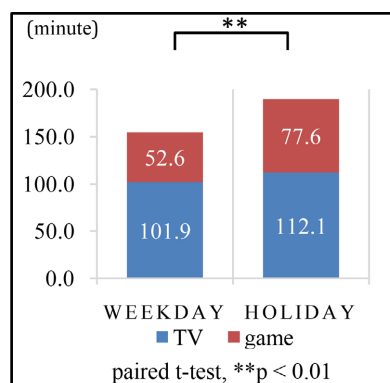**Figure 1.** Strong activity time: Difference between weekdays and holidays (***p < 0.001).

Figure 2. Comparison of screen time: Difference between weekdays and holidays.

Table 5. Pearson's correlation coefficient between variables (*p < 0.05, **p < 0.01).

	Steps on weekday	Steps on holiday	Screen time on weekday	Screen time on holiday	Self-evaluation/ acceptance	Self in a relationship	Self-assertion/ determination
Steps on weekday	1	0.322*	−0.006	0.088	−0.018	−0.161	0.026
Steps on holiday		1	−0.313*	−0.320*	0.259	0.26	0.378*
Screen time on weekday			1	0.750**	−0.167	0.173	−0.266
Screen time on holiday				1	−0.021	0.068	−0.143
Self-evaluation/ acceptance					1	0.583**	0.842**
Self in a relationship						1	0.517**
Self-assertion/ determination							1

As a result, a significant negative correlation was found between the number of steps on holidays and the time spent watching TV games on weekdays and holidays. In addition, there was a significant positive correlation between the number of steps on holidays and the "self-assertion/self-determination" score of self-esteem (Table 5).

4. Discussion

The obesity rate of the subjects in this study was 13.3%. The Japanese average is 8.63% for 9-year-olds, 8.89% for 10-year-olds, and 9.22% for 11-year-olds [8], which is higher than that of children of the same age in Japan. However, the rate of obesity among children in Aomori Prefecture is 12.58% at age 9, 11.73% at age 10, and 10.84% at age 11 [8], so it can be said that the rate of childhood obesity in Aomori Prefecture is high.

Regarding the number of steps per day, the average on weekdays for boys was 11,732 steps and that for girls was 12,172 steps. It can be said that the number of steps of these subjects was small, because in a previous study showing the amount of activity of elementary school students in Japan, the daily number of steps was 14,000 - 18,000 for boys and 13,000 - 14,000 for girls [7]. Furthermore, according to the results of surveys performed with the same method in other municipalities in Aomori Prefecture from 2010 to 2013, the number of weekday steps for boys was 16,000 - 17,000 and that for girls was 12,000 - 13,000. The number of weekday steps taken by boys in this study was 11,732 and it was lower than that of the surrounding areas in the past studies. As a background to this, there is only one elementary school Town A, and many children come to school from afar. In a previous study it is said that the longer the commute distance, the more steps were taken [14], but the subject in this study included children used

buses and private cars instead of walking. The result was that commuting on foot had significantly more steps and activity time than commuting by bus, and especially the time for fast walking was longer, so it can be said that to commute on foot had the effect of increasing moderate exercise. In other words, because the amount of activity is affected by the means of commuting to school, it was thought that even children commuting to school by bus or car would need to devise measures such as switching to walking even for only a part of the commuting route.

Furthermore, in this study, it was characteristic that boys took fewer steps than girls. However, it is generally said that boys take more steps than girls [7] [15]. Regarding this factor, according to the teachers at the school, dance activity was popular among girls during the survey period, and many girls danced during breaks between classes. In the latter half of elementary school, common pastimes with friends and peers of the same sex become more common. It was suggested that school recess and after-school activities are important for increasing the amount of exercise for school children. From the perspective of exercising while having fun, there are also efforts to try out athletic digital games [7]. Ideally, the amount of exercise naturally increases through playing and extracurricular activities.

Regarding the relationship between the degree of obesity and the amount of physical activity, previous studies have reported that the number of steps taken by obese children is less than that of children of standard body shape [7], but in our survey, the amount of exercise of obese children was not small. This is probably because the number of children targeted in this survey was small and it was not possible to make a sufficient statistical study.

Next, when comparing the amount of exercise on weekdays and holidays, the amount of activity in each item was significantly higher on weekdays. This is consistent with the results of previous studies [7] [16]. As for the activity time according to exercise intensity, on holidays, slow walking was performed in the same way as on weekdays, but exercise such as fast walking and jogging was significantly lower than on weekdays. From these facts, coming to school and receiving physical education provided a slightly stronger opportunity for exercise on weekdays, and those students were resting at home on holidays. We believe that this is also due to the influence of the family members with whom the children spend their holidays. Previous studies have shown that the exercise habits of fathers [17] and mothers [18] are related to the amount of exercise in young children. According to data from Aomori Prefecture, lack of exercise is mentioned as a health issue in adulthood, and more than 40% of children, regardless of age, spend their time watching TV, listening to music, or playing video games after school on weekdays, and the percentage increases as they get older [19]. From the results of this survey, there was a positive correlation between the screen times on weekdays and holidays, and the screen times on holidays were significantly longer than on weekdays, and the amount of activity such

as the number of steps was small, so the way of spending at home affects the amount of exercise considerably. Since childhood is affected by the lifestyle of adults living with them, it is possible that improving the lifestyle of adults may lead to the health of children.

Finally, the subject's self-esteem was the same as or slightly higher than that of junior high school students in the same area [20] or the same grade survey [21] in Tokyo. Compared to other countries, young people in Japan are less likely to think of themselves positively [22] and begin to decline from elementary school to junior high school [23]. There are many studies that exercise has a positive effect on self-esteem [11] [12], but in this study, the factors of "self-assertion/ self-determination" that constitutes self-esteem had a positive correlation with the number of steps taken on holidays and a negative correlation with the screen time. While watching TV and games is a passive activity, many holiday sports and exercises are voluntary, so they might be related to self-assertion and self-determination factors that are part of the child's self-esteem. It is said that children who often engage in sports and other activities with their families tend to have high self-esteem [24], suggesting that how they spend their holidays with their families may affect their self-esteem.

5. Limitation

As a limitation of this study, about half of the elementary school students who participated in the survey were excluded from the analysis because they forgot to wear the device or did not wear it correctly. This may have caused a bias in the subjects. In the future, it will be necessary to improve the method of explanation and so that all subjects can measure easily and accurately.

6. Conclusions

As a result of investigating the amount of physical exercise of elementary school students in A town, Aomori Prefecture in June 2018, the following points were clarified.

1) The amount of exercise such as the number of steps was significantly higher on weekdays than on holidays.

2) No significant difference was found between boys and girls and the presence or absence of obesity.

3) The amount of activity on holidays was correlated with self-assertion/ determination of self-esteem.

Health-relates promotions are needed so that the entire community, including family and friends, can develop healthy habits.

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Declaration of Conflicting Interests

All authors have no conflicts of interests directly relevant to the content of this article.

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