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Original Article

Lifestyles and Psychosomatic Symptoms among Elementary School Students and Junior High School Students

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Abstract

Objectives: To examine the relationship between lifestyles and psychosomatic symptoms in children, we conducted a self-administered questionnaire survey of elementary school students and junior high school students in Japan.

Methods: We designed an original questionnaire to investigate the lifestyles and psychosomatic symptoms of children. In 1997, responses to the questionnaires were elicited from public elementary school fourth grade students (then aged 9–10) and public junior high school seventh grade students (then aged 12–13). The survey was repeated annually for three years as the students advanced through school.

Results: For both boys and girls, each cross-sectional analysis revealed a strong relationship between lifestyle behaviors and psychosomatic symptoms. Psychosomatic symptoms scores varied according to daily hours of sleep, eating of breakfast, having strong likes and dislikes of food, bowel habits, and daily hours of television watching. Both boys and girls with "good" lifestyle behaviors evaluated by the HPI (Health Practice Index) showed lower scores for psychosomatic symptoms.

Conclusions: These findings show that the lifestyle behaviors of children are significantly associated with psychosomatic symptoms and suggest that poor lifestyle behaviors are likely to increase physical and psychological health risks.

Key words: lifestyles, psychosomatic symptoms, elementary school, junior high school, health practice index

I. Introduction

A number of studies have indicated that lifestyle behaviors are associated with physical health status and mortality in adults (1–7). In addition, our earlier studies demonstrated specifically that Japanese adults with poor lifestyle behaviors have higher frequencies of chromosomal damage (sister-chromatid exchanges, SCE), micronuclei, natural killer cell activity, lymphokine-activated killer cell activity, immunoglobulin E, and urinary mutagens (8–14). Further, for Japanese factory workers, good lifestyle behaviors are closely associated with good mental health status (15). In our studies we used self-reporting HPI (Health Practice Index) tests to evaluate lifestyle behaviors. The results revealed eight lifestyle behaviors that affect physical and psychological status for adults: smoking, drinking, sleeping hours, working hours, breakfast habits, nutritional balance, physical exercise, and subjective mental stress. Improper nutrition, insufficient sleep, and other poor lifestyle behaviors are likely to cause additional stress and to affect the physical and psychological health not only of adults but also of children and adolescents. Children and adolescents should be made aware of the long-term consequences of unhealthy behaviors and be encouraged to develop good lifestyle behaviors that bring them lasting benefits.

Psychosomatic symptoms in children, characterized by recurrent and unattributable physical complaints, have been defined as somatic sensations that are rarely associated with organic diseases (16). It was reported that psychosomatic symptoms were observed in as many as 5–10% of children at pediatric primary care facilities (17). Psychosomatic theory accounts for these psychosomatic symptoms as responses to life events or other stressful stimuli; these responses may be processed both consciously and unconsciously by the individual (18). Extreme effects of psychosomatic symptoms include disability and functional impairment, such as difficulty in school

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and frequent absences from school (19–22).

Are the lifestyle behaviors of children actually associated with their psychosomatic symptoms? There have been a number of studies of the relationships between life events, social support, and psychosomatic symptoms (23–28). Other studies have investigated the association of lifestyle behaviors with psychosomatic symptoms (29–33). These studies tend to suggest that the detrimental effects of insufficient hours of sleep, irregular breakfast habits or non-consumption of breakfast, excessive TV watching, and lack of physical exercise are closely related to psychosomatic symptoms. None of these studies has examined, however, the association of psychosomatic symptoms with lifestyle behaviors in children using a comprehensive evaluation method such as HPI.

This study investigated the relationship between self-reporting HPI and psychosomatic symptoms among Japanese elementary school students and junior high school students, examining the results of responses to the questionnaire by cross-sectional analyses.

II. Methods

1. Study design

During a period of three years we annually conducted a self-administered questionnaire in the two groups of elementary school students and junior high school students. After receiving approval from the local board of education and informed consent from the students and their legal guardians, questionnaires were distributed in nine public elementary schools and five public junior high schools in a city located in the suburbs of Osaka Prefecture. The city (population, 86,019) supports ten public elementary schools and five public junior high schools. One elementary school declined to participate in the study.

Starting in 1997, the fourth grade (then aged 9–10) and seventh grade (then aged 12–13) groups were asked to answer questions about lifestyle behaviors and psychosomatic symptoms. Responses were obtained annually during the period from November to January in 1997, 1998, and 1999.

2. Subjects

Table 1 details response numbers and rates of return. In the initial year, the survey population comprised 763 fourth grade and 868 seventh grade students. In the second year the population comprised 773 fifth grade and 865 eighth grade, and in the third year 764 sixth grade and 863 ninth grade students. No attempt was made to get responses from absentees and non-responders.

3. Questionnaire

For this study, we designed an original questionnaire. There were some differences between the questionnaires for elementary school students and junior high school students.

1) Health practice index (HPI)

Taking into account the lifestyles of respondents, we inquired about five lifestyle behaviors: sleeping hours, eating breakfast, likes and dislikes of food, bowel habits, and daily television watching hours. ‘Sleeping hours’ and ‘eating breakfast’ are items included in HPI questionnaires for adults. ‘Likes and dislikes of food’ and ‘bowel habits’ are both strongly related to eating habits. Educators and researchers often assert

Table 1 Questionnaire distribution and return rates

Year	1997	1998	1999
Elementary school students	Fourth grade (ages 9–10)	Fifth grade (ages 10–11)	Sixth grade (ages 11–12)
Boys/Girls	373/390	381/392	376/388
Total (Response rate)	763 (99.3%)	773 (97.2%)	764 (97.8%)
Junior high school students	Seventh grade (ages 12–13)	Eighth grade (ages 13–14)	Ninth grade (ages 14–15)
Boys/Girls	450/418	449/416	453/410
Total (Response rate)	868 (94.5%)	865 (92.5%)	863 (94.1%)

Table 2 Questionnaire items

Lifestyle behaviors (HPI)	1. Sleeping hours: Elementary school students; ≥8 hrs=1, <8 hrs=0 Junior high school students; ≥7 hrs=1, <7 hrs=0 2. Eating breakfast: Every day=1, Not every day=0 3. Likes and dislikes of food: Few=1, Many=0 4. Bowel habits: Regular=1, Not regular=0 5. Television watching hours: ≤2 hrs=1, >2 hrs=0
Psychosomatic symptoms (PS score)	1. Headache 2. Abdominal pain 3. Feeling sick 4. Loss of appetite 5. Difficulty in getting up in the morning 6. Eyestrain (seldom=1, sometimes=2, often=3, always=4)

HPI: total score of five lifestyle behaviors.
PS score: total score of five items (1–5) for elementary school students and six items (1–6) for junior high school students.

that Japanese children spend too much time watching TV. Further, reports from other countries have associated long hours of TV watching with obesity, lower daily physical activity, and resting energy expenditure among both children and adolescents (34–36). Table 2 shows the scores for the five lifestyle behaviors. The criterion of 'sleeping hours' for the elementary school students was revised as "eight" or more since in the preliminary survey almost all primary school students reported sleeping seven or more hours. We derived a HPI by totaling the lifestyle scores. Depending on the HPI score, each subject was categorized as either "poor" (score 0–1), "moderate" (score 2–3), or "good" (score 4–5).

2) Psychosomatic symptoms score (PS score)

Table 2 shows the scores for the psychosomatic symptom items. The questionnaire asked about incidence of headache, abdominal pain, feeling sick, loss of appetite, difficulty in getting up in the morning, and eyestrain. In the questionnaire for elementary school students, eyestrain was excluded because, in a preliminary study, almost all elementary school students answered that they experienced eyestrain "seldom". We selected survey items both because they were among the most commonly reported psychosomatic symptoms in previous studies of children and adolescents (16, 22, 31, 37–44), and because they were easy for the respondents to understand. Response options and scores were: seldom, 1; sometimes, 2; often, 3; and always, 4. The total ratings score for these five (or six) items provided a psychosomatic symptoms score (PS score). The internal reliability by Cronbach's alpha coefficient was 0.68–0.72 in either group of respondents.

4. Data analysis

Chi-square was used to test the distribution of each of the five lifestyle factors and the HPI distribution values. The HPI values were also analyzed by Mann-Whitney test. The grades for 'good' and 'poor' lifestyle factors were compared, using *t* testing with mean PS scores for each lifestyle behavior. Since PS scores showed log-normal distribution, they were converted to logarithms. The covariance of PS scores with HPI values was analyzed by one-way analysis of variance. In all analyses, differences in value of $p<0.05$ were considered significant. Analyses were carried out on a personal computer using Statistical Package for Social Sciences ($SPSS_{v10.0}$) (45).

III. Results

1. HPI scores

Table 3 shows the distribution of subjects in all grades who had a score of 1 ("good") in lifestyle in each of the five lifestyle behaviors. For both the elementary school students and junior high school students, except those in the fifth grade, the reported daily 'sleeping hours' differed significantly according to sex. In the fourth grade the percentage of boys who reported sleeping eight or more hours was lower than that of girls (86.3% vs. 91.4%). In the sixth grade, the percentage of boys who reported sleeping eight or more hours was higher than that of girls (75.6% vs. 65.9%). In all grades of junior high school, the percentages of boys who reported sleeping seven or more hours were higher than those of girls. Another significant difference by sex was in 'eating breakfast' in the seventh and ninth grades: the percentages of boys who reported eating breakfast every day were lower than those of girls. Among elementary school students there were no significant differences by sex for 'eating breakfast'. Neither elementary school students nor junior high school students showed any differences by sex for 'likes and dislikes of food' and 'TV watching hours'. The percentages of boys who reported having regular bowel habits were significantly higher than those of girls in all grades for both elementary school students and junior high school students.

Table 4 shows the distributions and the mean values of HPI. The mode of HPI was 4 in the fourth grade for both sexes, changing to 3 in both the fifth and sixth grades. Among junior high school students the mode of HPI was 3, except for eighth grade boys, whose mode of HPI was 4. There were significant differences in the sixth, eighth, and ninth grades by chi-square test. In these grades, the numbers of girls who had high HPI values (score 4–5) were smaller than those of boys. The mean

Table 3 Distribution of five lifestyle behaviors

	Elementary school students	Fourth grade		Fifth grade		Sixth grade	
Lifestyle behaviors		Boys (%)	Girls (%)	Boys (%)	Girls (%)	Boys (%)	Girls (%)
Sleeping hours	≥8 hrs	289 (86.3)	338 (91.4)*	311 (85.4)	313 (84.4)	266 (75.6)	249 (65.9)**
Eating breakfast	Every day	256 (76.4)	299 (80.8)	278 (76.4)	290 (78.2)	253 (71.9)	278 (73.5)
Likes and dislikes of food	Few	267 (79.7)	302 (81.6)	289 (79.4)	300 (80.9)	277 (78.7)	300 (79.4)
Bowel habits	Regular	187 (55.8)	156 (42.4)***	190 (52.2)	114 (30.7)***	176 (50.0)	101 (26.7)***
Television watching hours	≤2 hrs	146 (43.6)	181 (48.9)	152 (41.8)	147 (39.6)	139 (39.5)	130 (34.4)
	Junior high school students	Seventh grade		Eighth grade		Ninth grade	
Lifestyle behaviors		Boys (%)	Girls (%)	Boys (%)	Girls (%)	Boys (%)	Girls (%)
Sleeping hours	≥7 hrs	339 (87.4)	286 (82.4)*	317 (81.9)	262 (73.2)**	289 (73.4)	225 (61.1)***
Eating breakfast	Every day	236 (60.8)	235 (67.7)*	230 (59.4)	227 (63.4)	223 (56.6)	256 (69.6)***
Likes and dislikes of food	Few	311 (80.2)	275 (79.3)	310 (80.1)	282 (78.8)	303 (76.9)	287 (78.0)
Bowel habits	Regular	204 (52.6)	111 (32.0)***	255 (65.9)	150 (41.9)***	275 (69.8)	150 (40.8)***
Television watching hours	≤2 hrs	125 (32.2)	112 (32.3)	149 (38.5)	123 (34.4)	180 (45.7)	165 (44.8)

* $p<0.05$, ** $p<0.01$, *** $p<0.001$ by χ^2 test.

Table 4 Distribution and mean value of Health Practice Index (HPI)

	Fourth grade		Fifth grade		Sixth grade	
HPI	Boys (%)	Girls (%)	Boys (%)	Girls (%)	Boys (%)	Girls (%)
0	5 (1.5)	2 (0.5)	3 (8.3)	7 (1.9)	7 (2.0)	9 (2.4)
1	15 (4.5)	11 (3.0)	17 (4.7)	23 (6.2)	23 (6.5)	45 (11.9)
2	37 (11.0)	59 (15.9)	59 (16.2)	68 (18.3)	63 (17.9)	94 (24.9)
3	107 (31.9)	108 (29.2)	112 (30.8)	125 (33.7)	115 (32.7)	118 (31.2)
4	120 (35.8)	127 (34.3)	116 (29.6)	110 (29.6)	103 (29.3)	89 (23.5)
5	51 (15.2)	63 (17.0)	57 (15.7)	38 (10.2)	41 (11.6)	23 (6.1)
χ^2 test		n.s		n.s		**
Mean±SD	3.42±1.10	3.45±1.07	3.35±1.12	3.14±1.14	3.16±1.17	2.80±1.18
Mann-Whitney test		n.s		*		***
	Seventh grade		Eighth grade		Ninth grade	
HPI	Boys (%)	Girls (%)	Boys (%)	Girls (%)	Boys (%)	Girls (%)
0	2 (0.5)	2 (0.6)	1 (0.3)	5 (1.4)	0 (0)	7 (1.9)
1	29 (7.5)	31 (9.0)	24 (6.2)	34 (9.5)	31 (7.9)	34 (9.2)
2	81 (21.0)	87 (25.3)	74 (19.1)	96 (26.8)	75 (19.0)	90 (24.5)
3	121 (31.3)	114 (33.1)	113 (29.2)	108 (30.2)	120 (30.5)	110 (29.9)
4	111 (28.8)	89 (25.9)	125 (32.3)	81 (22.6)	111 (28.2)	96 (26.1)
5	42 (10.9)	21 (6.1)	50 (12.9)	34 (9.5)	57 (14.5)	31 (8.4)
χ^2 test		n.s		**		**
Mean±SD	3.13±1.13	2.93±1.08	3.26±1.11	2.92±1.17	3.22±1.15	2.94±1.18
Mann-Whitney test		*		***		**

* $p<0.05$, ** $p<0.01$,*** $p<0.001$.

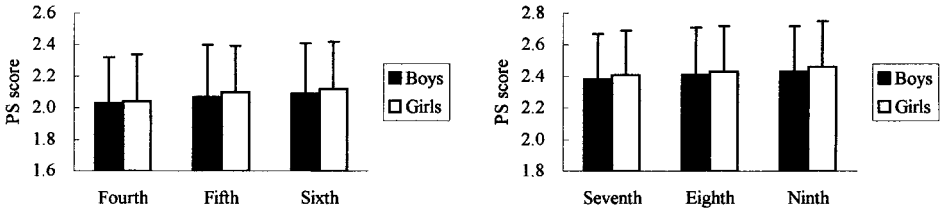

Fig. 1 Mean Psychosomatic Symptoms score (PS score) at each grade. Y-axis scales log PS scores. Error bars: SD. There are no significant differences between sexes by *t* test.

values of HPI for boys and girls were almost equal in the fourth grade. In the fifth or higher grades, the mean values of HPI for boys were higher than those for girls. There were also significant differences in these grades by Mann-Whitney test. The HPI scores had a tendency to decrease, with advancement in age, for both boys and girls among elementary school students. This tendency was not apparent in junior high school students.

2. PS scores

In the fourth, fifth, and sixth grades, the mean PS scores for boys were 7.95 (±2.41), 8.39 (±2.82), and 8.49 (±2.74), and for girls, 8.05 (±2.55), 8.55 (±2.62), and 8.72 (±2.76), respectively. Similarly, in the seventh, eighth, and ninth grades, the mean PS scores for boys were 11.2 (±3.32), 11.6 (±3.48), and 11.8 (±3.35), and for girls, 11.6 (±3.21), 11.9 (±3.43), and 12.2 (±3.50), respectively. The data shows that the PS score increased in both elementary school students and junior high school students as the groups advanced in age, irrespective of sex. Figure 1 shows the comparison of the mean PS scores by sex of all grades. As mentioned in the data analysis section, to compare the mean PS score data, values were converted to logarithms. There were no significant differences in mean PS scores between sexes by *t* test in all grades.

3. Relationship between lifestyles and PS score

Table 5 gives the PS score and *t* test analysis results for each lifestyle behavior of all grades. Irrespective of sex, respondents who reported 'good' lifestyle behavior for each lifestyle factor had a lower PS score than those who did not.

In every grade, girls who reported sleeping more had lower PS scores than those who slept less significantly. The same significant differences were apparent for boys in the fifth, sixth, and ninth grades. All elementary and junior high school groups of boys and girls who reported taking breakfast every day had significantly lower PS scores than those who did not. At the elementary school level, only the fourth grade girls with "few" likes and dislikes of food had significantly lower PS scores than those with "strong" likes and dislikes. At the junior high school level, however, the same association was observed in the seventh and eighth grade boys and the eighth grade girls. Except for the eighth grade, elementary and junior high school boys who reported regular bowel habits showed significantly lower PS scores than those who did not. However, no similar differences were apparent for girls in any grade. 'Daily TV

Table 5 Relationship between psychosomatic symptoms score (PS score) and lifestyle behaviors

	Elementary school students	Fourth grade		Fifth grade		Sixth grade	
		Boys (*N*=335)	Girls (*N*=368)	Boys (*N*=364)	Girls (*N*=371)	Boys (*N*=352)	Girls (*N*=378)
Lifestyle behaviors		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Sleeping hours	≥8 hrs	2.02 (0.29)	2.03 (0.29)**	2.06 (0.32)*	2.08 (0.28)**	2.06 (0.30)**	2.08 (0.29)**
	<8 hrs	2.10 (0.29)	2.19 (0.33)	2.18 (0.33)	2.22 (0.33)	2.18 (0.35)	2.19 (0.31)
Eating breakfast	Every day	2.00 (0.28)**	2.02 (0.29)**	2.02 (0.30)***	2.07 (0.28)***	2.05 (0.30)***	2.07 (0.29)***
	Not every day	2.12 (0.31)	2.13 (0.33)	2.24 (0.36)	2.23 (0.30)	2.19 (0.34)	2.25 (0.31)
Likes and dislikes of food	Few	2.02 (0.29)	2.02 (0.29)**	2.06 (0.32)	2.09 (0.29)	2.08 (0.32)	2.11 (0.29)
	Many	2.08 (0.27)	2.14 (0.32)	2.11 (0.33)	2.15 (0.30)	2.13 (0.30)	2.16 (0.33)
Bowel habits	Regular	2.00 (0.28)*	2.03 (0.31)	2.03 (0.32)**	2.07 (0.32)	2.05 (0.33)*	2.10 (0.32)
	Not regular	2.07 (0.29)	2.04 (0.29)	2.12 (0.32)	2.12 (0.28)	2.12 (0.31)	2.13 (0.30)
Television watching hours	≤2 hrs	2.01 (0.30)	2.01 (0.30)	2.01 (0.31)**	2.04 (0.29)**	2.03 (0.32)*	2.06 (0.29)**
	>2 hrs	2.05 (0.27)	2.06 (0.30)	2.12 (0.33)	2.14 (0.29)	2.12 (0.31)	2.15 (0.31)
	Junior high school students	Seventh grade		Eighth grade		Ninth grade	
		Boys (*N*=388)	Girls (*N*=347)	Boys (*N*=387)	Girls (*N*=358)	Boys (*N*=394)	Girls (*N*=368)
Lifestyle behaviors		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Sleeping hours	≥7 hrs	2.37 (0.29)	2.40 (0.27)*	2.40 (0.30)	2.40 (0.29)**	2.40 (0.29)***	2.43 (0.29)**
	<7 hrs	2.40 (0.33)	2.49 (0.31)	2.46 (0.30)	2.51 (0.28)	2.52 (0.30)	2.52 (0.30)
Eating breakfast	Every day	2.35 (0.29)*	2.37 (0.27)***	2.36 (0.30)***	2.38 (0.29)***	2.39 (0.30)**	2.42 (0.29)***
	Not every day	2.42 (0.29)	2.50 (0.31)	2.50 (0.28)	2.52 (0.27)	2.48 (0.28)	2.56 (0.27)
Likes and dislikes of food	Few	2.36 (0.29)*	2.40 (0.28)*	2.40 (0.31)*	2.42 (0.29)	2.42 (0.30)	2.45 (0.29)
	Many	2.45 (0.29)	2.47 (0.28)	2.47 (0.24)	2.48 (0.29)	2.45 (0.28)	2.50 (0.30)
Bowel habits	Regular	2.33 (0.30)**	2.39 (0.29)	2.39 (0.30)	2.42 (0.28)	2.40 (0.29)**	2.47 (0.30)
	Not regular	2.43 (0.28)	2.42 (0.28)	2.45 (0.30)	2.44 (0.29)	2.49 (0.29)	2.46 (0.29)
Television watching hours	≤2 hrs	2.36 (0.27)	2.40 (0.26)	2.40 (0.32)	2.42 (0.27)	2.42 (0.29)	2.46 (0.28)
	>2 hrs	2.39 (0.30)	2.42 (0.29)	2.42 (0.29)	2.44 (0.30)	2.44 (0.29)	2.46 (0.31)

PS scores have been converted to logarithmic values.
Analyses by *t* test were carried out on logarithmic PS scores. * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

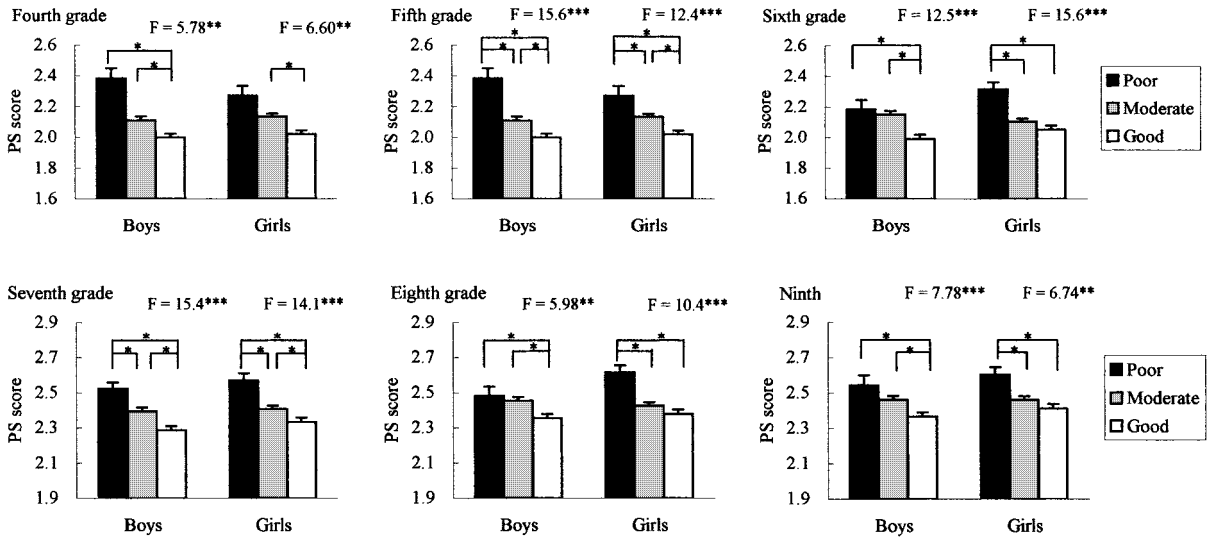

Fig. 2 Differences in Psychosomatic Symptoms score (PS score) with Health Practice Index (HPI). Y-axis scales log PS scores. Poor (HPI=0, 1), Moderate (HPI=2, 3), Good (HPI=4, 5). Error bars: SE. * $p<0.05$ (LSD test), ** $p<0.01$, *** $p<0.001$ (one-way analysis of variance).

watching hours' was significantly associated with PS scores in both sexes for elementary school students, except for the fourth grade. Those who reported watching TV longer (>2 hours) had higher PS scores than those who reported less than 2 hours. No significant differences were apparent in TV watching hours for junior high school students of either sex.

Figure 2 shows the relationship of HPI to PS scores in each sex for all grades. Significant differences are apparent in PS score relating to the HPI categories. Respondents in the HPI "poor" categories show the highest PS scores in all grades and both sexes. These data indicate that the poorer the reported lifestyle behavior was, the more severe the psychosomatic symptoms were.

IV. Discussion

This study used a self-reported HPI to evaluate lifestyle behaviors among elementary school students and junior high school students. HPI has been used to assess adult lifestyles and has been shown to provide useful evidence for evaluating the relationships between HPI scores and physical health of adult populations (1–7). In the present study, we introduced a five-item HPI questionnaire in which the survey items were chosen in consideration of the respondents' ability to understand the questions and relevance of their lifestyle characteristics.

Studies by Meijer et al. have found that, for Dutch children aged 9 to 14, quality of sleep is significantly correlated with neurotic and neurosomatic complaints (32). Eguchi et al. have reported that a significant relationship exists between wake-up time and feeling at waking among children aged 10 to 13 in Japan (33). Also, in the present study, for both elementary school students and junior high school students, 'sleeping hours' was strongly related to PS score in both sexes. 'Eating breakfast every day', which is included as one of the HPI questionnaire items for adults, was also associated with PS score in all grades and both sexes. 'Bowel habits' might be a useful question for boys because their responses revealed significant relationships with PS scores in all grades except for the eighth grade. For girls, however, no significant relationships between 'bowel habits' and PS score were observed. It is considered that behaviors such as 'sleeping hours', 'eating breakfast' and 'bowel habits' are characteristic of childhood and could determine healthy daily life. Although the reason why there were extreme differences between sexes should be further investigated, it was shown that the survey items concerning sleeping hours and diet habits were closely associated with psychosomatic symptoms. It is suggested that 'bowel habits' should be regarded more strongly as a lifestyle issue related to psychosomatic symptoms among children. The results of the present study also suggest many elementary school students and junior high school students have poor lifestyle behaviors. These behaviors are likely to cause stress in adolescence, a time of conflict during the radical change from childhood to adulthood.

Since this study was not a follow-up study, it was impossible to clarify how aging influences lifestyle behaviors. Nevertheless, some changes were observed along with age (Table 3). The percentages of respondents sleeping seven (eight) or more hours decreased as age advanced. This tendency was more strongly apparent in girls. Less than 70% of junior high school students reported eating breakfast every day, while more than 70% of elementary school students did. There seems to be a difference in eating habits between elementary school students and junior high school students. The difference was also apparent in TV-watching hours between elementary school students and junior high school students. The percentage of those who reported watching TV for two or fewer hours decreased as the respondents advanced through elementary school. However, with the lowest percentage at the seventh grade, the percentage is increased through junior high school.

In the present study, no significant differences between sexes were apparent in PS scores in all grades. For the elementary school students, aged 9–12 in this survey, it might be too early for developmental differences between sexes to appear clearly. A review by Campo et al. has drawn attention to differences between sexes in the presentation of psychosomatic symptoms (16). In a study of Japanese children aged 10 to 14, Morimoto reported a higher level of psychosomatic symptoms for girls than for boys (42). These differences between sexes may, in part, be related to differences in self-image and in reactions to pubertal development (38, 46).

The present study has indicated that HPI might be closely associated with PS score. As shown in Figure 2, significant differences in PS scores were correlated with HPI categories in all grades and both sexes. These findings suggest the possibility that psychosomatic symptoms could be prevented by improving lifestyle behaviors. There have been studies focused on individual lifestyle behaviors, such as sleeping hours and bedtimes, and there have also been a number of studies on the relationships between psychosomatic symptoms and life events, social support, and self-efficacy (21, 23–28, 47). Only a few studies, however, have reported on the relationship of overall lifestyles with psychosomatic symptoms among children. The present study is the first to show that there is a general association between HPI and psychosomatic symptoms among elementary school students and junior high school students. It has also shown that it is useful to assess the lifestyle behaviors of children using a comprehensive scoring method, such as HPI. Further studies are needed to refine the components of HPI for children or young people, since we could not investigate lifestyle behaviors such as physical activities, hours playing video games, and hours of cram school attendance in this study.

In conclusion, the lifestyle behaviors of children are closely associated with psychosomatic symptoms. Severe psychosomatic symptoms may arise that lead to increased physical and psychological heath risks. People who engage in childcare, education, or counseling should be more aware of the risks in childhood and be trained to encourage those with unhealthy behaviors to improve their lifestyles. The effect will contribute to long-term health promotion and reduce the burden on public healthcare resources.

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