The Psychological Characteristics of Tobacco Dependence in a Rural Area of Japan

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To investigate the psychological characteristics of smoking and tobacco dependence, a questionnaire survey was conducted of 2,051 consenting adults aged 21 to 65 years from the total population of a town in Akita Prefecture. Valid responses were received from 673 men and 818 women, for a total of 1,491 (72.7%). The questionnaires used were a tobacco dependence questionnaire, a personality questionnaire (the NEO Five-Factor Inventory: NEO-FFI), the WHO Subjective Well-being Inventory (SUBI), and the 12-Item General Health Questionnaire (GHQ-12). Subjects who responded that they had smoked daily for more than one month before the day of the survey were considered smokers. There were 400 male (59.8%) and 39 female (4.8%) smokers. Both male and female smokers were more extroverted than nonsmokers. Among smokers, there were 166 (41.5%) men and 19 (49%) women diagnosed as having a tobacco dependence of ICD-10. Among men, dependent smokers had a significantly higher score for Openness of the NEO-FFI and a lower score for Perceived Ill Health on the SUBI than nondependent smokers. Among smokers, 128 (32.0%) men and 13 (33%) women met the ICD-10 criteria for tobacco withdrawal. Among male smokers, those with tobacco withdrawal had a significantly higher score for Neuroticism and Openness on the NEO-FFI and a lower score for Negative Affect on the SUBI than those with no withdrawal. These results suggest that there is a relationship between tobacco dependence and personality or negative emotions.

J Epidemiol, 2000; 10 : 271-279.

tobacco dependence, tobacco withdrawal, personality, five-factor model, subjective well-being

Because cigarette smoking is the single most important source of preventable morbidity and premature mortality in developed countries, antismoking measures are among the most important public health measures that can be taken today. Smoking is widely recognized to be harmful to the health, and many people desire to stop. However, most of these people who would like to quit are unable to do so despite their desire. In fact, the smoking rate of adult Japanese males based on the National Nutrition Survey, 51.2% in 1997, remains at the highest level in developed countries.

In recent years, the thinking has become widespread that smoking has the characteristics of drug dependence, and that it is actually one type of drug dependence. Together with progress in the study of tobacco dependence, the notion of tobacco dependence has been adopted in the tenth revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10). In the ICD-10, tobacco dependence (F17.2) is considered to be one type of drug dependence (F1x.2) to which the same diagnostic criteria apply as are used with other drug dependence such as alcohol, opioids, cannabis, and cocaine. The Diagnostic and Statistical Manual of Mental Disorders IV (DSM-IV), U.S. standards for the diagnosis of mental disorders, refer to “tobacco dependence” as “nicotine dependence” since the cause of tobacco dependence is the nicotine in the tobacco.

With the ICD-10, drug dependence is diagnosed when any 3 of the following 6 items apply: (1) strong desire for drugs, (2) uncontrol, (3) withdrawal state, (4) tolerance, (5) preoccupation and, (6) use despite harmful consequences, as shown in Table 1. Thus, these diagnostic criteria, focusing on psychological dependence, or the psychopharmacological factors of drug dependence, are embodied on the behavioral level including...
subjective symptoms of physical dependence, that is, tolerance or withdrawal. Tobacco withdrawal is defined separately in F17.3.

Much research has been done on the mechanism of tobacco dependence, from the standpoints of pharmacology, epidemiology, behavioral genetics, psychology, and psychiatry. Clarifying the biological and social characteristics of smoking behavior would be useful in studying the mechanism of dependence. In particular, research on the relationship between smoking behavior or tobacco dependence and personality may provide clues as to why some people smoke and fall more easily into tobacco dependence.

Many studies have compared the personalities of smokers and non-smokers. There have also been studies on the differences in personality between dependent smokers and non-dependent smokers or on the relationship between withdrawal and personality. However, there have been no studies to date on tobacco dependence using a questionnaire based on the five-factor model, which is part of recent personality theory.

Therefore, the present study was undertaken with the objective of investigating smoking and tobacco dependence and its psychological characteristics. A survey was conducted of the general population of Nishime Town, Akita Prefecture, Japan, with ages ranging from 21 to 65 years. Psychometrical assess-
ments of personality based on the five factor model, subjective well-being, and symptoms of nonpsychotic psychiatric illness were made in order to investigate whether or not there is any relationship between these and smoking and tobacco dependence or tobacco withdrawal.

SUBJECTS

The total population of the town of Nishime, Akita Prefecture, between the ages of 20 and 64 years as of April 2, 1995, was 3,338. All residents were invited to participate in this study. Of these 3,338 people, there were 1,609 males (mean age 43.4 ± 11.8 years) and 1,729 females (mean age 44.1 ± 12.0 years). The survey was conducted with 2,051 people who agreed to participate. Self-administered questionnaire sheets were mailed in October 1996, and valid responses were received from 1,491 people (72.7%). There were 673 male respondents, with a mean age of 46.25 ± 11.73 years, and 818 female respondents, with a mean age of 45.84 ± 11.21 years. There was no significant difference between the mean ages of the male and female respondents (p = 0.49).

From a comparison between the age distribution of the respondents and that of Japanese nationwide population, males in their 20s were fewer and those in their 60s more numerous; females, on the other hand, were fewer only in their 20s. Nishime Town is located on the Japan sea coast in the southern part of Akita Prefecture, in a belt of flat farmland. There were 1,594 households and a population of 6,693 as of 1995. In that year the working population by industry was made up of 13.7% in primary, 41.8% in secondary, and 44.5% in tertiary industry. Farm households numbered 373, and farm households with both agrarian and other occupations combined accounted for 95% (1995).

METHODS

Self-administered questionnaire sheets were distributed to participants in October, 1996. The questionnaires were a tobacco-dependence questionnaire, the Japanese versions of the NEO Five-Factor Inventory (NEO-FFI) 22, WHO Subjective Well-Being Inventory (SUBI) 20, and 12-Item General Health Questionnaire (GHQ-12) 20. These survey sheets were collected by public health nurses from the Town Hall after about ten days.

For the diagnosis of tobacco dependence, a self-administered questionnaire was prepared with 26 items allowing diagnosis of tobacco dependence by the ICD-10, with reference to the tobacco dependence section of the Composite International Diagnostic Interview (CIDI) 25,26, which is for the diagnosis of mental diseases developed by WHO. The CIDI is a fully structured interview schedule, in which an interviewer does not have to be a psychiatrist and can simply read aloud the given questions. Because the CIDI has those characteristics and was modified as a self-administered questionnaire, it is thought that the validity of this questionnaire was kept almost as well as CIDI.

The NEO-FFI is a questionnaire widely used today to measure personality, developed by Costa and McCrae of the U.S. National Institute on Aging 20. This is composed of 5 scales with 60 items, based on a five-factor model used to evaluate personality traits according to 5 scales. The 5 factors are Neuroticism (N), Extraversion (E), Openness (O), Agreeableness (A), and Conscientiousness (C). An explanation of each factor is given in Table 2. According to their research, a relative consistency exists among the 5 personality factors, and there is agreement between the personality a subject uses to rate himself or herself and that rated by the people around, such as spouse or friends. Moreover, these characteristics of this questionnaire are seen to transcend different cultures, and not be greatly affected by the passage of time. A genetic component for each of the factors has also been observed. The validity of the Japanese version was examined by Yoshimura et al. 27.

The SUBI, a self-administered questionnaire of 40 items developed by the World Health Organization (WHO) 20, used to measure the degree of a person's physical, mental, and social well-being through individual experience. This questionnaire focuses on a person's overall health, not based simply on the person's emotions, but also on how well he or she recognizes their individual situations. It consists of 2 axes, Positive Affect and Negative Affect, and can measure not just the negative psychological state, but also the positive psychological side such as feelings of achievement or confidence. The SUBI is also comprised of the following 11 subscales: (1) General Well-Being - Positive Affect, (2) Expectation-Achievement Congruence, (3) Confidence in Coping, (4) Transcendence, (5) Family Group Support, (6) Social Support, (7) Primary Group Concern, (8) Inadequate Mental Mastery, (9) Perceived Ill Health, (10) Deficiency in Social Contacts, and (11) General Well-Being - Negative Affect. Higher scores on each item indicate a better state. The validity of the Japanese version has been examined by Tonan et al 20.

The GHQ-12, developed by Goldberg of the U.K. 20, is the most general self-administered questionnaire for screening for nonpsychotic psychiatric illness. A higher score indicates a poorer condition. The validity of the Japanese version of this test was investigated by Fukunishi et al. 28.

In this study, those who responded that they had smoked every day for more than one month up to the day of the survey were considered smokers, and those who responded that they had not were considered non-smokers.

Comparisons were made between the groups of scores on each psychological scale using Analysis of Covariance (ANCOVA) adjusting for age. Analyses were performed by gender. Persons with missing values were excluded from each of the analyses. The significance level was set at p < 0.05.
Table 2. Explanation of Each Scale of NEO Five-Factor Inventory (NEO-FFI).

1) Neuroticism (N)
   Neuroticism assesses adjustment versus emotional instability. It identifies individuals prone to psychological distress, unrealistic ideas, excessive cravings or urges, and maladaptive coping responses.

2) Extraversion (E)
   Extraversion assesses quantity and intensity of interpersonal interaction, activity level, need for stimulation, and capacity for joy.

3) Openness (O)
   Openness assesses proactive seeking, appreciation of experience for its own sake, and toleration for and exploration of the unfamiliar.

4) Agreeableness (A)
   Agreeableness assesses the quality of one's interpersonal orientation along a continuum from compassion to antagonism in thoughts, feelings, and actions.

5) Conscientiousness (C)
   Conscientiousness assesses the individual's degree of organization, persistence, and motivation in goal-directed behavior. It contrasts dependable, fastidious people with those who are lackadaisical and sloppy.

RESULTS

There were 400 male and 39 female smokers, and 273 male and 779 female nonsmokers. The proportions of smokers for males and females were therefore 59.4% and 4.8%, respectively, the smoking rate for women being far lower than that for men. Among both men and women, the smokers were significantly younger than the nonsmokers. Because there was such a large difference in the smoking rate between men and women, the psychological measure was investigated by gender.

Table 4 shows the scores for each scale of the NEO-FFI of smokers and nonsmokers among men and women. Among men, the personality trait of Extraversion was significantly higher in smokers than in nonsmokers, and that of Openness significantly lower. Among women, Extraversion was significantly higher among smokers than nonsmokers, and Agreeableness significantly lower.

For subjective well-being, there was no significant difference in either Negative Affect or Positive Affect between male smokers and nonsmokers (Table 4). In the subscales, General Well-Being - Positive Affect was significantly lower. Among women, Negative Affect was significantly lower among smokers than nonsmokers. An investigation of each subscale showed that Perceived Ill Health and General Well-Being - Negative Affect were significantly lower.

No significant difference was seen in GHQ scores among men, but female smokers had a significantly higher score than nonsmokers.

There were 166 men (24.7%) and 19 women (2.3%) diagnosed as having a tobacco dependence. Two hundred and thirty-four men (34.8%) and 20 women (2.4%) were nondependent smokers. Accordingly, 41.5% of male smokers and 49% of female smokers had a tobacco dependence (Table 3). There was no sex difference in the percentages (p=0.40, by Fisher's exact test).

Regarding the 1st item of diagnostic criteria of ICD-10 tobacco dependence (strong desire for drugs) there was agreement by 245 men (63.5%) and 26 women (68%); on the 2nd item (uncontrol) by 266 men (68.9%) and 27 women (71%); on the 3rd item (withdrawal state) by 176 men (45.6%) and 16 women (42%); on the 5th item (preoccupation) by 2 men (0.5%) and 0 women; and on the 6th item (use despite harmful consequences) by 114 men (29.5%) and 11 women (29%). The 4th item (tolerance) was excluded from the CIDI because almost no tolerance results from tobacco dependence.

Table 3. Proportion of Dependent Smoker, Nondependent Smoker, and Nonsmoker.

|          | Men   |   | Women |   |
|----------|-------|---|-------|---|
|          | N     | % | N     | % |
| Dependent smoker | 166   | 24.7% | 19   | 2.3% |
| Nondependent smoker | 234   | 34.8% | 20   | 2.4% |
| Nonsmoker | 273   | 40.6% | 779  | 95.2% |
| Total    | 673   | 100.0% | 818  | 100.0% |
Table 4. The Scores for Each Scale of Smokers and Nonsmokers among Men and Women.

|                  | Smoker                          | Nonsmoker                       | p=  |
|------------------|---------------------------------|---------------------------------|-----|
|                  | Mean   | SD   | N   | Mean   | SD   | N   |     |
| Age              |        |      |     |        |      |     |     |
| Men              | 44.9   | 11.4 | 367 | 48.0   | 12.0 | 255 | 0.001 |
| N of Cigarettes per Day | 22.0 | 9.3 | 358 | -      | -    | -   |     |
| NEO-FFI          |        |      |     |        |      |     |     |
| Neuroticism (N)  | 21.7   | 5.1  | 367 | 21.9   | 4.9  | 252 | 0.435 |
| Extraversion (E) | 23.8   | 3.8  | 367 | 23.1   | 4.1  | 252 | 0.039 |
| Openness (O)     | 25.7   | 4.6  | 367 | 26.9   | 4.3  | 252 | 0.001 |
| Agreeableness (A)| 28.0   | 3.9  | 367 | 28.1   | 3.8  | 252 | 0.828 |
| Conscientiousness (C) | 27.0 | 4.6 | 367 | 26.8   | 4.8  | 252 | 0.391 |
| SUBI: Positive Affect |       |      |     |        |      |     |     |
| General Well-Being - Positive Affect | 35.5 | 6.0 | 367 | 35.8  | 6.1 | 252 | 0.406 |
| Expectation-Achievement Congruence | 5.4  | 1.5 | 364 | 5.6   | 1.4 | 246 | 0.025 |
| Confidence in Coping | 6.0  | 1.3 | 367 | 5.9   | 1.4 | 246 | 0.465 |
| Transcendence    | 4.9    | 1.2  | 366 | 4.9    | 1.3  | 246 | 0.782 |
| Family Group Support | 6.3  | 1.4 | 365 | 6.5   | 1.3 | 246 | 0.098 |
| Social Support   | 5.7    | 1.5  | 367 | 5.8    | 1.5  | 246 | 0.360 |
| SUBI: Negative Affect |       |      |     |        |      |     |     |
| Primary Group Concern | 7.5   | 1.1  | 297 | 7.4    | 1.2  | 219 | 0.992 |
| Inadequate Mental Mastery | 16.7 | 2.5 | 367 | 16.6   | 2.6 | 246 | 0.661 |
| Perceived Ill Health | 15.1 | 2.0 | 365 | 15.1   | 2.0 | 246 | 0.804 |
| Deficiency in Social Contacts | 7.6  | 1.1 | 365 | 7.6    | 1.1 | 246 | 0.391 |
| General Well-Being - Negative Affect | 7.6  | 1.2 | 365 | 7.6    | 1.3 | 246 | 0.522 |
| GHQ-12           | 2.9    | 2.7  | 366 | 2.8    | 2.8 | 252 | 0.982 |
| Women            |        |      |     |        |      |     |     |
| Age              | 36.9   | 9.6  | 36  | 46.0   | 11.1 | 741 | 0.000 |
| N of Cigarettes per Day | 13.3 | 7.5 | 36 | -      | -    | -   |     |
| NEO-FFI          |        |      |     |        |      |     |     |
| Neuroticism (N)  | 22.8   | 6.3  | 36  | 22.7   | 5.3  | 741 | 0.611 |
| Extraversion (E) | 26.0   | 4.7  | 36  | 23.6   | 3.7  | 741 | 0.001 |
| Openness (O)     | 27.3   | 5.1  | 36  | 26.6   | 4.3  | 741 | 0.823 |
| Agreeableness (A)| 27.8   | 4.1  | 36  | 29.7   | 3.7  | 741 | 0.020 |
| Conscientiousness (C) | 27.5 | 5.6 | 36  | 26.3   | 4.3  | 741 | 0.076 |
| SUBI: Positive Affect |       |      |     |        |      |     |     |
| General Well-Being - Positive Affect | 34.7 | 6.9 | 36  | 34.9   | 5.7  | 732 | 0.727 |
| Expectation-Achievement Congruence | 5.2  | 1.5  | 36  | 5.1    | 1.2  | 736 | 0.586 |
| Confidence in Coping | 5.8  | 1.5  | 36  | 5.5    | 1.3  | 736 | 0.242 |
| Transcendence    | 4.6    | 1.5  | 36  | 4.7    | 1.2  | 726 | 0.617 |
| Family Group Support | 5.9  | 1.6  | 36  | 6.1    | 1.4  | 734 | 0.483 |
| Social Support   | 5.6    | 1.8  | 36  | 5.8    | 1.5  | 734 | 0.207 |
| SUBI: Negative Affect |       |      |     |        |      |     |     |
| Primary Group Concern | 7.5   | 1.5  | 23  | 7.4    | 1.2  | 654 | 0.857 |
| Inadequate Mental Mastery | 15.4 | 2.8 | 36  | 16.2   | 2.6  | 736 | 0.194 |
| Perceived Ill Health | 14.3 | 2.3 | 36  | 14.6   | 2.0  | 736 | 0.046 |
| Deficiency in Social Contacts | 7.4  | 1.3 | 36  | 7.7    | 1.1  | 736 | 0.975 |
| General Well-Being - Negative Affect | 7.0  | 1.7 | 36  | 7.6    | 1.2  | 734 | 0.009 |
| GHQ-12           | 4.2    | 3.4  | 36  | 2.9    | 2.9  | 739 | 0.018 |

**SD** : Standard Deviation  
NEO-FFI : NEO Five-Factor Inventory  
SUBI : Subjective Well-Being Inventory  
GHQ-12 : 12-Item General Health Questionnaire
Table 5 shows a comparison of age, number of cigarettes per day, and the psychological scale scores between smokers with and without a tobacco dependence among men. Those with a tobacco dependence tended to smoke more cigarettes than smokers without a tobacco dependence. Openness was significantly higher as a personality trait. A logistic regression analysis was carried out with the score on each scale of the NEO-FFI and age as the explanatory variables and either a dependent smoker or a nondependent smoker as the response variable. As a result, it was found that only the regression coefficient of Openness was significant (p=0.03), suggesting that the level of Openness is an independent risk factor of tobacco dependence among male smokers. On subjective well-being, the score for Perceived Ill Health of SUBI was significantly lower among men, showing that there were more physical complaints. No significant difference was seen in GHQ. Among women, no significant results were obtained in any scores.

The diagnostic criteria for tobacco withdrawal were fulfilled by 128 men (33.2%) among male smokers and 13 women (33%) among female smokers. Table 6 compares age, number of cigarettes per day, and the psychological scale scores between those who did and did not fulfill the criteria for tobacco withdrawal among male smokers. The scores for Neuroticism and Openness were significantly higher for those who fulfilled the diagnostic criteria for tobacco withdrawal than for those who did not. The same logistic regression analysis that was carried out for dependence was also carried out for withdrawal. The regression coefficients of Neuroticism and Openness were significant (p=0.04, 0.02, respectively), suggesting that the high score of each is an independent risk factor of tobacco withdrawal among male smokers. Negative Affect, Inadequate Mental Mastery, Perceived Ill Health, and Deficiency in Social Contacts of SUBI were all significantly low among male smokers with tobacco withdrawal. The GHQ score also tended to be high. No significant results were observed in any score among women.

**DISCUSSION**

This study revealed that smokers are more extroverted than nonsmokers among both men and women. Moreover, 41.5%...
of male smokers and 49% of female smokers have a tobacco dependence. Among male smokers, a high score for Openness of the NEO-FFI is an independent risk factor for tobacco dependence, and a relation was suggested between physical complaints and tobacco dependence. It was also found that withdrawal is related to the level of Negative Affect, and that the high scores for Neuroticism and Openness of the NEO-FFI are independent risk factors of tobacco withdrawal among male smokers.

According to the National Nutrition Survey, the smoking rate in 1996 was 55.1% among men and 13.3% among women aged 20 years and above. The results of the present survey were about the same for men, but showed that about one-third of women smoked. This may have been affected by the rural region of the survey or the age distribution of the responders; that is, there were fewer women in their 20s with a high smoking rate.

From an interview survey by CIDI of 200 randomly-selected people from the general population of Takayama City, Gifu Prefecture, Kawakami et al. reported a life-time prevalence of ICD-10 tobacco dependence of 48% among current male smokers. Miyasato and Ohara conducted a survey by mailed questionnaire of 100 men each in their 20s, 30s, 40s, and 50s in the Tokyo Metropolitan Area, and reported that 40.9% of subjects could be categorized as tobacco dependent according to the ICD-10. The results of the present survey agree well with the results of these past surveys.

The result that smokers have a higher Extraversion score than nonsmokers agrees with past studies using NEO. In many investigations using other personality measures, extraversion was higher among smokers than nonsmokers. For measures other than Extraversion in the present study, sex differences were recognized; among males smokers scored lower than nonsmokers in Openness, while females scored low in Agreeableness. According to the study by Kikuchi et al., among males smokers tended to score lower in Openness and Neuroticism than nonsmokers, whereas no such differences were seen among females.

Madden et al. grouped twin subjects into 3 groups according to the severity of nicotine withdrawal and investigated its rela-

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Table 6. The Scores for Each Scale of Smokers with and without Tobacco Withdrawal among Men.

| Scale                       | Smokers with Tobacco Withdrawal | Smokers without Tobacco Withdrawal |
|-----------------------------|---------------------------------|------------------------------------|
|                             | Mean   | SD    | N    | Mean   | SD    | N    | p=   |
| Age                         | 43.5   | 11.3  | 129  | 45.6   | 11.4  | 271  | 0.090 |
| N of Cigarettes per Day     | 22.8   | 9.5   | 124  | 21.6   | 9.1   | 261  | 0.220 |
| NEO-FFI                     |        |       |      |        |       |      |      |
| Neuroticism (N)             | 22.6   | 4.6   | 129  | 21.3   | 5.2   | 263  | 0.019 |
| Extraversion (E)            | 24.2   | 4.1   | 129  | 23.6   | 3.5   | 263  | 0.199 |
| Openness (O)                | 26.8   | 4.5   | 128  | 25.1   | 4.3   | 263  | 0.001 |
| Agreeableness (A)           | 27.6   | 3.8   | 129  | 28.1   | 4.0   | 263  | 0.360 |
| Conscientiousness (C)       | 26.9   | 4.1   | 129  | 27.0   | 4.7   | 263  | 0.849 |
| SUBI: Positive Affect       | 35.6   | 6.2   | 129  | 35.3   | 6.1   | 263  | 0.843 |
| General Well-Being - Positive Affect | 5.5   | 1.5   | 129  | 5.3    | 1.5   | 259  | 0.212 |
| Expectation-Achievement Congruence | 5.2   | 1.3   | 129  | 5.2    | 1.3   | 265  | 0.983 |
| Confidence in Coping        | 5.9    | 1.3   | 129  | 6.0    | 1.3   | 265  | 0.489 |
| Transcendence               | 5.0    | 1.2   | 128  | 4.9    | 1.2   | 264  | 0.427 |
| Family Group Support        | 6.3    | 1.4   | 128  | 6.3    | 1.3   | 262  | 0.771 |
| Social Support              | 5.6    | 1.4   | 129  | 5.8    | 1.5   | 263  | 0.268 |
| SUBI: Negative Affect       | 51.2   | 5.4   | 129  | 53.0   | 5.4   | 262  | 0.002 |
| Primary Group Concern       | 7.4    | 1.2   | 106  | 7.5    | 1.1   | 211  | 0.249 |
| Inadequate Mental Mastery   | 16.3   | 2.3   | 129  | 16.9   | 2.6   | 264  | 0.031 |
| Perceived Ill Health        | 14.7   | 2.1   | 129  | 15.3   | 1.9   | 262  | 0.002 |
| Deficiency in Social Contacts| 7.4    | 1.2   | 129  | 7.7    | 1.0   | 262  | 0.020 |
| General Well-Being - Negative Affect | 7.6   | 1.2   | 129  | 7.7    | 1.2   | 261  | 0.415 |
| GHQ-12                      | 3.3    | 2.8   | 129  | 2.7    | 2.8   | 264  | 0.069 |

SD : Standard Deviation
NEO-FFI : NEO Five-Factor Inventory
SUBI : Subjective Well-Being Inventory
GHQ-12 : 12-Item General Health Questionnaire
tionship with the personality scales: Eysenck Personality Questionnaire (EPQ) [32] and Tridimensional Personality Questionnaire (TPQ) [33]. They found that only Neuroticism of EPQ was significantly related. Harm Avoidance of TPQ tended to be high in those with moderate or severe withdrawal, and no relationships with other personality traits were reported [20].

From a study using TPQ, Pomerleau et al. reported that Novelty Seeking and Reward Dependence were related to the start of smoking, and that the degree of dependence was related to Harm Avoidance [16]. Breslau et al. also reported that the Neuroticism of the EPQ was related to tobacco dependence [40]. Because Harm Avoidance of TPQ is closely related with Neuroticism of NEO-FFI or EPQ, it may be predicted that a difference would appear with regard to tobacco dependence or tobacco withdrawal for Neuroticism only in the NEO-FFI. However, in the present study, a difference was seen in Neuroticism for tobacco withdrawal, but no relation was found between tobacco dependence and Neuroticism.

In this study, a relationship was observed between Openness and both tobacco withdrawal and tobacco dependence. The concept of Openness appears on neither the EPQ nor TPQ. Since there are no past reports in which the relationship between tobacco dependence or withdrawal and personality was investigated using NEO, there are no past studies with which a direct comparison can be made. There have long been reports based on twin studies claiming a genetic influence on personality as well as on smoking behavior [38-39], but recently the relationships between genetic polymorphism and personality as well as smoking behavior have been clearly demonstrated as developing molecular biology. That is, a relationship between genetic polymorphism of the D2 dopamine receptor (DRD2) and nicotine addiction has been reported [37-41]. A relationship between genetic polymorphism of the DRD2 and Novelty Seeking has also been indicated [42]. Openness of the NEO-FFI would seem to imply a wide range of interests and a tendency toward positive behavior; if it is considered to be closely related to Novelty Seeking on the TPQ, it may be that the present results occur due to polymorphism of the DRD2.

That perceived health was poor among those who had a dependence suggests that there may be some people who cannot quit smoking even though they want to because of their poor physical condition. It may also be that the smoking of dependent smokers is the cause leading to their poor physical condition.

Given the limitations of the present study, ex-smokers, meaning those who had successfully quit smoking, were not considered. A comparison of ex-smokers and those with a tobacco dependence would perhaps reveal a clearer difference between those with and without a tobacco dependence. In addition, because ours was a cross-sectional survey in one specific region, it is not clear whether or not the present findings can be generalized. A future study in a different region or a follow-up survey of the same subjects would be beneficial.

Future studies should include demographic factors, social factors, comorbidity of mental symptoms, and genetic factors related to smoking [40]. An elucidation of the causes of complex smoking behavior may also contribute to the improvement of anti-smoking or smoking prevention measures.

ACKNOWLEDGEMENTS

The author would like to thank Prof. Masahiro Asai, Drs. Naohito Yamaguchi, Yutaka Ono, and Kazuo Suzuki for their kind comments and suggestions. This research was supported in part by a Grant-in-Aid for the Second Term Comprehensive 10-Year Strategy for Cancer Control from the Ministry of Health and Welfare, Japan.

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