FOOD HABITS AND ECONOMIC IMPACT OF NON-COMMUNICABLE DISEASES IN SELECTED HOUSEHOLDS OF ERNAKULAM DISTRICT

DISSERTATION SUBMITTED

In partial fulfillment of requirement for the award of the degree of

MASTER'S PROGRAMME IN
CLINICAL NUTRITION AND DIETETICS

By

SHOYAL P.S

(Register No: SM23MCN015)

DEPARTMENT OF CLINICAL NUTRITION AND DIETETICS
ST. TERESA'S COLLEGE (AUTONOMOUS)
ERNAKULAM

APRIL 2025

CERTIFIED AS BONAFIDE RESEARCH WORK

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Signature of Internal Examiner **Signature of External Examiner**

DECLARATION

I hereby declare that the project entitled **"FOOD HABITS AND ECONOMIC IMPACT OF NON-COMMUNICABLE DISEASES IN SELECTED HOUSEHOLDS OF ERNAKULAM DISTRICT"** submitted in partial fulfilment of the requirement for the award of the degree of Master's Programme in Clinical Nutrition and Dietetics is a record of original research work done by me under the supervision and guidance of **Ms. Dr. Samja Sabu**, Assistant Professor, Department of Clinical Nutrition and Dietetics, Women's Study Centre, St. Teresa's College (Autonomous), Ernakulam and has not been submitted in part or full of any other degree/diploma/fellowship or the similar titles to any candidate of any other university.

Place: Ernakulam Shoyal P.S

Date: 28.04.2025

CERTIFICATE

I here certify that the dissertation entitled **"FOOD HABITS AND ECONOMIC IMPACT OF NON-COMMUNICABLE DISEASES IN SELECTED HOUSEHOLDS OF ERNAKULAM DISTRICT"** submitted in partial fulfilment of the requirement for the award of the degree of Master's Programme in Clinical Nutrition and Dietetics is a record of original work done by Ms. Shoyal P.S during the period of the study under my guidance and supervision.

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Shoyal P.S

ABSTRACT

Non-communicable diseases (NCDs) are chronic illnesses caused by a confluence of behavioral, physiological, environmental, and genetic factors. These non- infectious diseases provide a serious crisis for healthcare systems worldwide. According to studies, NCDs cause early death globally and affect individuals from all socio-economic backgrounds and geographical locations. Cardiovascular diseases, diabetes, cancer, chronic renal disease, and chronic respiratory illnesses were the most common NCDs. These disorders affect not just the individual but also the entire family, resulting in physical, mental, and financial suffering.

The objective of this present study was to assess the prevalence of NCDs by gender, food habits, and the economic burden of NCDs on households. The present study assessed prevalence by gender, and discovered that women were more prone to have NCDs. The predisposing factors include age, overweight/obesity, menopause, physical inactivity and dietary habits.

NCDs and economic burden are closely related; low productivity and incapacity to work reduce income, while higher healthcare costs lead to financial instability. Healthcare costs will differ depending on the condition's severity and type, and the lower and middle classes will bear a greater financial burden due to lack of savings.

The majority of NCDs are caused by factors that can be modified and prevented. Unhealthy diet, stress, alcohol use, smoking, and physical inactivity are the most modifiable risk factors. Elevated blood pressure, hyperglycemia, hyperlipidemia, overweight or obesity are metabolic risk factors that can also contribute to NCDs. To a certain extent, metabolic risk factors can be controlled using modifiable risk factors. The primary goal was to reduce the risk factors for NCDs, as treating the ill alone would not be sufficient to reduce the prevalence and complications of NCDs. Furthermore, the majority of the NCDs are caused by modifiable risk factors that can be controlled with appropriate lifestyle interventions. This would reduce the incidence of NCDs and the catastrophic expenses associated with them.

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1. INTRODUCTION

"Eat food as medicine, otherwise, you will have to eat medicine as food"

– Hippocrates

Non-communicable diseases (NCDs), are chronic diseases which are not contagious. According to WHO, non-communicable diseases are diseases that are not directly transmissible between individuals. They are caused by a confluence of behavioural, physiological, environmental, and genetic variables and these are long-lasting chronic illnesses that advance gradually. (WHO, 2024)

NCDs claimed the lives of at least 43 million individuals, with 18 million dying before the age of 70 years. NCDs affect people in all age categories, regions, and nations. Children, adults, and the elderly are all susceptible to the risk factors that lead to NCDs, which include poor diets, sedentary lifestyles, exposure to tobacco smoke, hazardous alcohol consumption, and air pollution. Obesity, rising blood lipids, elevated blood pressure, and elevated blood glucose are all symptoms of unhealthy eating habits and physical inactivity. These are known as metabolic risk factors, and they have the potential to cause cardiovascular disease, which is the NCD that causes the greatest number of premature deaths (WHO, 2024).

About 10 million individuals worldwide lose their lives to cancer each year, making it one of the main causes of chronic disease-related mortality. In India, cancer claims the lives of around 800,000 people annually. Breast cancer, cervical cancer, and oral cancer are the three most prevalent types of cancer. Almost 18 million deaths worldwide are attributed to cardiovascular disease (CVD), which includes heart attacks and strokes. 1.28 billion persons between the ages of 30 and 79 are thought to suffer from hypertension. There are about 537 million diabetics worldwide, making it one of the most prevalent diseases in the world. An estimated 41 million Indians suffer from diabetes, and "every fifth diabetic in the world is an Indian." India has been dubbed "the diabetes capital of the world". Diabetes has the potential to harm the heart, blood vessels, eyes, kidneys, and nerves over time. The most severe type of chronic kidney disease (CKD), kidney failure, is directly responsible for more than one million fatalities annually. Approximately 690 million people worldwide suffer from CKD. Interstitial lung disease, COPD, asthma, and occupational lung disorders are common chronic respiratory conditions that account for 10.9% of all fatalities in India. Asthma and COPD are two of these serious public health issues. (National Programme for Prevention and Control of Non-Communicable Diseases, 2023-2030).

Kerala is an Indian state with mother and child health indices, life expectancy, literacy rates, and fertility rates comparable to those of affluent nations. However, Kerala is now dealing with an ever-increasing burden of NCDs due to a number of factors, including foreign migration, rapid urbanization, rising income, changing age structure, and changing lifestyle (Aslesh, 2015).

NCDs are very expensive to treat. Globally, health spending amounts to about US$8.5 trillion annually. Since NCDs are common and may persist for many years, they are probably responsible for a significant portion of this expenditure (WHO, 2022). Compared to affluent countries, low-middle-income countries have a higher prevalence of these diseases because of urbanization. When compared to communicable diseases, the percentage of total healthcare costs that are spent on NCD care is higher. They significantly affect healthcare expenses, individual and national economic growth, and productivity (Rohini *et al.,* 2020).

A study on the factors affecting catastrophic health expenditure and impoverishment from medical expenses in China (2012) discovered that the rate of destitution was 7.5% and the rate of catastrophic health cost was 13.0%. Households with hospitalized, elderly, or chronically ill individuals, as well as those in rural or less affluent areas, had higher rates of catastrophic health expenditure (CHE). Compared to families registered in the new rural corporative plan, those enrolled in the urban employee or resident insurance schemes experienced lower rates of CHE. CHE was determined by demographics, provider payment methods, benefit package types, and the need and use of health care.

Menon *et al.,* (2022) studied the burden of non-communicable diseases and its associated economic costs in India and found that for all NCDs, health spending in private healthcare facilities was five times more than in public health facilities. The greatest mean out-of-pocket expense (OOPE) for hospitalization after reimbursement was deducted was for cancer (INR 61 299), followed by musculoskeletal disorders (INR 29,841), cardiovascular illnesses (INR 33,767), and stroke (INR 35,887). 47 percent of the households experienced catastrophic expenses as a result of hospitalization. Private healthcare treatment drove more families to CHE (66.3%) than public healthcare (17.1%).

One new area of study within health economics is nutrition economics. A team of multidisciplinary experts coined the phrase in early 2010 and described it as "a discipline dedicated to researching and characterizing health and economic outcomes in nutrition for the benefit of society." Unquestionably, one of the main modifiable determinants of disease is diet.

In contrast, the majority of high-income nations continue to see health care spending increase more quickly than economic growth. To maximize the health and well-being of society, nutrition economics is therefore essential to the development of food-based preventative health policies and the prioritization of interventional treatments (Wijnkoop *et al*., 2013). The NCD best buys are interventions that are thought to be the most practical and economical practices to use in every nation, offering outstanding value for the money and possibly extending the healthy lives of millions of individuals. Avoiding the catastrophic health and socioeconomic effects of NCDs can be achieved at a very low cost by investing in a limited number of WHO-recommended programs for NCD prevention and treatment. (Invisible numbers: the true extent of noncommunicable diseases and what to do about them. Geneva: World Health Organization; 2022).

Age is a crucial predictor, with older people especially those over 50 having a significantly higher risk than younger people. Due to substantial differences in access to resources, healthcare, and education, those in higher income groups typically have reduced health risks. It is clear that health inequities are made worse in rural areas by a lack of resources and inadequate infrastructure. The likelihood of developing NCDs is considerably higher in people with a family history of the disease (Sunil *et al.*, 2024).

The WHO's STEP-wise approach to NCD risk factor surveillance (STEPS) is a straightforward, standardized technique for gathering, evaluating, and sharing information on important NCD risk factors across nations. This study does not use STEPS approach, but incorporated important biological risk factors like being overweight or obese, having high blood pressure, high blood glucose, and abnormal blood lipids, as well as important behavioral risk factors like smoking, drinking, not exercising, and following an unhealthy diet.

In 2022, an estimated 37 million children under the age of five were overweight, while 2.5 billion individuals older than 18 were overweight, including approximately 890 million adults who were obese. (WHO 2024). Over 8 million people worldwide are killed by the tobacco epidemic each year, making it one of the greatest public health hazards the world has ever faced. Of those deaths, almost 7 million are directly related to tobacco use, and over 1.3 million are related to second-hand smoke exposure for nonsmokers (WHO 2023). In 2019, alcohol use was a contributing factor in 2.6 million deaths globally, with 0.6 million deaths among women and 2 million deaths among males. 1.8 billion individuals, or about one-third (31%) of the world's adult population, do not engage in physical activity. The global

recommendations of engaging in at least 150 minutes of moderate-intensity physical activity per week are not met by them. By 2030, it is anticipated that 35% of individuals will not be getting the necessary amounts of physical activity if this trend continues. One of the main environmental factors contributing to poor health is air pollution, both indoors and outdoors. Across the world's population, 99 percent lived in areas with air quality levels below WHO standards (WHO 2024).

The overall food environment pattern has changed as a result of the shift from traditional foods, which are minimally processed, to refined meals that use more sugars, oils, hydrogenated fats that contain trans-fat, saturated fat, sugar sweetened beverages, animal foods, dairy products, and salty snacks without much awareness. Whole grains, nuts, pulses, and legumes, as well as fruits and vegetables that positively influence disease processes, are also not ingested in the necessary amounts. However, due to taste preferences, availability in supermarkets and fast-food venues, and women's preference for economically rewarding jobs in urban areas, processed and convenience snacks, street foods, and ready-to-eat meals are on the rise and are gradually displacing traditional home cooking (Krishnaswamy *et al.,* 2016).

As per these findings, it can be assumed that there is a substantial economic burden imposed by NCDs in the nations. The type, duration, and facilities used for the treatment of NCD significantly influence the extent of this burden. Also unhealthy lifestyle choices contribute to the increased prevalence of NCDs. This study aims to assess the economic burden of NCDs in a household and to identify the food habits of NCD patients in selected households from Ernakulam district.

Since studies related to nutritional economics are limited, the present study is important in current period. The study conducted with the following objectives.

Objective of this study:

- To assess food habits of NCD patients.
- To estimate the economic burden of non-communicable diseases in a household.
- To investigate the prevalence of NCDs by gender.

2. REVIEW OF LITERATURE

The literature pertinent to the current study, **"Food habits and economic burden of non-communicable Diseases of Selected Households in Ernakulam District"** was done under following headings

2.1. Prevalence of non-communicable diseases

2.2. Economic burden of non-communicable diseases

2.3 Risk factors of non-communicable diseases

2.1. Prevalence of non-communicable diseases

WHO (2021) estimates that non-communicable diseases, such as cancer, diabetes, heart disease, stroke, and chronic lung disease, account for 74% of all deaths globally. NCDs were responsible for 86% of the 17 million premature deaths, or deaths that occurred before the age of 70. In 2019, the World Health Organization published a list of the ten threats to global health, including NCDs as one of the top 10 global health threats. Heart disease claimed 17.9 million lives per year, which is followed by cancer (9.3 million), chronic respiratory conditions (4.1 million), and 2 million of diabetes, including fatalities from kidney disease, as the leading causes of mortality. More than 80% of all early NCD fatalities are attributable to these four disease categories.

A study by Menon *et al.,* (2022) on the economic costs of non-communicable diseases in India found that, in 2017, India experienced around 4.7 million deaths and 226.8 million Disability Adjusted Life Years (DALY's) because of NCDs, with a DALY to mortality ratio of 48 to one. Males accounted for just over half of all DALY's (55%) and fatalities (58%). At all ages, the DALY rates per 100,000 people were 16939, with males having higher rates than females.

According to Arokiasamy (2018) study on India's growing burden of noncommunicable illnesses, CVDs, which include ischemic heart disease and stroke, accounted for the majority of the overall burden of death in 2016. Similarly, diabetes accounts for around 3.1% of the total mortality load, while asthma and chronic obstructive pulmonary disease (COPD) account for approximately 10.9%. The states with the highest rates of cardiovascular disease and death include Andhra Pradesh, Goa, Himachal Pradesh, Kerala, Maharashtra, Punjab, Tamil Nadu, and West Bengal.

Menon *et al*., (2020) conducted a study on noncommunicable disease awareness and control in a rural community in an epidemiologically advanced stage of transition (Kerala), and estimated that by 2030, India will have 218 million hypertensives and 101 million diabetics. By 2020, NCDs would be responsible for 53% of all deaths in India, with CVD accounting for 43%. Kerala is recognized as India's cardiovascular disease and diabetes capital, with prevalence rates that can be more than double the national norm. Kerala's age-adjusted death rates for coronary artery disease are 128 for women and 382 for men per 100,000, and CAD rates are three to six times higher than those in rural China and Japan.

The current burden of different non-communicable diseases in Kerala was reviewed by Dr. Aslesh (2015). Chronic non-communicable diseases (NCDs) have substituted communicable diseases as the leading determinants of morbidity and premature mortality globally. Over the past 30 years, the prevalence of diabetes has been on the rise, and it is more common in women than in men. This may be due to the higher prevalence of central obesity and physical inactivity among females in Kerala, while the prevalence of hypertension was almost equal for both sexes in both urban and rural areas. 60–80% of those over 60 years have hypertension, and the prevalence of the condition rises with age. Only one - fifth of our population has normal blood pressure and a very high percentage of population (up to 40%) are in the pre-hypertensive stage is even more concerning. COPD was the primary respiratory cause of death, contributing to 15.3% of all fatalities. No gender difference was observed in the distribution of chronic bronchitis (11% in men and 9% in women), and the prevalence was higher in rural areas (13.5%) than in urban areas (5%). Asthma prevalence in the state is 3.1%, and it is higher among females (males: 2.5, females: 3.7) and those who reside in rural areas (rural: 4.5, urban: 1.9). Kerala is currently seeing a sharp increase in cancer diagnoses, with males seeing a higher prevalence than females. The most common cancer location in men was lung cancer (14.5%), followed by oral cavity cancer (14.2%), and in women, breast cancer (29.8%) followed by thyroid cancer (12.5%). 10.7% of women and 39.5% of males had cancer (lungs, mouth, pharynx, larynx, oesophagus, bladder) as a result of tobacco usage. Leukaemia was the most common cancer among children aged 0-14 years, for both male and female. According to recent estimates, the age-adjusted incidence rate of end-stage renal disease (ESRD) in India is 22.9 per lakh. This corresponds to 7,500 new chronic kidney illnesses that necessitate kidney transplantation or dialysis in Kerala annually. Cardiovascular disorders account for up to 40% of all fatalities, making them the primary cause of death. The state's age-adjusted cardiovascular mortality rate is 231 per lakh for women and 490 per lakh for men

annually. And people under 45 years old account for almost one-fifth of all acute coronary events. Acute coronary events typically happen at age of 60, and they happen ten years earlier in men (56 years old) than in women (69 years old). Currently, coronary artery disease accounts for 18% of deaths among women and 30% of deaths among men in the state. The most frequent kind of stroke occurred in the population was ischemic stroke. There was no difference in the average age of stroke patients between urban and rural populations, which was 67 years.

2.2 Financial burden non-communicable diseases

A systemic review of the global impact of non-communicable diseases on healthcare spending and national income done by Muka *et al.*, (2015), shows that health expenditures associated with NCDs will differ by country, area and type. Moreover, the intensity and years spent with the illness are associated with higher expenses. Cardiovascular disease accounted for 12–16.5 percent of healthcare spending, while other NCDs accounted for 0.7–7.4 percent. The financial burden of NCDs on national welfare and healthcare budgets is substantial and is only expected to grow over time.

According to a study on the global economic burden of non-communicable diseases by Bloom *et al.*, (2012), states that NCDs are now recognized as a serious danger to economic growth and development in addition to human health. These illnesses currently account for 63% of all fatalities worldwide. Macroeconomic simulations indicate that during the next 20 years, the combined effects of cardiovascular illness, chronic respiratory conditions, cancer, diabetes, and mental health will result in a loss of US$47 trillion in production.

According to a systematic literature review by Loes Jaspers *et al.,* (2015), in the global impact of non-communicable diseases on households and impoverishment, examined that 6–11% of the population will live in poverty in 16 low and middle-income countries (LMIC). Globally, NCDs have a significant and increasing impact on households and poverty across all continents and income levels. Compared to other NCDs, the probability of impoverishment from cancer-related expenses was nearly 2.3 times higher, and household income losses after a CVD diagnosis were 26.3%.

According to Qun Wang *et al.* (2016), an observational study conducted in rural Malawi revealed that among the most commonly reported CNCDs, chronic neuropsychiatric and cardiovascular disorders had the highest direct, indirect, and overall expenses, causing households to incur catastrophic spending and further impoverishment. Each individual's specific condition had a significant impact on the economic burden.

Reports based on a study by Prinja *et al.,* (2022) indicate that India has a significantly greater percentage of out-of-pocket (OOP) spending on pharmaceuticals than other nations. Significant decreases were noted for clinics with only one doctor, particularly for ayurvedic (64.51-36.51%) and homeopathic (57.53-42.74%) practitioners. Due to a number of issues in the public sector, including the limited availability of essential drugs and diagnostics, patients may still have to pay out of pocket even if the Indian government provides supply-side financing to public facilities to cover their costs.

Rao *et al.,* (2011) investigated the socio-economic inequalities in the financing of cardiovascular and diabetes inpatient treatment in India and studied that households employed a range of strategies to pay for out-of-pocket hospital treatment. Among these were their present earnings and savings, borrowing (from moneylenders, banks, friends/relatives), and, in dire circumstances, selling their assets. The majority (57%) of the total OOPS expenses that households incurred for hospitalizations associated to CVD were covered by household savings, with borrowings coming in second at 35% and asset sales at 8%. Just 38% of OOPS expenses were paid for by savings for the lowest population, compared to 62% for the wealthiest. As economic status grew, the percentage of OOPS expenses that were covered by borrowing decreased, with the poorest group accounting for 55% of it.

A study conducted by Garg (2024) in Chhattisgarh, showed that Medical Colleges have the highest OOPE among public facilities, followed by district hospitals. Public facilities at the primary level have the lowest OOPE. Compared to public facilities, the formal-private providers average OOPE was around four times higher, the average OOPE of informal private providers was higher than that of primary level public facilities like Primary Health Centers (PHCs) and Sub Health Centers (SHCs). It was also found that each patient with an NCD in public sector facilities had an average monthly care cost of INR 688.

According to Rivya Dias's (2023) study on the burden of non-communicable diseases and its economic impact on households in Goa, discovered that NCDs necessitate frequent health and non-health expenses due to their chronic and long-term nature. One frequently changes their behavior and way of life as a result, these changes can occasionally come with increased expenses for things like counselling, altered eating habits, and exercise. Thus, having a patient with the condition results in expenses for the home. According to Goa's National Health Mission data from 2021, NCDs cause 56.1% of the state's premature deaths, while NCD-related morbidity and disability make up 43.9%. Public hospitals typically charge

approximately Rs. 3,039 for rural households and for urban households Rs. 5,666 per hospitalized case. These expenses can frequently result in household hardship because NCDs necessitate frequent treatment and hospitalizations in cases of high disease severity. The two primary methods for covering catastrophic medical expenses are borrowing and asset sales. Savings, income, borrowing, and asset sales were the most popular ways to finance distress financing for cancer treatment, although savings are often used to pay for diabetes-related expenses. Savings was a significant source for CKD treatment, along with other sources of funds from loans, land sales, and asset sales. The money needed for CVD expenses is provided by savings and selling of assets. In the case of diabetes and cardiovascular illness, the income losses are determined by the severity and duration of the condition.

Devi *et al.,* (2020) conducted a study in rural Kerala based on non-communicable diseases and public health facility utilization, found that regardless of their socioeconomic background, patients with NCDs seek to lower their medical expenses by using public health facilities. In order to safeguard the most vulnerable populations, a comprehensive health care finance plan is essential for patients with chronic NCDs.

A cross-sectional study of out-of-pocket expenditure on non-communicable diseases during COVID-19 in Kannur by Resmi *et al.,* (2022) found that costs for NCD care during COVID-19 were high, and that private facility users spent significantly more than those using government facilities. The non-medical cost of NCD care can be decreased by strengthening the services through subcenters, which will also lower travel expenses. The location of NCD service consumption and cost were significantly correlated. Compared to public institutions, the cost of receiving care from private facilities was significantly greater.

2.3. Risk factors of non-communicable diseases

The WHO's (2014) Global Status Report on non-communicable diseases examines the four behavioural risk factors—tobacco use, poor diet, physical inactivity, and hazardous alcohol use—that account for a substantial percentage of chronic diseases. Obesity, elevated blood pressure, elevated blood glucose, and elevated blood total cholesterol are major metabolic risk factors. The single biggest risk factor linked to NCDs has been shown to be tobacco use. Additionally, there is a sharp rise in the prevalence of overweight and obesity. In India, approximately 10% of adults over the age of 18 have high blood glucose levels, putting additional financial and service strain on healthcare systems, while one in every four adults over the age of 18 has hypertension. In India, the average person consumes 5.2 liters of pure

alcohol per year (age +15). According to WHO criteria, nearly two-thirds of Indian teens aged 11 to 17 are not physically active.

Thi Phuong Lan Nguyen *etal*.,(2023) study on the cost effectiveness of preventing noncommunicable diseases in Southeast Asia examined interventions to prevent tobacco use, such as raising tobacco product prices or taxes, taxing tobacco products, reducing the attractiveness of tobacco packaging, prohibiting tobacco product marketing, establishing smoke-free environments, removing second-hand smoke exposure, smoking cessation programs, and public awareness. One of the most important measures for managing CVD events and blood pressure is to limit salt and sodium intake. The burden of CVDs is also thought to be reduced by lowering cholesterol levels with medicine and taxing sugar-sweetened beverages.

According to the study the cost effectiveness of preventing non-communicable diseases in Southeast Asia by Thi Phuong Lan Nguyen *et al.,* (2023), examined interventions to prevent tobacco use, such as raising tobacco product prices or taxes, taxing tobacco products, reducing the attractiveness of tobacco packaging, prohibiting tobacco product marketing, establishing smoke-free environments, removing second-hand smoke exposure, smoking cessation programs, and public awareness campaigns about the dangers of tobacco. One of the key strategies for managing CVD events and regulating blood pressure is cutting back on salt / sodium intake. The burden of CVDs has also been said to be lessened by lowering cholesterol levels with medication and reducing sugar intake by taxing sugar-sweetened beverages.

Risk Factors of Non-Communicable Diseases among Higher Secondary School students was studied by Sogarwal *et al.,* (2014) in selected districts of India and discovered that the use of alcohol was less common than the use of tobacco in any form. Compared to their male peers, female students used tobacco at a substantially lower rate: 12% of boys and 3% of girls chewed tobacco, while 13% of boys and 3% of girls smoked cigarettes or bidis. The effects of use among family members, siblings, and friends are statistically significant and have a stronger influence on chewing, smoking, and alcohol consumption. For students whose family members use alcohol or tobacco, the likelihood of using these substances at least once is higher. The main elements that appear to be influencing the students use of alcohol and tobacco are age, knowledge or awareness of the risks, exposure from peers and family, and television watching. Age clearly increases student's exposure, which raises their chance of alcohol and tobacco usage and consequently, their risk of developing NCDs in later life.

According to Sarma *et al.,* (2019) in the cross-sectional investigation on the prevalence of risk factors of non-communicable diseases in Kerala, seven risk factors were investigated they are alcohol use, obesity, abdominal obesity, high blood pressure, high blood sugar, physical inactivity, and tobacco use. Women had low rates of alcohol and smoke usage. Men and women reported being physically inactive at rates of 23.7% and 20.8%, respectively. The rates of alcohol and tobacco use, physical inactivity, and fruit and vegetable consumption did not differ significantly between urban and rural populations. Women consumed much more salt (7.5 g) than men (5.3 g) per day, with the participant's average daily intake being 6.7 g. The majority of persons in the 18–64 age range (82.4%) had at least one NCD risk factor, and 47.1% had several risk factors, according to this study. In Kerala, 30.4% and 19.2% of individuals, respectively, had elevated blood pressure and fasting blood glucose. Up to 30.4% of people were overweight, and 60.2% of people had abdominal obesity, which was much more common in women. Furthermore, it was shown that 54.5% of adults had dysglycemia. Additionally, 36% of men and 35% of women had pre-diabetes.

The study conducted by Priyanka *et al.,* (2018) in Kani tribes of Thiruvananthapuram district explores NCD risk factors in a rapidly modernising indigenous population in Kerala. The Kani tribe in Kerala had higher rates of hypertension (48.3%), tobacco use (81.5%), and alcohol drinking (36.2%) than the general population. Compared to other Indian tribal groups, Kani tribes have a higher rate of abdominal obesity (22.1%). Tobacco use, low educational attainment, male sex, advanced age was all scientifically linked to hypertension. According to multivariate analysis, the main risk variables for hypertension were determined to be age and alcohol use, while a high level of education was found to be protective. The rate of alcohol consumption was 36.2%, with men consuming more (66.4%) than women (6%). They were also used to more contemporary types of alcohol, such as beer, rum, and brandy. These tribes consumed substantially fewer fruits and vegetables than the slum dwellers in Kerala. Tribes in India faced additional pressure to disregard their health issues because of poverty, a shortage of trained medical personnel, difficult access to medical facilities, a lack of funding, and a lack of health infrastructure.

Aida Budreviciute *et al*., (2020) investigated non-communicable disease (NCD) management and prevention measures, as well as risk variables. Risk factors are classified as modifiable or non-modifiable. High blood pressure, smoking, diabetes, obesity, physical inactivity, and high blood cholesterol are all modifiable risk factors, although age, gender, genetics, race, and ethnicity are not. Although NCDs are often associated with the elderly, they

can affect people of all ages, including newborns. Many illnesses begin in early childhood and can deteriorate throughout childhood, youth, and old age.

3. METHODOLOGY

The methodology of the study entitled **"Food habits and economic impact of non-communicable diseases in selected households of Ernakulam district"** is presented under the following headings.

3.1 Selection of area

The present study was conducted among the population of Ernakulam district. This region was chosen because of its cultural diversity, rapid urbanization and rising standard of life, widespread availability to various food categories, and improved healthcare facilities.

3.2 Selection of samples

The study used a purposive sampling approach. It was also referred to as judgmental sampling since participants are selected "on purpose" rather than at random. Families having at least one member diagnosed with any of the following non-communicable diseases such as diabetes, cardiovascular disease, respiratory disorders, cancer, and chronic kidney disease were selected for the study.

3.2.1 Sample size

To determine the sample size, a pilot study was conducted with 17 samples. The results show a relative precision of 20% and 95% confidence, and the minimum sample size was estimated to be 109. The sample size was expanded in order to improve the accuracy of the

results. For the present study 200 households were visited, and 208 samples were taken overall because some households had more than one patient diagnosed with non-communicable diseases.

3.3 Data collection methods

3.3.1 Ethical clearance

This study protocol was approved by the Institutional Research Ethics Committee of St. Teresa's College, Ernakulam (approval number: STCAU/111/25).

3.3.2 Data collection tools

A self-administered structured questionnaire was used to collect data. The questionnaire included questions to elicit information on sociodemographic profile, health history based on the diagnosis and treatment of non-communicable diseases, costs associated with non-communicable diseases, dietary information, and lifestyle.

3.3.3 Collection of data

Patients were interviewed personally and a self- administered structured questionnaire was used to collect data for the study.

To obtain data on socio-demographic details, the Kuppuswamy scale (2024) was used which included educational status and occupational status of the household head, monthly income of the family and thus the socio-economic class is assessed.

Socio-economic class (S) = S1+ S2+S3

- S1 educational status of the household head.
- S2 employment status of the house hold head.
- S3 monthly family income in INR.

Information on the type of NCD, diagnosis, treatment, and medical facilities utilized were also collected from the participants. Data, such as blood pressure measurements, lipid profiles, and blood glucose levels, were also gathered by reviewing their existing medical records.

The participants were self- reported the approximate amount they spend on NCD's each month. Its calculated based on various cost components including:

- Direct medical costs involve consultation, medication, lab.
- Direct non-medical costs involve travel, meals, care taker wages.
- Indirect costs involve loss of salary due to loss of working days.

3.3.4. Anthropometric measurements

According to WHO, anthropometry offers the most affordable, non-invasive, portable, and widely applicable method for determining the size, proportions, and composition of the human body. It assesses both health and nutritional status and predicts performance, health, and survival.

Measurements such as height and weight were taken from each participant to calculate BMI.

3.3.4.1 Height

Height is a highly accurate indicator of an individual's overall growth and size. It was measured using a standard measuring tape. Participants were asked to stand without shoes on a flat, level surface. The measurement of height was taken in centimetres.

3.3.4.2 Weight

Weight is the most widely used and simplest anthropometric assessment for evaluating an individual's nutritional status. A digital weighing scale was used to determine each participant's weight. Measurements were taken without shoes and with minimal clothing. Participants stood in the centre of the platform, distributing their weight evenly on both feet. The weight was displayed on the machine's screen in units of kilograms (kg).

Plate 1. Measurement of height

Plate 2. Measurement of weight

3.3.4.3 Body mass index

Body weight in relation to height is measured by BMI. BMI, originally known as the Quetelet index, is a metric used to assess an adult's nutritional health. It is calculated by dividing a person's weight in kilograms by their height in meters squared (kg/m2).

BMI = Weight (kg) / Height (m)^2

Table 1. BMI classification

BMI	**Classification**
< 18.5	Underweight
18.5-24.9	Normal weight
25-29.9	Pre-obesity
30-34.9	Obesity class I
35–39.9	Obesity class II
≥ 40	Obesity class III

(WHO 2010)

3.3.5 Assessment of Food Habits

Assessment food habits were done using a food frequency questionnaire.

3.3.5.1 Food frequency questionnaire

FFQs consist of a list of food items with response categories to indicate the usual frequency of consumption. The table categorized food items into cereals and millets, legumes, vegetables, fruits, nuts and oil seeds, milk and milk products, animal products and sugars. Participants mark how often they consume each food item in the table under the headings 'daily, weekly, monthly, rarely'.

3.4. Data analysis and interpretation

Statistical analysis was performed using EZR software version 3.6.1. All categorical variables were summarized as frequency and percentage and all quantitative variables using as mean and SD if the data follows normality assumption, else using median and IQR (Q3-Q1).

KS test was used to check the normality of data. Mann Whitney U test was used to compare the average monthly expenditure with non-communicable diseases and Kuskal-walis test was used to compare the average monthly expenditure between socio-economic classes. A p value <0.05 was considered to be statistically significant.

Research design

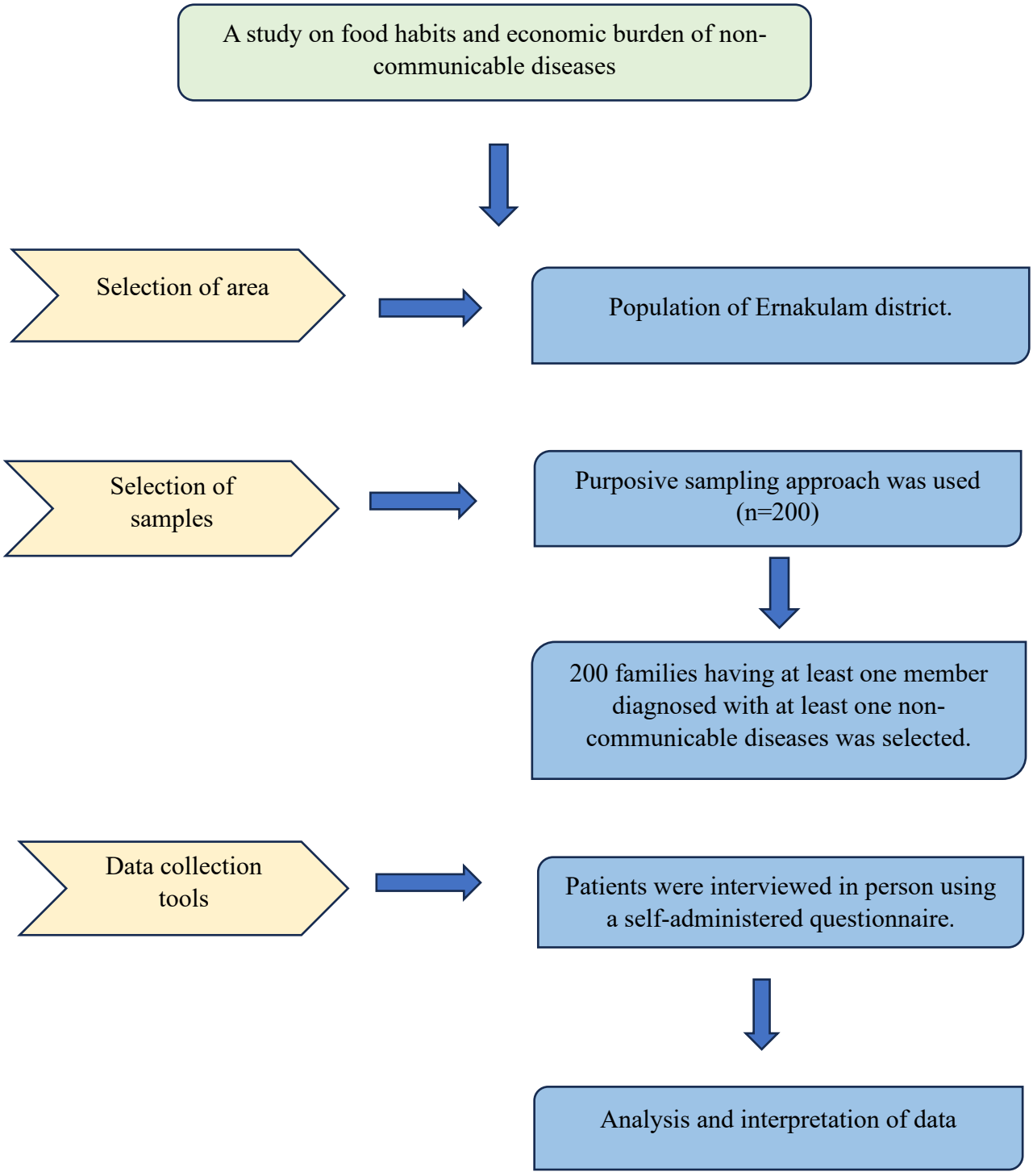

Figure 1. Research design

4. RESULTS AND DISCUSSIONS

The outcomes of the study entitled **"Food habits and economic impact of non-communicable diseases in selected households of Ernakulam district"** were discussed under the following heads:

4.1. Socio-demographic profile

4.2. Assessment of NCD patient

4.3. Healthcare facility

4.4. Economic status and NCDs

4.5. Assessment of risk factors

4.6. Assessment of food habits

4.1. Socio-demographic profile

4.1.1. Gender distribution

The study used a sample size of 200 households in Ernakulam district, and data were collected through face-to-face interviews using a self-administered structured questionnaire.

The demographic information of the study participants is highlighted in this section. To assess the socio-economic class Kuppuswamy scale was used.

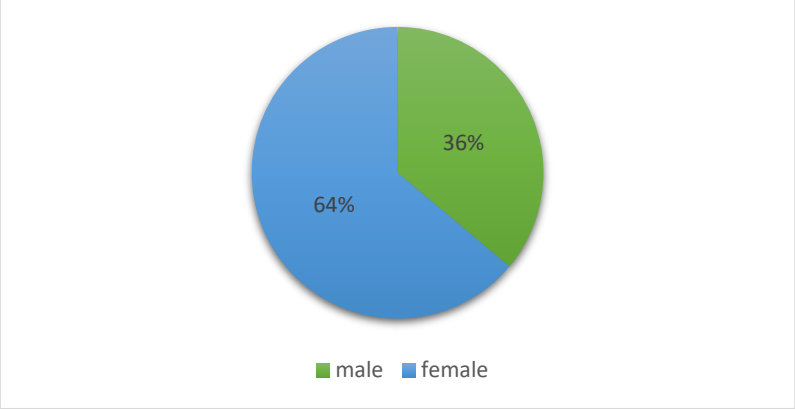

Figure 2. Distribution of study participants according to gender

The gender-wise prevalence of NCDs were given in Figure 2. Among the 208 participants, 75 were men and 133 were women, represented 36.1% and 63.9% of the study populations, respectively. There were more female participants in the study population, and the findings indicate that women were more prone to NCDs than men.

At the national level, it was noted that women were far more likely than men to have NCDs. Both men and women over 60 were at significant risk of developing NCDs, with older women (247 per 1,000) disproportionately experienced more NCDs than older males (234 per 1,000), regardless of socioeconomic status (Patra *et al*., 2016).

Women who suffered from a single chronic condition had a mean age of 30 years, whereas those who had multiple chronic conditions had an average age of 35 years. Age of woman was also found to positively correlate with the multimorbidity of chronic conditions. Individual risk factors, such as the waist-to-hip ratio, menopause, tobacco and alcohol use, and dietary habits, were identified as important risk factors in addition to age. These factors had a major impact on the multimorbidity status of women in the reproductive age group (Chauhan *et al*., 2023).

4.1.2. Educational profile of household head

The educational qualification of the household head was presented in Table 2.

Table 2. Educational qualification of the household head.

S. N.	Education of the head	Percentage (%)
1	Professional degree	9.6
2	Graduate	29.8
3	Intermediate / diploma	29.3
4	High school	21.6
5	Middle school	6.7
6	Primary school	1
7	Illiterate	1.9

The education levels were ranked from illiterate to professional, and the results indicated that the majority of people had either a degree (29.8%) or an intermediate / diploma (29.3%). Also, 21.6% of the study population had a high school qualification but the professional degrees were held by just 9.6% of the population. A very small proportion of households were headed with individuals who were uneducated (1.9%) and have primary level of education (1%).

The majority of research participants clearly hailed from educated families. In this study 69.2% of the population was found to be educated.

Having a basic education is essential to being healthy. Lack of fundamental knowledge, reasoning skills, emotional capacity of self-awareness and emotional regulation, and social interaction abilities are all indicators of a sick person (Truman *et al.,*2015).

4.1.3. Employment status of the household head

The employment status of the household head were given in Figure 3.

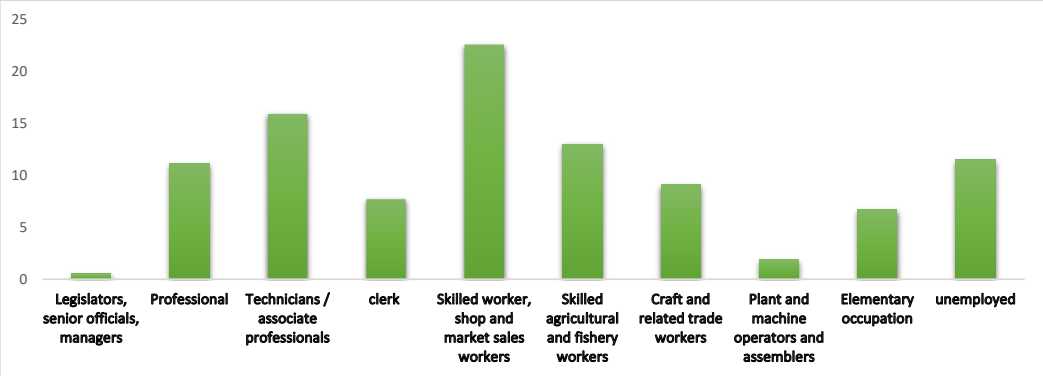

Figure 3. Distribution of study participants according to the employment status of the household head.

As depicted in Figure 3, 22.6% of the samples were skilled workers and shop and market sales workers, followed by technicians/associate professionals (15.9%), skilled agriculture and fisheries workers (13%), and professionals (11.1%). Although 11.5% of the population is unemployed, this number does not cover all of them; it also includes retired people who were not employed during the study period. 9.1% were in craft and related trade workers, 7.7% were in clerical occupations, and 6.7% were in elementary occupations. Only 1.9% who worked as plant and machine operators and assemblers. Only 0.5% of the samples were legislators, senior officials, and managers.

4.1.4. Income of the households

The details of the monthly family income of households were presented in Figure 4.

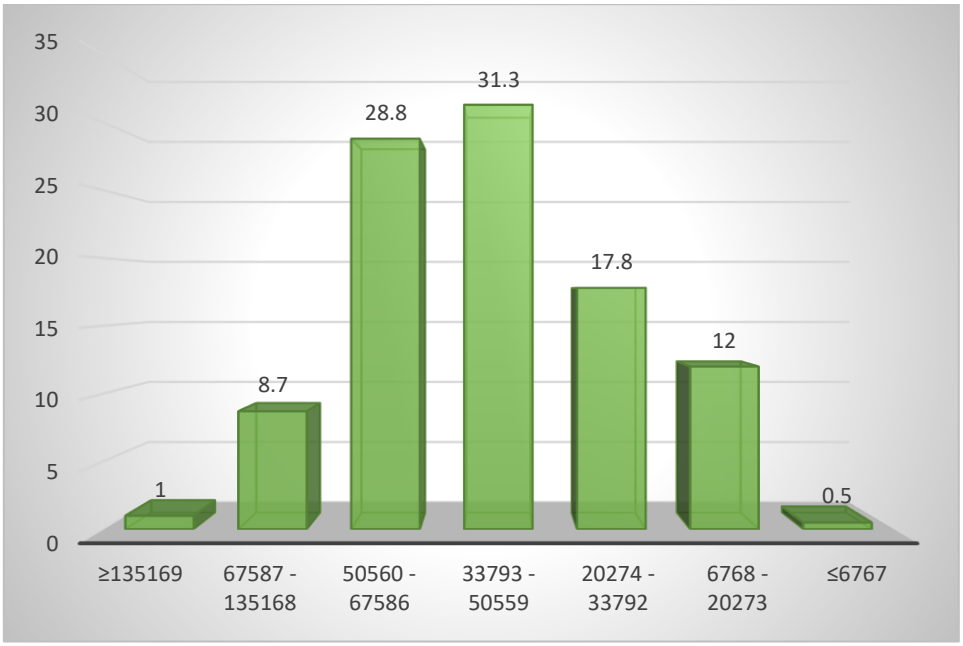

Figure 4. Details of the monthly family income

Figure 4, showed the class of monthly family income of the households. The present study showed that 31.3% of the population belongs to an income class of 33793 and 50559 rupees per month, followed by those who had income between 50560 and 67586 rupees (28.8%) and those who earn between 20274 and 33792 rupees (17.8%). Only 0.5% of people made less than 6767 rupees per month, while 12% made between 6768 and 20273 rupees. Hence as per the present study, the majority of the population falls into the middle-class and lower-middle-class categories. Only 1% of the population earned 135169 rupees or more, while a lesser percentage (8.7%) falls between 67587 and 135168 rupees. The bigger the share of the middle-class group, the risk of battling to obtain financial security were more. These people would become even poorer as a result of the financial difficulties brought on by NCDs.

4.1.5. Socio-economic classification

The socio-economic classification of the study population were presented in Table 3.

Table 3. Socio-economic classification of households

S.N	Socio-economic class	Percentage (%)
1	Upper class	2.4
2	Upper middle class	44.2
3	Lower middle class	37.5
4	Upper lower class	13.9
5	Lower class	1.9

Considering the socio-economic class, as shown in Table 3. The study population were categorised according to their level of education, income, and occupation. With 44.2% of the population, the upper middle class is the largest category, followed by the lower middle class (37.5%) and the upper lower class (13.9%). Only 2.4% of people belong to the upper class, which is the group at the top of the socio-economic hierarchy, their income is high, and they are financially secure; in contrast, 1.9% of people belong to the poorer class. They mostly consist of low-income individuals who have not saved for the future, as well as those who lack education and employment.

4.2. Assessment of NCD patients

The present study, the NCD patients were analysed based on the type of NCD they have, treatment, preference of healthcare facility, and medication adherence pattern.

Table 4. Prevalence of non-communicable diseases

S.N	Type of NCD	Percentage (%)
1.	Diabetes	61.1
2.	Cardiovascular diseases	78.4
3.	Respiratory disorder	5.8
4.	Cancer	2.4
5.	Chronic kidney disease	2.9

In the study population most common NCD's were cardiovascular diseases (78.4%) and diabetes (61.1%). This is followed by respiratory disorders (5.8%) chronic kidney diseases (2.9%) and cancer (2.4%). Together, hypertension, high cholesterol, coronary artery diseases, and stroke account for 78.4% of the prevalence of cardiovascular diseases. Obesity/overweight and elevated cholesterol and blood glucose levels are closely associated with CVDs.

With an estimated 17.9 million deaths annually, CVDs are the world's largest cause of death. Heart attacks and strokes account for more than four out of five deaths from CVD, with one-third of these deaths occurring in individuals under the age of 70 (WHO 2021).

Diabetes is the second most prevalent condition (61.1%). In addition to have a high blood glucose level, a primary cause of chronic renal disorders, which over time seriously harm the heart, blood vessels, eyes, and nerves.

Review studies have shown that 20% to 40% of diabetics develop diabetic kidney disease, a dangerous consequence characterized by decreased glomerular filtration rate (GFR), increased excretion of urine albumin, or both (Gheith *et al*., 2015). Diabetes affects 830 million people globally, most of whom reside in low- and middle-income nations. In India, an estimated 77 million adults have diabetes, while another 25 million people are in the prediabetic stage. Heart attacks and strokes are more common in adults with diabetes (WHO 2014).

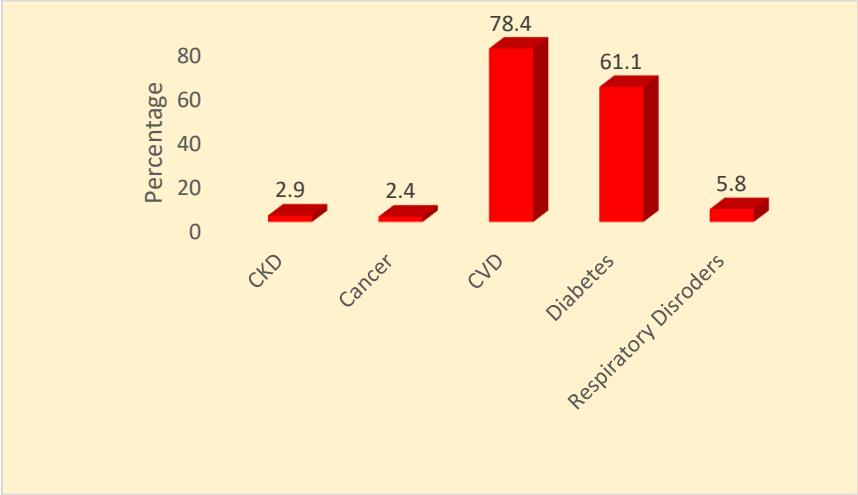

Figure 5. Prevalence of NCDs

4.3 Healthcare facility

The availability and use of health care facilities were assessed as follows.

4.3.1 Preferences of the healthcare facility

The preferences of the healthcare facility by the participants were presented in Figure6.

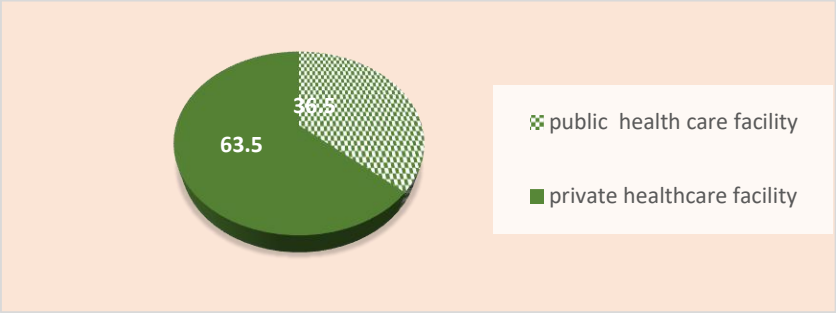

Figure 6. Distribution of healthcare facility preferences among study participants.

As per Figure 6, a major portion of the population (63.5%) uses private healthcare facilities, whereas only 36.5% use public healthcare facilities. Health care facility preferences will vary based on socio-economic status and disease condition. A private healthcare institution is preferred because of its higher service quality, more individualized care, and comprehensive bundle of services. Private health facilities are used by many participants for major surgical procedures or treatment of conditions similar to chronic kidney disease and cancer. Following these treatments, some individuals would go back to public health facilities for further examinations and follow up care. Among the study population, 94.2% are presently undergoing treatment, 73.1% have been receiving treatment for more than two years, and 29.8% require monthly visits to these facilities.

A study conducted by Garg in Chhattisgarh (2024), showed that, Medical Colleges have the highest OOPE among public facilities, followed by district hospitals. Public facilities at the primary level have the lowest OOPE. Compared to public facilities, the formal-private providers average OOPE was around four times higher; the average OOPE of informal private providers was higher than that of primary-level public facilities like Primary Health Centers (PHCs) and Sub Health Centers (SHCs). It was also found that each patient with an NCD in public sector facilities had an average monthly care cost of INR 688.

4.3.2 Adherence in medication

The adherence pattern on medication by the samples were presented in Table 5.

Table 5. Adherence pattern on medication

S.N	Medication intake pattern	Percentage (%)
1.	During doctor's appointment	3.8
2.	Regularly	84.1
3.	Only when symptoms appear	12

Considering the data given in Table 5, the majority of study participants (84.1%) took their medications on a regular basis, which suggested significant medication adherence, participant awareness, and the severity of their conditions. But 12% of the sample took medications only when some symptoms appeared. Also, 3.8% took medication after the appointment with doctor. This may indicate that they may not be well-informed on treatment maintenance or prevention of their NCD.

4.4 Economic status and NCDs

The details on economic expenses for NCDs were analysed as follows.

4.4.1 Assessment of financial burden upon NCDs

Financial burden would be influenced by socioeconomic background, healthcare facility utilization, and the type of NCD. Additionally, taking out loans, selling assets, and losing job would make financial problems worse. Depending on the type of NCD, there is a notable variation in the average monthly expenditure

Table 6. Methods for covering the cost of NCD treatment

S.N	Method of covering the cost	Percentage (%)
1.	Health insurance	14.9
2.	Government programs	37.0
3.	Out of pocket	37.5
4.	Loan facility	9.7

According to Table 6, the number of participants who pay out of pocket for NCD treatment was 37.5% and those who receive government assistance was 37.0%. The difference between paying for NCD's out of pocket and using government programs is minimal. The findings showed that government services are crucial to public health care and many people, regardless of socio-economic background, take advantage of them all. Due to factors like complexity, restricted availability, and lack of knowledge, just 14.9% of participants had health insurance. Furthermore, the burden of NCD-related costs on households was demonstrated by the fact that 9.7% of the population need loan facilities for treatment. The financial burden of diseases was closely correlated with their severity. Financial difficulties were reported by 54.8% of people, and 35.6% of them borrow money or sell assets to pay for NCDs. For 38.9% of the population, missing work days or hours results in a substantial loss of income. It is clear that NCDs cause financial difficulties for households, with socially disadvantaged population suffering the most.

The health expenditures associated with NCDs will differ by country, area, and type, and years spent with the illness are associated with higher expenses. (Muka T *et al*., 2015). Reports based on a study by Prinja *et al.,* (2022) indicated that India has a significantly greater percentage of out-of-pocket (OOP) spending on pharmaceuticals than other nations. Significant decreases were noted for clinics with only one doctor, particularly for ayurvedic (64.51-36.51%) and homeopathic (57.53-42.74%) practitioners. Due to several issues in the public sector, including the limited availability of essential drugs and diagnostics, patients may still have to pay out of pocket even if the Indian government provides supply-side financing to public facilities to cover their costs.

NCDs necessitate frequent treatment and hospitalizations in cases of high disease severity. The two primary methods for covering catastrophic medical expenses are borrowing and asset sales. Savings, income, borrowing, and asset sales were the most popular ways to finance distress financing for severe conditions (Rivya Dias, 2023).

4.4.2. Average Monthly Expenditure for NCDs

The average monthly expenditure for different NCDs by the samples based on its occurrence were depicted in Table 7

Table 7. Average Monthly Expenditure for different NCDs

NCD	Present/Absent	Average monthly expenditure	p value
CKD	Present	5500 (2525,11500)	**0.002**
	Absent	975 (300,2500)	
Cancer	Present	8000(4250,14000)	**0.001**
	Absent	1000 (300,2500)	
CVD	Present	1000 (350,2700)	0.069
	Absent	700 (292.5,1500)	
Diabetes	Present	1500 (500,3000)	**<0.001**
	Absent	500 (200,1550)	
Respiratory Disorders	Present	2250 (362.5,3600)	0.243
	Absent	1000 (312.5,2500)	

The average monthly expenditure of participants with NCDs was analysed in Table 7, and it was found that there were notable variations in spending patterns. Individuals diagnosed with a particular type of NCD were compared to a control group of people who did not have that specific disease, but might have another NCD. This approach allows for an accurate assessment of the additional financial burden associated with specific NCD in the study population.

A p-value of 0.002 indicated statistical significance, participants with CKD reported an average monthly spend of 5,500, which was significantly greater than those without CKD but had other NCDs, whose average expenditure was 975. With a statistically significant p-value of 0.001, those with cancer also bear a financial burden, spending an average of 8,000 rupees for those without the disease. A substantial difference in expenses was also shown by diabetes, spending an average of 1,500 rupees compared to 500 for those without diabetes (p-value < 0.001).

The average spending for those with CVD was 1,000, while the average spending for those without CVD was 700. This difference in spending, however, was not statistically significant. The difference was not significant in the case of respiratory disorders either; the average cost for participants with the condition was 2,250, whereas the average expenditure for those without the condition was 1,000, with a p-value of 0.243.

According to the present study, there were statistically significant changes in monthly expenses for CKD, cancer, and diabetes, but not for CVD or respiratory conditions.

The probability of impoverishment from cancer-related expenses was nearly 2.3 times higher, and household income losses after a CVD diagnosis were 26.3% (Loes Jaspers *et al.,* (2015)

Cancer inpatient treatment has the highest catastrophic costs of any NCD. Many cancer patients are forced to turn to distressed means to pay for their care due to inadequate health financing systems and a significant reliance on out-of-pocket medical expenses (Rajpal, S.,2014).

Compared to those without problems, diabetic patients with CKD before ESRD spend more money on hospital stays. Compared to other CKD patients, hemodialysis patients overall average cost was much greater. The average price for a kidney transplant was 392,920 rupees. Dialysis was substantially more expensive than transplantation in terms of the overall cost of hospital stays during a two-year period (Satyavani *et al*., 2014).

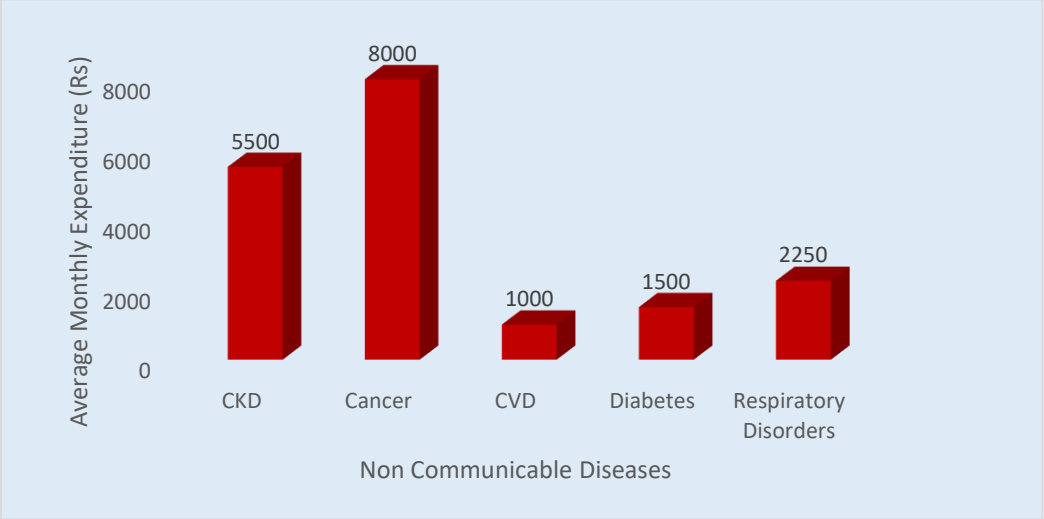

Figure 7. Average monthly expenditure of NCDs

Mann Whitney U test reveals that there is a statistically significant difference in the average monthly expenditure for CKD, Cancer and Diabetes.

4.4.3. Average monthly expenditure for NCDs between socio-economic classes

The average monthly expenditure on NCDs across different socio-economic classes is displayed in the Table 8.

Table 8. The average monthly expenditure on NCDs across socio-economic classes

S.No	Socio-economic class	Average monthly expenditure for NCD	p value
1.	Lower class	2250	**0.017**
2.	Lower middle class	800	
3.	Upper Lower class	500	
4.	Upper middle class	1500	
5.	Upper class	1600	

According to Table 8, the lower class reported the highest average monthly expenditure of ₹2250, this category is susceptible to financial stress and losses due to their limited resources and inability to cope with or adjust to the economic downturn. In contrast to the average spend by the upper class and upper middle class were 1600 rupees and 1500 respectively. The utilization of premium private services or severe chronic diseases may be the cause of their high average expenditure.

Nonetheless, the lower middle and upper lower classes had lower average spending (₹800 and ₹500, respectively), which may be due to lack of awareness or restricted access to services. Although the lower and upper classes had the smallest sample sizes (n = 4 and n = 5), they also ranked first in terms of spending. With a p-value of 0.017, the Kruskal-Wallis test indicated that there were statistically significant differences in average monthly expenditure for NCDs by each socioeconomic class.

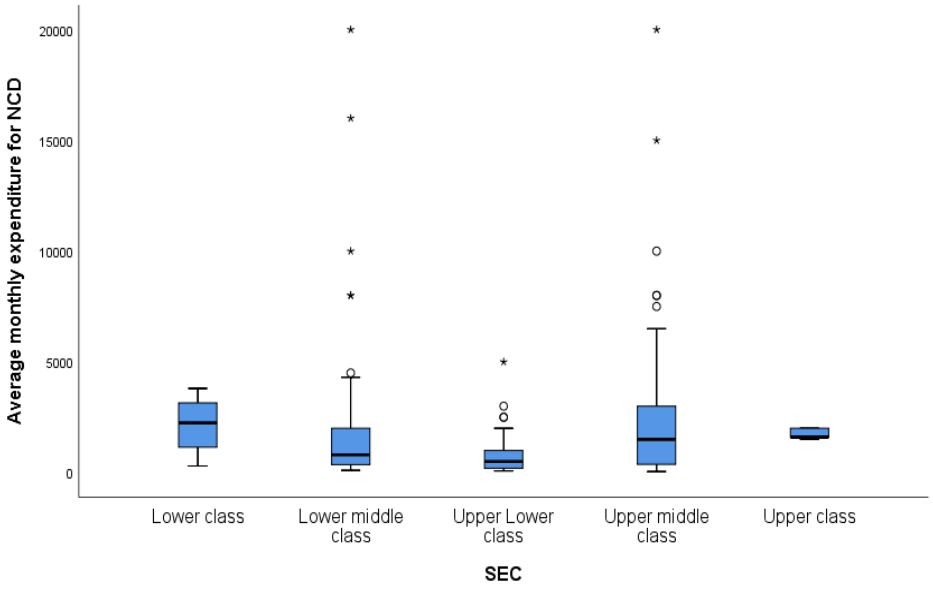

Figure 8. Average monthly expenditure for NCDs in relation with socio-economic classes

4.5. Assessment of risk factors

According to WHO (2024), the top 6 leading risk factors contributing to the global burden of NCDs, are reported as high blood pressure, tobacco use, increased blood glucose levels, physical inactivity, harmful consumption of alcohol and obesity/overweight. Most NCDs are caused by preventable and modifiable factors. WHO made a target to reduce NCDs by controlling behavioural risk factors (consumption of alcohol, tobacco, salt, and physical activity) and metabolic risk factors (obesity and blood pressure).

4.5.1. Family history of NCDs

The family of participants for NCDs were presented in Figure 9.

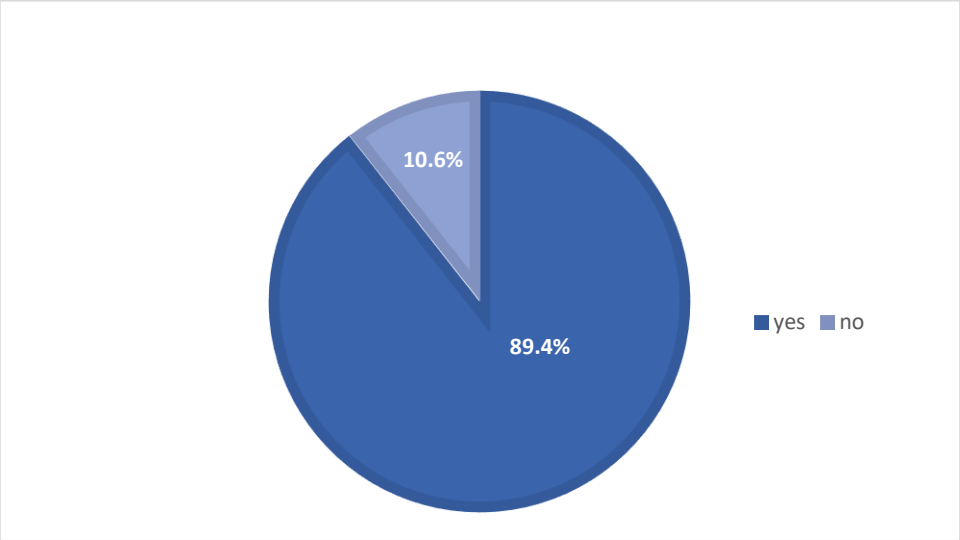

Figure 9. Family history of NCDs

From the results of the present study, 89.4% of people show a strong link with genetic factors, it is likely that genetic factors are a major contributor to the development of noncommunicable diseases (NCDs). An individual's genetic factors do not change over time, in contrast to behavioural risk factors; genetic factors can help prevent and detect NCDs early.

The status of parents and siblings family medical histories and NCDs was substantially correlated. Respondents who have at least one first-degree relative with a medical history have a significantly increased chance of developing NCDs. In fact, one of the main risk factors for chronic disease among older persons in India was the medical history of first-degree relatives. This study backs the use of a disease history tool as a useful indicator of NCD risk for chronic disease prevention and early detection strategies (Bramhankar *et al*.,2025).

4.5.2. Body mass index (BMI)

Adults' BMI is a measure used to assess their nutritional status. The study participants BMI-based classification was shown in the Table 9.

Table 9. BMI of study participants

S.N.	BMI (kg/m2).	Percentage (%)
1.	Underweight	15.9
2.	Normal	39.4
3.	Overweight	27.4
4.	Obesity class I	13.0
5.	Obesity class II	4.3

Considering the data, 39.4%, have body weight in proportion to their height and fall within the recommended BMI range of 18.5–24.9 kg/m². Overweight, which makes up 27.4% of the population, was defined as having a BMI above the normal range, that is 25 to 29.9 kg/m², which is not regarded as obesity. But 15.9% of the population falls into the underweight category (< 18.5 kg/m²) of low weight for age. Additionally, 13% and 4.3% of individuals, respectively, belong to obesity class I (30 and 34.9 kg/m2) and II (35 and 39.9 kg/m2). Obesity class I carries a moderate risk, whereas class II carries a severe/extreme risk. None of the subjects fall into the morbid obesity group, which is defined as obesity class III with a BMI of 40 kg/m² or higher.

Obesity and overweight are major metabolic risk factors that might hasten the onset of NCDs. The National Family Health Survey for 2019–2021 found that the prevalence of overweight and obesity in the country is 24% among women aged 15–49 and 22.9% among males. The prevalence of overweight/obesity increased by over six percentage points for males and nearly ten percentage points for women between 2017–2018 and 2022–2023. Overweight and obesity were found to be significantly more common in women than in males (Rai *et al*., 2025).

4.5.3. Fasting Blood Glucose Level

The fasting blood glucose levels of participants were presented in Table 10.

Table 10. Fasting blood glucose levels

S.N.	Fasting blood glucose level	Percentage (%)
1.	70-100 mg/dl	21.6
2.	100-125 mg/dl	21.2
3.	>125 mg/dl	57.2

Out of the 208 participants, 7 had no medical records, and 201 of them had records of their FBG levels. Considering the data, 21.6% of the study participants had normal fasting blood glucose levels (70–100 mg/dl), while 21.2% were in the prediabetes stage (100–125 mg/dl), which is an intermediate stage of hyperglycemia with glycemic parameters above normal. One is still at risk of developing diabetes if they have prediabetes. A number of detrimental health consequences have been linked to prediabetes (Bansal, 2015).

4.5.4. Blood pressure readings

Tables 11 and 12 display the blood pressure readings.

Table 11. Systolic blood pressure

S.N.	Systolic blood pressure categories	Percentage (%)
1.	Normal (<120 mmHg)	10.9
2.	Elevated (120-129 mmHg)	24.4
3.	Hypertension stage I (130-139 mmHg)	18.7
4.	Hypertension stage II (>140 mmHg)	35.2
5.	Hypertensive crisis (>180 mmHg)	10.9

Table 12. Diastolic blood pressure

S.N.	Systolic blood pressure categories	Percentage (%)
1.	Normal (< 80 mmHg)	36.8
2.	Elevated (< 80 mmHg)	36.8
3.	Hypertension stage I (80-89 mmHg)	13.0
4.	Hypertension stage II (>90 mmHg)	39.4
5.	Hypertensive crisis (>120 mmHg)	10.9

Tables 11 and 12 display the blood pressure readings of the participants. Among the participants, 15 lacked blood pressure data, and 193 participants blood pressure data were analysed. Only 10.9% and 36.8% of the participants had normal systolic and diastolic blood pressure, respectively, and 24.4% and 36.8% of the participants in the study had elevated systolic and diastolic blood pressure, respectively. Also, 64.8% of participants were in the hypertensive range for systolic pressure, including Stage I, Stage II, and hypertensive crisis, whereas 63.3 % of participants showed elevated diastolic pressure among the same categories. Appropriate therapies would assist 18.7% of participants with systolic blood pressure and 13% with diastolic blood pressure in the stage I hypertension category. People with stage II hypertension, which included 35.2% of those with systolic blood pressure and 39.4% of those with diastolic blood pressure, required clinical care and management to avoid problems or lessen their effects. Both systolic and diastolic readings showed that 10.9% of individuals were in the hypertensive crisis group, a crucial stage that calls for immediate medical attention and therapy.

Severe heart damage can result from hypertension. High blood pressure not only causes hardening of arteries, which decreases the flow of blood and oxygen to the heart. It can also burst or clog arteries that supply blood and oxygen to the brain, increasing the risk of stroke. Moreover, renal failure may arise from hypertension-induced kidney injury (WHO 2023).

4.5.5. Lipid profile

Table 13 includes key indicators such as total cholesterol (TC), HDL (high-density lipoprotein), and LDL (low-density lipoprotein) which shows the distribution of lipid profile of the participants.

Table 13. Lipid profile

S. N.	Category	Range (mg/dl)	Percentage (%)
1.	LDL	<100	7.7
		>/=100	51.9
2.	HDL	>/=40	26.4
		<40	33.2
3.	TC	<200	37.5
		>/=200	54.8

The majority of participants (51.9%) had elevated LDL cholesterol, also known as "bad cholesterol," at levels of 100 mg/dL or above. Elevated LDL levels may cause atherosclerosis, coronary artery disease, and cerebral vascular disorders. These complications can be reduced with early care. Only 7.7% of individuals fall into the reduced risk category, which denotes that their LDL levels were less than 100 mg/dL.

On the other hand, HDL cholesterol, also referred to as the "good cholesterol," aids in the removal of excess cholesterol from the body. Here, 33.2% of individuals had low HDL levels

(less than 40 mg/dL), which increases the risk of cardiovascular illnesses. Furthermore, only 26.4% of people have HDL levels that are within the ideal range of 40 mg/dL or higher; higher HDL levels are linked to a lower risk of coronary heart disease. According to this study, a considerable percentage had higher LDL levels than HDL levels, which required the implementation of suitable therapies. LDL, HDL, and other lipid components make up total cholesterol (TC), and 54.8% of individuals had high TC readings (>/= 200 mg/dL), which also suggested a possible risk of a number of illnesses, particularly cardiovascular disorders. Just 37.5% of individuals had levels below 200 mg/dL, which was the ideal range.

Cardiovascular illness, particularly atherosclerotic cardiovascular disease, is associated with an increased incidence of dyslipidaemia (Qin *et al*., 2023). Patients with hyperlipidemia have a nearly two-fold increased chance of developing CVD (Yao *et al.*, 2020). Of the heart patients, nearly 75% had at least one dyslipidemia. Lipids have a major role in the development and progression of atherosclerosis, which can lead to clinical consequences such as myocardial infarction, heart failure, stroke, and kidney failure. Each person and place has a different prevalence of dyslipidaemia, which is significantly influenced by age, disease, environment, nutrition, and lifestyle (Addisu *et al*.,2023).

4.5.6. Behavioural risk factors

Modifiable risk factors are behavioural factors. Tobacco use is a major risk factor for the emergence of conditions like diabetes, cancer, chronic respiratory disorders, and cardiovascular disease. Alcohol consumption has a strong relation to NCDs such as diabetes, pancreatitis, liver disease, cardiovascular disease, and cancer. NCDs can be prevented and treated with a healthy diet and regular exercise. NCDs are mostly caused by unhealthy diets and the malnutrition that results. Diseases due to behavioral risk factors will add additional financial burden to family.

Tobacco use patterns among the study population are shown in Table 14.

Table 14. Prevalence of use of tobacco products

S. N.	Tobacco usage		Percentage (%)
1.	Former tobacco users		19.7
2.	Current tobacco users		6.7
3.	Frequency of use	Daily	5.3
		Weekly	0.5
		Rarely	1.0

Among all study participants, 19.7% had used tobacco in the past but were not used at the time of study. Also, 6.7% of the participants currently use tobacco, with frequency ranges of daily (5.3%), weekly (0.5%), or rarely (1%).

The tobacco epidemic is one of the biggest public health threats the world has ever faced, killing almost 8 million people annually. One tobacco-related death occurs every four seconds, and up to half of current users will eventually die from a tobacco-related disease.

Additionally, second-hand smoke exposure has been linked to negative health consequences and is responsible for 1.2 million fatalities globally each year. Approximately 1.3 billion individuals use tobacco products globally, with 80% of those users living in low- and middle-income nations. By taking household funds away from necessities like food and housing, tobacco smoking exacerbates poverty. Given how addicting tobacco is, it is challenging to stop this spending pattern, it causes the productive-age individuals in homes to die young and become disabled, which lowers household income and raises healthcare expenses (WHO 2025).

4.5.7. Prevalence of alcohol consumption

The frequency and prevalence of alcohol usage in the study population were shown in Table 15.

Table 15. Prevalence of alcohol consumption

S.N.	Alcohol usage		Percentage (%)
1.	Current alcohol users		30.3
2.	Frequency of use	Daily	2.4
		Weekly	9.1
		Rarely	18.8
		Never	69.7

Among the studied population, alcohol use was 30.3% prevalent, with a higher proportion of men than women. The prevalence of people who never drink was discovered to be 69.7%, among those who do drink, there are wide variations in frequency. 2.4% of participants drink alcohol daily; this is a smaller percentage but still shows alcohol dependence. On a weekly basis, 9.1% of individuals drink, followed by the larger group of rarely drinkers (18.8%).

Across the Globe, 4.8% disease and injury burden can be attributed to alcohol use. More than 10% of the world's NCD burden is thought to be caused by alcohol use, including pancreatitis, liver cirrhosis, oesophageal, liver, colorectal, laryngeal, and oral and pharyngeal malignancies, haemorrhagic stroke, and hypertension (WHO 2025).

4.5.8. Physical activity

The physical activity patterns of participants were presented in Table 16.

Table 16. Physical activity

S.N.	Physical activity status		No. of participants	Percentage (%)
1.	Those who exercise regularly		70	33.7
2.	Those who have difficulties that prevents them from physical activities	Always	24	11.5
		Sometimes	48	23.1
		Rarely	30	14.4
		Never	106	51.0

As presented in Table 16, 33.7% of participants do exercise on a regular basis. A sizable proportion of participants (51%) reported no difficulties with physical discomfort, which included both problems during exercise and difficulties that interfere with daily activities or work-related tasks. Nevertheless, 23.1% and 14.4% of the population experience difficulty occasionally and rarely, respectively, while 11.5% of individuals always have physical difficulties, showing their health issues and limitations. A greater percentage of the population (65.9%) in this survey were physically inactive. The most preferred form of exercise among participants was walking, and maintaining a regular exercise routine is greatly impacted by the accessibility of exercise facilities and locations.

Physical inactivity increases the risk of NCDs and other detrimental health outcomes, while physical activity enhances health and well-being. Physical inactivity and sedentary lifestyles are contributing to the rise of NCDs and the strain on healthcare systems. A recent study found that 1.8 billion adults globally are physically inactive, accounting for more than one-third (31%) of the world's population. They don't meet the global standard of 150 minutes or more of moderate-intensity exercise each week (WHO 2024).

4.6. Assessment of food habits

Food habits highly influence the occurrence of NCDs. Hence it is important to know the basic food habits of participants.

4.6.1. Basic dietary pattern

Table 17, showed the dietary pattern of the study participants.

Table 17. Basic dietary pattern

S.N	Dietary pattern		Percentage (%)
1.	Type of diet	Vegetarian	6.3
		Non-vegetarian	91.3
		Gluten free	0.5
		Lacto-ovo-vegetarian	1.9
2.	Those who modified diet after being diagnosed with NCD	Modified	73.1
		Not modified	26.9

As per the information from participants a substantial percentage of participants (91.3%) followed a non-vegetarian diet that includes fish and other seafood as staple foods because the area is coastal and has an abundance of seafood. The percentage of participants that follow vegetarian diet is as low as 6.3%. Furthermore, just 1.9% and 0.5% of the population, respectively, were lacto-ovo-vegetarian diet and gluten-free diet. After being diagnosed with NCD, majority of the population (73.1%) modified their diet. It demonstrates a favourable response; adjusting diet based on individual requirements has a stronger impact on disease management, whereas 26.9% did not make any dietary changes. However, it was not a negligible percentage; maintaining an unhealthy diet is a controllable issue, and with good nutrition information and support, the gap may be closed. Another major problem was that 51% of the population does not have a regular eating habit, whereas 49% does. Those with irregular eating habits are slightly more likely, which could be related to busy lifestyles, a lack of meal preparation, limited access to food, eating disorders, avoidance, or stress. Diet preference varies based on food availability, traditions and beliefs, nutritional awareness, health issues, purchasing capacity, and mental level.

An improper diet is responsible for 14% of all deaths worldwide, including roughly one-third of CVD and diabetes deaths and one-tenth of cancer deaths. Dietary risk is associated with a high intake of sodium, red/processed meat, trans fat, and sugar-sweetened beverages, as well as a poor intake of whole grains, legumes, fruits, fiber, nuts and seeds, vegetables, mono/polyunsaturated fats, seafood, and omega-3 fatty acids (Branca *et al.,* 2023).

4.6.2. Prevalence of outside food consumption

The habit of food consumption from outside by the participants are presented in Table 18.

Table 18. Prevalence of outside food consumption

S.N.	Outside meal consumption pattern		Percentage (%)
1.	Habit of food consumption from outside		43.8
2.	Types of food consumed	Fast food	20.7
		Street food	10.1
		Carbonated drinks	0.5
		Others	13

3.	Frequency	Daily	5.3
		Weekly	4.8
		Once in 2-3 weeks	18.8
		Rarely	71.1

Among the participants, 43.8% reported eating meals from outside. Fast food was consumed by 20.7% of these, followed by street food by 10.1%; carbonated drinks were consumed by only 0.5% of the population, and other meal types were consumed by 13%. Among the population, 5.3% eat food from outside every day, 4.8% weekly, 18.8% eat it once every two to three weeks, and a major proportion of 71.1% eat it rarely.

4.6.3. Food frequency distribution

The frequency pattern of participants were given in Table 19.

Table 19. Distribution of participants based on food frequency

S.N.	Food groups	Frequency	Percentage %
1.	Cereals and millets	Weekly	1.0
		Daily	99
2.	Pulses and legumes	Monthly	2.9
		Weekly	97.1
3.	Vegetables	Weekly	15.4
		Daily	84.6
4.	Fruits	Rarely	5.3
		Monthly	21.2
		Weekly	71.2
		Daily	2.4
5.	Nuts and oil seeds	Rarely	65.9
		Monthly	24.5
		Weekly	9.1
		Daily	0.5

6.	Milk and milk products	Rarely	2.4
		Monthly	3.4
		Weekly	29.8
		Daily	64.4
7.	Animal products	Rarely	6.3
		Monthly	6.3
		Weekly	77.9
		Daily	9.6
8.	Sugars	Rarely	18.3
		Monthly	12.0
		Weekly	7.7
		Daily	62.0

The food frequency scores and distribution are given in Table 19 according to different food groups.

Cereals and millets

The frequency of food consumption for cereals and millets were depicted in Figure 10.

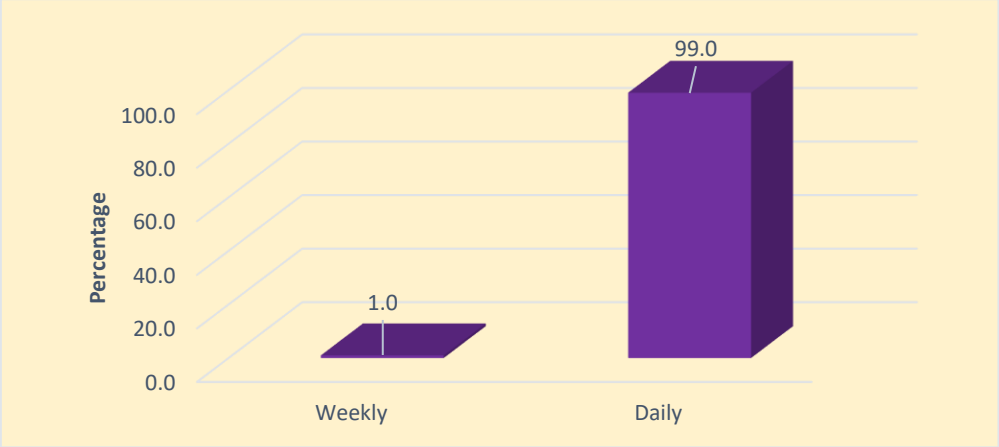

Figure 10. Frequency of intake of cereals and millets

In addition to being a significant source of energy, cereals are also a rich source of fiber and carbohydrates. Millets are a class of small-seeded grains that are high in fiber, proteins, vitamins, and minerals. In the cereals and millets category, the majority of participants received a score of 4, indicating adequate intake on a daily basis, whereas only 1% received a score of 3 with a frequency of weekly intake.

Pulses and legumes

The frequency of food consumption pattern for pulses and legumes were shown in Figure 11.

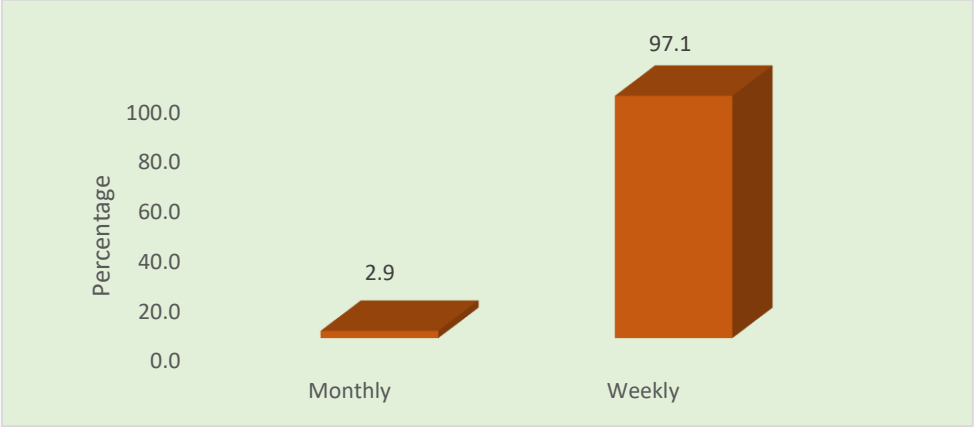

Figure 11. Frequency of consumption of pulses and legumes

The primary protein source for vegetarian diets is pulses and legumes. According to the results, the majority of population (97.1%) consume pulses and legumes weekly, of 3, while only 2.9% of population consumed them monthly, which indicates a small proportion with lower intake.

Vegetables

The frequency of food consumption for vegetables is shown in Figure 12.

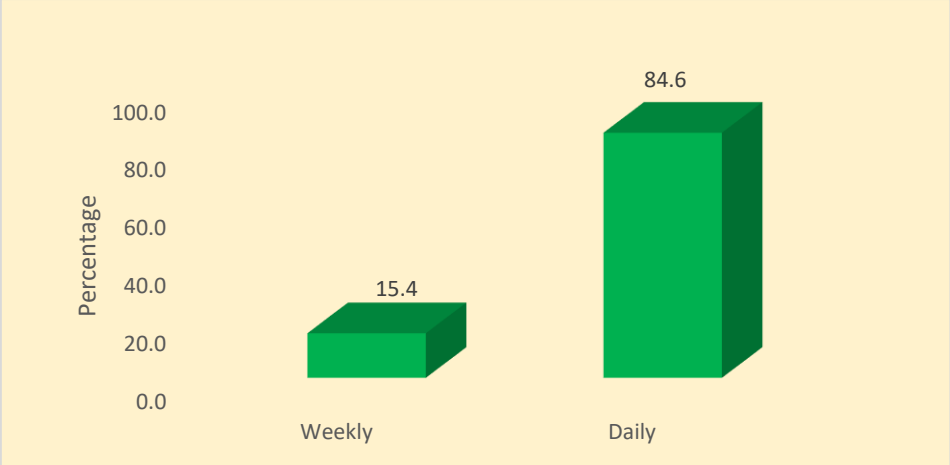

Figure 11. Frequency of consumption of pulses and legumes

The broad category of plant foods known as vegetables, is high in vitamins and minerals and varies widely in energy content. As per this study, 15.4% consumed weekly while 84.6% on a daily basis. The majority of individuals regularly consume vegetables, which provide dietary fibre, and are associated with a lower risk of obesity and cardiovascular disease.

Fruits

The frequency of food consumption patterns for fruits was presented in Figure 13

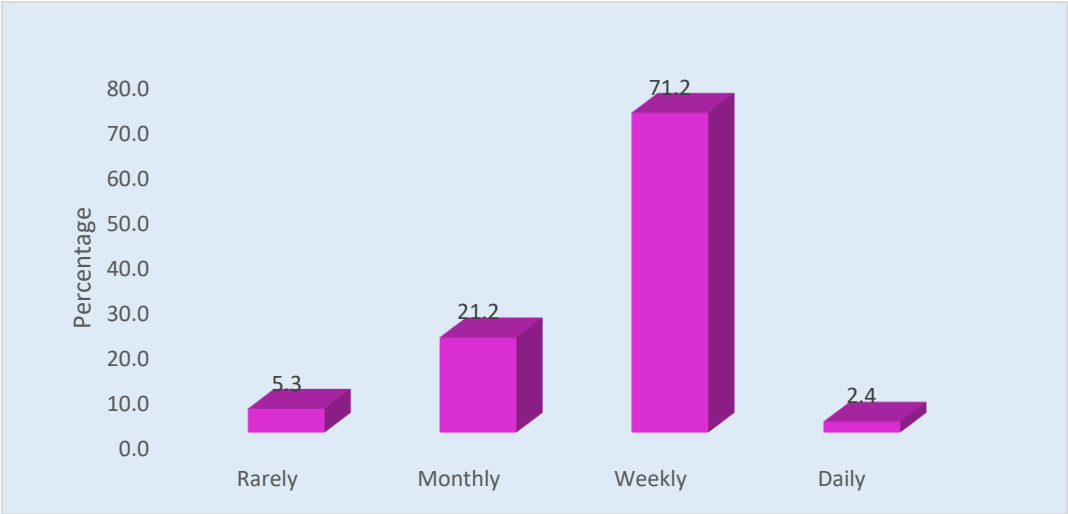

Figure 13. Frequency of consumption of fruits

Essential vitamins, minerals, antioxidants, and fiber are abundant in fruits, their frequency of consumption varies in the present study. Only 2.4% of the population daily ate fruits, so very small proportion consumes fruits at an optimal level, whereas 71.2% of the population consumed it on weekly basis. Also, 21.2% reported eating fruits on a monthly basis,

and 5.3% consumed it rarely. These fluctuations would be caused by affordability, a lack of nutritional awareness, avoidance, or health issues.

Nuts and oil seeds

The frequency of food consumption pattern for nuts and oil seeds were presented in Figure 14.

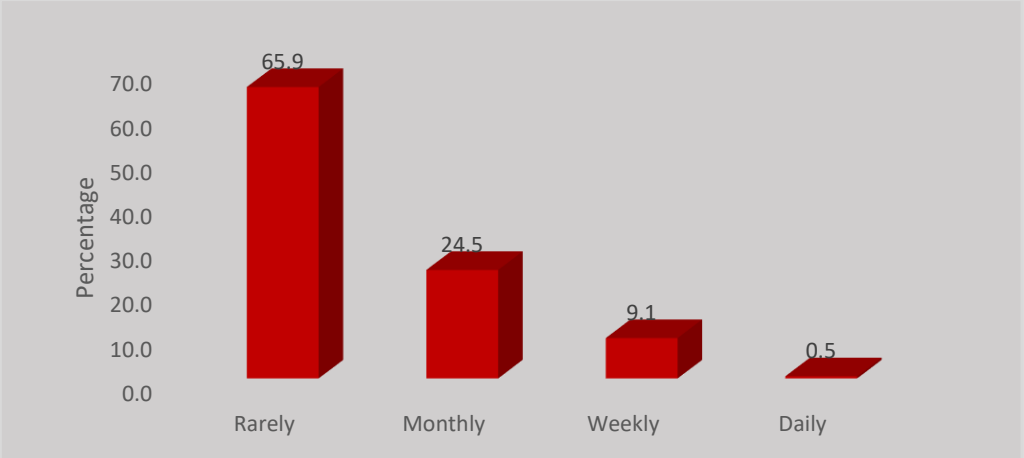

Figure 14. Frequency of consumption of nuts and oil seeds

Nuts and oil seeds are rich in healthy fats, proteins, fiber, vitamins, minerals, and antioxidants; these components contribute to enhanced heart health, better metabolic function, and lower rate of inflammation. Regretfully, a greater percentage of the study population (65.9%) consumed them rarely, followed by 24.5% on monthly basis and 9.1% on weekly basis. Only 0.5% of population eat nuts and oil seeds on a daily basis; this low consumption may be caused by dietary preferences, allergies, and poor affordability.

Milk and milk products

This category included milk and its products like curd, paneer, butter, and ghee. The food frequency for the same is given in Figure 15.

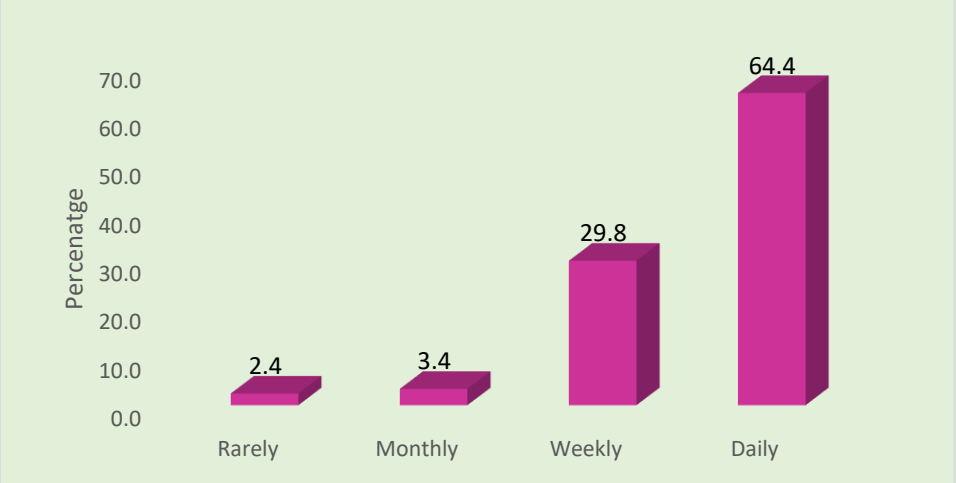

Figure 15. Frequency of consumption of milk and milk products

A daily consumption pattern was reported among 64.4% of the population, whereas 29.8% consume weekly, with milk and curd being the most preferred. Only a small proportion of population of 3.4% scored 2 and 2.4% scored 1 which indicates a limited consumption.

Animal products

The frequency of food consumption pattern for animal products is given in Figure 16.

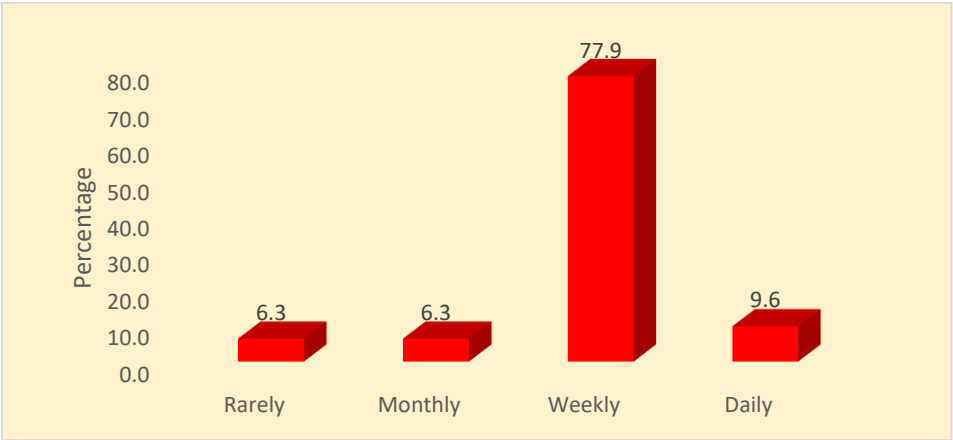

Figure 16. Frequency of consumption of animal products

A smaller proportion of 9.6% of the population consumed them daily, reflecting higher intake, whereas 77.9% of the population consumed them weekly. While 6.3% of the population consumed it monthly and 6.3% consume rarely. Consumption of animal products regularly would have beneficial effects but also it predisposes to certain health risk factors like heart diseases, cancers, obesity.

Sugars

The frequency of consumption pattern for sugar is given in Figure 17.

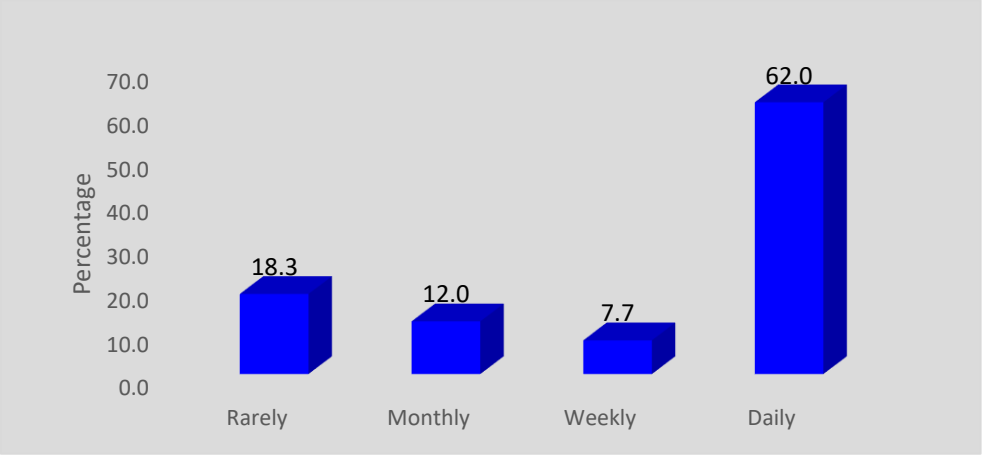

Figure 17. Frequency of consumption of sugar

Among the participants, 62% of the population consume sugar on a daily basis, whereas 18.3% consume it rarely, 12% of the population consume it monthly, and 7.7% weekly.

Across the globe, there was an increase in obesity in both high-income and low-income countries, due to dietary sugar and fat and decreased physical activity. Noncommunicable diseases (NCDs) are the leading cause of death. We continue to deal with the problem of a rapid upsurge in NCD risk factors such as obesity and overweight, particularly in urban settings. Obesity rates among children are rising faster than obesity rates in adults. The risk of cardiovascular disease mortality increases once added sugar intake surpasses 15% of daily calories. Fructose, which is metabolized in the liver, seems to have unique adverse effects in the pathogenesis of metabolic syndrome. The sugar-sweetened beverages are a marker of an unhealthy lifestyle and their drinkers consume more calories, exercise less, smoke more, and have a poor dietary pattern. There is a need to educate the population about the health hazards associated with sugar consumption (Mojto *et al.,* 2023). Similar results were observed in the present study also as 62% of the study population consume sugar on a daily basis which may elevate the condition of existing NDCs.

5. SUMMARY AND CONCLUSION

Non-communicable diseases (NCDs) are chronic diseases characterized by permanent impairment and non-reversible pathology, necessitating patient rehabilitation training and care. The prevalence of NCDs was increasing as life expectancy rises, urbanization accelerates, and sedentary lifestyles proliferate. It affects not just the patient, but also the entire family, resulting in physical, emotional, and financial suffering. Globally, NCDs have grown to represent a serious threat to health.

The objective of this present study was to assess the prevalence of NCDs, food habits, and the financial burden of NCDs on households in the Ernakulam district. Rapid expansion, combined with easy access to a range of food types and enhanced medical services, had downsides, including a lack of physical activity and unhealthy eating habits, which can exacerbate NCDs.

The current study found a prevalence of 36.1% and 63.9% among males and females, respectively. Socio-economic status and NCDs development and management were found to be strongly correlated. Also, 69.2% of the population was found to be educated and a larger proportion were semi-skilled workers who were stable in their occupations but lacked financial security. Lack of financial security will increase the risk of economic burden due to catastrophic spending on NCD's and the burden will depend upon the type of NCD.

Healthcare facility preferences vary according to socioeconomic status and illness condition, although the use of government services does not differ significantly across the study population. The most preferred healthcare facility was found to be private healthcare facilities (63.5%), while only 36.5% use public healthcare facilities. The findings showed that government services are crucial to public health care and that many people, regardless of socio-economic background, take advantage of them all. Financial difficulties were noted by 54.8% of respondents, with 35.6% borrowing money or selling assets to pay for NCDs. Also, 38.9% of the population had missed work days or hours, which means a significant loss of income. The lower class has the greatest average monthly expenditure of ₹2250, which makes them subject to financial stress and losses due to limited resources and difficulty reacting to economic downturns.

According to the present study, cancer has the highest average monthly expenditure (₹8000), followed by CKD (₹5500), respiratory illnesses (₹2250), diabetes (₹1500), and cardiovascular disease (₹1000). Monthly expenses for CKD, cancer, and diabetes have shown statistically significant changes.

All of these costs can be avoided up to a point with early diagnosis, prevention, and management. The majority of NCDs are caused by factors that can be prevented or modified. WHO set a goal of reducing NCDs by addressing behavioural risk factors (alcohol, tobacco, salt, unhealthy diet, and physical activity) and metabolic risk factors (obesity and blood pressure).

People of all ages, geographical locations, and nationalities are impacted by NCDs. Poor diets, sedentary lifestyles, exposure to tobacco smoke, hazardous alcohol consumption, and air pollution are risk factors for NCDs that can affect children, adults, and the elderly. Unhealthy eating patterns and sedentary lifestyles are associated with obesity, raised blood lipids, elevated blood pressure, and elevated blood glucose. These are referred to as metabolic risk factors (WHO 2024).

Genetic factors are non-modifiable risk factors; 89.4% of the population had a strong link to genetic factors, being obese or female are also factors that may accelerate the onset of NCDs. The study discovered that a larger population had higher fasting blood glucose, cholesterol, and blood pressure readings, indicating the severity and complexity of NCD's.

Of all study participants, 6.7% of the population currently use tobacco and 30.3% consume alcohol. Alcohol is strongly linked to NCDs, specifically cancer, cardiovascular disease, liver disease, pancreatitis, and diabetes. A higher percentage of the population (65.9%) in this study was physically inactive, and these trends were concerning; maintaining a regular exercise regimen was influenced by the availability of facilities and locations. Some individuals were interested in physical activities but could not do so regularly due to lack of time, accessibility, and environment.

The majority of the population (73.1%) changed their diet after being diagnosed with NCD. It showed a positive response; modifying diet according to personal needs has a greater influence on illness management.

In the assessment of the frequency pattern of food, the majority of the population (97.1%) reported weekly consumption of pulses and legumes, while cereals and millets

accounted for 99% of daily consumption. It has been demonstrated that the daily consumption of fruits and vegetables were 2.4% and 84.6%, respectively. Merely 0.5% of people consume nuts on a daily basis. A daily consumption pattern was found for 64.4% of the population in the milk and milk product category, 9.6% in the animal product category, and 62% in the sugar category. Consumption of nuts and oil seeds is lower than that of other categories, dietary preferences, allergies, and poor affordability may be reasons. In contrast, 43.8% of the population consumes food from outside, with 5.3% consuming outside food on a daily basis.

Reducing the risk factors for NCDs was the main goal, as treating the ill alone will not be enough to lower their prevalence and complications.

This study highlights the food habits and the economic burden of non-communicable diseases. Further research in this area will not only raise public awareness about the importance of diet as a modifiable risk factor, with proper nutrition-related strategies and physical activity, individuals and societies can mitigate the economic burden of NCDs, ultimately promoting better health outcomes and sustainable development.

Limitations of the study

The absence of participant medical records was one of the main limitations of this study, they have a primary condition, and they were unaware of the additional risk factors associated with it. And they have not even undergone the necessary tests.

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APPENDIX I

SURVEY QUESTIONNAIRE:

FOOD HABITS AND ECONOMIC IMPACT OF NON-COMMUNICABLE DISEASES IN SELECTED HOUSEHOLDS OF ERNAKULAM DISTRICT

GENERAL INFORMATION

1. Name of participant:
2. Sex:
3. Age:
4. Area of residence in Ernakulam:
5. Marital status: ☐ Single ☐ Married ☐ Divorced ☐ Widowed
6. Mail ID:

SOCIO-DEMOGRAPHIC PROFILE

Educational status assessment

7. Number of family members: _____
8. Are all of the members of your household literate? ☐ Yes ☐ No
9. Educational qualification of household head

Sl. No.	Educational status of head	Score
1.	Professional degree	7
2.	Graduate	6
3.	Intermediate/ diploma	5
4.	High school	4
5.	Middle school	3
6.	Primary school	2
7.	Illiterate	1

Score:

Employment status assessment

10. How many of the members in your household are employed? _____
11. Occupational status of household head:

Sl. No.	Employment status of head	Score
1.	Legislators, senior officials, managers	10
2.	Professional	9
3.	Technicians /associate professionals	8
4.	Clerk	7
5.	Skilled worker, shop and market sales workers	6
6.	Skilled agricultural and fishery workers	5
7.	Craft and related trade workers	4

8.	Plant and machine operators and assemblers	3
9.	Elementary occupation	2
10.	Unemployed	1

Score:

Economic status assessment

12. Monthly income of the family:

Sl. No.	Monthly family income in INR (June 2024)	Score
1.	≥135169	12
2.	67587 - 135168	10
3.	50560 - 67586	6
4.	33793 - 50559	4
5.	20274 - 33792	3
6.	6768 - 20273	2
7.	≤6767	1

Score:
Total score: S1+S2+S3

13. Socio-economic class:

Total score	Socio-economic class
26-29	Upper class
16-25	Upper middle class
11-15	Lower middle class
5-10	Upper lower class
<5	Lower class

ASSESSMENT OF NCD PATIENT

14. Number of members diagnosed with NCD: _____
15. Age of patients:

Patient 1: Patient 2: Patient 3:

16. Which of the following illnesses do you have?

☐ Diabetes ☐ Cardio vascular diseases

☐ Respiratory disorders ☐ Cancer ☐ Chronic kidney diseases

17. How were you diagnosed with your illness / diseases?

☐ Doctor's consultation ☐ Self – diagnosis

☐ Health screening ☐ Others

18. Are you currently receiving any treatment? ☐ Yes ☐ No

19. How long has the treatment been going on?
    - ☐ Less than 3 months
    - ☐ 3 – 12 months
    - ☐ 1 – 2 years
    - ☐ More than 2 years
    - ☐ Lifelong
    - ☐ Unknown / others

20. What is your preferred healthcare facility?
    - ☐ Public health facility
    - ☐ Private health facility

21. How often do you visit these medical facilities?
    - ☐ Weekly
    - ☐ Monthly
    - ☐ Every 2 – 3 months
    - ☐ Every 6 months
    - ☐ Yearly

22. How often do you have to undergo medical tests?
    - ☐ Weekly
    - ☐ Monthly
    - ☐ Every 2 – 3 months
    - ☐ Every 6 months
    - ☐ Yearly

23. How often do you have to buy your medications?
    - ☐ During doctor's appointment
    - ☐ Regularly
    - ☐ Only when symptoms appear

ASSESSMENT OF FINANCIAL BURDEN

24. Have you had any financial challenges because of your NCD treatment? ☐ Yes ☐ No

25. How do you cover the cost of your NCD care?
    - ☐ Health insurance
    - ☐ Government programs
    - ☐ Out of pocket
    - ☐ Loan facility

26. Did you borrow money or sell assets to fund your NCD-related expenses? ☐ Yes ☐ No

27. What is your average monthly expenditure for NCD treatment? _____

28. Did you reduce work hours or switch to part-time work for NCD-related care? ☐ Yes ☐ No

    a) If yes, how much of your monthly income have you lost as a result of working fewer hours or missing workdays? _____

ASSESSMENT OF RISK FACTORS

Biological risk factors:

29. Is there a family history of any particular NCD? ☐ Yes ☐ No

30. Height_____ cm Weight_____ kg BMI____ kg/m2

31. What was your fasting blood glucose level at your most recent checkup? _____ mg/dl

a) Do you take any drugs to control your blood sugar levels? (if applicable) ☐ Yes ☐ No

32. What was your most recent blood pressure reading? _____ mmHg

a) Do you take any drugs to control your blood pressure levels? (if applicable)
☐ Yes ☐ No

33. What was your most recent LDL reading? _____ mg/dl

34. What was your most recent HDL reading? _____ mg/dl

35. What was the most recent total cholesterol level you recorded? _____ mg/dl

Behavioural risk factors:

36. Have you used any tobacco products in the past? ☐ Yes ☐ No

37. Do you presently use any tobacco products? ☐ Yes ☐ No

a) How often do you smoke? ☐ Daily ☐ Weekly ☐ Rarely ☐ Never

38. Do you consume alcohol? ☐ Yes ☐ No

a) If yes, how often do you consume alcohol?
☐ Daily ☐ Weekly ☐ Rarely

39. How many hours a day do you usually sleep?

☐ Less than 5 hours ☐ 5 – 7 hours
☐ 7 – 8 hours ☐ More than 8 hours

40. Do you follow a regular exercise or physical activity schedule? ☐ Yes ☐ No

a) If yes, how often?
☐ Daily ☐ 3 - 4 times per week
☐ 1 - 2 times per week ☐ Weekly
☐ Rarely ☐ Never

b) Do you have any physical discomfort that prevents you from exercising effectively?
☐ Always ☐ Rarely
☐ Sometimes ☐ Never

c) What kind of exercises are you doing?
Walking / Jogging / Running / Cycling / Swimming /Strength training exercise / High intensity exercise / low impact exercises/ yoga

41. Do you follow any particular dietary pattern?
☐ Vegetarian ☐ Non – vegetarian
☐ Gluten free ☐ Lacto – ovo – vegetarian

42. Did you make any dietary modifications after being diagnosed with an NCD? ☐ Yes ☐ No

43. Do you have a regular eating routine? ☐ Yes ☐ No

44. Do you consume meals from outside? ☐ Yes ☐ No

a) If yes, what kinds of foods do you typically eat?
☐ Fast food ☐ Street food ☐ Carbonated drinks ☐ Others

b) How frequently do you eat out from home?
☐ Daily ☐ Once in 2 – 3 weeks
☐ Weekly ☐ Rarely

45. How often do you eat fruits?
☐ Daily ☐ About once a week
☐ Several times a week ☐ Rarely

46. How often do you eat vegetables?
☐ Daily ☐ About once a week
☐ Several times a week ☐ Rarely

47. What is your estimated daily intake of salt?
☐ ≤ 1000 mg ☐ 1000 – 1500 mg
☐ 1500 – 2000 mg ☐ ≥ 2000 mg

48. What kind of oil is most frequently used in your home to prepare meals?
☐ Vegetable oil ☐ Butter / Ghee
☐ Lard / Suet ☐ Margarine
☐ Others ☐ Don't know

49. Food frequency table

FOOD ITEM	DAILY	WEEKLY	MONTHLY	RARELY
Cereals and millets Ragi Rice Wheat Semolina Oats				
Grain legumes Bengal gram Green gram Dal Peas Black gram				
Vegetables Amaranth leaves Cabbage Drumstick leaves Cauliflower				

Bitter gourd Cucumber Beans Pumpkin Tomato Brinjal Ladies finger Snake gourd Beetroot Carrot Potato Tapioca Elephant yam Onion				
Fruits Apple Avocado Banana Dates Grapes Guava Jackfruit Mango Orange Papaya Pineapple Pomegranate Water melon				
Nuts and oil seeds Almond Cashew nut Ground nut Walnut				
Milk and milk products Milk Curd Paneer Butter Ghee				
Animal products Egg Chicken Beef Pork Fish Prawns				
Sugars Jaggery Sugar Honey				

APPENDIX II

ETHICAL CLEARANCE CERTIFICATE

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INSTITUTIONAL RESEARCH ETHICS COMMITTEE

Decision of the Institutional Research Ethics Committee

No: STCAU/ 111/25 **Dated: 04/02/2025**

Protocol Title	**Food Habits and Economic Burden of Non-Communicable Disesases**
Principal Investigator	**Ms.Shoyal P S** Student Masters in Clinical Nutrition and Dietectics St. Teresa's College (Autonomous), Ernakulam
Guide	**Dr. Samja Sabu** Assistant Professor Department of Clinical Nutrition and Dietectics St. Teresa's College (Autonomous), Ernakulam
Name and address of the Institution	St. Teresa's College (Autonomous) Park Avenue, Kochi 682011
Date of review	30/01/2025
Decision of the IEC • Approved • Pending revision • Rejected	Approved
Remarks	➢ Inform IREC immediately in case of any amendments to protocol, change of study procedure, site or investigator and premature termination of study with reasons. ➢ Final report to be submitted to IREC.

Dr: Shilpa Jose

Member Secretary

APPENDIX III

CERTIFICATE OF PLAGIARISM CHECK

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ERNAKULAM

Certificate of Plagiarism Check for Dissertation

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Name of Guide	Dr. Samja Sabu
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