



## A Study on Health Hazards to Employees near Main Streets

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In order to evaluate the physical and psychological health effects from automobile air pollution, 99 employees who worked near a main street were given a general health questionnaire, and the prevalence of their subjective complaints was measured. The collected data were classified according to gender, sleep time, degree of regular exercise, self-consciousness of symptoms, length of employment, work time, rest time, and smoking status. The results obtained were summarized as follows: The scores related to health complaints regarding physical and psychological items were higher in females than in males. THI scores were higher for the < 4 hour sleep time group. The health complaint scores for physical items were higher in the regular exercise group, whereas most scores for mental items were higher in the irregular exercise groups. The health complaints scores for physical and psychological items were higher in the unhealthy symptom group than in other groups. Those employees who had worked for > 4 years showed significantly higher rates of complaints regarding the eyes and skin. THI scores were higher for the < 6 hour working time group. The smoking group showed higher scores regarding health complaints related to physical items. The THI scores of the respiratory organs, mouth, anus, and digestive organs were significantly higher for the smoking group than for the non-smoking group. In summary, this study shows that the health complaint scores regarding physical and psychological symptoms tended to be higher among the unhealthy group, the less sleep time group, the less work time group, smokers, and females. These results can be used to improve the psychosomatic health status and working environments of employees who work near a main street.

**Key words:** Health, Hazards, Employees, Main streets

### INTRODUCTION

In modern society, the degree of air pollution has been gradually coming to the fore as a serious social problem. Increases in the number of automobiles and accompanying increases in the frequency of exposure to automobile exhaust fumes have emerged as important environmental problems. Harmful substances discharged by automobiles have diverse adverse effects on human health. Therefore, mankind's interest in air pollutants has begun to increase. Air pollution via harmful substances is recognized as one of the environmental factors that has the largest effect on human health. Harmful substances discharged by automobiles include carbon monoxide, hydrocarbons, nitrogen compounds, and lead compounds, and heavy metals exist in large quantities in the air of downtown areas (Brunekreef and Holgate, 2002). Without any particular filter, polluted

air directly infiltrates human respiratory organs, and harmful substances existing in the polluted air are transported to not only the lungs but also to various other human organs, causing diseases. These diseases are known to be quite diverse, ranging from general respiratory diseases, such as bronchitis and asthma, to mutations and cancer in serious cases. In main traffic street, too many cars are operated on narrow roads, and many kinds of pollutants are floating in the air. Merchants and employees who work near a main road are frequently exposed to exhaust fumes from automobiles and air pollutants. They are adversely affected in terms of their health by these environments.

Health status can be studied by examining acute and chronic subjective complaints. The Todai Health Index (THI), designed by the Faculty of Medicine at the University of Tokyo, is a health questionnaire created by revising and complementing the Cornell Medical Index (CMI), and it contains questions about the physical, mental, psychological, and behavioral patterns common to Asians in order to examine the subjective symptoms, backgrounds, daily life behaviors, and habits of the subjects (Brodman *et al.*, 1949;

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Suzuki and Roberts, 1991). The THI has been widely used internationally (Kunugita *et al.*, 1989) and has been applied by many researchers in Korea to studies on the health status of humans exposed to diverse environments, such as nuclear power generation, smoking, noise, industrial settings, subway stations, and taxi driving (Choi and Kim, 1992; Lee, 1996; Sohn *et al.*, 2003a; Sohn *et al.*, 2003b; Tsuchiya *et al.*, 1986; Kunugita *et al.*, 1993).

Therefore, the purpose of the present study is to understand the health statuses of individual temporary employees, as well as the health hazards to the entire group, by using the THI. This result will provide basic data that may help develop guidelines for managing the health of employees working in environments containing air pollution from automobiles.

## MATERIALS AND METHODS

**Study subjects and methods.** In the present study, researchers visited major streets in Seoul to distribute THI questionnaire sheets to employees and merchants who work near a main street. Of the questionnaire sheets, 99 copies containing faithful answers were used as the analysis data in the present study.

**Study tools and evaluation methods.** The THI health questionnaire consists of a total of 128 questions under 12 items, which are multiple subjective symptoms (I), respiratory organs (A), eyes/skin (B), mouth/anus (D), digestive organs (C), impulsiveness (H), lie scale (L), mental irritability (J), depression (K), aggressiveness (F), nervousness (E), and irregular life (G) (Table 1). This questionnaire enables the quantitative processing and assessment of subjective symptoms, such as scaling and standardization, as well as the observation and analysis of the characteristics of groups. In this questionnaire, around ten similar questions are asked

**Table 1.** Classification of 12 Items according to Today Health Index

Items	Abbreviation (Marks)	Number of Question
Multiple Subjective Symptoms	SUSY(I)	20
Respiratory	RESP(A)	10
Eye and Skin	EYSK(B)	10
Mouth and Anus	MOUT(D)	10
Digestive	DIGE(C)	9
Impulsiveness	IMPU(H)	9
Lie Scale	LISC(L)	10
Mental Irritability	MENT(J)	14
Depression	DEPR(K)	10
Aggressiveness	AGGR(F)	7
Nervousness	NERV(E)	8
Irregular Life	LIFE(G)	11
Total		128

in order to constitute each of the twelve scales, and answers to all the questions are of a three-choice type consisting of "yes," "neither yes nor no," and "no." Because the questionnaire is scored so that higher scores indicate more severe subjective symptoms or higher rates of complaints and high rates of health complaints mean lower levels of health, the mean scores for the complaints and the related standard deviations were calculated, analyzed, and organized item by item. The THI health questionnaire has been created by revising and complementing the CMI, which is a health questionnaire created based on the questionnaire type developed by Brodman *et al.* (1949) after considering the weaknesses of the CMI, such as unclear content and unnecessary questions about diseases that rarely occur in Asians. Thus, the THI is composed of questions about physical, mental, and psychological health problems commonly experienced by Asians.

**Method of analysis.** All collected data were made into computer codes and statistically processed by the computer using the SPSS Package. The statistical processing was conducted using t-tests and One way-ANOVA and when significant differences between levels were recognized, Duncan's Multiple Range Tests were used to conduct posteriori tests.

## RESULTS

**General characteristics.** As for the general characteristics of the survey subjects, 70 were males (70.7%), and 29 were females (29.3%). Daily sleep time was typically 6~8 hours, with 60 people selecting this answer (52.2%), and work time per day was typically 6~8 hours, with 64 people selecting this answer (64.6%). Of the subjects, 49 (49.5%) had 3~4 holidays per month. Sixteen subjects (16.2%) perceived that they were not healthy, and 59 subjects (59.6%) were smokers.

### **Rates of subjective physical and psychological complaints in the study groups.**

**Responses regarding subjective physical and psychological complaints according to regular/irregular lifestyles:** Responses regarding subjective physical and psychological complaints according to regular/irregular lifestyles showed a tendency toward higher rates of physical complaints related to respiratory, eye/skin, mouth/anus, multiple subjective symptoms, and digestive organs among employees who were living a regular life (Table 2). On the other hand, employees who were not living a regular life showed a tendency toward having higher rates of complaints regarding all mental symptoms, such as impulsiveness, the lie scale, mental irritability, depression, aggressiveness, nervousness, and irregular lifestyles. This result indicates that employees who live irregular lives experience high degrees of emotional stress. These results indicate that employees who

**Table 2.** Physical and Psychological complaints of study groups according to degree of regular lifestyles (mean ± SD)

Item	Regular lifestyles	
	Y (n = 16)	N (n = 83)
Multiple Subjective Symptoms	I 38.94 ± 6.71	37.81 ± 9.44
Respiratory	A 19.44 ± 3.12	16.92 ± 4.76*
Eye and Skin	B 17.81 ± 4.32	16.95 ± 4.50
Mouth and Anus	D 16.63 ± 3.48	15.41 ± 4.55
Digestive	C 17.31 ± 3.98	16.48 ± 4.53
Impulsiveness	H 15.88 ± 3.61	17.05 ± 3.46
Lie Scale	L 18.31 ± 3.81	19.43 ± 3.66
Mental Irritability	J 23.94 ± 5.13	25.19 ± 5.97
Depression	K 16.50 ± 3.74	17.78 ± 4.27
Aggressiveness	F 15.25 ± 1.95	13.67 ± 2.50*
Nervousness	E 14.69 ± 3.59	15.46 ± 3.68
Irregular Life	G 20.94 ± 3.64	21.92 ± 4.05

\* (P < 0.05 Student's t-test).

were living irregular lives should maintain emotional stability.

**Responses regarding subjective physical and psychological complaints according to sleep time:** Although subjective physical and psychological complaints did not show significant differences according to sleep time in general, tendencies toward high rates of subjective physical and psychological complaints were found among those who slept less than four hours a day (Table 3). It is believed that employees who maintain sleeping times of 6–8 hours, which is appropriate, are more physically and mentally stable than those who sleep for too short a time. Employees who slept for less than four hours a day showed significant increases in eye/skin complaints as compared to those who slept for four hours or more per day. Meanwhile, employees who slept for less than four hours a day showed significant increases in the lie scale as compared to those who slept for eight hours or more per day. From this result, it can be seen

**Table 4.** Physical and Psychological complaints of study groups according to gender (mean ± SD)

Item	Gender	
	M (n = 70)	FM (n = 29)
Multiple Subjective Symptoms	I 36.80 ± 9.01	40.86 ± 8.56*
Respiratory	A 17.43 ± 4.49	17.07 ± 5.00
Eye and Skin	B 16.69 ± 4.52	18.07 ± 4.24
Mouth and Anus	D 15.79 ± 4.45	15.17 ± 4.34
Digestive	C 16.37 ± 4.20	17.21 ± 5.00
Impulsiveness	H 16.70 ± 3.50	17.24 ± 3.50
Lie Scale	L 18.77 ± 3.80	20.41 ± 3.18*
Mental Irritability	J 24.50 ± 6.18	26.17 ± 4.83
Depression	K 17.09 ± 4.32	18.76 ± 3.70
Aggressiveness	F 13.64 ± 2.61	14.62 ± 2.01
Nervousness	E 15.14 ± 3.79	15.79 ± 3.35
Irregular Life	G 21.56 ± 3.83	22.24 ± 4.38

\* (P < 0.05 Student's t-test)

that insufficient sleep may increase subjective lie scale and eye/skin complaints among employees.

**Responses regarding subjective physical and psychological complaints according to gender:** The response rates regarding subjective physical and psychological complaints according to gender were generally higher among females than among males, and in particular, the multiple subjective symptoms and lie scales showed statistically significant increases among males (Table 4). This indicates that management work is physically harder on females than on males, and thus, related mental stress occurs more frequently among females.

**Responses regarding subjective physical and psychological complaints according to the self-consciousness of symptoms:** Based on responses regarding the subjective physical and psychological complaints according to self-consciousness of symptoms, most of the rates of sub-

**Table 3.** Physical and Psychological complaints of study groups according to sleep time (mean ± SD)

Item		Sleep time (hours)			
		< 4 (n = 6)	4–6 (n = 35)	6–8 (n = 53)	> 8 (n = 5)
Multiple Subjective Symptoms	I	40.50 ± 9.14	36.89 ± 11.06	38.49 ± 7.54	37.40 ± 9.56
Respiratory	A	19.17 ± 6.18	17.23 ± 5.07	17.30 ± 4.28	16.00 ± 3.39
Eye and Skin	B	21.50 ± 4.04a	16.63 ± 4.78	17.06 ± 4.15	15.40 ± 3.78
Mouth and Anus	D	16.83 ± 3.87	15.23 ± 4.19	15.62 ± 4.50	16.60 ± 6.35
Digestive	C	17.67 ± 5.54	17.31 ± 4.59	15.85 ± 4.13	18.60 ± 5.08
Impulsiveness	H	17.17 ± 4.62	17.31 ± 3.35	16.49 ± 3.58	17.20 ± 2.49
Lie Scale	L	20.50 ± 2.51a	20.00 ± 3.69ab	18.85 ± 3.81ab	16.80 ± 2.17b
Mental Irritability	J	28.33 ± 4.46	24.89 ± 6.20	24.68 ± 5.70	25.00 ± 6.56
Depression	K	18.00 ± 5.33	17.89 ± 4.29	17.60 ± 4.06	14.60 ± 3.78
Aggressiveness	F	13.33 ± 0.82	14.17 ± 2.33	13.79 ± 2.65	14.40 ± 3.36
Nervousness	E	13.33 ± 3.14	15.97 ± 3.59	15.19 ± 3.73	14.80 ± 3.83
Irregular Life	G	21.83 ± 3.49	21.26 ± 4.26	22.08 ± 3.93	21.80 ± 3.96

Different alphabet means significant difference (P < 0.05). One way-ANOVA followed by Duncan's Multiple Range Test.

**Table 5.** Physical and Psychological complaints of study groups according to self-consciousness of symptoms (mean  $\pm$  SD)

Item		Self-Consciousness Symptoms			
		Very healthy (n = 6)	Healthy (n = 31)	Normal (n = 46)	Unhealthy (n = 16)
Multiple Subjective Symptoms	I	43.00 $\pm$ 8.81b	34.35 $\pm$ 9.54a	38.04 $\pm$ 8.07ab	43.00 $\pm$ 8.10b
Respiratory	A	18.83 $\pm$ 4.54	16.58 $\pm$ 4.93	16.93 $\pm$ 4.29	19.31 $\pm$ 4.69
Eye and Skin	B	18.33 $\pm$ 4.50	15.90 $\pm$ 4.48	17.30 $\pm$ 4.36	18.31 $\pm$ 4.60
Mouth and Anus	D	17.50 $\pm$ 4.59	14.58 $\pm$ 3.45	15.33 $\pm$ 4.22	17.69 $\pm$ 5.83
Digestive	C	17.17 $\pm$ 5.74	15.32 $\pm$ 3.85	17.15 $\pm$ 4.39	17.38 $\pm$ 5.02
Impulsiveness	H	15.83 $\pm$ 4.79	16.42 $\pm$ 3.01	16.87 $\pm$ 3.54	18.06 $\pm$ 3.73
Lie Scale	L	17.33 $\pm$ 4.08a	18.58 $\pm$ 3.33ab	19.48 $\pm$ 3.78ab	20.63 $\pm$ 3.70b
Mental Irritability	J	24.83 $\pm$ 6.37	23.77 $\pm$ 4.94	25.09 $\pm$ 6.51	27.13 $\pm$ 5.05
Depression	K	15.33 $\pm$ 6.09a	16.35 $\pm$ 3.84ab	18.17 $\pm$ 4.21ab	19.06 $\pm$ 3.44b
Aggressiveness	F	15.67 $\pm$ 2.66a	14.03 $\pm$ 2.04ab	13.87 $\pm$ 2.39ab	13.25 $\pm$ 3.28b
Nervousness	E	14.83 $\pm$ 4.07a	13.68 $\pm$ 2.98a	15.67 $\pm$ 3.63ab	17.75 $\pm$ 3.49b
Irregular Life	G	22.33 $\pm$ 3.56	20.06 $\pm$ 4.08	22.91 $\pm$ 3.92	21.50 $\pm$ 3.16

Different alphabet means significant difference ( $P < 0.05$ ). One way-ANOVA followed by Duncan's Multiple Range Test.

**Table 6.** Physical and Psychological complaints of study groups according to length of employment (mean  $\pm$  SD). Different alphabet means significant difference ( $P < 0.05$ )

Item		Length of employment (years)			
		1 > (n = 60)	1~2 (n = 25)	2~4 (n = 10)	4 < (n = 4)
Multiple Subjective Symptoms	I	38.10 $\pm$ 9.26	38.68 $\pm$ 7.96	37.00 $\pm$ 11.10	34.50 $\pm$ 8.74
Respiratory	A	17.10 $\pm$ 4.49	18.28 $\pm$ 4.77	17.10 $\pm$ 5.51	15.25 $\pm$ 3.59
Eye and Skin	B	17.05 $\pm$ 4.42	17.88 $\pm$ 4.27	17.30 $\pm$ 5.17	12.25 $\pm$ 1.89a
Mouth and Anus	D	14.60 $\pm$ 3.85	17.32 $\pm$ 4.43	16.40 $\pm$ 5.60	18.00 $\pm$ 6.06
Digestive	C	16.48 $\pm$ 4.52	18.04 $\pm$ 3.86	14.50 $\pm$ 5.15	15.00 $\pm$ 2.94
Impulsiveness	H	17.05 $\pm$ 3.30	17.28 $\pm$ 3.65	15.30 $\pm$ 4.42	15.25 $\pm$ 2.22
Lie Scale	L	19.57 $\pm$ 3.45	19.44 $\pm$ 3.91	17.00 $\pm$ 4.08	19.00 $\pm$ 4.40
Mental Irritability	J	25.03 $\pm$ 5.62	26.56 $\pm$ 6.51	22.20 $\pm$ 4.19	21.50 $\pm$ 6.14
Depression	K	17.20 $\pm$ 3.99	18.48 $\pm$ 4.78	17.10 $\pm$ 3.51	18.75 $\pm$ 5.68
Aggressiveness	F	13.90 $\pm$ 2.35	13.72 $\pm$ 2.95	14.60 $\pm$ 2.46	14.00 $\pm$ 1.83
Nervousness	E	15.08 $\pm$ 3.67	15.88 $\pm$ 3.14	15.40 $\pm$ 4.38	15.50 $\pm$ 5.75
Irregular Life	G	21.82 $\pm$ 3.48	22.16 $\pm$ 4.09	21.70 $\pm$ 6.31	18.50 $\pm$ 3.51

One way-ANOVA followed by Duncan's Multiple Range Test.

jective physical and psychological complaints were shown to be higher among those who thought that their health was poor (Table 5). In particular, they showed significant increases in the rates of complaints regarding the following items: multiple subjective symptoms, the lie scale, mental irritability, depression, aggressiveness, and nervousness. Employees who thought that their health was poor showed significantly higher rates of complaints regarding mental items, in particular among subjective physical and psychological complaints. Therefore, it could be seen that self-consciousness of symptoms had larger effects on mental complaints than on physical complaints.

**Responses regarding subjective physical and psychological complaints according to the length of employment:** Based on responses regarding subjective physical and psychological complaints according to length of employment, those employees who had worked more than four years showed significantly higher rates of complaints

related to the eyes and skin, which could have been induced by their jobs (Table 6).

**Responses regarding subjective physical and psychological complaints according to work time:** Based on responses regarding subjective physical and psychological complaints according to work time, the rates of subjective physical and psychological complaints showed a tendency toward being higher in most items among those who worked for less than six hours a day, which is a short time (Table 7). In particular, this group showed significant increases in multiple subjective symptoms, respiratory complaints, impulsiveness, and nervousness as compared to other groups. Although it cannot be determined whether those with short working times were engaged in other employment during the remaining time, in terms of the results of the present study, they showed a tendency toward higher rates of subjective complaints. It is believed that this result could have been produced because most of the

**Table 7.** Physical and Psychological complaints of study groups according to work time (mean  $\pm$  SD). Different alphabet means significant difference ( $P < 0.05$ )

Item		Work time (hours)			
		< 6 (n = 15)	6~8 (n = 64)	8~10 (n = 9)	> 10 (n = 11)
Multiple Subjective Symptoms	I	43.60 $\pm$ 7.37a	37.27 $\pm$ 8.57ab	36.78 $\pm$ 8.91ab	35.55 $\pm$ 11.78b
Respiratory	A	19.27 $\pm$ 4.45a	17.47 $\pm$ 4.42ab	16.44 $\pm$ 3.91ab	14.55 $\pm$ 5.57b
Eye and Skin	B	18.67 $\pm$ 4.05	17.17 $\pm$ 4.43	15.78 $\pm$ 4.87	15.55 $\pm$ 4.66
Mouth and Anus	D	15.53 $\pm$ 4.49	15.63 $\pm$ 4.33	16.67 $\pm$ 5.00	14.73 $\pm$ 4.67
Digestive	C	17.87 $\pm$ 5.17	16.44 $\pm$ 4.16	16.44 $\pm$ 3.78	16.09 $\pm$ 5.70
Impulsiveness	H	19.13 $\pm$ 3.54b	16.50 $\pm$ 3.22ab	15.78 $\pm$ 3.63a	16.73 $\pm$ 4.05ab
Lie Scale	L	20.13 $\pm$ 2.88	19.22 $\pm$ 3.60	19.00 $\pm$ 4.77	18.45 $\pm$ 4.50
Mental Irritability	J	26.00 $\pm$ 5.29	25.02 $\pm$ 5.84	24.33 $\pm$ 5.57	24.00 $\pm$ 7.27
Depression	K	19.53 $\pm$ 3.72	17.28 $\pm$ 3.78	16.67 $\pm$ 6.42	17.36 $\pm$ 4.84
Aggressiveness	F	14.13 $\pm$ 2.23	13.95 $\pm$ 2.69	13.67 $\pm$ 2.74	13.73 $\pm$ 1.35
Nervousness	E	17.67 $\pm$ 3.37b	15.05 $\pm$ 3.49ab	13.00 $\pm$ 3.00a	15.73 $\pm$ 4.17ab
Irregular Life	G	22.60 $\pm$ 3.16	21.36 $\pm$ 3.57	23.11 $\pm$ 4.99	21.82 $\pm$ 6.18

One way-ANOVA followed by Duncan's Multiple Range Test.

**Table 8.** Physical and Psychological complaints of study groups according to smoking status (mean  $\pm$  SD)

Item		Smoker of Non-smoker	
		S (n=59)	N.S (n=40)
Multiple Subjective Symptoms	I	38.63 $\pm$ 8.67	37.05 $\pm$ 9.57
Respiratory	A	18.20 $\pm$ 4.73	16.02 $\pm$ 4.18*
Eye and Skin	B	17.51 $\pm$ 4.57	16.48 $\pm$ 4.28
Mouth and Anus	D	16.53 $\pm$ 4.70	14.25 $\pm$ 3.56*
Digestive	C	17.49 $\pm$ 4.28	15.33 $\pm$ 4.41*
Impulsiveness	H	16.95 $\pm$ 3.70	16.73 $\pm$ 3.20
Lie Scale	L	19.12 $\pm$ 3.85	19.45 $\pm$ 3.48
Mental Irritability	J	24.59 $\pm$ 6.08	25.58 $\pm$ 5.49
Depression	K	17.63 $\pm$ 4.33	17.50 $\pm$ 4.06
Aggressiveness	F	14.14 $\pm$ 2.73	13.63 $\pm$ 2.06
Nervousness	E	15.08 $\pm$ 3.78	15.70 $\pm$ 3.50
Irregular Life	G	22.25 $\pm$ 3.72	21.03 $\pm$ 4.30

\* ( $P < 0.05$  Student's *t*-test).

employees were part-time workers.

**Responses regarding subjective physical and psychological complaints according to smoking status:** With regard to subjective physical and psychological complaints according to smoking status, smokers showed a tendency toward higher rates of complaints related to all the physical symptom items and showed significant increases in respiratory organ, mouth/anus, and digestive organ complaints (Table 8). Regarding mental symptoms, increases in subjective complaints among smokers were not found. Therefore, it was concluded that smoking would increase the rates of employees' subjective physical complaints but not the rates of their subjective mental complaints.

**Responses regarding subjective physical and psychological complaints according to the number of holidays per month:** With regard to subjective physical and psychological complaints according to the number of holidays

**Table 9.** Physical and Psychological complaints of study groups according to number of holidays per month (mean  $\pm$  SD). Different alphabet means significant difference ( $P < 0.05$ )

Item		Number of Holidays per Month			
		1~2 (14)	3~4 (49)	5~6 (19)	7~8 (17)
Multiple Subjective Symptoms	I	39.07 $\pm$ 14.47	38.08 $\pm$ 7.77	38.84 $\pm$ 7.87	35.88 $\pm$ 8.50
Respiratory	A	17.14 $\pm$ 5.48	17.88 $\pm$ 4.64	16.68 $\pm$ 4.56	16.59 $\pm$ 4.05
Eye and Skin	B	18.43 $\pm$ 4.67	16.78 $\pm$ 4.83	17.95 $\pm$ 4.14	15.94 $\pm$ 3.31
Mouth and Anus	D	15.14 $\pm$ 4.64	15.71 $\pm$ 4.18	16.47 $\pm$ 5.22	14.71 $\pm$ 4.03
Digestive	C	18.43 $\pm$ 5.76b	17.22 $\pm$ 4.13b	15.79 $\pm$ 3.74ab	14.29 $\pm$ 4.04a
Impulsiveness	H	17.71 $\pm$ 4.55	16.94 $\pm$ 3.29	17.16 $\pm$ 3.34	15.59 $\pm$ 3.22
Lie Scale	L	19.86 $\pm$ 3.04	19.10 $\pm$ 3.42	19.21 $\pm$ 4.05	19.24 $\pm$ 4.70
Mental Irritability	J	27.64 $\pm$ 4.57	24.65 $\pm$ 6.05	24.79 $\pm$ 5.78	24.00 $\pm$ 6.08
Depression	K	17.29 $\pm$ 4.60	17.27 $\pm$ 3.79	17.95 $\pm$ 3.82	18.29 $\pm$ 5.51
Aggressiveness	F	14.00 $\pm$ 2.11	13.69 $\pm$ 2.26	14.00 $\pm$ 2.94	14.47 $\pm$ 2.94
Nervousness	E	15.57 $\pm$ 3.88	15.35 $\pm$ 3.64	14.74 $\pm$ 3.60	15.76 $\pm$ 3.85
Irregular Life	G	22.71 $\pm$ 5.01	21.61 $\pm$ 3.72	22.21 $\pm$ 4.05	20.88 $\pm$ 3.89

One way-ANOVA followed by Duncan's Multiple Range Test.

**Table 10.** Physical and Psychological complaints of study groups according to rest time (mean  $\pm$  SD). Different alphabet means significant difference ( $P < 0.05$ )

Item		Rest time (hours)			
		< 1 (n = 16)	1~2 (n = 54)	2~3 (n = 24)	> 3 (n = 5)
Multiple Subjective Symptoms	I	42.00 $\pm$ 7.73b	37.28 $\pm$ 7.65ab	38.25 $\pm$ 11.69ab	31.60 $\pm$ 9.45a
Respiratory	A	17.13 $\pm$ 4.56	17.02 $\pm$ 4.42	18.25 $\pm$ 5.15	16.80 $\pm$ 5.17
Eye and Skin	B	17.63 $\pm$ 4.46	16.81 $\pm$ 4.57	17.79 $\pm$ 4.37	15.00 $\pm$ 4.00
Mouth and Anus	D	14.19 $\pm$ 4.10ab	15.57 $\pm$ 4.58ab	17.13 $\pm$ 4.21b	13.20 $\pm$ 1.92a
Digestive	C	16.94 $\pm$ 5.08	16.87 $\pm$ 4.51	16.54 $\pm$ 3.92	13.20 $\pm$ 3.56
Impulsiveness	H	16.50 $\pm$ 4.46	16.93 $\pm$ 3.40	17.33 $\pm$ 3.24	15.00 $\pm$ 2.00
Lie Scale	L	18.63 $\pm$ 3.56ab	19.19 $\pm$ 3.35ab	20.46 $\pm$ 4.15b	16.20 $\pm$ 4.09a
Mental Irritability	J	25.50 $\pm$ 5.23	24.87 $\pm$ 5.66	25.63 $\pm$ 6.70	21.60 $\pm$ 5.73
Depression	K	17.56 $\pm$ 3.48ab	17.20 $\pm$ 4.39ab	19.08 $\pm$ 4.13b	14.40 $\pm$ 2.30a
Aggressiveness	F	14.63 $\pm$ 2.42	13.94 $\pm$ 2.42	13.42 $\pm$ 2.72	14.00 $\pm$ 2.35
Nervousness	E	16.81 $\pm$ 3.89	15.13 $\pm$ 3.51	15.58 $\pm$ 3.41	11.60 $\pm$ 3.78a
Irregular Life	G	21.31 $\pm$ 3.86	21.98 $\pm$ 4.23	21.38 $\pm$ 3.63	22.60 $\pm$ 4.22

One way-ANOVA followed by Duncan's Multiple Range Test.

per month, little difference could be found among the various groups. Those who rested for more than 7 days per month showed significant decreases, as compared to those who rested for 1~2 days or 3~4 days, indigestive organ complaints (Table 9). It can be seen that in the case of the digestive organs, as the number of holidays per month increased, subjective complaints gradually decreased, and as the number of holidays per month increased, subjective complaints increased.

**Responses regarding subjective physical and psychological complaints according to rest time:** With regard to subjective physical and psychological complaints according to rest time, some differences in tendencies could be found between various groups. Those who rested for three hours or longer showed significant decreases in their rates of complaints, as compared to other groups, regarding multiple subjective symptoms, the mouth and anus, the lie scale, depression, and nervousness (Table 10). Therefore, it can be seen that as rest time increases, responses regarding many subjective physical and psychological complaints decreased among employees.

## DISCUSSION

In modern society, various kinds of industries developed rapidly alongside increases in populations, and as a result, many problems related to environmental pollution appeared. This environmental pollution can be said to be wide-ranging as it includes air pollution, water pollution, soil pollution, waste, and noises/vibrations. Among these types of pollution, the air pollution caused by the harmful gases emitted by automobiles can most easily cause direct damage to human bodies (Brunekreef and Holgate, 2002). In particular, because the number of automobiles is increasing, employees working near main streets in large cities can

be easily exposed to harmful substances. Employees working in poor working environments can be damaged in terms of their health because they are easily exposed to harmful substances such as air pollutants, noises, vibrations, and smoke and because of their irregular working hours.

To understand the health hazards of environmental pollution from automobiles, a questionnaire survey was conducted on 99 temporary employees working near main streets in Seoul by using a THI health questionnaire, and based on the results, the following conclusions were obtained:

The response rates regarding subjective physical and psychological complaints according to gender were generally higher among females than among males and showed statistically significant increases in multiple subjective symptoms and lie scales.

Although subjective physical and psychological complaints according to sleep time did not show significant differences in general, tendencies toward high rates of subjective physical and psychological complaints were found among those who slept less than four hours a day. Employees who slept for less than four hours a day showed significant increases in eye/skin and lie scale complaints as compared to those who slept for four hours or more per day.

Responses regarding subjective physical and psychological complaints according to regular/irregular lifestyles showed a tendency toward higher rates of physical complaints among employees who were living regular lives. On the other hand, employees who were not living regular lives showed a tendency toward higher rates of complaints related to all mental symptoms.

Based on responses regarding subjective physical and psychological complaints according to self-consciousness of symptoms, most of the rates of subjective physical and psychological complaints were shown to be higher among those who thought that their health was poor. In particular,

they showed significant increases in the rates of complaints related to mental symptoms.

Based on responses regarding subjective physical and psychological complaints according to work time, the rates of subjective physical and psychological complaints showed a tendency toward being higher for most items among those who worked for less than six hours a day. In particular, this group showed significant increases in complaints related to multiple subjective symptoms, respiratory issues, impulsiveness, and nervousness as compared to other groups.

With regard to subjective physical and psychological complaints according to rest time, some differences could be found among various groups. Those who rested for three hours or longer showed significant decreases in complaints regarding multiple subjective symptoms, the mouth and anus, the lie scale, depression, and nervousness.

With regard subjective physical and psychological complaints according to smoking status, smokers showed a tendency toward higher rates of complaints related to all physical symptoms and showed significant increases in complaints regarding the respiratory organs, the mouth/anus, and the digestive organs.

Therefore, when these results are assembled, higher rates of subjective physical and psychological complaints were shown by temporary employees working near main streets if they were females, if their sleep times were shorter, if they thought that their health was poor, if their work times were shorter, and if they were smokers. If the health hazards resulting from automobile air pollution are solved, considering the aforementioned results, more efficient work will be ensured.

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