

A CROSS-SECTIONAL STUDY ON THE BURDEN OF NON-COMMUNICABLE DISEASES AMONG CONSTRUCTION WORKERS IN CHENNAI

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Abstract

Background: India's construction industry employs over 50 million people and is the second largest contributor to the GDP after the agricultural sector. These workers are exposed to various occupational and lifestyle risk factors like smoke, prolonged physical labour, irregular working hours and stressful responsibilities, which make them more vulnerable to NCDs. The aim is to determine the prevalence of major NCDs (e.g., hypertension, diabetes, dyslipidaemia) and to analyse the risk factors associated with them among construction workers in Chennai. **Materials and Methods:** A cross-sectional study was conducted in Chennai from May to June 2024 among construction workers aged 18 years and above. A sample of 94 workers was selected by a simple random sampling technique. WHO STEPS questionnaire was used to collect information on behavioural risk factors, followed by physical measurements and blood sampling for biochemical profile. **Result:** Mean age of the workers were 45.69 years and among them 50 were males and 44 were females. The prevalence of diabetes, hypertension and dyslipidemia was 28%, 29% and 54% respectively. Tobacco and alcohol consumption was 61.7% and 28.72% respectively. Prevalence of overweight and obesity was 18.08% and 70.2% respectively. Abdominal obesity was present in 42.5% of our workers with a higher prevalence of 84.09% among female workers. **Conclusion:** Our study reported a high prevalence of behavioural risk factors like smoking and alcohol consumption and increased central obesity compared to the general population. There is an urgent need for targeted health interventions and policies to address the high prevalence of NCDs among construction workers. Improving access to healthcare services, promoting healthy lifestyles, and implementing regular health screenings are essential measures to mitigate the risk of NCDs in this population.

INTRODUCTION

Non-communicable diseases (NCDs) encompass a vast group of diseases such as cardiovascular diseases, cancer, diabetes, and chronic respiratory diseases.^[1] Non-communicable diseases (NCDs) kill 41 million people each year, equivalent to 74% of all deaths globally.^[2] Each year, 17 million people die from an NCD before age 70. Of these premature deaths, 86% are estimated to occur in low- and

middle-income countries. In India, NCDs account for over 60% of total deaths, posing a severe public health issue.^[3] It has significant impacts on the working-age population, contributing to economic losses and increased healthcare costs.^[4] According to the Ministry of Labour and Employment, the construction sector in India employs over 50 million people, making it one of the largest sources of employment in the country.^[5] (Ministry of Labour and Employment, 2022). In

Tamil Nadu, over 2.5 million workers were engaged in various construction activities.^[6] (Tamil Nadu Construction Workers Welfare Board, 2023). In Chennai, the industry is driven by urban development projects, including the Smart City Mission and various infrastructure initiatives, contributing to a substantial portion of employment and economic activity in the region.^[7] The construction industry is a significant contributor to India's GDP, employing many workers.

Construction workers are at a heightened risk due to various occupational and lifestyle factors. Workers are exposed to several risk factors, such as smoke, dust, different harmful chemicals, metals, prolonged physical labour, irregular working hours, and often inadequate access to healthcare etc. every day.^[8]

These occupational hazards combined with lifestyle factors such as poor diet, smoking, and alcohol consumption,^[9] stressful responsibilities make these construction workers more vulnerable to NCDs. These workers are mostly migrants from villages, often less educated and not aware of their high-risk behaviours and preventive measures which makes them more vulnerable. Despite the evident risks, there is a lack of comprehensive studies focusing on the burden of NCDs among construction workers in India, particularly in urban centres like Chennai. This study aimed to evaluate the prevalence of NCDs and their risk factors and emphasise the need for targeted health interventions and policies to address the high prevalence of NCDs among construction workers.

Objectives:

- To determine the prevalence of major NCDs (e.g., Hypertension, diabetes, Dyslipidaemia) among construction workers in Chennai.
- To identify and analyse the risk factors associated with these NCDs

MATERIALS AND METHODS

Study Design: A cross-sectional study design was employed to investigate the prevalence of Non-Communicable Diseases (NCDs) and associated risk factors among construction workers in Chennai. The study was conducted from May 2024 to June 2024. The study was conducted in Chennai, a major metropolitan city in the state of Tamil Nadu, India. Chennai was selected due to its significant construction industry and large population of construction workers. The study included workers from various construction sites across the city to ensure a representative sample.

Study Population: Both male and female construction workers aged 18 years and above who were employed at construction sites in Chennai for more than six months were included. The period was to ensure that the participants had sufficient exposure to occupational risk factors. Construction workers who did not provide consent were excluded from the study.

Sample Size Estimation: The sample size was estimated using the Open Epi tool, based on an expected diabetes prevalence of 9.2% (as per the International Diabetes Federation).^[10] With a confidence interval of 90%, the total sample size was determined to be 94 participants.

Study tool and data collection: A simple random sampling technique was used to select construction workers from various sites across Chennai. Data were collected using structured questionnaires, clinical assessments, and interviews to gather comprehensive information on health status, risk factors, and socio-economic conditions. The interviews were conducted until we got the desired sample size. WHO STEPS questionnaire was used for this study.^[11] The questionnaire was pre-tested before use. The STEPS instrument is comprised of three different levels or "steps" of risk factor assessment: STEP 1 included information on age, sex, education, occupation, marital status, tobacco use, alcohol consumption, intake of fruits and vegetables and physical activity. STEP 2 consist of physical measures of height, weight, waist circumference and blood pressure. and STEP 3 consists of biochemical measures of fasting blood glucose and total cholesterol levels.

Participants underwent health assessments to diagnose the presence of NCDs. Trained healthcare professionals conducted these assessments, which included measurements of blood pressure, blood glucose levels, and lipid profiles. Standard diagnostic criteria were used to identify cases of hypertension, diabetes, and dyslipidaemia.

Study Variables: Risk Factors: Manual work, duration of work, type of work, socio-economic status, literacy, smoking, alcoholism, high salt intake, Blood pressure, Body Mass Index (BMI), blood glucose levels, lipid profile and gender. The operational definition used in the study is given in the Box-1

Box 1: Operational Definitions used in the study

Socio-Economic Status: B.G. Prasad's socio-economic scale was used.

- Per capita income of Rs. 9097 and above was considered Upper class,
- Rs. 2729-4548 was Middle class, and below Rs. 1364 was Lower class.

Body Mass Index (BMI): According to the Asian-Pacific cutoff:

- Underweight: <18.5 kg/m²
- Normal weight: 18.5–22.9 kg/m²
- Overweight: 23–24.9 kg/m²
- Obese: ≥25 kg/m²

Abdominal Obesity: Waist circumference (WC) was used as a measure of central obesity. WC >94 cm in men and >80 cm in women was associated with an increased risk of metabolic complications.

Anaemia: HB values less than 13g/dl and 12 g/dl in males and females are considered anaemia respectively.

Random Blood Sugar (RBS): RBS above 140 mg/dL was considered indicative of diabetes

mellitus. Any value of RBS in already diagnosed diabetic respondents was also noted.

Hypertension (HT): Blood pressure readings above 140/90 mmHg (either systolic or diastolic or both) were considered hypertensive

Dyslipidaemia: Defined based on the following lipid profile values:

Total Cholesterol \geq 200 mg/dL, Triglycerides \geq 150 mg/dL, LDL \geq 130 g/dL

and VLDL \geq 30 mg/dL were considered dyslipidaemia.

Ethical Considerations: Ethical principles for biomedical research were followed. Implied consent was obtained as it is conducted as a part of institutional regular screening. Participants were assured of the confidentiality of their data and the voluntary nature of their participation.

Data analysis: The collected data from the structured questionnaires and clinical assessments were entered into MS Excel and presented in the form of tables, charts, and graphs. Data analysis was performed using Statistical Package for the Social Sciences (SPSS) version 25.0.

Descriptive Statistics: The demographic characteristics of the participants, such as age, gender, educational level, and occupational history, were summarized using frequencies and percentages.

Prevalence of NCDs: The prevalence rates of hypertension, diabetes, and dyslipidaemia were calculated as the proportion of participants diagnosed with each condition.

Risk Factor Analysis: Chi-square tests were used to examine associations between categorical variables (e.g., smoking status, and alcohol consumption) and the presence of NCDs. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The project was conducted in two broad construction establishments in Chennai. A total of 94 construction workers were interviewed, with 47 workers from each of the two construction sites. The interviews were conducted at their workplaces.

Sociodemographic characteristics of the study participants:

[Table 1] shows the Sociodemographic profile of our study participants. The mean age of the workers was 45.69 years (SD 13.03 and Range 23-72 years). Among them 50(53.2%) were males and 44(46.8%) were females. Most of the workers were illiterate (73.4%), and only 4.3% had completed high school. Most of the study participants belong to the lower class of socioeconomic status (69.1%). Most of the workers were migrants (84%) and the remaining were local residents.

A) Prevalence of Behavioural risk factors of the study participants:

Fruits, vegetables and Salt intake: Among workers, 58.5% are consuming fruits daily. But daily vegetable

intake was highest (94.7%) when compared to fruits. The extra salt consumption was 37.2%. [Table 2].

Smoking and alcohol consumption: Among the male study participants, 52% were smokers while none of the female participants smoked. About 69% were smokeless tobacco users. More women (39%) use smokeless tobacco when compared to men (30%). Among the male smokers, 13(50%) participants smoke 6 beedis or cigarettes per day while 2 (8%) of them consume 8 beedis or cigarettes per day.

54% of the male participants have the habit of alcohol consumption. The frequency of alcohol consumption varied from 1 to 6 days per week. Among the alcohol users, 8(30%) of the workers consume alcohol 5 days a week, while 4 (15%) of the participants consume alcohol 6 days a week. [Table 2].

Severity of the work: Most of the workers were in the field about 22.76 years (Range:5-50 years; SD:11.35). The average working hours per day was 7.94%. All the respondents were manual workers. Most of them 78(83%) were engaged in shift work, and 70.2% did overtime work.

Among 94 workers, 67% were doing moderate kind of work and 76.7% were engaged in strenuous work [Table 2].

B) Prevalence of biological risk factors of the study participants: Most of the study participants 66(70%) came under the obese category as per BMI and 17 (18.08%) were overweight. Abdominal obesity was seen in 43% of participants and this was presented more in females (84%) when compared to males (3%). The mean waist circumference was 81.93 cm [Table 3].

Blood Pressure: In our study, 14(14.9%) workers had reported hypertension and 12(12.8%) had reported both HT and DM. The mean Systolic Blood Pressure and Diastolic Blood pressure were 122.55mmHg and 79.6 mmHg respectively. [Table 4]. Among those on treatment for hypertension, 13 out of 23 (56%) had controlled blood pressure. Four were newly diagnosed with HT. The total number of hypertension cases in our study was 27 (28.7%) [Table 5].

About 40.4% of the workers were in a pre-HT stage which warrants regular physical examinations. There was a statistically significant association between sex and hypertension, with males having a higher prevalence ($p < 0.02$). Age was significantly associated with hypertension, particularly among older age groups ($p < 0.001$). BP was found to be significantly associated with family history of NCDs ($p < 0.001$), smoking ($p < 0.01$), high salt intake ($p < 0.001$), Obesity ($p < 0.01$) and dyslipidaemia ($p < 0.001$) (Table 7).

Blood Sugar: 11(11.7%) of our study participants had reported diabetes and 12(12.8%) had reported both HT and DM. Among those taking medication, 9 out of 22 (39.13%) had controlled blood sugar levels (RBS $<$ 200 mg/dL). Four were newly diagnosed with diabetes. The total number of diabetes cases found in this study was 26 [Table 5].

The prevalence of diabetes was significantly higher ($p < 0.01$) among the male workers 21 (42%) when compared to 5 (11%) female workers. Age was significantly associated with DM, particularly among older age groups ($p < 0.001$). Residence type and migration status were also significantly associated with DM, with higher prevalence among those living in shelters and migrants ($p = 0.03$ and $p = 0.02$, respectively). Higher prevalence of DM were significantly associated with family history of NCDs ($p < 0.001$), alcoholism ($p = 0.02$), lower physical activity levels ($p < 0.05$) and being obese ($p < 0.02$) [Table 6].

Dyslipidaemia: Out of 94 study participants, 51(54%) had dyslipidaemia with a higher prevalence (58%) in males, when compared to females 50% [Table 5]. 11.7% of the participants had total cholesterol levels above 200 mg/dL while 45(47.9%) workers had triglyceride levels above 150 mg/dL. 40% of our study participants had LDL levels above 130 mg/dL, and 35.1% had VLDL levels above 30 mg/dL.

Prevalence of DM, HT and Dyslipidaemia of study participants.

Table 1: Sociodemographic characteristics of study participants.

Demographics		Frequency	Percentage
Gender	Male	50	53.2
	Female	44	46.8
Age (years)	20-30	13	13.8
	31-40	23	24.4
	41-50	27	28.7
	51-60	19	20.2
	>60	12	12.7
Education	Illiterate	69	73.4
	Primary School	11	11.7
	Middle School	10	10.6
	High School	4	4.3
Socio-economic status	Lower class	65	69.1
	Middle class	22	23.4
	Upper class	7	7.44
Migration status	Migration	79	84
	Local	15	16
Local stay	Shelter	67	71.3
	Rental	22	23.4
	Own house	5	5.3

Table 2: Behavioural risk factors of study participants

Particulars	Frequency	Per cent
Daily Fruit intake		
Yes	55	58.5
No	39	41.5
Daily vegetable intake		
Yes	89	94.7
No	5	5.3
Extra Salt intake		
Yes	35	37.2
No	59	62.8
Smoking		
Male	26	52
Female	0	0
Smokeless tobacco		
Male	15	30
Female	17	39
Alcohol		
Male	27	54
Female	0	0
Severity of the work (Physical activity)		
Low	9	9.5%
Moderate	63	67%
Strenuous	72	76.5%

Table 3. Biological risk factors of study participants. Mean (Standard deviation) of biochemical risk factors of study participants

Parameter	Frequency	Percentage
BMI		
Normal	11	11.7
Overweight	17	18.08
Obese	66	70.2
Abdominal obesity (waist circumference)		

Male	3	6
Female	37	84.09

Table 4: Mean (Standard deviation) of non-communicable risk factors of study participants

Parameter	Minimum	Maximum	Mean	Std. Deviation
SBP (mmHg)	100	150	122.55	13.435
DBP (mmHg)	60	100	79.68	10.208
Haemoglobin g/dl	9.8	14.5	11.933	1.5611
RBS mg/dl	83	288	136.36	52.914
Total cholesterol mg/dl	120	250	177.64	26.03
Triglyceride mg/dl	75	245	143.15	31.271
LDL mg/dl	30	130	89.53	21.347

Table 5: Prevalence of DM, HT and Dyslipidaemia of study participants

Disease	Male	%	Female	%	Total	%
Hypertension						
HT	21	42%	6	14%	27	29%
Normal	29	58%	38	86%	67	71%
DM						
DM	21	42%	5	11%	26	28%
Normal	29	58%	39	89%	68	72%
Dyslipidaemia						
Dyslipidaemia	29	58%	22	50%	51	54%
No Dyslipidaemia	21	42%	22	50%	43	46%

Association of DM and HT with various risk factors:

A) Association of DM with various risk factors:

Table 6: Association of DM with various risk factors

Characteristic	DM	No DM	Total	P value
Sex				
Male	21	29	50	<0.01
Female	5	39	44	
Education				
Illiterate	19	50	69	0.22
Primary School	1	10	11	
Middle School	5	5	10	
High School	1	3	4	
Socio economic status				
Lower Class	14	51	65	0.09
Middle Class	10	12	22	
Upper Class	2	5	7	
Residence				
Shelter	12	55	67	0.03
Rental	12	10	22	
Own House	2	3	5	
Age Group				
20-30	0	13	13	<0.001
30-40	1	22	23	
40-50	8	19	27	
50-60	7	12	19	
>60	10	2	12	
Migration status				
Yes	18	61	79	0.02
No	8	7	15	
Family History of NCD				
Yes	24	13	37	<0.001
No	2	55	57	
Smoking				
Yes	8	18	26	0.67
No	18	50	68	
Alcoholism				
Yes	12	15	27	0.02
No	14	53	67	
Diet				
Non-Veg	25	60	85	0.24
Veg	1	8	9	
Fruits intake daily				
Yes	3	52	55	<0.001
No	23	16	39	
Vegetable intake daily				

Yes	24	65	89	0.52
No	2	3	5	
Physical activity				
Low	2	7	9	<0.05
moderate	22	41	63	
Strenuous	2	20	22	
BMI category				
Normal	8	3	11	<0.02
Overweight	3	14	17	
Obese	15	51	66	

B) Association of HT with various risk factors:

Table 7: Association of HT with various risk factors

Characteristics	HT	No HT	Total	P value
Sex				
Male	21	29	50	<0.02
Female	6	38	44	
Education				
Illiterate	20	49	69	0.55
Primary School	3	8	11	
Middle School	4	6	10	
High School	0	4	4	
Socio economic status				
Lower Class	20	45	65	0.77
Middle Class	5	17	22	
Upper Class	2	5	7	
Residence				
Shelter	20	47	67	0.88
Rental	6	16	22	
Own House	1	4	5	
Age Group				
20-30	2	11	13	<0.001
30-40	1	22	23	
40-50	7	20	27	
50-60	12	7	19	
>60	5	7	12	
Migration status				
Yes	24	55	79	0.41
No	3	12	15	
Family History of NCD				
Yes	27	10	37	<0.001
No	0	57	57	
Smoking				
Yes	14	12	26	<0.01
No	13	55	68	
Alcoholism				
Yes	14	13	27	0.02
No	13	54	67	
Diet				
Non-Veg	25	60	85	0.65
Veg	2	7	9	
Fruits intake daily				
Yes	8	47	55	<0.001
No	19	20	39	
Vegetable intake daily				
Yes	25	64	89	0.56
No	2	3	5	
Physical activity				
Low	2	7	9	0.87
moderate	19	44	63	
Strenuous	6	16	22	
High Salt intake				
Yes	27	8	35	<0.001
No	0	59	59	
BMI category				
Normal	5	6	11	<0.01
Overweight	0	17	17	
Obese	22	44	66	
Dyslipidaemia				
Dyslipidaemia	22	29	51	<0.001
No Dyslipidaemia	5	38	43	

DISCUSSION

The study aimed to determine the prevalence of Non-Communicable Diseases (NCDs) such as hypertension, diabetes mellitus (DM), and dyslipidaemia among construction workers in Chennai and to identify associated risk factors. Construction workers are exposed to various occupational hazards and lifestyle factors that increase their risk for NCDs. Understanding the health challenges faced by these workers is crucial for developing targeted interventions to improve their health outcomes and overall quality of life.

The findings of this study are consistent with previous research highlighting the high prevalence of NCDs among construction workers. A study conducted in Mumbai reported a hypertension prevalence of 28% among construction workers,^[12] which aligns with the 29% prevalence found in our study. Similarly, the prevalence of diabetes mellitus in our study (28%) is comparable to the 30% prevalence reported in a Delhi study.^[13] The high prevalence of dyslipidaemia (54.3%) observed in our study is also consistent with another study in Tamil Nadu which reported a 50% prevalence of dyslipidaemia among construction workers.^[14] These similarities underscore the widespread nature of NCDs among construction workers across different regions in India.

Our study also found significant associations between NCDs and various demographic and lifestyle factors. For instance, males had a higher prevalence of hypertension and diabetes mellitus compared to females. This is consistent with findings from other studies that report higher NCD prevalence in males due to factors such as higher rates of smoking and alcohol consumption.^[15]

The prevalence of tobacco use in all forms among our study participants was 61.7%. As per Akram et al,^[17] prevalence of tobacco use among industrial workers was 53.7% and Ansari et al,^[19] found an 85.9% prevalence of tobacco use among power loom workers. Another study carried out by Laad et al,^[18] revealed the prevalence of tobacco use to be 63.8%. The prevalence of tobacco use in our workers is very high compared to the general population according to NFHS survey24. The low education and low socioeconomic status of our study participants could be the cause of the high prevalence of tobacco use.

The prevalence of alcohol use in our study was found to be 28.72%. This is similar to a study done by Laad et al,^[18] among construction workers where alcohol use was found to be 15.8%. Alcohol consumption is high in our male study participants (54%) when compared to the general population according to NFHS 5 survey24 which revealed about 19% prevalence among men.

Our study revealed that 18.08% of workers were overweight. This is consistent with another study done by M. Parashar et al,^[16] among male construction workers in Delhi where 14.3% were

overweight. Obesity is high (70.2%) in our study participants when compared to the general population according to a nationwide study done by Venkatrao M et al which revealed a nationwide prevalence of 40.32% and that of southern India of 46.51%. Moreover, our study analysis showed that obesity and low physical activity were significantly associated with diabetes which is similar to the results in other studies.^[18-24]

The abdominal obesity in our study was seen in 42.5% of participants and this was presented more in females (84%) when compared to males (3%). This is consistent with another study done in a large industry in north India by Prabhakaran, D., et al,^[20] where 43% of study participants had central obesity. Central obesity is high in our female workers compared to the general population according to NFHS 5 data which revealed that 40% of women have abdominal obesity in our country.

Several limitations of the study need to be acknowledged. Firstly, the cross-sectional design limits our ability to establish causal relationships between risk factors and NCDs. Longitudinal studies are necessary to understand the temporal relationship between exposure to risk factors and the development of NCDs. Secondly, relying on self-reported data for certain variables, such as dietary habits and physical activity, may introduce reporting biases. Additionally, the study was conducted in Chennai, and the findings may not apply to construction workers in other regions. Lastly, although the sample size is statistically adequate, it may limit the power to detect associations with less common variables.

CONCLUSION

The study emphasizes the heavy impact of non-communicable diseases (NCDs) on construction workers in Chennai. It reveals high prevalence rates of hypertension (29%), diabetes mellitus (28%), and dyslipidemia (54.3%) among this group. These findings align with similar studies in other regions, indicating that construction workers face a heightened risk of NCDs. The study also pinpoints a higher prevalence of behavioural risk factors like smoking and alcohol consumption and increased central obesity than the general population posing a high risk of developing NCDs.

These results underscore the importance of targeted health interventions and policies to tackle the high prevalence of NCDs among construction workers. Improving access to healthcare services, promoting healthy lifestyles, and implementing regular health screenings are crucial steps to reduce the risk of NCDs in this population.

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