

Prevalence of Metabolic Syndrome and its Associated Risk Factors among the Sanitation Workers Employed in Urban Puducherry

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Abstract: ***Background and Objectives:** Metabolic syndrome (MetS), a clustering of cardiovascular risk factors, significantly contributes to the global non-communicable disease (NCD) burden. Sanitation workers, due to their socio-economic and occupational vulnerabilities are potentially at higher risk for Metabolic Syndrome. This study aimed to estimate the prevalence of Metabolic Syndrome and its associated risk factors among sanitation workers in an urban municipality of Puducherry and the seroprevalence of hepatitis B and C. **Methods:** A cross-sectional analytical study was conducted among 317 sanitation workers. Data collection included socio-demographic details, behavioural risk factors (assessed via WHO STEPS tool), anthropometric and biochemical measurements and stress assessment using Cohen's Perceived Stress Scale. Hepatitis sero-prevalence was assessed in a subsample of 100 participants. Descriptive statistics, proportions with 95% Confidence Interval and prevalence ratios were calculated using SPSS version 16. **Results:** The prevalence of Metabolic Syndrome was 38.9%. Elevated waist circumference (85.5%), low HDL (63.4%), and high fasting glucose (37.5%) were the most common abnormalities. Significant associations with Metabolic Syndrome were observed for overweight (PR: 1.89), obesity (PR: 1.03), elevated BP (PR: 1.4), high FBS (PR: 1.5), and moderate/severe stress. All participants reported unhealthy dietary practices; 73% had severe stress. Seroprevalence of hepatitis C was 6%, while hepatitis B was 0%. **Interpretation and Conclusions:** Metabolic Syndrome is highly prevalent among sanitation workers in Puducherry, with modifiable factors such as diet, obesity, and stress playing key roles. Targeted workplace health interventions are crucial to mitigate this emerging public health concern.*

Keywords: Abdominal Obesity, Cardiovascular Risk, Hepatitis C, Metabolic Syndrome, Occupational Health, Sanitation Workers

1. Introduction

Globally the prevalence of (NCD) is increasing and causing high mortality rates in developing countries[1]. The major factor involved in the NCD pandemic is Metabolic syndrome (MetS) which is a cluster of impaired glucose tolerance, abdominal obesity, insulin resistance, hypertension, and hyperlipidemia. MetS has a significant notification due to its association with increased Cardiovascular mortality and morbidity [2].

Many criterias are used for the diagnosis of MetS. However the most commonly used are the International Diabetic Federation (ID F) and the National Cholesterol Education

Program Adult Treatment Panel III (NCEP ATP III) crietria [3]. The global prevalence of the adult MetS ranges between 20 to 25%. The prevalence of MS among Indian adult population was 30% (95%CI: 28%-33%)[2]. Metabolic syndrome increases the risk of type 2 DM, vascular diseases like Myocardial Infarction and stroke in the next 5 to 10 years by five times. Identifying these high risk individuals will help to prevent the worst outcomes through a promotive and preventive action [4].

In India five million sanitary workers are present. Many challenges are faced by them due to their occupational hazard. Some include risk of developing infections like gastroenteritis, hepatitis A, hepatitis B, respiratory problems,

lack of standard operating procedures at work site, inadequate legal protection and financial insecurities and social stigma [5].

Numerous studies show the risk factors like smoking and alcohol use was high in the lower social economic class like that of sanitation workers. Moreover the work pressure, financial problems, chronic stress and the odd times of the work results in an unhealthy lifestyle pattern predisposing them to NCD [6,7].

Even though there are studies addressing about the infectious diseases, pulmonary diseases and dermatological problems among sanitation workers, limited studies were conducted in South India regarding metabolic syndrome. Hence the current study was conducted to address the issue.

2. Objectives

To estimate the prevalence of metabolic syndrome using the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria, to find out the association between the selected risk factors and metabolic syndrome and to estimate the prevalence of HBV and HCV infections and selected risk factors for the same

3. Methodology

It was a cross-sectional analytical study on sanitation workers of Urban Pondicherry.

Inclusion Criteria: Consenting sanitation workers who were working for at least six months in selected Municipality of the urban Pondicherry.

Exclusion Criteria: Subjects who were not present on the day of data collection

Sample size calculation: Considering prevalence of metabolic syndrome of 30% among adult Indian population with relative precision of 20%, 95% confidence interval, sample size was calculated using the formula $n = Z^2 \cdot p \cdot (1-p) / d^2$, this yielded a required sample size of 323 using open Epi version 3.01 [2]

Sampling technique: 400 sanitary workers were employed in the selected municipality. No sampling strategy was used. All the sanitary workers who consent for the study were included in the study.

Study tool: Pretested, validated questionnaire using STEPS III, Bathroom weighing scale, Stadiometer, Non stretchable Inch tape, Rapid diagnostic card kits for Hepatitis B and Hepatitis C were used.

4. Review of Literature

Author	Study findings
Prabhakumari Chellamma and et. al. (8)	601 sanitation workers in Thrissur corporation (Kerala) shows that there is 34.4% workers presented with one acute illness, 43.26% had chronic morbidities. Also there is 14.61% prevalence of DM and 13% prevalence of hypertension.
Omesh Kumar Bharti and et. al (9)	among 380 sanitation workers working under Shimla municipality in Himachal Pradesh (India) shows that 33 (18.5%) of them were found to have high blood pressure and 1 has diagnosed with blood sugar level of more than 200 mg%.
Masoumeh Ghiasvand and et al (10)	Among 424 rail road workers between the age of 21 and 64 years and Sub-populations in this study were consisting of 158 (37.3%) shift workers and 266 (62.7%) dayworkers. High levels of total cholesterol (> 200 mg/dl) and LDL-cholesterol (> 130 mg/dl) were significantly more prevalent in nearly all groups of shift workers irrespective of age. But there is no differences in the serum levels of triglyceride, HDL-C, fasting blood glucose and blood pressure between shift workers and day workers.
S M Nazri and et al (11)	among 148 workers (76 shift workers and 72 days workers) shows the prevalence of hypercholesterolaemia (47.4%) and hypertriglyceridaemia (42.1%) were significantly higher among shift workers compared to day workers with p-value of 0.014 and 0.044 respectively. There was no significant different in the prevalence of hyper-LDL and hypo-HDL cholesterolaemia and shift work was not significantly associated with dyslipidaemia, ORadj = 1.27; 95% CI 0.63- 2.57
Jussi Konttinen and et al (12)	Among 312 middle-aged Finnish municipal workers a cross-sectional study of Finnish municipal workers at risk of diabetes and cardiovascular disease" was conducted. waist circumference, fasting glucose, glycated hemoglobin, triglycerides, body fat percentage, body mass index, current smoking, and impaired fasting glucose or diabetes were separately associated with lower F-RHI, and HDL cholesterol
M. A. A. De Assis and et al (13)	Among 66 Brazilian garbage collectors shows the total number of eating events per day was significantly higher for night shift workers. Over 24-h, 'two HND meals' were the most common events and contributed the most energy, in all three shifts. Night shift workers ate more at dawn and less in the morning than other shifts. In all three shifts, meat was the most important food contributing to energy intake.
Joanna Strzemecka and et al. (14)	A cross-sectional study among 700 shift workers done in the Bogdanka mine in Leczna. The most frequently consumed meal during the day was the hot one (50.9%), three meals and more were consumed the least frequently (8.1%). Almost half of respondents considered their eating habits as inappropriate (46.3%). Among those, nearly half (68.2%) stated that shift – work is the reason for their nutrition habits. More than half of respondents (66.0%) admitted that shift work hampers regular consumption of meals.
N Sherrin Sophia (15)	a study on sanitation workers at Tiruchirappalli" done among Sanitation work in Tiruchirappalli shows 58% are not respected by their higher authorities, 70% reported that they were stigmatized by society. And 68% consume alcohol
Joy et al (16)	A community based cross sectional study was conducted among 73 street sweepers and sanitary workers in a zone of Greater Chennai Corporation by multistage sampling method, in 2016 using a semi structured questionnaire, 67.1% were females, 2/3rd of them belonged to the age group of 30-40 years. Majority of them (82.2%) had reported to

	have musculoskeletal problems followed by respiratory problems (61.6%), ophthalmic problems (53.4%), skin problems (38.4%), mental health problems (39.7%). Most of the respondents had multiple problems.
Ewis et al (17)	A total of 138 street sweepers and waste collectors and a matching control group of randomly selected 127 university workers and clerks were interviewed with laboratory investigations. The street sweepers and waste collectors had significantly higher rates of HCV seropositivity, parasitic infestations, skin irritation, respiratory complaints and work-related injuries; but with significantly lower mean hemoglobin levels, ($p < 0.05$).
Kanjanar, Banarjee et al (18)	Association between the risk factors with health hazards in street sweepers showed physiological hazard was not significantly associated, chemical hazard was significantly associated with educational background and take a short break, biological hazard was significantly associated with working experience, physiological was significantly associated with age group, and ergonomic was significantly associated with gender, age, working experience, educational background, take a short break, BMI, length of broom and weight of broom

Method of Data Collection

The study was carried out in the supervisor office where all the workers assemble for the headcount for the day. Data was collected after obtaining written informed consent from the participants. The data collection interview included the questionnaires assessing socio-demographic factors, family history of NCD and various cardiovascular risk factors (Physical inactivity, Unhealthy diet, Tobacco, alcohol usage, stress) and risk factors for blood borne infections. After these height, weight, waist circumference, Blood were recorded. Fasting blood sample of 5ml was taken for the estimation of Fasting Blood Sugar and Fasting Lipid Profile. Serology of viral hepatitis was obtained from the study population through rapid testing kit (Hepacard Manual 1-2.pmd - J. Mitra & Co Pvt. Ltd) after the interview from a subsample of 100 from the study population due to the logistic constraints in getting the testing kit on time. Study variables and corresponding statistical analysis method is given in Table 1. Data was entered in MS excel and analysed by SPSS 16.0 Software.

Table 1: Data variables and analysis

S. No.	Variable	Statistical analysis
1	Continuous variable: Age, Income, Family member	Mean (SD) or median (IQR)
2	Categorical variables: Metabolic syndrome DM/HTN Comorbidities Gender Educational status Socio-economic status Marital status Family type Relationship with other family members Religion Family history of diabetes/hypertension/ coronary heart diseases	Proportion with 95% Confidence Interval (CI)
3	Association between independent and outcome variables	Prevalence ratio

Table 2: Operational definitions of Metabolic syndrome

Parameters	Revised NCEP ATP III
Elevated waist circumference	≥ 88 cm in women ≥ 102 cm in men
Triglyceride (TG)	≥ 1.7 mmol/l (150mg/dl) or TG treatment
HDL-C	Men < 1.03 mmol/l (40mg/dl) or women < 1.29 mmol/l (50mg/dl) or HDL-C treatment
Blood pressure	Systolic ≥ 130 mmHg or Diastolic ≥ 85 mmHg or hypertension treatment or previously diagnosed

	hypertension
Fasting blood glucose	≥ 5.6 mmol/l (100mg/dl) or treatment for elevated glucose or previously diagnosed Type 2 Diabetes

* metabolic syndrome - any three of the above 5 features if present

Hepatitis B and Hepatitis C will be diagnosed through rapid diagnostic card test.

5. Results

Section A: Socio demographic profile of study participants

A total of 317 sanitation workers from the selected Pondicherry Urban Municipality were taken up for the study. Mean (SD) age of the participants was 50(8.7) with a minimum age of 27 and maximum of 75. Three-fourth (74.4%) of the study population were in the age category of 40 to 60 years. Educational status of the study participants was classified as four as per the International Standard Classification of Education as no formal schooling in 197 (62%), less than primary school in 18 (5.7%), Primary school in 61 (19.2%) and High school in 41(12.9%). It was observed that 99% of the study population was married and 96% of the participants were from the joint family set up. (Table 3)

Table 3: Socio-demographic characteristics of the study participants (N=317)

Socio demographic characteristics	Number of participants n (%)
Gender	
Female	283(89.3)
Male	34(10.7)
Age category (in years)	
20-30	6 (1.9%)
31-40	48 (15.1%)
41-50	107 (34.7%)
51-60	132 (41.6%)
61-75	24 (7.6%)
Educational status*	
No formal schooling	197 (62.2%)
Less than primary school	18 (5.7%)
Primary school	61 (19.2%)
High school	41(12.9%)
Marital status	
Married	315 (99.4%)
Divorced	2 (0.6%)
Family type	
Nuclear	10(3.2)
Joint	307(96.8)

*ISCED: International Standard Classification of Education

Table 4: Family and previous history of chronic disease among the study participants (N=317)

Family history of chronic disease	Number of participants n (%)
None	299(94.3%)
Hypertension (HTN)	8(2.5%)
Diabetes mellitus (DM)	10 (3.2%)
Previous history of chronic disease	
None	302(95.3)
Hypertension (HTN)	6 (1.9)
Diabetes mellitus (DM)	6 (1.9)
Both	3 (0.8)

Family history of chronic diseases reveals that 2.5% and 3.2% of study people had hypertension (HTN) and diabetes in their family. In case of previous history, only 1.9 % were known cases of hypertension and diabetes and 0.8% were found to have both. (Table 4)

Table 5: Duration of work among the study participants (N=317)

Working related characteristics	
Duration of working experience (in years)	Number of participants n (%)
0-5	146 (46.1%)
6-10	104 (32.8%)
11-15	46 (14.5%)
16-20	21 (6.6%)

Most of the participants (46%) belong to less than 5 years of working experience and 33% were found to have an experience between 6 and 10 years (Table 5).

Section B: Prevalence of behavioral and lifestyle related risk factors (tobacco, alcohol, diet and physical activity)

1) Prevalence of Behavioural and Lifestyle Related Risk Factors

WHO-STEPPS questionnaire was used to assess the behavioral and lifestyle related risk factors. About 99% of the study participants have never used tobacco in the past and meagre of 1% were the current tobacco users. Only 7.3% of the participants have ever used alcohol in the entire lifetime. About 14.5% were found to be current alcohol users who had history of alcohol intake in the past one year (Table 6).

Table 6: Behavioral characteristics of the study participants using the STEPS questionnaire (N=317)

Behavioral characteristics	
Tobacco use	Number of participants n (%)
Never used tobacco	314 (99%)
Current smokers*	3 (1%)
Alcohol use	
Never used alcohol	294(92.7%)
Current alcohol users**	23 (7.3%)

*Current smokers- history of tobacco use in the past 30 days at the time of interview were considered as current tobacco user

** Current alcohol users- history of alcohol use in the past one year at the time of interview were considered as current alcohol user

The prevalence of tobacco and alcohol use was 1% and 7.3% respectively.

Table 7: Dietary characteristics of the study participants (N=317)

Dietary characteristics	Number of participants n (%)
At least a servings of fruit per day for 5 days/week &	20 (6.3)
At least a servings of vegetable per day for 5 days/week	217(68.5)
Unhealthy diet*	317(100)

*WHO advice on maintaining healthy diet – at least 5 servings of fruits and vegetable per day for 5 days per week

The study found that only 6.3% of the study participants were taking at least ones serving of fruit intake per week. And 5 (1.6%) were taking adequate vegetable intake per week. All the study participants followed unhealthy dietary habit (Table 7).

All (100%) the study participants were reported have at least 150 minutes of moderate intensity physical activity per week.

2) Prevalence of anthropometric and physical risk factors (Obesity, abdominal obesity and hypertension), biochemical risk factors (raised fasting sugar, triglycerides)

Mean (SD) of BMI was found to be 24.7 (5.1) kg/m². Mean (SD) of waist circumference was found to be 90.9 (11.8) cm. Classification of BMI was done based on Asia-Pacific guidelines and it showed that majority (34.7%) of the participants belonged to the obese category (BMI ≥ 25.00 kg/m²). Overweight was seen in 16% of the population. Abdominal obesity was diagnosed in 85% of the study population (Table 8).

Table 8: Anthropometric characteristics of the study participants (N=317)

Anthropometric characteristics	Number of participants n (%)
BMI Category*	
Underweight (<18.50)	44 (13.8)
Normal (18.50 – 22.99)	112 (35.3)
Overweight (23.00 – 24.99)	51 (16.1)
Obesity (≥ 25.00)	110 (34.7)
Abdominal obesity#	
Present	271(85.5)
Absent	46(14.5)

*WHO Asia Pacific guidelines for classification of obesity; # ≥ 88 cm in women, ≥ 102 cm in men

Table 9: Parameters as per Revised NCEP ATP III among the study participants (N=317)

Parameters as per Revised NCEP ATP III		Number of participants n (%)
Elevated waist circumference	≥ 88 cm in women ≥ 102 cm in men	271(85.5)
Triglyceride (TG)	≥150mg/dl	83(26.3)
HDL-C	<40mg/dl (men); <50mg/dl (women)	201(63.4)
Blood pressure	Systolic ≥ 130 mmHg or	130(41)
	Diastolic ≥ 85 mmHg	107(33.8)
Fasting blood glucose	≥ 100mg/dl	119(37.5)
Metabolic syndrome*	Any three of the above 5 features if present	122(38.9)

* metabolic syndrome - any three of the above 5 features if present

As per NCEP ATP III criteria, 39% of the study population were found to have metabolic syndrome. Elevated waist circumference was observed in 85%, high triglyceride in 26%, low HDL level in 63%, elevated systolic blood pressure in 41% and elevated diastolic blood pressure in 33% of the study group. More than one third (39%) of the participants were found to have high fasting blood sugar (Table 9).

3) Prevalence of stress by Cohen's Perceived Stress Scale (CPSS)

Almost one fifth (19.5%) of the participants had low or average level of perceived stress with score ranging from 0-15. Majority (80.5%) of the study participants had either high (38.8% of the participants with score ranging between 16 and 20) or very high (41.7% of the participants with score more than or equal to 20) level of perceived stress.

Table 10: Perceived Stress level among the study participants using CPSS questionnaire (N=312)

Perceived stress	Number of participants n (%)
Low (0-13)	6 (1.9)
Moderate (14-26)	81(25.5)
Severe (27-40)	230(72.6)

More than two third (73%) of the participants were in the severe (27-40) stress category and 25% of the study population were in moderate stress category (14-26) (Table 10).

Section C: Association between various determinant factors and metabolic syndrome

The association of various socio-demographic and working related characteristics with was estimated by binomial regression and the risk was reported as Odds ratio

Table 11: Association of socio-demographic and working related characteristics with metabolic syndrome among the study participants (N=317)

Socio- demographic character	Total participants	Participants with metabolic syndrome n=122 (%)	Participants without metabolic syndrome n=195 (%)	Prevalence Ratio (95% CI)	P value
Gender					
Male	34	16(13.1)	18(93.2)	1	0.2
Female	283	106(86.9)	177(94.4)	0.6(0.3-1.3)	
Age category (in years)					
25-50	161	65(53.3)	57(46.7)	1	0.8
51-75	156	96(49.2)	99(50.8)	0.9(0.5-1.5)	
Educational status*					
No formal schooling	197	82(67.2)	115(58.9)	1	
Less than primary school	18	4(3.3)	14(7.2)	0.4(0.1-1.4)	0.2
Primary school	61	23(18.9)	38(19.5)	0.7(0.4-1.4)	0.3
High school	41	13(10.7)	28(14.4)	0.6(0.3-1.3)	0.2

Metabolic syndrome was more common in females and less than 50 years of age. The prevalence of metabolic syndrome was high among women (86%), in the age group <50years (53%). It shows females are more protected from metabolic

syndrome as compared to males. As compared to nil education, people who had some formal education was found to have a protective effect for metabolic syndrome. However, the association was not statistically significant (Table 11).

Table 12: Association of lifestyle and behavioral factors with metabolic syndrome among the study participants (N=317)

Lifestyle and behavioral factors	Total participants	Participants with metabolic syndrome n=122 (%)	Participants without metabolic syndrome n=195 (%)	Prevalence Ratio (95% CI)	P value
Tobacco user					
Never used tobacco	314	122(100)	192 (98.5%)	1	
Current smokers*	3	0	3 (1.5%)	0.69(0.097-4.97)	0.718
Current alcohol user					
Never used alcohol	294	114(93.4)	180 (92.3)	1	
Current alcohol users**	23	8(6.6)	15 (7.7)	0.4 (0.1-1.8)	0.3
Perceived stress					
Low (0-13)	6	5(4.1)	1(0.5)	1	
Moderate (14-26)	81	29(23.8)	52(26.7)	1.10(0.1-0.8)	0.04*
Severe (27-40)	230	88(72.1)	142(72.8)	1.12(0.13-1.1)	0.05*

*statistically significant

There was no significant association found between alcohol use, tobacco use and metabolic syndrome. Perceived stress by the workers found to have a significant association with

metabolic syndrome when compared with low stress with moderate and severe stress (Table 12).

Table 13: Association of anthropometric characteristics with metabolic syndrome among the study participants (N=317)

Anthropometric factors	Total number of participants	Participants with metabolic syndrome n=122 (%)	Participants without metabolic syndrome, n=195 (%)	Prevalence Ratio (95% CI)	P value
BMI Category*					
Underweight (<18.50)	44 (13.8)	17(13.9)	27(13.9)	0.65(0.07-5.84)	0.5
Normal (18.50 – 22.99)	112 (35.3)	42 (34.4)	70(35.9)	1	
Overweight (23.00 – 24.99)	51 (16.1)	20 (16.4)	67 (15.9)	1.89(1.1-3.45)	0.02*
Obesity (≥ 25.00)	110 (34.7)	43 (35.3)	195 (34.4)	1.03(0.14-7.45)	0.05*
Abdominal obesity					
Present	271	107(87.7)	164(84.1)	1.34 (0.8-2.5)	0.1
Absent	46	15(12.3)	31(15.9)	1	
Blood pressure					
Normal (<130/85)	187	75(61.5)	112(57.4)	1	0.001*
High ($\geq 135/85$)	130	47(38.5)	83(42.5)	1.4	
Fasting blood sugar					
Normal	198	83(68.1)	115(58.9)	1	0.05*
High(≥ 100)	119	39(31.9)	80(41.1)	1.5(1-2.5)	
Triglyceride					
Normal	234	89(72.9)	145(74.1)	1	0.3
High(≥ 150)	83	33(27.1)	50(25.9)	1.2(0.4-1.6)	
HDL					
Normal	116	38(31.2)	78(40)	1	0.1
Low(<40)	201	84(68.8)	117(60)	1.4(1-2.4)	

*Statistically significant

The prevalence of metabolic syndrome was more in the overweight and obese group which is 16 % and 35% in the respective groups. On comparing with normal BMI group, people in the overweight and obese category had the risk is 1.9 times and 1.03 times with significant p value. Participants with high blood pressure was found to have 1.4 odds having metabolic syndrome as compared with the normal BP and fasting blood sugar was also significantly associated with metabolic syndrome with PR (1.5), $p < 0.005$ (Table 13).

Table 14: Seroprevalence of hepatitis B and Hepatitis C, N=100

Hepatitis B	Number of participants, n (%)
Positive	0
Negative	100
Hepatitis C	
Positive	6
Negative	94

The prevalence of the selected study population for hepatitis B was 0 and Hepatitis C was 6% (Table 14).

6. Discussion

The current study was community based cross sectional study done in the selected Urban Municipality of Pondicherry to find the prevalence of metabolic syndrome among the sanitation workers using NCEP ATEP III criteria. Behavioral risk factors such as dietary habits, physical activity, tobacco and alcohol use was assessed using the STEPS questionnaire and stress was assessed through Cohen's perceived stress scale. Elevated waist circumference was observed in 85%,

high triglyceride in 26%, low HDL level in 63%, elevated systolic blood pressure in 41% and elevated diastolic blood pressure in 33% of the study group. More than one third (39%) of the participants were found to have high fasting blood sugar.

Majority (34.7%) of the participants belonged to the obese category (BMI ≥ 25.00 kg/m²). Overweight was seen in 16% of the population. As per NCEP ATP III criteria, 39% of the study population were found to have metabolic syndrome.

Factors such as BMI status, abdominal obesity and moderate to severe stress were significant predictors of metabolic syndrome among the study participants.

Prabhakumari Chellamma and et. al (8) did a study among 601 sanitation workers in Thrissur corporation which showed 14.61% prevalence of DM and 13% prevalence of hypertension.(7).The low prevalence in this study as compared to the current study is due to the age category of the study population.

Omesh Kumar Bharti and et. al (9) did a study among 380 sanitation workers in Shimla municipality in Himachal Pradesh (India) shows that 33 (18.5%) of them were found to have high blood pressure and 1 has diagnosed with blood sugar level of more than 200 mg%.(10) which is much lower than the current study due to the socioeconomic factors and study population characteristics.

Study in Kolkata by **Suvro Banerjee and et al. in (18)** 10,175 adults slum population aged more than or equals to 20 years, the prevalence of hypertension 42% (34).

Savitharani BB and et al (19) did a cross-sectional study conducted among 900 supportive staffs in JSS Hospital, Karnataka shows 30 (3.3%) had hypertension.(15)

The current study showed that more than two third (73%) of the participants were in the severe (27-40) stress category and 25% of the study population were in moderate stress category (14-26).

Many global studies have reported that the stress as a significantly higher among sanitation workers when compared to general population due to the nature of work and social stigma. Aditya Khetan and et.al (20) done a cross-sectional study among 3556 participants in age group of 35 to 70 years among the lowest SES group, found that 31.3% of them suffer for anxiety, 30.7% suffer work and family stress and 18.7% from depressive symptoms.(6)

Tomoyuki Kawada (21) et al in their study had found that proportion of metabolic syndrome as per IDF and NCEP/III criteria were 13.6% and 14.8%, respectively. The author had conducted the study among the car labourers of age group of 20-50 years. The prevalence was less than our current study due to the difference in the age category and the characteristic of the study population.

Elnaz Niazi (22) et al in his hospital- based study among 410 healthcare workers in Iran found that the metabolic syndrome was 22.4%. he also estimated the associated factors like blood pressure and occupational stress no significant relationship between metabolic syndrome and occupational stress. Higher age, having shift work and less physical activity were associated with metabolic syndrome. Our study had high prevalence of metabolic syndrome among overweight and obese group which is 16 % and 35%. On comparing with normal BMI group, people in the overweight and obese category had the risk is 1.9 times and 1.03 times with significant p value. Participants with high blood pressure was found to have 1.4 odds having metabolic syndrome as compared with the normal BP and fasting blood sugar was also significantly associated with metabolic syndrome with PR (1.5), $p < 0.005$. The difference between the associated risk factors could be due to the difference in the study population and the other characters like lifestyle and environmental conditions.

Hasan Hüseyin Eker (23) et al in their study among the solid waste disposal employees in Turkey had found that 40.9% of the employees were diagnosed with metabolic syndrome. The authors used NCEP-ATP III diagnostic criteria to estimate the prevalence of metabolic syndrome. Employees working in work stations other than administrative offices had a 2.60 times higher risk compared to those working in administrative offices with hypertriglyceridemia was the most common risk factor (57.7%) the differences could be due to lifestyle and health-related behaviors of solid waste sector workers.

Felix et al (24) total of 370 waste pickers were included in this analysis 68.57% were smoking whereas it was only 1%

on the current population which could due to the social desirability bias. In the multivariable regression model, elevated blood glucose had a non-significant increase in the mean percentage of 10-year risk of fatal CVD. Waste pickers who were over- weight/ obese, and hypertensive had high statistically significant mean percentages of the 10-year risk of fatal CVD compared to those who did not have the metabolic risk factors. Similar risk factor pattern was also observed in our study.

Maqbool et al (25) in 2011 et al did a study to estimate the prevalence of hepatitis B & C among sanitary workers at selection stage was 5.64 % [8]. **Shakeel et al (26)** in Pakistan reported the prevalence of HBV to be 33.6% with ELISA while HCV was present in 36.4% of the sanitary workers who worked in the same occupation for >5 years.

7. Conclusion

The cross- sectional study was conducted among sanitary workers of Urban Pudukcherry reported high prevalence of metabolic syndrome of 38%. The most common associated risk factor were overweight, obesity and abdominal obesity. Perceived stress by the workers found to have a significant association with metabolic syndrome when compared with low stress with moderate and severe stress. None of the participants were found to follow healthy diet pattern. The prevalence of Diabetes mellitus was in one third population while hypertension was found in > 40% participants. The prevalence of hepatitis C was 6% among the study population. There is an urgent need to focus on these risk factors among the vulnerable group like Sanitation workers and provide them with adequate Personal Protective Equipment to prevent the spread of the Hepatitis related infections.

8. Summary

The global prevalence of the adult MetS ranges between 20 to 25%. The prevalence of MS among Indian adult population was 30% (95%CI: 28%-33%)[2]. Metabolic syndrome increases the risk of type 2 DM, vascular diseases like Myocardial Infarction and stroke in the next 5 to 10 years by five times. Identifying these high risk individuals will help to prevent the worst outcomes through a promotive and preventive action. The present was conducted among 317 Sanitation workers employed in selected Municipality of the urban Pondicherry using the Pretested, validated questionnaire using STEPS III, physical and biochemical parameters were collected. The study was commenced after obtaining the permission from the Administrative Municipality officers . The study was carried out in the supervisor office where all the workers assemble for the headcount for the day. Data was collected after obtaining written informed consent from the participants. The data collection interview included the questionnaires assessing socio-demographic factors, family history of NCD and various cardiovascular risk factors (Physical inactivity, Unhealthy diet, Tobacco, alcohol usage, stress) and risk factors for blood borne infections

The current study was community based cross sectional study done in the selected Urban Municipality of Pondicherry to find the prevalence of metabolic syndrome among the

sanitation workers using NCEP ATEP III criteria. Behavioral risk factors such as dietary habits, physical activity, tobacco and alcohol use was assessed using the STEPS questionnaire and stress was assessed through Cohen's perceived stress scale. Elevated waist circumference was observed in 85%, high triglyceride in 26%, low HDL level in 63%, elevated systolic blood pressure in 41% and elevated diastolic blood pressure in 33% of the study group. More than one third (39%) of the participants were found to have high fasting blood sugar. Majority (34.7%) of the participants belonged to the obese category (BMI ≥ 25.00 kg/m²). Overweight was seen in 16% of the population. As per NCEP ATP III criteria, 39% of the study population were found to have metabolic syndrome. Factors such as BMI status, abdominal obesity and moderate to severe stress were significant predictors of metabolic syndrome among the study participants.

Ethics Statement and Conflict of Interest Disclosures

Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Institute Ethics Committee issued approval No.424/IEC-35/IGMC&RI/PP-29/2022. The Project Proposal No.424/IEC-35/IGMC&RI/PP-29/2022.

Conflicts of interest: No conflict of interest

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