Indian Journal of Pharmacy Practice., 2026; 19(2):262-271.
https://www.ijopp.org

Original Article

Evaluation of Risk Factors of Non-Communicable Diseases among Women: A Pharmacoepidemiological Study

Sharmila Nirojini, Narmadha Sathyamoorthy, Neelufer Naz Dowlath Basha*, Niveda Sivakumar

Department of Pharmacy Practice, Swamy Vivekanandha College of Pharmacy, Tiruchengode, Namakkal, Tamil Nadu, INDIA.

ABSTRACT

This cross-sectional study, conducted between March and August 2023, assessed the risk factors of Non-Communicable Diseases (NCDs) among 302 healthy women aged 18-45 years using a modified WHO STEPS approach. Data on behavioral and biological risk factors were collected and analyzed using correlation matrices with 95% confidence intervals. The findings revealed a high prevalence of behavioral risks, including insufficient physical activity (82.7%), inadequate fruit and vegetable intake (78.4%), and overweight/obesity (38%). Biological risks identified were hypertension (75.1%), anemia (40.1%), elevated cholesterol (19.6%), and high blood sugar (17%). The study concludes that behavioral risk factors are more prevalent than biological ones, emphasizing the need for urgent action through health education, improved nutrition, promotion of physical activity, and integrated national strategies to prevent and control NCDs in women.

Keywords: Non-Communicable Diseases, Biological Risk Factor, Behavioural Risk Factor, WHO Steps.

Correspondence:
Ms. Neelufer Naz Dowlath Basha
Department of Pharmacy Practice, Swamy Vivekanandha College of Pharmacy, Namakkal, Tamil Nadu, INDIA.
Email: neelufernaz11@gmail.com

Received: 22-07-2025;
Revised: 12-09-2025;
Accepted: 03-11-2025.

INTRODUCTION

Each year, Non-Communicable Diseases (NCDs) include cancer, diabetes, heart disease, and chronic respiratory conditions cause around 41 million fatalities, or 71% of all deaths worldwide (World Health Organization, n.d). A mix of behavioural and biological risk factors, many of which are avoidable, contribute to these illnesses. Reducing these risk factors is essential to lowering the NCD burden worldwide. The risk of acquiring Non Communicable Diseases (NCDs) is increased by biological risk factors such as obesity, dyslipidaemia, hypertension, and hyperglycemia, which are frequently connected to one another (GBD 2019 Risk Factors Collaborators, 2020 and Lim *et al*., 2012). One major cause of cardiovascular illnesses is hypertension, and obesity is closely linked to diabetes and some types of cancer (Forouzanfar *et al*., 2016 and Ng *et al*., 2014). Although lifestyle and environmental factors typically have an impact, these factors can also result from genetic predispositions (Eckel *et al*., 2005). NCDs are largely caused by behavioural risk factors, including poor diets, hazardous alcohol use, physical inactivity, and tobacco use (World Health Organization, 2014 and Prabhakaran *et al*., 2016). While bad diets and a lack of physical activity lead to obesity and associated metabolic disorders, smoking is directly connected to a number of cancers and chronic respiratory conditions (World Health Organization, 2010 and Popkin *et al*., 2012). Drinking too much alcohol increases the risk of heart disease, liver disease, and several types of cancer (Rehm and Shield, 2019). These activities frequently stem from more general social determinants of health, such as cultural customs, urbanisation, and socioeconomic position (Marmot *et al*., 2012). The World Health Organisation (WHO) created the STEPwise approach to NCD risk factor surveillance (STEPS) in order to methodically track and manage these risk factors (World Health Organization, n.d.). Countries can gather and examine NCD risk factor data in an organised way according to this standardised approach. Three elements make up the STEPS methodology: (1) behavioural risk factor questionnaires; (2) physical measurements including height, weight, and blood pressure; and (3) biochemical evaluations like lipid profiles and blood glucose (Riley *et al*., 2016 and Bonita *et al*., 2003). Policymakers can assess progress in lowering the burden of NCDs, prioritise interventions, and spot trends by using the WHO STEPS framework.

MATERIALS AND METHODS

A crosssectional study was conducted in Vivekanandha Educational Instituition, Tiruchengode, Namakkal from March 2023 to August 2023. Women between the age of 18-45 (Healthy volunteers) were included in the study and women of less than 18 years age, pregnant women, patient with non-communicable diseases, critically ill women, those who are mentally unfit, with

DOI: 10.5530/ijopp.20260572

physical disability, and those not consented were excluded from this study.

Sampling techniques

The WHO STEPwise Approach to NCD Risk Factor Surveillance (STEPS), a straightforward and standardised system for gathering, examining, and distributing data on important NCD risk factors, has been adopted by our team. This study tool covers important biological risk variables including overweight and obesity, raised blood pressure, high blood sugar levels, and abnormal blood lipids, as well as crucial behavioural risk factors like tobacco use, alcohol consumption, physical inactivity, and unhealthy diet.

Sample size and Participants

Simple sampling technique was used. A sample size of 277 was determined using a finite population of 1000 people, which was rounded off to 300. This sample size was based on the assumption that 2% of the general population had NCDs, with a margin of error of 5% and a 95% confidence interval. 302 people made up the total sample size.

Data collection procedure

The study followed the WHO STEP wise approach for NCD risk factor surveillance, conducted through health screening camps. Pamphlets were distributed beforehand to staff, students, and workers. Data collection occurred in three stages: face-to-face interviews for demographic and behavioral details, physical measurements, and biochemical analysis, with participants fasting for at least 10 hr prior to the biochemical tests.

Step 1: Demographic and Behavioural information

The study measured height, weight, waist circumference, limb length, and blood pressure using standardized, calibrated equipment. BMI was calculated from height and weight, waist measured at normal expiration, and blood pressure recorded with OMRON equipment, averaging the last two of three readings taken at 5-min intervals.

Step 2: Physical measurements

Standardized procedures were used to measure height, weight, waist circumference, limb length, and blood pressure. Height was measured barefoot using a stadiometer, and weight was recorded with a digital platform scale after participants removed shoes and emptied pockets. BMI was calculated from height and weight. Waist and limb dimensions were measured with tension tape, with waist circumference taken at the end of normal expiration. Blood pressure was measured on the left arm using ICMR-recommended OMRON digital equipment, with three readings taken at 5-min intervals and the average of the last two used for analysis. All equipment was routinely calibrated before and during data collection.

Step 3: Biochemical analysis

Blood tests for cholesterol, haemoglobin, and glucose were conducted on consenting participants after a 10-hr fast. Glucose was measured using the Easy Touch Blood Glucose Monitoring System, while 2.5 mL venous samples were collected for haemoglobin (spectrophotometric method) and cholesterol (CHE/CHO/POD method) analysis in the central lab under cold chain transport. Results were recorded, and participants received soft copies of their reports. All procedures followed aseptic techniques, with proper disinfection and disposal of samples and waste. The study was approved by the institutional ethics committee.

Definition of variables

This study classified NCD risk factors into three groups based on WHO definitions:

Behavioural factors: Poor fruit and vegetable intake (less than 5 servings/day), insufficient physical activity (under 150 min of moderate or 75 min of vigorous exercise per week), high salt use, excess fried/processed food, and tobacco use.

Physical factors: Overweight and obesity (BMI≥25 kg/m^2), abnormal waist-to-hip ratio (≥0.85 in women, ≥0.90 in men), high blood pressure (SBP≥140 mmHg or DBP≥90 mmHg), and elevated heart rate.

Biochemical factors: High total cholesterol (≥240 mg/dL), elevated blood glucose (>140 mg/dL) or low blood glucose (<70 mg/dL), and anemia (hemoglobin <12 g/dL).

Statistical analysis

The statistical analysis was done using Microsoft Excel and Graphpad Prism version 10.1.0.

Results were analysed using correlation matrix, the level of significance to test the statistical association of various factors was taken as $p<0.05$.

RESULTS

Demographics of the population and socio-economic characteristics

A total of 302 individuals aged 18 to 45 years consented to participate in the STEPS survey. The response rates for Step 1 (questionnaire) and Step 2 (physical measurements) were 99.9%, with 302 participants completing these steps. Step 3, which involved biochemical measurements requiring blood samples, had a response rate of 95.3%, with 287 participants providing blood specimens.

Age wise distribution of Healthy volunteers

Among the 302 participants, the age distribution was as follows: 44.7% were between 18 and 25 years, 27.8% between 26 and 35

years, and 27.5% between 36 and 45 years. Participants aged 18-25 years constituted the largest age group in the sample (Figure 1).

Distribution based on Marital status

Among the 302 participants, 53% reported being married, whereas 47% were unmarried (Figure 2).

Distribution based on Level of Education

Among the 302 survey respondents, 98.37% had completed higher education, 2.64% had completed secondary education, 2.31% had completed primary education, and 0.99% reported having no formal education. The percentages exceed 100% as some participants may have reported more than one level of educational attainment (Figure 3).

Biological risk factors

Overweight and Obesity

According to the study, out of 302 individuals, 36.09% were found to be overweight, 2.6% were obese, and 12.25% were underweight. A healthy weight was observed in only 49% of the respondents. Women between the ages of 36 and 45 demonstrated a significantly higher prevalence of obesity compared to other age groups (Figure 4).

Distribution based on Waist Circumference

Based on waist circumference measurements, 34.1% of participants had values above the normal threshold, 25.8% were classified at a discreet level, and 40.1% fell within the normal range (Figure 5).

Blood Pressure

Among the 302 participants, blood pressure measurements indicated that 5% had stage 2 hypertension, 5% had stage 1 hypertension, 29% were classified as pre-hypertensive, 34% had normal blood pressure, and 27% had low blood pressure. Notably, women aged 36 to 45 years exhibited a significantly higher prevalence of elevated blood pressure compared to other age groups (Figure 6). Out of a total of 302 respondents, 117 were newly diagnosed with hypertension. Among these, 87 individuals were classified as prehypertensive, 14 were diagnosed with stage 1 hypertension, and 16 with stage 2 hypertension.

Categorization of participants based on Heart Rate

Out of 302 participants, 89% exhibited a normal heart rate, 10% had a lowered heart rate, and 1% demonstrated an elevated heart rate based on test results (Figure 7).

Blood Cholesterol

Overall, 19.4% of the 302 participants had elevated total cholesterol levels, while 72.5% had normal levels. Notably, 7.9% of participants did not consent to blood sampling. Women aged 36 to 45 years exhibited a significantly higher prevalence of elevated blood cholesterol compared to other age groups (Figure 8). Out of a total of 302 participants, 59 were newly diagnosed with hyperlipidemia. Among these, 50 participants had borderline cholesterol levels, while 9 had high cholesterol levels.

Blood Sugar

Of the 302 participants, 17 had their fasting and postprandial blood glucose levels measured, while 285 underwent random blood glucose testing. Among all participants, 5.59% had critically high blood glucose levels, 11.58% had elevated blood glucose, 78.47% had normal levels, and 4.63% had low blood glucose. Notably, women aged 36 to 45 years exhibited a significantly higher prevalence of elevated blood glucose levels compared to other age groups (Figure 9). Out of the total 302 participants, 51 were newly diagnosed with diabetes mellitus. Among these,

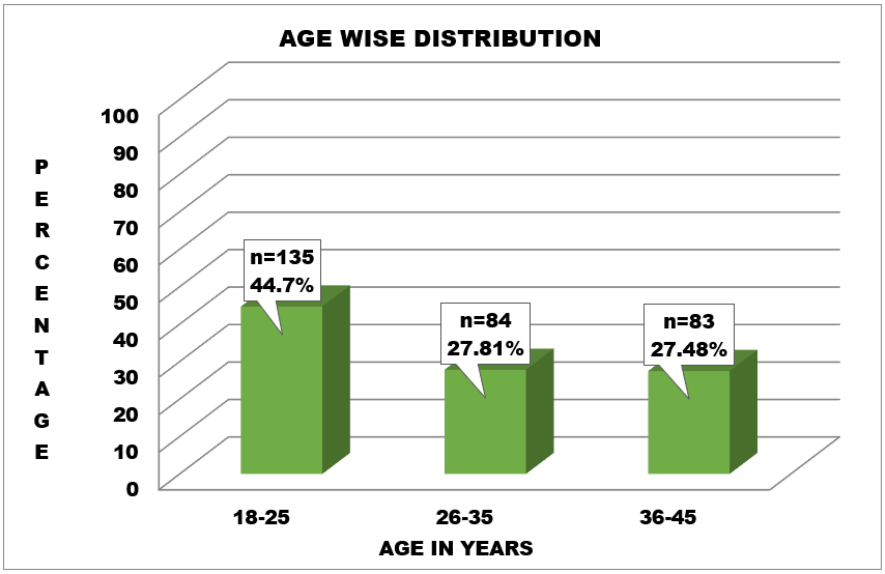

Figure 1: Age wise distribution of Healthy volunteers.

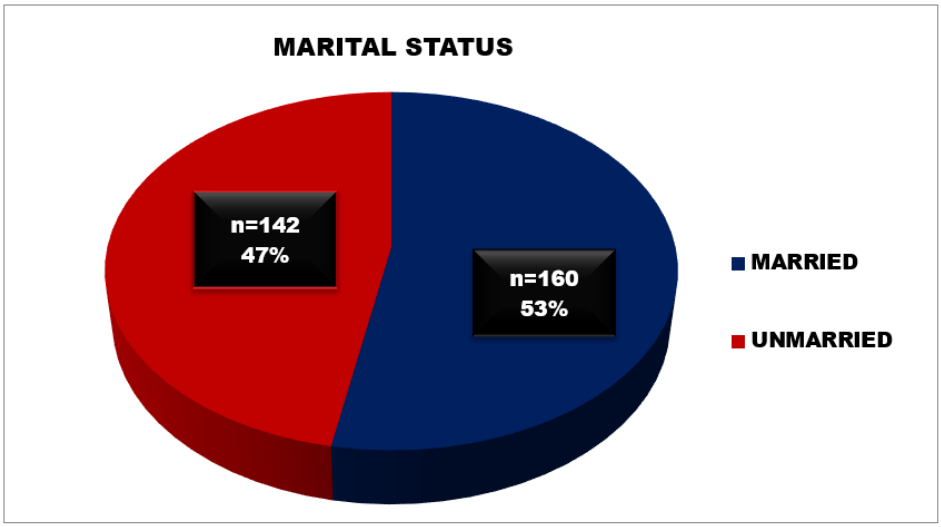

Figure 2: Distribution based on marital status

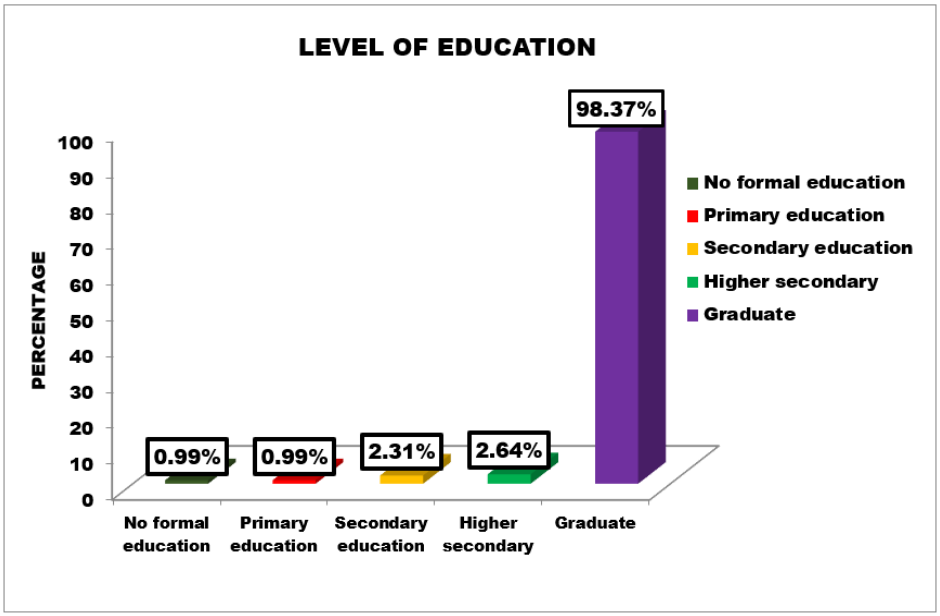

Figure 3: Distribution based on Level of Education.

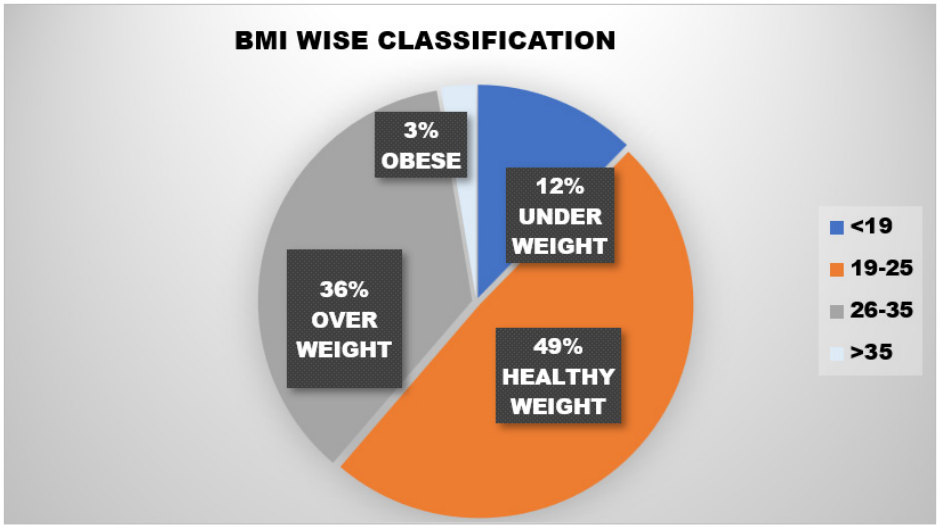

Figure 4: Categorization of participants based on Body Mass Index.

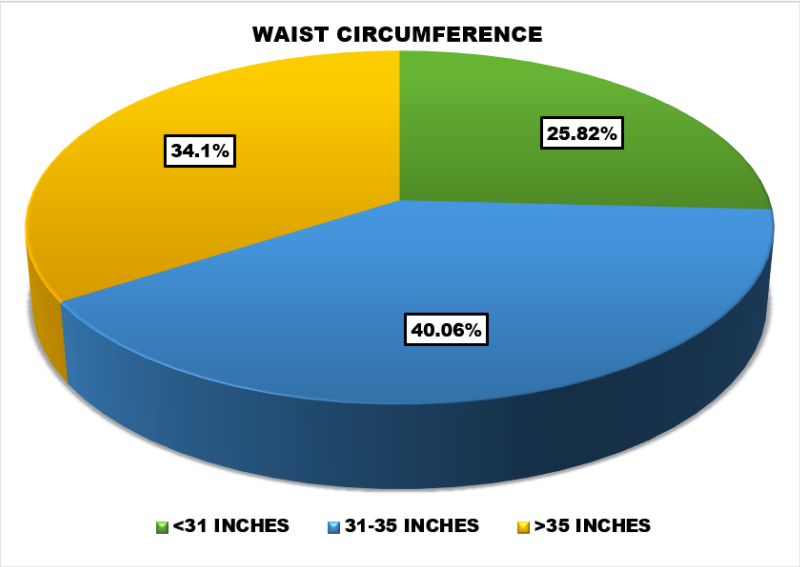

Figure 5: Distribution based on Waist Circumference.

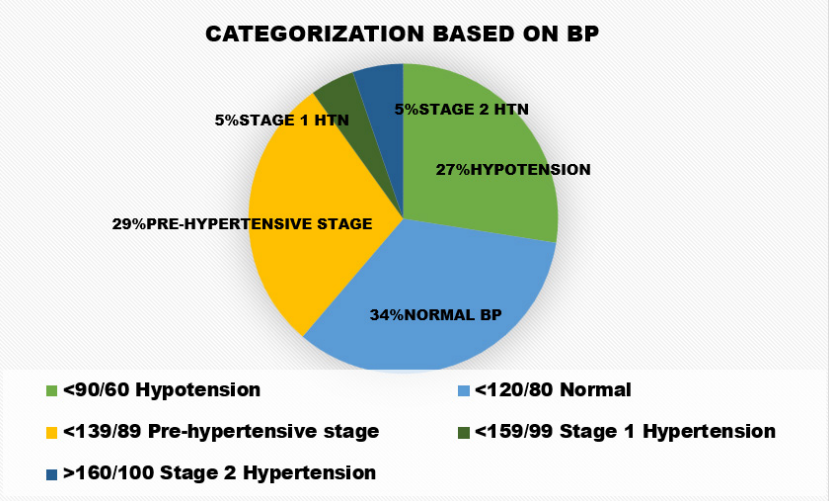

Figure 6: Categorization of participants based on Blood Pressure.

35 were classified as pre-diabetic, and 16 were diagnosed with diabetes.

Haemoglobin

Based on hemoglobin measurements among 302 participants, 16.9% were classified as mildly anemic, 16.2% as moderately anemic, 9.6% as severely anemic, and 50.7% had normal hemoglobin levels. Women aged 18 to 25 years exhibited a significantly higher prevalence of anemia compared to other age groups (Figure 10). Out of 302 individuals, 51 participants were classified as mildly anemic, 49 as moderately anemic, and 29 as severely anemic.

Behavioural risk factors

Fruits and Vegetable intake

According to the survey, 78.4% of respondents consumed fewer than five servings of fruits and vegetables per day, while only 21.5% met the recommended intake of five or more servings daily. Regarding weekly consumption, 37.1% of respondents consumed five servings of fruits and vegetables, 40.1% did so occasionally, 0.7% frequently, and 0.7% did not consume five servings at all. Inadequate fruit and vegetable intake was more common among individuals aged 18 to 25 years. However, no sociodemographic factors were found to be statistically significantly associated with the number of fruit and vegetable servings consumed (Figure 11).

Intake of Fried foods

According to the survey, 91.7% of respondents reported consuming fried and processed foods, while 8.2% had never consumed such foods. Among those who consumed fried and processed foods, 53.9% did so occasionally, 27.4% weekly, 8.3% daily, and 2.0% frequently. Individuals aged 18 to 25 years exhibited a higher prevalence of unhealthy dietary habits compared to other age groups (Figure 12).

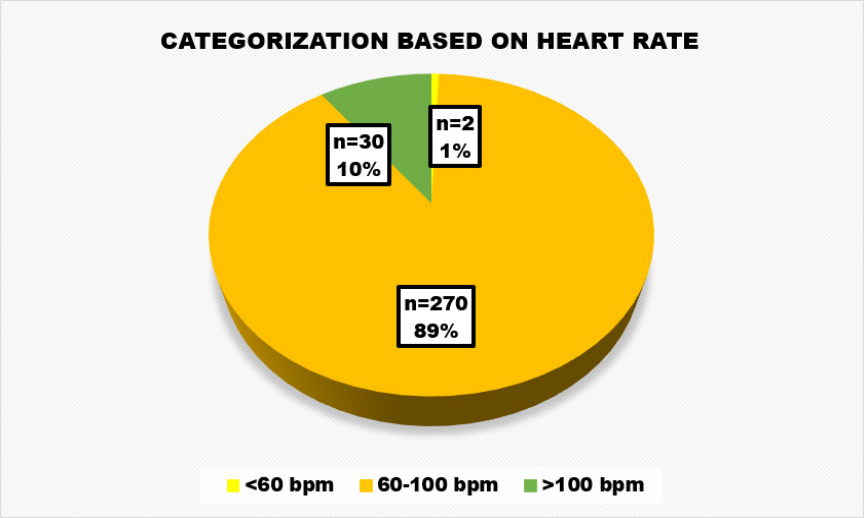

Figure 7: Categorization of participants based on Heart Rate.

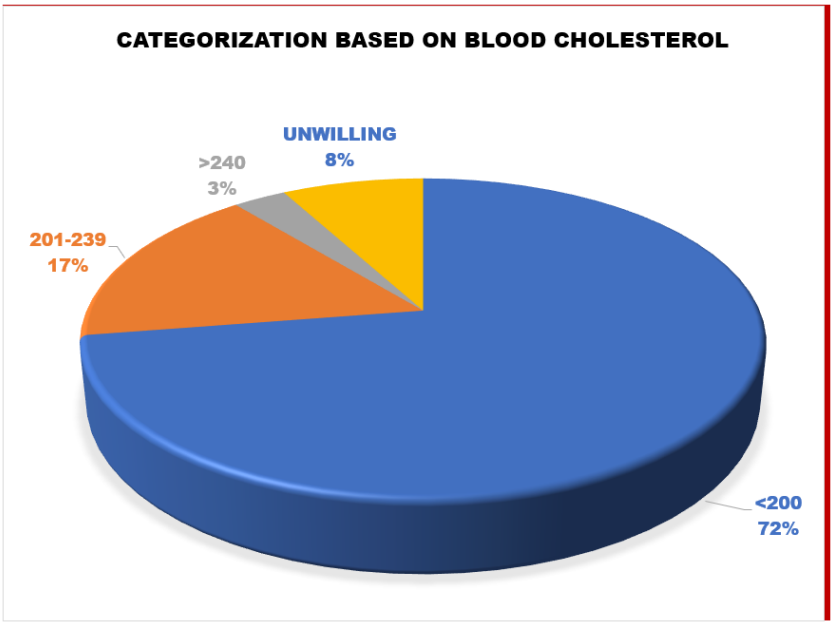

Figure 8: Categorization of participants based on Blood Cholesterol level.

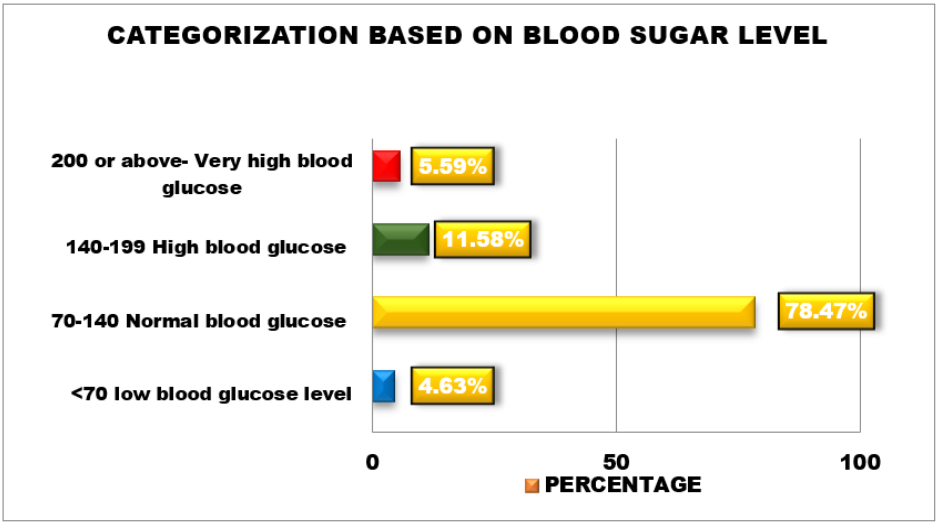

Figure 9: Categorization of participants based on Blood Sugar level.

Salt intake

According to the survey, 62.9% of respondents consumed an appropriate amount of salt, while 13.5% consumed excessive salt and 23.5% consumed insufficient amounts. Individuals aged 18 to 25 years showed a higher prevalence of excessive salt intake compared to other age groups (Figure 13).

Physical activity

A total of 82.7% of participants reported inadequate physical activity, with the majority of women not engaging in sufficient exercise. Only 17.2% of respondents met the recommended levels of physical activity. Among those reporting inadequate activity, 7.9% engaged in physical activity weekly, 17.5% occasionally, 0.6% frequently, and 56.6% had never engaged in physical activity. The prevalence of insufficient physical activity was higher among individuals aged 18 to 25 years (Figure 14).

DISCUSSION

A WHO STEPS survey conducted at Vivekanandha Educational Institution assessed biological and behavioral risk factors for non-communicable diseases. The results showed high prevalence of overweight and obesity, hypertension, elevated cholesterol, anemia, excessive salt intake, and low physical activity among participants.

Behavioural risk factors

The study revealed that none of the participants met the WHO dietary standards, with 78.4% consuming fewer than five daily servings of fruits and vegetables. Lack of awareness about

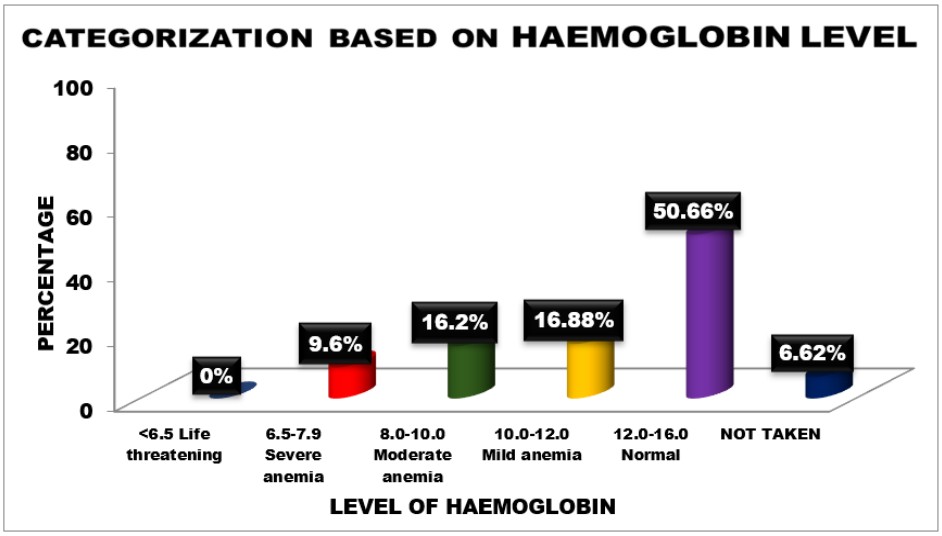

Figure 10: Categorization of participants based on Haemoglobin level.

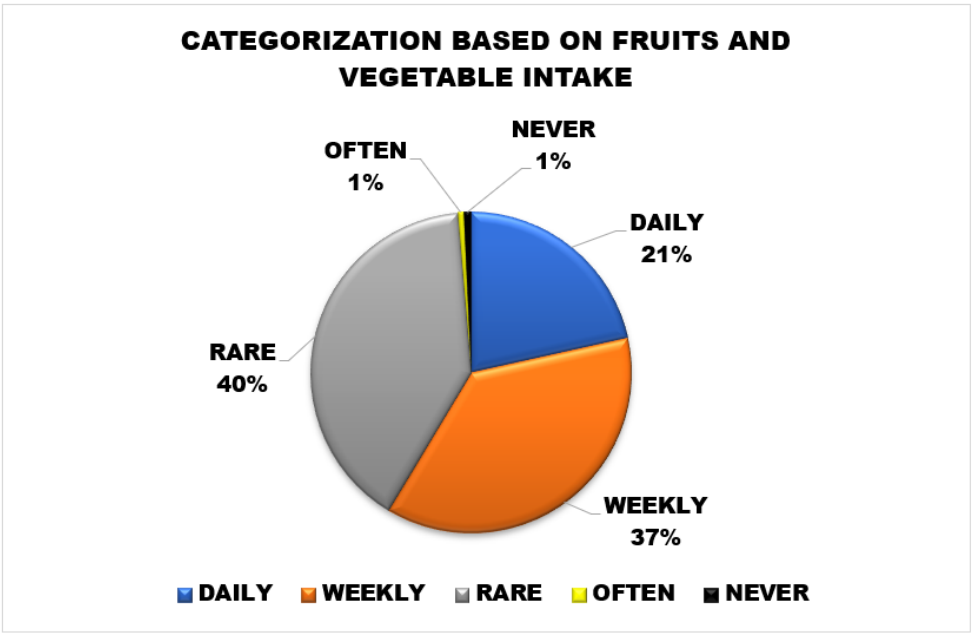

Figure 11: Categorization of participants based on Fruits and Vegetables intake.

recommended intake and the high cost of produce due to economic factors were major barriers. Additionally, 14% of participants regularly added salt to their food, raising concerns about excessive salt intake, with women playing a key role in influencing household dietary habits. The findings highlight the need for health education, strategies to promote fruit and vegetable consumption, and measures to reduce salt intake, especially among young adults.

Biological risk factors

The study found high rates of weight-related and metabolic issues: 38.7% of participants were overweight or obese, while 12.3% were underweight, largely due to lifestyle shifts and urbanization. Blood pressure abnormalities were significant, with 34% showing low blood pressure and 20% having high blood pressure, indicating the urgent need for targeted interventions. Elevated blood glucose affected 17% of participants, with age influencing higher levels, and 5% had low glucose, emphasizing the importance of early action in pre-diabetic groups. Elevated cholesterol was present in 20% of the population, especially among women aged 36-45, underscoring the need for public awareness and strategies to manage cardiovascular risk factors.

Number of behavioural or biological risk factors

The study showed that biological risk factors were more common in participants aged 36-45 years, while behavioral risk factors were higher in those aged 18-25 years. Only 1% of participants were free of NCD risk factors, while most had multiple: 10% had four, 26% had three, 39% had two, and 24% had one. This clustering indicates a likely rise in the NCD burden without urgent interventions. Unlike previous broader studies, such as that by Adhra Al-Mawali, which included both healthy and

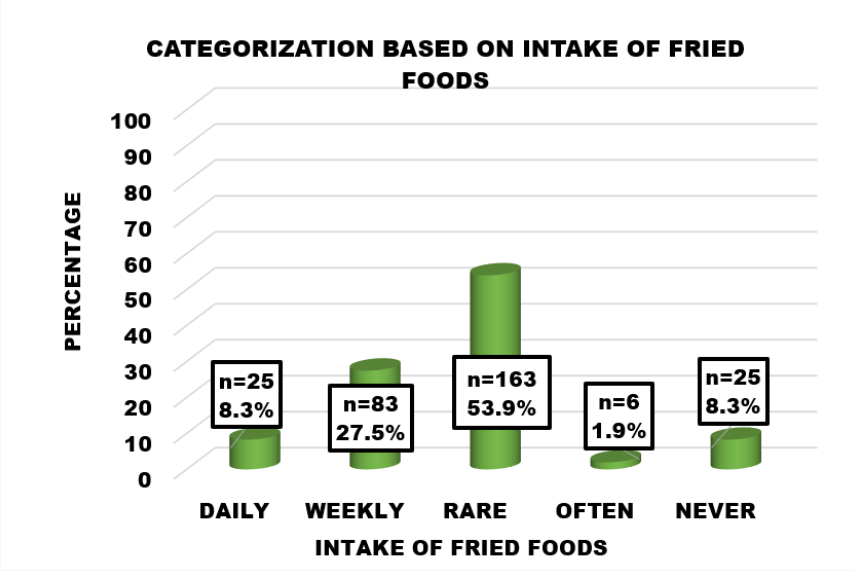

Figure 12: Categorization of participants based on intake of Fried foods.

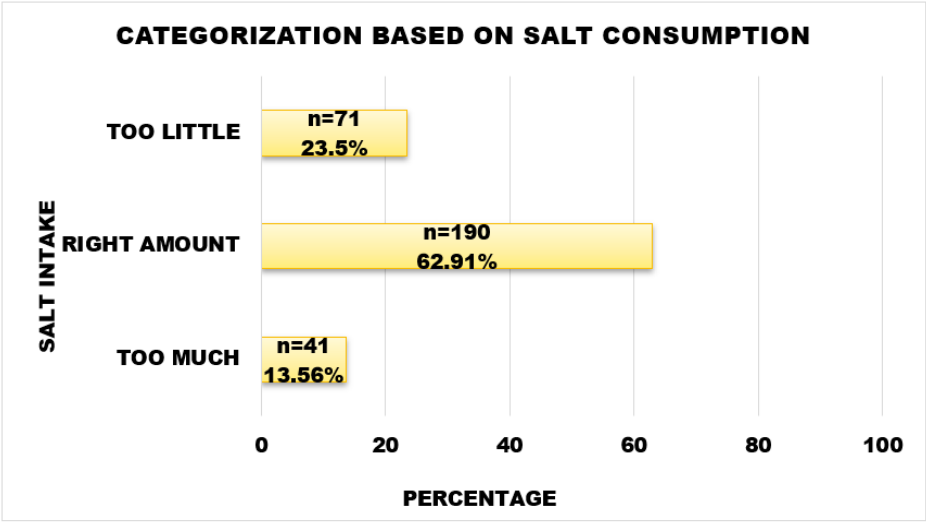

Figure 13: Categorization of participants based on Salt consumption.

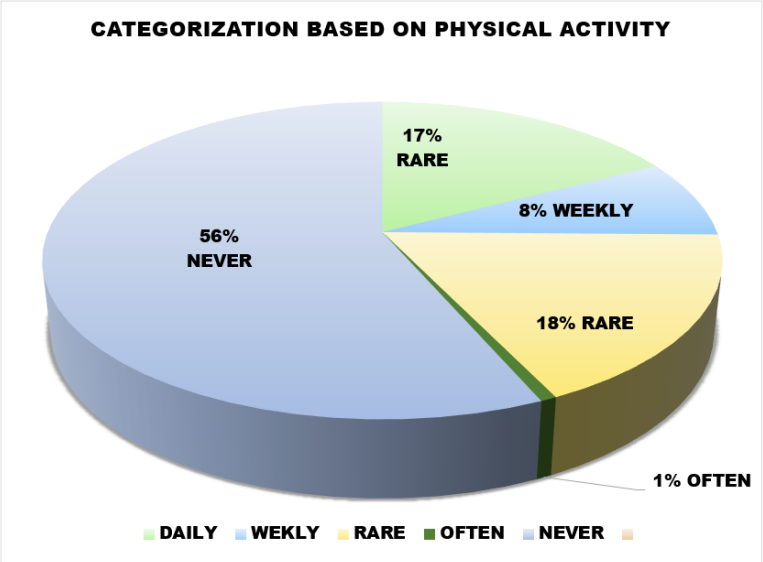

Figure 14: Categorization of participants based on Physical activity.

diseased individuals aged 18-85, this research focused specifically on healthy women aged 18-45 to enable early detection of risk factors.

STRENGTHS AND LIMITATIONS

The study effectively addressed both biological and behavioral NCD risk factors in women, highlighting the value of early detection and the need for gender-specific interventions, while also providing baseline data for future research. Its limitations include representativeness issues, self-reporting bias, and the cross-sectional design, but it underscores the importance of targeted interventions and further studies.

CONCLUSION

The study assessed NCD risk factors among healthy women and highlighted the importance of early detection for better health outcomes. Behavioural risk factors, particularly unhealthy diet, physical inactivity, and overweight/obesity, were found to be more common than biological ones. High prevalence rates were observed for obesity (38%), inadequate fruit and vegetable intake (78.4%), insufficient physical activity (82.7%), elevated blood pressure (20%), high cholesterol (19%), high blood sugar (17%), and anemia. Most participants (80%) had multiple risk factors, with younger women (18-25) showing more behavioural risks and older women (36-45) more biological risks. These findings emphasize the urgent need for targeted, evidence-based interventions such as promoting healthy diets, increasing access to affordable fruits and vegetables, encouraging physical activity, and addressing socioeconomic determinants of health. Strengthening national policies and integrating NCD indicators into health surveys will support more accurate planning and effective prevention strategies.

ACKNOWLEDGEMENT

The authors thank their management and hospital for providing resources, their Head of the Department and mentor Dr. P. Sharmila Nirojini and all faculty members for continuous support, and Dr. S. Arthanareeswaran, Joint Managing Director and Consultant in Internal Medicine, Diabetology, and Obesity, for his generous guidance and for making the necessary facilities available for the study.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ETHICAL CONSIDERATION

The study was carried out after taking permission from the Institutional Ethical Committee of Vivekanandha Medical Care Hospital, Elayampalayam (Ref. No. EC/NEW/INIT/2021/1811). The consent was taken from the patient to participate in the study. The study approval was permitted by the institutional ethics committee.

SUMMARY

This study evaluated risk factors for Non-Communicable Diseases (NCDs) among women using a cross-sectional survey conducted between March and August 2023. Data were collected through a modified WHO STEPS method from 302 women aged 18-45 years. The findings revealed that behavioural risk factors were more common than biological ones: 82.7% had insufficient physical activity, 78.4% consumed inadequate fruits and vegetables, and 38% were overweight or obese. Biological risks included hypertension (75.1%), anaemia (40.1%), high cholesterol (19.6%), and high blood sugar (17%). The study concluded that urgent interventions are needed to address these

risk factors by promoting healthier diets, increasing awareness, and tackling socio-economic determinants of health. Prevention and control of NCDs must be prioritized at both community and national levels to reduce their impact on health, society, and economic development.

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Cite this article: Nirojini S, Sathyamoorthy N, Basha NND, Sivakumar N. Evaluation of Risk Factors of Non-Communicable Diseases among Women: A Pharmacoepidemiological Study. Indian J Pharmacy Practice. 2026;19(2):262-71.