

Assessment of tobacco dependence in waterpipe smokers in Egypt

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SUMMARY

SETTING: Waterpipe smoking is increasing worldwide. Nevertheless, little is known about nicotine dependence in tobacco smokers who use waterpipes.

OBJECTIVE: To assess evidence of dependence among non-cigarette smoking waterpipe smokers in Egypt.

METHODS: A total of 154 male exclusive current waterpipe smokers were enrolled for the present study. We adapted the Fagerström test for nicotine dependence and the Reasons for Smoking (RFS) scales and related these to smoking behavior.

RESULTS: The mean age of the subjects was 47 ± 14 years, the mean age at smoking initiation was 22 ± 9 years, and average daily consumption was 4 ± 8 hagars

(tobacco units). The time to the first smoke of the day ($P < 0.001$), smoking even when ill ($P = 0.003$), time to tobacco craving ($P < 0.001$), and hating to give up the first smoke of the day ($P = 0.033$) were each significantly associated with the number of hagars smoked per day. The RFS subscales of addictive smoking, smoking to relieve negative affect, and smoking for stimulation were also associated with these variables.

CONCLUSION: The overall findings suggest that waterpipe smokers exhibit many of the same features of nicotine dependency attributed to cigarette smokers.

KEY WORDS: waterpipe smoking; nicotine dependence; FTND; RFS; Egypt

UNLIKE CIGARETTES, waterpipe tobacco smoking devices have a water container that acts as a partial filter through which the tobacco smoke passes before reaching the smoker. In addition to variations in the design of the apparatus itself, the type of tobacco used in waterpipe smoking differs from cigarette tobacco in the addition of flavorings and molasses.¹ Recent investigations suggest that levels of harm from waterpipe smoking are comparable to those of cigarette smoking,^{2–4} possibly due to cellular damage induced by carcinogens and other chemical constituents. Waterpipes also deliver nicotine, the primary addictive substance in tobacco. Nicotine has been measured in waterpipe tobacco,⁵ waterpipe tobacco smoke,⁶ and the blood plasma of waterpipe smokers.⁷ Some studies suggest that, compared to cigarettes, waterpipes can deliver the same or greater doses of nicotine,^{8–10} given the complex interplay between the length of the smoking session, smoking topography, and the chemical characteristics of waterpipe smoke.¹¹ Furthermore, waterpipe use is associated with classic features of tobacco/nicotine dependence: abstinent waterpipe

smokers report symptoms similar to those reported by abstinent cigarette smokers (e.g., urge to smoke, restlessness, and craving), and these symptoms are reduced by subsequent waterpipe tobacco smoking.^{12,13}

Dependence on nicotine is attributed to its ability to stimulate the brain's reward pathway.^{14–17} Other behavioral, cognitive, and social components are also involved,^{18,19} including sensory cues accompanying the act of smoking, such as taste, aroma, handling, puffing, and inhaling.²⁰ Waterpipe smoking has its own specific cues, including varied smells and tastes from sweetened and flavored waterpipe tobacco, the hand-to-mouth action, and the highly social setting of many waterpipe sessions in restaurants or cafés.^{2,11} To our knowledge, only a few studies have addressed the issue of nicotine dependence among waterpipe users.^{2,11,21} Unlike cigarette smoking, for which decades of research led to the development and validation of instruments to assess dependency, such as the Fagerström Tolerance Questionnaire (FTQ), the Fagerström test for nicotine dependence (FTND)²² and the Reasons for Smoking (RFS) scales, very little research has been carried out on these characteristics in waterpipe smokers. In the present study, we aimed to assess

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evidence for nicotine dependence in habitual waterpipe smokers, using adapted versions of the FTND and RFS scales.

METHODS

Participants were recruited from a population-based survey of nine villages in the Qalyubia Governorate in the Nile Delta region of Egypt in 2003–2004, where a household smoking prevalence survey was carried out.²³ In each village, 300 households were selected using a systematic random sampling method; 10 160 adults in total (>90% participation rate) were interviewed. The survey estimated that about 11% of adult males and <1% of adult females had ever smoked tobacco products, and 6% of adult males were currently exclusively smoking waterpipes. Participants for the current study were recruited from that survey; inclusion criteria restricted the study to adult males (≥ 18 years) who currently smoked waterpipes and had smoked at least once per week in the past 4 weeks. Exclusion criteria were the inability to provide informed consent and being a current cigarette smoker. All eligible individuals were invited to participate in an interview on waterpipe smoking. Among the 160 potential subjects from the baseline survey who met these criteria, 154 (96%) agreed to participate in the second survey and provided informed consent.

The study protocol and human subject protection procedures were approved by the Institutional Review Boards of the Ministry of Health and Population in Egypt and of the University of Maryland, Baltimore, MD, USA.

Participants completed an interviewer-administered questionnaire that contained sections on social and demographic factors and smoking-related variables. The questionnaire asked about age at initiation of waterpipe smoking, the usual number of tobacco units (hagars) smoked per day and per week, the frequency of café visits to smoke, past quitting attempts, attitudes toward quitting, and weekly expenditures on smoking. As there were no validated tools available for the assessment of nicotine dependence among waterpipe smokers, we adapted the FTND items²⁴ by replacing the word 'cigarette' with 'waterpipe' (*shisha*, as commonly used in Egyptian Arabic). The time to the first smoke in the morning was modified to reflect the required time to prepare a waterpipe device for smoking (~1 h). Participants were also asked about the maximum time they could abstain from smoking before experiencing feelings of craving. The subjects also completed a modified version of the Horn-Waingrow Reasons for Smoking (RFS) scale,²⁵ replacing the word 'cigarette' by 'waterpipe' (*shisha*). We selected three subsets of questions (negative affect, addiction, and stimulation) for inclusion in our questionnaire. The negative affect subset included the

following items: 'I light up a *shisha* when I'm uncomfortable or upset,' 'When I feel blue or want to take my mind off cares and worries, I smoke a *shisha*,' and 'I smoke a *shisha* when I feel angry.' The addiction subset included: 'I get a real gnawing hunger to smoke when I have not smoked for a while,' 'I find it unbearable when I run out of *shisha*,' and 'Without a *shisha* I do not know what to do with my hand.' Finally, the stimulation subset included: 'Smoking *shisha* helps me to think and concentrate,' 'I smoke more when I'm rushed and have lots to do,' 'Smoking *shisha* helps me keep going when I am tired,' and 'I get a definite lift and feel more alert when smoking.' For each item, subjects indicated the degree to which they agreed with the statement on a Likert scale from 0 (not at all) to 3 (very much so), and the items were summed to create scores for the three subscales.

Data were double-entered into a Microsoft Access database (Microsoft, Redwoods, WA, USA). Three subjects did not provide the number of hagars consumed per day, and they are not included in Table 1. Continuous variables were tested with the Shapiro-Wilk test to determine any departures from the normal distribution; we subsequently used non-parametric tests if needed. The Mann-Whitney *U*-test for continuous variables and the χ^2 test for categorical variables were used to examine the associations between smoking motives, addiction and waterpipe smoking behavior variables. SPSS statistical software

Table 1 Smoking behavior among different tobacco consumption levels (hagar/day), expressed as percentage of total subjects

Smoking behavior	Numbers of hagars/day		
	1–3 (n = 48) n (%)	4–7 (n = 71) n (%)	≥ 8 (n = 32) n (%)
Maximum duration before craving*			
0–3 h	4 (8)	23 (32)	24 (75)
4–23 h	18 (38)	22 (31)	5 (16)
One day	11 (23)	15 (21)	3 (9)
A few days	15 (31)	11 (16)	0
Time to first <i>shisha</i> session, h [†]			
0–1	14 (29)	32 (45)	23 (72)
2–4	17 (35)	25 (35)	5 (16)
≥ 5	17 (35)	14 (20)	4 (13)
Hates most to give up the morning <i>shisha</i>	15 (31)	27 (38)	13 (41)
Regular daily smoker	44 (92)	68 (96)	32 (100)
Wants to quit	42 (88)	64 (90)	28 (88)
Ever tried quitting*	37 (77)	47 (66)	11 (34)
Inhales deeply when smoking	4 (8)	15 (21)	9 (28)
Morning smoking	4 (8)	8 (11)	4 (13)
Smokes even if sick in bed	4 (8)	9 (13)	8 (25)
Has a <i>shisha</i> at home	47 (98)	70 (99)	31 (97)
Uses a shared <i>shisha</i>	28 (58)	56 (79)	27 (84)

**P* < 0.001.

[†]*P* < 0.05.

(Version 12, Statistical Package for the Social Sciences Inc, Chicago, IL, USA) was used for data analysis. All statistical tests were two sided, with $\alpha = 0.05$.

RESULTS

In this sample of 154 males who were current waterpipe users, the mean age was 47 ± 14 years (range 19–88). Almost all subjects were or had been married (95%), the majority had received no formal education (67%), and were employed either in agriculture or manual labor (76.5%). The mean age at initiation of waterpipe smoking was 22 ± 9 years. The prevalence of daily waterpipe use was 95%, with an average daily tobacco consumption of 4 ± 8 hags. Almost all respondents (98%) owned their own waterpipe at home. They spent an average of 8 ± 12 Egyptian pounds (median 7; US\$1.30 \pm 2, median \$1.20) monthly on waterpipe smoking.

Smoking behavior among different tobacco consumption levels (hags/day) is shown in Table 1. There were inverse relationships between hags/day (dose) and the amount of time subjects were able to remain without smoking, and the time they waited before smoking upon waking, with those consuming more tobacco able to wait less time. Those who smoked greater amounts were also more likely to inhale deeply, to smoke even when sick in bed, and to share the waterpipe with others, but were less likely to attempt quitting.

Table 2 shows the frequency and intensity of

smoking, age of smoking initiation and quit attempts in relation to modified FTND items. Those who reported a shorter time (<1 h) to the first smoking session of the day smoked 12.6 hags/day on average, compared to those who waited longer (4.7 hags/day, $P < 0.001$). Those who reported smoking the waterpipe even when ill had a heavier daily habit than those who did not smoke when ill (13.7 vs. 5.4 hags/day, $P = 0.003$), and those who stated that they could stand a maximum of less than a day without smoking consumed more tobacco than those who could abstain for a longer duration (7.8 vs. 4.1 hags/day, $P < 0.001$). There was also a small but statistically significant difference in usual dose between those who said they hated most to give up the first waterpipe session of the day (7.3 hags/day) compared to those who hated to give up any other session (6.2 hags/day, $P = 0.033$).

The results of the RFS subscales in relation to the items from the adapted FTND are shown in Table 3. Increased scores for addictive smoking were significantly associated with every component of the FTND. Smoking to relieve negative affect was significantly and positively associated with increased frequency and intensity of waterpipe smoking, shorter duration before symptoms of craving, and smoking when ill. Smoking for stimulation was significantly and positively associated with intensity (but not frequency) of smoking, younger age at onset, smoking when ill, and shorter duration before symptoms of craving.

The association between social and other reasons

Table 2 Frequency and intensity of smoking, age at smoking initiation and quit attempts in relation to modified FTND items

FTND items	Frequency of smoking (days/week) mean (SD)*	Intensity of smoking mean (SD)*	Age at onset of smoking, years mean (SD)*	Quit attempts (yes) n (%)†
Time to first <i>shisha</i> session, h				
<1 (n = 35)	7.0 (0.0)	12.6 (14.0)	19.4 (11.2)	16 (45.7)
≥ 1 (n = 116)	6.8 (0.8)	4.7 (3.0)	22.8 (8.4)	79 (68.1)
P value	0.213	0.000	0.000	0.016
<i>Shisha</i> you hate to give up‡				
First one in the morning (n = 56)	6.8 (0.8)	7.3 (8.5)	21.2 (9.5)	32 (57.1)
Other one (n = 85)	6.7 (0.9)	6.2 (8.0)	22.5 (8.8)	57 (67.1)
P value	0.557	0.033	0.271	0.232
Morning smoking				
No (n = 138)	6.8 (0.9)	5.9 (5.7)	22.3 (9.4)	91 (65.9)
Yes (n = 16)	7.0 (0.0)	11.5 (17.4)	19.0 (6.5)	7 (43.8)
P value	0.358	0.399	0.188	0.081
Smoking when ill				
No (n = 132)	6.8 (0.9)	5.4 (5.0)	22.6 (9.5)	87 (65.9)
Yes (n = 21)	6.8 (0.7)	13.7 (15.8)	18.9 (6.0)	11 (52.4)
P value	0.982	0.003	0.032	0.230
Maximum duration before craving				
Less than a day (n = 98)	7.0 (0.3)	7.9 (9.3)	20.5 (7.9)	54 (55.1)
A day or more (n = 55)	6.6 (1.3)	4.1 (3.1)	24.9 (10.5)	44 (80.0)
P value	0.005	0.000	0.033	0.002

* Mann-Whitney test.

† χ^2 test.

‡ 13 subjects responded with 'do not know' and were excluded.

FTND = Fagerström test for nicotine dependence; SD = standard deviation.

for smoking in waterpipe smokers is shown in Table 4. The reported frequency of visiting *shisha* cafés for smoking and the tendency to share the waterpipe

Table 3 Mean scores of reasons for smoking scales by selected smoking variables and modified FTND items

Smoking variables and FTND items	Addictive smoking mean (SD)	Smoking to relieve negative affect mean (SD)	Smoking for stimulation mean (SD)
Frequency of smoking			
Non daily users (<i>n</i> = 7)	1.4 (1.4)	3.4 (2.1)	2.1 (2.3)
Daily users (<i>n</i> = 147)	3.9 (2.9)	5.5 (3.0)	4.2 (3.8)
<i>P</i> value*	0.019	0.045	0.172
Intensity of smoking, hags/day			
≤4 (<i>n</i> = 78)	2.9 (2.7)	4.4 (3.0)	3.2 (3.1)
>4 (<i>n</i> = 76)	4.8 (2.8)	6.4 (2.7)	5.1 (4.1)
<i>P</i> value*	0.000	0.000	0.003
Age at onset of smoking, years			
≤20 (<i>n</i> = 96)	4.5 (2.8)	5.7 (2.9)	4.6 (3.9)
>20 (<i>n</i> = 58)	2.7 (2.7)	4.9 (3.1)	3.3 (3.4)
<i>P</i> value*	0.000	0.097	0.035
Quit attempts			
No (<i>n</i> = 56)	4.5 (3.0)	5.8 (3.1)	4.5 (4.0)
Yes (<i>n</i> = 98)	3.4 (2.8)	5.2 (3.0)	3.9 (3.6)
<i>P</i> value*	0.039	0.165	0.412
Maximum duration before craving			
Less than a day (<i>n</i> = 98)	4.6 (2.7)	6.0 (2.7)	4.6 (3.9)
A day or more (<i>n</i> = 55)	2.5 (2.6)	4.2 (3.1)	3.3 (3.3)
<i>P</i> value*	0.000	0.001	0.046
Time to first <i>shisha</i> , h			
<1 (<i>n</i> = 35)	5.8 (2.9)	6.5 (2.5)	5.8 (4.0)
≥1 (<i>n</i> = 116)	3.2 (2.7)	5.1 (3.1)	3.6 (3.6)
<i>P</i> value*	0.039	0.165	0.412
Morning smoking			
No (<i>n</i> = 138)	3.6 (2.8)	5.3 (3.1)	3.9 (3.5)
Yes (<i>n</i> = 16)	5.6 (3.3)	6.3 (2.0)	5.7 (5.1)
<i>P</i> value*	0.017	0.362	0.228
Smoking when ill			
No (<i>n</i> = 132)	3.4 (2.8)	5.1 (3.1)	3.8 (3.6)
Yes (<i>n</i> = 21)	6.4 (2.6)	7.2 (2.0)	6.6 (4.2)
<i>P</i> value*	0.000	0.003	0.004
Inhalation of tobacco smoke			
No (<i>n</i> = 123)	3.3 (2.7)	5.2 (3.0)	4.0 (3.7)
Yes (<i>n</i> = 29)	6.1 (2.6)	6.5 (2.6)	4.7 (3.8)
<i>P</i> value*	0.000	0.033	0.312

*Mann-Whitney test.

FTND = Fagerström test for nicotine dependence; SD = standard deviation.

with others were each significantly and positively associated with higher usual number of hags/day, younger age at smoking initiation, and increased tendency to inhale the tobacco smoke (data not shown). These social variables were also correlated with the addictive smoking subscore and with the negative affect subscore of the RFS, but not with the stimulation subscore. Finally, these subjects spent significantly ($P < 0.001$) less on waterpipe smoking every month compared to cigarette smokers in the same villages (data not shown).

DISCUSSION

These results suggest that addictive behaviors similar to those measured by the FTND scale for cigarette smoking were associated with waterpipe smoking. Time to first waterpipe smoking session of the day, hating to give up the first smoking session of the day, duration before symptoms of craving, and smoking when ill were strongly associated with the usual daily dose. In addition, the usual number of hags/day was strongly and consistently associated with all of the tested motivational aspects for smoking waterpipes. Reasons for addictive smoking have previously been correlated with similar behavioral aspects of cigarette consumption, which suggests that similarities may exist in some features of dependence between cigarette and waterpipe smoking.^{26,27} Gad et al. estimated that 9% of cigarette smokers in the same surveyed Egyptian villages were heavily dependent on nicotine, using the time to first morning smoke.²⁸ This may reflect the common nature of dependency among both kinds of smokers.

In assessing motives for smoking among waterpipe users, we identified associations between smoking for addictive reasons and all of the assessed smoking behavior variables, as well as all individual items of the adapted FTND. Smoking for stimulation and smoking to relieve negative affect were significantly associated with intensity of smoking and smoking when ill in bed. These two specific motivating factors have been used to assess self-medication smoking motives in previous research.²⁹ Furthermore, these motives

Table 4 Associations between reason for smoking scales and social behaviors in waterpipe smokers

RFS	Frequency of visiting <i>shisha</i> cafes to smoke			Share with others when smoking <i>shisha</i>		
	Less than once/week (<i>n</i> = 111) mean (SD)	Once or more/week (<i>n</i> = 43) mean (SD)	<i>P</i> value*	No (<i>n</i> = 41) mean (SD)	Yes (<i>n</i> = 113) mean (SD)	<i>P</i> value*
Addictive	3.3 (2.9)	5.1 (3.0)	0.001	2.6 (2.6)	4.2 (2.9)	0.001
To relieve negative affect	5.4 (3.1)	5.3 (2.9)	0.854	4.4 (2.7)	5.8 (3.0)	0.004
Stimulation	4.1 (3.5)	4.1 (4.2)	0.696	4.0 (3.8)	4.2 (3.7)	0.685

*Mann-Whitney test.

RFS = Reasons for Smoking scales; SD = standard deviation.

have been found to mediate the influence of depressive symptoms on nicotine dependence. These findings underscore the psychological aspects of dependence.²⁹

Social and economic factors also play an important role in the initiation and maintenance of tobacco addiction, and are widely cited as integral to understanding diverse sources of resistance to tobacco control.³⁰ The social dimension has been considered a salient feature specific to waterpipe smoking,^{2,31–33} as it involves long periods of sitting with friends and colleagues, sharing pipes, engaging in conversation, and other aspects of social interaction. Maziak et al. have proposed that the transition from social to individual patterns of waterpipe smoking is an important step towards dependence.¹¹ They observed in Syria that sharing the waterpipe, which was predominant among intermittent users, diminished in more established smokers who tended to carry their own waterpipe and often smoked alone. Consistent with these findings, we found that almost all current waterpipe smokers owned a waterpipe at home (96%). We also noted that the more frequent visitors to cafes consumed higher amounts of tobacco per day, initiated waterpipe smoking at a younger age, had a tendency to inhale the tobacco smoke, and scored high in their addictive (RFS) motives. Sharing the waterpipe with other smokers was associated with these same factors and with negative affect reduction smoking (RFS). The lower cost of waterpipe tobacco as compared to cigarettes could have played a major role in establishing this kind of smoking behavior among manual and agricultural workers in our study in a rural area of Egypt. Personality traits such as a tendency to socialize, plus attributes such as education and occupation, could therefore be contributing factors to both the initiation and maintenance of waterpipe smoking, and should be taken into account in planning tobacco control programs.

In summary, our findings suggest that waterpipe smokers exhibit some of the features of dependence previously described in cigarette smokers. The lack of validated nicotine dependence scales in waterpipe smokers, and the lack of precise quantification and standardization of the tobacco and nicotine contents of the hagar currently hamper research in this field, and contribute to a delay in effective tobacco control policies for waterpipe smoking. There is therefore a need for expanded research to fill the present gaps in knowledge and to further understand the social and physiological contexts of this smoking method.

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