

Relationships between Chronic Fatigue, Subjective Symptoms of Fatigue, Life Stressors and Lifestyle in Japanese High School Students

Hidetsugu Kobayashi* and Shinichi Demura**

*Fukui National College of Technology
Geshi, Sabae, Fukui 916-8507 Japan
hkoba@fukui-nct.ac.jp

**Kanazawa University, Faculty of Education
Kakuma-machi, Kanazawa, Ishikawa 920-1192 Japan
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Purpose: This study surveyed Japanese high school students in order to examine the relationship between chronic fatigue (CF), lifestyle, subjective symptoms of fatigue (SSF) and life stressors. **Method:** The questionnaire surveyed male and female students aged between 15 and 18; 2,944 effective replies were obtained. The questionnaire consisted of information on personal characteristics (school name, grade, course, age and gender), CF by Performance Status (PS), SSF, life stressors and lifestyle questions. A logistic analysis model was used to define the cause of CF. **Results:** Of the students surveyed, 168 (5.7%) were determined to have CF. Since the results of logistic regression analysis did not reveal a significant association between CF and lifestyle, lifestyle may not be a cause of CF. The present study shows that a significant association was apparent between CF and a 'feeling of physical disintegration' ($P<0.01$; odds ratio, 1.12). These results do not signify a high risk but they do indicate that there is a relationship between CF and physical symptoms.

Keywords: chronic fatigue syndrome, performance status, logistic analysis

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1. Introduction

Subjective symptoms of fatigue (SSF) are a general phenomenon in daily life. A research team from the Japanese Ministry of Health and Welfare reported that, among 4000 people in Japan, 59% 'felt fatigue or felt weary now', 36% had 'continuous fatigue for half a year' and 17% noted 'being absent from school or work' and that their 'efficiency and quantity of work fell clearly compared with before' (Kuratsune, 2000). However, the mechanisms of fatigue are not completely understood and consequently it is imperative that the academic community examines the phenomenon further.

SSF has been investigated through basic studies (Kuratsune, 2000) and also from the standpoint of chronic fatigue syndrome (CFS) and chronic fatigue (CF). CFS is a situation of illness that is manifested by boredom, a slight fever, headache, listlessness, inability to concentrate and to think, nervousness, depression, etc. People with CFS are

not able to maintain a healthy social life over the long term (Kuratsune, 2000). CF indicates subjective symptoms lasting for half a year and is not related to a disease, the degree of perceived fatigue or other symptoms. Namely, CF is one of the criteria for CFS and is generally judged according to Performance Status (PS) (Kuratsune, 1994).

There have been some reports in the literature on the relationship between SSF and lifestyle (Monden, 1990; Kobayashi, et al., 1999a, Kobayashi, et al., 1999b). These reports have suggested that SSF in high school students is caused by their irregular lifestyle. However, the cause of CF in high school students is not apparent in the published data. The purpose of this study was to investigate the relationships between CF based on PS, lifestyle, SSF, and life stressors of high school students in Japan.

Table 1 Gender in relation to performance status

	Performance status		Total
	NCF group	CF group	
Male	1558	92	1650
Female	1218	76	1294
Total	2776	168	2944

Table 2 Comparison of the characteristics of male and female between NCF and CF groups

	Male						Female									
	NCF group			CF group			t value	P value	NCF group			CF group				
	n	Mean	SD	n	Mean	SD			n	Mean	SD	n	Mean	SD	t value	P value
Breakfast	1545	1.3	0.6	91	1.6	0.8	-4.57	<0.0001	1207	1.3	0.6	76	1.6	0.7	-3.57	0.0004
Between-meal Snack and Midnight Snack	1542	2.0	0.7	91	1.9	0.7	0.95	0.3428	1205	1.9	0.7	74	1.9	0.7	0.52	0.6007
Drinking	1537	1.4	0.7	91	1.7	0.9	-4.26	<0.0001	1192	1.3	0.6	76	1.5	0.8	-2.40	0.0165
Smoking	1537	1.2	0.6	91	1.6	1.2	-6.72	<0.0001	1194	1.1	0.3	76	1.3	0.6	-5.65	<0.0001
Exercise Frequency	1383	3.5	2.8	80	3.2	2.8	1.15	0.2486	916	2.6	2.8	52	2.6	2.9	0.21	0.8357
Sleeping Hours	1527	6.4	1.1	90	5.9	1.7	4.61	<0.0001	1193	6.1	1.1	71	6.0	1.4	1.03	0.3055
Sleeping Time	1523	24.3	1.2	91	25.0	1.7	-5.08	<0.0001	1185	24.4	1.2	69	24.5	1.3	-1.14	0.2559
Rising Time	1525	6.8	0.6	91	6.9	0.9	-1.03	0.3009	1191	6.6	0.6	70	6.6	0.9	-0.30	0.7623
Self-assessment of health status	1542	3.0	1.1	91	3.6	1.3	-4.87	<0.0001	1196	3.2	0.9	74	3.6	1.2	-2.97	0.0030
BMI	1492	21.4	3.3	87	21.4	3.2	0.02	0.9838	868	20.5	2.6	42	19.8	3.2	1.69	0.0913
Subjective symptoms of fatigue																
Difficulty with concentrated thinking	1539	5.2	2.9	92	7.5	3.4	-7.25	<0.0001	1195	5.7	2.6	76	7.7	2.9	-6.47	<0.0001
Languor	1531	3.7	3.2	92	6.7	3.8	-8.73	<0.0001	1196	3.7	2.9	73	6.6	3.1	-8.35	<0.0001
Reduced motivation	1542	3.6	2.9	92	6.2	3.4	-8.27	<0.0001	1205	3.7	2.7	76	6.0	3.3	-7.11	<0.0001
Reduced activity	1546	4.5	3.2	86	7.2	3.5	-7.76	<0.0001	1203	5.0	3.0	76	7.9	3.2	-8.19	<0.0001
Drowsiness	1548	7.6	3.0	90	10.0	2.4	-7.21	<0.0001	1211	8.4	2.6	74	9.8	2.3	-4.44	<0.0001
Feeling of physical disintegration	1536	4.3	3.1	89	7.6	3.4	-9.53	<0.0001	1210	5.0	3.1	75	6.5	3.6	-4.04	0.0001
Life stressors																
Club activities	1555	4.2	6.6	91	9.2	10.7	-6.79	<0.0001	1217	3.8	5.9	76	11.1	10.4	-9.76	<0.0001
Studies	1556	2.4	6.1	92	5.5	9.6	-4.52	<0.0001	1216	2.2	5.3	75	3.4	7.9	-1.93	0.0536
Teachers	1552	7.5	8.3	92	10.8	11.0	-3.61	0.0003	1215	9.9	9.0	76	12.6	10.2	-2.51	0.0123
Family	1556	3.9	5.4	92	8.0	8.7	-6.89	<0.0001	1217	4.8	6.0	76	9.6	7.6	-6.64	<0.0001
Friends	1557	1.6	3.2	92	5.8	8.7	-10.72	<0.0001	1217	2.8	4.1	76	7.5	7.5	-9.04	<0.0001

2. Methods

2.1. Subjects and Survey

The questionnaire was sent to all 24 high schools in Fukui Prefecture in Japan after consent was obtained. The questionnaire surveyed 3,680 males and females aged between 15 and 18 years. Effective replies were obtained from 2,944 students (the valid response rate was 80%, see **Table 1**). The survey was conducted in 2003, avoiding times immediately before an examination and after physical education. Ethical approval for the study was granted by the Kanazawa University Institutional Review Board, Japan.

The survey was conducted twice at six-month intervals. We performed a longitudinal study of the 2944 high school students in the period from June through December. Prior to the survey, teachers explained the following to the subjects: 1) The purpose of this survey was to determine the actual status of various symptoms of fatigue in daily life; 2) It was not necessary for subjects to write their own name on the survey; 3) The survey would not be

related to the subject's schoolwork; 4) Collected data would be statistically analyzed and privacy would be protected.

The questionnaire consisted of information on personal characteristics (grade, course, age, gender), the Subjective Fatigue Scale for the Young Adults (SFS-Y) (Kobayashi, et al, 2000), the Adolescent Daily Events Scale-20 (ADES-20) (Takakura, et al., 1998), Performance status (PS) (Kuratsune, 1994) (vide infra) and lifestyle questions (Breslow, 1977).

The SFS-Y consists of 24 items representing six subscales: 'difficulty with concentrated thinking,' 'languor,' 'reduced motivation,' 'reduced activity,' 'drowsiness' and 'feeling of physical disintegration' (Kobayashi, et al., 2000). Each item was assessed on a 4-point scale (1=never, 2=rarely, 3=sometimes, 4=often).

The Adolescent Daily Events Scale-20 (ADES-20, see **Table 2**) (Takakura, et al., 1998) measures life stressors. This scale consists of 20 items representing five subscales, 'club activities,' 'studies,' 'teachers,' 'family,' and 'friends.' Each item was assessed according to two 4-point scales: frequency as designated by frequency of the

experience in the previous week (possible answers: 'nothing', 'rarely', 'sometimes', and 'often') and aversion (possible answers: 'not disagreeable at all', 'somewhat disagreeable', 'disagreeable' and 'quite disagreeable.') The items were scored from 3 to 0, respectively. The index score is calculated by multiplying frequency and aversion.

The subjects were examined for CF using PS (Kuratsune, 1994). One PS questionnaire item ('a feeling of general fatigue causes absence from class several days a month') was used as a criteria for CF and the item was used to divide subjects into a CF group and a non-CF group for self-evaluation of current status within the most recent half year.

The lifestyle questions were selected based on Breslow's (Breslow, 1977) lifestyle behaviors. These items were measured on the Likert scale. The values means on a point scale.

1. Breakfast: everyday (1), sometimes (2) and none (3)
2. Between-meal snack or midnight snack: habitually (1), sometimes (2) and seldom (3)
3. Sleeping hours
4. Sleeping time
5. Rising time
6. Exercise frequency (times per week)
7. BMI (Weight[kg]/Height[m]*Height[m])
8. Self-assessment of health status: excellent (1), moderately excellent (2), normal (3), somewhat inferior (4) and inferior (5)
9. Drinking: never (1), seldom (2), sometimes (3), and almost everyday (4)
10. Smoking: non-smoker (1), occasional smoker (2), average (3), above average (4) and heavy (5)

2.2. Analysis

In order to compare SSF, life stressors and lifestyle between the NCF and CF groups, the two-independent-sample t test was applied.

Logistic regression analysis was used to evaluate risk factors for CF. Specifically, PS was used as a dependent variable and the lifestyle evaluations, 6 SSF factors and 5 life stressors were used as independent variables.

3. Results

Table 1 summarizes gender in relation to

performance status. **Table 2** shows the test results of group differences for lifestyle, 5 life stressors and 6 SSF factors. Significant differences were found in the 'breakfast,' 'drinking,' 'smoking,' 'self-assessment of health status' factors and in the 6 factors for SSF in males and females. 'Sleeping time' and 'rising time' were not significantly different between the NCF and CF groups in females. Life stressors related to 'studies' and 'teachers' were not recognized as significantly different in females.

Table 3 shows the results of logistic regression analysis for males and females. Significant associations were apparent in the 'feeling of physical disintegration' and 'friends' factors in males and 'reduced activity' and 'club activities' in females. These odds ratios were under 1.3.

4. Discussion

This study attempted to clarify CF by utilization of PS as one of the criteria for CFS. Miike (2003) reported that 2.6% of elementary and junior high school students and 5-10% of high school students stopped going to school because of CF. The report of a prior epidemiologic survey (Kuratsune, 2000) showed that among males and females aged 15-65 years 36% were deemed to have CF and 0.3% to have CFS. In this study, 168 (5.7%) of the males and females were determined to have CF according to PS, a ratio almost the same as that reported by Miike. Although it cannot be concluded that all of the truancy was caused by CF, it can not be disregarded that 5.7% of persons were judged to suffer from it.

Comparing the results for lifestyle between the CF and NCF groups identified significant differences in the 'breakfast', 'smoking', 'drinking', and 'self-evaluation of health' categories for both males and females. Monden (1990) reported that high school students who suffered from a lack of sleep and who went without breakfast exhibit a higher level of SSF complaints. Our results also show that the CF group did not have breakfast or a good opinion of their own health, and therefore these are possible causes of CF. It may also be possible that delinquent behavior such as 'drinking' and 'smoking' causes CF.

Miike (2003) reported that dyssomnia is an unidentified complaint. Moreover, it has been reported that dyssomnia was observed in 80% of truanancies (Miike, 2003). These previous reports indicate that factors related to sleep may be involved

Table 3 Odds ratios and their corresponding 95% confidence intervals

	Male		Female	
	Odds ratio	95% confidence interval (lower-upper)	Odds ratio	95% confidence interval (lower-upper)
Breakfast	1.40	(0.96-2.03)	1.00	(0.46-2.16)
Between-meal Snack and Midnight Snack	0.84	(0.54-1.29)	1.43	(0.75-2.72)
Drinking	1.07	(0.73-1.55)	1.24	(0.63-2.45)
Smoking	1.32	(0.92-1.90)	0.57	(0.13-2.51)
Exercise Frequency	1.00	(0.90-1.11)	1.02	(0.85-1.22)
Sleeping Hours	1.00	(0.68-1.46)	1.34	(0.66-2.72)
Sleeping Time	1.20	(0.84-1.70)	0.98	(0.50-1.93)
Rising Time	0.98	(0.62-1.54)	0.56	(0.23-1.34)
Self-assessment of health status	1.08	(0.83-1.41)	0.98	(0.60-1.60)
BMI	1.03	(0.95-1.11)	1.01	(0.86-1.18)
Subjective symptoms of fatigue				
Difficulty with concentrated thinking	1.00	(0.88-1.14)	1.12	(0.92-1.38)
Languor	0.98	(0.87-1.10)	1.13	(0.91-1.39)
Reduced motivation	1.10	(0.98-1.24)	1.18	(0.98-1.43)
Reduced activity	1.01	(0.88-1.15)	1.26	(1.00-1.58)
Drowsiness	1.08	(0.93-1.25)	0.91	(0.69-1.20)
Feeling of physical disintegration	1.19	(1.07-1.33)	0.90	(0.75-1.09)
Life stressors				
Club activities	1.01	(0.98-1.05)	1.09	(1.02-1.15)
Studies	1.01	(0.97-1.05)	1.04	(0.98-1.10)
Teacher	0.97	(0.94-1.01)	0.95	(0.90-1.01)
Family	0.98	(0.93-1.03)	1.03	(0.96-1.11)
Friends	1.13	(1.06-1.19)	1.01	(0.91-1.12)

in CF. In this study, significant differences were observed between the CF and NCF groups in the 'sleeping time' and 'rising time' of males but not of females. Thus, these results suggest that situations related to sleep are not guaranteed to be a cause of CF.

On the whole, SSF and life stressor scores in the CF group for males and females were higher than in the NCF group, except for the life stressor categories 'studies' and 'teachers' in females. The results of logistic regression analysis did not show a significant association between CF and lifestyle; thus lifestyle factors may not be a cause of CF. After examining the results, differences between the CF and NCF groups did not show any aspect of lifestyle to be a substantial risk factor. A previous cross-sectional study by Kobayashi, et al., (2002) reported that 'difficulty with concentrated thinking' was associated with CF ($P < 0.01$; odds ratio, 1.68). Our results disagreed with that study. This longitudinal study suggests that 'difficulty with concentrated thinking' is a temporary symptom. Kobayashi, et al., (2002) also reported that the contribution of a physical symptom to the determination of CF is high in males. The present study shows that a significant association was apparent in the 'feeling of physical disintegration' category ($P < 0.01$; odds ratio, 1.12). This did not indicate a high risk, but did indicate that there is a relationship between CF and physical symptoms.

It has also been reported that mental stress

response in females is higher than in males (Ozeki, et al., 1994). Lazarus (1985) reported that even if a comparable stressor is added to a human body, when cognitive appraisal differs (not taking in to account the degree of the stressor), the mental stress response also differs. Kobayashi, et al., (1998) reported on gender differences in SSF according to cognitive appraisal and found the tendency to be high in females. But this study suggested that 'reduced activity', a kind of physical response, was associated with CF ($P < 0.01$; odds ratio, 1.26).

In this study, significant associations with life stressors were apparent in two factors, 'friends' (males) and 'club activities' (females). The odds ratios were 1.13 and 1.09, respectively. These two life stressors were different questionnaire items but the stressor for human-networks is the same for both sexes. Takakura, et al., (1998) reported that the 'friend' life stressor group had the highest depression score compared to the other stressor groups and exhibited a necessity for intervention. Thus, an intervention for improvement of the 'friend' life stressor is also required for relief of CF or depression, especially among males.

CF is a continued feeling of fatigue over a half-year period for which it is difficult to identify a cause. Early treatment is required. Moreover, CFS, which is a continuation of CF, prevents the ability to enjoy a healthy life. The present study concluded the cause of CF is unknown and that, while SSF or life stressors may be observed, lifestyle factors are not

the principle cause. Prevention of CF can potentially be achieved by observing SSF and life stressor factors that indicate the existence of the condition.

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Name:

Hidetsugu Kobayashi

Affiliation:

Fukui National College of Technology

Address:

Geshi, Sabae, Fukui 916-8507 Japan

Brief Biographical History:

1995-2002 Assistant Professor, Fukui National College of Technology

2002- Associate Professor, Fukui National College of Technology

Main Works:

- Time series analysis of subjective fatigue symptoms in young male students. *The Journal of Education and Health Science*, 50(3):151-158, 2005
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