Valitation of The Malay Version Of Fagerstrom Test For Nicotine Dependence (FTND-M) Among a Group of Male Staffs in a University Hospital

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Abstract

Objective: The aim of this study was to evaluate the validity and reliability of the Malay version of the Fagerstrom Test for Nicotine Dependence (FTND-M) based on a group of male staffs in the hospital. This study will also determine whether an abbreviated version of the FTND-M can be used as a screening tool for nicotine dependence. Methods: 107 male staffs participated in the study. They were given the FTND-M and Malay version of Mini-International Neuropsychiatric Interview (M.I.N.I.)-L component. Their carbon monoxide level measured in their breath by using exhaled air. One week later, these participants were again given FTND-M. Result: The discriminatory ability of FTND-M was good with AUC 0.74 (P<0.01). The optimal cutoff point for FTND-M was >2 with the sensitivity of 70.1%, specificity of 70%, PPV of 79.7% and NPV of 58.3%. The FTND-M had moderate internal consistency with a Cronbach’s alpha of 0.67. The test-retest reliability after 1 week was fair (Spearman’s rho=0.5, p<0.01). Total score of FTND-M was significant correlated with the biomarker (Spearman’s rho=0.46, P<0.01). Factor extraction revealed 3-items from the 6 items FTND-M and became Brief FTND-M. The most valid cutoff point for BFTND-M >1 which gave 78%, 62%, 77.6% and 62.5% respectively, which were also similar to that of FTND-M. Conclusion: The Malay version of FTND displayed and BFTND-M displayed fair psychometric performance among the male staffs, who were smokers in University Malaya Medical Center, Malaysia.

Keywords: Smoking, Fagerstrom Test for Nicotine Dependence, smoking-related disease, Fagerstrom Tolerance Questionnaire

Introduction

According to the World Health Organization (WHO) estimation, about a third of the male adult global population smokes and smoke-related disease causes 4 million deaths globally[1]. In Malaysia, about half of all Malaysian men smoke and the age of smoking is getting younger. Every year, nearly 10,000 people die of smoking-related
diseases[2]. Smokers will not only have physical, but psychological dependent to nicotine after few years of regular smoking. This was due to the addictive effect that nicotine exerted in hippocampus, reward and emotion center in the brain[3]. Smokers will continue to smoke even though they know that smoking is harmful to them because nicotine is positively reinforcing the reward center. Smokers will have to smoke regularly in order to avoid the physical or psychological discomfort (withdrawal symptoms) due to the short half life of nicotine[3].

The Fagerstrom Test for Nicotine Dependence (FTND) is a self-report questionnaire which is easy to use, feasible, non invasive, low cost, and it gives immediate feedback with good sensitivity and specificity to assess the nicotine dependence among the smokers. Hence, FTND is commonly used to assess the nicotine dependence for clinical treatment and research[4]. FTND contains 6 items which are derived from the eight-item Fagerstrom Tolerance Questionnaire (FTQ)[5]. The six items are – assessing the time of the first cigarette after waking, the difficulty to refrain from the smoking forbidden places, the hardest cigarette to give up in a day, the amount of the cigarettes used per day, the ability to smoke less during the first hours after awakening compare to the rest of the day and the ability to stop smoking in case of sickness[4].

The validity and reliability of English version of FTND was established[4]. The purpose of this study is to evaluate the validity and reliability of the Malay version of the FTND (FTND-M) based on a group of male staffs in the hospital. This study will also determine whether an abbreviated version of the FTND-M can be used as a screening tool for nicotine dependence.

Methods

Approval from the Medical Ethical Committee (MEC), University Malaya Medical Centre, Kuala Lumpur was obtained to conduct the study. Permission from the original author of the FTND was obtained.

Study design

Stage 1

The English version (“Source language”) of FTND was translated into Malay language (“Target language”) by two doctors who were bi-lingual (Malay and English). The two forward versions were later compared and combined into one version which was called “reconciliation” version (The first version). Another two doctors who were also bi-lingual and blinded to the original FTND, would then back-translate the “reconciliation version” into English version (back-translated version). Later, the author and another doctor assessed semantic equivalence between the English version (“Source language”) and the back-translated version for each item and made the appropriate changes of the item descriptions in Malay. This produced the second version of the FTND in Malay language[6].

Stage 2

The second version of the FTND in Malay version was pilot tested among 6 medical staffs from psychiatric ward in University Malaya Medical Centre, who were native speakers of Malay language. Any flaws which were identified by these 6 respondents were then corrected. The finalized version of FTND in Malay language (FTND-M) was reviewed by a psychiatrist to ensure satisfactory face, semantic, criterion and conceptual equivalence [7].
Stage 3
A group of 107 male staffs who smoke were approached for the study. They agreed to participate and completed the Malay version of Mini-International Neuropsychiatric Interview (M.I.N.I.-L) component[8] and FTND-M questionnaires. Besides, they were required to have their carbon monoxide level measured in their breath by using exhaled air and simple handheld breath analyzer (piCO+ Smokerlyer). This instrument provided a direct measure of the carbon monoxide in parts per million. The cut-off point between smoker and non-smoker was found to be 6 ppm CO. The piCO+ Smokerlyzer showed that the CO level of a non-smoker to be 0 to 6 ppm, a low dependence smoker to be 7 to 15 ppm and strongly addicted smokers to be over 15ppm [9]. FTND-M was compared with the carbon monoxide level among the participants. The hypothesis is that the higher score of the Malay version of FTND, the higher levels of carbon monoxide among the participants.

One week later, these participants would again complete the FTND-M but the sequence of the items was shuffled.

Data analysis
All the data were analyzed using the statistical software package, SPSS for Windows version 16.0. (Chicago, IL, USA).

Validity Testing
Receiver Operating Characteristic (ROC) analyses were applied to compare the screening performance of the FTND-M by using the M.I.N.I-L component as the standard diagnostic test of nicotine dependence. The cut-off score of the FTND-M was determined from the co-ordinate points whereby the sensitivity and specificity were optimal. The Area Under Curve (AUC) of the ROC was determined.

Factor analysis
Bartlett’s test of sphericity[10] and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy[11] were applied to assess the factorability of the data. If KMO value more that 0.6 and Bartlett’s test was significant, Principal Components Analysis (PCA) would be used to investigate item reduction. Oblique rotation was performed to allow various amount of correlation among the factors. Based on this rotation, pattern and structure matrix were produced. Due to the apparent difference between the high and low loading, pattern matrix with minimum factor loading of 0.3 was used. Internal reliability of FTND-M was calculated in express of Cronbach’s Alpha coefficient. Later, the validity test was conducted for an abbreviated version of FTND-M which derived from PCA – namely the “Brief Fagerstrom Test for Nicotine Dependence-Malay version” (BFTND-M).

Results

Characteristics of participants
A total of 107 male medical staffs, from age 20 to 58 years old, were consented and recruited for the study. 68% were married and 94.4% had at least secondary education. They began to smoke at the average of 19 years old. More than 50% had smoked more than 10 cigarettes a day.

Translation and face validity
Item 1 (How soon after you wake up do you smoke your first cigarette?) needed to be rephrased so that it matched the meaning of the original question in English (“After waking up, how soon will you smoke the first cigarette?”). In item 3 (“Which cigarette would you hate most to give up?”) the description of “hate most to give up” was revised to “find it the most difficult to avoid” so that it had equal meaning as in the
original question in English. Items 2, 4, 5 and 6 had no difficulty in translation.

**Validity of FTND-M**

The discriminatory ability of FTND-M based on M.I.N.I. was high with AUC 0.74 (P<0.01). The optimal cutoff point for FTND-M was more than 2 with the sensitivity of 70.1%, specificity of 70%, positive predictive value (PPV) of 79.7% and negative predictive value (NPV) of 58.3%. The FTND-M had moderate internal consistency with a Cronbach’s alpha of 0.67. The test-retest reliability after 1 week was fair (Spearman’s rho=0.5, p<0.01).

Table 1 showed that items 1, 3 and 4 had significant correlation with exhaled CO level. The correlation coefficients ranged from 0.36 to 0.49 (P<0.01). Item 2, 5 and 6 were not significantly correlated with exhaled CO. However, total score of FTND-M was significant correlated with the biomarker (Spearman's rho=0.46, P<0.01).

**Table 1. Correlation between items and CO**

<table>
<thead>
<tr>
<th>Question</th>
<th>CO</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Time to the first cigarette of the day</td>
<td>0.363**</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>2 Difficulty refraining from smoking forbidden place</td>
<td>0.196</td>
<td>0.04</td>
</tr>
<tr>
<td>3 Which cigarette would you hate most to give up</td>
<td>0.326**</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>4 Cigarettes per day</td>
<td>0.488**</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>5 Increase smoking in the morning</td>
<td>0.113</td>
<td>0.245</td>
</tr>
<tr>
<td>6 Continue of smoking even ill</td>
<td>0.085</td>
<td>0.382</td>
</tr>
</tbody>
</table>

**Item reduction**

The mean score of FTND-M was 3.15 (SD=2.48) which was relatively high. The CO level was 13.48ppm (SD=8.43). 62.9% of them were detected as nicotine dependence in M.I.N.I.

The Barlett’s test of sphericity was significant (p<0.01) and the KMO measure of sampling adequacy for FTND-M was 0.73. Therefore, PCA was conducted to reduce the number of items in FTND-M. In scree plot test, the rule of eigenvalue more than 1 and oblique rotation suggested that FTND-M contained two factors. (These 2 factors accounted for 57.6% of the total variance. The results show that Factor 1 was loaded by items 1, 3, 4 and Factor 2 was loaded by the other 3 items. There were cross-loading in item 1 and 5 (Table 2.) In relation to internal consistency, the respective Cronbach Alpha coefficients for factor 1 and 2 were 0.56 and 0.62

**Validity of BFTND-M**

Using the 3-item scale (items 1, 3 and 4), and a case defined as score >1, the AUC of BFTND-M (0.70, P<0.01) was still compatible with the AUC of FTND-M (0.74, P<0.01) from the ROC analysis. The
sensitivity, specificity, PPV and NPV of BFTND-M were 78%, 62%, 77.6% and 62.5% respectively, which were also similar to that of FTND-M.

**Table 2.** Oblique rotated pattern matrix from principal component analysis of FTND items

<table>
<thead>
<tr>
<th>Question</th>
<th>Factor 1</th>
<th>Factor 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Time to the first cigarette of the day</td>
<td>0.714</td>
<td>0.314</td>
</tr>
<tr>
<td>2 Difficulty refraining from smoking forbidden place</td>
<td></td>
<td>0.762</td>
</tr>
<tr>
<td>3 Which cigarette would you hate most to give up</td>
<td>0.825</td>
<td></td>
</tr>
<tr>
<td>4 Cigarettes per day</td>
<td>0.586</td>
<td></td>
</tr>
<tr>
<td>5 Increase smoking in the morning</td>
<td>0.419</td>
<td>0.569</td>
</tr>
<tr>
<td>6 Continue of smoking even ill</td>
<td></td>
<td>0.809</td>
</tr>
</tbody>
</table>

Loading below 0.3 was suppressed

**Discussion**

**Reliability of the Malay version of FTND**
This study showed that FTND-M had similar internal consistency with the original version of FTND; Cronbach’s alpha of 0.6 [4]. Test-retest reliability was fair. Revision of the items is needed in order to improve the reliability of FTND-M.

**Validity of the Malay version of FTND**
In this study, it was shown that FTND was multifactorial. There were two factors identified from principal component analysis. The three items (1, 3, 4) loaded on factor 1 were strongly correlated with the CO level. Items 2, 5 and 6 which loaded on factor 2 were found to be not correlated with the carbon monoxide level. This finding was consistent with the previous study by Heatherton et al, 1991[4]. The authors found that very few participants gained points from items 2, 5 and 6 (ranged from 11% to 29.9%) and was more related to the behavioral indices rather than biochemical levels. Therefore, there would be a need to alter these 3 items to adapt the cross-cultural differences[12]. For example, in Item 5, most of the participants would have the urge to smoke after a meal rather than “in the morning” because a meal was considered as a reward amongst the Asians after some hard work. Hence, smoking was perceived as extra reward after a meal.

**Brief version of the Malay version of FTND**
A short version of FTND-M was developed which consists of items 1, 3 and 4. These items loaded on factor 1 and significantly correlated with CO level. The 3-item BFTND-M demonstrated a comparable sensitivity, specificity, PPV and NPV with FTND-M. The optimal cut off threshold for the BFTND-M was 1 based on the ROC analysis. The internal consistency was slightly reduced in BFTND-M.

**Conclusion**
The Malay version of FTND displayed fair psychometric performance among the male
staffs, who were smokers in University Malaya Medical Center, Malaysia. The Brief version of Malay version of FTND was also comparable to FTND-M in terms of validity and reliability.

However, some of the items need to be revised for further improvement in the psychometric performance.

**Limitations**

There are few limitations in this study which were also found in previous similar studies[13]. Firstly, the sample used in the current study was male staffs in a hospital setting whereby the smoking behavior was altered as all hospitals forbid smoking. It would be useful for the researcher to investigate the psychometric and factorial structure of FTND-M in different population. Second, the sample size was relatively small. It is suggested that the sample size in a factorial analysis should be at least 200 [14].

**Acknowledgement**

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