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Chapter

A Study on the Relationship between Health and Physical Fitness and School Life of Children

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Abstract

In this study, in order to clarify the relationship between health and physical strength, athletic capability, school life, and lifestyles, we collated the results of physical fitness tests with questionnaire surveys of 102 elementary school fifth-grade males and females. In the school life aspect, children who scored high on the physical fitness test, like Physical Education, enjoy learning, play well with friends while in the lifestyle aspect, they clean up their surroundings and rooms, study even without being told and there is a tendency for them to make their own plan. In addition, it was confirmed that children with high physical fitness test scores were in good condition, such as being healthy every day and hardly getting sick. On the other hand, in relation to the physical fitness test scores and the body shape by BMI, there were many high scorers among the children whose body figure was standard. These results suggest that physical fitness and athletic capability are related to children's school life and health, and that high physical fitness has a positive impact on children's school life and health.

Keywords: physique, physical fitness, school life, health, elementary school student

1. Introduction

Physical strength is the source of human activity and an important element of “the power to live” such as abundant humanity, the ability to learn by oneself and the ability to think for themselves [1, 2].

In recent years, changes in the social environment and lifestyle have led to great changes in the environment surrounding children. There is a decrease in walking opportunities for children due to the development of transportation, the neglect of adults to disregard children's play and sports, a decrease in helping children's housework, and the development of information equipment, etc.

As a result, children's human relationships become weak, and there are fewer opportunities to have more friends and to move their bodies [1, 2].

Along with this, the current physical strength of children around 1985, has been declining over the long term in all ages, such as their running power, throwing power and gripping power, etc. [3].

Also, recently, the bipolarization of physical strength between children who are actively engaged in exercise and sports and those who lack exercise has been pointed out [4]. Children's lack of exercise is not just a decline in physical strength, but also has an adverse effect on the improvement of mental and physical health [5].

In a questionnaire survey on children's experience activities conducted by the Ministry of Education, Culture, Sports, Science, and Technology in 1998, a total of 33% of elementary school second graders answered that they "often" or "sometimes" feel tired on a daily basis and it is reported that it reaches 60% in the second grade of junior high school [6].

Also, there are quite a few children who have stress in their school life resulting in disturbed lifestyles such as spending a considerable amount of time studying at school, studying at cram school or at home, having insufficient sleeping time, being unable to sleep at night, being easy to get tired, having no desire for breakfast, wanting to speak out loud somehow and being frustrated with nothing.

Furthermore, disruption of children's lifestyles can have a negative impact on reduced energy and motivation and a lack of concentration [7]. It may be said that the lack of exercise in children greatly affects the development of their strength and growth.

Therefore, it is thought to be extremely important to examine athletic ability and physical strength which is the basis for living.

Up to now, many research endeavors have been conducted from various angles to solve this problem, and various improvement measures have been tried on how children's physical fitness and exercise capacity are related to school life and lifestyle and it is deemed necessary to conduct further verification.

Therefore, the purpose of this study is to examine in detail the physical strength and athletic capability of elementary school students such as running ability, jumping ability, throwing ability and endurance and to clarify the relationship between health and physical strength, athletic capability, school life and lifestyle.

2. Method

2.1 Participants

A self-administered questionnaire survey was conducted for fifth graders of a public elementary school in Tokyo. There were 47 boys and 55 females for a total of 102 respondents.

2.2 Investigation contents

2.2.1 Fitness test

The physical fitness tests conducted at the school were: muscle strength: grip strength, muscle endurance: upper body, flexibility: sit and reach, agility: repeated sideways jump, whole body endurance: 20 m shuttle run, speed, running ability: 50 m run, muscle power, jumping ability: standing long jump, skill, and muscle power and throwing power: softball throwing. The results were recorded on a 10-point scale according to the score table for each item set by the Sports Bureau of the Ministry of Education, Culture, Sports, Science, and Technology (MEXT). In addition, the total result was calculated by adding the scores of each item. Based on the comprehensive

evaluation criteria table of the new physical fitness test, comprehensive evaluation was obtained in five stages from A to E. A and B were set to “high,” C was set to “standard,” while D and E were set to “low.”

2.2.2 Figure

At the school, the BMI was calculated from the height and weight of body measurements. Based on that, we used Kato's [8] age-specific BMI percentile curves up to 18 years old by classifying obesity, standard, and lean body types. The body type is determined by setting the 10 to 90 percentile value of each age in the BMI percentile curve as “standard” (15.0 to 18.5). In addition, “lean” is defined as less than this range, and “obesity” is defined as exceeding this range.

2.2.3 Analysis method

The physical fitness test and body type and each question item were examined by gender. Furthermore, we examined the relationship between physical strength tests and school life and health; and between physical strength tests and body types.

All analyzes were performed with SPSS19.0 for Windows, with a significance level of 5%. The χ^2 test was used to test the ratio bias, and the unmatched t-test was used to test the difference between the average values of BMI and physical strength test results.

3. Result

3.1 Gender differences in physical characteristics and physical strength/athletic capability test results

In terms of physical characteristics, the sitting height was 75.6 ± 3.6 for boys and 77.3 ± 3.7 for girls, with girls significantly higher than boys ($p < 0.05$) (Table 1). In the physical strength test, for softball throwing: the score was 21.72 ± 6.97 m for boys and 11.87 ± 3.32 m for girls ($p < 0.001$). In repeated sideways jumps, the score was 36.36 ± 7.05 for boys and 33.51 ± 33.51 for girls ($p < 0.05$). In the 20 m shuttle run, the boys had 43.60 ± 20.84 times while the girls were 30.98 ± 12.77 times ($p < 0.001$).

On the other hand, in the sit and reach test the score was 31.00 ± 7.94 cm for boys and 38.00 ± 8.73 cm for girls, with girls showing significantly higher results compared to boys ($p < 0.000$). The overall fitness test score was slightly higher for girls than for boys, but there was no significant difference. In addition, boys have low scores and little higher standard scores, while girls had slightly higher scores.

3.2 Gender differences in physical fitness and athletic capability test evaluation

The percentage of “high” scores for both boys and girls exceeded 50%, but the percentage of girls was slightly higher than that of boys. However, the percentage of “low” scores was slightly higher for boys than for girls, but no significant difference was observed (Table 2).

| | Boys (11) | | | | | Girls (11) | | | | | 95% confidence interval for difference | | Significance |
|-----------------------------------|-----------|-------|------|---------------|---------------|------------|-------|------|---------------|---------------|--|---------------|----------------------|
| | n | m | sd | Minimum value | Maximum value | n | m | sd | Minimum value | Maximum value | Minimum limit | Maximum value | |
| Physical characteristic | | | | | | | | | | | | | |
| Height (cm) | 47 | 139.8 | 6.9 | 122.5 | 153.3 | 55 | 142.2 | 6.5 | 124.8 | 154.7 | -4.956 | 0.319 | 0.526 |
| Weight (kg) | 47 | 35.5 | 9.3 | 21.3 | 72.0 | 55 | 34.4 | 6.0 | 22.6 | 50.2 | -2.049 | 4.252 | 0.026 [*] |
| Sit height (cm) | 47 | 75.6 | 3.6 | 65.3 | 83.2 | 55 | 77.3 | 3.7 | 68.0 | 84.3 | -3.192 | -0.298 | 0.989 |
| BMI (kg/m ²) | 47 | 18.0 | 3.5 | 14.2 | 32.6 | 55 | 16.9 | 2.0 | 13.5 | 22.0 | -0.042 | 2.131 | 0.007 ^{**} |
| Physical strength test | | | | | | | | | | | | | |
| Grip strength (kg) | 47 | 17.7 | 3.3 | 10 | 27 | 55 | 18.0 | 4.0 | 8 | 27 | -1.792 | 1.153 | 0.062 |
| Upper body development (times) | 47 | 20.3 | 4.1 | 11 | 28 | 55 | 19.9 | 3.4 | 10 | 27 | -1.107 | 1.836 | 0.226 |
| Sit and reach (cm) | 47 | 31.0 | 7.9 | 5 | 43 | 55 | 38.0 | 8.7 | 18 | 57 | -10.301 | -3.699 | 0.541 |
| Repeated horizontal jump (points) | 47 | 36.4 | 7.1 | 18 | 48 | 55 | 33.5 | 5.9 | 15 | 43 | 0.312 | 5.393 | 0.150 |
| 20 m shuttle run (times) | 47 | 43.6 | 20.8 | 5 | 91 | 54 | 31.0 | 12.8 | 12 | 75 | 5.638 | 19.591 | 0.001 ^{***} |
| 50 m race (seconds) | 47 | 9.7 | 2.3 | 8.1 | 20.1 | 54 | 9.4 | 0.8 | 7.9 | 12 | -0.467 | 0.927 | 0.035 [*] |
| Standing long jump (cm) | 47 | 147.4 | 20.9 | 89 | 187 | 55 | 145.8 | 18.6 | 100 | 185 | -6.144 | 9.383 | 0.657 |
| Throw a ball (m) | 47 | 21.7 | 7.0 | 11 | 38 | 55 | 11.9 | 3.3 | 6 | 23 | 7.632 | 12.069 | 0.001 ^{***} |
| Physical strength general score | 47 | 57.6 | 9.4 | 37 | 76 | 55 | 59.7 | 8.6 | 41 | 83 | -5.655 | 1.440 | 0.595 |

BMI: Body Mass Index.

^{*}: $p < .05$. ^{**}: $p < .01$. ^{***}: $p < .001$.

Table 1.

Gender differences in physical characteristics and physical fitness test results.

| | | Boys | Girls | Total | Significance |
|--|----------|---------------|---------------|----------------|--------------|
| Comprehensive evaluation of physical fitness | low | 9 (19.1) | 7 (12.7) | 16 (15.7) | 0.523 |
| | standard | 13 (27.7) | 13 (23.6) | 26 (25.5) | |
| | high | 25 (53.2) | 35 (63.6) | 60 (58.8) | |
| | Total | 47 (100.0) | 55 (100.0) | 102 (100.0) | |

N (%).

Table 2.
 Gender differences in physical fitness test evaluation.

3.3 Gender differences in school life aspect, lifestyle aspect, health aspect, degree of obesity, and sleep time

At school, many children answered that they were having fun. In particular, a high percentage of male respondents answered the items “I like physical education classes” and “play well with friends when playing” compared to girls. Compared with boys, girls responded more frequently to items such as “school is fun”, “study is fun”, and “has good friends” (Table 3). In terms of lifestyle habits, boys and girls accounted for more than 70% of the children who answered “yes” in the “staying at home alone” item. For most items, more children answered “No” than “Yes”.

In the items “I have decided what I want to be in the future” and “I have something I want to do when I grow up” ($p < 0.01$), the percentage of “Yes” for girls was higher than that for boys.

| | | Boys | Girls | Total | Significance |
|-------------|--|------------|------------|-------------|--------------|
| School life | Is school fun? | | | | 0.423 |
| | Yes, it's fun. | 33 (70.2) | 41 (74.5) | 74 (72.5) | |
| | No, it is not. | 6 (12.8) | 3 (5.5) | 9 (8.8) | |
| | Neither | 8 (17.0) | 11 (20.0) | 19 (18.6) | |
| | Total | 47 (100.0) | 55 (100.0) | 102 (100.0) | |
| | Is studying at school fun? | | | | 0.080 |
| | Yes, it is. | 28 (59.6) | 43 (78.2) | 71 (69.6) | |
| | No, I do not. | 8 (17.0) | 3 (5.5) | 11 (10.8) | |
| | Neither | 11 (23.4) | 9 (16.4) | 20 (19.6) | |
| | Total | 47 (100.0) | 55 (100.0) | 102 (100.0) | |
| | Do you like school physical education? | | | | 0.430 |
| | Yes, I do. | 42 (89.4) | 45 (81.8) | 87 (85.3) | |
| | No, I do not. | 1 (2.1) | 4 (7.3) | 5 (4.9) | |
| | Neither | 4 (8.5) | 6 (10.9) | 10 (9.8) | |
| | Total | 47 (100.0) | 55 (100.0) | 102 (100.0) | |

| | Boys | Girls | Total | Significance | |
|---|---|------------|-------------|--------------|---------|
| Do you have close friends? | | | | | |
| Yes, I do. | 46 (97.9) | 54 (98.2) | 100 (98.0) | 0.911 | |
| No, I do not. | 1 (2.1) | 1 (1.8) | 2 (2.0) | | |
| Total | 47 (100.0) | 55 (100.0) | 102 (100.0) | | |
| Do you often play with friends during the playing time at school? | | | | | |
| Yes, I do. | 39 (83.0) | 42 (76.4) | 81 (79.4) | 0.669 | |
| Sometimes | 7 (14.9) | 12 (21.8) | 19 (18.6) | | |
| No, I do not. | 1 (2.1) | 1 (1.8) | 2 (2.0) | | |
| Total | 47 (100.0) | 55 (100.0) | 102 (100.0) | | |
| Lifestyle aspects | I get up alone in the morning. | 22 (46.8) | 27 (49.1) | 49 (48.0) | 0.818 |
| | I stay at home alone. | 33 (70.2) | 38 (69.1) | 71 (69.6) | 0.902 |
| | I clean up my surroundings and my room. | 20 (42.6) | 27 (49.1) | 47 (46.1) | 0.509 |
| | I stop playing when the set time comes even during the play. | 23 (48.9) | 27 (49.1) | 50 (49.0) | 0.988 |
| | I decide what TV programs I want but do not watch constantly. | 14 (29.8) | 18 (32.7) | 32 (31.4) | 0.750 |
| | I make plans and study even if not told. | 15 (31.9) | 22 (40.0) | 37 (36.3) | 0.397 |
| | I decide what I want to be in the future | 21 (44.7) | 33 (60.0) | 54 (52.9) | 0.122 |
| | There are things I want to try when I grow up. | 19 (40.4) | 37 (67.3) | 56 (54.9) | 0.007** |
| Health | I feel heavy and maybe tired | | | | |
| | Often | 4 (10.5) | 4 (9.1) | 8 (9.8) | 0.514 |
| | Sometimes | 22 (57.9) | 19 (43.2) | 41 (50.0) | |
| | Not much | 9 (23.7) | 15 (34.1) | 24 (29.3) | |
| | Not at all | 3 (7.9) | 6 (13.6) | 9 (11.0) | |
| | Total | 38 (100.0) | 44 (100.0) | 82 (100.0) | |
| | I spend time well every day. | | | | |
| | Very well | 17 (44.7) | 24 (54.5) | 41 (50.0) | 0.247 |
| | Healthy | 19 (50.0) | 20 (45.5) | 39 (47.6) | |
| | Not fine at all | 2 (5.3) | 0 | 2 (2.4) | |
| Total | 38 (100.0) | 44 (100.0) | 82 (100.0) | | |
| There's a time that I feel sick | | | | | |
| Often | 2 (5.4) | 1 (2.3) | 3 (3.7) | 0.660 | |
| Sometimes | 15 (40.5) | 21 (47.7) | 36 (44.4) | | |
| Almost never | 20 (54.1) | 22 (50.0) | 42 (51.9) | | |
| Total | 37 (100.0) | 44 (100.0) | 81 (100.0) | | |

| | | Boys | Girls | Total | Significance |
|-------------------|--|------------|------------|-------------|--------------|
| Degree of obesity | Slender | 5 (10.6) | 9 (16.4) | 14 (13.7) | 0.434 |
| | Standard | 29 (61.7) | 36 (65.5) | 65 (63.7) | |
| | Obese | 13 (27.7) | 10 (18.2) | 23 (22.5) | |
| | Total | 47 (100.0) | 55 (100.0) | 102 (100.0) | |
| Sleep time | Sleep time on weekdays | | | | |
| | More than 6 hours but less than 7 hours | 5 (13.2) | 2 (4.5) | 7 (8.5) | 0.340 |
| | More than 7 hours but less than 8 hours | 10 (26.3) | 15 (34.1) | 25 (30.5) | |
| | More than 8 hours but less than 9 hours | 13 (34.2) | 19 (43.2) | 32 (39.0) | |
| | More than 9 hours but less than 10 hours | 10 (26.3) | 7 (15.9) | 17 (20.7) | |
| | More than 10 hours | 0 0 | 1 (2.3) | 1 (1.2) | |
| | Total | 38 (100.0) | 44 (100.0) | 82 (100.0) | |
| | Sleep time on holidays | | | | |
| | More than 6 hours but less than 7 hours | 2 (5.4) | 2 (4.8) | 4 (5.1) | 0.080 |
| | More than 7 hours but less than 8 hours | 3 (8.1) | 7 (16.7) | 10 (12.7) | |
| | More than 8 hours but less than 9 hours | 21 (56.8) | 11 (26.2) | 32 (40.5) | |
| | More than 9 hours but less than 10 hours | 6 (16.2) | 14 (33.3) | 20 (25.3) | |
| | More than 10 hours | 5 (13.5) | 8 (19.0) | 13 (16.5) | |
| | Total | 37 (100.0) | 42 (100.0) | 79 (100.0) | |

Table 3.
Gender differences in school life aspect, lifestyle aspect, health aspect, degree of obesity, and sleep time.

In terms of health, most of the boys and girls were “very well” and “healthy” in the item “I spend time well every day”. On the other hand, there were about 50% of children were feeling heavy or tired and sometimes get sick.

In terms of obesity, the percentage of leanness was slightly higher for girls than for boys, and the percentage of obesity was 27.7% for boys and 18.2% for girls, which was higher for boys. In the sleeping hours on weekdays, both boys and girls had a high rate of 8 hours to less than 9 hours. On holidays, boys had the highest rate of 8 hours to less than 9 hours, and girls had a slightly higher rate of 9 hours to less than 10 hours.

3.4 Relationship between physical strength and athletic capability test evaluation and school life

Many children with high physical strength and athletic capability test evaluations answered that they enjoyed studying ($p < 0.05$), liked physical education at school (p

| | Low | Standard | High | Total | Significance |
|--|------------|------------|------------|-------------|--------------|
| Is school fun? | | | | | |
| Yes, it is. | 9 (56.3) | 17 (65.4) | 48 (80.0) | 74 (72.5) | 0.071 |
| No, it is not. | 4 (25.0) | 3 (11.5) | 2 (3.3) | 9 (8.8) | |
| Neither | 3 (18.8) | 6 (23.1) | 10 (16.7) | 19 (18.6) | |
| Total | 16 (100.0) | 26 (100.0) | 60 (100.0) | 102 (100.0) | |
| Is studying at school fun? | | | | | |
| Yes, it is. | 7 (43.8) | 17 (65.4) | 47 (78.3) | 71 (69.6) | 0.042* |
| No, it is not. | 3 (18.8) | 5 (19.2) | 3 (5.0) | 11 (10.8) | |
| Neither | 6 (37.5) | 4 (15.4) | 10 (16.7) | 20 (19.6) | |
| Total | 16 (100.0) | 26 (100.0) | 60 (100.0) | 102 (100.0) | |
| Do you often play with friends well during the playing time at school? | | | | | |
| Yes, I do. | 8 (50.0) | 20 (76.9) | 53 (88.3) | 81 (79.4) | 0.001*** |
| Sometimes | 6 (37.5) | 6 (23.1) | 7 (11.7) | 19 (18.6) | |
| No, I do not. | 2 (12.5) | 0 0 | 0 0 | 2 (2.0) | |
| Total | 16 (100.0) | 26 (100.0) | 60 (100.0) | 102 (100.0) | |
| Do you like physical education of the school? | | | | | |
| Yes, I do. | 10 (62.5) | 20 (76.9) | 57 (95.0) | 87 (85.3) | 0.003** |
| No, I do not. | 3 (18.8) | 1 (3.8) | 1 (1.7) | 5 (4.9) | |
| Neither | 3 (18.8) | 5 (19.2) | 2 (3.3) | 10 (9.8) | |
| Total | 16 (100.0) | 26 (100.0) | 60 (100.0) | 102 (100.0) | |
| Do you have close friends? | | | | | |
| Yes, I do. | 15 (93.8) | 25 (96.2) | 60 (100.0) | 100 (98.0) | 0.201 |
| No, I do not. | 1 (6.3) | 1 (3.8) | 0 0 | 2 (2.0) | |
| Total | 16 (100.0) | 26 (100.0) | 60 (100.0) | 102 (100.0) | |

n(%).
*: *p* < .05. **: *p* < .01. ***: *p* < .001.

Table 4.
Relationship between physical fitness test evaluation and school life.

< 0.01) and played well with friends during play time ($p < 0.001$) (**Table 4**). Although it was not a significant difference, 80% of the children who answered “high” in the physical strength/athletic capability test said that school was fun. In addition, in the “I have good friends” item, there were almost no children answered it regardless of the high or low score of physical strength and physical capability test.

3.5 Relationship between physical strength, athletic capability evaluation test scores and lifestyle aspects

Children with high scores for physical strength and athletic capability clean up their surroundings and rooms more than children with low scores ($p < 0.01$) and

many children answered that they would plan and study without saying ($p < 0.05$) (Table 5). Children with high scores for physical strength and athletic capability evaluation tests answered the following items: “stop when the time is decided in the middle of play”, “decide what TV programs they want but do not watch constantly”, “decide what they want to be in the future”, and “there are things they want to do when they grow up.” Although they answered many items, there was no significant difference. On the other hand, in the item of “staying at home alone” the “low” score was higher than “standard” and “high” scores.

3.6 The relationship between physical strength and athletic capability test scores and health aspect.

In the item “spending time well every day,” it was found that many children with high scores responded “very cheerfully” ($p < 0.01$) (Table 6). In addition, the number of children who responded that their condition was worse was “frequently” or “sometimes occasionally” ($p < 0.05$), which had no significant difference. On the other hand, many of the children who scored “low” answered “frequently” or “sometimes” to be tired or to be feeling heavy.

| | | | | | |
|---|-----------|-----------|-----------|-----------|---------|
| I get up alone in the morning | 7 (43.8) | 13 (50.0) | 29 (48.3) | 49 (48.0) | 0.923 |
| I stay at home alone | 13 (81.3) | 17 (65.4) | 41 (68.3) | 71 (69.6) | 0.525 |
| I clean up my surroundings and my room. | 2 (12.5) | 11 (42.3) | 34 (56.7) | 47 (46.1) | 0.006** |
| I stop playing when the set time is over even during the play | 5 (31.3) | 13 (50.0) | 32 (53.3) | 50 (49.0) | 0.290 |
| I decide what TV programs I want to watch but do not watch constantly | 2 (12.5) | 8 (30.8) | 22 (36.7) | 32 (31.4) | 0.180 |
| I make plans and study even if not told | 1 (6.3) | 9 (34.6) | 27 (45.0) | 37 (36.3) | 0.016* |
| I decide what I want to be in the future | 6 (37.5) | 11 (42.3) | 37 (61.7) | 54 (52.9) | 0.103 |
| There are things I want to try when I grow up | 8 (50.0) | 14 (53.8) | 34 (56.7) | 56 (54.9) | 0.886 |

n(%).
 *: $p < .05$. **: $p < .01$.

Table 5.
 Relationship between physical fitness test scores and lifestyle aspects.

| | Low | Standard | High | Total | Significance |
|-------------------------------|------------|------------|------------|------------|--------------|
| I feel heavy and may be tired | | | | | |
| Frequently | 3 (25.0) | 1 (4.8) | 4 (8.2) | 8 (9.8) | 0.097 |
| Sometimes | 8 (66.7) | 8 (38.1) | 25 (51.0) | 41 (50.0) | |
| Not much | 0 0 | 8 (38.1) | 16 (32.7) | 24 (29.3) | |
| Never | 1 (8.3) | 4 (19.0) | 4 (8.2) | 9 (11.0) | |
| Total | 12 (100.0) | 21 (100.0) | 49 (100.0) | 82 (100.0) | |

| | Low | Standard | High | Total | Significance |
|---------------------------------|------------|------------|------------|------------|--------------|
| I spend time well everyday | | | | | |
| Very well | 4 (33.3) | 7 (33.3) | 30 (61.2) | 41 (50.0) | 0.002** |
| Healthy person | 6 (50.0) | 14 (66.7) | 19 (38.8) | 39 (47.6) | |
| Not fine at all | 2 (16.7) | 0 0 | 0 0 | 2 (2.4) | |
| Total | 12 (100.0) | 21 (100.0) | 49 (100.0) | 82 (100.0) | |
| There's a time that I feel sick | | | | | |
| Often | 2 (16.7) | 1 (5.0) | 0 0 | 3 (3.7) | 0.037* |
| Sometimes | 7 (58.3) | 9 (45.0) | 20 (40.8) | 36 (44.4) | |
| Almost never | 3 (25.0) | 10 (50.0) | 29 (59.2) | 42 (51.9) | |
| Total | 12 (100.0) | 20 (100.0) | 49 (100.0) | 81 (100.0) | |

n(%).
*: $p < .05$. **: $p < .01$.

Table 6.
The relationship between physical strength and athletic capability test scores and health aspect.

3.7 The relationship between physical strength and athletic capability test and sleep time

Regardless of whether the physical strength and athletic capability test scores were high or low, the percentage of sleep time on weekdays was “more than 8 hours but less than 9 hours” (Table 7). On the other hand, during holidays, the percentage of children with high physical strength and athletic capability test scores of “high” was “more than 8 hours but less than 9 hours, but this was not a significant difference.

3.8 The relationship between physical strength and athletic capability test score and obesity

Although it was not a significant difference, there were many children whose physical strength and athletic capability test scores were “standard” and many of the

| | | Low | Standard | High | Total | Significance |
|------------------------|--|----------|------------|------------|------------|--------------|
| Sleep time on weekdays | More than 6 hours but less than 7 hours | 0 0.0 | 2 (9.5) | 5 (10.2) | 7 (8.5) | 0.888 |
| | More than 7 hours but less than 8 hours | 3 (25.0) | 7 (33.3) | 15 (30.6) | 25 (30.5) | |
| | More than 8 hours but less than 9 hours | 7 (58.3) | 7 (33.3) | 18 (36.7) | 32 (39.0) | |
| | More than 9 hours but less than 10 hours | 2 (16.7) | 5 (23.8) | 10 (20.4) | 17 (20.7) | |
| | More than 10 hours | 0 0.0 | 0 0.0 | 1 (2.0) | 1 (1.2) | |
| | Total | | 12 (100.0) | 21 (100.0) | 49 (100.0) | 82 (100.0) |

| | | Low | Standard | High | Total | Significance |
|------------------------|--|------------|------------|------------|------------|--------------|
| Sleep time on holidays | More than 6 hours but less than 7 hours | 0 (0.0) | 1 (4.8) | 3 (6.5) | 4 (5.1) | 0.354 |
| | More than 7 hours but less than 8 hours | 1 (8.3) | 2 (9.5) | 7 (15.2) | 10 (12.7) | |
| | More than 8 hours but less than 9 hours | 8 (66.7) | 7 (33.3) | 17 (37.0) | 32 (40.5) | |
| | More than 9 hours but less than 10 hours | 0 (0.0) | 8 (38.1) | 12 (26.1) | 20 (25.3) | |
| | More than 10 hours | 3 (25.0) | 3 (14.3) | 7 (15.2) | 13 (16.5) | |
| | Total | 12 (100.0) | 21 (100.0) | 46 (100.0) | 79 (100.0) | |

n(%).

Table 7.
The relationship between physical fitness test and sleep time.

| | Low | Standard | High | Total | Significance |
|----------|------------|------------|------------|-------------|--------------|
| Slender | 3 (18.8) | 4 (15.4) | 7 (11.7) | 14 (13.7) | 0.458 |
| Standard | 7 (43.8) | 17 (65.4) | 41 (68.3) | 65 (63.7) | |
| Obese | 6 (37.5) | 5 (19.2) | 12 (20.0) | 23 (22.5) | |
| Total | 16 (100.0) | 26 (100.0) | 60 (100.0) | 102 (100.0) | |

N (%).

Table 8.
The relationship between physical fitness test score and obesity.

children with “high” scores had “standard” body shapes (**Table 8**). However, about 20% of children who are slender and about 40% of those who are obese had “low” overall athletic capability test scores.

4. Discussion

In this study, for the purpose of clarifying the relationship between physical strength, athletic capability, school life, lifestyle, and health, we examined in detail the physical strength and athletic capability of both fifth-grade boys and girls such as their running power, jumping power, throwing power and endurance. As a result, the boys performed softball throwing repeatedly sideways, and a 20-m endurance runs while the girls performed a sit and reach test. In the physical strength test, the girls scored more than the boys. In addition, it was also suggested that children with high physical strength test scores were significantly higher in the aspects of school life, lifestyle, and health.

According to the 2016 national physical strength, athletic capability, and exercise habits survey results [9], in the fifth grade of elementary school, the average physical strength and athletic capability of boys was higher than that of girls in gripping strength, raising the upper body, repeated side jump, 20 m endurance run, standing long jump and softball throw. Moreover, the average value of girls was higher than

that of boys in the sit and reach and in the 50 m run. However, the overall score was higher for girls than boys, and the results were similar to this study.

In addition, in this study, there was a difference between the minimum and maximum values in boys which was seen in the four events: repeated side jump, 20 m shuttle run, 50 m run, and standing long jump. In women's other events, the difference between the minimum and maximum values was small, but the difference was slight. From this, it is presumed that the physical strength level of boys who can exercise and those who cannot do is more polarized in boys than girls.

The tendency of the decline in the physical strength of children has been pointed out since the mid-1980s, and since the 2000s, the tendency of bipolarization has been taken up [10]. In relation to this, there were reports (Toyoshima [11, 12]) on the tendency of children's physical activity and the tendency to become bipolar in physical strength and athletic capabilities such as frequency of exercise for middle and high school students, long jump between 10 and 20 years old, shuttle run and ball throwing from elementary school to high school students, etc. There are extreme children who have a lot of physical activity and children who have little physical activity, or both children who have good physical strength and athletic capability and children who are inferior. In other words, it was recognized as a problem of "gap" [13].

In the lower grades of elementary school, students learn various basic movements such as walking, running, jumping, avoiding, turning, falling, floating, hanging, and climbing. And in the upper grades, it becomes possible to acquire the ability to combine various movements and develop the adjustment power, but there are gender differences and individual differences in physical strength/athletic capability and type of exercise. In addition, the difference is likely to increase with age, leading to bipolarization. It is important to experience various movements during this period called Golden Age. However, instead of capturing this time uniformly, I think it is important to give exercise guidance with due consideration of the developmental stages of elementary, middle, and upper grades.

According to the Niigata Physical Fitness and Life Survey [14], students with high scores and low scores with the new physical fitness test reported differences in living conditions. Atsuko [15] conducted a child QOL survey for parents and analyzed the relationship with physical activity, and reported that there were many steps for children with high health. Reizo [16] emphasizes the link between physical activity in childhood and the mental and physical health of the child. In this study as well, it was speculated that many children with high physical strength and athletic capability have good school life and good health and that physical strength and athletic capability affect their lifestyle.

The upper grades of elementary school are said to be the beginning of the time when the mind and body grow the most in a lifetime [17]. Therefore, in order to establish a healthy lifestyle, it is essential to form basic lifestyle, exercise, and physical activity habits during this period.

Hidetoshi [18] showed that the relationship between physique and motor skills in elementary school students showed that muscle power and instantaneous power of the upper limbs during throwing were affected by height and weight development, and increased Rohrer index with weight gain. It was suggested that it may be a factor to reduce the performance of exercise with physical movement. There were many children with physical strength/exercise capability test scores of "standard" and "high" for children whose body type was "standard." For this reason, further study is necessary on the relationship between body shape and athletic capability. In addition, this study is a cross-sectional study that was limited to a single academic year, so it is

necessary to increase the number of regions and subjects and to conduct a longitudinal study in the future.

5. Conclusion

In this study, in order to clarify the relationship between children's physical strength, athletic capability, and school life and health, we collated and examined the results of the physical strength tests and questionnaire surveys of the said fifth graders. As a result, in the physical strength test, the boys performed softball throwing, repeated side jumps, and the 20 m shuttle run while the girls had a good performance with sit and reach test and there were more girls who scored higher than boys. In addition, it was confirmed that children with high scores for physical strength tests were found to be in good condition in terms of school life, health, and body shape.

The above suggests that physical strength and athletic capability are also related to children's school life and health and it was suggested that high physical strength had a positive impact on children's school life and health.


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