ORIGINAL RESEARCH ARTICLE

Magnitude and Correlates of Nicotine Dependence Among Brick Kiln Workers in A Rural Block of Murshidabad District, West Bengal, India

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DOI: 10.55489/njcm.151120244533

ABSTRACT

Background: Nicotine dependence, a major public health problem, causes respiratory illnesses like asthma, COPD, chronic bronchitis, pneumoconiosis (e.g. silicosis) and respiratory infections. Occupational exposure of smoke and dust among brick kiln workers, in addition to tobacco addiction result in worsening of lung function and increase the risk of mortality. This study planned to estimate the prevalence of nicotine dependence among tobacco users of a brick kiln factory and identify the factors associated with nicotine dependence among them.

Methodology: A cross-sectional study was conducted for a period of one month in a brick kiln of Murshidabad district among 135 adult workers who had been consuming any form of tobacco. Nicotine dependence was assessed by interviewing the participants using Fagerstrom Test for Nicotine Dependence (FTND) and Fagerstrom Nicotine Dependence Scale for smokeless Tobacco (FTND-ST) questionnaire.

Results: About, 52.6% were smokers, 24.4% were smokeless tobacco users and 23% were addicted to both. Approximately 73.6% and 78.2% were nicotine dependent among smokers and smokeless tobacco users respectively. Age, illiteracy, initiation of nicotine consumption at an adult age and long duration of consumption were found to be significantly associated with nicotine dependence.

Conclusions: A high level of nicotine dependence was found among workers. Awareness generation and behavior change communication is recommended.

Keywords: Nicotine dependence, Brick kiln workers, Smokeless tobacco, FTND, FTND-ST

ARTICLE INFO

Financial Support: None declared

Conflict of Interest: None declared

Received: 31-07-2024, **Accepted**: 28-09-2024, **Published**: 01-11-2024

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How to cite this article: Bandyopadhyay P, Ghosh R, Roy A, Das M. Magnitude and Correlates of Nicotine Dependence Among Brick Kiln Workers in A Rural Block of Murshidabad District, West Bengal, India. Natl J Community Med 2024;15(11):936-941. DOI: 10.55489/njcm.151120244533

INTRODUCTION

Nicotine dependence is defined as "cluster of behavioral, cognitive and physiological phenomena that develop after repeated tobacco use and that typically include a strong desire to use tobacco, difficulties in controlling its use, persistence in tobacco use despite harmful consequences, a higher priority given to tobacco use than other activities and obligations, increased tolerance and sometimes a physical withdrawal state".[1] The habitual tobacco use, fuelled by affordability and social media marketing, persists as a major global health issue. Nicotine addiction, primarily from smoking and tobacco chewing, is highly prevalent, quick to develop, and challenging to overcome, causing substantial morbidity and mortality, warranting significant public health attention.[2]

Brick kiln industry is one of the fastest growing sectors in India and the second largest in the world followed by china. Approximately 250-300 workers are employed in each brick kiln.[3] Majority of these workers are migrant laborers and a high rate of tobacco consumption have been found among them.[4,5] Respiratory illnesses like asthma, COPD, chronic bronchitis, pneumoconiosis (e.g. silicosis) and respiratory infections are prevalent among these workers due to occupational exposure of smoke and dust. In addition, tobacco consumption worsens the lung function and increase the risk of mortality.[6]

Several studies on nicotine dependence were conducted in India, but such studies scarce among brick-kiln workers. Therefore, the present study was conducted among brick kiln workers in a rural block of Murshidabad district, West Bengal with the aim of achieving the following objectives.

Present study aimed to estimate the prevalence of nicotine dependence among tobacco users in a brick-kiln factory and identify the factors associated with nicotine dependence among study participants.

METHODOLOGY

A cross-sectional study was carried out in a brick kiln factory situated in a rural village of Murshidabad district among the workers between July 2022 to Aug 2022. The study population included all adult brick-kiln workers (both male and female) who had been consuming any form of tobacco products at least for a year.

Sampling Size and technique: The sample size was determined using the formula: $N = \frac{Z_{(1-\alpha/2)}^2 \, p(1-p)}{d^2}$.

Given that similar studies were not conducted in India, prevalence of nicotine dependence among brick kiln workers was assumed to be 50%, absolute precision of 9%, and 15% non-response rate, resulting in an ultimate sample size of 135. Study subjects who met the inclusion criteria were recruited through consecutive sampling until the desired sample size was reached.

Inclusion and exclusion criteria: Adult male and female workers (aged 18 years and above) who have been consuming tobacco products in any form at least for 1 year and willing to participate in the study were included. Those who were critically ill, excluded from the study.

Study tool and data collection: Data were gathered through interviews with the study subjects, utilizing a predesigned pre-tested questionnaire following the acquisition of informed consent. Relevant information was collected on sociodemographic factors, including age, gender, education level, family structure, and total monthly family income. The pattern of tobacco use was evaluated based on the types of tobacco products, age at initiation, and duration of use. Nicotine dependence was measured using the Fagerström Test for Nicotine Dependence (FTND)[7] for tobacco smokers and the Fagerström Nicotine Dependence Scale for Smokeless Tobacco (FTND-ST)[8] for users of smokeless tobacco. Each of these scales contains six items. In the FTND for smokers, two items (items 1 and 4) are multiple-choice and scored from 0 to 3, while the remaining four items (items 2, 3, 5, and 6) are scored as 0 (no) or 1 (yes). The total score ranges from 0 to 10, with scores of 0-3 indicating minimal dependence, 4-6 indicating moderate dependence, and 7-10 indicating high dependence. During analysis, participants with scores of 4 or higher (moderate to high dependence) were categorized as "nicotine dependent," while those scoring 0-3 were categorized as having "no nicotine dependence." For smokeless tobacco users, the FTND-ST scale was used. This scale also contains six items: three items (items 3, 5, 6) are scored 0 (no) or 1 (yes), two items (items 2 and 4) are multiple-choice and scored from 0 to 2, and one item (item 1) is scored from 0 to 3. The total score ranges from 0 to 10, with scores of 5 or more indicating significant dependence and scores of 4 or less indicating low to moderate dependence. For those who consumed both smoking and smokeless tobacco products, both the FTND and FTND-ST scales were applied and were classified as "nicotine dependent" if they were found to be dependent on either scale. Since nicotine dependence is the outcome variable for smoking, smokeless and both users, the total nicotine dependence was calculated by summing the dependence values across each group. The questionnaires were translated to vernacular and back translated in English and assessed for content validity. The content validity index (CVI) and Cronbach's alpha was 0.8 and 0.76 respectively.

Ethical Consideration: Ethics approval was taken from the Institutional ethics committee, referenced as IEC-MSD/MCH/PR/1522/2022/J dated 24 June 2022

Data analysis: Data were entered into an Excel master sheet and analyzed using SPSS IBM version 20.0.

Descriptive analysis was performed for qualitative variables, which are presented as proportions. Bivariate analysis was conducted using the Chi-square test to assess associations between categorical variables. Multivariable analysis was performed using binary logistic regression to identify independent predictors of nicotine dependence to any form of tobacco use. The Hosmer-Lemeshow test was applied to assess the goodness of fit for the model. Odds ratios (OR) with 95% confidence intervals (CI) were calculated, and a p-value of less than 0.05 was considered statistically significant for all analyses.

RESULTS

Socio demographic characteristic: The majority of the study participants were aged between 30-49 years (42.2%) with the mean age of 38.28 years (± 12.88). More than three-fourth of the participants were males (78.5%) and lacked any formal education (73.3%). Most of them resided in joint family (51.1%) and belonged to lower socioeconomic status (94.07%) [Table-1].

Table 1: Distribution of study subjects according to their socio demographic profile (N=135)

Variables	Participants (%)
Age (in years)	
18-29	42 (31.2)
30-49	57 (42.2)
≥ 50	36 (26.6)
Gender	
Male	106 (78.5)
Female	29 (21.5)
Education	
Illiterate	99 (73.3)
Primary school	15 (11.2)
Middle school	13 (9.6)
High school and above	8 (5.9)
Type of Family	
Joint	69 (51.1)
Nuclear	66 (48.9)
Family income (in Rs. /month)	
≤ 5000	79 (58.5)
5001-10,000	48 (35.6)
> 10,000	8 (5.9)

Table 2: Distribution of study subjects according to pattern of tobacco use (n=135)

Variable	Participants (%)
Type of tobacco use	
Tobacco smoking	71 (52.6)
Smokeless tobacco	33 (24.4)
Both	31 (23)
Age at initiation	
Adolescent	91 (67.4)
Adult	44 (32.6)
Duration (in years)	
< 5	15 (11.1)
10-May	37 (27.4)
>10	83 (61.5)

Pattern of Tobacco use: Over half of the study participants were smokers (52.6%), with 24.4% using smokeless tobacco and 23% addicted to both smoking and tobacco chewing. The majority-initiated tobacco uses during adolescence (67.4%) and had been consuming it for over a decade (61.5%) [Table-2], indicating prolonged and early-onset tobacco dependency among the participants.

Nicotine dependence among tobacco smokers: The overall nicotine dependence among smokers, smokeless tobacco users, and users of both was found to be 77.1%. Among the tobacco smokers, 73.6% exhibited moderate to high level of nicotine dependency. Most of them smoked 21-30 bidis per day (29.4%) with 48.2% lighting up within 6-30mins after waking. Nearly three-fourths (73.5%) reported finding it challenging to refrain from smoking in areas where the use of tobacco is prohibited, while 75.5% struggled to give up the first smoke in the morning. Additionally, 71.5% reported increased smoking frequency within the first hours after waking and persisted even during illness [Table-3].

Nicotine dependence among smokeless tobacco users: Among smokeless tobacco users, over three fourth (78.2%) were found to have high nicotine dependence.

Table-3: Distribution of study subjects according to nicotine dependence among tobacco smokers (n=102)

Fagerstrom Nicotine dependence (FND) questionnaire	Participants (%)
Q.1. Time taken to smoke the first bidi/cigarette after waking up	
Within 5 min	16 (15.6)
6-30 min	49 (48.2)
31-60 min	11 (10.7)
After 60 min	26 (25.5)
Q.2. Difficulty refraining from smoking in prohibited places (e.g., church, library, cinema).	
No	27 (26.4)
Yes	75 (73.5)
Q.3. Most difficult bidi/cigarette to give up	
The first one in the morning	77 (75.5)
Any other	25 (24.5)
Q.4. Number of bidis/cigarettes smoked per day	
10 or less	27 (26.5)
20-Nov	27 (26.5)
21-30	30 (29.4)
31 or more	17 (16.6)
Q.5. Smoke more frequently during the first hours after waking than during the rest of the day	
No	29 (28.4)
Yes	73 (71.5)
Q.6.Smoking during illness when confined to bed for most of the day?	
No	29 (28.4)
Yes	73 (71.5)
Level of nicotine dependence according to FND score	
0-3 (Minimal dependence)	27 (26.4)
4-6 (Moderately dependent)	10 (9.8)
7-10 (Highly dependent)	65 (63.8)

Table-4: Distribution of study participants according to nicotine dependence among smokeless tobacco users (n=64)

Fagerstrom Nicotine Dependence-Smokeless Tobacco (FND-ST) questionnaire	Participants (%)
Q.1. Time taken to place the first dip after waking up	
Within 5 min	12 (18.7)
6-30 min	24 (37.6)
31-60 min	16 (25)
After 60 min	12 (18.7)
Q.2. Frequency of intentionally swallowing tobacco juice	
Always	27 (42.2)
Sometimes	24 (37.5)
Never	13 (20.3)
Q.3. Most difficult chew to give up	
The first one in the morning	54 (84.3)
Any other	10 (15.6)
Q.4. Number of cans/pouches used per week	
More than 3	27 (42.2)
3-Feb	24 (37.5)
1	13 (20.3)
Q.5.Chewing tobacco more frequently during the first hours after waking than during the rest of the day?	
No	12 (18.7)
Yes	52 (81.3)
Q.6.Chewing tobacco during illness when confined to bed most of the day	
No	11 (17.2)
Yes	53 (82.8)
Level of nicotine dependence according to FND –ST score	
≤ 4 (Minimal dependence)	14 (21.8)
≥ 5 (High dependence)	50 (78.2)

Most of them (42.2%) consumed more than three pouches of tobacco per week, while 37.6% initiated their first dip within 6 to 30mins after waking up. About 42.2% intentionally swallowed tobacco juice and disliked giving up the first dip in the morning (84.3%). Majority (81.3%) reported chewing tobacco within the first hour after waking and 82.8% indicated that they continued to do so even during illness. [Table-4].

Factors influencing nicotine dependence: Nicotine dependence among the brick kiln workers was found to be significantly associated with age over 30 years (p <0.00001), illiteracy (p<0.00001), initiation of nicotine consumption at an adult age (p=0.025) and long duration of consumption (p<0.00001) [Table-5]. On multivariable regression analysis, we found age 30 years and above (AOR of 0.232, 95%CI 0.068-0.790, p=0.019), illiteracy (AOR of 0.112, 95%CI 0.038-0.329, p<0.0001) and 10 years and more duration of tobacco use (AOR of 0.315, 95%CI 0.092-1.080, p=0.046) were the significant predictors of nicotine dependence among study subjects [Table-6].

DISCUSSION

The present cross-sectional study in a brick kiln of Murshidabad district showed that a significant proportion of brick kiln workers were nicotine dependent. Age, illiteracy, adult age of initiation of tobacco consumption and long duration of consumption were the factors found to be significantly associated with nicotine dependence.

Tobacco use is widely recognized as the leading preventable cause of premature deaths and diseases worldwide.[9] According to the Global Adult Tobacco Survey (GATS-2) conducted in India, 28.6% of the population uses tobacco in any form, with 10.7% smokers and 21.4% using smokeless tobacco.[10] In the present study we observed a much higher level of tobacco consumption among brick kiln workers with 52.6% were smokers, 24.4% using smokeless tobacco, and 23% were using both. Similar studies conducted among different categories of industrial workers in India have reported diverse prevalence rates. For instance, a study by Parashar *et al* conducted among 172 construction workers in Delhi, reported 49% of workers were smokeless tobacco users, 22% were smokers and 22% were dual users.[11] This high level of tobacco dependency among the workers is congruent with our study. Another study by Akram et al. found a tobacco use prevalence of 53.7% among wood and plywood workers in Mangalore, with 11.9% identified as smokers and 41.5% as tobacco chewers.[12]

Additionally, a higher prevalence of tobacco smoking is also found in a study by Ansari *et al*, where a survey of 448 power loom workers in Allahabad revealed a smoking prevalence of 62.2% and a tobacco chewing prevalence of approximately 66.1%.[13] Similarly, another survey conducted among BPO industry employees showed that 49.5% of workers were tobacco users, with 10% being smokers and 16% using smokeless tobacco.[14] These are consistent with the current study findings. However, it's evident that smokeless tobacco use is much higher among workers than smoking tobacco. A study conducted by Prasad *et al* among brick industry workers in Wardha district revealed that 89% of the workers chewed tobacco products and only 4% smoked tobacco.[15] Similar finding was observed among workers in brick kilns under a gram Panchayat of South India where 85% used smokeless tobacco products, 7.5% were smokers and 7.5% used both forms.[16] In contrast, 96% of brick kiln workers were reported to smoke tobacco in a study by Shrestha *et al* in Uttar Pradesh, which is similar to our present study finding.[17]

Nicotine dependence is a major public health problem in both the developing and the developed countries which causes premature death in one in every six smokers and one in every two chronic smokers.[11] A high level of nicotine dependence among smokers (73.6%) as well as among smokeless tobacco users (78.2%) was observed in the present study. The overall nicotine dependence among brink kiln workers was 77%. Higher mean age (38.28± 12.88 years), illiteracy, adult age of initiation of tobacco consumption, 10 or more years of tobacco consumption were found to have a significant association with nicotine dependence among brick kiln workers.

Table 5: Factors influencing nicotine dependence among study participants (n=135)

Variables	Participants with Nicotine Dependence (%)	Participants without nicotine dependence (%)	OR (95% CI)	*p-value*
Age (in years)				
< 30	19 (45.2)	23 (54.8)	1 (Ref)	**<0.00001**
≥ 30	85 (91.4)	08 (8.6)	**12.86** (4.99-33.11)	
Gender				
Male	79 (74.5)	27 (25.50)	1 (Ref)	0.185
Female	25 (86.2)	04 (13.8)	**2.13 (0.68-6.69)**	
Education				
Illiterate	89 (89.8)	10 (10.2)	**12.46** (4.91-31.60)	**<0.00001**
Literate	15 (41.6)	21 (58.4)	1 (Ref)	
Type of Family				
Joint	55 (79.7)	14 (20.3)	1.36 (0.60-3.04)	0.45
Nuclear	49 (74.2)	17 (25.8)	1 (Ref)	
Family income (in Rs./ month)				
< 5000	58 (73.4)	21 (26.6)	1 (Ref)	0.235
≥5000	46 (82.1)	10 (17.9)	1.66 (0.71-3.88)	
Type of tobacco use				
Tobacco smoking	50 (70.4)	21 (29.6)	0.57 (0.20-1.59)	0.124
Smokeless tobacco	29 (87.9)	04 (12.1)	1.74 (0.44-6.87)	
Both	25 (80.6)	06 (19.4)	1 (Ref)	
Age at initiation				
Adolescent	65 (71.4)	26 (28.6)	1 (Ref)	**0.0258**
Adult	39 (88.6)	05 (11.4)	**3.12 (1.10-8.79)**	
Duration (in years)				
< 10	24 (51.1)	23 (48.9)	1 (Ref)	**<0.00001**
≥ 10	80 (90.9)	08 (9.1)	**9.58 (3.80-24.16)**	

Table 6: Multivariable regression analysis of factors associated with nicotine dependence among study participants

Variables	Adjusted Odds Ratio	95% Confidence interval	p-value
≥ 30 years of Age	0.232	0.068-0.790	0.019
Illiterate	0.112	0.038-0.329	<0.0001
Adolescent age of initiation	0.528	0.134-2.087	0.363
≥ 10 years of exposure	0.315	0.092-1.080	0.046

Nicotine dependence varies across geographical areas and diverse occupational groups. The study by Parashar *et. al* revealed that 60% of tobacco users found it challenging to refrain from smoking or chewing in places where tobacco use is prohibited and 55% smoked or chewed tobacco within first hours after waking up. A moderate to high level of nicotine dependence was found among them. Lower level of education, lower income was found to be associated with nicotine dependence among the construction workers.[11] These finding is consistent with the current study findings. Another study by Sushanti *et al* conducted among construction workers in Chennai showed the similar findings. Over half of the tobacco users (53.1%) had medium tobacco dependence, 12% had low and 10.5% had very high dependence to tobacco. Lower level of education, older age was found to be associated with nicotine dependence which is similar to our present study.[18] A cross-sectional survey among individuals aged 14 years and more done in Andaman and Nicobar Island by Manimunda *et al* showed that 48.9% of study participants were tobacco smokers while 40.9% uses smokeless tobacco. Nicotine dependence was found in one tenth of males and 3% of female participants.[19] Another study by Subedi *et al* in Dharan, Nepal among tobacco users revealed a moderate to severe level of nicotine dependence among 80% of smokeless tobacco users and 48% of smokers were found to have an association with the duration of tobacco use and low socio-economic status which is also congruent with the current study findings.[20] Increase in nicotine dependence among these workers may be influenced by the anxiety, depression from excessive workload, long working hours, lack of training, and poor communication among them which may lead to poor quality of life. In addition, easy availability of tobacco products and lack of awareness regarding the harmful effects of it, encourage them to initiate tobacco consumption from an early age and prolong duration of exposed contribute to the development of nicotine dependence.

LIMITATIONS

The small sample size restricts the generalizability of the study findings. Self-reported responses regarding patterns of tobacco use, duration of use, age of initiation may be subjected to recall bias.

Conclusion

The present study revealed a higher level of nicotine dependence among brick-kiln workers as compared to the general population. Higher age of the participant illiteracy, adolescent age at initiation and 10 or more years of tobacco use were found to be associated with nicotine dependence among the workers. Based on these findings of this study, there is need for targeted interventions to reduce nicotine dependence among brick-kiln workers. Further research is required to identify and implement effective strategies for reducing tobacco use in this population. Future studies should focus on evaluating specific interventions that can address both smoking and smokeless tobacco use in order to mitigate the health risks associated with tobacco consumption

Acknowledgement

We extend our gratitude to the study participants and all supporting staff for their cooperation.

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