Original Research

NON-COMMUNICABLE DISEASES - RISK FACTORS SURVEILLANCE AMONG ADULT POPULATION IN THENI DISTRICT, SOUTHERN TAMIL NADU

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ABSTRACT

Context: Non-communicable diseases (NCDs) are the leading cause of morbidity and mortality worldwide, with India contributing a significant share of the global burden. The early onset and poor control of NCDs in rural populations highlight the need for comprehensive risk factor assessment.

Aims & Objectives: This study aimed to determine the prevalence of behavioural, physical, and biochemical risk factors among adults with NCDs and find out their association with metabolic control.

Materials & Methods: A cross-sectional analytical study was conducted from September 2023 to February 2024 at a tertiary care hospital in Theni, Tamil Nadu. Using systematic random sampling, 402 adults (≥18 years) attending the NCD outpatient clinic were enrolled. Data were collected employing the WHO STEPS approach, encompassing behavioural, physical, and biochemical parameters. Statistical analyses were performed using Epi-Info; categorical variables were tested using the Chi-square test, and $P<0.05$ was considered statistically significant.

Results: Among the 402 participants, 55.2% had uncontrolled blood pressure (BP), 51% exhibited poor glycaemic control (fasting blood glucose ≥126 mg/dL), and 31.6% had elevated total cholesterol (≥190 mg/dL). Low physical activity (72.1%), obesity (36.8%), tobacco (16.9%), and alcohol use (15.4%) were found among the study participants. Smoking and alcohol use were significantly associated with poor glycaemic control ($P=0.001$, $P=0.021$), while alcohol consumption was linked to uncontrolled Blood Pressure ($P=0.031$). None of the variables were found to be associated with elevated Total Cholesterol.

Conclusion: A high prevalence of modifiable risk factors and poor metabolic control underscores the urgent need for integrated lifestyle interventions and robust primary healthcare strategies to mitigate the escalating NCD burden in rural India.

Keywords: Non-Communicable Diseases, Risk Factors, Metabolic Control, Rural Health, Theni.

INTRODUCTION

Worldwide, Non-communicable diseases (NCDs) are the leading cause of morbidity and mortality.[1] According to World Health Organization (WHO) projections, the total annual number of deaths from NCDs will increase to 55 million by 2030, if timely interventions are not done for the prevention and control of NCDs[1].

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In India, nearly 5.8 million people (WHO report, 2015) die from NCDs (heart and lung diseases, stroke, cancer, and diabetes) every year.[2] It is found that there is increase in the contribution of NCDs from 30% of the total disease burden- 'disability-adjusted life years' (DALYs) in 1990 to 55% in 2016 and an increase in proportion of deaths due to NCDs from 37% in 1990 to 61% in 2016.[3]

NCDs are no longer considered a disease of predominantly rich countries, Rapid urbanization and social development in middle-income countries have led to alterations in day-to-day activities, including Physical Inactivity, Unhealthy diet, and Tobacco use.[4] These Modifiable risk factors progress to NCDs in the age group of 30 to 70 years.[5] Around 85% of these "premature" deaths occur in

middle- and low-income countries. Thus, NCDs remain one of the major public health challenges globally in this century, in terms of human suffering and also the country's socio-economic development.[6,7]

NCDs typically present in individuals aged 55 years or older in many developed countries, but their onset occurs in India a decade earlier. Exacerbating this problem are the issues of multiple chronic conditions and the fact that many remain undiagnosed due to a lack of awareness and insufficient health-care access.[8] In addition, NCDs and their complications harshly impact the finances of individuals and their families, and the economies of nations. [1]

Addressing NCDs is now recognized as a priority not only for health but also for social development. An NCD target has been incorporated in the Sustainable Development Goals (SDG 3) to reduce premature deaths from NCDs by one-third by 2030.[1.] India has implemented specific targets and aims to reduce the burden of NCD mortality by 25% by the year 2025—the so-called 25 × 25 target.[7]

Most of the NCDs are attributable to eight modifiable risk factors, and WHO has classified them into behavioral, Physical, and biochemical risk factors. The modifiable risk factors, if timely controlled, could prevent the emergence of future NCDs.[7]

In a country like India, regional and social differences in various parts of the country, influenced by diet, culture, socioeconomic status, etc. States such as Kerala and Tamil Nadu are possibly at higher risk of threats due to lifestyle diseases, with a study in Kerala showing rates of some risk factors to be like those in the United States.[9]

Integrated Disease Surveillance Project (IDSP)-NCD risk factor survey in Tamil Nadu 2007-2008[10] found that smoking and alcohol status were 27% and 15% in males, respectively. Moreover, 66% of the study population had low physical activity, and 23% were obese.

During the IDSP survey, behavioral and physical parameters were measured, but biochemical parameters were not measured.

Moreover, WHO insists on doing regular periodic surveys for NCD risk factor surveillance, so that the common risk factors can be identified, and it could help control future NCD occurrences.[5]

Thus, this study aims to estimate prevalence of the risk factors for NCD among the adult NCD population in Theni district, which is the southern rural district of Tamil Nadu, using the WHO STEPS survey method, which includes all three Steps (Demographic and Behavioral, Physical, and Biochemical Measurements) and also find out the association of risk factors in control of Blood Pressure, Fasting Blood Sugar, and Total Cholesterol in NCD population.

METHODOLOGY

A cross-sectional analytical study was conducted at a tertiary care hospital in Theni district, Tamil Nadu. This study was carried out over the period of six months, from September 2023 to February 2024. The sample size was calculated to be 398 by taking 60% as the prevalence of Physical inactivity among the adult population in Tamil Nadu [11], and with an absolute error of 5% and a confidence interval of 95%, a non-response rate of 8%, using the open-epi software. All the adults (more than 18 years) who have been on treatment for Hypertension / Diabetes / Both and came to NCD OPD in the selected tertiary care hospital in Theni district, Tamil Nadu State, were included in this study. Unwilling adults or those who have cognitive and physical impairment to a level that hinders them from understanding the questions and responding were excluded from this study.

Makkalai Thedi Maruthuvam (MTM) is the unique flagship program of Tamil Nadu regarding NCD Screening and Treatment. This program provides screening and care at all levels of health care in Tamil Nadu. Study Participants had been selected based on a systematic sampling method. On average, 50 to 60 NCD patients were coming to the MTM-NCD OPD per day for the treatment of NCDs in this tertiary care hospital in Theni. Considering 25 working days per month, for achieving the sample size of 398, the sampling interval was calculated to be 20. First person was selected using a lottery method; from there, every twentieth adult NCD person coming for getting treatment in MTM-NCD OPD was included in this study.

Study Tool, Definitions, and Procedure

The study was conducted after approval from the Institutional Review Board and Ethics Committee of the Institution carrying out the project. The protocol and the benefits of this study were explained to the participants, and written informed consent was obtained from the participants before carrying out the study.

After obtaining the informed consent, the interviewer collected the information using the pre-designed and pre-tested WHOSTEPS questionnaire[5] in the local language (Tamil).

Questions were read out to the participants in the same order as listed in the instrument, and sufficient time was given for responses. If the participants did not understand the question, the question was repeated and explained without probing for an answer.

To begin with, participants were asked about their sociodemographic details such as age, gender, education, occupation, and marital status. Marital Status was recorded as married, never married, widowed, and separated.

The educational status was classified as illiterate, primary (1–5 standards), middle school (6–8

standards), high school (9–10 standards), higher secondary (11–12 standards), and degree.[12] Occupational status was recorded and later categorized as employed and unemployed, or homemaker.

As per World Health Organization, the following operational definitions were used in the present study.

(i) Behavioral risk factors (STEP 1 variables):

"Current smoker" was defined as someone who had smoked / Smokeless tobacco (daily or less than daily) for the past 1 month. 'Current Alcoholics' were defined as those who had consumed (daily or less than daily) any alcoholic drink such as whisky, beer, gin, rum, brandy, or local alcohol preparations for the past 1 month. Physical activity:

Physical activity will be calculated based on intensity and duration of physical activity, based on WHO guidelines.

Vigorous Physical activity: Activities make breathing much harder than normal. Moderate Intensity: Activities make breathing somewhat harder than normal. Low intensity: Activities make breathing normal in the resting position.[5] Diet Consumption of fruits and vegetables was classified as Never Consumed to 1-2 days per week, and ≥3 days of consumption per week. [12]

(ii) Physical measurements (STEP 2 variables)

Height and Weight Measurements

Height will be measured using a stadiometer with an accuracy of one millimeter as per the guidelines given in the WHO-STEPS instrument and recorded in centimeters.[5] Weight will be measured using an electronic flat weighing scale with an accuracy of 100 g and recorded in kilograms.

According to standards for adult Asian Indian, BMI value <18.5 was classified as underweight, 18.5–22.9 was classified as normal, 23–24.9 as overweight, ≥25 -29.99 as obese, and ≥30 as morbid obese.[13]

Blood Pressure Measurement

Participants will be requested to sit for at least 10 minutes with his/her legs uncrossed. Blood pressure will be measured using a digital sphygmomanometer. An adult cuff will be used, and in a sitting posture, the left arm will be used for blood pressure measurement. Three readings will be recorded with a gap of 3 minutes. The mean will be taken as final BP.[5]

SBP ≥140 mm Hg or DBP ≥ 90 mm Hg was classified as uncontrolled BP as per the Joint National Committee JNC-8.[14]

(iii) Biochemical measurements (STEP 3 variables)

Blood Collection: Following Universal precautions, Blood samples were taken from the participants to be used to perform tests to measure Fasting Blood Glucose and Total Blood Cholesterol. Participants were advised to fast for 8 hours, and samples were collected the next day. FBG ≥126 mg/dl, Total Cholesterol ≥190 mg/dl were considered as uncontrolled in FBG and TC, respectively [5,15]

Statistical Analysis: Data were entered in Microsoft Excel 2021 and analyzed using Epi-Info Software. Descriptive statistics such as Age, Gender, Occupation Status, Educational Status, Marital Status, and Risk Factors like Smoking, Alcohol, Diet pattern, and Physical Activity were given as frequency, percentages, and mean ± standard deviation. To find out the association between various Socio-demographic and Risk factors with Uncontrol status of Blood pressure, Fasting Blood Glucose, and Total Cholesterol were tested by using the Chi-square test. *P*-value of <0.05 was considered statistically significant.

RESULTS

Socio-demographic details of the Study Population: This study included 402 total participants during the study period. The majority were in the age group of 51-65 years (N=186, 46.3%), followed by 36-50 years (N=128, 31.8%). Age groups 18-35 years and ≥ 65 years were 9.2% and 12.7%, respectively. The mean age and standard deviation of the study population were 52.97 ± 11.6 years. Among the study participants, 195 (48.5%) had only Hypertension, 135 (33.5%) had only Diabetes, and 72 (17.9%) had both. The majority of respondents were females (N=228, 56.7%). Similarly, the majority were coming from rural areas (N=222, 55.2%). Most of the study participants were married, living with their couples (N=335, 83.3%), and the remaining 16.7% were widowed (N=56, 13.9%) / separated (N=9, 2.2%) / divorced (N=2, 0.5%). Around 45% (N=182) of the study participants were studied up to Primary and primary completed, 36.8% (N=148) were illiterate, 12.9% (N=52) were Secondary to Higher secondary completed, and a few 5% (N=20) were graduates. Around half of the study participants were Homemakers or unemployed (N=203, 50.5%), and the remaining were employed /retired (N=199, 49.5%). (Table 1)

Table 1. Socio-Demographic Details of the Study Participants

Variables	Number (%) Total N=402
Age Group (in Years)	
18- 35	37 (9.2)
36-50	128 (31.8)
51-65	186 (46.3)
>65	51 (12.7)

Gender Male Female	 174 (43.3) 228 (56.7)
Area Urban Rural	 180 (44.8) 222 (55.2)
Marital Status Married Separated/ Divorced / Widow	 335 (83.3) 67 (16.7)
Education Status No Formal Education Less than Primary to Primary Completed Secondary to Higher Secondary Graduate	 148 (36.8) 182 (45.3) 52 (12.9) 20 (5.0)
Occupation Status Unemployed / Homemaker Employed	 203 (50.5) 199 (49.5)

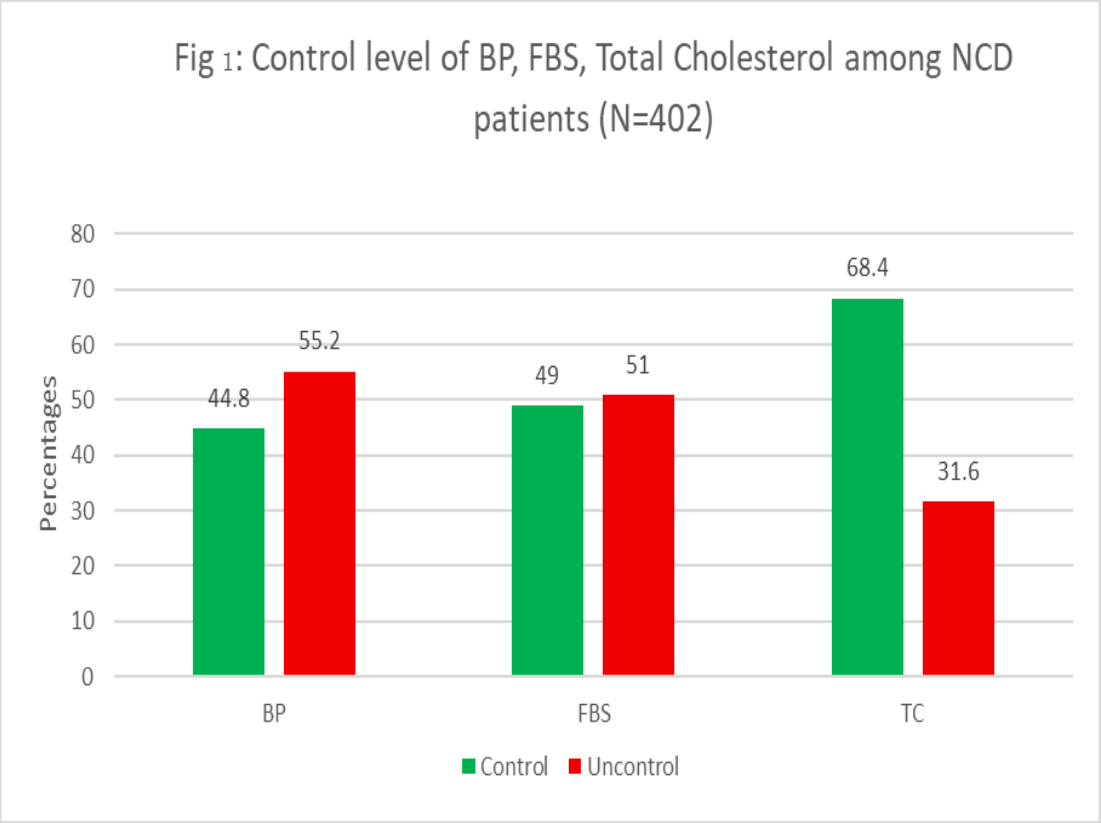
Risk Factors of the Study Participants

Current Smokers and Current Alcoholics were 16.9% (N=68) and 15.4% (N=62), respectively. The majority (N=290, 72.1%) were involved in low Physical activity, the Moderate and High Physical activity groups were only 16.9% (N=68) and 10.9% (N=44), respectively. Only 25.6% (N=103) were involved in brisk walking for a minimum of 20 minutes for 5 days a week, and the majority were not involved in brisk walking (N=299, 74.4%). According to BMI, only 27.1% (N=109) were Normal / Underweight, the majority were in the Obese (N=148, 36.8%) and Morbid Obese (N=73, 18.2%) categories. The majority (N=381, 94.8%) were eating vegetables regularly for ≥ 3 days a week, and only 56.7% (N=174) were taking fruits ≥ 3 days a week. (Table 2)

Table 2. Risk Factors for NCD in Study Participants

Variables	Number (%) Total N=402
Current Smoker Yes No	 68 (16.9) 334 (83.1)
Current Alcoholics Yes No	 62 (15.4) 340 (84.6)
Physical Activity Low Moderate High	 290 (72.1) 68 (16.9) 44 (10.9)
Brisk Walking (Min 20 mins for 5 days) Yes No	 103 (25.6) 299 (74.4)
BMI Normal/underweight Overweight Obese Morbid Obese	 109 (27.1) 72 (17.9) 148 (36.8) 73 (18.2)
Eating Fruits Never consumed to consumed fruits 1-2 days in a week ≥ 3 days of consumption of fruits	 174 (43.3) 228 (56.7)
Eating Vegetables Never consumed to consumed vegetables 1-2 days in a week ≥ 3 days of consumption of vegetables	 21 (5.2) 381 (94.8)

Fig No.1, revealed that 55.2% (N=222) of the study participants had uncontrolled Blood Pressure (SBP ≥140 or DBP ≥90 mmHg), 51.0% (N=205) of them had uncontrolled fasting blood sugar (FBS ≥126 mg/dl), and 31.6% (N=127) of them had elevated total cholesterol (≥190 mg/dl) respectively among the total study population.



Association of risk factors with uncontrolled status of BP, FBS, TC

Tables 3-5 showed the association of risk factors with the uncontrolled status of Blood Pressure, Fasting Blood Sugar, and Total Cholesterol. A statistically significant association was found between poor glycaemic control in the increasing age group (p<0.001), Current Smokers (p=0.001), and Current Alcoholics (p=0.021), respectively (Table 3). Other risk factors, such as area of residence (Urban), lower educational group, and eating fruits ≤ 3 days were near-significant associations with poor glycaemic control. Other factors such as gender, physical activity, and BMI showed no significant association with FBS control. Similarly, A statistically significant association was found between current alcohol consumption and Uncontrolled blood pressure status (p=0.031) (Table 4). A near-significant association was found between increasing age with uncontrolled Blood Pressure (P=0.064). Moreover, no significant associations were found between other risk factors such as gender, area of residence, educational level, physical activity, BMI, smoking, and dietary habits. However, no significant associations were found between total cholesterol control and any socio-demographic or lifestyle variables (Table 5)

Table 3. Association of Risk Factors with Control of FBS (N=402)

Variables	FBS ≤ 125 (Control) 197 (49.0)	FBS ≥ 126 (Uncontrol) 205 (51.0)	**ChiSquare Test (df)**	**P Value**
Age Group (in Years) 18- 35 36-50 51-65 >65	29 (78.4) 69 (53.9) 74 (39.8) 25 (49.0)	8 (21.6) 59 (46.1) 112 (60.2) 26 (51.0)	20.332 (3)	**<0.001***

Gender Male Female	78 (44.8) 119 (52.2)	96 (55.2) 109 (47.8)	2.142 (1)	0.143
Area Urban Rural	79 (43.9) 118 (53.2)	101 (56.1) 104 (46.8)	3.414 (1)	0.065
Education Status No Formal Education Less than Primary to Primary Completed Secondary to Higher Secondary Graduate	63 (42.6) 90 (49.5) 31 (59.6) 13 (65.0)	85 (57.4) 92 (50.5) 21 (40.4) 7 (35.0)	6.859 (3)	0.077
Marital Status Married Separated/ Divorced / Widow	169 (50.4) 28 (41.8)	166 (49.6) 39 (58.2)	1.674 (1)	0.196
Occupation Status Unemployed / Homemaker Employed	108 (53.2) 89 (44.7)	95 (46.8) 110 (55.3)	2.891 (1)	0.089
Current Smoker Yes No	21 (30.9) 176 (52.7)	47 (69.1) 158 (47.3)	**10.756 (1)**	**0.001**
Current Alcoholics Yes No	22 (35.5) 175 (51.5)	40 (64.5) 165 (48.5)	**5.363(1)**	**0.021**
Physical Activity Low Moderate High	141 (48.6) 33 (48.5) 23 (52.3)	149 (51.4) 35 (51.5) 21 (47.7)	0.211 (2)	0.9
Brisk Walking (Min 20 mins for 5 days) Yes No	56 (54.4) 141 (47.2)	47 (45.6) 158 (52.8)	1.594 (1)	0.207
BMI Normal/underweight Overweight Obese Morbid Obese	56 (51.4) 25 (34.7) 80 (54.1) 36 (49.3)	53 (48.6) 47 (65.3) 68 (45.9) 37 (50.7)	7.635 (3)	0.054
Eating Fruits Never consumed to consumed fruits 1-2 days in a week ≥ 3 days of consumption of fruits	76 (43.7) 121 (53.1)	98 (56.3) 107 (46.9)	3.483 (1)	0.062
Eating Vegetables Never consumed to consumed vegetables 1-2 days in a week ≥ 3 days of consumption of vegetables	10 (47.6) 187 (49.1)	11 (52.4) 194 (50.9)	0.017 (1)	0.896

Table 4. Association of Risk Factors with Control of Blood Pressure (N=402)

Variables	**BP (Control) (<139SBP/<89DBP) 180 (44.8)**	**BP (Uncontrol) (≥140SBP/≥90DBP) 222 (55.2)**	**ChiSquare Test (df)**	**P Value**

Age Group (in Years) 18- 35 36-50 51-65 >65	24 (64.9) 58 (45.3) 76 (40.9) 22 (43.1)	13 (35.1) 70 (54.7) 110 (59.1) 29 (56.9)	7.262 (3)	0.064
Gender Male Female	74 (41.1) 106 (46.5)	100 (57.5) 122 (53.5)	0.627 (1)	0.429
Area Urban Rural	80 (44.4) 100 (45)	100 (55.6) 122 (55)	0.015 (1)	0.904
Education Status No Formal Education Less than Primary to Primary Completed Secondary to Higher Secondary Graduate	66 (44.6) 81 (44.5) 22 (42.3) 11 (55.0)	82 (55.4) 101 (55.5) 30 (57.7) 9 (45.0)	0.981 (3)	0.806
Marital Status Married Separated/ Divorced / Widow	154 (46) 26 (38.8)	181 (54) 41 (61.2)	1.159 (1)	0.282
Occupation Status Unemployed / Homemaker Employed	92 (45.3) 88 (44.2)	111 (54.7) 111 (55.8)	0.049 (1)	0.825
Current Smoker Yes No	30 (44.1) 150 (44.9)	38 (55.9) 184 (55.1)	0.014 (1)	0.905
Current Alcoholics Yes No	20 (32.3) 160 (47.1)	42 (67.7) 180 (52.9)	4.646 (1)	0.031
Physical Activity Low Moderate High	133 (45.9) 33 (48.5) 14 (31.8)	157 (54.1) 35 (51.5) 30 (68.2)	3.514 (2)	0.173
Brisk Walking (Min 20 mins for 5 days) Yes No	44 (42.7) 136 (45.5)	59 (57.3) 163 (54.5)	0.237 (1)	0.626
BMI Normal/underweight Overweight Obese Morbid Obese	49 (45) 36 (50) 70 (47.3) 25 (34.2)	60 (55) 36 (50) 78 (52.7) 48 (65.8)	4.450 (3)	0.217
Eating Fruits Never consumed to consumed fruits 1-2 days in a week ≥ 3 days of consumption of fruits	84 (48.3) 96 (42.1)	90 (51.7) 132 (57.9)	1.520 (1)	0.218
Eating Vegetables Never consumed to consumed vegetables 1-2 days in a week ≥ 3 days of consumption of vegetables	10 (47.6) 170 (44.6)	11 (52.4) 211 (55.4)	0.072 (1)	0.788

Table 5. Association of Risk Factors with Control of Total Cholesterol (N=402)

Variables	TC (Control) (<190mg/dl) 180 (44.8)	TC (Uncontrol) (≥190 mg/dl) 222 (55.2)	ChiSquare Test (df)	P Value
Age Group (in Years) 18- 35 36-50 51-65 >65	26 (70.3) 81 (63.3) 131 (70.4) 37 (72.5)	11 (29.7) 47 (36.7) 55 (29.6) 14 (27.5)	2.373 (3)	0.499
Gender Male Female	124 (71.3) 151 (66.2)	50 (28.7) 77 (33.8)	1.158 (1)	0.282
Area Urban Rural	124 (68.9) 151 (68)	56 (31.1) 71 (32)	0.035 (1)	0.852
Education Status No Formal Education Less than Primary to Primary Completed Secondary to Higher Secondary Graduate	103 (69.6) 125 (68.7) 33 (63.5) 14 (70.0)	45 (30.4) 57 (31.3) 19 (36.5) 6 (30.0)	0.715 (3)	0.870
Marital Status Married Separated/ Divorced / Widow	234 (69.9) 41 (61.2)	181 (54) 41 (61.2)	1.936 (1)	0.164
Occupation Status Unemployed / Homemaker Employed	132 (65) 143 (71.9)	71 (35) 56 (28.1)	2.172 (1)	0.141
Current Smoker Yes No	50 (73.5) 225 (67.4)	18 (26.5) 109 (32.6)	0.993 (1)	0.319
Current Alcoholics Yes No	42 (67.7) 233 (68.5)	20 (32.3) 107 (31.5)	0.015 (1)	0.902
Physical Activity Low Moderate High	198 (68.3) 46 (67.6) 31 (70.5)	92 (31.7) 22 (32.4) 13 (29.5)	0.106 (2)	0.948
Brisk Walking (Min 20 mins for 5 days) Yes No	77 (74.8) 198 (66.2)	26 (25.2) 101 (33.8)	2.583 (1)	0.108
BMI Normal/underweight Overweight Obese Morbid Obese	75 (68.8) 56 (77.8) 99 (66.9) 45 (61.6)	34 (31.2) 16 (22.2) 49 (33.1) 28 (38.4)	4.636 (3)	0.2
Eating Fruits Never consumed to consumed fruits 1-2 days in a week ≥ 3 days of consumption of fruits	124 (71.3) 151 (66.2)	50 (28.7) 77 (33.8)	1.158 (1)	0.282
Eating Vegetables Never consumed to consumed vegetables 1-2 days in a week ≥ 3 days of consumption of vegetables	12 (57.1) 263 (69)	9 (52.4) 118 (31.0)	1.301 (1)	0.254

DISCUSSION

This cross-sectional study conducted in a tertiary care hospital in South Tamil Nadu provides significant insights into the prevalence and determinants of non-communicable disease (NCD) risk factors. The findings revealed a high burden of modifiable behavioural and biological risk factors, with more than half of the study population exhibiting poor glycaemic and blood pressure control, and nearly one-third having elevated cholesterol levels.

This study found that the high prevalence of low physical activity (72.1%) among the NCD study population is concerning and aligns with findings from the ICMR-INDIAB study, which reported that nearly 55% of rural areas were physically inactive, with higher rates in urban areas 71%.[11] In comparison, the NFHS-5 (2019–21) also indicated an increasing trend of sedentary lifestyles, especially among middle-aged adults in both rural and urban areas.[16] Similarly, a Study done at Vellore found that 43.3% were involved in very low physical activity, and moderate physical activity were 31%.[15] Moreover, a Study done at Villupuram also found that >50% were physically inactive.[12]

Current Tobacco use was 16.9% and alcohol consumption was 15.4% in this study, which were slightly lower than national estimates. The GATS-2 (2016–17) reported tobacco use prevalence at 28.6% in Tamil Nadu and alcohol consumption at around 19.8% among men.[17] Moreover, studies done at Villupuram and Vellore found that Current Smokers and Alcoholics were slightly higher (>19%) than in this study.[12,15] This difference could be attributed to the hospital-based setting, where respondents may underreport socially undesirable behaviours. Despite this, both behaviours were found to be significantly associated with poor glycaemic control (p=0.001 and p=0.021, respectively) in this study, A statistically significant association was found between current alcohol consumption and Uncontrolled blood pressure status (p=0.031), which is consistent with the study from Kerala, where lifestyle factors like alcohol were associated with Hypertension, Smoking were not associated with Hypertension.[9]

Regarding dietary patterns, while 94.8% of participants reported consuming vegetables more than three times per week, only 56.7% had a similar frequency for fruit consumption. Similar results were found in a community-based study in Villupuram, 95% were consuming vegetables more than three times a week, but this was not so much in fruit intake, noting that despite widespread knowledge of healthy eating, adherence remains low, particularly among lower socio-economic groups, especially in fruit intake.[12]

Obesity was a major concern, with 36.8% of participants classified as obese and 18.2% as morbidly obese. Similar findings were reported in the Vellore urban area, where 36.7% were obese, and 17.7% were morbidly obese.[15] This was higher than the national average reported by NFHS-5, which found obesity in 24% of women and 22.9% of men aged 15–49 years.[16] The higher obesity prevalence in this study may reflect the middle-aged, health-seeking population visiting the NCD clinic and their low physical activity status. A Study done in rural West Bengal has also reported rising obesity trends, particularly in populations with low physical activity and high caloric intake.[18]

In terms of clinical parameters, 55.2% of participants had uncontrolled blood pressure, and 51% had uncontrolled fasting blood glucose. A study conducted in Kerala also reported high levels of uncontrolled hypertension and diabetes (>65%),[9] supporting the notion that control of NCDs remains a significant challenge even among diagnosed populations. Moreover, this study was done at a Tertiary care centre, which may be a reason for many uncontrolled Blood Pressure and Fasting Blood Glucose. NCD adults might be referred from peripheral areas, and a higher prevalence of low physical activity and obesity among them.

The lack of statistically significant associations between cholesterol levels and demographic or lifestyle variables may indicate that cholesterol dysregulation is multifactorial and not easily attributable to isolated behaviours. Similar findings were reported by the Kerala NCD Risk Factor Surveillance Study, where cholesterol was poorly associated with diet or activity but linked with genetic predisposition and comorbidities.[9]

Despite adherence to standardized data collection using the WHO STEP Method, the study had few limitations. Self-reported behaviours may be subject to recall, and social desirability bias is a concern. Uncontrolled Status of Diabetes and Dyslipidaemia was measured by only Fasting Blood Glucose and Total Cholesterol, not able to measure HbA1C and Lipid profile including HDL, LDL, and VLDL. The cross-sectional design limits causal inference, and as a facility-based study, external generalizability is also constrained in this study. However, the systematic sampling approach and robust statistical analysis increase the internal validity of the study findings.

CONCLUSION

The study underscores a high prevalence of modifiable risk factors such as obesity, physical inactivity, tobacco and alcohol use, and poor metabolic control among adults attending an NCD clinic in a Tertiary care centre, South India. Key lifestyle factors such as smoking and alcohol use were significantly associated with poor glycaemic and blood pressure control. While vegetable intake was relatively high, fruit consumption and physical activity remained low.

These findings are in line with several Indian studies that reflect the growing burden of NCDs and lifestyle disorders across both urban and rural settings. The results highlight the urgent need for intensified public health interventions focusing on behaviour change communication, early screening, and structured follow-up in primary and tertiary healthcare settings to curb the escalating NCD crisis. Future longitudinal studies and community-based interventions are warranted to assess the long-term impact of such risk factor modifications.

Conflict of Interest: None

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