Assessment of Smoking Dependence by FAGERSTROM Test and its Association with Some Comorbidities and Educational level

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Abstract

Background: Nicotine addiction is the inevitable result for many smokers. Regardless of control and intervention strategies for smoking cessation, it is important to determine the nicotine dependence score for each smoker.

Objectives: To assess the nicotine dependence by FAGERSTRŐM Test for nicotine dependence (FTND score) and to find out the association of nicotine dependence with some smoking-related comorbidities and with the level of education.

Patients and Methods: This is a cross-sectional study on a total of 200 adult smokers who were attending different departments in Al-Imamain Al-Kadhimain Medical City during the period from April 2019 to October 2019. Demographic data including age, sex and educational level, number of cigarettes/day, number of attempts to quit smoking, as well as comorbidities including hypertension, ischemic heart disease, and malignancies were obtained. Nicotine dependency was assessed by FTND which consists of six items and has a total maximum score of 10.

Results: The overall average of FTND among smokers was 5.8 ± 2.81. A low score was found in 12.5% of the participants, moderate score in 33% and high score in 54.5%. FTND score showed a significant positive correlation with the number of cigarette/day ($r= 0.758$, $p< 0.001$), age of the smoker ($r= 0.457$, $p<0.005$), and duration of smoking ($r= 0.536$, $p< 0.001$), while a negative correlation was found with the educational level ($r=-0.547$, $p<0.001$). The presence Smoking-related comorbidities, particularly, ischemic heart disease (IHD) and malignancy, was associated with higher FTND scores compared with the absence of these comorbidities ($P<0.001$).

Conclusions: More than one half of smokers studied had a high nicotine dependence score. Nicotine dependence score correlates positively with the number of smoked cigarettes per day, age of the smoker and duration of smoking, and negatively correlated with the educational level.

Keywords: Smoking, Dependence, FAGERSTRŐM Test

Introduction:

Cigarette smoke contains over 4000 different chemicals and many of them cause cancer [1]. One of the most important contents is the black sticky tar that contains toxic chemicals such as ammonia, toluene and acetone. Tar is the main cause of throat and lung cancer. It also causes the yellowish brown stains on fingers, teeth and lung tissue [2]. Nicotine is the major drug found in tobacco which contributes to addiction

to cigarette smoking which was first isolated from tobacco leaves as early as 1828. Nicotine has a number of harmful effects on the human body including nervous system stimulation, tachycardia, raising blood pressure and shrinking the subcutaneous small blood vessels, causing wrinkles [3]. In 2015, there were 933.1 million daily smokers in the world, 82·3% of whom were men (768.1 million) [4]. Tobacco-smoking leads to the premature death of approximately six million people worldwide each year. Many of these deaths occur in people who have stopped smoking but whose health has already been harmed by smoking. Smokers who do not stop smoking lose an average of 10 years of life expectancy compared with never-smokers and they start to suffer diseases of old age around 10 years earlier than non-smokers [5].

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Cigarette addiction stems from the fact that smoking provides highly controllable doses of the drug (nicotine) rapidly to the brain in a form that is accessible, affordable and palatable [6]. The psychopharmacology of cigarette addiction is complex and far from fully understood [1]. When smokers abstain from cigarettes, within a few hours many of them start to experience nicotine withdrawal symptoms, which include: Irritability, restlessness and difficulty to concentrate. Depression and anxiety have also been observed in some smokers. The symptoms typically last 1 - 4 weeks [7].

Cigarette smoking contributes to remarkable risk factors of non-communicable diseases, including chronic obstructive pulmonary disease (COPD), ischemic heart disease (IHD), peripheral vascular disease, hypertension, peptic ulcer disease [8]. Cigarette smoking is strongly associated with emphysema, chronic bronchitis and type 2 diabetes mellitus [9].

This study aimed to assess the smoking dependence by Fagerstrom test of nicotine dependence "FTND" score, and to find out the association of nicotine dependence score with some comorbidities that are commonly associated with smoking and with the severity and duration of smoking.

Patients and Methods:
Design and Settings:This is a cross-sectional study on a total of 200 adult smokers who were attending different departments in Al-Imamain Al-Kadhimain Medical City during the period from April 2019 to October 2019, they were collected randomly. The study protocol was approved by the Hospital Ethics Committee. A verbal consent was obtained from each participant before being enrolled in the study.
Inclusion criteria

Criterion (concurrent) validity was assessed by correlations of nicotine dependence scores with age at initiation of smoking and cumulative smoking volume in pack years.

Age ≥ 25 years
Current smoker
Have had at least one previous attempt to quit smoking
Exclusion criteria
Senescence (age over 80 years)
Ex-smokers
Those who used to smoke shisha or vape because of the difficulty associated with the measurement of smoking severity
Data Collection
Demographic data including age, sex and educational level (pre- or post-college), number of cigarettes/day, number of attempt to quit smoking, as well as comorbidity data including hypertension, IHD, and malignancies were obtained through direct interview with the smokers.
Assessment of Nicotine Dependency
Nicotine dependency was assessed using the Fagerstrom test for nicotine dependency scale. The FTND scale consists of six items and has a total maximum score of 10 [10], as illustrated in the table hereunder. The six items include:
1- Time to take up the first cigarette after waking up in the morning
2- Difficulty in refraining from smoking in places where it is not allowed
3- Unwillingness to give up the first cigarette in the morning
4- Number of cigarettes smoked per day
5- Intensity of smoking during the morning hours
6- Smoking even when bedridden due to illness
The FTND scale classified into:
 * A score of 5 or more indicates high dependence
 * A score of 3-4 indicates moderate dependence
 * A score of 1-2 indicates mild dependence
Fagerstrom test for nicotine dependency scale [10]

The age at start of smoking was calculated by subtracting the current age in years from the duration of smoking in years. To measure the amount smoked by a person over a period of time, pack years was calculated

Please tick {□) one box for each question

How soon after waking do you smoke your first cigarette?	Within 5 minutes	□	3
	6-30 minutes	□	2
	31-60 minutes After 60 minutes	□	1
		□	0
Do you find it difficult to refrain from smoking in places where it is not allowed? e.g. Church, Library, etc.	Yes No	□ □□	1 0
Which cigarette would you hate to give up?	The first in the morning Any other	□ □□	1 0
How many cigarettes a day do you smoke?	10 or less 11 - 20	□	0
	21 - 30 31 or more	□	1
		□	2
		□	3
Do you smoke more frequently in the morning?	Yes No	□ □□	1 0
Do you smoke even if you are sick in bed most of the day?	Yes No	□ □□	1 0

Total Score

as number of cigarettes/day × number of years smoked/10. A finding of higher correlations would support criterion validity.

Statistical Analysis

All data were recorded in Microsoft excel and analyzed with Statistical package for Social Sciences (SPSS) version 23 was used. Descriptive statistics were used to analyze the data. Continuous variables were expressed as mean ± standard deviation, while categorical variables were expressed as percentages. Pearson's correlation was used to analyze the association between FTND score with the of number of attempts to quit smoking, level of education, and number of smoked cigarettes. Analysis of variance (ANOVA) test was used to find out the significant differences in FTND score among different comorbidities. A p-value equal or less than 0.05 was considered statistically significant.

More than one quarter of the participants were between 15-33 years of age, while older ages (71-80 years) accounted for only 12%. As expected, the majority of the participants (75%) were males. The FTND score was low in only 12.5% of the participants, moderate in 33% and high in 54.5%. The overall average of FTND among smokers was 5.8±2.81. For the duration of smoking 44% had smoked for 2-15 years, and 11.5% for 46- 60 years. As for the number of cigarettes smoked/day, 48% of the participants smoke ≤ 20 cigarette/day, and 1% smoke more than 60 cigarettes/day. A small percent (15.5%) had one attempt to quit the smoking, while 47.5% had 2-5 attempts and 37% had six attempts and more. The educational level (66%) of the participants was pre-college versus (34%) who had a college or post-college degree. There were no comorbidities in (54%) of the participants had, while hypertension was the most common reported single comorbidity (8%) and (32.5%) have co-existence of more than one comorbidity as in table 1.

Table1: Demographic and clinical characteristic of the study group

Variables / Categories		No.	%
Age (years)	15-33	52	26.0
	34-42	43	21.5
	43-61	44	22.0
	62-70	37	18.5
	71-80	24	12.0
Gender	Male	150	75.0
	Female	50	25.0
FTND score	Low	66	33.0
	Moderate	25	12.5
	High	109	54.5
Duration of smoking (years)	2-15	88	44.0
	16-30	53	26.5
	31-45	36	18.0
	46-60	23	11.5
No. cigarette/ day	≤ 20	96	48.0
	21-40	76	38.0
	41-60	26	13.0
	>60	2	1.0
Number of attempts to quit	Once	31	15.5
	2-5	95	47.5
	≥6	74	37.0
Educational Level	Precollege	132	66.0
	Post-college	68	34.0
Comorbidities	None	108	54.0
	Ischemic heart diseases	7	3.5
	Hypertension	16 4	8.0
	Malignancy	4	2.0
	Co-existence of more than one	64	32.5

The correlation between FTND score and number of attempts to quit smoking as the independent variable, was not a significant (r= -0.023, p= 0.749) as in figure 1.
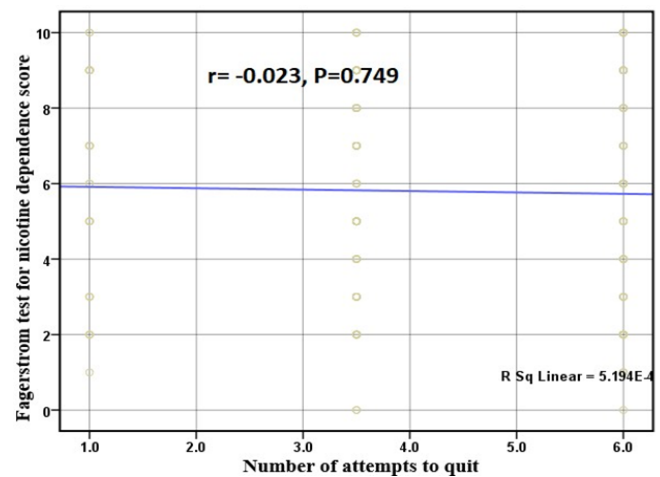

Figure 1: Correlation between FTND and number of attempts to quit smoking

The FTND score was found to be significantly associated with different comorbidities (p value < 0.001). The highest FTND score was found among patients with IHD (8.9±1.77), followed by Co-existence of more than one diseases 7.7±1.78, then

malignancy 7.0±1.63, Hypertension 6.7±2.98, with the lowest score found in those with no diseases 4.3±2.42, as in table 2.

Table 2: Association between FTND score and comorbidities

Comorbidities	FTND score (Mean± SD)	p- value
None	4.3±2.42[a†]	
Coexistence of more than one	7.7±1.78[bc]	< 0.001
Hypertension	6.7±2.98[b]	
Ischemic heart diseases	8.9±1.77[c]	
Malignancy	7.0±1.63[bc]	

There was a negative significant correlation between FTND score and educational level as an independent variable (r= -0.547, p<0.001) as shown in figure 2.
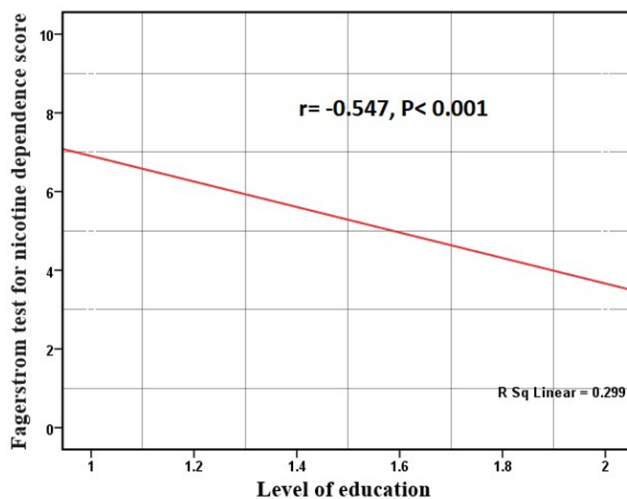

Figure 2: Correlation between FTND score and level of education

The Pearson's correlation test revealed a strong positive highly significant correlation between FTND score and the number of cigarettes/day (r= 0.758, p< 0.001) as shown in figure 3.
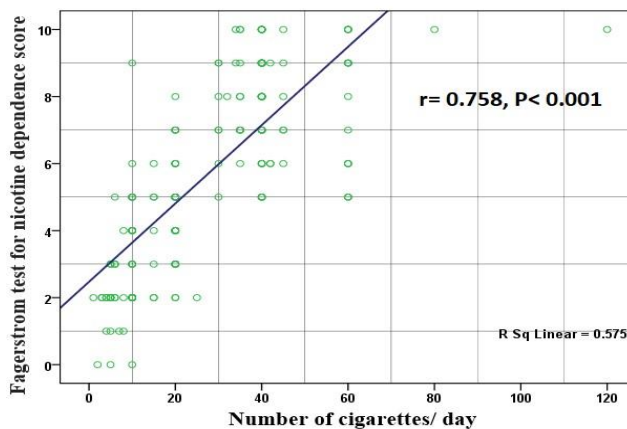

Figure 3: Correlation between FTND and number of smoked cigarettes/day

There was a positive highly significant correlation between FTND score and age of the participant (r= 0.457, p<0.005) as in figure 4.
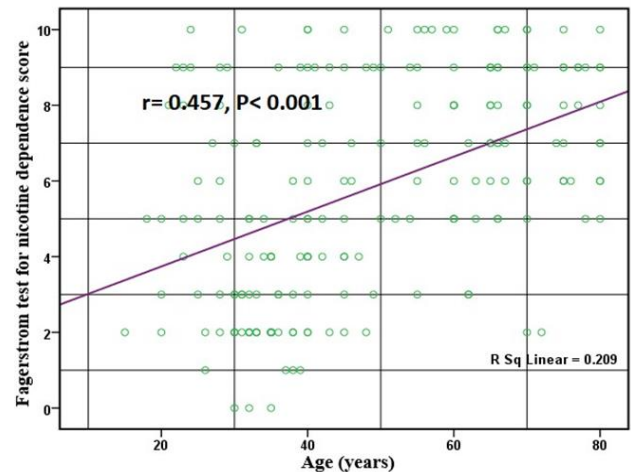

Figure 4: Correlation between FTND score and age of the participant

The duration of smoking had a positive highly significant correlation with FTND core (r= 0.536, p< 0.001) as indicated in figure 5.
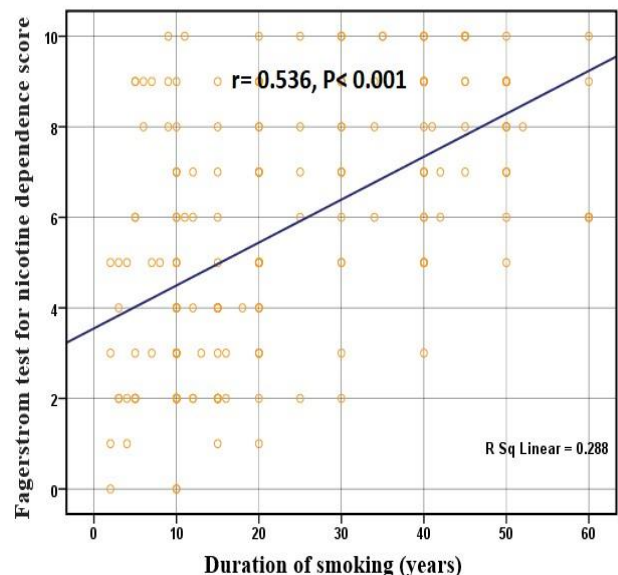

Figure 5: Correlation between FTND score and duration of smoking

Discussion
Evaluation of nicotine dependency is an important step before planning any treatment for smoking addiction. In this study the overall average of FTND was 5.8±2.81 which can be classified as a moderate score. Compared with the other international studies, this score is considered relatively high. A study from India [11] reported 4.92 FTND score among smokers in rural areas of the country. In the USA, this score ranged between

4.3-4.6 [12, 13], while in Europe it was much lower ranging between 2.8-3.4 [14]. Some studies reported higher FTND score than the present study, as in an Iranian study on 673 smokers where FTND score was 7.4±0.81 [15]. Stratification of FTND score into low, moderate and high showed that 54.5% of the smokers in the current study had high scores, which is a very high proportion compared with the other studies. A study from Germany investigated a total of 2535 smokers and found that only 10.9% had FTND score of 6 or above. In a Brazilian study on 93 smokers, 36.6% had high or very high nicotine dependence [14]. These discrepancies between the different studies are expected because several factors can interfere with nicotine dependence such as age, sex, comorbidities, duration of smoking and stress, which differ in different studies. There was no significant association between FTND score and attempts to quit smoking in the current study. International studies in this regard are controversial. In an Iranian study, smokers without a history of quitting attempts had a higher FTND score than those with recurrent attempts (a significant inverse correlation) [14]. On the other extreme, a large cohort American study [16] on 2603 smokers found a significant positive association between nicotine dependence and attempt to quit smoking. The discrepancies between these studies and the current study may be explained by the sample size which was much larger in the American study compared to the current study, in addition to some demographic characteristics (like male: female ratio, and alcohol consumption) which are widely prevalent among western societies, and can influence the results. Logically, increased attempts to quit reflect the higher number of failed attempts which indicates a higher nicotine dependence. Other factors may interfere with this assumption and not all failed attempts are related to nicotine dependence. Generally, smokers with different comorbidities were found to have higher FTND scores than those free from such comorbidities. These results are in accordance with many previous studies despite the different comorbidities included in each study. A recent study from Bangladesh [17] investigated 128 adult smokers to find out the relationship between tobacco-related morbidities and nicotine dependence. The results showed that 57.8% of smokers were free form comorbidities and had an average FTND score which was significantly lower than those with comorbidities (4.7±2.25 versus 7.3±2.23). Four tobacco-related illnesses were recognized which were COPD, gastritis, hypertension and leukoplakia. However, the authors did not find significant differences in FTND score among smokers having these illnesses. In most other studies, comorbidities involved illnesses that are not directly associated with smoking, like diabetes and depressive or anxiety disorder [18, 19]. A significant association were reported between these illnesses and FTND score. Tobacco-related illnesses like IHD and malignancies usually develop slowly. Smoking as a risk factor for these illnesses has to be practiced for a long time which implies an increase in the nicotine dependence. This explains the significant association between these comorbidities and FTND score. The current study revealed a significant negative correlation between FTND score and the educational level. This result agrees with many previous studies [20, 21, 22] which showed that lower educational levels had a significant association with higher nicotine dependence as well as a higher prevalence of smoking. Subjects with higher education usually have a higher awareness about the risk of smoking and its addiction than those with lower educational level. Accordingly, a large proportion of highly educated smokers tried not to be a victim of smoking addiction, and this trend highly contributes to lowering nicotine dependence scores. A strong positive highly significant correlation between FTND score and the number of cigarettes/day was reported in the current study. In accordance with this result is a large American study [23] in which data was collected from three randomized placebo-controlled smoking cessation trials. Although the authors used scales other than FTDN, the number of cigarettes smoked per day was significantly associated with all scales. Almost similar result was reported from Nepal [24] and Malaysia [25]. The explanation for this association is that frequent nicotine consumption causes changes in the ventral tegmental area and nucleus accumbens. Thus, when brain concentrations of nicotine are lower than usual, it causes a low level of neural activity in these regions. This is associated with feelings of a need for smoking which can be thought of as a kind of 'nicotine dependence [26]. There was a moderate positive highly significant correlation between FTND score and age in the present study, which is in accordance with many prior studies. A study from India [11] on 926 male smokers with an age range of 18-60 years reported a significant association between age and FDNT score. A Similar finding was obtained by a Chinese study [27] conducted among a migrant population in China. However, other studies reported different results. In a cross-sectional study from China [28] on 596 Chinese smokes to find out the association between age and nicotine dependence, it was found that the mean FTND score in the middle-aged group (45–64 year) was higher than that in the younger (<45 year old) and older groups (≥65 year old).In the present study, a highly significant positive correlation was found between FTND scores and the duration of smoking, in agreement with a cross-sectional study on 587 Nepalese smokers [24] with a median smoking duration of 10 years (range 5-10 years), where in the latter study the authors used two scales for nicotine dependence, FTND and Heaviness of Smoking Index (HSI). Both scales were found to be significantly associated with smoking duration. Other studies conducted on Indian and Dutch populations found similar results [11, 29]. In the same context

another study [13] stated that the number of years of smoking and the number of cigarettes smoked per day are powerful factors that increase the FTND score. In conclusion, more than a half of smokers had high nicotine dependence score. Nicotine dependence score correlated positively with the number of smoked cigarettes/day, age of the smoker and the duration of smoking, and negatively with the educational level. There was no correlation between nicotine dependence and the number of attempts to quit. Smoking-related comorbidities associated significantly with high nicotine dependence.

Authors' Contributions

Marawah Riyadh Salim**:** collection of sample, interpretation of data, drafting of manuscript
Hashim Mahdi Hashim: Design of sample, interpretation of data
Haider Noori Dawood: Design of sample, interpretation of data

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تقييم مدى الادمان على التدخين بواسطة (FTND Score) وعلاقتها مع بعض الامراض المصاحبة للتدخين

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خلفية الدراسة: إن إدمان النيكوتين هو النتيجة الحتمية لكثير من المدخنين. بغض النظر عن إستراتيجيات السيطرة أو أساليب التداخل للإقلاع عن التدخين، فمن الأهمية تحديد درجة الإعتماد على النيكوتين لكل مدخن.

الاهداف: هدفت هذه الدراسة إلى تقييم الإعتماد على النيكوتين حسب مقياس فاجرستروم ومعرفة إرتباط درجة الإعتماد هذه مع بعض الأمراض المصاحبة للتدخين وشدة التدخين ومدته.

المرضى والمنهجية: شملت هذه الدراسة المقطعية ما مجموعه 200 مدخنا بالغا. تم الحصول على البيانات الديموغرافية بما في ذلك العمر والجنس والمستوى التعليمي وعدد السجائر / اليوم وعدد محاولات الإقلاع عن التدخين وكذلك البيانات السريرية بما في ذلك إرتفاع ضغط الدم وأمراض القلب الإقفارية والأورام الخبيثة. تم تقييم الإعتماد على النيكوتين بإستخدام مقياس فاجرستروم الذي يتكون من 6 عناصر وله أقصى مجموع نقاط 10.

النتائج: كان المتوسط العام لمقياس فاجرستروم بين المدخنين 81.2 ± 8.5. سجلت درجات منخفضة لهذا المقياس في 5.12٪ فقط من المشاركين، ودرجات معتدلة في 33٪ ودرجات مرتفعة في 5.54٪. أظهرت نتائج مقياس فاجرستروم ارتباطاً موجباً مع عدد السجائر / اليوم p<0.001، عمر المدخن 005< p،مدة التدخين p<0.001، وارتباطاً سلبيا مع المستوى التعليمي 0001< p، رافق وجود الأمراض المصاحبة ذات الصلة بالتدخين، لا سيما امراض القلب الإقفارية والأورام الخبيثة درجات أعلى معنويا من مقياس فاجرستروم مقارنة مع عدم وجود هذه الامراض p<0.001.

الإستنتاجات: لدى أكثر من نصف المدخنين درجات عالية من الاعتماد على النيكوتين، وترتبط هذه الدرجات إيجابيا مع كل من عدد السجائر المدخنة في اليوم، عمر المدخن ومدة التدخين، وبشكل سلبي مع المستوى التعليمي.

الكلمات المفتاحية: التدخين ، الادمان، اختبار فاغرستوم