

RESEARCH COMMUNICATION

Validity and Reliability of the Fagerstrom Test for Cigarette Dependence in a Sample of Arabic Speaking UK-Resident Yemeni Khat Chewers

Saba Kassim^{1*}, Mohamed Salam², Ray Croucher¹

Abstract

Background: The Fagerstrom Test for Cigarette Dependence (FTCD) (formally FTND) is widely used for measuring physical dependence on nicotine. **Objective:** To explore the cross cultural validity and reliability of FTCD amongst Arabic speaker cigarette consumers who chew khat leaf, a stimulant green leaf. **Methods:** The psychometric properties of the FTCD were assessed in a subsample (91 regular cigarette smokers) of purposively selected 204 UK-resident Yemeni khat chewers recruited during random visits to khat sale outlets. Data were collected via a structured face-to-face interview. Data analyses included descriptive tests and factor analysis. **Results:** Two factors were obtained by a principle axis factor analysis and these were termed as urgency of restoring the level of nicotine after abstinence during sleeping and maintaining the level of nicotine during waking. The internal reliability (Cronbach's alpha coefficient) of the whole FTCD is low (.68) as well as for the two subscales (.60) and (.62) respectively. **Conclusion:** The psychometric properties of the Arabic version of the FTCD scale in this sample of Yemeni khat chewers who smoked regularly confirmed what has been established in other cultural settings. The findings of this study have yet to be cross validated amongst other appropriately representative sample of Arabic speakers.

Keywords: FTCD - validity - reliability - cross-culture - Arabic speaking Yemeni residents of the UK

Asian Pacific J Cancer Prev, 13, 1285-1288

Introduction

Cigarette smoking remains a leading cause of preventable disease (cancer, heart disease) and premature death in the United States and other countries (Surgeon General's report, 2004, 2010). The prevalence of tobacco smoking in the developed world has decreased dramatically in the last decades whilst the trend for the increase in the developing countries is growing. It is estimated that by 2030, 80% of all tobacco-related deaths will occur in developing countries (Mathers & Loncar, 2006). In the Arabic speaking countries in the Middle East the consumption of cigarette smoking has increased by 24% between 1990-1997 and the prevalence is higher amongst males with the Yemen having the highest rate (75%) of male prevalence of smoking followed by Jordan, Tunisia, Syria, Lebanon and Palestine at 40% (Shafey, 2007). The use of khat chewing amongst the Yemeni in homeland and diaspora to facilitate social interaction is often associated with tobacco smoking. Khat is an established drug of dependence resembling amphetamine chemically and in mode of action (Kalix, 1992). High prevalence of regular cigarette smoking amongst khat chewers has been reported recently (Kassim & Croucher, 2011). According to the Surgeon General's report (1988),

nicotine dependence treatment approaches should be based on assessment of their dependence. The FTCD scale, formerly FTND, has been adapted globally as a measure of physical dependence on nicotine in particular cigarette (Fagerstrom, 2012) due to its ease of understanding and rapidity of application (De Meneses-Gaya et al., 2009). Its validity and reliability has been assessed in different cultural settings (Becona & Vazquez, 1998; Uysal et al., 2004; Huang, 2006; De Meneses-Gaya et al., 2009; Jhanjee & Sethi, 2010) despite recognized variations in its psychometric properties. The psychometric properties of FTCD in Arabic speakers have not been tested, in particular amongst this group who smoke cigarette and chew khat concurrently.

The objective of this communication is to assess the cross cultural validity and reliability of the FTCD scale in Arabic speakers, specifically, a sample of UK-resident male adult Yemeni khat chewers who smoked cigarettes regularly.

Materials and Methods

Recruitment and sample selection have been previously reported (Kassim & Croucher, 2010). This study involves a subsample (91 regular cigarette smokers)

¹Queen Mary University of London, Barts and The London School of Medicine and Dentistry, Institute of Dentistry, London, UK,
²Université de Franche-Comté UFR SLHS, LASELDI, Besançon cedex, France *For correspondence: s.kassim@qmul.ac.uk

of randomly recruited residents Yemeni khat chewers. Socio-demographics, severity of dependency on khat chewing (SDS-Khat) and cigarette smoking data have been assessed.

Measures

Socio-demographic characteristics of the sample were collected using a pre-piloted questionnaire (Kassim & Croucher, 2011). Levels (high and low) of cigarette dependence were measured using FTCD (Heatherton et al., 1991) as well as different levels of cigarette dependence (very low, low and medium) (Fagerstrom & Kozlowski, 1990). We also used SDS-Khat (Kassim & Croucher, 2010) to assess participants' severity of dependency on khat chewing. Adaptation/translation of the scale (FTCD) was carried out before the pilot study following the process of adaptation proposed by Hunt & Bhopal (2004). Four bilingual Yemeni khat chewers who smoked forward translated the English version of the questionnaire. Monolingual (Arabic speakers) khat chewers who smoked were consulted during this process and field-testing was conducted. This was then followed with back translation from Arabic to English. The researcher along with one Yemeni medical professional (who was fully aware of tobacco and khat chewing among Yemeni community) reviewed the adaptation/translation (Table 1). In this Arabic version the word 'mosque' was used instead of 'church' due to its relevance to the religion of most Yemenis.

Ethical approval and confidentiality

This study was approved by the The East London and City Health Authority Local Research Ethics Committee (REC Ref. No. 05/Q06034/195).

Statistical analysis

The data were analysed using SPSS v 16. A descriptive statistical analysis was undertaken first to report sample characteristics. The following steps were then performed to evaluate the validity and reliability of the FTCD. Construct validity of the FTCD was assessed using factorial structural analysis. Adequacy of the data for

factor analysis was assessed. Exploratory factor analysis was adopted using the principle component method without limit on factors extracted. The number of factors was assessed by the scree test plot adopting the eigenvalue criteria exceeding 1 and the variance explained was observed. A factor loading of .40 or above was a prior criterion for item inclusion in defining a factor (Steven, 2002). As for the reliability of the scale, the item-total correlations were calculated and the impact of removing an item on the internal reliability of the scale was assessed. To ease interpretation of factors both Promax and Varimax rotated solutions were conducted. The internal consistency of the scale and subscales extracted was tested using Cronbach's alpha coefficient.

Results

Sample characteristics

The mean/sd age of the sample was 41.36 (± 17.84) years (range 18-87). The mean (sd) age of tobacco smoking initiation was 19 years (± 6.21) (range 10-40), 68% were married, 65% with low level of education (up to high school education) and 35% only employed. The mean/sd of khat chewing dependency was 5.09 (± 3.57) and 45% were self reported more likely dependent on khat chewing.

Cigarette smoking dependency

The scores of the FTCD were normally distributed

Table 2. Responses to FTCD Items and Psychometric Properties (Reliability) of FTCD in a Sample of 91 UK-Resident Male adult Yemeni Khat Chewer Smokers

Items	Response scores coding	Responses (%)	Item-total correlations	Cronbach's alpha if item deleted
1) How many cigarettes per day do you smoke?				
10 or less	0	45.1		
11-20	1	34.1		
21-30	2	8.8		
31 or more	3	12.1	0.443	0.687
2) How soon after you wake do you smoke your first cigarette?				
Within 5 min	3	20.9		
6-30 min	2	68.1		
31-60 min	1	6.6		
After 60 min	0	4.4	0.551	0.563
3) Which cigarette would you most hate to give up?				
The first one in the morning /after waking	1	91.2		
All others	0	8.8	0.334	0.666
4) Do you smoke more frequently during the first hours after waking than during the rest of the day?				
Yes	1	31.9		
No	0	68.1	0.489	0.605
5) Do you smoke cigarettes even if you are so ill that you are in bed much of the day?				
Yes	1	47.3		
No	0	52.7	0.391	0.620
6) Do you find it difficult to refrain from smoking in places where it is forbidden, such as Mosque, library, or cinema?				
Yes	1	48.4		
No	0	51.6	0.461	0.595

Table 1. Arabic Version of Fagerstrom Test For Cigarette Dependence

1) كم عدد السجائر التي تدخنها في اليوم الواحد؟	<input type="checkbox"/> 10 سجائر أو أقل
	<input type="checkbox"/> 11-20 سجارة
	<input type="checkbox"/> 21-30 سجارة
	<input type="checkbox"/> 31 سجارة أو أكثر
2) متى تدخن السجارة الأولى بعد استيقاظك من النوم مباشرة؟	<input type="checkbox"/> خلال 5 دقائق
	<input type="checkbox"/> ما بين 6 - 30 دقيقة
	<input type="checkbox"/> ما بين 31 - 60 دقيقة
	<input type="checkbox"/> بعد 60 دقيقة
3) ماهي السجارة التي يصعب عليك الامتناع عنها؟	<input type="checkbox"/> أول سجارة في الصباح / أول سجارة بعد الاستيقاظ من النوم
	<input type="checkbox"/> أي سجارة أخرى خلال اليوم
4) هل تدخن أكثر في الساعات الأولى بعد استيقاظك من النوم عن بقية اليوم؟	<input type="checkbox"/> نعم
	<input type="checkbox"/> لا
5) هل تدخن السجائر حتى لو كنت مريضاً جداً و ملازم الفراش؟	<input type="checkbox"/> نعم
	<input type="checkbox"/> لا
6) هل تجد صعوبة في الامتناع عن التدخين في الأماكن المحظورة (مثل نور العبادة المسجد أو المكتبة أو السينما والخ...)?	<input type="checkbox"/> نعم
	<input type="checkbox"/> لا

Table 3. FTCD Factors, Items Factors Loading and FTCD Factors Rotation Matrix

Factors	Varimax rotation		Promax rotation	
	Variance 58.36%		Variance 58.36%	
	(30.87% & 27.51%)		(41.64% & 16.74%)	
	Loadings		Loadings	
	1	2	1	2
1) How soon after you wake up do you smoke your first cigarettes?	0.674	0.00	0.738	0.500
2) Which cigarette would you most hate to give up?	0.758	-0.104	0.718	0.00
3)How many cigarettes do you smoke per day?	0.680	0.194	0.706	0.327
4) Do you smoke more frequently during the first hours after waking than during the rest of the day?	0.563	0.00	0.631	0.480
5) Do you smoke cigarettes even if you so ill that you are in bed much of the day?	0.00	0.826	0.267	0.827
6) Do you find it difficult to refrain from smoking in places where it is forbidden, such as mosque, library or cinema?	0.189	0.801	0.358	0.823

with a mean of 5.12 (SD±2.29) and a median of 5.00 (range 0-10). Nine respondents (9.9%) had very low cigarette dependence (0-2 scores), 30 (33.0%) low cigarette dependence (3-4 scores), 12 (13.1%) medium cigarette dependence (5 scores), 25 (27.5%) high cigarette dependence (6-7 scores), and 15 (16.5%) very high cigarette dependence (8-10 scores).

The psychometric properties analysis of the FTCD

The psychometric properties analysis of the FTCD was as follows. First, the data set satisfied the criteria for factor analysis with a correlation matrix of many coefficients of .3 and above, a sampling adequacy (KMO) of 0.76 and a statistically significant value of Bartlett's Test of Sphericity 0.005. Second, a two factor solution accounting for 58.36% (41.64%, 16.74%) of the variance was obtained from exploratory factor analysis with principle components. Extraction of these factors was supported with the use of the Catell (1966) scree plot test which revealed a clear break after the second component. Third, the internal consistency of the FTCD was .68 overall and .60 and .62 respectively for each subscale. Fourth, as for the reliability of the scale, item three of the scale performed least well on the construct reliability test (Table 2). A key item of nicotine addiction (item 2) the restoration of level of nicotine after abstinence during sleeping, showed a significant reduction in the reliability of the scale if omitted (Table 2) and similarly item 6 which indicates the maintenance of nicotine level during waking. Fourth, the analysis derived by using the orthogonal (Promax) and oblique (Varimax) rotations extracted two factors explaining 58.36% of the total variance (Table 3). The items loaded on Factor 1 (urgency of restoring the level of cigarette nicotine after abstinence during sleeping) were 'How soon after you wake up do you smoke your first cigarettes?', 'Which cigarette would you most hate to give up?' and 'How many cigarettes do you smoke per day?'. As for Factor 2 (maintaining the level of nicotine during waking) these were 'Do you smoke more frequently during the first hours after waking than

during the rest of the day?', 'Do you smoke cigarettes even if you so ill that you are in bed much of the day?' and 'Do you find it difficult to refrain from smoking in places where it is forbidden, such as mosque, library or cinema?'. The loading items on two factors identified with the varimax rotation resembled that of the promax rotation apart from the items 'How soon after you wake up do you smoke your first cigarettes?' and 'Do you smoke more frequently during the first hours after waking than during the rest of the day?' which loaded on both factors with the promax rotation.

Discussion

In this study we have assessed the psychometric properties of FTCD in a sample of UK-resident Yemeni khat chewers. The key findings of the study were as follows: two factors were found to fit the data and the internal reliability of the scale was low alongside its underlying subscales. The study lends further support to the bi-dimensionality of the scale as reported in other cultural settings (Payne et al., 1994; Etter & Perneger, 1999; Haddock et al., 1999; Radzius et al., 2003). This study confirmed as well that Factor 1 reflects the degree of urgency to restore nicotine levels to a given threshold after waking whilst Factor 2 reflects the persistence with which nicotine concentration are maintained during waking hours (Radzius et al., 2003). The number of daily cigarettes has reported before to be loaded on the second factor (Radzius et al., 2003). According to Nunnally & Bernstein (1994) generalisability and validity of one psychometric characteristic to all contexts may not be possible as these features are influenced by the nature of the population being assessed. A recent systematic review has reported the bi-factorial structure of FTCD with small differences observed among the questions that compose the factors (De Menezes-Gaya et al., 2009). The two factors revealed from the promax rotation showed two distinguishable and correlated domains of nicotine dependence which lends further support to a construct of nicotine dependence that manifests itself by urgency of use and maintenance of nicotine levels (Jhanjee & Sethi, 2010).

The internal consistency of the Cronbach's alpha score was low (.68) and did not reach the standard Cronbach's alpha threshold of $\geq .70$ (Nunnally & Bernstein, 1994). This is not surprising and has been reported elsewhere (Pomerleau et al., 1994; Etter & Perneger, 1999). Item 3 'Which cigarette would you most hate to give up?' performed poorly on the reliability test as in other studies (Etter & Perneger, 1999; Uysal et al., 2004).

The findings of this study diverged from other studies (Etter & Perneger, 1999; Uysal et al., 2004) in terms of the high percentages (88% and 91% respectively) of smokers who reported their first daily cigarette within 30 minutes of waking and this cigarette as the least desirable to give up, supporting the pressing need to restore systemic nicotine levels. The SDS-khat established the psychological khat dependence, so there remains a knowledge gap with respect to the physical dependence on khat related stimulants such as cathinone measured by time of first intake after waking. Future research should

clarify the relationship between first intake of nicotine and khat related stimulants such as cathinone. This could be explored amongst khat chewing smokers and smokers only.

Limitations, this study reported cigarette dependence amongst khat chewers, and a possible overlap of nicotine and khat chewing dependence should be considered. Our study sampling framework was khat selling outlets which meant that khat chewer smokers who did not buy khat themselves from these places were excluded. Additionally, probability sampling was not employed; hence, extrapolation of findings from this study to the whole population would be inappropriate. The sample size for running factor analysis is contentious (Tabachnick & Fidell, 2007). The adequacy of this study sample was assessed and the number of cases per variable was five or more (Norman & Streiner, 2000). Further validation of this scale amongst larger samples of both male and female Arabic speakers is required. Test-retest has not been reported in this study.

In conclusions, the psychometric properties of the Arabic version of the FTCD scale in this sample of Yemeni khat chewers who smoked regularly confirmed what has been established in other cultural settings. The findings of this study have yet to be cross validated amongst other appropriately representative sample of Arabic speakers.

Acknowledgements

This study was supported by the U.K. Ambassador of the United Arab Emirates Sheik Issa Al-Kark, Princess Fadaw Bent Khalid, and Dr. Elham Danish Head of the Cultural Department in Saudi Arabia Embassy-U.K. These parties have no role in the study design, data collection, analysis or interpreting, writing of the manuscript or the decision to submit the manuscript for publication. All authors declare that they have no conflicts of interest.

References

Becona E, Vazquez FL (1998). The Fagerstrom Test for Nicotine Dependence in a Spanish sample. *Psychological Reports*, **83**, 1455-8.

Cattell RB (1966). The scree test for the number of factors. *Mult Behav Res*, **1**, 245-76.

de Meneses-Gaya C, Zuairi AW, de Azevedo Marques JM, et al (2009). Psychometric qualities of the Brazilian versions of the Fagerstrom Test for Nicotine Dependence and the Heaviness of Smoking Index. *Nicotine Tob Res*, **11**, 1160-5.

Etter JF, Duc TV, Perneger TV (1999). Validity of the Fagerstrom test for nicotine dependence and of the Heaviness of Smoking Index among relatively light smokers. *Addiction*, **94**, 269-81.

Fagerstrom K (2012). Determinants of tobacco use and renaming the FTND to the Fagerstrom Test for Cigarette Dependence. *Nicotine Tob Res*, **14**, 75-8.

Fagerstrom KO, Heatherton TF, Kozlowski LT (1990). Nicotine addiction and its assessment. *Ear Nose Throat J*, **69**, 763-5.

Haddock CK, Lando H, Klesges RC, Talcott GW, Renaud EA (1999). A study of the psychometric and predictive properties of the Fagerström Test for Nicotine Dependence in a population of young smokers. *Nicotine Tob Res*, **1**, 59-66.

Heatherton TF, Kozlowski LT, Frecker RC, Fagerstrom KO (1991). The Fagerstrom Test for Nicotine Dependence: a revision of the Fagerstrom Tolerance Questionnaire. *Bri J Addiction*, **86**, 1119-27.

Huang CL, Lin HH, Wang HH (2006). The psychometric properties of the Chinese version of the Fagerstrom Test for Nicotine Dependence. *Addictive Behaviour J*, **31**, 2324-7.

Hunt SM, Bhopal R (2004). Self report in clinical and epidemiological studies with non-English speakers: the challenge of language and culture. *J Epidemiol Commu Health*, **58**, 618-22.

Jhanjee S, Sethi H (2010). The Fagerstrom test for nicotine dependence in an Indian sample of daily smokers with poly drug use. *Nicotine & Tob Res*, **12**, 1162-6.

Kalix P (1992). Cathinone, a natural amphetamine. *Pharmacol Toxicol*, **70**, 77-86.

Kassim S, Islam S, Croucher R (2010). Validity and reliability of a Severity of Dependence Scale for khat (SDS-khat). *J Ethnopharmacology*, **132**, 570-7.

Kassim S, Islam S, Croucher RE (2011). Correlates of nicotine dependence in U.K. resident Yemeni khat chewers: a cross-sectional study. *Nicotine Tob Res*, **13**, 1240-9.

Mathers CD, Loncar D (2006). Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Med*, **3**, e442.

Norman GR, Streiner DL (2000). Biostatistics, the bare essentials. (2nd). Hamilton. London.

Nunnally JC, Bernstein IH (1994). Psychometric Theory, (3rd ed.) (New York, M cGraw -Hill).

Payne TJ, Smith PO, McCracken LM, McSherry WC, Antony MM (1994). Assessing nicotine dependence: a comparison of the Fagerstrom Tolerance Questionnaire (FTQ) with the Fagerstrom Test for Nicotine Dependence (FTND) in a clinical sample. *Addictive Behaviour*, **19**, 307-17.

Pomerleau CS, Carton SM, Lutzke ML, Flessland KA, Pomerleau OF (1994). Reliability of the Fagerstrom Tolerance Questionnaire and the Fagerstrom Test for Nicotine Dependence. *Addictive Behaviour*, **19**, 33-9.

Radzius A, Gallo JJ, Epstein DH, et al (2003). A factor analysis of the Fagerstrom Test for Nicotine Dependence (FTND). *Nicotine Tob Res*, **5**, 255-60.

Shafey O (2007). Health issues in the Arab American community (2007). Global epidemiology and health hazards of tobacco use: Arab world patterns. *Ethn Dis*, **17**, 3-13.

Stevens JP (2002). Applied multivariate statistics for the social sciences (4 th ed.). Hillsdale, NJ: Erlbaum.

Tabachnick B, Fidell L (2007). Using multivariate statistics (5th ed.). Boston:Pearson Education.

US Department of Health and Human Services (1988). The health consequences of smoking :Nicotine dependence, a report of the Surgeon General. Rockvillia, MD:Author.

US Department of Health and Human Services (2010). How Tobacco Smoke Causes Disease: The Biology and Behavioral Basis for Smoking-Attributable Disease: A Report of the Surgeon General. Atlanta, GA: U.S.

US Department of Health and Human Services.(2004). The Health Consequences of Smoking: A Report of the Surgeon General. Atlanta, GA: U.S.

Uysal MA, Kadakal F, Karsidag C, et al (2004). Fagerstrom test for nicotine dependence: reliability in a Turkish sample and factor analysis. *Tuberk Toraks*, **52**, 115-21.