An Innovative Questionnaire Examining Psychological Nicotine Dependence, “The Kano Test for Social Nicotine Dependence (KTSND)”

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The Kano Test for Social Nicotine Dependence (KTSND) working group

Abstract: A smoking habit is maintained by psychological and physical nicotine dependence. We thought up a new concept, “social nicotine dependence”, which is a part of psychological dependence, and developed a new questionnaire, “The Kano Test for Social Nicotine Dependence (KTSND)” version 2. The KTSND has ten questions with a total score of 30. In order to investigate the validity of the KTSND, we applied it to the employees of 10 pharmaceutical companies and collected 344 respondents. The total KTSND scores of 18.4 ± 5.2 (mean ± SD, n = 105) for smokers were significantly higher than those of 14.2 ± 6.1 (n = 88) for ex-smokers, and 12.1 ± 5.6 (n = 151) for non-smokers. Each question produced significantly different scores among these groups. Smokers were subclassified by factors of physical nicotine dependence, namely, “number of cigarettes smoked per day” and “time until the first cigarette of the day”. The total scores did not reflect these physical factors. On the other hand, the total KTSND scores reflected one of the psychological nicotine dependence factors, namely, “the stages for quitting smoking”. The KTSND scores were significantly different among 4 groups: 22.4 ± 6.3 for immotives, 19.0 ± 3.9 for pre-contemplators, 16.1 ± 3.8 for contemplators and 14.5 ± 5.9 for preparers. These results showed that the KTSND reflected the smoking status and the stages for quitting smoking. We consider that the KTSND is a useful method to evaluate psychological aspects of smoking.

Key words: the Kano Test for Social Nicotine Dependence (KTSND), smoking, nicotine dependence, psychological nicotine dependence, physical nicotine dependence.

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Introduction

It is generally recognized that nicotine dependence consists of physical nicotine dependence and psychological nicotine dependence. In order to examine this physical nicotine dependence, the Fagerström Tolerance Questionnaire (FTQ) [1] or the Fagerström Test for Nicotine Dependence (FTND) [2] has been widely used. In 2002, Dijkstra et al [3] investigated if the FTND could measure psychological nicotine dependence, and concluded that when the FTND and the indices of psychological dependence were combined in one model, the psychological dependence measures predicted quitting activity more consistently than the FTND. However, up to the present date, a short, convenient self-report measure like the FTND for psychological nicotine dependence has not been available.

In 2003, Kano thought up the concept of “social nicotine dependence” as a factor of psychological nicotine dependence and defined it as “a distorted cognition of smoking, for example, denying the ill effects of smoking or rationalization and justification of smoking as cultural and social behavior”. This status can apply not only to smokers but also to non-smokers. To evaluate this dependence, he proposed the idea of making a questionnaire. Researchers who agreed with his proposal organized the Kano Test for Social Nicotine Dependence (KTSND) working group. It consisted of 20 members (14 medical doctors, 3 dentists, one pharmacist, one nurse and one academic staff) from all over Japan. The working group members discussed the questions and point allocation by an e-mail mailing list and released the KTSND version 1 in 2004 [4]. The KTSND version 1 demonstrated the difference among smokers, ex-smokers and non-smokers with regard to the cognition of smoking. However, the overall distribution of the total scores shifted to lower scores, and some questions were difficult for respondents to answer. Consequently, the working group continued to improve the questionnaire and released version 2 in March 2005. In order to investigate the validity of the KTSND version 2, we applied it to the employees of ten pharmaceutical companies.

Methods

Questionnaire development

The KTSND version 2 (Table 1) was developed by the KTSND working group. The questionnaire consists of 10 questions with a total score of 30, namely, each question has 3 points. The point allocation of question 1 is 0 points for “definitely yes”, 1 point for “probably yes”, 2 points for “probably no” and 3 points for “definitely no”. That of questions from 2 to 10 is 0 points for “definitely no”, 1 point for “probably no”, 2 points for “probably yes” and 3 points for “definitely yes”. In order to ensure face validity, the questions were pre-tested on various occasions.
Table 1. The Kano Test for Social Nicotine Dependence (KTSND)

<table>
<thead>
<tr>
<th>Q</th>
<th>Statement</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Smoking itself is a disease</td>
<td>DN(3), PN(2), PY(1), DY(0)</td>
</tr>
<tr>
<td>2</td>
<td>Smoking is a part of culture</td>
<td>DN(0), PN(1), PY(2), DY(3)</td>
</tr>
<tr>
<td>3</td>
<td>Tobacco is one of life's pleasures</td>
<td>DN(0), PN(1), PY(2), DY(3)</td>
</tr>
<tr>
<td>4</td>
<td>Smokers' lifestyles may be respected</td>
<td>DN(0), PN(1), PY(2), DY(3)</td>
</tr>
<tr>
<td>5</td>
<td>Smoking sometimes enriches people's life</td>
<td>DN(0), PN(1), PY(2), DY(3)</td>
</tr>
<tr>
<td>6</td>
<td>Tobacco has positive physical or mental effects</td>
<td>DN(0), PN(1), PY(2), DY(3)</td>
</tr>
<tr>
<td>7</td>
<td>Tobacco has effects to relieve stress</td>
<td>DN(0), PN(1), PY(2), DY(3)</td>
</tr>
<tr>
<td>8</td>
<td>Tobacco enhances the function of smokers' brains</td>
<td>DN(0), PN(1), PY(2), DY(3)</td>
</tr>
<tr>
<td>9</td>
<td>Doctors exaggerate the ill effects of smoking</td>
<td>DN(0), PN(1), PY(2), DY(3)</td>
</tr>
<tr>
<td>10</td>
<td>People can smoke at places where ashtrays are available</td>
<td>DN(0), PN(1), PY(2), DY(3)</td>
</tr>
</tbody>
</table>

DN: Definitely No, PN: Probably No, PY: Probably Yes, DY: Definitely Yes ( ) = each score

Sampling

The subjects were male and female employees of 10 pharmaceutical companies, all of whom were university-educated. The sampling period was between March and April 2005. The KTSND (Table 1) was distributed mainly to the Fukuoka or Kitakyushu branch of each company without showing point allocation. In each company, sales representatives handled the administration and collection of the questionnaires. They were collected within two weeks of distribution. We asked respondents' background to identify gender, age and smoking status (smoker, ex-smoker and non-smoker). Smokers were asked additional questions in the questionnaire. 1. How many cigarettes per day do you smoke? 2. How many years have you been smoking? 3. When do you smoke your first cigarettes of the day after you wake up? 4. Do you think about quitting smoking? (choices: a) I would never quit smoking. b) I am interested in quitting smoking, but not within 6 months. c) I plan to quit smoking within 6 months, but not within one month. d) I plan to quit smoking within one month.)

Statistical analysis

All data is presented as the mean ± SD, which is indicated by bars in figures. Statistical analysis was performed by the KaleidaGraph (Synergy Software, Reading, PA, USA) statistical analysis system. Significant statistical differences were subjected to one-way ANOVA with a post hoc test (Scheffe). P < 0.05 was considered to be statistically significant.

Results

Background characteristics of subjects

We received answers from 382 respondents. A complete data set was available from 344 respondents (Table 2). They consisted of 105 current smokers (30.5%), 88 ex-smokers (14.2%) and 151 non-smokers (43.9%). The number of males (76.5%) was greater than that of females (23.5%). The majority of the subjects were in their 30's (45.4%), followed
by 40’s (24.7%), 20’s (23.8%) and 50’s (6.1%). Among smokers, the smoking status of 11 to 20 cigarettes per day was 48.6%, followed by 1 to 10 cigarettes (31.4%), 21 to 30 cigarettes (13.3%) and more than 31 cigarettes (6.7%). The time until the first cigarette of the day was 23.5% for within 5 minutes, 33.3% for 6 to 30 minutes, 20.0% for 31 to 60 minutes and 22.9% for more than 61 minutes. With regard to the stages for quitting smoking, the smokers who answered, “I would never quit smoking” are defined as immotives in accordance with Dijkstra et al. [5]; “I am interested in quitting smoking, but not within 6 months” are precontemplators; “I plan to quit smoking within 6 months, but not within one month” are contemplators; “I plan to quit smoking within one month” are preparers [6]. Precontemplators (47.6%) were the most predominant, followed by contemplators (22.9%), immotives (17.1%) and preparers (12.4%).

Table 2. Background characteristics of subjects

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>All the subjects</td>
<td>344</td>
<td>100.0</td>
</tr>
<tr>
<td>Smoking status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoker</td>
<td>105</td>
<td>30.5</td>
</tr>
<tr>
<td>Ex-smoker</td>
<td>88</td>
<td>25.6</td>
</tr>
<tr>
<td>Non-smoker</td>
<td>151</td>
<td>43.9</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>263</td>
<td>76.5</td>
</tr>
<tr>
<td>Female</td>
<td>81</td>
<td>23.5</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-29</td>
<td>82</td>
<td>23.8</td>
</tr>
<tr>
<td>30-39</td>
<td>156</td>
<td>45.4</td>
</tr>
<tr>
<td>40-49</td>
<td>85</td>
<td>24.7</td>
</tr>
<tr>
<td>50-59</td>
<td>21</td>
<td>6.1</td>
</tr>
<tr>
<td>Smokers only</td>
<td>105</td>
<td>100.0</td>
</tr>
<tr>
<td>Cigarettes per day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-10</td>
<td>33</td>
<td>31.4</td>
</tr>
<tr>
<td>11-20</td>
<td>51</td>
<td>48.6</td>
</tr>
<tr>
<td>21-30</td>
<td>14</td>
<td>13.3</td>
</tr>
<tr>
<td>31-</td>
<td>7</td>
<td>6.7</td>
</tr>
<tr>
<td>The time until the first cigarette of the day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within 5 minutes</td>
<td>25</td>
<td>23.8</td>
</tr>
<tr>
<td>6 to 30 minutes</td>
<td>35</td>
<td>33.3</td>
</tr>
<tr>
<td>31 to 60 minutes</td>
<td>21</td>
<td>20.0</td>
</tr>
<tr>
<td>After 60 minutes</td>
<td>24</td>
<td>22.9</td>
</tr>
<tr>
<td>Stages for quitting smoking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immotive</td>
<td>18</td>
<td>17.1</td>
</tr>
<tr>
<td>Precontemplator</td>
<td>50</td>
<td>47.6</td>
</tr>
<tr>
<td>Contemplator</td>
<td>24</td>
<td>22.9</td>
</tr>
<tr>
<td>Preparer</td>
<td>13</td>
<td>12.4</td>
</tr>
</tbody>
</table>
The Kano Test for Social Nicotine Dependence (KTSND)

![Bar chart showing total scores of the KTSND among smokers, ex-smokers, and non-smokers.](image)

**Fig. 1.** The total scores of the KTSND among smokers, ex-smokers, and non-smokers. Scales represent the total scores of the KTSND. Data is presented as the mean ± SD. *: P < 0.05, **: P < 0.01.

<table>
<thead>
<tr>
<th>Question</th>
<th>Non-smokers Mean ± SD</th>
<th>Ex-smokers Mean ± SD</th>
<th>Smokers Mean ± SD</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q 1: Smoking itself is a disease</td>
<td>1.12 ± 1.00</td>
<td>1.35 ± 1.11</td>
<td>1.65 ± 1.02</td>
<td>0.0004</td>
</tr>
<tr>
<td>Q 2: Smoking is a part of culture</td>
<td>1.36 ± 1.00</td>
<td>1.35 ± 1.03</td>
<td>1.71 ± 1.04</td>
<td>0.0131</td>
</tr>
<tr>
<td>Q 3: Tobacco is one of life’s pleasures</td>
<td>2.06 ± 0.95</td>
<td>2.10 ± 0.97</td>
<td>2.51 ± 0.69</td>
<td>0.0002</td>
</tr>
<tr>
<td>Q 4: Smokers’ lifestyles may be respected</td>
<td>1.19 ± 0.95</td>
<td>1.56 ± 0.98</td>
<td>2.04 ± 0.77</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Q 5: Smoking sometimes enriches people’s life</td>
<td>1.48 ± 1.00</td>
<td>1.63 ± 0.97</td>
<td>1.87 ± 0.87</td>
<td>0.0072</td>
</tr>
<tr>
<td>Q 6: Tobacco has positive physical or mental effects</td>
<td>0.74 ± 0.84</td>
<td>1.13 ± 0.97</td>
<td>1.50 ± 0.95</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Q 7: Tobacco has effects to relieve stress</td>
<td>1.53 ± 0.88</td>
<td>1.66 ± 0.97</td>
<td>2.20 ± 0.75</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Q 8: Tobacco enhances the function of smokers’ brains</td>
<td>0.73 ± 0.82</td>
<td>0.91 ± 0.87</td>
<td>1.27 ± 0.93</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Q 9: Doctors exaggerate the ill effects of smoking</td>
<td>0.40 ± 0.69</td>
<td>0.73 ± 0.97</td>
<td>1.21 ± 0.95</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Q 10: People can smoke at places where ashtrays are available</td>
<td>1.50 ± 1.03</td>
<td>1.80 ± 1.08</td>
<td>2.42 ± 0.70</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

**Table 3. Scores of each question**

**Total scores of the KTSND among smokers, ex-smokers and non-smokers**

The total scores of smokers (18.4 ± 5.2) were significantly higher than those of ex-smokers (14.2 ± 6.1) and non-smokers (12.1 ± 5.6) (P < 0.01). Also, the scores of ex-smokers were significantly higher than non-smokers (P < 0.05) (Fig. 1).

**Scores for each question**

With regard to the 10 questions of the KTSND, scores for each question show significant differences among smokers, ex-smokers, and non-smokers (Table 3). In smokers, Q3 (Tobacco is one of life’s pleasures) showed the highest score (2.51 ± 0.69), followed by Q 10.
(People can smoke at places where ashtrays are available) (2.42±0.70) and Q7 (Tobacco has effects to relieve stress) (2.20±0.75). Even ex-smokers and non-smokers tended to answer positively to Q3.

**Analysis of smokers**

1) Cigarettes smoked per day

The total scores of smokers with 21 to 30 cigarettes per day (22.5±5.9) were significantly (*P*<0.05) higher than those with 1 to 10 cigarettes per day (17.2±5.4) and 11 to 20 cigarettes per day (17.8±4.3) (Fig. 2). However, the total scores of smokers with more than 31 cigarettes (19.4±5.0) did not show any differences compared to other groups.

2) The time until the first cigarette of the day

The total scores of smokers classified by the time until the first cigarette of the day did not show any statistical difference among the four groups (Fig. 3): within 5 minutes (20.3±4.4), 6 to 30 minutes (18.8±4.9), 31 to 60 minutes (17.4±6.1) and after 60 minutes (16.6±4.9).

3) The stages for quitting smoking

The total scores of immotives (22.4±6.3) were significantly (*P*<0.01) higher than those of preparers (14.5±5.9) and contemplators (16.1±3.8) (Fig. 4). Furthermore, the total scores of precontemplators (19.0±3.9) were significantly (*P*<0.05) higher than those of preparers.
The Kano Test for Social Nicotine Dependence (KTSND)  

Fig. 4. The total KTSND scores in smokers subclassified by the stages for quitting smoking. Scales represent the total scores of the KTSND in smokers. Data is presented as the mean ± SD. *: $P < 0.05$, **: $P < 0.01$.

Discussion

We consider that the significance of the KTSND is: 1. the potential for quitting smoking might be estimated more accurately if combined with the FTND, 2. if it is used for quitters, it may predict the likelihood of recurrence of smoking, 3. it may diagnose the severity of distorted cognition of smoking as psychological nicotine dependence, 4. even non-smokers might use the KTSND to check if they show attitudes toward acceptance of smoking. In order to cover the significance of the KTSND and also to reflect the definition of social nicotine dependence, we carefully created the 10 questions.

In the KTSND version 2, the items asking about the glorification of smoking are: Q2 smoking is a part of culture, Q3 smoking is one of life’s pleasures, Q4 smokers’ lifestyles may be respected, and Q5 smoking sometimes enriches people’s life. The items asking about the rationalization and justification of smoking are: Q6 tobacco has positive physical and mental effects, Q7 tobacco has effects to relieve stress, and Q8 tobacco enhances the function of smokers’ brains. Furthermore, the items about denying the ill effects of smoking and passive smoking are: Q1 smoking itself is a disease, Q9 doctors exaggerate the ill effects of smoking, and Q10 people can smoke at places where ashtrays are available. Although each question of version 1 had two or three answering choices, all the questions in version 2 have four answering choices, so that the respondents chose compellingly either the yes side or no side choices, to avoid neutral answers. In our results, smokers answered strongly positive in Q3, Q7 and Q10. We assume that these items are core issues of psychological nicotine dependence. Even ex-smokers and non-smokers answered positively, especially to
Q3. This kind of positive image of tobacco might be the greatest obstacle to smoking cessation or to tobacco control in society.

Dijkstra et al. emphasized the importance of psychological nicotine dependence and pointed out several different cognitive factors that cause and maintain this dependence [3]. Among the factors, the core of psychological dependence lies in expectations of the positive outcomes of smoking, such as the expectations that smoking will help to relax, to socialize, to cope with anger, etc. They also explained that psychological dependence is considered to be stronger to the extent that smokers: a) expect to lose certain functions of smoking in the case of quitting [7]; b) are less confident that they will be able to stay abstinent [8]; c) expect fewer positive outcomes of quitting [7]; d) adhere more strongly to excuses to smoke [9]; and e) expect more withdrawal symptoms if they quit. With regard to ex-smokers, they pointed out that those who still have high residual outcome expectations (ROEs) tend to relapse to smoking [10]. The dimensions of the ROEs of smoking are the ability to concentrate, to relax, to control yourself when angry, to feel the satisfaction of socializing, to cope with a depressed mood, to be satisfied with your body weight, etc. Our concept appears to agree with their thoughts, and the questions in the KTSND version 2 fit them. As the FTND [2] cannot be applied to ex-smokers, we strongly recommend applying the KTSND instead.

In the FTND, the time until the first cigarette of the day (TTF) and the number of cigarettes smoked per day (CPD) are considered to be the most important factors of physical nicotine dependence [2]. In this study, we originally planned to use the FTND for smokers in combination with the KTSND, but we used TTF and CPD instead of the FTND to avoid complicated procedures. The total scores of the KTSND did not reveal any differences among subgroups classified by the TTF. However, with regard to the CPD, smokers who smoke 21 to 30 cigarettes per day showed the highest score. In this study, the smokers who smoked more than 31 cigarettes per day were few in number, therefore we cannot conclude that the KTSND scores correlate with the CPD. Further accumulation of subjects will be needed to confirm this point.

On the other hand, our data demonstrated that the KTSND scores well reflected the four stages for quitting smoking. In 1998, Dijkstra et al. [5] reported that these four stages differed from each other through the factors pertaining to positive outcomes and perceived self-efficacy. They showed no differences among the four stages concerning the CPD, the FTND and the number of smoking years. It can be understood that the four stages for quitting smoking relate to psychological nicotine dependence, and our data could support their results.

This time, we targeted the employees of pharmaceutical companies. The reason was that their academic background and medical knowledge were almost the same levels, so we expected only the difference by the smoking status to be detected. Moreover, we expected the advantage of little description leakage and incompleteness, when they answered the...
KTSND. Judging from the occupation, our subjects have the possibility that the smoking rate is lower and the CPD is smaller in number than the general population. As far as we know, smoking is prohibited in the offices in which we distributed the KTSND. That may also influence the CPD. In the general population, the ratio of the stages for quitting smoking among smokers is 30~40% for precontemplators (including immotives), 55~60% for contemplators and 3~5% for preparers [11]. On the other hand, that of our subjects was 17.1% for immotives, 47.6% for precontemplators, 22.9% for contemplators and 12.4% for preparers. Thus, our subjects seem to show polarization in the stages for quitting smoking.

In summary, we introduced our new questionnaire, the Kano Test for Social Nicotine Dependence (KTSND) to measure psychological nicotine dependence. This study demonstrated that the KTSND well reflected the smoking status of the subjects and the stages for quitting smoking among smokers, although it did not show a relationship with the factors of physical nicotine dependence. The subjects we examined were pharmaceutical company employees, who are well educated and have medical knowledge. We have to use the KTSND for subjects with various backgrounds and accumulate the data of smokers, ex-smokers and non-smokers. In order to sufficiently complement the FTND, we urge the use of the KTSND in smoking cessation programs.

Acknowledgement

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References

3. Dijkstra A & Tromp D (2002): Is the FTND a measure of physical as well as psychological tobacco
心理的ニコチン依存を評価する新しい質問票
—加濃式社会的ニコチン依存度調査票（KTSND)—

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5北里大学病院 薬剤部 6茅ヶ崎健研所 7国立成育医療センター研究所 8加濃式社会的ニコチン依存度ワーキンググループ

要旨：喫煙習慣は心理的依存と身体的依存から成り立っている。我々は心理的依存の一要素として社会的ニコチン依存という新しい概念を考え出し、それを評価する新しい調査票として「加濃式社会的ニコチン依存度調査票 Version 2」（the Kano Test for Social Nicotine Dependence；KTSND）を作成した。KTSND は10問30点満点からなるが、その有用性を検討するため製薬会社社員に配布し、344名から有効な回答を得た。喫煙者（105名）、元喫煙者（88名）、非喫煙者（151名）の各群で、総合得点は18.4±5.2、14.2±6.1、12.1±5.6と3群間でいずれも有意差を認めた。設問別の検討では10問すべてで喫煙歴による有意差を認めた。さらに喫煙者をニコチンの身体的依存の指標である「1日喫煙本数」および「朝の1本を起床何分後に吸うか」で細分類し、総合得点との関連を検討したが、ほとんど差は出なかった。これに対して禁煙のステージによる細分類では、全く禁煙の意志がないimmotives（無関心期）で22.4±6.3、precontemplators （前熟考期）が19.0±3.9、contemplators （熟考期）が16.1±3.8、preparers（準備期）が14.5±5.9と、各群間で有意差を認めた。これらの結果から、KTSND は喫煙習慣の有無や禁煙のステージをよく反映し、喫煙の心理的依存を評価する手段として有用な方法と考えられた。

キーワード：加濃式社会的ニコチン依存度調査票(KTSND), 喫煙, ニコチン依存, 心理的ニコチン依存, 身体的ニコチン依存,

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