ORIGINAL RESEARCH

Evaluation of Nicotine Dependence among Smokers in Salem District Using Modified Fagerstrom Questionnaire (m-FTQ)

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ABSTRACT

Nicotine dependence is a challenging health problem presently among smokers as it involves a compulsive use of a substance in spite of its known harmful effects.

Aim: The primary aim is to assess the nicotine dependence in a group of smokers by using seven-question m-FTQ (modified Fagerstrom questionnaire) and to assess the nicotine dependence with age, duration in years, and the number of packets smoked per day.

Materials and methods: Only those who use smoking forms of tobacco in the age groups between 16 years and 79 years were randomly selected by visiting Vinayaka Mission's Sankarachariyar Dental College, Vinayaka Missions Research Foundation. The total sample size is 200 patients. The age groups were divided into < 20, 21–30, 31–40, 41–50, 51–60, 61–70, and 71–80. Informed consents were obtained from the participants of the study. The questionnaire was carried at chairside in the outpatient Department of Oral Medicine, Diagnosis and Radiology, Vinayaka Missions Sankarachariyar Dental College, Vinayaka Missions Research Foundation, Salem.

Results: *Beedi* smokers were at a risk of developing nicotine dependence when compared to cigarette and *churut* smokers.

Conclusion: *Churut* smokers were found to have high mean nicotine dependence Fagerstrom score than *beedi* and cigarette smokers. In this study, moderate nicotine dependence Fagerstrom score was found to be predominant among the smoking population of Salem.

Clinical significance: This study helps to assess nicotine dependence among smokers in Salem and the necessity to provide counseling for the cessation of tobacco and establishment of tobacco cessation centers.

Keywords: Contemplation, Modified-Fagerstrom rating questionnaire scale (m-FTQ), Nicotine dependence, Pre-contemplation, Smokers.

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INTRODUCTION

Smoking tobacco still prevails among the people owing to its euphoric effect in spite of its deleterious effects it causes and its addictive nature. About 266.8 million people currently use tobacco.[1] Addiction is characterized by compulsive drug-seeking and use, even after knowledge about its negative health consequences.[2]

WHO in its International Classification of Diseases (ICD) and the American Psychiatric Association (APA) in its Diagnostic and Statistical Manual (DSM-IV) stated that dependence is a maladaptive pattern of substance use, leading to clinically significant impairment or distress, as manifested by three (or more) of the following, occurring at any time in the same 12-month period:

(a) Tolerance, as defined by either a need for markedly increased amounts of substances to achieve the desired effect, or markedly the diminished effect with the continued use of the same amount of substances. (b) Withdrawal, as manifested by either the characteristic withdrawal syndrome for the substance or the substance being taken to relieve or avoid withdrawal symptoms. (c) Taking larger amounts of the substance or taking over a longer period than it was intended. (d) A persistent desire or unsuccessful efforts to cut down on the substance's use. (e) A great deal of time being spent in activities necessary to obtain or use a substance. (f) Abandonment or reduction of important social, occupational, or recreational activities because of substance abuse.[3]

Diagnostic and statistical manual on mental disorders (DSM-V) stated that "the essential feature of a substance abuse disorder is a cluster of cognitive, behavioral, and physiological symptoms indicating the individual who continues to use the substance despite significant substance related problems."[4]

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AIMS AND OBJECTIVES

The aims and objectives of the study is to assess the nicotine dependence in a group of smokers aged 16–79 years by using seven question m-FTQ and to assess the nicotine dependence with age, duration in years, and the number of packets smoked per day among *beedi* and cigarette smokers.

MATERIALS AND METHODS

The nicotine dependence was assessed based on the seven-question m-FTQ as proposed by Prokhorov et al.[5] modified from six questionnaire Fagerstrom test developed by Heatherton et al.[6] Carpenter et al. validated FTND (Fagerstrom test for nicotine dependence) is a better tool for assessing smoking behavior in adults.[7] Informed consents are obtained from the participants before

conducting the study. 200 patients those who use only smoking forms of tobacco in the age groups between 16 and 79 years were randomly selected by visiting Vinayaka Missions Sankarachariyar Dental College, Vinayaka Missions Research Foundation. The smoking forms of tobacco among the study population were divided into three groups namely *beedi* smokers, cigarette smokers, and *churut* smokers. The total sample size is 200 patients. Age groups were divided into < 20, 21–30, 31–40, 41–50, 51–60, 61–70, and 71–80. Among them, 159 were *beedi* smokers, 38 were cigarette smokers, and 3 were *churut* smokers. Informed consents were obtained from the participants of the study. The questionnaire was carried at chairside in the outpatient Department of Oral Medicine, Diagnosis and Radiology, Vinayaka Missions Sankarachariyar Dental College, Vinayaka Missions Research Foundation, Salem (Fig. 1).

Inclusion criteria: (a) age groups 16–79 years were included. (b) Those who use only smoking forms of tobacco and are willing to participate in the study. (c) Smokers with duration more than one year. Three groups of smokers were selected: (a) those who were *beedi* smokers. (b) Those who are cigarette smokers. (c) Those who were *churut* smokers. Exclusion criteria: (a) those who are not willing to participate in the study. (b) Those who use chewing forms of tobacco. (c) Those who are terminally ill or bed-ridden are excluded from the study. Results were tabulated in excel and statistical data were obtained using Anderson Darling Normality test.

RESULTS

Age groups among smokers were divided into <20, 21–30, 31–40, 41–50, 51–60, 61–70, 71–80, and 81–90. Among them, 159 (79.5%) were *beedi* smokers, 38 (19%) were cigarette smokers, and 3 (1.5%) were *churut* smokers. The Pareto chart shows that *beedi* smokers were more common among the South Asian population (Fig. 2).

The mean age group of the population in our study is 50.945. About 159 among 200 were exclusively *beedi* smokers. The highest population of *beedi* smokers was seen among the age group 51–60 years (28.93%).

The interval plot of nicotine dependence score vs duration in years is plotted in Figure 3.

Among 159 *beedi* smokers, 98 had a moderate nicotine dependence score, 37 had a high nicotine dependence score, 21 had a low-moderate nicotine dependence score, and 3 had a low nicotine dependence score (Fig. 4).

Out of 38 cigarette smokers, 10 had a high nicotine dependence score, 25 had a moderate nicotine dependence score, 2 had a low-moderate nicotine dependence, and 1 had a low nicotine dependence score (Fig. 5).

The nicotine dependence score based on Anderson-Darling Normality test is represented. The mean nicotine dependence score among the population was 6.3100, A-squared 4.52 with a p value < 0.005, which is found be statistically significant and the 95% confidence interval (CI) was 6.1015–6.5185 (Fig. 6).

The distribution of population among *beedi* smokers based on the age group is represented (Fig. 7).

The mean duration of age in years is 47.25, SD 15.492 with a p value 0.178, which was not statistically significant among the study population. The mean duration of smoking in years, packets per day, pack years, and nicotine dependence score among the entire 200 study population was 16.580, 1.1050, 17.730, 6.310, respectively, with standard deviation values of 11.892, 0.3073, 13.247, 1.495, respectively, with a p value of 0.005, which is found to be statistically significant (Table 1).

Mean, standard deviation based on the total number of persons, and duration of habit in years were tabulated (Table 2).

The mean age in years, duration in years, packets per day, pack years, and nicotine dependence score among the *beedi* smokers were 48.13, 18.170, 1.1069, 19.50, and 6.233, respectively, with standard deviation (SD) values of 15.89. 11.937, 0.3100, 13.54, and 1.498, respectively, with 95% confidence interval (CI) values of 45.957–50.302, 16.300–20.040, 1.0584–1.1555, 17.376–21.618, and 5.9981–6.4673, respectively, (Table 3).

The mean age in years, duration in years, packets per day, pack years, and nicotine dependence score among the cigarette smokers were 41.053, 9.9211, 1.0789, 19.497, and 6.2327, respectively, with standard deviation (SD) values of 10.677, 9.4765, 0.2733, 13.539, and 1.4977 with a 95% confidence interval (CI) for mean values of 37.543–44.562, 6.8062–13.0359, 0.9891–1.1688, 17.376–21.618, and 5.9981–6.4673 with p value of <0.005 for duration in years, packets per day, pack years, and nicotine dependence score, which is found to be statistically significant (Table 4).

The mean age in years, duration in years, packets per day, pack years, and nicotine dependence score among the *churut* smokers were 65.000, 16.667, 1.3333, 18.333, and 7.000, respectively, with a standard deviation (SD) values of 15.000, 10.408, 0.5774, 7.638, and 1.7321 with a 95% confidence interval (CI) for mean values of 27.738–102.262, −9.189 to 42.522, 0.1009–2.7676, −0.640 to 37.306, 2.6973–11.3027 with p value of 0.631, 0.334, 0.057, 0.487, 0.057, <0.005 for age, duration in years, packets per day, and pack years, respectively. Nicotine dependence score is found to be statistically significant based only on the nicotine dependence score (Table 5).

The highest amount of cigarette smokers was seen among 41–50 age group. 24.5% of the population had high nicotine dependence, 62% had moderate nicotine dependence, 11.5% had low-moderate nicotine dependence, and 2% had low dependence. 12.5% of the *beedi* smokers had moderate nicotine dependence.

The relative risk (RR) among the *beedi* smokers is 3.083049, this suggested that *beedi* smokers had a high nicotine dependence and those among the cigarette smokers is 0.234568 and *churut* smokers is 0.015. The absolute risk among *beedi* smokers of developing nicotine dependence was 79%, cigarette smokers was 19%, and *churut* smokers was 3%. This suggested that *beedi* smokers had more risk of developing nicotine dependence when compared to cigarette and *churut* smokers.

DISCUSSION

Nicotine dependence is defined as a chronic relapsing compulsive behavior of nicotine use and inability to withdraw from the use of nicotine in spite of its known adverse effects.

Nicotine dependence includes the following stages such as precontemplation, contemplation, preparation, action, and maintenance (Fig. 8). Precontemplation is the initial stage in which an individual acquires the habit of a new behavior of smoking. Contemplation is a stage where the individual desires to experiment with smoking. Preparation is a stage in which the individual have the intention to smoke within the next 30 days and seek out persons who smoke and may begin to experiment with smoking.[8]

Nicotine, a 3-(1-methyl-2-pyrrolidinyl)pyridine, is a volatile alkaloid with a molecular weight of 162.33 and can be highly absorbed through the lungs and oral mucosa and has the highest first pass metabolism. (The products of metabolism can reach the systemic circulation before entering the liver.) Nicotine is metabolized by cytochrome CYP2A6 and variation in the rate of

DEPARTMENT OF ORAL MEDICINE AND RADIOLOGY

VINAYAKA MISSION'S SANKARACHARIYAR DENTAL COLLEGE

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DATE :   OP. NO: Serial No :

NAME :   AGE/SEX :

HABIT :   TYPE OF SMOKING FORM OF TOBACCO : BEEDI /CIGARETTE/CHURUT

DURATION: FREQUENCY:

Principal Investigator : Dr.Karthik MDS, Reader, Department of Oral medicine & Radiology

Guided by : Dr. N. Mohan MDS, Professor and Head, Department of Oral medicine & Radiology

Student investigator : Dr.Jeyavel M J (PG Student)

Evaluation of Nicotine dependence using modified Fagerstrom Tolerance questionnaire (m–FTQ) among smokers

1. How many cigarettes a day do you smoke?
   a. Over 26 cigarettes a day
   b. About 16-25 cigarettes a day
   c. About 1-15 cigarettes a day
   d. Less than 1 a day

2. Do you inhale?
   a. Always
   b. Quite often
   c. Seldom
   d. Never

3. How soon after you wake up do you smoke your first cigarette?
   a. Within the first 30 minutes
   b. More than 30 minutes after waking but before noon
   c. In the afternoon
   d. In the evening

4. Which cigarette would you hate to give up?
   a. First cigarette in the morning
   b. Any other cigarette before noon
   c. Any other cigarette afternoon
   d. Any other cigarette in the evening

Contd...

5. Do you find it difficult to refrain from smoking in places where it is forbidden (church, library, movies, etc.)?
   a. Yes, very difficult
   b. Yes, somewhat difficult
   c. No, not usually difficult
   d. No, not at all difficult

6. Do you smoke if you are so ill that you are in bed most of the day?
   a. Yes, always
   b. Yes, quite often
   c. No, not usually
   d. No, never

7. Do you smoke more during the first 2 hours than during the rest of the day?
   a. Yes
   b. No

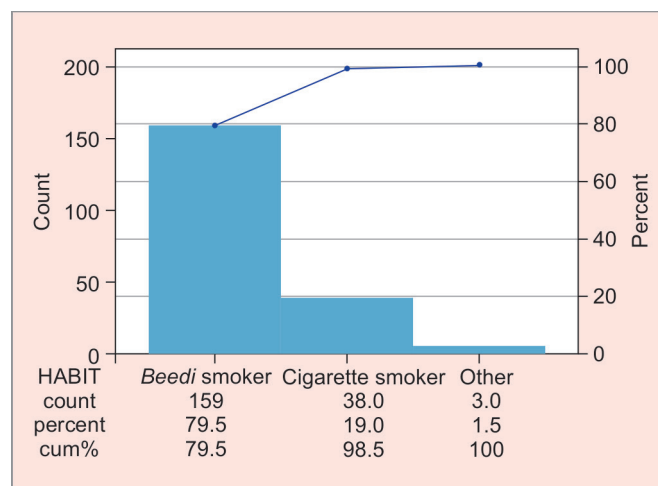| Nicotine Dependence	Score
No nicotine dependence	0
Low Nicotine dependence	<2
Low – Moderate Nicotine dependence	2-5
High Nicotine dependence	6-9

Fig. 1: m-FTQ used in the study

Fig. 2: Pareto chart for various smoking habits

nicotine metabolism contributes to differences in vulnerability to tobacco dependence and response to smoking cessation treatment.[8]

The amount of nicotine in various smoking forms of tobacco used in the study in *beedi* and cigarette was 22.52 and 12.94, respectively.[9]

Colby et al. stated that the complex mechanism of nicotine dependence and the rapid fluctuations in their smoking behavior makes it challenging to assess the level of nicotine dependence.[10]

Maisto et al. described nicotine on inhalation reaches the brain in approximately 7 seconds.[11]

Beedi is the most common form of smoking tobacco used among South Asian population among Salem district.[12]

Grady et al. stated that nicotine in tobacco smoke when inhaled stimulates the nicotinic anticholinergic receptors causing dopamine release from the corpus striatum, pre-frontal cortex, nucleus accumbens regions producing a euphoric effect, thereby causing an addiction.[13]

Benowitz et al. stated that nicotine activates the alpha 4 beta 2 receptors in the ventral tegmental area causing dopamine release in the shell of nucleus accumbens.[14]

Our study showed that *beedi* is the most common form of smoking tobacco in India, which is in accordance with the study by Garg et al.[12,15]

The mean age in our study population was 47.25 years, which was not in accordance with the study by Parashar et al. in which the mean age group among the study population was 16.58 years.[16]

The probability plot in our study shows moderate dependence Fagerstrom score is most abundant among the smokers in Salem (Fig. 9), whereas in a study conducted by Samatha et al., mild nicotine dependence is predominantly seen among the smokers in Belgaum.[17]

Males account for the majority of the study population in Salem whereas females with mean age group of 48.5 years were predominant. The highest nicotine dependence is seen among the age group of 51–60 years in our study population whereas the highest nicotine dependence is seen among the smokers of age group 45–54 years in study population in China as stated by Ma et al.[18]
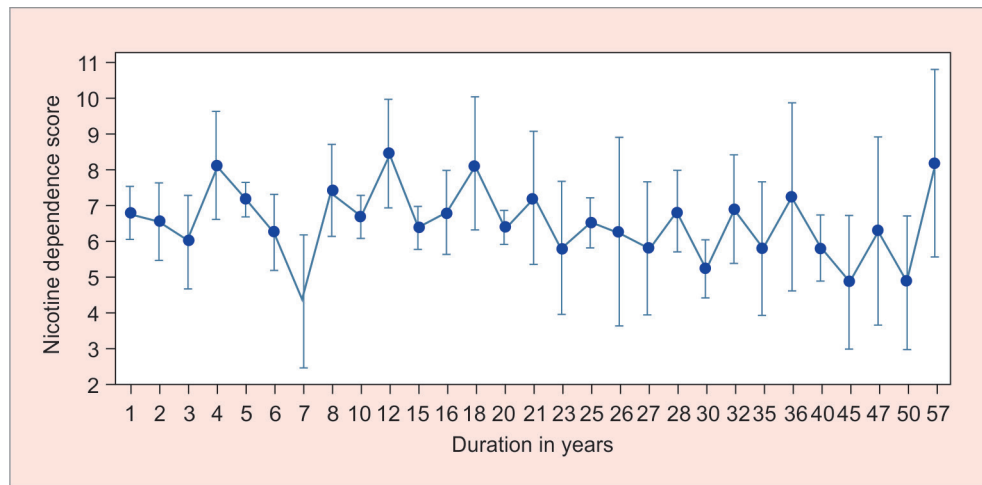
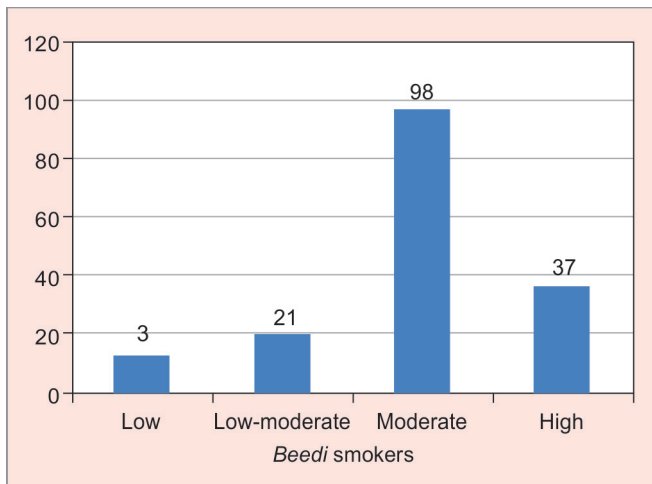**Fig. 3:** Interval plot of nicotine dependence score vs duration of smoking in years

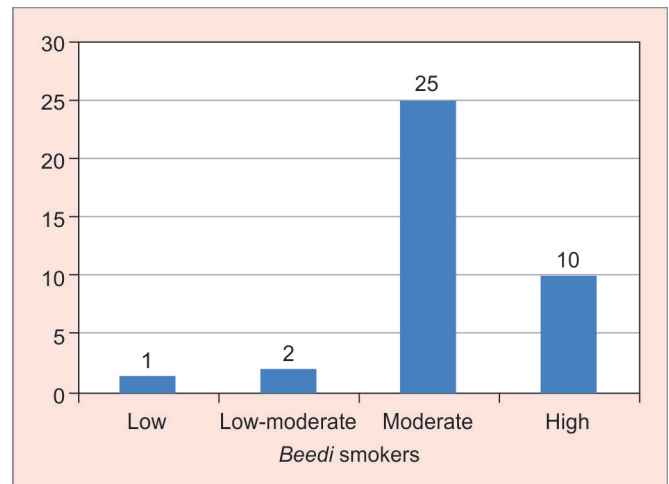**Fig. 4:** Distribution of nicotine dependence among *beedi* smokers

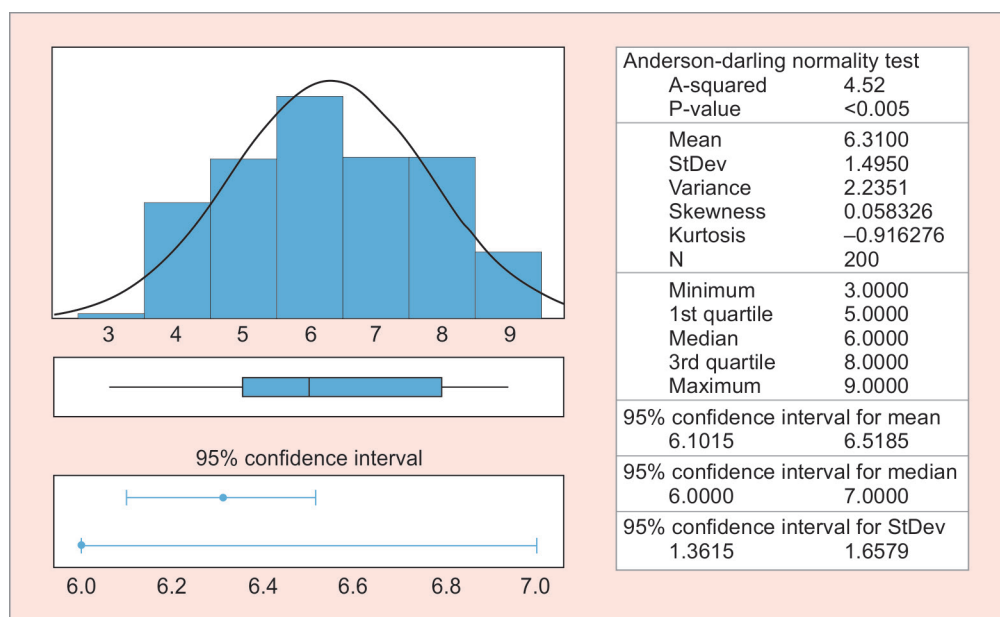**Fig. 5:** Distribution of nicotine dependence among cigarette smokers

Fig. 6: Nicotine dependence score based on Anderson-Darling Normality test

Table 1: Mean, standard deviation based on age, duration in years, packets per day, and nicotine dependence score

	Mean	Standard deviation	Confidence interval	p value
Age	47.25	15.492	45.319–49.187	0.178
Duration in years	16.580	11.892	14.922–18.238	<0.005
Packets per day	1.1050	0.3073	1.0621–1.1479	<0.005
Pack years	17.730	13.247	1.0621–1.1479	<0.005
Nicotine dependence score	6.310	1.495	6.1015–6.5185	<0.005

Table 2: Mean, standard deviation based on the number of persons, and duration of habit

Duration in years	N	Mean	Standard deviation	95% CI
1	12	6.583	0.793	(5.784, 7.383)
2	6	6.333	1.506	(5.202, 7.464)
3	4	5.75	2.06	(4.37, 7.13)
4	3	8.000	0.000	(6.401, 9.599)
5	28	7.000	1.388	(6.477. 7.523)
6	6	6.000	1.549	(4.869, 7.131)
7	2	4.000	0.000	(2.041, 5.959)
8	4	7.25	2.22	(5.87, 8.63)
10	17	6.471	1.419	(5.799, 7.142)
12	3	8.333	1.155	(6.734, 9.933)
15	20	6.150	1.348	(5.531, 6.769)
16	5	6.600	1.673	(5.361, 7.839)
18	2	8.000	0.000	(6.041, 9.959)
20	31	6.161	1.485	(5.664, 6.659)
21	2	7.000	0.000	(5.041, 8.959)
23	2	5.50	2.12	(3.54, 7.46)
25	14	6.286	1.437	(5.545, 7.026)
26	1	6.000	*	(3.230, 8.770)
27	2	5.500	0.707	(3.541, 7.459)
28	5	6.600	1.342	(5.361, 7.839)
30	11	4.909	0.831	(4.074, 5.744)
32	3	6.67	2.52	(5.07, 8.27)
35	2	5.50	2.12	(3.54, 7.46)
36	1	7.000	*	(4.230, 9.770)
40	8	5.500	1.512	(4.521, 6.479)
45	2	4.500	0.707	(2.541, 6.459)
47	1	6.000	*	(3.230, 8.770)
50	2	4.500	0.707	(2.541, 6.459)
57	1	8.000	*	(5.230, 10.770)

Pooled SD (standard deviation) = 1.40327

Table 3: Mean, standard deviation, 95% confidence interval for mean based on age, duration in years, packets per day, pack years, and nicotine dependence score among *beedi* smokers

Beedi smokers	Mean	Standard deviation (SD)	95% CI for mean
Age	48.13	15.89	45.957–50.302
Duration in years	18.170	11.937	16.300–20.040
Packets per day	1.1069	0.3100	1.0584–1.1555
Pack years	19.50	13.54	17.376–21.618
Nicotine dependence score	6.233	1.498	5.9981–6.4673

Table 4: Mean, standard deviation, 95% confidence interval for mean based on age, duration in years, packets per day, pack years, and nicotine dependence score among cigarette smokers

Cigarette smokers	Mean	Standard deviation (SD)	95% CI for mean	p value
Age	41.053	10.677	37.543–44.562	0.467
Duration in years	9.9211	9.4765	6.8062–13.0359	<0.005
Packets per day	1.0789	0.2733	0.9891–1.1688	<0.005
Pack years	19.497	13.539	17.376–21.618	<0.005
Nicotine dependence score	6.2327	1.4977	5.9981–6.4673	<0.005

Table 5: Mean, standard deviation, 95% confidence interval for mean based on age, duration in years, packets per day, pack years, and nicotine dependence score among *churut* smokers

Churut smokers	Mean	Standard deviation (SD)	95% CI for mean	p value
Age	65.000	15.000	27.738–102.262	0.631
Duration in years	16.667	10.408	−9.189 to 42.522	0.334
Packets per day	1.3333	0.5774	0.1009–2.7676	0.057
Pack years	18.333	7.638	−0.640 to 37.306	0.487
Nicotine dependence score	7.0000	1.7321	2.6973–11.3027	0.057
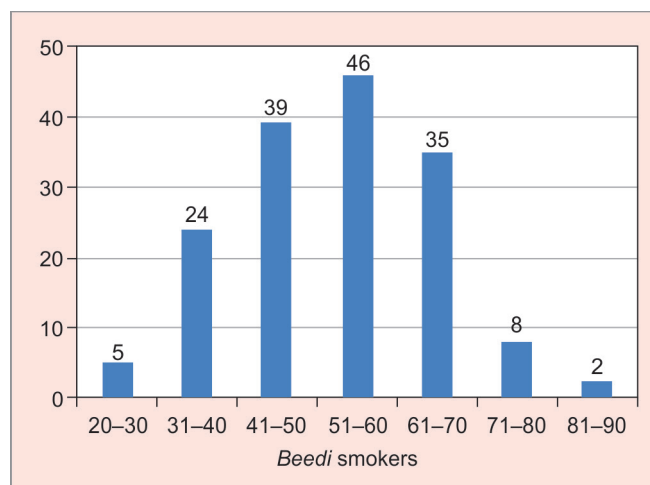
Fig. 7: Distribution of *beedi* smokers based on age in years

Batra et al. concluded that 4 mg nicotine chewing gum may be an efficacious harm-reduction alternative for smokers who are not ready to quit and may promote smoking cessation.[19]

The ultimate goal in the treatment of nicotine dependence due to smoking tobacco and its clinical recommendation was suggested by Fagerstrom.[20]

The treatment of nicotine dependence involves cognitive behavioral therapy with interactive counseling and explaining the harmful effects of tobacco use.

Various nicotine substitutes in the form of nicotine chewing gum, Polacrilex, the first marketed nicotine chewing gum used for nicotine dependence. Nicotine transdermal patch applied on the extensor aspect on the skin of a forearm delivers between 5 mg
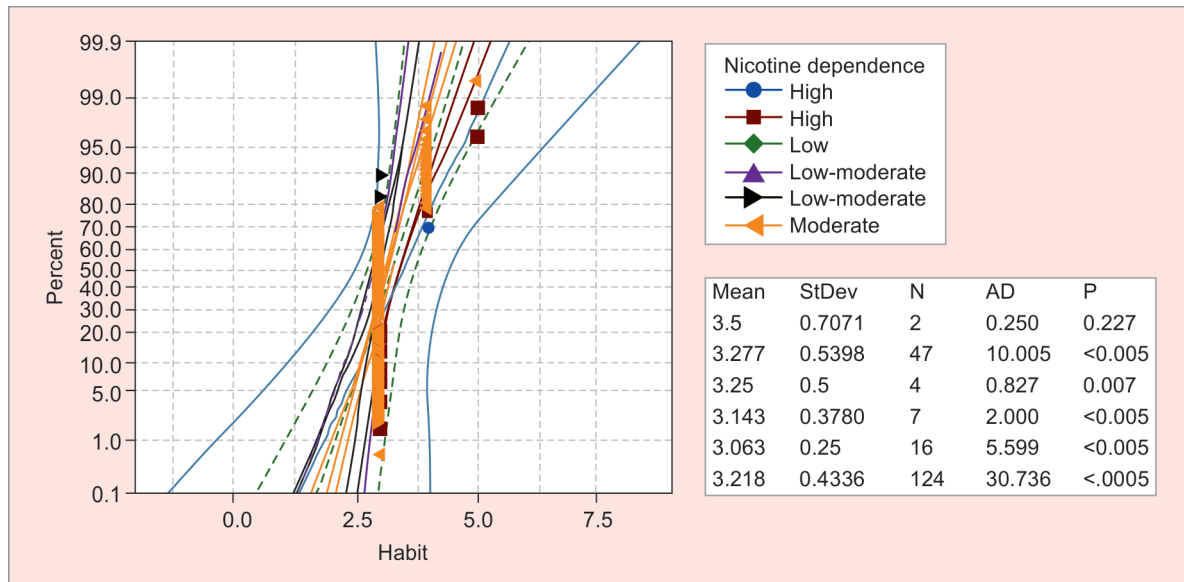
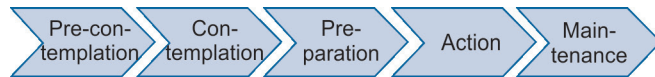**Fig. 8:** Probability plot of smoking habits with nicotine dependence score

Fig. 9: Stages of nicotine dependence

and 22 mg of nicotine over a 24 hour period, and the major adverse effect is localized anaphylactic skin reactions. Nicotine nasal spray delivers 0.5 mg of nicotine per 50 μL squirt. Each dose consists of two squirts, one to each nostril. Patients should be started with one or two doses per hour, which may be increased up to the maximum of 40 doses per day, one dose of nasal spray per hour (1 mg nicotine) for 10 hours produces average plasma concentrations of 8 ng/mL. A true pulmonary inhaler provides direct delivery of nicotine into the lungs comparable to cigarette smokers and allows for the rapid relief of acute cravings and especially morning craving and sublingual tablets/lozenges in dosages of 2 mg or 4 mg nicotine prescribed as alternative to those smokers who are unable to accept nicotine chewing gum. Recent research is more focusing on rapid delivery of nicotine (true pulmonary inhaler) and immunological approaches (nicotine vaccine) to tackle nicotine dependence.[21]

The US Food and Drug Administration (FDA) approved a nicotine vaccine named NicVAX developed by Nabi Biopharmaceuticals. It is a hapten 3′-aminomethylnicotine conjugated to exoprotein A used to treat nicotine addiction and to prevent relapses of smoking tobacco. The only disadvantage is that these vaccines are short lived.[21]

Novel medications like varenicline, a partial nicotinic cholinergic agonist selective for α4β2 receptors, produce a modest level of mesolimbic dopamine thereby diminishing nicotine cravings at a dose of 0.5 mg and bupropion, a dopamine reuptake inhibitor at an initial dose rate of 150 mg per day, can be gradually increased to 300 mg per day on the subsequent weeks for 4 weeks used in nicotine replacement therapy helps in overcoming the addictive nature of smoking tobacco and nicotine dependence.[22]

U.S. FDA has cleared two repititive transcranial magnetic stimulation (rTMS) devices (Neuronetics, Malverne, PA, USA (October 2008); Brainsway, Jerusalem, Israel (February 2013)) for the treatment of obsessive-compulsive disorders and recently in research trials for nicotine addiction.[22]

Repititive transcranial magnetic stimulation (r-TMS), a new approach of physiological intervention being tested to treat nicotine addiction, noninvasively stimulates neural activity in the targeted areas of the brain using magnetic fields. The mechanisms of rTMS potential therapeutic action in treating addictions involve increased dopamine and glutamate function in corticomesolimbic brain circuits and the modulation of neural activity in brain circuits that mediate cognitive processes relevant to addiction, such as response inhibition, selective attention, and reactivity to drug-associated cues. rTMS impulses generated from rTMS devices using magnetic fields of 5–20 Hz frequencies targeted to the DLPFC (Dorsolateral Prefrontal cortex) significantly reduced spontaneous or cue-induced nicotine craving. The major disadvantage is that TMS devices cause noise during the procedure and risk of induction of seizure. It is reported that the adverse effects of noise during the procedure are more frequent and rTMS are contraindicated in patients with stents, cochlear implants, and aneursymal drug clips.[23]

LIMITATIONS

The limitation in our study is that this study is conducted only among the people of Salem, Tamil Nadu. This study does not assess the nicotine dependence among those who use chewing forms of tobacco.

CONCLUSION

Churut smokers were found to have a high mean nicotine dependence Fagerstrom score than *beedi* and cigarette smokers. In this study, a moderate nicotine dependence Fagerstrom score was found to be predominant among the smoking population of Salem.

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was obtained from the Institutional Ethics Committee-Vinayaka Missions Sankarachariyar Dental College, Vinayaka Missions Research Foundation.

CONSENT FOR PUBLICATION

Informed written consents were received for the publication of manuscript and figures. Written informed consents were obtained

from the participants for the publication of their individual details and accompanying images in this manuscript.

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