EXPLORATORY STUDY ON FOOD PURCHASING BEHAVIOURS AMONGST ADULTS IN URBAN VADODARA

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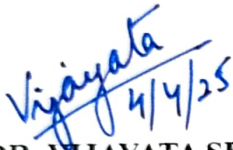**APRIL 2025**

BACHELOR OF SCIENCE

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EXPLORATORY STUDY ON FOOD PURCHASING BEHAVIOURS AMONGST ADULTS IN URBAN VADODARA

A dissertation submitted for partial fulfilment of the requirement of

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CERTIFICATE

This is to certify that the research work embodied in the thesis has been carried out independently by **Ms. Neha Upadhyay** in pursuit of a degree of Master of Science in Foods and Nutrition (Public Health and Nutrition) in Faculty of Family and Community Sciences under the guidance of Dr. Vijayata Sengar and represents her original work.

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LIST OF ABBREVIATIONS

BMI	Body Mass Index
BP	Blood Pressure
CDC	Centers for Disease Control and Prevention
CKDs	Chronic Kidney Diseases
COPDs	Chronic Obstructive Pulmonary Diseases
CVDs	Cardiovascular Diseases
DALYs	Disability-Adjusted Life Years
DBP	Diastolic Blood Pressure
DP	Dietary Pattern
FD&C	Food, Drug, and Cosmetic Act
FE	Food Environment
FFQ	Food Frequency Questionnaire
FFR	Fast Food Restaurant
FOPL	Front-of-Pack Labeling
FSSAI	The Food Safety and Standards Authority of India
GBD	Global Burden of Disease
HDDS	Household Dietary Diversity Score
HFSS	High in Fat, Sugar and Salt
HTN	Hypertension
IGT	Impaired Glucose Tolerance
LMICs	Low-and Middle-Income Countries
NAFLD	Non-alcoholic Fatty Liver Disease
NCDs	Non-Communicable Diseases
NFHS	National Family Health Survey
OOH	Out-of-home
PAHO	Pan American Health Organization
PFs	Processed Foods

PPFs	Packaged Processed Foods
RCTs	Randomized Control Trials
RTE	Ready-To-Eat
SAGE	Study on AGEing and Adult Health
SBP	Systolic Blood Pressure
SEP	Socio-Economic Positions
SES	Socio-Economic Status
SRS	Sample Registration System
SSBs	Sugar Sweetened Beverages
T2DM	Type-2 Diabetes Mellitus
TFAs	Trans Fatty Acids
UPFs	Ultra-Processed Foods
WCRF	World Cancer Research Fund
WHO	World Health Organization
WHR	Waist Hip Ratio
WHtR	Waist Height Ratio
WTP	Willingness to Pay

ABSTRACT

In the fast-paced world where everything is busier, individuals adopt unhealthy eating habits to save time. These unhealthy dietary practices are the leading cause of obesity and other non-communicable diseases. The present study was carried out to bridge the observed gap and evaluate the food purchasing behaviours of adults.

A cross-sectional study was conducted in four administrative wards of Vadodara, with 400 participants selected through snowball sampling. Data on socio-economic status, medical and family history, anthropometric measurements, biophysical parameters, body composition, dietary intake, and purchasing behaviour were collected through a semi-structured questionnaire.

The results of the study revealed that the mean age of the participants was 39 ± 12.4 years, mostly married and residing in a nuclear household setup. The subjects showed a strong family history of diabetes and hypertension. Also, the prevalence of hypertension was found to be 41.8%, whereas self-reported cases of hypertension were 8.5%, showing the lack of diagnosis and unawareness of being at risk of hypertension. More than half of the population was found to be obese. Additionally, dietary patterns suggested a gap between nutritional knowledge and actual consumption habits. The mean intake of energy, carbohydrates, protein, and fat was found to be 1086.39 ± 295.75 kcal, 132.94 ± 38.96 g, 31.98 ± 16.28 g, and 45.17 ± 17.008 g respectively.

Preliminary findings indicated that a higher proportion of subjects frequently purchased packaged processed foods or foods high in fat, sugar and salt, with the younger age group more actively reporting this behaviour. Meal skipping correlated with the frequency of purchase of PPFs, with males skipping and purchasing in the morning, and females doing so in the evening. The online food purchasing behaviour was more common among males of the younger age group than among females. Brand was found to be one of the most influential factors for food purchasing across all ages. The results indicated that younger individuals were more inclined to read labels frequently than older adults. The majority of the subjects reported having home-cooked meals, and nearly one-fourth reported never substituting healthy foods with processed alternatives.

Further, the results for perception showed that people were well aware of the effects of consuming foods high in fat, sugar and salt, as the majority of them agreed with the statement that these foods contribute to weight gain and other health issues. The risk

was reported to be on the higher side for having packaged processed foods regularly. As reported, a busy lifestyle acted as a barrier in choosing healthy options by nearly one-fourth of the total population, with around 93% of participants reporting no hardships in accessing healthy foods.

The present study suggested the requirements for focused interventions in improving food purchasing behaviours and dietary habits, through educational methods and initiatives for promoting a healthier food environment.

INTRODUCTION

INTRODUCTION

Over the last 20th century, population has shown a huge shift in their diets, they have increased the intake of processed foods, increased eating outside and high usage of edible oil and sugar-sweetened beverages. There is a drastic change in the lifestyle of people's life, with increased sedentary recreation along with decrease in physical activity. This transition was not recognized early until diseases like diabetes mellitus, hypertension and obesity were on rise worldwide and become a public health issue. Currently irrespective of the economic condition people are suffering from a rapid increase in overweight and obesity in urban areas of low-income countries to people residing in high income countries (Popkins et.al, 2011).

One of the major contributors or accelerators in the shift of dietary intake in today's time is urbanization, increased income, capital flow, and market liberalization. The rapid global advancements in technology have influenced diet and physical activity by lowering energy expenditure in daily life, such as during leisure, commuting, and work. Modern food processing, marketing, and distribution on a global scale, along with widespread mass media, have contributed significantly to these shifts, impacting even rural areas worldwide. While direct links between globalization in trade, services, and technology with diet and physical activity are limited, globalization is a substantial underlying factor driving this phase of the nutrition transition (Popkins, 2006).

All the changes and shifts have significantly increased the burden on health and that's concerning as one of the leading causes of Non-Communicable Diseases (NCDs) is obesity.

NON-COMMUNICABLE DISEASES

Non-communicable Diseases (NCDs) are increasingly recognized as significant contributors to mortality and morbidity worldwide, including in India, affecting individuals across all age groups. Data from the Global Burden of Disease (GBD) indicates that NCDs account for 95.6% of deaths and injuries globally, with India alone bearing 57.16% of the NCD burden. NCDs refer to a category of health conditions that are not primarily the result of acute infections but instead lead to long-term health issues, often necessitating extended treatment and care. This category includes diseases such as cancers, cardiovascular disorders, diabetes, and chronic respiratory diseases, as

noted by PAHO/WHO. These diseases are non-infectious and are influenced by various environmental factors, including poor diet, lack of physical activity, tobacco use, excessive alcohol consumption, and air pollution, all of which contribute to physiological changes that elevate the risk of NCDs, such as increased blood pressure, obesity, elevated blood sugar levels, and high cholesterol. NCDs encompass conditions like diabetes, cardiovascular diseases, cancers, strokes, Chronic Obstructive Pulmonary Diseases (COPDs), chronic kidney diseases (CKDs), and Non-alcoholic Fatty Liver Disease (NAFLD). The rise of NCDs signifies a global epidemiological shift from communicable to non-communicable diseases. According to the Global Burden of Disease data from 2021, India represents 54.56% of the global burden of NCDs, as measured by disability-adjusted life years (DALYs).

Figure 1.1 and 1.2 shows an analysis of global and national trends in NCDs over the years respectively. It illustrates a decline in the percentage of deaths attributed to NCDs worldwide from 1990 until approximately 2019, followed by a notable increase around 2020. In contrast, national data indicates a steady rise in the percentage of deaths due to NCDs over time.

RISK FACTORS OF NCDs

Numerous risk factors associated with Non-Communicable Diseases (NCDs) have been recognized and categorized into various groups.

Modifiable risk factors:

1. Unhealthy diet
2. Physical inactivity
3. Tobacco use
4. Harmful use of alcohol
5. Air pollution

Metabolic risk factors:

1. Raised blood pressure
2. Overweight/obesity
3. Hyperglycemia
4. Hyperlipidemia

Figure 1.1: Global trends -Non Communicable Diseases

Deaths, %
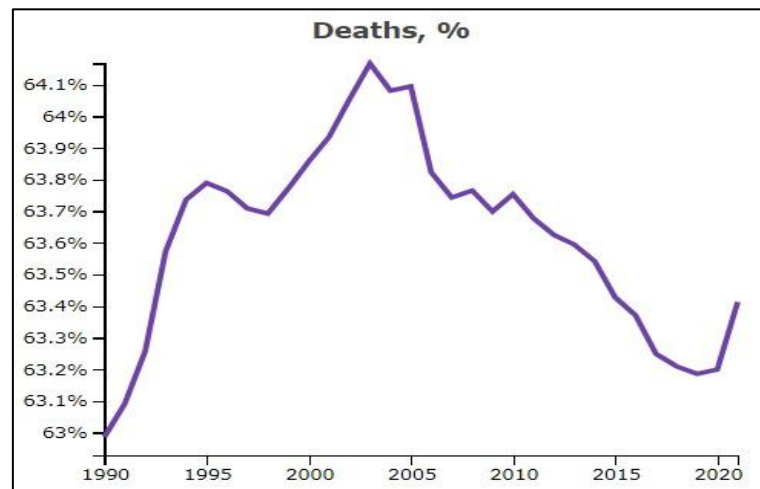
Figure 1.2: National trends -Non Communicable Diseases

Deaths, %
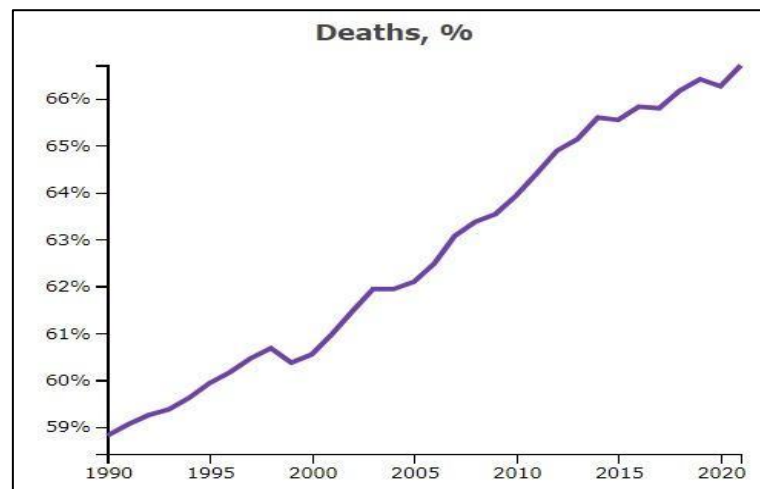
To summarize, the increasing prevalence of NCDs over time can also be attributed to additional elements such as stress and mental health issues, genetic predisposition, socio-economic conditions, heightened consumption of saturated fats, salt intake, elevated cholesterol levels, urbanization, among others. However, overweight and obesity stand out as the primary contributors to NCDs, serving as a significant underlying cause for many of these diseases (Nethan et al., 2017). When discussing risk factors, it is crucial to highlight that hypertension is the most significant risk factor for NCDs in India. Studies from the Global Burden of Disease (GBD) indicate that over the past 25 years, age-adjusted mortality rates have risen by 31%, leading to increased deaths and disabilities due to cardiovascular diseases (CVD). The GBD study estimated that hypertension was responsible for 1.6 million deaths and 33.9 million disability-adjusted life years (DALYs) in 2015, making it the foremost contributor to the disease burden in India (Gupta et al., 2021).

Furthermore, a recent study conducted by the World Health Organization (WHO) revealed that globally, deaths attributed to high systolic blood pressure (≥110–115 mmHg) account for 18% of male deaths and 20% of female deaths. High systolic blood pressure is linked to one in every five deaths, establishing it as the leading risk factor for mortality worldwide, surpassing all other behavioral, metabolic, or environmental risk factors.

The statistics presented in Figures 1.3 and 1.4 indicate a rise in fatalities attributed to elevated systolic blood pressure, which has been a contributing factor to the increasing mortality rates associated with ischemic heart diseases, strokes, chronic kidney diseases (CKDs), and other cardiovascular diseases (CVDs) on a global scale. In the WHO regions, a similar pattern is observed, particularly in the European region, where the proportion of deaths resulting from hypertension has remained consistent over the past three decades. Notably, 38% of deaths related to high systolic blood pressure occur in individuals under the age of 70 (WHO, 2023).

Figure 1.3: Percentage of global deaths attributable to high systolic blood pressure (1990 and 2019), by cause of death
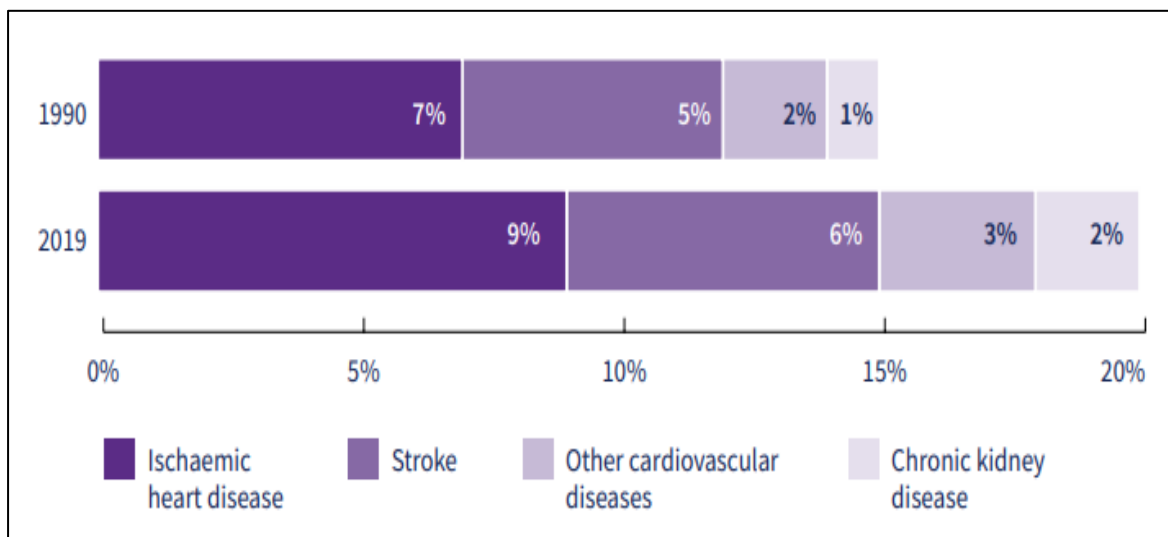
Figure 1.4: Deaths attributable to high systolic blood pressure (1990 and 2019), by WHO region
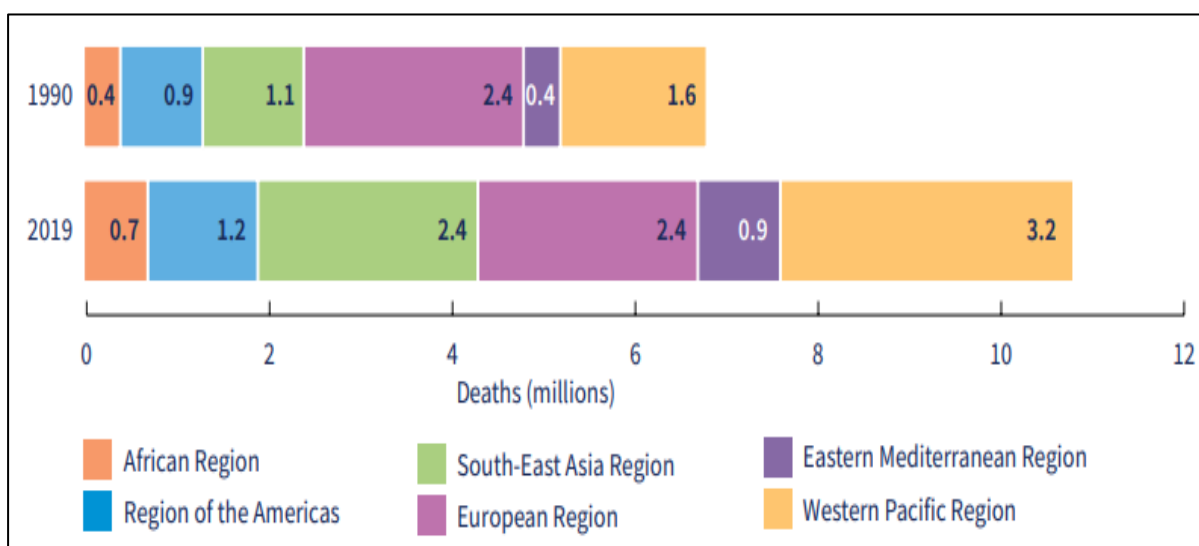
OVERWEIGHT/OBESITY

Obesity is a worldwide epidemic (Wilson et al, 2002; McTigue et al, 2006). It is a condition where excessive or abnormal amount of fat get deposited in our body and increases the risk or probability of health problems. Obesity is a chronic health condition and raises the risk associated with heart diseases that is the leading cause of deaths (WHO, 2024). As per the statement release by The Obesity Society, "Obesity is a long-term, complex disease that can occur at any age and stems from an extended period of consuming more energy than the body uses, leading to an accumulation of excess body fat. Over time, this buildup causes structural, physiological, and functional issues. Obesity not only raises the likelihood of other chronic conditions but also contributes to a higher risk of early death. Like other chronic diseases, obesity varies widely in its characteristics, symptoms, and responses to treatment" (Jastreboff et. al, 2019). Studies reveal that the prevalence of overweight and obesity increased with a breakneck speed in India over the last two decades (Shannawaz et. al, 2018). Etiological factors of obesity are multifactorial and varies to a greater extent being it hormonal disturbance, genetics, environmental, too socio-economic status (Jehan et. al, 2020). Obesity rates tend to rise with age, as people often become less physically active over time. This increase in obesity heightens the risk of developing elements of metabolic syndrome, such as high blood pressure and type 2 diabetes, which can contribute to cardiovascular disease and raise the likelihood of early mortality (Wilson et. al, 2002).

It was projected that by 2008, there would be 1.5 billion adults worldwide classified as overweight or obese. However, a more recent estimate based on updated data indicates that by 2030, the number of overweight adults could reach 2.16 billion, while the count of obese adults may rise to 1.12 billion globally (Kastorini et al.). Additionally, a study that analyzed the prevalence of overweight and obesity among adults aged 20 to 69 years utilized nationally representative datasets from the National Family Health Surveys 3 and 4 (NFHS 3, 4), the Study on Global AGEing and Adult Health (SAGE), the Sample Registration System (SRS), as well as the United Nations World Population Prospects 2019 and World Urbanization Prospects 2018. This research revealed that the prevalence of overweight among Indian adults in this age group is expected to more than double, with the prevalence of obesity anticipated to triple (Luhar et al., 2020).

The global rate of obesity has more than tripled from 1975 to 2022, making it one of the most critical public health challenges worldwide today (WOF, 2024).

National Prevalence of Obesity

An examination of the national statistics on overweight and obesity reveals that 4% and 18.9% of men, 6.4% and 17.6% of women, 1.8% and 2.4% of boys, and 0.9% and 2.4% of girls are classified as obese and overweight, respectively as shown in fig. 1.5.

Furthermore, data from 2019-21 indicates that 5.2% of adults are categorized as obese, while 18.3% are considered overweight. Between 1975 and 2022, the obesity rates among adults have seen a significant increase, nearly tripling for women (from 6.6% to 18.5%) and quadrupling for men (from 3% to 14.0%). This translates to approx. 504 million women and 374 million men living with obesity in 2022 as depicted in fig. 1.6.

Globally, out of 5 billion adults, nearly 2 billion are classified as overweight or obese, with one in twelve individuals affected by diabetes mellitus (Global Nutrition Report, 2016). Currently, around 40% of all adults and 20% of all children fall into the overweight or obese category. Obesity is no longer confined to developed and affluent nations; it is increasingly prevalent in developing countries as well. According to the World Obesity Federation, the obesity prevalence among men in India stands at 14%, while for women, it is 18.5% (World Obesity Federation, 2022).

CONSEQUENCES OF OBESITY

Obesity is recognized as a significant health disorder, distinct from various metabolic complications that may arise as a result. Individuals with obesity generally experience poorer health outcomes compared to those with a healthy weight, as obesity heightens the risk of numerous health issues. Among the primary diseases linked to obesity are chronic conditions such as hypertension, type 2 diabetes mellitus, respiratory issues including asthma and sleep apnea, joint disorders like osteoporosis and musculoskeletal pain, as well as gallstones and gallbladder diseases, among others (CDC, 2022). Furthermore, research indicates that at least 18 co-morbidities are associated with being overweight and obese (Djalalinia et al., 2015).

Figure 1.5: National prevalence of obesity
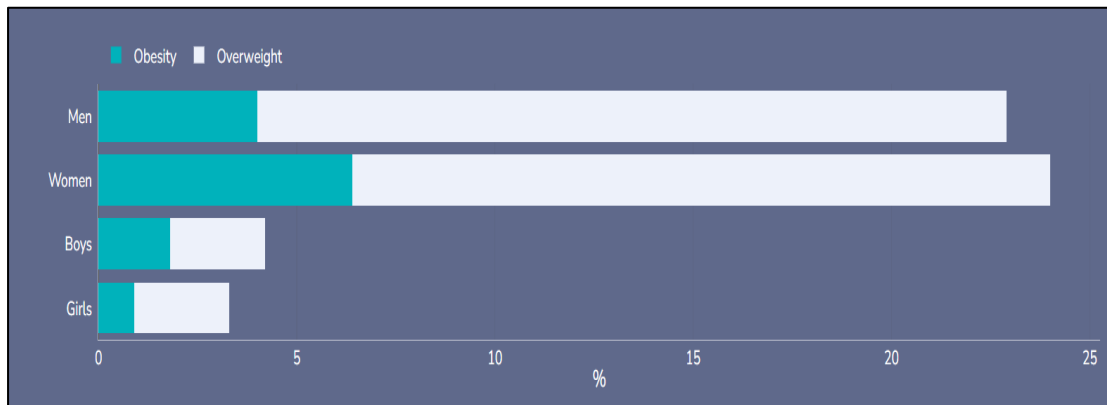
Image credits: World Obesity federation (2022)

Figure 1.6: Statistics for obese and overweight adults
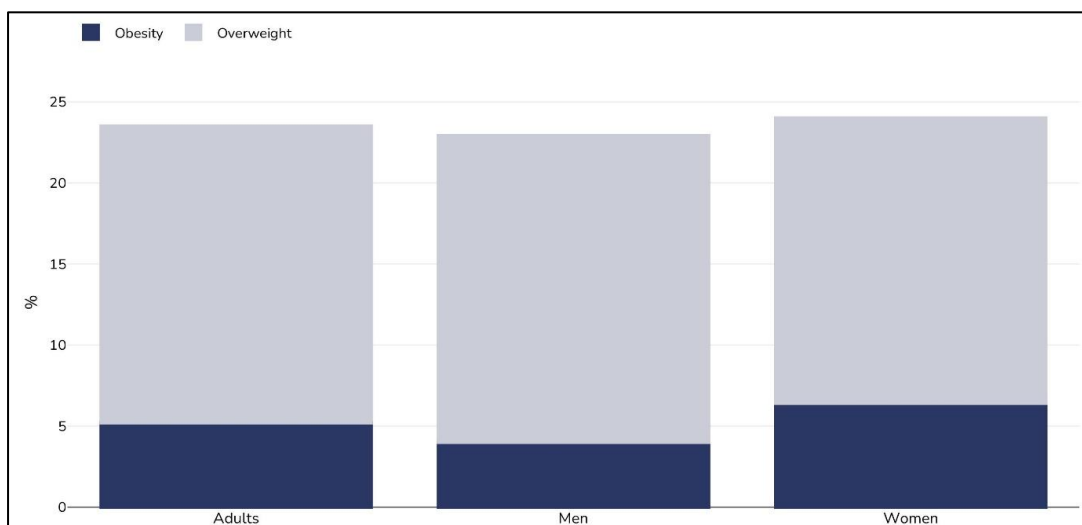
Image credits: World Obesity Federation (2019- 21)

CHANGING DIETARY PATTERNS IN INDIA

In India, dietary patterns are undergoing significant changes due to rising incomes and urbanization, leading to increased consumption of animal products, fats and oils, refined grains, and processed foods. This phenomenon, referred to as "nutrition transition," is contributing to a higher prevalence of obesity and overweight individuals, as well as diet-related health issues such as cardiovascular diseases and diabetes (Hawkes et al., 2017). Similarly, Asian diets are evolving to include more meat, dairy, vegetables, fruits, and fats, driven by rapid economic growth, urbanization, and globalization. The primary catalysts for this transformation are globalization and the influence of the urban middle class. To address the growing demand for diverse diets, it is essential to reform the food retail sector and enhance the vertical integration of the supply chain. Consequently, Asian agriculture is adapting to these changes, shifting towards a more diverse and commercialized agricultural framework. These emerging dietary trends reflect a Western model that contrasts sharply with the traditional eating habits developed by Indians over generations. Consumers are increasingly favoring meat or fish, dairy products, temperate fruits like apples, and highly processed convenience foods and beverages available in new supermarkets and fast-food outlets. The transformation of diets can be divided into two distinct phases: i) diversification of diets driven by income, and ii) globalization and westernization of dietary habits (Pingali, 2007). Research indicates that Indian diets, regardless of state or income level, tend to be unhealthy, characterized by an excessive intake of cereals while lacking sufficient proteins, fruits, and vegetables. As a result, these diets significantly diverge from the guidelines set by the Indian Council of Medical Research (ICMR) and the EAT-Lancet reference diet, posing health risks (Sharma et al., 2020).

The survey indicates a significant shift in the eating habits of Indian consumers over time, with a growing preference for dining out rather than preparing meals at home. This research, which included 600 participants from six towns across India, reveals that while individuals are generally conscious of the adverse effects associated with processed foods, their primary motivation for choosing these options is the convenience they offer.

Food represents the largest category of consumption in India, with a substantial portion of monthly budgets allocated to it. This trend is influenced by lifestyle changes such as increased income, longer working hours, and a rise in the number of working mothers, all of which contribute to a culture centered around convenience foods (Madhvapaty et al., 2015). Additionally, the fast-food culture has become an integral aspect of the lives of children and adolescents. Factors such as accessibility, appealing taste, affordability, and the influence of celebrity endorsements and media promotion have made fast food particularly popular among the younger demographic (Kaushik et al., 2015). A study focusing on young adults in Kolkata found that 39.71% of the population regularly consumes ready-to-eat foods (Choudhary et al., 2024). Furthermore, research conducted among adolescent Tibetan girls revealed that 45.28% of them consume junk food (Singh et al., 2023).

PURCHASING ASPECTS

Purchasing power is the amount of goods and services that a person or group can buy with a unit of currency at a given time. It is influenced by income, inflation, and the cost of goods and services in a market.

Purchasing behavior is the decision-making processes and actions of consumers when they buy products or services. This behavior is shaped by personal preferences, cultural influences, social factors, and economic conditions.

Food Environment (FE) which is seen as the physical, economical, and socio-cultural context in which each consumer engages with the food system. FE plays a vital role in purchasing behavior of an individual. Food environment consists various factors like promotion, affordability, availability, convenience, quality, and sustainability properties (Downs, 2020).

Figure 1.7: Possible causes of Nutrition transition
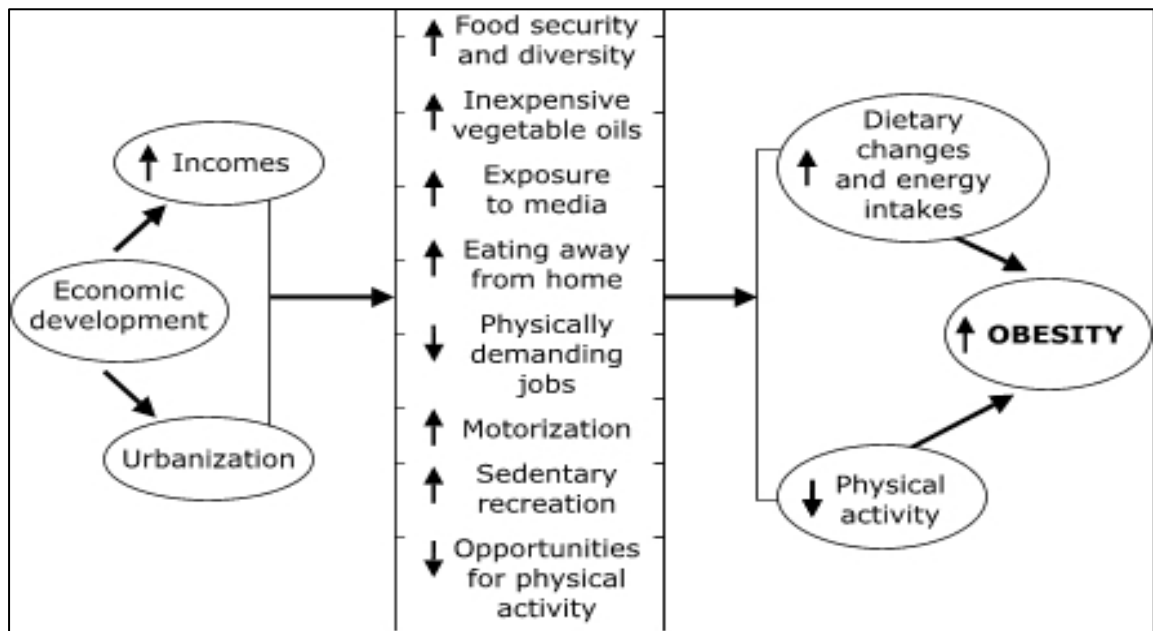
Source: Martorell and Stein, 2001

Figure 1.8: Drivers for changing dietary pattern in India
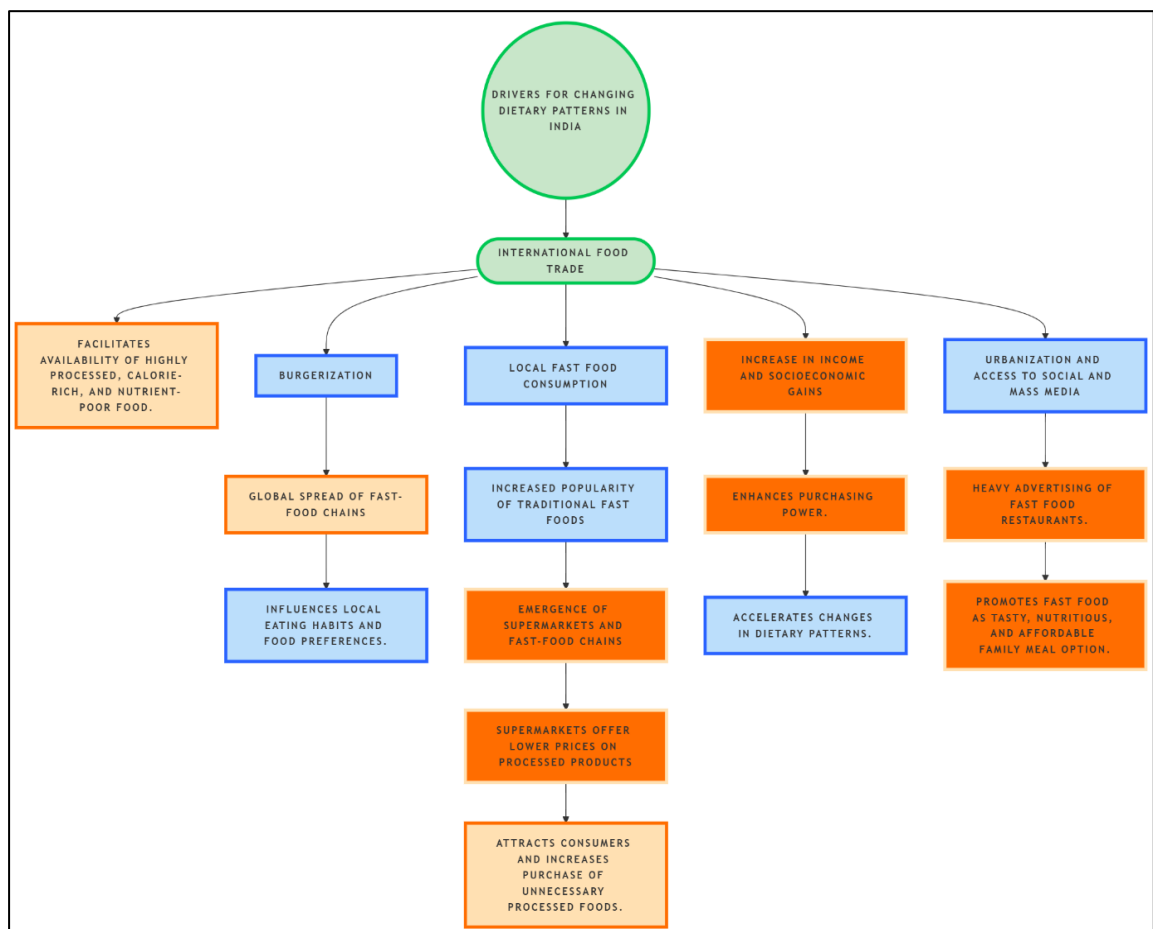
(Source: Soon and Tee, 2014)

BRONFENBRENNER'S ECOLOGICAL MODEL

This model focuses on an individual's development within the context of the system of relationships that form between the individual's environment. The theory defines complex "layers" of environment, each influencing an individual's development. In order to understand an individual development then, it is important to not only look at the immediate environment but also at the interactions of the larger environment as well.

The structure of environment:

1) **The Microsystem:** the closest layer to a child, includes relationships and interactions with their immediate surroundings, such as family, school, neighborhood, or childcare. These relationships have bi-directional impacts, with the child's beliefs and behavior influencing the parent's behavior. Bi-directional influences occur at all levels of the environment, with outer interactions still impacting inner structures.

2) **The Mesosystem:** this layer connects a child's microsystem structure.

3) **The Exosystem:** this layer defines the larger social system in which child does not function directly. The child's development is influenced by structures in their microsystem, such as parent workplace schedules etc.

4) **The macrosystem:** this is the outermost layer in a child's environment is the macrosystem, consisting of cultural values, customs, and laws. The macrosystem's larger principles influence all other layers, such as parental responsibility, resources, and the child's microsystem. This affects parents' ability to raise their children.

5) **The chronosystem:** this system considers time in a child's environment, including external elements like parent's death timing and internal physiological changes with aging. As children age, they react differently (Beck, 2000).

Looking the food environment of an individual in context of this theory explains diet being their immediate environment, individual factors as a mesosystem as their preferences or food choices, food environment being their exosystem where the behavior exhibit not only their habits but also the way they have been raised in an environment. The first aspect of food environment is;

1) **Promotion:** how a food item is presented, marketed, promoted, and front-of-pack labelling which is designed to influence the desirability of food.

2) **Affordability:** the prices of food items relative to other foods or to a defines income standard.

3) **Availability:** whether a food item is present with in a given physical range.

4) **Convenience:** time cost of obtaining, preparing, and consuming a food item.

5) **Quality:** external characteristics of food including its freshness, integrity, safety, nutrient and phytochemical profiles, objective sensory attributes.

6) **Sustainability properties:** the environmental and social impact associated with the food item. (Downs et al., 2020)

ULTRA-PROCESSED/ PROCESSED FOODS

According to the NOVA FOOD Classification system, the foods are categorized in four major groups, i.e., Group 1: unprocessed or minimally processed foods; Group 2: processed culinary ingredients; Group 3: processed foods; Group 4: Ultra-processed foods.

1) **PROCESSED FOODS** these are a group of products that is being manufactured by industry incorporating salt, sugar, oil or other substances (Group 2) added to naturally or minimally processed foods (Group 1) to preserve or make them more palatable. These are generally used as a part of side dish in culinary preparations made using natural or minimally processed foods. Mostly processed foods have minimum of two or three ingredients. For example; canned or bottles vegetables in salt/ pickling, canned fish like tune or sardines, tomato extracts or pastes, fruits in sugar syrup, salted or sugared nuts and seeds, coconut fat, freshly-made cheeses just to name a few.

Figure 1.9: Factors of food environment
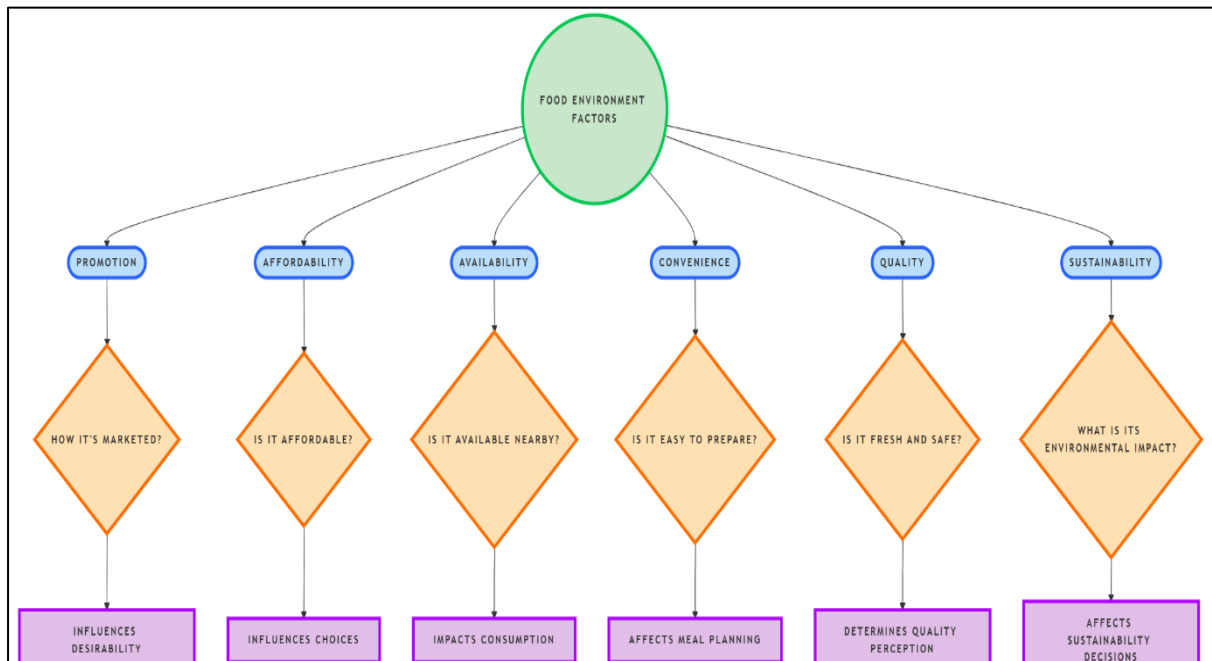
Figure 1.10: NOVA classification of food
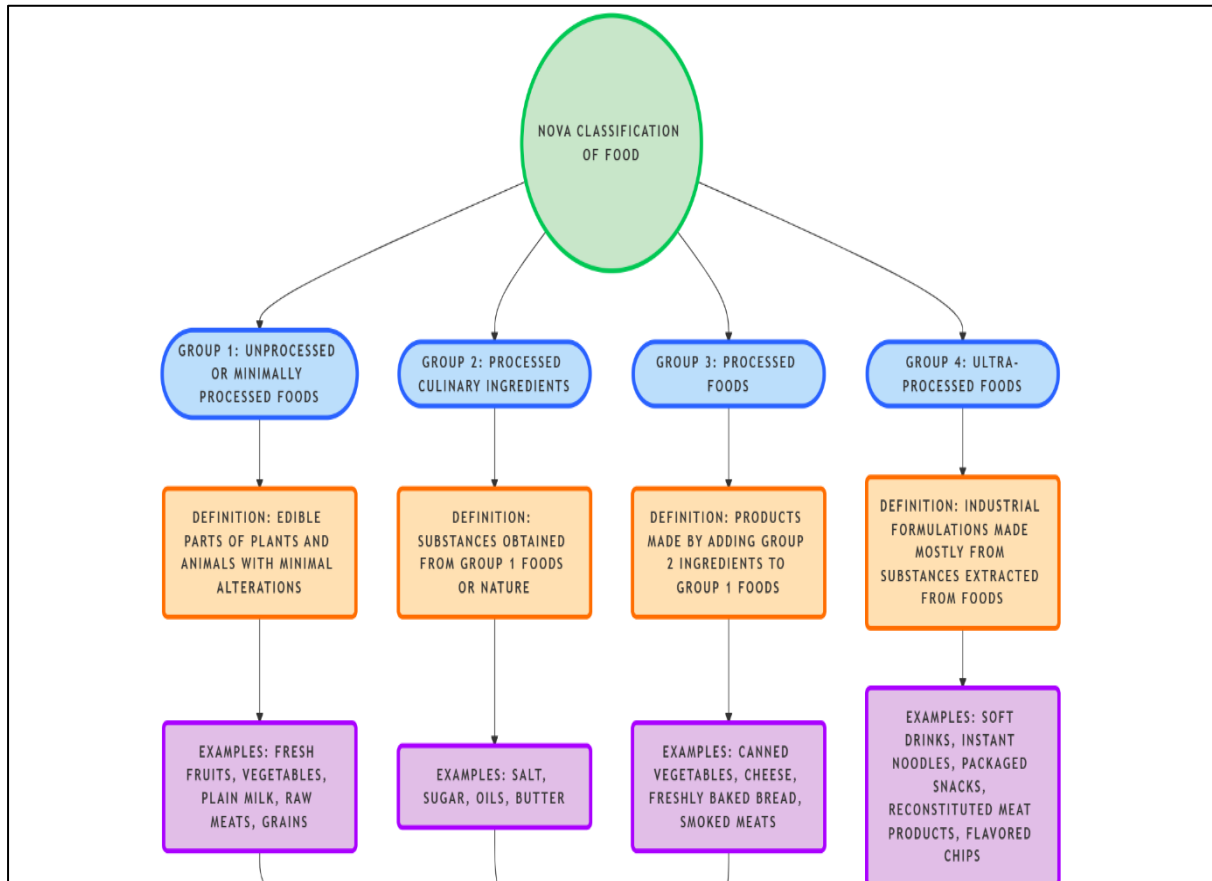
ULTRA-PROCESSED FOODS these are industrial formulations made entirely or mostly from these food extracts (sugar, fats, starch, oils, and proteins) derived from food constituents (hydrogenated fats and modified starch), or synthesized in laboratories from food substrate or other organic sources like colors, flavor enhances, food additive to make the product palatable. For example; biscuits/cookies, chocolates or confectionery, carbonated or energy/sports drinks, alcoholic beverages, sweetened or flavored yogurt, dairy drinks including chocolate milk, margarines and spreads, breakfast cereals and bars, baked products made with hydrogenated vegetable oil, sugar, yeast, whey, emulsifiers, and other additives just to name a few.

RATIONALE

The issue goes beyond consumption; the purchasing of food is a crucial first step in this cycle. Food behavior is primarily driven by the decisions and actions consumers take when purchasing goods. This behavior is shaped by a range of factors, including personal preferences, cultural influences, social dynamics, and economic conditions. Hence, non-communicable diseases (NCDs) are on the rise, presenting significant health challenges which is mainly due to an increase in the consumption of unhealthy foods. It is crucial to evaluate the Food purchasing behaviors of adults in order to understand and address the changing dietary trends. Also, there is limited research in India focusing on food purchasing behaviors. Therefore, this proposed study aims to address the gaps identified after review of literature.

OBJECTIVES

Broad objective

To explore food purchasing behaviours amongst adults of urban Vadodara.

Specific objectives

1. To collect data on socio-economic and nutritional status of the subjects.
2. To evaluate food purchasing behaviours of the enrolled subjects.
3. To identify barriers faced by the subjects in purchasing healthy foods.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Food is essential for survival, serving as a fundamental element of all societies through communal eating and shared meals. Consequently, food is integral to culture. Furthermore, food acts as a source of power within society, shaping social relationships and hierarchies. The choices individuals make regarding food and their consumption habits not only mirror but also reinforce distinctions in social class, gender roles, and cultural identities (Food and Health, n.d.). Non-communicable diseases (NCDs) in India are closely linked to changing dietary habits characterized by increased consumption of processed foods, unhealthy fats, and sugars along with sedentary lifestyles. The nutrition transition driven by urbanization and rising incomes has led to diets high in calories but low in essential nutrients, contributing to obesity and related health issues. Consequently, these dietary patterns significantly elevate the risk of developing NCDs such as diabetes, cardiovascular diseases, and hypertension.

2.1 NON-COMMUNICABLE DISEASES/ OBESITY

Previous research has highlighted worldwide consequences of poor dietary habits on non-communicable diseases (NCDs) such as type 2 diabetes (T2D), cardiovascular diseases (CVDs), and obesity. In 2020, there were 2.2 million new cases of T2D and 1.2 million new cases of CVD attributed to sugar-sweetened beverages (SSBs), with the most significant impact observed in Latin America and the Caribbean, alongside an increase in cases in Sub-Saharan Africa. Conversely, Southeast and East Asia exhibited the lowest incidence rates. Thailand reported some of the highest diabetes and obesity rates in Southeast Asia, with the frequent intake of high-fat, sugar, and salt (HFSS) foods and ultra-processed foods (UPFs) linked to impaired glucose tolerance and a 28% rise in all-cause mortality (Dehghan et al., 2023).

Western dietary habits, characterized by the consumption of red and processed meats, fast food, and SSBs, were associated with an elevated risk of prediabetes and obesity. Additionally, trans fatty acids (TFAs) were found to increase the risks of CVD, cancer, and diabetes, with a 2% increase in TFA consumption correlating with a 23% rise in cardiovascular risk. The study established a notable connection between sweets and obesity, although no definitive link was found between junk food and hypertension. It identified two distinct dietary patterns: one high in both sugars and fats, which

heightened the risk of obesity, and another high in sugars but low in fats, which did not correlate with increased adiposity (Ambrosini et al., 2016).

The prevalence of obesity and overweight was significant, with 44.18% of males and 38% of females classified as obese, and regular consumption of ready-to-eat (RTE) foods associated with higher BMI and increased CVD risk. Among adolescents, the most frequently consumed junk foods included salty snacks, fried foods, and SSBs, contributing to both general and central obesity, particularly among girls. The study advocates for immediate public health initiatives, including promoting healthier dietary choices, regulating unhealthy food marketing, and implementing policy measures such as taxation to mitigate the global burden of NCDs (Singh et al., 2023). Table: 2.1 shows the related studies focusing on the NCDs and HFSS foods.

Table 2.1: Studies on the relationship between Non-Communicable Diseases and foods rich in Fat, Sugar, and Salt

Title	Author, year, place	Participants/ study population	Key findings
Burden of type 2 diabetes and cardiovascular diseases attributable to sugar-sweetened beverages in 184 countries	L.L. Castor et.al, 2025	N=180 countries	In 2020, 2.2 million new T2D cases and 1.2 million new CVD cases were linked to SSBs. Highest burdens in Latin America and the Caribbean; disparities noted by education and urbanicity in regional insights. Highest T2D incidence (24.4%) and significant CVD burden (11.3%). Notable increases in T2D (21.5%) and CVD (10.5%) cases from 1990 to 2020 in Sub-Saharan Africa and lowest T2D (3.1%) and CVD incidence (46.8 new cases per million) in Southeast and East Asia.
Relationship between consumption of high fat, sugar or sodium (HFSS) food and obesity and non-communicable diseases	S. Thapsuwan et.al, 2024, Thailand	N=84,000 households	This study reported a significant association between HFSS food consumption and obesity and NCDs among the Thai population. Among all the NCDs Thailand had a higher rate of diabetes and obesity amongst Southeast Asian countries.
The Association between Unhealthy Food Consumption and Impaired Glucose Metabolism among Adults with	A. Pramono et.at 2023, Indonesia	N=8752	Concluded that having processed foods > once a day as a strongest risk factor for IGT.

Overweight or Obesity: A Cross-Sectional Analysis of the Indonesian Population			
Ultra-processed foods and mortality: analysis from the Prospective Urban and Rural Epidemiology Study	M. Dehghan et.al, 2023	N=185,635 of 5 continents	Higher intake of UPFs was associated with a higher risk of all-cause mortality with 28% higher risk.
The impact of taxing sugar-sweetened beverages on diabetes: a critical review	J.L. Penalvo, 2024		This review suggests that Type 2 diabetes is rising globally, which is linked to SSBs. SSB taxes can reduce consumption, particularly among lower-income groups. Evidence shows SSB taxes lead to higher prices and lower sales, with potential health benefits. Tax revenues can fund health initiatives, addressing diabetes and health inequalities.
Ultra-processed foods and health: a comprehensive review	Y. Zhang, 2022, France	N=44,551	Positive relation with Consumption of UPFs and all-cause mortality, dyslipidemia, diabetes & hypertension but none with CVDs specific deaths. UPFs also have an association with weight gain, change in body composition and fat deposition.
Ultra-processed foods and health: a comprehensive review	G.G. Natalia, 2022, Brazil	N=10 775, middle aged	Study concluded that there is a positive effect of UPFs and cognitive decline if the total daily calories intake is more than 19.9% from UPFs alone.

Impact of the intake of snacks and lifestyle behaviors on obesity among university students living in Jeddah, Saudi Arabia	N.M. Aljefree et.al, 2022, Saudi Arabia	N= 659, 18-29 years university students	This study noticed a pattern of higher consumption of cereals in the morning and a higher tendency to snack that were high in fat, sugar and salt such as biscuits, popcorn and potato chips in between the meals than that of students who were non-obese.
Association between dietary patterns and prediabetes risk in a middle-aged Chinese population	X. Ming Shen et.al 2020, China	N=1761	This shows an association between a western diet characterized by high consumption of red meat, processed meat, fast food, alcoholic beverages, and SSBs which have a higher risk of prediabetes.
Trans fatty acids and lipid profile: a serious risk factor to cardiovascular disease, cancer and diabetes	M.A. Islam et.al, 2019		This study showed that trans fatty acids (TFAs) were linked to increased risks of cardiovascular diseases, cancer and diabetes. A 2% increase in energy intake from TFAs correlates with a 23% rise in cardiovascular risk. TFAs raise low-density lipoprotein (LDL) and high-density lipoprotein (HDL) levels. Although it is stated that complete elimination of TFAs is challenging due to their natural presence in some of the foods. It is recommended to reduce TFA intake to less than 1% of total energy.
Association of junk food consumption with high	M. Payab et.al, 2015, Iran	N=14,880 students aged 6-18 years	It is reported that there is a significant association between sweets and obesity. No significant link is found between

blood pressure and obesity in Iranian children and adolescents: the CASPIAN- IV Study			junk food and hypertension. Seldom consumption of sweets and sweetened beverages reduced obesity risk. It is recommended that reducing advertisements and increasing taxes on junk food can influence the behaviour and eventually can help lower the risk of obesity.
The sweetening of the global diet, particularly beverages: patterns, trends and policy responses for diabetes prevention	B.M. Popkins et.al, 2016,	-	Evidence showed high risks of weight gain and diabetes from SSBs. In order to reduce the risk of diet related diseases several policy responses including SSBs taxes, marketing restrictions and public awareness campaigns were being focused.
Free sugars and total fat are important characteristics of a dietary pattern associated with adiposity across childhood and adolescents	G.L. Ambrosini et.al, 2016, England	N=6722	This study identifies two dietary patterns (DPs); DP1: high in sugars and fats, linked to increased fat mass and obesity risk, showing 12% higher odds of obesity in an individual. DP2: high in sugars but lower in fats, not associated with adiposity. The study concluded by summing up that both sugar and fat contribute to obesity so one should focus on both types of dietary patterns.
Dietary Sugar and Body Weight:	G.A. Bray et.al, 2014	-	This study highlights the impact of increased SSBs intake with health risks of diabetes, CVDs, and fatty liver. It also

Have We Reached a Crisis in the Epidemic of Obesity and Diabetes?			concluded that reducing SSBs consumption helps prevent weight gain.
Cardiovascular Disease Risks Related to Consumption of Ready-To-Eat Food Products between Young Adults of Kolkata, West Bengal, India	S.R. Choudhury et.al 2024, Kolkata	N=150	The study concluded, 44.18% and 38% of males and females were obese; and 39.71% of the population consume RTE foods on a regular basis. This regular consumption is reported to be associated with high BMI and overweight leading to CVDs, coronary heart disease and more.
Obesogenic Food Cues and Increasing Body Weight Among Adults' Male and Female: A Cross-Sectional Study in Mysore City in South India	B. Shahrokhisahneh, 2024, Mysore	N=444	The obesogenic food cues have a positive impact on the body weight particularly among women, and study shows that obese or overweight individuals score higher as food cues significantly impacted food perception and eating behaviors.
Dynamics of junk food consumption with central and general obesity: a cross-sectional study	N. Singh et. Al 2023, Tibet	N=276	The consumption of junk food was found to be 45.28%. Also, 25.4% and 16.3% of girls were found centrally obese as per WHR and WHtR respectively. The overall prevalence of general obesity is 23.5% among these adolescent girls.

among adolescent Tibetan girls in India			The most consumed junk food was salty snacks (96.8%), fried foods (92.8%), followed by SSBs (82.40%).

2.2 FOOD ENVIRONMENT

Recent research underscores the intricate connection between food environments and health outcomes, particularly concerning obesity and diabetes. On a global scale, the presence of supermarkets was found to be inversely related to obesity rates, whereas access to fast food establishments showed a positive correlation. It was noted that individuals tend to favor supermarkets for healthier food choices; however, these outlets frequently lack nutritious options. Additionally, the studies indicated that exposure to fast food restaurants heightened the risk of Type 2 Diabetes Mellitus and obesity, especially among women and low-income populations. Further investigations highlighted the widespread availability of unhealthy, high-fat, salt, and sugar (HFSS) foods in proximity to educational institutions, despite existing legal restrictions (Bassi et al., 2021).

Collectively, these studies emphasize the significant impact of food environments on dietary habits and chronic diseases across various demographics. Furthermore, rural food environments exhibit unbalanced dietary patterns characterized by low intake of nutritious foods and moderate consumption of unhealthy options, influenced by factors such as cost and availability. Urbanization has exacerbated these challenges through increased dining out, food marketing, and the prevalence of fast-food outlets, all of which affect diet quality. Snacking is a crucial factor in determining eating behaviors, and proximity to fast-food locations is associated with elevated obesity rates. While access to fresh produce and supermarkets is linked to a reduced risk of obesity, evidence regarding consistent relationships between food environments and purchasing behaviors remains scarce (Pineda et al., 2024). These findings highlight the need for targeted interventions aimed at fostering healthier eating habits in rural communities. Table: 2.2 shows the studies related to the food environment and how it affects the purchasing or impacts health of an individual.

Table: 2.2 Studies exploring the food environment and its impact on Consumer Purchasing Behavior

Title	Author, year, place	Participants/ study population	Key findings
Consumers' health and environmental attitudes and local food purchases	L. Tran et.al, 2025, Missouri, USA	N=511	Environmental attitudes show minimal effect on willingness to pay (WTP). Health concerns about genetically modified organisms (GMOs) and pesticides negatively impact WTP.
Rural diets under pressure: Food environments and their influence on food choice in South Asia	A. Chauhan et.al, 2025, South Asia	N=4000	The analysis of rural food environments highlights that; dietary patterns in these areas were often imbalanced, characterized by insufficient consumption of nutritious foods and a moderate intake of unhealthy options, underscoring the urgent need to encourage healthier eating habits. Affordability plays a crucial role in determining the intake of healthy foods, while the combined influence of cost, desirability, and availability drives the preference for unhealthy choices, reflecting the intricate socio-economic factors shaping dietary behavior. These rural environments were experiencing rapid urbanization, evident in the rise of dining out, increased exposure to targeted food advertising, shifting tastes and preferences, enhanced market accessibility, and the expanding presence of fast-food outlets—all of which have a notable impact on diet quality. Snacking between meals stands out as a significant determinant

			of both healthy and unhealthy food consumption, highlighting its dual influence on overall dietary practices.
Food environment and obesity: a systematic review and meta-analysis	E. Pineda et.al, 2024		The review highlighted that the proximity to fast-food outlets linked to higher obesity rates (OR: 1.15). Fresh fruits/vegetable outlets density and supermarket proximity were inversely associated with obesity.
Associations between the food environment and food and drink purchasing using large-scale commercial purchasing data: a cross-sectional study	A.Kalbus, 2023, England	N=2,118 household-level take-home-grocery 447 individual-level out-of-home	It is found that increased distance to out-of-home (OOH) outlets is linked to reduced calories from ultra-processed foods (UPFs). Limited evidence was seen of consistent associations between food environment and purchasing behaviours. It is also observed that specific regions affect the purchase of alcohol.
Effectiveness of food environment policies in improving population diets: a review of	K.L. Hansen et.al, 2022,	-	This review concluded that behaviour change can be done through price interventions. There is an inverse relation between price of the commodity and intake of those among people. Hence, larger the tax greater the effect. But the main thing highlighted is that tax below 6% may be ineffective.

systematic reviews			
How does the food environment influence people engaged in weight management? A systematic review and thematic synthesis of the qualitative literature	K.L. Neve et.al, 2021		The study draws a finding by saying; sustained efforts were necessary to make healthy choices within the existing food environment. The widespread availability and easy access to less nutritious foods consistently undermine these efforts. The higher actual and perceived cost of healthier food options poses significant challenges, especially for individuals with lower incomes.
Effectiveness of school food environment policies on children's dietary behaviours: a systematic review and meta-analysis	R. Micha et.al, 2018,		Policies like direct food provision, competitive food and beverage standards, and school meal guidelines show promising results. Notably, direct provision and meal standards seem more effective in increasing fruit consumption compared to vegetables, likely because fruits were often more palatable and require less preparation.
Exploring pro-environmental	T. Laureti, 2017, Italy	N=50,000 individuals	This study concluded that environmental concerns significantly impact organic food purchasing. Regional differences affect consumption

food purchasing behaviour: An empirical analysis of Italian consumers			behavior. Higher education and awareness of environmental issues correlate with increased organic product purchases.
The relationship of the local food environment with obesity: A systematic review of methods, study quality, and results	L.K. Cobb et.al 2015, US	N=71	The study summarizes that there is no predominantly association between local food environment and obesity. But it is also observed in the study conducted in adults that supermarket availability and fast-food availability has a negative and positive association with obesity respectively.
Urban food environments and residents' shopping behaviour	C.C. Carolyn et.al 2013, US	N=514	a) People choose to shop at large scale supermarkets for varied variety and healthful options at lower prices. b) Assessment of the food environment there were fewer healthful food items at the supermarket.
Food environment and diabetes mellitus in South Asia: A geospatial	D. Kusuma et.al, 2022, South Asia	N=12,167	It is observed, Fast Food Restaurant exposure (share, density and proximity) has a positive association with a greater risk of T2DM especially in females from high-income earners.

analysis of health outcome data			
Food environments and obesity: A geospatial analysis of the South Asia Biobank, income and sex inequalities	P. Atanasova et.al, 2022, South Asia	N=12,167	This study finds the availability of supermarkets has a negative impact while availability of FFR has a positive impact with higher BMI, WC, and likelihood of obesity in females & low-income individuals.
Food environment in and around schools and colleges of Delhi and National Capital Region (NCR) in India	S. Bassi et.al, 2021, Delhi and NCR	N=310	From this study it is evident that the food and beverages options in & around the institution were high in fat, salt & sugar. Despite the law restricting HFSS food availability in & around the education institution.

2.3 CHANGING DIETS

Urbanization and modernization in low- and middle-income countries (LMICs) have resulted in a heightened intake of ultra-processed foods (UPFs), which has contributed to a dual and even triple burden of malnutrition, characterized by escalating rates of both obesity and undernutrition. Economic limitations and poor dietary habits have compelled consumers to opt for cheaper, calorie-rich, and nutritionally poor food options, thereby worsening the prevalence of obesity and chronic diseases. The research identified two primary dietary patterns: a healthy pattern, consisting of vegetables, fruits, and white meat, and an unhealthy pattern, comprising red/processed meat and processed foods. Notably, men generally exhibited superior diet quality compared to women. Enhanced educational attainment and healthier lifestyle choices were correlated with improved dietary patterns, while adherence to traditional diets was associated with more favorable health outcomes. Economic downturns further restricted access to fruits and vegetables, leading to an increased dependence on diets high in fats and sugars, which in turn elevated the risks of obesity and non-communicable diseases (NCDs) (Green et al., 2016).

Global dietary transformations, spurred by urbanization and globalization, have resulted in greater consumption of animal fats and sugars, alongside a decline in fiber intake, with fast food and processed options becoming more readily available. These dietary shifts impose considerable economic and health burdens, particularly in developing nations (Popkin, 2006).

Table: 2.3 shows the shift in diet over time and how it leads to the greater risk off non-communicable diseases.

Table: 2.3 Studies analyzing evolving dietary trends over time

Title	Author, year, place	Participants/ study population	Key findings
The nutrition transition to a stage of high obesity and noncommunicable diseases prevalence dominated by ultra-processed foods is noy inevitable	B.M. Popkins et.al, 2021,	Low- and middle-income countries	Due to increased urbanization and modernization in low- and middle-income countries (LMICs) leading to higher UPFs consumption. Due to all this many regions face double or triple burden of malnutrition, with rising obesity and undernutrition rates.
Changing time, changing diet	J. Fanzo et.al, 2020, Kenya		This covers a wide variety of issues; under local promotion: government initiatives for manioc promotion lack consumer support. Company faced financial hardships from taxes limiting the growth and machinery investment. Women in Kenya prioritize health and market prospects in organic farming, while conventional farmers focus on yield and labor reduction. It is reported that the dietary practices were poor contributing to the global issue.
Education and lifestyle predict	M.G. Thorpe et.al, 2019, Australia	N=1005 males 1106 females	Two dietary patterns were identified while making conclusions which were as follows; healthy (vegetables, fruits, white meat) and

change in dietary patterns and diet quality of adults 55 years and over			unhealthy (red/processed meat, processed food). Men showed improved diet quality than women. It was obvious that higher education and healthy lifestyle choices predicted better dietary patterns.
Dietary patterns in India: a systematic review	R. Green et.al, 2016, India		Study identified eleven dietary models, most patterns were vegetarian, emphasizing fruits, vegetables and pulses. There is significant difference in dietary patterns across regions, no notable differences by age or sex. High-fat and high-sugar diets were linked to increased BMI and diabetes risks; traditional diets were associated with better health outcomes.
Use of seemingly unrelated equations to assess changes in dietary behaviours during the UK's economic crisis	M. Cecchini, 2014	21 OECD countries	This study reported that countries affected by economic crises have lower consumption of vegetables and fruits. Also, it is evident from this study that economic constraints may have driven consumers to opt for lower-cost, calorie-dense, and less nutritious food choices. As a result, the financial crisis may have played a role in the rising prevalence of obesity and related chronic diseases. Prior research indicates that while these effects may appear minor at the population level, they can obscure significant disparities among different socioeconomic groups.
Global nutrition dynamics: the world is shifting rapidly towards a	B.M. Popkins, 2006,		This study stated that the world is shifting towards diets linked with noncommunicable diseases (NCDs) due to rising obesity levels. Higher-income countries face degenerative diseases, while lower-income countries experience a transition from famine to obesity.

| diet linked with noncommunicable diseases | | | Dietary changes include increased consumption of animal fats and sugars, and decreased fiber intake. Urbanization and globalization contribute to these shifts, with fast food and processed foods becoming more accessible. The economic costs of obesity were significant, particularly in developing countries. |

2.4 FOOD PURCHASING BEHAVIOURS

The global research findings indicate a positive correlation between the purchase of processed foods (PF), ultra-processed foods (UPF), and socio-economic status (SES). Additionally, in-store cues significantly affect the purchasing decisions related to PF and UPF, while taxation directly influences food purchases, excluding sugar-sweetened beverages. Key determinants of purchasing behavior included trust, safety, and age, while brand endorsements and ethical considerations had a negligible effect (Baskar & Sundaram, 2014).

Parents frequently employ innovative methods to promote healthy eating among children, although financial limitations and children's preferences pose significant challenges. Fiscal measures, such as taxes on saturated fats, sugars, and salts, have been effective in encouraging healthier food choices, whereas subsidies have shown limited impact. Consumer preferences were notably influenced by factors such as freshness, quality, and curiosity, with local products becoming more favored during economic downturns. Women placed a higher emphasis on nutrition and reliability compared to men, and educational attainment significantly influenced shopping habits, underscoring the necessity for consumer education (Sanlier & Seren Karakus, 2010). A national study conducted to evaluate the purchasing patterns and socio-economic factors influencing processed and ultra-processed food purchases in urban Indian households during 2013 and 2016 revealed that approximately three-quarters of these households tend to buy a wider variety of PF and UPF. The study also highlighted the importance of regional factors in shaping these purchasing behaviors. It was observed that exposure to traditional advertising for high-fat, salt, and sugar (HFSS) products correlates with increased household purchases of energy-dense foods (Finlay et al., n.d.). Table: 2.4 shows the studies relevant to the food purchasing behaviour and the several aspects impacting the behaviour of an individual all over the world.

Table: 2.4 International and national studies on Food Purchasing Patterns

Title	Author, year, place	Participants/ study population	Key findings
Associations between exposure to advertising of foods high in fats, salt and sugar and purchase of energy and nutrients: a cross-sectional study	A.H. Finlay et.al, 2024, London and North of England	N=1289 households	Study reported that there is a positive relation between exposure to HFSS advertising through traditional advertising and greater purchase of energy and nutrients. The data shows an average household increase in purchase of 9779 kcal, 416g of protein, 1164g of carbohydrates, and 514g of sugars in a month-long period every household exposed to traditional HFSS advertising.
Indian consumer purchasing behaviour towards branded processed food	M.V. Baskar et.al, 2024, India	N=102 majorly Southern Indian cities	It was concluded that trust and safety were prime factors influencing brand preference. Age impacts purchasing decisions, younger and older consumers show different behaviours. It is found that brand endorsements do not significantly affect consumer choices. Ethical concerns and brand equity have limited authority on purchasing.
Understanding family food purchasing behaviour of low-income urban UK	C. Screti et.al, 2024, UK	N=16 Parents (13F, 3M)	The study found that parents use strategies to encourage healthy eating in children, such as disguising vegetables in preferred foods. Allowing children to choose their foods increases their motivation to eat healthily. Eating outside the home is often viewed as a treat, leading to less healthy choices. There were some barriers to healthy food

families: An analysis of parent capability, opportunity and motivation			purchasing also reported which include financial constraints and children's preferences. Access to healthy halal foods significantly influences Muslim parents' purchasing decisions. Improving family food purchasing through fiscal policies and motivation strategies could enhance children's diets.
Socio-economic difference in purchases of ultra-processed foods in Australia: an analysis of a nationally representative household grocery purchasing panel	D.H. Coyle et. al 2022, Australia	N= 10,000 Australian households	The association between purchase of Ultra-processed Foods (UPFs) by SES. i.e., people from disadvantaged socio-economic backgrounds purchased the highest volumes of UPFs. UPFs in Australia considered in majority of household grocery purchases
The effect of food prices changes on consumer purchases: a randomized experiment	W.E. Waterlander et.al, 2019, New Zealand	N=1132 adults	Saturated fat, sugar and salt taxes increased healthy food purchases. A significant substitution effect is observed; e.g., increased sugar intake with saturated fat tax. Also sweetened beverage tax and fruit/vegetable subsidy showed non-significant effects. Hence, combination of different taxes and subsidy policies may optimize the dietary improvement among the population.

What factors influence ultra-processed food purchases and consumption in households with children? A comparison between participants and non-participants in the Supplemental Nutrition Assistance Program (SNAP).	A.J. Moran et. al 2019, United States		The in-store food cues like placement and promotions influence the food choices of purchasing UPFs.
Nutrition quality of food purchases varies by household income: the SHoPPER study	S.A. French et.al 2019	N=202 household	Household Food Purchase is essential to measure as it influences dietary intake quality. It is concluded that the overall nutritional quality of foods and beverages purchased was significantly lower among lower income households compared with higher income households.

Rapid evidence review: the impact of promotions on HFSS food and drink on consumer purchasing and consumption behaviour and the effectiveness of retail environment interventions	L. Martin et.al, 2017		This review concluded that price promotions significantly increase the HFSS food purchase.
Factors affecting consumers' purchasing behaviour towards local foods in Greece: the case of the prefecture of Xanthi	A. Koutroulou et.al, 2011, Greece	N=100	The study found topicality, quality, health, appearance, freshness, curiosity, and prestige as influencing factors for choosing local foods. Two consumer groups were identified; Group 1: influenced by curiosity and freshness. Group 2: focused on topicality and quality. Economic crisis shifted the preferences towards local products.
Evaluation of food purchasing	N. Sanlier et.al, 2010, Turkey	N=430 consumers	This study concluded that women prioritize nutrition and reliability more than men. Also, it reported that education level influences

behaviour of consumers from supermarkets			shopping criteria. There's a significant relationship between income percentage spent on food and shopping criteria. Hence, effective education can improve consumer awareness and rational shopping behaviour.

2.4.1 FOOD AND TAXATION POLICIES

Reformulating food products has demonstrated the potential to decrease sugar consumption, reduce body weight, and enhance health outcomes thereby addressing concerns such as obesity, type 2 diabetes, and dental issues—especially in nations like the UK, where sugar intake surpasses recommended limits. Although no direct correlation has been established between food marketing policies and the consumption of HFSS (high-fat, sugar, and salt) foods, research indicates that broader tax bases and elevated rates can effectively diminish HFSS consumption, particularly among lower-income demographics. Notable examples include Denmark's tax on saturated fats and Hungary's excise tax on sugary products, which have impacted consumer purchasing decisions. Taxes imposed on sugar-sweetened beverages (SSBs) have been shown to significantly lower the intake of empty calories and sugar, with the type and rate of tax being influential in altering consumer behavior. Policies in school canteens that classify foods into "red," "yellow," and "green" categories, along with regulations on junk food advertising and nutrition education, encourage healthier food selections among children to address escalating obesity rates (Centre for Science and Environment, 2014).

The NOURISHING framework, established by WCRF International, serves as a global standard for food policy, concentrating on food environments, systems, and communication for behavior change. It advocates for enhancing the availability and affordability of nutritious foods while restricting unhealthy alternatives. Market deregulation has been associated with increased fast-food consumption and rising BMI, with soft drink consumption identified as a significant predictor of obesity (De Vogli et al., 2014). In the United States, where obesity rates have reached 68% among adults and 19% among children, government initiatives have primarily concentrated on clinical guidelines and education, often overlooking environmental influences. Behavioral economics highlights how defaults in food environments influence consumption habits, making policy measures such as SSB taxes and marketing restrictions essential, despite pushback from the food industry (Novak & Brownell, 2012). Table: 2.4.1 shows the various tax and regulation implies for various HFSS foods.

Table: 2.4.1 Studies concentrating on taxation and policies pertaining to HFSS foods

Title	Author, year, place	Participants/study population	Key findings
Effects of product reformulation on sugar intake and health—a systematic review and meta-analysis	K.M. Hashem et.al, 2025, UK		After conducting RCTs, modeling studies and observational research the result came out as reformulating the product can lead to decreased sugar intake, reduce body weight, and can potentially improve health outcomes. As excessive sugar consumption contributes to obesity, type 2 diabetes, and dental caries, especially in the UK, where average sugar intake exceeds recommended levels.
How an agreement with restriction of unhealthy food marketing and sodium taxation influenced high fat, salt or sugar (HFSS) food consumption	N. Jindarattanaporn et.al, 2024, Thailand	N= 86,216 participants, 44,768 households	This study found no association between the food marketing and taxation agreement policy and HFSS food consumption. Female subjects were in favor of sodium taxation and food marketing restriction than the male subjects.

Review: Effectiveness and policy implications of health taxes on foods high in fat, salt, and sugar	E. Pineda et.al, 2024		Studies indicate that broader tax bases and higher rates effectively reduce HFSS food consumption, particularly benefiting lower-income groups. Denmark implemented a saturated fat tax (16 DKK/Kg) on high-fat products, aimed to reduce fat intake. Hungary excise duty tax on sugary foods (100- 500 HUF/Kg) to decrease consumption, observed shifts from brand-name to home-brand products.
The impact of the tax on sweetened beverages: a systematic review	M. Redondo et.al, 2018		The study showed that there is a significant impact on purchasing behaviours if there were taxes implied on SSBs. But the rate and type of tax play an important role in determining the extent of that particular behaviour of consumption of sweetened beverages. Hence, SSBs taxes have the potential to reduce empty calories and sugar intake.
Junk food targeted at children	CSE, 2014		Several school canteen policy and junk food regulations were; Canteen policy specifies food categories (red, green, yellow) for sale in school. The policy applicable to all types (primary, secondary, daycare, and boarding). Rising obesity rates linked to junk food consumption among children. Regulatory measures include advertising restrictions, nutrition education and food taxation. All of this focuses on promoting healthier food choices in schools to combat obesity and related health issues.

A food policy package for healthy diets and the prevention of obesity and diet-related non-communicable diseases: the NOURISHING framework	C. Hawkes et.al, 2013		The NOURISHING framework promotes healthy diets and prevents obesity through comprehensive food policies. This is developed by WCRF International, it categorizes policy actions into three domains: food environment, food system, and behavior change communication. It allows policymakers flexibility to adapt strategies to local contexts while providing a global benchmark for monitoring progress The framework emphasizes improving the availability and affordability of healthy foods while reducing unhealthy options.
The influence of market deregulation on fast food consumption and body mass index: a cross-national time series analysis	R.D. Vogli et.al, 2013	25 high income OECD countries	The study concluded that market deregulation correlated with increased fast-food consumption and BMI. Each unit increase in fast food transactions per capita linked to a 0.033 kg/m² rise in BMI. It is found that soft drink intake was a significant mediator; animal fats and total calories were not. Soft drinks were said to be the predictor of BMI.
Role of policy and government	N.L. Novak et.al, 2012		Obesity is a significant public health issue in the US, with rates rising to 68% among adults and 19% among children. Government policies have focused on clinical guidelines and education but often overlook

in the obesity epidemic			environmental factors. Behavioural economics shows that defaults in food environments influence consumption patterns. Effective policy interventions include taxing sugary drinks and restricting marketing to children. Opposition from the food industry makes it challenging to enforce these policies.

2.4.2 FOOD LABELLING AND UNDERSTANDING

Increasing focus is being placed on food labeling as a strategic method to improve dietary habits at the population level, to tackle the escalating rates of obesity and nutrition-related diseases. The research highlights the prevalent consumption of high-fat, salt, and sugar (HFSS) foods, especially among children, which contributes to the growing obesity crisis and associated health risks. The Food Safety and Standards Authority of India (FSSAI) oversees food safety and labeling, proposing front-of-pack labeling (FOPL) to assist consumers in making informed dietary choices. For FOPL to be effective, it must be straightforward, accessible, and applicable to various socioeconomic groups (Bera et al., 2023).

Food labels are essential in shaping consumer perceptions and dietary choices by providing critical information regarding ingredients, nutrients, and allergens. Studies indicate that clear and interpretive labels, such as the five-color nutrition label and Multiple Traffic Lights, were more successful in encouraging healthier food selections and decreasing the purchase of unhealthy items. Labeling initiatives have resulted in a 23.7% reduction in purchases of high-in beverages and a 4.8% increase in the consumption of healthier options, with more significant impacts observed among households with higher education levels (Taillie et al., 2020). Additionally, labels have prompted industry reformulation efforts, leading to an 8.9% reduction in sodium and a 64.3% decrease in trans fats. Despite these advantages, nutrition labels are still underutilized, and prior knowledge of nutrition enhances their effectiveness in capturing attention, improving understanding, and facilitating decision-making. The study also reveals that younger consumers prefer home-cooked meals over fast food, prioritizing taste, quality, hygiene, and ambiance, while showing an increasing demand for more information related to nutrition and hygiene (Goyal & Singh, 2007). Table 2.4.2 shows studies related to understanding of food labelling amongst people.

Table: 2.4.2 Studies on Understanding of food labelling

Title	Author, year, place	Participants/ study population	Key findings
Food literacy & food labeling laws—a legal analysis of India's food policy	O.P. Bera et.al, 2023		High-fat, salt, and sugar (HFSS) foods were prevalent, especially among children, leading to obesity and health risks. The Food Safety and Standards Authority of India (FSSAI) regulates food safety and labeling. Front-of-pack labeling (FOPL) is proposed to help consumers make informed choices. Effective labeling should be simple and relevant across diverse socioeconomic groups. Legal frameworks exist to ensure compliance and protect consumer health.
Information avoidance in consumer choice: do avoidance tendencies and motives vary by age	S.L. Deng et.al, 2023,	N=195	Across the studies, it is found that older adults tend to avoid decision-relevant but potentially distressing information more often than younger adults. Another study reported older age is associated with greater information avoidance. Older adults expressed less concern about the emotional impact of information, even though they prioritized emotion regulation over information seeking. The study found no clear association between avoidance motives or cognitive limitations and age, indicating that older adults may avoid information they view as less useful or potentially distressing.
Food labeling: analysis,	D. Martini et.al, 2021		Food labels provide essential information on ingredients, nutrients, and allergens. They influence consumers' perceptions and dietary choices. The special issue includes 25 contributions focusing on;

understanding, and perception			nutrient profiles and health claims, consumer understanding of food labels, impact of labeling on purchasing behaviour. Studies reveal variability in nutritional quality among products and the effectiveness of FOP labels.
An evaluation of Chile's Law of Food Labeling and Advertising on sugar-sweetened beverage purchases from 2015 to 2017: A before-and-after study	L.S. Taillie, 2020, Chile	N=2,383 households	This study concluded that high-in beverage purchases decreased by 23.7% (22.8mL/capita/day). Purchases of not-high-in beverages increased by 4.8%. Larger relative reductions observed in high-educated households.
A meta-analysis of food labeling effects on consumer diet behaviours and industry practices	S. Shangguan et.al, 2018,	Systematic review and meta-analysis of 60 studies across 11 countries	This review concluded that food labeling effectively influences dietary choices and industry practices. Food labels affect the consumption of total energy and fat while increasing vegetable consumption. Reduced energy intake by 6.6%, total at by 10.6% and unhealthy options by 13%. While increasing vegetable consumption by 13.5%. and industry reformulated products, reducing sodium by 8.9% and trans-fat by 64.3%.

Food labeling: revision of the nutrition and supplement facts labels	FDA, 2016		Several aspects were being covered in this revised version. Where, Class I nutrition (potassium) was removed, and Class II nutrient must meet 80% of declared value. Apart from nutrient content the focus was shed on the misbranding too, here it is stated that I declared nutrient values exceeding 20% is taken as misbranding under FD&C Act. Vitamins and minerals must be separated by the bar and type size requirements specification is mandatory for label formatting. Declaration of added sugar and additional non-digestible CHO need to be specified. Specific labeling requirements for infants, children, pregnant and lactating women is needed on a particular target group.
Impact of food labelling systems on food choices and eating behaviours: A systematic review and meta-analysis of randomized studies	M. Cecchini et.al, 2016,		Food labeling significantly influences consumers' choices towards healthier options by approximately 17.95%, reduces calorie intake by 3.59%, encourages the food industry to produce healthier options through nutrient reformulation, and interpretive labels were potentially more effective than other labelling schemes.

Impact of different front-of-pack nutrition labels on consumers purchasing intentions	P. Ducrot et.al, 2016	N=11,981	Here, the greater acceptability was given to the five-color nutrition label based on color coded and graded scale emphasizing overall nutrition quality in promoting healthier food choices among the population resulting in lowering the content of lipids, saturated fatty acids, and sodium. Followed by Multiple Traffic Lights. Also, the impact of different FOP labels was found to be similar across socio demographic groups.
The effects of nutrition knowledge on food label use: a review of the literature	L.M.S. Miller et.al, 2015		The study concluded that nutrition labels were underutilized by consumers despite their importance. Prior nutrition knowledge enhances effective use of food labels, aiding attention, comprehension, and decision-making. Research shows a positive correlation between nutrition knowledge and food label use. Most studies focus on nutrition labels; fewer examine ingredient lists and claims. Increasing nutrition knowledge may improve food label communication and dietary choices.
Consumer perception about fast food in India: an exploratory study	Goyal & Singh, 2007		It was found that young consumers prefer home-cooked meals over fast food. The key factors were taste, quality, ambience and hygiene. McDonald's rated higher than Nirula's on most attributes. Consumers also desire more information on nutritional values and hygiene.

2.4.3 CONSUMPTION OF HFSS FOODS

Several studies emphasize the intricate connection between the consumption of processed foods and living situations among the elderly. Individuals residing in multigenerational households tend to consume higher amounts of high-fat foods and sugar-sweetened beverages (SSBs) compared to those living independently, who frequently choose instant meals and drinks. In India, there are 23 categories of ultra-processed foods (UPFs) available, with traditional foods increasingly being altered through the use of additives such as anti-caking agents, flavor enhancers, and artificial colors (Jerath et al., 2024).

While these modifications may enhance their attractiveness, they often replace home-cooked meals. The consumption of high HFSS (high-fat, salt, sugar) foods is associated with both undernutrition, affecting 38% of children aged 6–10, and obesity, impacting 10% of adolescents aged 11–16, highlighting the critical need for nutritional education and intervention strategies (Bhat et al., 2024).

Emotional eating significantly influences unhealthy dietary choices, resulting in increased intake of fast foods, processed snacks, desserts, and SSBs, particularly during activities such as binge-watching. Lifestyle factors, including smoking, alcohol consumption, and sedentary behavior, further worsen poor dietary habits, while the practice of reading nutrition labels is linked to healthier food selections.

The study reveals concerning obesity statistics, with 18% classified as overweight, 40% as obese, and 90% exhibiting abdominal obesity. UPFs account for 17.8% of total food consumption and 37% of energy intake, with a notable rise in energy consumption during weekends. Although education and urbanization levels did not significantly affect UPF consumption, a closer proximity to supermarkets and restaurants was associated with reduced intake (Pinho et al., 2021). Meal skipping was more common among females and urban adolescents, often driven by snacking habits, with the most frequent snacking times occurring after school, while watching television, and in social settings with friends. Despite the prevalence of snacking, not all choices result in empty calories, as some traditional, healthier snacks continue to be included in the diet. This study highlights the necessity of promoting healthier eating practices and regulating the availability of HFSS foods to combat the growing burden of malnutrition and obesity (Savige et al., 2007). Table: 4.2.3 shows the connection between the consumption of

HFSS foods and related factors that is affecting the behaviour of purchasing ultra-processed foods.

2.4.4 SOCIO ECONOMIC STATUS

Previous research accentuates the influence of socioeconomic status (SES) on dietary habits and health outcomes. Individuals from lower-income backgrounds tend to consume more calorie-rich, nutritionally poor foods such as grains, whereas those from higher-income brackets favor fruits and meats. However, milk consumption remains uniformly low across all income levels due to cultural practices. A higher SES is associated with a broader variety of food choices, yet it also correlates with an increased consumption of high-fat, salt, and sugar (HFSS) products (Kalita et al., 2024). The prevalence of overweight and obesity is escalating among all socioeconomic strata, particularly among urban women in lower SES categories, suggesting that these health challenges are no longer confined to wealthier populations. Additionally, maternal education significantly influences health outcomes, exhibiting an inverted U-shaped relationship. Exposure to advertising plays a crucial role in shaping dietary preferences, with individuals of lower SES being more susceptible to unhealthy food marketing (Yau et al., 2021).

Women and working individuals report greater exposure to HFSS food advertisements than men. In the UK, individuals typically view between 1 to 4 hours of advertisements weekly, with lower SES groups facing a higher volume of unhealthy food promotions. Factors such as price, healthiness, taste, and the distance to grocery stores heavily impact meal choices for older adults, with healthiness being the paramount consideration. This study highlights the urgent need for targeted interventions to address nutritional inequalities and alleviate the rising incidence of obesity and non-communicable diseases across various socioeconomic groups (Kamphuis et al., 2015). Table: 2.4.4 shows the variation in socioeconomic strata and how it effects the people perception and behaviour of purchasing processed/ultra-processed foods.

Table: 2.4.3 Global and national studies examining the impact of HFSS food consumption

Title	Author, year, place	Participants/ study population	Key findings
Influence of multigenerational and living-alone households on high fat, sugar or sodium (HFSS) food consumption pattern in aging pattern	N. Loyfah et.al, 2025, Thailand	N=39,384 older adults i.e., 60 years or above	This study reported a significant association between processed food consumption and elderly living in multigenerational households. Elderly residing with children, or working-age people tend to consume more of food in fat, SSBs than to elderly living alone. Although it is reported that elderly living alone tend to purchase instant food and beverages.
Mapping ultra-processed foods (UPFs) in India: A formative research study	S. G. Jerath et.al, 2024		Indian consumers had access to 23 categories of UPFs. It was also evident that several traditional foods were being transformed into ultra-processed ones by using anti-caking agents, flavour enhancers, and artificial colours. Even though the nutrient composition of these traditional foods was the same but due to the look, the acceptance of it increased, even displacing cooked meals.

Trends of high fat, salt and sugar food consumption and its impact on nutritional status of school children	P. Bhat et.al, 2024,	N=360 school student (6- 16 years)	It was observed that high HFSS food consumption was linked to undernutrition and obesity. 38% of younger children (6-10 years) faced undernutrition; 10% of adolescents (11-16 years) were overweight. Urgent need for nutritional education and interventions is necessary to combat malnutrition. This can be manhandled by emphasizing and promoting healthy eating habits and regulating HFSS food availability
Association between emotional eating and frequency of unhealthy food consumption among Taiwanese adolescents	C. Bui et.al, 2021, Taiwan	N=18,461 adolescents	High emotional eating correlates with increased consumption of fast foods, high fat snacks, processed meats, dessert and sugar-sweetened beverages in ascending order. Generally, the consumption of HFSS foods is higher while doing some kind of activity like binge watching. Other factors like drinking, smoking, and sedentary lifestyle also contribute to unhealthy eating. Nutrition label reading is inversely associated with unhealthy food consumption. In short, emotional eating significantly influences unhealthy food choices in adolescents.
Consumption pattern of foods high in fat, salt, and sugar in the adult population of urban Vadodara	S. Dhruv et.al, 2021, Vadodara	N=400 adults	The findings came out as 18% overweight, 40% obese, 90% abdominally obese. High consumption of HFSS foods is linked to taste preference. Mean per capita intake: oil (56.15g), sugar (32.05g), salt (12.69g). Increased energy intake on weekends.

Ultra-processed food consumption patterns among older adults in the Netherlands and the role of the food environment	M.G.M. Pinho et.al, 2021, Netherlands	N=8104 older adults	It was evident that UPFs constituted 17.8% of food intake and 37% of energy intake. Closer proximity to supermarkets and restaurants is correlated with lower UPF consumption. There is no significant difference based on education or urbanization levels.
Snacking behaviours of adolescents and their association with skipping meals	G. Savige et.al, 2007, Australia	N=9842	The study concluded that meal skipping is more prevalent among females and urban adolescents. Frequent snacking on the run or at night linked to higher meal skipping rates. The most common snacking time is after school (4.6 times/week), watching TV (3.5), with friends (2.4). It is said that snacking context can aid in promoting healthier eating habits among adolescents.
Definitions and perception of snacking	A.P. Smith, 2006,	N=136	Participants consider snacks to be "food or beverages consumed between main meals." The frequency of eating episodes is found to be 3 meals and 1.5 snacks making it 4.5 in total, which is constant among all the age groups. With 80% people at the very least having one snack a day. Although it is observed that people also snack traditionally healthy foods so it varies in the nutritional value and hence not all snacks lead to empty calories and eventually obesity.

Table: 2.4.4 Global and national studies on Association between socioeconomic status and consumption and availability of HFSS foods

Title	Author, year, place	Participants/study population	Key findings
Income-based environmental effects of family food consumption and the affordability towards healthy diets	J. Kou et.al, 2024, China		Chinese residents vary significantly in terms of income, influencing food choices and nutritional intake. Lower-income groups consume more grain and cheap, calorie-dense foods with lower nutritional value, while higher-income groups prefer fruits and meats, though milk consumption remains low across all income levels due to traditional dietary habits.
Socio-economic patterns of diet, obesity, and biomarkers for cardiovascular disease among Indian adolescents	N. Kalita et.al, 2024, India	N=35,830	The study shows higher SES correlates with greater dietary diversity but increased consumption of unhealthy foods (HFSS). One in four adolescents show abnormalities in CVD biomarkers, with higher prevalence in urban and wealthier households. Maternal education influences health outcomes, revealing an inverted U-shaped trend.
Socioeconomic, eating- and health-related limitations	J. Hamulka et.al, 2021, Poland		The study summarized that lower socioeconomic status was linked to reduced fruit/vegetable and dairy intake. Eating-related limitations correlated with lower consumption of key food groups.

of food consumption among polish women 60+ years: the 'ABC of healthy eating' project			Health-related limitations were also associated with inadequate food intake.
Sociodemographic differences in self-reported exposure to high fat, salt and sugar food and drink advertising: a cross-sectional analysis off 2019 UK panel data	A. Yau et.al, 2021, United Kingdom	N=1552 Adults	With 84.7% of participants the exposure reported was high. The lower SES had higher odds of exposure to seeing or hearing advertising for less healthy foods, younger adults were more likely to report the self-administered exposure of such advertisements. Apart from that it is also evident that working subjects had an odd to report the exposure for sweet snacks whereas, the women had a higher rate of reporting advertisement for HFSS foods than men.
Trends in the socioeconomic patterning of overweight/obesity in India: a repeated cross-sectional study using	S. Luhar et.al, 2018, India	N=628795 women aged 15-49 93618 men aged 15-54 years	The study sums up by saying overweight/obesity is no longer solely a "disease of affluence." The findings were as follows; overweight/obesity increased among all socioeconomic positions (SEP), especially in urban areas. There is a significant rise among lower SEP individuals, particularly in urban women. Convergence in prevalence across SEP in urban areas, less so in rural areas.

nationally representative data			
Factor affecting food choices of older adults from high and low socio-economic groups: a discrete choice experiment	C.B.M. Kamphuis et.al, 2015		This study concluded that people belonging from high socioeconomic groups valued health more than people belonging from low socioeconomic groups. Also, it is evident that price, healthiness, taste, and travel time to the shopping place for groceries majorly influenced older adults' meal decisions. Healthiness being the most important food determinant followed by taste.
Socio-economic differences in exposure to television food advertisements in the UK: a cross-sectional study of advertisements broadcast in one television region	J. Adams et.al, 2012, United Kingdom	-	This study estimated that people residing in the UK watch advertisements for 1-4 hours a week, including 11 min of food advertising and at least 7 min of less healthy food advertising on average. With people from low socio background were exposed to few food advertisements, but their overall exposure to all type foods and HFSS food advertisement was much higher than people belonging from high socio background.

According to the aforementioned studies, it is evident that inadequate or poor dietary practices contribute to a rise in obesity, type 2 diabetes, and cardiovascular diseases worldwide, especially in economically disadvantaged areas. The trend of urbanization leads to an increase in the consumption of ultra-processed foods, exacerbating issues of malnutrition. The availability of unhealthy food options is linked to elevated obesity rates, while supermarkets encourage the selection of healthier alternatives. Hence, proximity plays a bigger role in shaping food behaviour. Economic status plays a significant role in food selection, with individuals from lower-income backgrounds tending to prefer calorie-rich foods. These measures have proven effective in curbing the consumption of unhealthy foods, particularly among lower-income populations. The present study is proposed to address the food purchasing behaviour among the adults in order to understand the trends and patterns of food purchasing especially of foods high in fat, sugar and salt to know the aggravating causes of consistent rise in NCDs and risk factors like obesity.

METHODS AND MATERIALS

METHODOLOGY

Obesity has emerged as a significant global public health concern, with its prevalence consistently increasing since the beginning of the 21st century. This observation underscores the escalating influence of obesity on a worldwide scale, drawing attention to its rising incidence over recent decades and its acknowledgment as a critical health challenge. (Chaudhary & Sharma, 2023). The increasing prevalence of non-communicable diseases (NCDs) can be primarily linked to the escalating intake of foods rich in fats, salt, and sugar. A multitude of studies have established a connection between these eating patterns and an increased likelihood of developing conditions such as type 2 diabetes, hypertension, cardiovascular diseases, and obesity. Being overweight and obese are acknowledged as major factors that lead to the emergence of various NCDs, affecting individuals of all ages.

The prevalence of non-communicable diseases (NCDs) has been increasing, posing considerable health challenges, primarily attributed to a rise in the intake of unhealthy foods. To comprehend and address the evolving dietary patterns, it was essential to assess the food purchasing habits of adults. Furthermore, research in India that examined food purchasing behaviors is scarce. Consequently, this study aimed to fill the identified gaps as highlighted in the literature review.

OBJECTIVES

Broad objective

To explore food purchasing behaviours amongst adults of urban Vadodara.

Specific objectives

1. To collect data on the socio-economic and nutritional status of the subjects.

2. To evaluate food purchasing behaviours of the enrolled subjects.

3. To identify barriers faced by the subjects in purchasing healthy foods.

ETHICAL APPROVAL

The institutional review board of the Maharaja Sayajirao University of Baroda's Faculty of Family and Community Sciences provided ethical approval for the study's design

and protocol. The ethical approval number for the present study was IECHR/FCSc/M.Sc./10/2024/36.

STUDY AREA

The study was conducted in the urban wards of Vadodara. Four hundred subjects (200 males and 200 females) were enrolled for the study using snowball sampling. All the subjects were healthy and were between the ages of 20- 59 years. The nature, purpose and benefits of the study were explained before obtaining written informed consent. The data was collected from all four wards of Vadodara, as per the Vadodara Municipal Corporation list.

STUDY DESIGN

Enrolment of subjects

The cross-sectional study was conducted in the four wards of urban Vadodara. The free-living population was selected through snowball sampling, and 100 participants from each ward (n=400) were included after obtaining informed consent.

Sample size calculation

Use **Slovin's formula** for sample size calculation

n = N / (1 + Ne2)

Where:

n = Number of samples,

N= Total adult population of Vadodara city (65% of total population [21 lakhs] as per Census 2011)

e = Error tolerance (level) 5%

Total sample size (n) = 399.88 ≈400

Final sample size rounded off to 400 population.

Figure 3.1: Study design
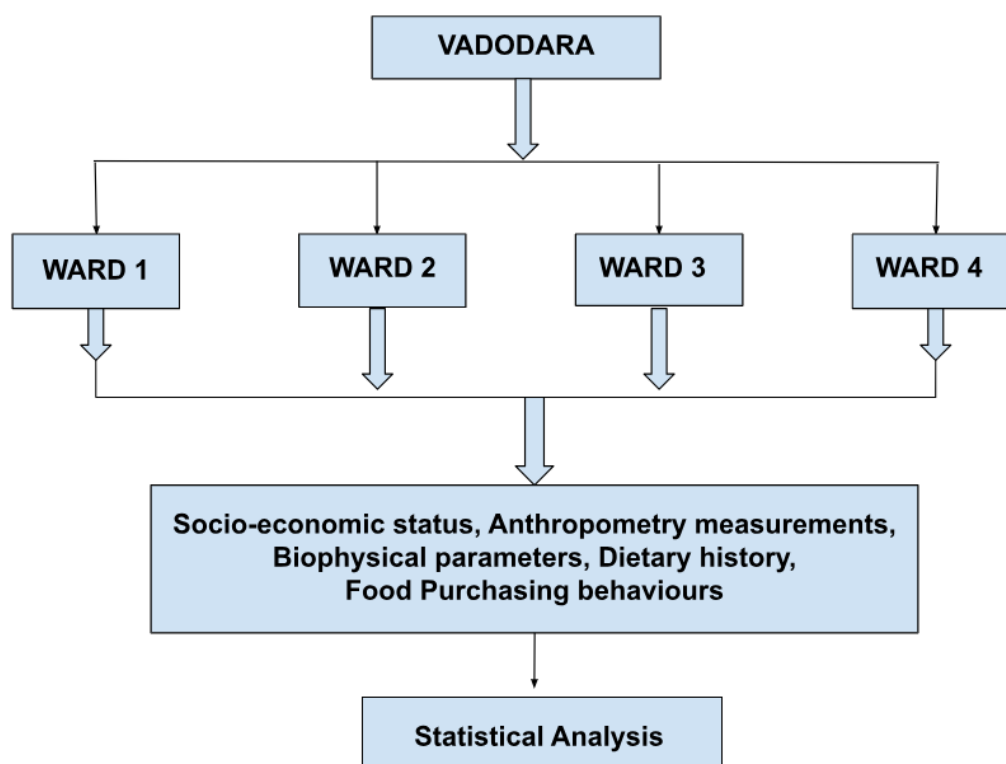
SOCIO-ECONOMIC STATUS

Information on the socio-economic profile of the subjects was collected using a semi-structured questionnaire (Modified Kuppuswamy socioeconomic scale 2023). Socioeconomic status (SES) is assessed by considering a family's income, the educational attainment of its members, and the occupation of the household head (Appendix III).

Table 3.1: Education Qualification categorization

Education Category
Professional degree
Graduate
Intermediate/ diploma
High school
Middle school
Primary school
Illiterate

(Source: Modified Kuppuswamy Scale, 2023)

Table 3.2: Occupation categorization

Occupational Category
Legislators, senior officials, managers
Professional
Technicians/ associate professional
Clerk
Skilled worker, shop and market sale workers
Skilled agricultural and fishery workers
Craft and related trade workers
Plant and machine operators and assemblers
Elementary occupation
Unemployed

(Source: Modified Kuppuswamy Scale, 2023)

Table 3.3: Income categorization

Income Category
≥146,104
109,580- 146,103
73,054- 109,579
68,455- 73,053
63,854- 68,454
59,252- 63,853
54,651- 59,251
45,589- 54,650
36,527- 45,588
21,914- 36,526
7,316- 21,913
≤7,315

(Source: Modified Kuppuswamy Scale, 2023)

ANTHROPOMETRIC MEASUREMENTS

In the current study, the following anthropometric measurements were collected using standard techniques;

Weight

A Digital Bathroom Weighing Scale was utilized to assess the body weight of the participant. The weight was determined using an electronic balance that provides 100% accuracy. Precautions were taken to ensure accurate readings, including minimal clothing, no footwear, and empty pockets. Initially, the scale was placed on a leveled surface, and after confirming the "zero" reading, participants were instructed to stand at the center of the scale with their weight evenly distributed on both feet, avoiding contact with any other objects. The recorded weight was noted in kilograms, rounded to the nearest 100 grams.

Height

The height was measured using a stadiometer.

BMI

According to the National Heart, Lung, and Blood Institute (NHLBI), BMI or Body Mass Index, is a metric that employs a straightforward formula to express the relationship between an individual's weight and height.

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

Table 3.4: Classification of BMI according to Asia Pacific criteria, 2004

Presumptive Diagnosis	Cut-offs
Underweight	>18.5
Normal	18.5- 22.9
Overweight	23.0- 24.9
Obese	≥25

Waist Circumference

According to the WHO protocol for measuring waist circumference, the measurement should be taken at the midpoint between the lower edge of the last palpable rib and the top of the iliac crest. The participant was instructed to breathe normally without tensing their muscles or holding their breath during the measurement. A non-stretchable fiberglass tape was employed for this assessment.

Hip Circumference

The measurement of hip circumference was conducted around the widest part of the buttocks using a non-stretchable fiberglass tape.

Waist Hip Ratio (WHR)

WHR = Waist circumference / Hip circumference

BODY COMPOSITION ANALYSIS

The Omron HBF-375 model for the Karada scan was used to evaluate the fat percentage. The subject's height was measured beforehand. Furthermore, for the fat percentage analysis, subjects were asked to wear the minimal clothing without gloves and socks. The details of the subjects including their height, age, and gender were entered into the machine. Then, the subjects were asked to stand on it and once the weight was measured, the subjects were given the bar and were asked to hold it at their shoulder level (90°) to analyze the fat percentage. Along with visceral fat, body age, resting metabolism, and regional body fat for trunk, arms, and legs, and muscle mass.

Body Fat

Fat plays an important role in good health—it's the body's way of storing energy to support your metabolism. There are two primary types of fat present in the human body: 1) essential fat, which is stored in minimal quantities to safeguard bodily functions, and 2) adipose tissue, or stored fat, which provides cushioning and insulation for internal organs, envelops nerves, facilitates the transport of vitamins throughout the body, and serves as the largest reservoir of energy available for physical activity. While excessive body fat can lead to health issues, insufficient fat levels can also pose significant health risks. Furthermore, the distribution of body fat varies between men and women, necessitating different criteria for classifying body fat percentage across genders. Body

fat percentage is defined as the proportion of body fat mass relative to total body weight, expressed as a percentage.

Body fat percentage (%) = {Body fat mass(kg) / Body weight (kg) × 100

Table 3.5: Categorization based on percent Body Fat

Classification	Male	Female
Low (-)	5.0- 9.9%	5.0- 19.9%
Normal (0)	10.0- 19.9%	20.0- 29.9%
High (+)	20.0-24.9%	30.0- 34.9%
Very high (++)	≥25.0%	≥35.0%

Source: (Omron health care)

Visceral Fat

Visceral fat is in the abdominal area and encases essential organs. This type of fat differs from subcutaneous fat, which is situated just beneath the skin. Visceral fat often remains undetected as it is not externally visible. An excess of visceral fat is believed to be associated with elevated fat levels in the bloodstream, potentially resulting in health issues such as high cholesterol, cardiovascular diseases, and type 2 diabetes.

Table 3.6: Categorization based on percent visceral fat

Category	Cut-off (%)
Normal (0)	≤9.9
High (+)	10- 14.9
Very high (++)	≥15

Source: (Omron health care)

Skeletal Muscle

Skeletal muscles are connected to the skeleton and function in pairs, with one muscle facilitating movement in one direction and the opposing muscle enabling movement in the opposite direction. An increase in skeletal muscle mass elevates the body's energy demands. Developing skeletal muscle can assist in averting "rebound" weight gain. The preservation and enhancement of skeletal muscle are significantly associated with the resting metabolic rate.

Table 3.7: Categorization based on percent Skeletal Muscle

Gender	Age	Low (-) %	Normal (0) %	High (+) %	Very high (++) %
Male	18- 39	<33.3	33.3- 39.3	39.4- 44.0	≥ 44.1
	40- 59	<33.1	33.1- 39.1	39.2- 43.8	≥ 43.9
	60- 80	<32.9	32.9- 38.9	39.0- 43.6	≥ 43.7
Female	18- 39	<24.3	24.3- 30.3	30.4-35.3	≥ 35.4
	40- 59	<24.1	24.1- 30.1	30.2- 35.1	≥ 35.2
	60- 80	<23.9	23.9- 29.9	30.0- 34.9	≥ 35.0

Source: (Omron health care)

BIOPHYSICAL MEASUREMENTS

Blood pressure was assessed utilizing a digital sphygmomanometer following standard procedures.

Table 3.8: Classification of Hypertension

Blood pressure category	Systolic (mm Hg)		Diastolic (mm Hg)
Normal	Less than 120	and	Less than 80
Elevated	120- 129	and	Less than 80
HTN Stage I	130- 139	or	80- 89
HTN Stage II	140 or higher	or	90 or higher
Hypertensive crisis	Higher than 180	and/or	Higher than 120

(Source: American Heart Association, 2018)

MEDICAL AND FAMILY HISTORY

The medical and family histories of the participants were gathered to identify any existing co-morbidities or complications, such as diabetes, hypertension, chronic heart disease, cancer, or other relevant conditions using a semi structured questionnaire (Appendix III).

DIETARY PATTERN

The evaluation of the subjects' dietary patterns was conducted through a structured questionnaire addressing the following areas:

Food Habits: Information regarding eating behaviors, meal skipping, frequency of dining out, and food preferences while eating out was collected (Appendix III).

Food Purchasing Behavior: Participants' understanding of food labeling, motivations for consuming high-fat, sugar, and salt (HFSS) foods, and their preferred purchasing habits were assessed (Appendix III).

24-hour Dietary Recall: Data on food consumption over the previous 24 hours was obtained. Each subject provided a 3-day dietary recall (comprising two weekdays and one weekend), excluding any fasting or feast days (Appendix IV).

Food Frequency Questionnaire: Food Frequency method was used to assess habitual food intake of the subjects, qualitatively. The frequency of consumption of foods high in fat, salt, and sugar was recorded using a food frequency questionnaire that included 80 food items, designed to evaluate the intake of specific foods rich in these components. The frequency was daily, 4-5 times a week, thrice a week, once a week, once in 10 days, fortnightly, once a month, occasionally, and never (Appendix V).

Household Dietary Diversity Score: It serves as a proxy indicator to evaluate a household's access to a range of food options. It reflects food security and the variety of food groups consumed within the past 24 hours (Appendix VI).

TOOLS AND PARAMETERS

Table 3.9: Tools and techniques used for data collection

S/N	Parameters	Tools
1	**Background information**	Semi-structured Questionnaire*
2	**Socio-Economic status**	Semi-structured Questionnaire* (Modified Kuppuswamy Scale, 2023)
3	**Medical History (self and family)**	Semi-structured Questionnaire*
4	**Anthropometry measurements**	
	Weight (kg)	Bathroom scale
	Height (cm)	Stadiometer
	Body Mass Index	Calculation
	Waist circumference	Fibre glass tape
	Hip circumference	Fibre glass tape
	Waist Hip Ratio (WHR)	Calculation (WHO, 2008)
	Body Composition	Bio Impedance using Karada scan (Omron HBF-375 model)
5	**Biophysical parameters**	
	Hypertension	Sphygmomanometer (AHA, 2017)
6	**Dietary practices**	
	Three consecutive days 24 Hour Dietary recall	Semi-structured Questionnaire*
	Food Frequency Questionnaire	Structured Questionnaire*
	Household Dietary Diversity	Structured Questionnaire* (FANTA, 2006)
7	**Food Purchasing behaviours**	Semi-structured Questionnaire*

*All semi-structured questionnaires were administered using Epicollect 5

INCLUSION AND EXCLUSION CRITERIA

Inclusion criteria

- All individuals between the ages of 20-59 years who expressed a willingness to participate.

Exclusion criteria

- Individuals who were unwilling to participate.

DATA MONITORING, MANAGEMENT AND ANALYSIS

The data was entered and then analysed using Microsoft excel (2016 or above), and SPSS version 20 or above.

- Frequency distribution and percentage was calculated for all parameters that were expressed in a rank order fashion.
- Means and standard errors was calculated for all parameters that was expressed numerically.
- Analysis of variance and independent 't' test was used to compare differences between the means in different groups.
- Chi-square test was used to assess the differences between the frequency distribution of the groups.

RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

The World Health Organization acknowledges that excessive consumption of sodium, sugar, and fats is linked to the onset of chronic conditions, including diabetes and cardiovascular diseases (Waxman & World Health Assembly, 2004). A strong preference for salty foods can impede the healthy eating pattern, especially in mean and women with limited education (Carbonneau et al., 2021).

Four hundred participants, comprising 200 males and 200 females, were enrolled for the study. The study aimed to explore the food purchasing behaviours of adults living in urban Vadodara.

Results of the study will be presented under the following sections:

- Socio- economic and background profile of the subjects
- Medical History
- Anthropometric data
- Biophysical measurements
- Dietary intake data
- Food purchasing behaviours

The mean age for male and female subjects was found to be 38.9±12.4 years and 39.1±12.4 years respectively. The subjects were fairly distributed among four age categories: 20-29 years (24.8%), 30-39 years (25.3%), 40-49 years (25.0%), and 50-59 years (25.0%). The gender distribution among the sample was of equal number of males (50.0%) and females (50.0%). A significant majority of respondents (65.0%) were part of nuclear families, with joint families comprising 24.5% and extended families making up 10.5%. Whereas, a large portion of the participants were married (72.5%), while 27.0% were unmarried, and a minor percentage (0.5%) were engaged (Table 4.1).

SOCIO-ECONOMIC STATUS

The table 4.2, illustrates the socio-economic aspects. There was diversity in terms of education, occupation and the income of the household. For the majority of subjects, family head had attained graduation/post-graduation comprising of 40.3%, followed by high school, intermediate/diploma, middle school, and professional degree with 22.5%, 19%, 10.0%, and 3.3% respectively.

Table: 4.1 Background information of the subjects (N=400)

Variable	Response	n (%)
Age category	20- 29	99 (24.8)
	30- 39	101 (25.3)
	40- 49	100 (25.0)
	50- 59	100 (25.0)
Gender	Female	200(50.0)
	Male	200(50.0)
Type of family	Extended	42 (10.5)
	Joint	98 (24.5)
	Nuclear	260 (65.0)
Marital status	Engaged	2 (0.5)
	Married	290 (72.5)
	Unmarried	108 (27.0)

Values in parenthesis indicate percentages

Very few reported to have completed their primary schooling or were illiterates. Further, the same trends were shown in the occupation of the head too, where also diverse occupations were noted. Around 22.8% were skilled worker, shop and market sales worker, suggested mostly businesses were handled here, followed by professional occupations, clerk, legislators, senior officials, managers, skilled agricultural and fishery workers and elementary occupation with 16.0%, 14.3%, 9.5%, 7.0% and 2.8%. Other were reported to have less frequency. A notable proportion of subjects, i.e., one fourth were unemployed at the moment. Also, it was reported people living in joint or extended families had the elderly as a head of the household.

Table 4.2.1, represented the socio-economic status (SES) distribution of the study participants, categorized into five groups i.e., upper, upper middle, lower middle, upper lower and lower. Nearly 6.5% of people belonging from upper socio-economic status, followed by the upper middle also the majority of subjects comprising of 42% of the total population. More than one-fourth of the population i.e., 33.25% was from lower middle-class category. Almost 18.0% of subject belonged to upper lower class, means they faced financial hardships that may impact the quality of diet and overall health. Only 1 individual belonging from lower category indicating the economically disadvantaged group.

Table 4.2: Socio-economic status (N=400)

Variable	Response	n (%)
Education of the head of the family	Professional degree	13 (3.3%)
	Graduate/post graduate	161 (40.3%)
	Intermediate/diploma	76 (19%)
	High school	90 (22.5%)
	Middle school	40 (10.0%)
	Primary school	11 (2.8%)
	Illiterate	9 (2.3%)
Occupation of the head of the family	Legislators, senior officials, managers	38 (9.5%)
	Professional	64 (16.0%)
	Technicians/associate professionals	3 (0.8%)
	Clerk	57 (14.3%)
	Skilled worker, shop and market sales worker	91 (22.8%)
	Skilled agricultural and fishery workers	28 (7.0%)
	Craft and related trade workers	5 (1.3%)
	Plant and machine operators and assemblers	2 (0.5%)
	Elementary occupation	11 (2.8%)
	Unemployed	101 (25.3%)
Household income	≥ 146,104	25 (6.3)
	109,580- 146,103	14 (3.5)
	73,054- 109,579	31 (7.8)
	68,455- 73,053	16 (4.0)
	63,854- 68,454	19 (4.8)
	59,252- 63,853	21 (5.3)
	54,651- 59,251	37 (9.3)
	45,589- 54,650	49 (12.3)
	36,527- 45,588	45 (11.3)
	21,914- 36,526	88 (22.0)
	7,316- 21,913	54 (13.5)
	≤7,315	1 (0.3)

Values in parenthesis indicate percentages

Table 4.2.1: Categorization of Socio-economic status (N=400)

Variables	Response	n (%)
Category SES (As per Modified Kuppuswamy Scale 2023)	Upper (I)	26 (6.5)
	Upper middle (II)	168 (42.0)
	Lower middle (III)	133 (33.25)
	Upper lower (IV)	72 (18.0)
	Lower (V)	1 (0.3)

Values in parenthesis indicate percentages

MEDICAL AND FAMILY HISTORY

The medical history for self and family shows that diabetes and hypertension were the two most prevalent medical conditions among the subjects. With diabetes being most prevalent in fathers (13.3) and hypertension in mothers (13.5). Whereas, for self-reporting it was observed that 6.5% of subjects were diabetic, while 8.5% being hypertensive. Also, 68.3% and 5.5% reported no history of hypertension and diabetes in their family. A notable percentage (78.3%) did not take any dietary supplements, whereas 21.8% did incorporate them into their diets (as shown in table 4.3).

ANTHROPOMETRIC DATA

A comprehensive anthropometric assessment was conducted on a sample of 400 subjects, (as shown in table 4.4) the subjects exhibited mean weight and height of 66.01 ± 13.12 kg and 161.45 ± 9.10 cm in general respectively. With their BMI at an average of 25.4 ± 4.78 kg/m^2 which falls under obese category, as per Asia Pacific classification. The further measurements indicated a mean waist circumference of 89.3 ± 11.2 cm and a hip circumference of 100 ± 10.2 cm. The Waist Hip Ratio (WHR) was calculated to be 0.887 ± 0.08, indicating a moderate distribution of body fat and a potential metabolic risk.

Table 4.4.1 illustrates anthropometric characteristics of both males and females, presented as mean ± standard deviation. Males demonstrated a marginally greater weight (66.8 kg) and height (162 cm) than females, who weighed 65.2 kg and measured 161 cm. Conversely, males exhibited a higher body mass index (BMI) of 25.6 compared to 25.1 for females.

Table 4.4.2 outlines the anthropometric attributes across various age categories (20–29, 30–39, 40–49, and 50–59 years). Weight remained consistent among the different age groups, with a minor rise observed in the 40–49 age category, where the average weight was 67.3 kg. Height tends to decrease slightly with advancing age, dropping from 164 cm in the youngest cohort to 161 cm in the older groups. The Body Mass Index (BMI) showed an upward trend with age, increasing from 24.9 ± 14.9 in the 20–29 age group to 25.6 ± 4.43 in the 50–59 age group, indicating a gradual rise in body mass over time. Additionally, waist and hip circumferences were greater in the older group, with means of 93.51 ± 10.01 cm and 102.90 ± 9.89 cm, respectively, compared to 85.14 ± 10.79 cm and 97.54 ± 9.86 cm in the younger group. This disparity was also evident in the

Waist-to-Hip Ratio (WHR), which was significantly higher in the older age group (0.90 ± 0.073) than in the younger group (0.86 ± 0.082), collectively all the differences in waist and hip circumference leading to difference in WHR among younger and older adults was statistically significant (p<0.001).

Body Mass Index

The table 4.4.3, presents the Body Mass Index (BMI) distribution of the study participants (N=400). The majority of subjects were falling into obese category comprising of 53.5%, followed by normal, and overweight with 23.8% and 15.5 respectively. 7.3% of the total population was from underweight category.

The following table 4.4.4, illustrates the relation between BMI along with gender, which was found to be statistically significant where p <0.001, which suggested that gender had an impactful association with BMI categories. Among males, 4.5% were underweight, whereas only 2.8% of females were found to be underweight. Sixteen percent males were under normal category whereas nearly double the proportion of females i.e., 7.8% were normal. Around 9.3% and 6.3% of males and females respectively fell in overweight category. A significantly higher proportion of females (33.3%) were found to be obese compared to males (20.3%).

When looking at the BMI with age per se, it was also found to be statistically significant with 'p' value being <0.001, which expressed that the BMI distribution was meaningfully different between the age categories. In younger adults, underweight were found to be 6.5%, whereas 0.8% in older adults. Younger adults (20-39 years) were found to be double the proportion in normal category i.e., 16.0% than the older adults. The percentage of overweight individuals were almost the same with 7.5% and 8.0% in younger and older adults respectively. Obesity was most commonly observed in older adults with 33.5% compared to 20.0% of young adults. From the given data, we can conclude that, there was a declined trend in normal BMI with age (as shown in table, 4.4.5).

In summary, the data indicate a progressive increase in fat accumulation, a reduction in muscle mass, with age, underscoring the necessity for health interventions tailored to different age groups.

Table 4.3: Medical and Family history of the subjects (N=400)

Type	Self	Mother	Father	Siblings	Grand parents	None
Diabetes	26 (6.5)	49 (12.3)	53 (13.3)	5 (1.3)	19 (4.8)	22 (5.5)
Hyper tension	34 (8.5)	54 (13.5)	43 (10.8)	3 (0.8)	17 (4.3)	273 (68.3)
Coronary heart diseases	3 (0.8)	1 (0.3)	6 (1.5)	1 (0.3)	1 (0.3)	388 (97.0)
Hyper-lipidemia	6 (1.5)	3 (0.8)	11 (2.8)	0 (0.0)	1 (0.3)	379 (94.8)
Stroke	0 (0.0)	0 (0.0)	2 (0.5)	0 (0.0)	1 (0.3)	397 (99.3)
Hypo/hyper thyroidism	15 (3.8)	16 (4.0)	2 (0.5)	2 (0.5)	5 (1.3)	360 (90.0)
Asthma	2 (0.5)	2 (0.5)	1 (0.3)	1 (0.3)	2 (0.5)	392 (98.0)
Cancer	0 (0.0)	1 (0.3)	4 (1.0)	0 (0.0)	1 (0.3)	394 (98.5)
Dietary supplements	No			313 (78.3)		
	Yes			87 (21.8)		

Values in parenthesis indicate percentages

Table 4.4: Mean values for anthropometric data of the subjects (N=400)

Variable	Mean ± SD
Weight (kg)	66.01± 13.12
Height (cm)	161.45 ± 9.10
BMI (kg/m^2)	25.4 ± 4.78
Waist circumference (cm)	89.3 ± 11.2
Hip circumference (cm)	100 ± 10.2
Waist Hip Ratio	0.887 ± 0.08

Table: 4.4.1 Mean anthropometric measurements – Gender wise (N=400)

Variable	Male	Female
	(mean ± s.d)	
Weight (kg)	66.8 ± 12.7	65.2 ± 13.5
Height (cm)	162 ± 8.99	161 ± 9.22
BMI (kg /m²)	25.6 ± 4.81	25.1 ± 4.75

Table: 4.4.2 Mean anthropometric measurements – Agewise (N=400)

Variables	20- 29	30- 39	40- 49	50- 59	Total	't' value
Weight (kg)	66.4 ± 12.6	64.1 ± 13.5	67.3 ± 14.4	66.3 ± 11.9	66.01 ± 13.1	1.180[NS]
Height (cm)	164 ± 9.10	160 ± 8.87	161 ± 9.89	161 ± 8.26	161.45 ± 9.1	0.939 [NS]
BMI (kg /m²)	24.9 ± 4.91	24.9 ± 25.4	25.9 ± 4.77	25.6 ± 4.43	25.34 ± 4.78	1.722 [NS]
Waist circumference (cm)	81.253 ± 10.784	88.965 ± 9.384	92.635 ± 8.434	94.399 ± 11.351	89.332 ± 11.210	8.039***
Hip circumference (cm)	94.874 ± 10.360	100.158 ± 8.624	102.940 ± 9.345	102.875 ± 10.464	100.225 ± 10.225	5.431***
WHR	0.853 ± 0.0962	0.884 ± 0.0643	0.896 ± 0.0703	0.913 ± 0.0763	0.887 ± 0.0804	4.583***

(***- Significant at $p<0.001$) (NS – Not Significant)

Table 4.4.3: BMI categories of the subjects (N-400)

BMI categories (Asia Pacific)	n (%)
Underweight (< 18.5 kg/m²)	29 (7.3)
Normal (18.5–22.9 kg/m²)	95 (23.8)
Overweight (23.0- 24.9 kg /m²)	62 (15.5)
Obese (>25 kg /m²)	214 (53.5)

Values in parenthesis indicate percentages

Table 4.4.4: Body mass Index categories- Genderwise (N-400)

BMI categories (Asia Pacific)	Male	Female	Total	Chi-square
Underweight	18 (4.5)	11 (2.8)	29 (7.3)	28.111***
Normal	64 (16.0)	31 (7.8)	95 (23.8)	
Overweight	37 (9.3)	25 (6.3)	62 (15.5)	
Obese	81 (20.3)	133 (33.3)	214 (53.5)	

Values in parenthesis indicate percentages (***- Significant at $p<0.001$)

Table 4.4.5: Body mass Index Categories- Agewise

BMI categories (Asia Pacific)	20-39 years	40-59 years	Total	Chi-square
Underweight	26 (6.5)	3 (0.8)	29 (7.3)	43.395***
Normal	64 (16.0)	31 (7.8)	95 (23.8)	
Overweight	30 (7.5)	32 (8.0)	62 (15.5)	
Obese	80 (20.0)	134 (33.5)	214 (53.5)	

Values in parenthesis indicate percentages (***- Significant at $p<0.001$)

Table 4.4.6: Prevalence of Abdominal obesity- Genderwise

Gender	Wasit circumference		Total	Chi-square
	Normal	Abdominal obesity		
Male	103 (25.8)	97 (24.3)	200 (50.0)	33.451***
Female	47 (11.8)	153 (38.3)	200 (50.0)	

Values in parenthesis indicate percentages (***- Significant at p<0.001)

Table 4.4.7: Prevalence of Abdominal obesity- Agewise

Age Category	Wasit circumference		Total	Chi-square
	Normal	Abdominal obesity		
20-39 years	106 (26.5)	94 (23.5)	200 (50.0)	41.003***
40-59 years	44 (11.0)	156 (39.0)	200 (50.0)	

Values in parenthesis indicate percentages (***- Significant at p<0.001)

Figure 4.1: BMI Categories- Agewise
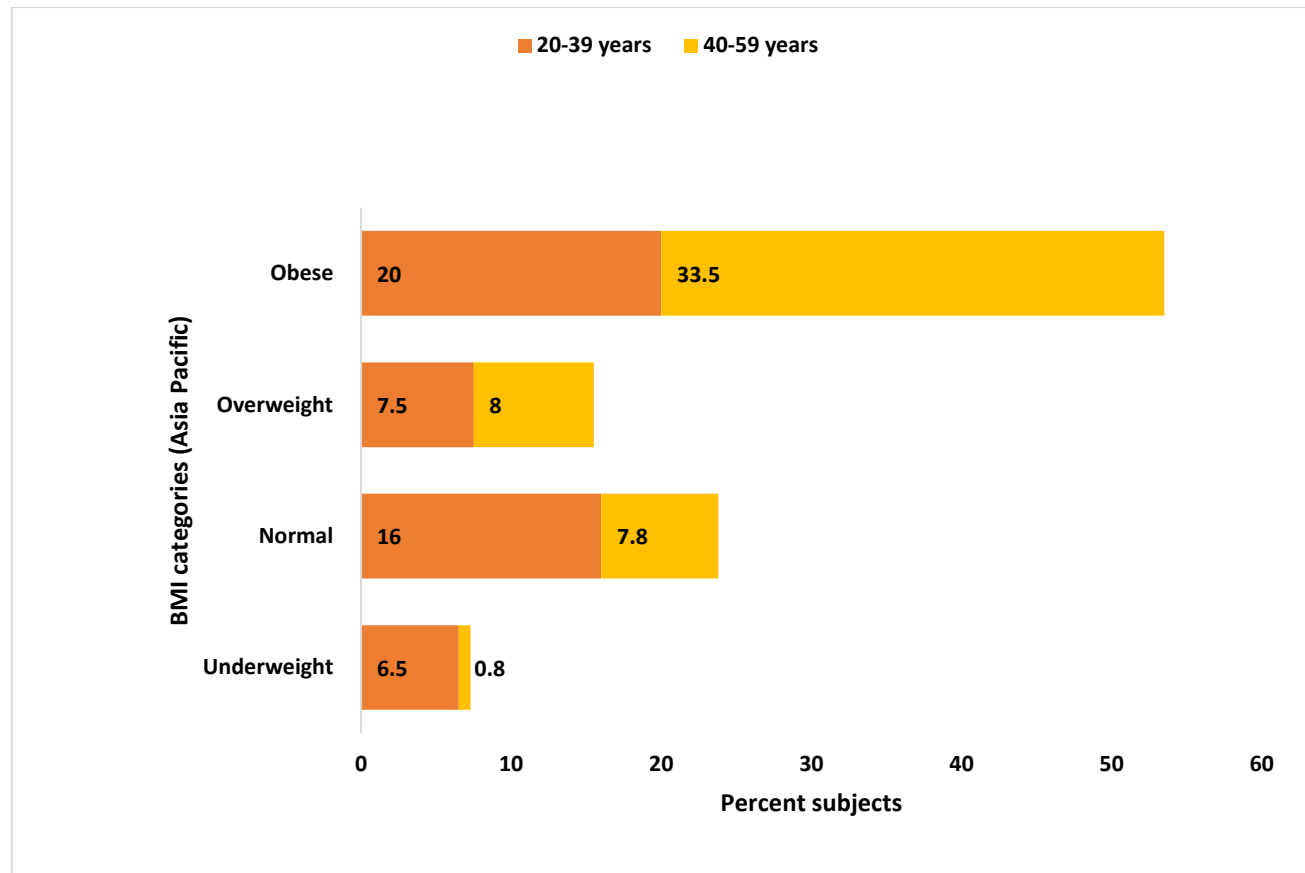
Table 4.4.6 represents the association between waist circumference and gender. Almost one-fourth males and 11.8% of females were found to be have a normal waist circumference whereas, 24.3% of males had abdominal obesity. Abdominal obesity was significantly higher in females i.e., 38.3%. This difference was also found to be significantly different with p value being <0.001, expressed that gender plays a role in the onset of abdominal obesity. The data indicated that higher proportion of females were at risk of other metabolic disorders. The odds ratio i.e., 0.289, with a 95% confidence interval from 0.188 to 0.444, suggested that the odds of the people being abdominally obese was higher among females than in males.

The table 4.4.7, illustrates the relation between the waist circumference and age. Nearly 26.5% of younger adults (20-39 years) and 11.0% older adults (40-59 years) were found to be normal. The result indicated that as age increased the normal waist circumference tend to decrease. While, 23.5 % and 39.0% of younger and older adults were having abdominal obesity, which showed that the prevalence of abdominal obesity increased considerably with age, nearly doubling between the younger and older adults. This difference in the circumference of waist with age was statistically significant with 'p' value of <0.001. Here, the odds ratio was 3.998, from 2.588 to 6.176, this indicated that the risk of individual being abdominally obese was approximately 4 times higher in older adults than in younger adults.

BIOPHYSICAL MEASUREMENTS

Mean overall SBP and DBP for all the subjects was found to be 125 ± 20.1 mm of Hg and 85 ± 12.3 mm of Hg respectively. The observed SBP and DBP measurements indicate that most subjects were classified within the normal range to pre-hypertensive range. The SD values revealed significant variability in BP readings among the subjects, highlighting individual variations in cardiovascular health (as shown in table 4.5).

Gender wise analysis for biophysical metrics as shown in table 4.5.1, revealed that males exhibited elevated systolic blood pressure (131.71 mmHg) and diastolic blood pressure (88.67 mmHg) in contrast to females, who had readings of 119.07 mmHg and 81.42 mmHg, respectively. This result underscores the differences between genders in terms of cardiovascular health indicators.

Table 4.5: Mean Blood Pressure of the subjects (N=400)

Variables	Mean ± SD
SBP (mm Hg)	125 ± 20.1
DBP (mm Hg)	85 ± 12.3

Table 4.5.1: Gender wise mean blood pressure of subjects

Variables	Male	Female	Total
SBP	131.710 ± 18.072	119.070 ± 20.012	125.39 ± 20.06
DBP	88.665 ± 12.575	81.415 ± 10.962	85.04 ± 12.32

Table 4.5.2: Age wise mean blood pressure of subjects

Variable	20-29 years	30-39 years	40-49 years	50-59 years	Total
SBP (mm Hg)	115.616 ± 16.993	120.960 ± 18.230	127.750 ± 17.658	137.180 ± 20.687	125.390 ± 20.067
DBP (mm Hg)	81.152 ± 12.175	83.881 ± 11.825	87.750 ± 11.887	87.350 ± 12.406	85.040 ± 12.328

Table 4.5.3: Age vs Blood Pressure

Variables	20-39 years	40-59 years	't' test	ANOVA
SBP (mm Hg)	118.31 ± 17.78	132.46 ± 17.75	7.527***	56.658***
DBP (mm Hg)	82.53 ± 12.04	87.55 ± 12.04	4.154***	17.256***

(***- Significant at $p < 0.001$)

Age wise analysis of BP as shown in table 4.5.2, concluded that both systolic and diastolic blood pressure rise with age, with systolic blood pressure (SBP) increasing from 115.6 mmHg to 137.2 mmHg, and diastolic blood pressure (DBP) rising from 81.15 mmHg to 87.75 mmHg, indicating an elevated risk of hypertension among older individuals.

The table 4.5.3, illustrates the comparing means of systolic and diastolic blood pressure means across two broader age groups (20-39 years and 40-59 years). The average mean of SBP was greater in older adults compared to the younger counterparts, which was 132.46 ± 17.75 and 118.31 ± 17.78 respectively. Similar trend was observed for DBP that was 87.55 ± 12.04 in older and 82.53 ± 12.04 in younger adults. Significant differences were observed in blood pressure readings between the two age groups. The older group had a notably higher systolic blood pressure (132.46 ± 19.75 mmHg) than the younger group (118.31 ± 17.78 mmHg), with a significant 't' value of 7.527. Similarly, diastolic blood pressure was significantly elevated in the older group (87.55 ± 12.12 mmHg) compared to the younger group (82.53 ± 12.04 mmHg), with a 't' value of 4.154 and p <0.001 for both systolic and diastolic blood pressure. Even there was a significant difference in the variance of SBP and DBP which reinforced the observation that blood pressure varies meaningfully with age.

Table 4.5.4, represents a summary of blood pressure distribution among all the subjects, as observed only 1.0% of the participants showed signs of hypotension, which may raise concerns if symptomatic but is generally less prevalent than hypertension. While more than half of the participants (54.3%) exhibited normal blood pressure levels, reflecting a relatively healthy segment of the population. Whereas, 3.0% of individuals fall into the category of elevated Hypertension (prehypertension), which suggests a risk of progression to hypertension if preventive measures were not taken. 19.0% of subjects fell into the category of Hypertension Stage I, required lifestyle modifications and, in some cases, medical intervention. Besides that, a notable percentage (21.5%) was identified as having Stage II hypertension, requiring clinical oversight and possible medication. However, a small fraction (1.3%) of participants were signifying critically high blood pressure that demands urgent medical intervention.

This data showed that some form of hypertension, indicating a considerable public health issue, affects a significant portion of the study population (41.8%). Although

more than half of the participants maintained normal blood pressure, the existence of elevated and hypertensive cases highlights the necessity for focused interventions. The results emphasize the urgent need for lifestyle modification initiatives, consistent monitoring, and possible pharmacological treatments to manage hypertension and avert complications such as cardiovascular diseases.

Table: 4.5.4 Prevalence of Hypertension (N=400)

Variable	Response	n (%)
Blood Pressure	Hypotension	4 (1.0)
	Normal	217 (54.3)
	Elevated HTN	12 (3.0)
	HTN stage I	76 (19.0)
	HTN stage II	86 (21.5)
	Hypertensive crisis	5 (1.3)

Values in parenthesis indicate percentages

Table 4.5.5: Stages of HTN and Age

Variables	20-29	30-39	40-49	50-59	Total	Chi-square
Hypotension	4 (1.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (1.0)	64.908***
Normal BP	70 (17.5)	66 (16.5)	51 (12.8)	30 (7.5)	217 (54.3)	
Elevated BP	3 (0.8)	5 (1.3)	3 (0.8)	1 (0.3)	12 (3.0)	
HTN stage I	9 (2.3)	15 (3.8)	21 (5.3)	31 (7.8)	76 (19.0)	
HTN stage II	13 (3.3)	14 (3.5)	23 (5.8)	36 (9.0)	86 (21.5)	
Hypertensive crisis	0 (0.0)	1 (0.3)	2 (0.5)	2 (0.5)	5 (1.3)	

Values in parenthesis indicate percentages (***- Significant at $p < 0.001$)

Table 4.5.5, illustrates the association between stages of hypertension and age categories. The analysis revealed significant variation between variables with a chi-square value of 64.908 (p <0.001%), showing a statistically significance between the two variables also.

The analysis of hypertension stages across various age demographics revealed significant trends. Hypotension was solely identified in the youngest demography (ages 20-29), with four individuals (1.0%) from the sample affected by this condition. The majority of participants, specifically 54.3%, displayed normal blood pressure, with the highest percentage occurring in the 20-29 age group totaling 17.5%, followed by 30-39 with 16.5%. it was observed that, as age increased the number of individuals with normal blood pressure decreased with 12.8% in 40-49 age group and 7.5% in the 50-59 age group. Elevated blood pressure was relatively uncommon across all age groups totaling 3.0%, with the 30-39 age group exhibiting the highest occurrence, comprising 1.3% of the total sample. The prevalence of hypertension stages I and II increased with age, peaking particularly notable in the 50-59 age group, where these stages represented 19.0% and 21.5% of the total subjects, respectively. Instances of hypertensive crisis were rare, with only 1.3% reported, distributed among the three older age groups. Notably, the youngest adults (20-29) exhibited a wider range of blood pressure compared to older age group subjects. The data concluded a trend of rising hypertension prevalence as age advanced, while it contradicts with the normal blood pressure with increasing age. Hence, indicating that blood pressure profiles undergo considerable changes as individuals age.

The prevalence of hypertension among the study population was determined to be 41.8%. However, 8.5% of respondents reported having a self-history of hypertension, implying a high discrepancy between awareness and diagnosis. The gap points towards a large percentage of the population being at risk of having undiagnosed hypertension, pointing towards a greater need for more screening, education, and early detection in order to enhance health outcomes. It was gathered that this generally happened because of the perceived feeling of not being ill with underlying ailments as they appeared to be physically fit.

BODY COMPOSITION

Table 4.6 outlines essential body composition metrics, such as fat percentage, visceral fat, and skeletal muscle distribution, among a cohort of 400 participants. A significant majority of participants (56.3%) were classified under "Very High" fat percentage category, indicating a considerable number with excessive body fat. Additionally, 17.3% were categorized as having a "High" fat percentage, while 11.8% maintained "Normal" levels. A smaller segment (14.8%) was identified with a "Low" fat percentage whereas, over half of the participants (55.3%) exhibited visceral fat levels of ≤9, which is regarded as healthy. A further 29.8% fell within the 10-14% range, suggesting a moderate risk. Notably, 15.0% have visceral fat levels of ≥15, indicating a heightened risk for metabolic disorders. Lastly, among those aged 20-39, 29.3% display low skeletal muscle, while 20.6% have normal levels, and only 0.3% possess high muscle mass. In the 40-59 age group participants, a significant portion (48.9%) shows low skeletal muscle, with merely 1.3% achieving normal levels. The percentage of body fat was significantly elevated in the older group (34.05 ± 6.82) compared to the younger group (28.93 ± 7.95). Likewise, visceral fat levels were considerably higher in the older participants (11.66 ± 5.077) than in the younger group (7.01 ± 4.69). Conversely, skeletal muscle mass was more pronounced in the younger age group (28.25 ± 5.22) compared to the older group (24.88 ± 4.007), with a highly significant difference reflected with a $p<0.001$.

A substantial segment of the study population demonstrated elevated body fat levels, which may heighten the risk of health complications associated with obesity. The distribution of visceral fat indicated that while more than half of the participants maintained healthy levels, nearly 45% were categorized within moderate to high-risk groups. The high incidence of low skeletal muscle, particularly in the 40-59 age group, raises concerns regarding age-related muscle deterioration, which could adversely affect physical capabilities and metabolic health.

Table 4.6: Body composition analysis of subjects (N=400)

Variable	Response	n (%)	't' value
Fat percentage (%)	Low	59 (14.8)	6.907***
	Normal	47 (11.8)	
	High	69 (17.3)	
	Very high	225 (56.3)	
Visceral fat (%)	≤9	221 (55.3)	9.507***
	10-14	119 (29.8)	
	≥15	60 (15.0)	
Skeletal muscle (%)	20- 39 Low	117 (29.3)	7.229***
	20- 39 Normal	82 (20.6)	
	20- 39 High	1 (0.3)	
	40-59 Low	195 (48.9)	
	40- 59 Normal	5 (1.3)	

Values in parenthesis indicate percentages (***- Significant at $p<0.001$)

Table 4.6.1, shows the mean value for assessed body age. The body age was greater in females (50.82 years) than in males (43.30 years), which usually occurs due to inflammation occurred in body that results in the greater body age than the chronological one. Table 4.6.2 expresses the mean of difference in body age according to age of the subjects. The mean difference in body age was 6.465 ± 9.67 years in 20-29 years, while 9.752 ± 9.93 years was for people belonging from 30- 39 years age category. Thus, a greater average difference signified that individual who belonged to higher age group were having body age further from their chronological age. This trend was also seen in the 40-49 years age group with the mean difference in body age 9.520 ± 8.16 years. While mean difference declined back to 6.470 ± 10.71 for 50-59 years individual, showed the variability within the group for their body age with respect to chronological age.

Table 4.6.3, shows a significant difference between the variation in the mean value of body age with gender. The mean difference of body for males was 4.415 ± 9.53 years which indicated that males had less difference between their chronological and body age, whereas in contrast to those females had a mean difference of body age as 11.705 ± 8.57 years, which tend to have a greater difference between their chronological and body age. This difference was also found to be significantly different genderwise with 'p' <0.001, this implied that gender significantly influenced the gap between body age and chronological age. The table 4.6.4, presents the difference in the mean value of body age with age. The mean difference of body age for 20-39 years was 8.125 ± 9.920 years, whereas the difference of body age for 40-59 years was 7.995 ± 9.623 years. The 't' value of 0.133 indicated that the difference in the body age between the two age groups was not statistically significant.

Table 4.6.5, illustrated the average anthropometric data of the study participants, classified by gender. The results revealed that the average Body Mass Index (BMI) for males was 25.6 ± 4.81, whereas for females, it was marginally lower at 25.1 ± 4.75. Visceral fat levels were similar across genders, with males showing a mean of 9.533 ± 5.495 and females at 9.138 ± 5.332, leading to a non-significant 't' value of -0.73. Body age was significantly higher in females (50.820 ± 16.036) than in males (43.295 ± 14.832), with non-significant 't' value of 4.87. Additionally, resting metabolism differed significantly between the genders, with males exhibiting a higher mean (1547.760 ± 199.29) compared to females (1293.005 ± 172.580), resulting in a highly

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Table 4.6.1: Gender wise (Mean ± SD) of Body age of subjects

Variable	Male	Female	Total
Body age	43.29 ± 14.832	50.82 ± 16.036	47.05 ± 15.88

(***- Significant at p<0.001)

Table 4.6.2: Mean of difference in body age - Agewise

Age category	Mean ± SD
20-29 years	6.465 ± 9.67
30-39 years	9.752 ± 9.93
40-49 years	9.520 ± 8.16
50-59 years	6.470 ± 10.71

Table 4.6.3: Mean difference in body age- Genderwise

Variable	Mean ± SD of diff. in body age of subjects		't' value
	Male	**Female**	
Difference in body age	4.415 ± 9.53	11.705 ± 8.57	8.043***

(***- Significant at p<0.001)

Table 4.6.4: Mean difference in body age - Agewise

Variable	Mean ± SD of diff. in body age of subjects		't' value
	20-39 years	**40-59 years**	
Difference in body age	8.125 ± 9.920	7.995 ± 9.623	0.133[NS]

NS: Not significant

Table 4.6.5: Mean anthropometric values of the study subjects as per gender

Variable	Mean anthropometry of the subjects (mean ± S.D)			't' value
	Male	**Female**	**Total**	
BMI	25.6 ± 4.81	25.1 ± 4.75	25.34 ± 4.78	0.934
Visceral fat	9.533 ± 5.495	9.138 ± 5.332	9.33 ± 5.41	0.73
Body age	43.295 ±14.832	50.820 ± 16.036	47.05 ± 15.88	4.87***
Resting metabolism	1547.760 ± 199.29	1293.005 ± 172.580	1420.38 ± 225.67	13.66***
Systolic (mm Hg)	131.710 ± 18.072	119.070 ± 20.012	125.39 ± 20.06	6.62***
Diastolic (mm Hg)	88.665 ± 12.575	81.415 ± 10.962	85.04 ± 12.32	6.14***

(*-Significantly different at p<0.05) (**-Significantly different at p<0.01)

(***-Significantly different at p<0.001)

significant 't' value of 13.66 (p<0.05). Regarding blood pressure measurements, systolic blood pressure was elevated in males (131.710 ± 18.072 mmHg) compared to females (119.070 ± 20.012 mmHg), with a 't' value of 6.62. Likewise, diastolic blood pressure was also higher in males (88.665 ± 12.575 mmHg) than in females (81.415 ± 10.962 mmHg), yielding a 't' value of 6.14. Although there was a difference in both systolic and diastolic blood pressure but that difference was not statistically significant.

In summary, the results indicated significant gender differences in body age, resting metabolism, and blood pressure parameters, while BMI and visceral fat levels were relatively consistent between males and females. But the difference was only found statistically significant for resting metabolism across both the gender.

DIETARY INTAKE DATA

Information was obtained on dietary habits, timings of meals, number of meals, food allergies, supplement intake etc. Twenty-four-hour dietary recall method was utilized for obtaining nutrient intake data.

Table 4.7 provides an examination of dietary practices, food allergies, supplement usage, meal frequency, and instances of meal skipping of all the subjects. A significant portion of participants (53.5%) adhered to a vegetarian diet, while 38.0% were non-vegetarians, and 8.5% classified themselves as ovo-vegetarians. Most of them (95.5%) did not experience any kind of food allergies, with only 4.5% reporting such conditions. Most participants (61.5%) ate three meals daily, while 30.8% consumed two meals. A small fraction (5.5%) had four meals, and 2.0% limited themselves to one meal per day. An extremely small percentage (0.3%) reported having more than four meals and a substantial majority (76.3%) had all their meals at home. In contrast, 12.5% ate two meals at home, 7.0% had only one meal at home, and 4.3% consumed three meals at home. Irrespective of all that, 67.3% of participants indicated that they skipped meals, while only 32.8% did not. A significant portion, specifically 46.0%, indicated that they often skipped breakfast, identifying it as the most frequently omitted meal. Lunch followed as the second most frequently skipped meal, with 18.8% of participants reported this behavior, whereas a mere 3.3% admitted to skipping dinner. Additionally, a noteworthy 32.0% of respondents stated that they did not skip any meals.

The prevalence of vegetarianism may reflect cultural or regional dietary trends. The low incidence of food allergies suggested that participants face few dietary restrictions. The limited use of dietary supplements may indicate a preference for obtaining nutrition from whole foods. While most participants adhered to a typical three-meal structure, a considerable number consumed only two meals, which could affect their nutritional intake. The high rate of meal skipping among two-thirds of participants raised concerns regarding irregular eating patterns and possible nutritional deficiencies. Breakfast being the most often overlooked meal, which may have consequences for dietary practices and overall health. All these results underscore the necessity for nutritional education initiatives aimed at promoting meal regularity and dietary balance.

Nutrient Intakes- 24-hr Dietary recall

Table 4.7.1, shows gender-wise analysis of dietary intake revealed notable differences between males and females where males were reported to have a higher intake of energy

as well as other macronutrients such as carbohydrate, protein, and fats too. As mentioned, males exhibited a higher energy consumption, averaging 1194.06 ± 311.58 kcal, compared to females, who averaged 978.72 ± 234.52 kcal with the overall mean intake across both genders 1086.39 ± 295.75 kcal.

Table 4.7.2, shows the analysis of nutrient intake across different age groups which revealed a trend of decreasing intake with increasing age. The younger adults (20-29 years) had the highest energy intake, averaging 1181.60 ± 361.29 kcal, followed by a gradual reduction in subsequent age groups; 30-39 years (1084.35 ± 278.22 kcal), 40-49 years (1075.03 ± 259.03 kcal), and 50-59 years (1005.56 ± 249.49 kcal). A similar downward trend was noted in carbohydrate intake, with the highest consumption in the younger adults (142.05 ± 51.63 g) and the lowest in the older adults (125.87 ± 32.24 g). Protein intake exhibited some variation but generally decreased with age, from 33.45 ± 13.58 g among younger adults to 30.53 ± 15.13 g in the older adults. Whereas, fat intake showed the most significant decline with age, decreasing from 50.51 ± 19.75 g in the 20-29 years group to 39.97 ± 14.92 g in the 50-59 years group. The overall pattern indicated that both energy and macronutrient consumption tended to decline as individuals aged, with the most significant variations noted between younger and older adults. Hence, nutrients intake is inversely proportional to ageing.

Table 4.7.3, illustrates the nutrient intake of broader age groups i.e., 20-39 years and 40- 59 years. The average energy intake was 1132 ± 324.89 and 1040.29 ± 256.04 for younger and older adults, where the energy intake was decreasing with the increase in age. Similar trends were also noticed for average carbohydrate, proteins and fats which was 136.78 ± 44.91 in younger and 129.10 ± 31.57 in older elders, followed by average protein with 32.52 ± 13.86 and 31.44 ± 18.41 in younger and older adults, and average fat for younger and older adults were 48.20 ± 17.71 and 42.13 ± 15.73 respectively. When looked at the significance of the intakes with age; the energy, carbohydrate and fat intakes were significantly different with 'p' value <0.001, <0.05, and <0.001 respectively. But the difference for average protein intake was not found to be statistically different. When looked at the difference in variance it was also significantly different for energy, CHO, and fat. The difference in intake of energy and fat in younger and older adults might be due to the higher metabolic demands and shift in metabolism or dietary adjustments respectively, whereas the CHO intake was mildly different

indicated that younger adults consume slightly more carbohydrates in their diet. Although protein intake remained consistent across both the age groups.

Table: 4.7 Dietary habits of the subjects (N=400)

Variable	Response	n (%)
Food habits	Vegetarian	214 (53.5)
	Non-vegetarian	152 (38.0)
	Ovo-vegetarian	34 (8.5)
Food allergy	No	382 (95.5)
	Yes	18 (4.5)
Number of meals consumed in a day	1 meal	8 (2.0)
	2 meals	123 (30.8)
	3 meals	246 (61.5)
	4 meals	22 (5.5)
	>4meals	1 (0.3)
Number of meals consumed at home	1 meal	28 (7.0)
	2 meals	50 (12.5)
	3 meals	17 (4.3)
	All	305 (76.3)
Skipping meals	No	131 (32.8)
	Yes	269 (67.3)
Major skipping meal time	Breakfast	184 (46.0)
	Dinner	13 (3.3)
	Lunch	75 (18.8)
	N/A	128 (32.0)

Values in parenthesis indicate percentages

Table 4.7.1: Gender wise mean nutrient intake of the subjects

Variables	Male	Female	Total
Energy (kcal)	1194.06 ± 311.58	978.72 ± 234.52	1086.39 ± 295.75
Carbohydrate (g)	147.69 ± 40.26	118.19 ± 31.38	132.94 ± 38.96
Protein (g)	35.09 ± 12.77	28.87 ± 18.68	31.98 ± 16.28
Fat (g)	48.83 ± 18.7	41.50 ± 14.21	45.17 ± 17.008

Table 4.7.2: Age wise mean nutrient intake of the subjects

Variables	Energy (kcal)	Carbo-hydrate(g)	Protein (g)	Fat (g)
20-29 years	1181.60 ± 361.29	142.05 ± 51.63	33.45 ± 13.58	50.51 ± 19.75
30-39 years	1084.35 ± 278.22	131.61 ± 36.71	31.61 ± 14.14	45.95 ± 15.22
40-49 years	1075.03 ± 259.03	132.34 ± 30.71	32.35 ± 21.23	44.31 ± 16.30
50-59 years	1005.56 ± 249.49	125.87 ± 32.24	30.53 ± 15.13	39.97 ± 14.92
Total	1086.39 ± 295.76	132.94 ± 38.96	31.98 ± 16.28	45.17 ± 17.01

Table 4.7.3: Nutrient intakes in early and mid-adulthood vs late adulthood

Variables	20-39 years	40-59 years	't'-test	ANOVA
Avg Energy (kcal)	1132 ± 324.89	1040.29 ± 256.04	3.152***	9.935***
Avg Carbohydrate (g)	136.78 ± 44.91	129.10 ± 31.57	1.977*	3.910*
Avg Protein (g)	32.52 ± 13.86	31.44 ± 18.41	0.665	0.442
Avg Fat (g)	48.20 ± 17.71	42.13 ± 15.73	3.621***	13.109***

(*-Significantly different at $p < 0.05$) (***-Significantly different at $p < 0.001$)

Frequency of consumption for various foods

The frequency of consumption of foods high in fat, sugar and salt was collected using a semi-quantitative food frequency questionnaire including detailed food items was used to assess the frequency of foods rich in fat, sugar, and salt. The frequency of consumption of foods high in fats is shown in Table 4.7.4 reveals that majority of the subjects reported occasional consumption of foods rich in fats. The frequency of consumption of samosa was found to be once a week by 14.3% of subjects, followed by Pani puri i.e., 12.3%. 17.5% of the subjects reported consumption of wafers once a week, while 3.3% of them consumed daily. Nearly one fourth of the subjects reported fortnightly consumption of Vadapav, followed by Sevusal (18.0%), and kachori (15.5%).

Table 4.7.5 shows frequency of consumption of foods high in sugar, majority of the subjects reported occasional consumption of foods rich in sugar. Cola being one of the most frequently consumed sugary beverages with 28.3% of the subjects consuming it occasionally and 7.5% consuming it once in 10 days. Almost all (90.3%) the subjects reported rare consumption of energy drinks, followed by alcoholic beverages (87.5%), and tang or other ready mixes (87.0%). It was reported that more than half the population i.e., 65.3% preferred not eating jam, while 70.3% of subjects were infrequently consuming ketchups. Table 4.7.6 shows the frequency of consumption of foods high in salt. It was observed that there was occasional consumption of foods high in salts. Around 5.0% of subjects reported to have papad once a week along with their meals. The consumption of soup and oats was 27.0% and 8.3% monthly.

Table 4.7.7 shows consumption of foods high in sugar and fat, where most participants reported occasional consumption. Nearly 4.3% of subjects frequently reported consuming ice-cream weekly, followed by chocolate i.e., 4.0%. 85% of subjects reported consuming cake occasionally followed by basundi with 75.5%. Nearly three fourth of the subjects consumed pudding, with 32.2% having them occasionally and 34.8% at least once a month. Table 4.7.8, illustrates the frequency of consumption of foods that are high in salt and fat. It was seen that 60.8% of the subjects consumed salty biscuits, with 13.3% consuming them fortnightly, 32.5% once a week and 15.0% thrice a week. Almost one third of the subjects consumed packaged noodles like maggi/ yippee once a month. The majority consumption of traditional Gujrati snacks like

gathiya, papdi, chawanu, sev etc. was found to be weekly. It was found that 21.3% and 20.3% of participants consumed burgers and pizza respectively, on a monthly basis.

Table 4.7.4 Frequency of consumption- High Fat foods (N=400)

S/N	Food items	Daily	4-5 times a week	Thrice a week	Once a week	Once in 10 days	Once in 15 days	Once a month	Occasionally	Never
1	**Puff**	1 (0.3)	0 (0.0)	13 (3.3)	38 (9.5)	17 (4.3)	53 (13.3)	102 (25.5)	146 (36.5)	30 (7.5)
2	**Samosa**	2 (0.5)	3 (0.8)	16 (4.0)	57 (14.3)	26 (6.5)	68 (17.0)	57 (14.3)	68 (17.0)	10 (2.5)
3	**Vadapav**	1 (0.3)	2 (0.5)	9 (2.3)	31 (7.8)	38 (9.5)	91 (22.8)	167 (41.8)	53 (13.3)	6 (1.5)
4	**Frankie**	0 (0.0)	1 (0.3)	2 (0.5)	7 (1.8)	17 (4.3)	34 (8.5)	106 (26.5)	167 (41.8)	66 (16.5)
5	**Sandwich (cheese)**	0 (0.0)	0 (0.0)	3 (0.8)	19 (4.8)	20 (5.0)	47 (11.8)	116 (29.0)	144 (36.0)	51 (12.8)
6	**Sabudana vada**	0 (0.0)	0 (0.0)	1 (0.3)	5 (1.3)	18 (4.5)	45 (11.3)	104 (26.0)	189 (47.3)	38 (9.5)
7	**Panipuri**	2 (0.5)	3 (0.8)	14 (3.5)	49 (12.3)	35 (8.8)	91 (22.8)	115 (28.8)	82 (20.5)	9 (2.3)
8	**Chaat**	1 (0.3)	0 (0.0)	6 (1.5)	17 (4.3)	14 (3.5)	26 (6.5)	65 (16.3)	197 (49.3)	74 (18.5)
9	**Sev usal**	0 (0.0)	1 (0.3)	2 (0.5)	33 (8.3)	30 (7.5)	72 (18.0)	137 (34.3)	68 (17.0)	57 (14.3)
10	**Kachori**	0 (0.0)	0 (0.0)	6 (1.5)	15 (3.8)	25 (6.3)	62 (15.5)	173 (43.3)	108 (27.0)	11 (2.8)
11	**Dabeli**	1 (0.3)	0 (0.0)	5 (1.3)	29 (7.3)	22 (5.5)	53 (13.3)	148 (37.0)	110 (27.5)	32 (8.0)
12	**Chinese**	0 (0.0)	3 (0.8)	2 (0.5)	11 (2.8)	11 (2.8)	22 (5.5)	120 (30.0)	183 (45.8)	48 (12.0)
13	**Pasta**	0 (0.0)	1 (0.3)	2 (0.5)	11 (2.8)	9 (2.3)	37 (9.3)	162 (40.5)	139 (34.8)	39 (9.8)
14	**Pav bhaji**	0 (0.0)	0 (0.0)	2 (0.5)	8 (2.0)	8 (2.0)	50 (12.5)	143 (35.8)	155 (38.8)	33 (8.3)
15	**Egg items**	5 (1.3)	6 (1.5)	21 (5.3)	47 (11.8)	32 (8.0)	37 (9.3)	17 (4.3)	10 (2.5)	225 (56.3)
16	**Bhajiyas**	1 (0.3)	2 (0.5)	3 (0.8)	6 (1.5)	15 (3.8)	28 (7.0)	160 (40.0)	169 (42.3)	16 (4.0)
17	**Bataka vada**	1 (0.3)	2 (0.5)	11 (2.8)	32 (8.0)	38 (9.5)	91 (22.8)	166 (41.5)	52 (13.0)	7 (1.8)
18	**Puri**	1 (0.3)	0 (0.0)	4 (1.0)	9 (2.3)	6 (1.5)	23 (5.8)	91 (22.8)	251 (62.8)	15 (3.8)
19	**Wafers**	13 (3.3)	9 (2.3)	22 (5.5)	70 (17.5)	63 (15.8)	74 (18.5)	69 (17.3)	70 (17.5)	10 (2.5)
20	**Pune missal**	0 (0.0)	0 (0.0)	0 (0.0)	6 (1.5)	6 (1.5)	7 (1.8)	43 (10.8)	134 (33.5)	204 (51.0)
21	**Bread (brown)**	3 (0.8)	1 (0.3)	8 (2.0)	6 (1.5)	14 (3.5)	37 (9.3)	57 (14.3)	127 (31.8)	147 (36.8)
22	**Bread (white)**	1 (0.3)	1 (0.3)	5 (1.3)	3 (0.8)	7 (1.8)	23 (5.8)	49 (12.3)	196 (49.0)	115 (28.8)

Table :4.7.5: Frequency of consumption- High Sugar foods (N=400)

S/N	Food items	Daily	3-4 times a week	Thrice a week	Once a week	Once in 10 days	Once in 15 days	Once a month	Occasionally	Never
1	Colas	3 (0.8)	0 (0.0)	13 (3.3)	19 (4.8)	30 (7.5)	23 (5.8)	53 (13.3)	113 (28.3)	146 (36.5)
2	Fruit syrups	0 (0.0)	0 (0.0)	0 (0.0)	3 (0.8)	2 (0.5)	3 (0.8)	5 (1.3)	105 (26.3)	282 (70.5)
3	Fruit drinks (mazza,slice)	1 (0.3)	0 (0.0)	2 (0.5)	5 (1.3)	0 (0.0)	15 (3.8)	32 (8.0)	94 (23.5)	251 (62.8)
4	Fruit juices (tropicana)	0 (0.0)	0 (0.0)	5 (1.3)	6 (1.5)	10 (2.5)	38 (9.5)	64 (16.0)	97 (24.3)	180 (45.0)
5	Fruit crush/sherbets	0 (0.0)	0 (0.0)	1 (0.3)	1 (0.3)	3 (0.8)	3 (0.8)	13 (3.3)	139 (34.8)	240 (60.0)
6	Tang/Rasna/ any readymix	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)	1 (0.3)	1 (0.3)	9 (2.3)	40 (10.0)	348 (87.0)
7	Energy drinks	2 (0.5)	0 (0.0)	1 (0.3)	0 (0.0)	1 (0.3)	1 (0.3)	5 (1.3)	29 (7.3)	361 (90.3)
8	Alcoholic beverages	1 (0.3)	0 (0.0)	1 (0.3)	4 (1.0)	4 (1.0)	3 (0.8)	3 (0.8)	34 (8.5)	350 (87.5)
9	Ketchups	0 (0.0)	0 (0.0)	2 (0.5)	5 (1.3)	2 (0.5)	9 (2.3)	47 (11.8)	281 (70.3)	54 (13.5)
10	Jam/jellies	0 (0.0)	0 (0.0)	3 (0.8)	3 (0.8)	1 (0.3)	3 (0.8)	20 (5.0)	109 (27.3)	261 (65.3)
11	Breakfast cereals	0 (0.0)	0 (0.0)	1 (0.3)	4 (1.0)	4 (1.0)	6 (1.5)	15 (3.8)	67 (16.8)	303 (75.8)
12	Sweet pickle	2 (0.5)	0 (0.0)	6 (1.5)	5 (1.3)	4 (1.0)	30 (7.5)	101 (25.3)	163 (40.8)	89 (22.3)
13	Sweet chutney	3 (0.8)	1 (0.3)	3 (0.8)	2 (0.5)	0 (0.0)	3 (0.8)	29 (7.3)	281 (70.3)	78 (19.5)

Table 4.7.6: Frequency of consumption- High Salt foods (N=400)

S/N	Food items	Daily	4-5 times a week	Thrice a week	Once a week	Once in 10 days	Once in 15 days	Once a month	Occasionally	Never
1	**Soups**	0 (0.0)	1 (0.3)	5 (1.3)	6 (1.5)	10 (2.5)	27 (6.8)	108 (27.0)	191 (47.8)	52 (13.0)
2	**Oats**	2 (0.5)	0 (0.0)	5 (1.3)	7 (1.8)	5 (1.3)	15 (3.8)	33 (8.3)	168 (42.0)	165 (41.3)
3	**Papad**	5 (1.3)	1 (0.3)	9 (2.3)	20 (5.0)	44 (11.0)	68 (17.0)	119 (29.8)	114 (28.5)	20 (5.0)
4	**Masala mixes**	1 (0.3)	0 (0.0)	2 (0.5)	4 (1.0)	7 (1.8)	12 (3.0)	46 (11.5)	292 (73.0)	36 (9.0)
5	**Rasoi masala**	0 (0.0)	0 (0.0)	0 (0.0)	6 (1.5)	8 (2.0)	17 (4.3)	49 (12.3)	276 (69.0)	44 (11.0)

Table 4.7.7: Frequency of consumption- High Sugar and Fat foods (N=400)

S/N	Food items	Daily	4-5 times a week	Thrice a week	Once a week	Once in 10 days	Once in 15 days	Once a month	Occasion-ally	Never
1	**Gulab jamun**	2 (0.5)	0 (0.0)	3 (0.8)	7 (1.8)	6 (1.3)	12 (3.0)	32 (8.0)	295 (73.8)	43 (10.8)
2	**Kala jam**	1 (0.3)	0 (0.0)	2 (0.5)	1 (0.3)	1 (0.3)	2 (0.5)	12 (3.0)	277 (69.3)	104 (26.0)
3	**Bundi**	0 (0.0)	1 (0.3)	1 (0.3)	2 (0.5)	1 (0.3)	5 (1.3)	10 (2.5)	260 (65.0)	120 (30.0)
4	**Ladoo**	0 (0.0)	1 (0.3)	1 (0.3)	3 (0.8)	5 (1.3)	12 (3.0)	42 (10.5)	255 (63.8)	81 (20.3)
5	**Peda**	0 (0.0)	0 (0.0)	3 (0.8)	2 (0.5)	4 (1.0)	6 (1.5)	25 (6.3)	277 (69.3)	83 (20.8)
6	**Rasgulla**	1 (0.3)	0 (0.0)	1 (0.3)	4 (1.0)	3 (0.8)	8 (2.0)	42 (10.5)	278 (69.5)	63 (15.8)
7	**Rasmalai**	0 (0.0)	0 (0.0)	0 (0.0)	3 (0.8)	2 (0.5)	9 (2.3)	30 (7.5)	290 (72.5)	66 (16.5)
8	**Rabdi**	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.5)	9 (2.3)	30 (7.5)	69 (17.3)	243 (60.8)	47 (11.8)
9	**Jalebi**	0 (0.0)	0 (0.0)	1 (0.3)	6 (1.5)	6 (1.5)	8 (2.0)	45 (11.3)	276 (69.0)	58 (14.5)
10	**Basundi**	0 (0.0)	0 (0.0)	0 (0.0)	4 (1.0)	1 (0.3)	4 (1.0)	21 (5.3)	302 (75.5)	68 (17.0)
11	**Ice-cream**	1 (0.3)	5 (1.3)	11 (2.8)	17 (4.3)	31 (7.8)	64 (16.0)	118 (29.5)	127 (31.8)	26 (6.5)
12	**Chocolates**	10 (2.5)	3 (0.8)	14 (3.5)	16 (4.0)	22 (5.5)	43 (10.8)	54 (13.5)	157 (39.3)	81 (20.3)
13	**Puddings**	0 (0.0)	0 (0.0)	3 (0.8)	9 (2.3)	19 (4.8)	76 (19.0)	139 (34.8)	129 (32.3)	25 (6.3)
14	**Bun**	5 (1.3)	1 (0.3)	1 (0.3)	11 (2.8)	13 (3.3)	22 (5.5)	51 (12.8)	213 (53.3)	83 (20.8)
15	**Cakes**	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.5)	4 (1.0)	5 (1.3)	5 (1.3)	340 (85.0)	44 (11.0)
16	**Pastry**	0 (0.0)	0 (0.0)	1 (0.3)	1 (0.3)	3 (0.8)	9 (2.3)	20 (5.0)	126 (31.5)	240 (60.0)

Table 4.7.8: Frequency of consumption- High Salt and Fat foods (N=400)

S/N	Food items	Daily	4-5 times a week	Thrice a week	Once a week	Once in 10 days	Once in 15 days	Once a month	Occasion-ally	Never
1	**Noodles (Maggie, yippee)**	1 (0.3)	2 (0.5)	5 (1.3)	15 (3.8)	13 (3.3)	54 (13.5)	154 (38.5)	129 (32.3)	27 (6.8)
2	**Mayonnaise**	0 (0.0)	0 (0.0)	3 (0.8)	4 (1.0)	1 (0.3)	5 (1.3)	5 (1.3)	234 (58.5)	148 (37.0)
3	**Cheese spread**	0 (0.0)	0 (0.0)	1 (0.3)	3 (0.8)	2 (0.5)	4 (1.0)	3 (0.8)	136 (34.0)	251 (62.8)
4	**Other sauces**	0 (0.0)	0 (0.0)	2 (0.5)	2 (0.5)	2 (0.5)	2 (0.5)	13 (3.3)	186 (46.5)	193 (48.3)
5	**Frozen food (McCain)**	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)	3 (0.8)	4 (1.0)	4 (1.0)	58 (14.5)	330 (82.5)
6	**Fryums**	1 (0.3)	0 (0.0)	2 (0.5)	8 (2.0)	18 (4.5)	47 (11.8)	129 (32.3)	160 (40.0)	35 (8.8)
7	**Biscuits (salty)**	20 (5.0)	12 (3.0)	60 (15.0)	130 (32.5)	93 (23.3)	53 (13.3)	20 (5.0)	10 (2.5)	2 (0.5)
8	**Biscuits (cream)**	5 (1.3)	5 (1.3)	8 (2.0)	23 (5.8)	21 (5.3)	24 (6.0)	60 (15.0)	199 (49.8)	55 (13.8)
9	**Fries**	0 (0.0)	3 (0.8)	5 (1.3)	0 (0.0)	2 (0.5)	12 (3.0)	54 (13.5)	159 (39.8)	165 (41.3)
10	**Chips**	14 (3.5)	11 (2.8)	15 (3.8)	64 (16.0)	91 (22.8)	75 (18.8)	73 (18.3)	51 (12.8)	6 (1.5)
11	**Kurkure**	5 (1.3)	3 (0.8)	13 (3.3)	27 (6.8)	23 (5.8)	55 (13.8)	64 (16.0)	142 (35.5)	68 (17.0)
12	**Khakhra**	12 (3.0)	14 (3.5)	42 (10.5)	146 (36.5)	77 (19.3)	42 (10.5)	19 (4.8)	32 (8.0)	16 (4.0)
13	**Soya sticks**	4 (1.0)	4 (1.0)	18 (4.5)	88 (22.0)	67 (16.8)	60 (15.0)	50 (12.5)	79 (19.8)	30 (7.5)
14	**Gathiya**	7 (1.8)	7 (1.8)	64 (16.0)	129 (32.3)	61 (15.3)	45 (11.3)	26 (6.5)	45 (11.3)	16 (4.0)
15	**Papdi**	8 (2.0)	14 (3.5)	57 (14.3)	111 (27.8)	54 (13.5)	43 (10.8)	20 (5.0)	56 (14.0)	37 (9.3)
16	**Chawanu**	13 (3.3)	10 (2.5)	49 (12.3)	110 (27.5)	109 (27.3)	60 (15.0)	24 (6.0)	17 (4.3)	8 (2.0)
17	**Sev**	14 (3.5)	26 (6.5)	67 (16.8)	141 (35.3)	65 (16.3)	44 (11.0)	17 (4.3)	19 (4.8)	7 (1.8)
18	**Sev mamra**	26 (6.5)	53 (13.3)	109 (27.3)	114 (28.5)	33 (8.5)	25 (6.3)	17 (4.3)	16 (4.0)	7 (1.8)
19	**Burger**	0 (0.0)	0 (0.0)	4 (1.0)	15 (3.8)	10 (2.5)	40 (10.0)	85 (21.3)	194 (48.5)	52 (13.0)

20	**Pizza**	0 (0.0)	0 (0.0)	2 (0.5)	10 (2.5)	6 (1.5)	25 (6.3)	81 (20.3)	187 (46.8)	89 (22.3)
21	**Subway**	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.5)	0 (0.0)	3 (0.8)	9 (2.3)	79 (19.8)	307 (76.8)
22	**Fafda**	0 (0.0)	0 (0.0)	5 (1.3)	12 (3.0)	21 (5.3)	53 (13.3)	75 (18.8)	202 (50.5)	32 (8.0)
23	**Khaman**	0 (0.0)	0 (0.0)	4 (1.0)	10 (2.5)	42 (10.5)	68 (17.0)	186 (46.5)	76 (19.0)	14 (3.5)
24	**Sour pickle**	10 (2.5)	3 (0.8)	11 (2.8)	19 (4.8)	9 (2.3)	30 (7.5)	53 (13.3)	176 (44.0)	89 (22.3)
25	**Chinese food**	0 (0.0)	1 (0.3)	5 (1.3)	6 (1.5)	10 (2.5)	27 (6.8)	108 (27.0)	191 (47.8)	52 (13.0)

Table 4.7.9: Frequency of consumption- Homemade food High in Fat, Sugar and Salt (N=400)

S/N	Food items	Daily	4-5 times a week	Thrice a week	Once a week	Once in 10 days	Once in 15 days	Once a month	Occasion-ally	Never
1	**Chakli**	2 (0.5)	0 (0.0)	4 (1.0)	7 (1.8)	6 (1.5)	15 (3.8)	39 (9.8)	281 (70.3)	46 (11.5)
2	**Mathri**	0 (0.0)	0 (0.0)	8 (2.0)	4 (1.0)	7 (1.8)	12 (3.0)	32 (8.0)	264 (66.0)	73 (18.3)
3	**Sukhadi**	1 (0.3)	0 (0.0)	2 (0.5)	8 (2.0)	4 (1.0)	18 (4.5)	38 (9.5)	165 (41.3)	164 (41.0)
4	**Chikki**	2 (0.5)	1 (0.3)	9 (2.3)	34 (8.5)	53 (13.3)	99 (24.8)	69 (17.3)	104 (26.0)	29 (7.3)
5	**Shakarpara**	0 (0.0)	0 (0.0)	0 (0.0)	6 (1.5)	4 (1.0)	7 (1.8)	30 (7.5)	271 (67.8)	82 (20.5)
6	**Kachariyu pak**	6 (1.5)	0 (0.0)	11 (2.8)	45 (11.3)	27 (6.8)	45 (11.3)	51 (12.8)	145 (36.3)	70 (17.5)

Values in parenthesis indicate percentages

As demonstrated in the table 4.7.9, the frequency of homemade foods rich in fats, sugar, and salt were consumed. Notable highlights were as follows:

- The participants exhibited a lower consumption of homemade snacks.
- Nearly 8.5% reported having chikki once a week, while majority consumption was reported to be fortnightly 24.8%.
- Around 12.8% of the subjects consumed kachariyu pak at least once a month.

Household Dietary Diversity

The data on household dietary diversity revealed that a significant majority of subjects consumed cereals (98.8%), foods prepared by oil or butter (99.0%), or sugar/ honey in any form (91.0%). A considerable number of subjects also reported eating vegetable i.e., green leafy and other vegetables (82.3%), lentil or nuts (75.5%), and milk or milk products like buttermilk, curd, paneer (89.5%). However, the consumption of fruits was relatively low, with only 37.8% of subjects indicating they included it in their diet. The consumption of animal-source foods such as meat (6.0%), eggs (6.8%), and fish (2.0%) was reported to be low. Additionally, 84.5% of subjects incorporated condiments or beverages like tea or coffee in their diets as shown in table 4.7.10.

The results indicated a diet primarily focused on plant-based staple foods, with limited fruits and animal protein intake.

Table 4.7.11, presents the categorization of Household Dietary Diversity Score (HDDS) based on the number of food groups consumed by participants.

Low diversity (<4 food groups): Only 4.3% individuals consumed fewer than 4 food groups, which indicated that a small segment of population had a limited dietary diversity, and restricted diet that may lack essential nutrients or that set of individuals are at risk of food insecurity.

Moderate diversity (4-8 food groups): The majority, 75.5% consumed 4 to 8 food groups. This suggested that most individuals have a reasonably diverse dietary pattern, which indicated a balanced intake of nutrients.

High diversity (>8 food groups): Around 20.3% showed high diversity, which generally reflects the nutrients adequacy and food security.

Table 4.7.10: Household Dietary Diversity Score of the subjects (N=400)

Variable	Response	n (%)
Any cereals	Yes	395 (98.8)
	No	5 (1.3)
Any Roots and tubers	Yes	290 (72.5)
	No	110 (27.5)
Any vegetables	Yes	329 (82.3)
	No	71 (17.8)
Any fruits	Yes	151 (37.8)
	No	249 (62.3)
Any meat	Yes	24 (6.0)
	No	376 (94.0)
Any eggs	Yes	27 (6.8)
	No	373 (93.3)
Any fish	Yes	8 (2.0)
	No	392 (98.0)
Any lentil or nuts	Yes	318 (79.5)
	No	82 (20.5)
Any milk or milk products	Yes	358 (89.5)
	No	42 (10.5)
Any food with oil, or butter	Yes	396 (99.0)
	No	4 (1.0)
Any sugar or honey	Yes	364 (91.0)
	No	36 (9.0)
Any condiment or coffee/tea	Yes	338 (84.5)
	No	62 (15.5)

Values in parenthesis indicate percentages

Table 4.7.11: Classification of HDDS score

Number of food groups consumed	n (%)
<4	17 (4.3)
4-8	302 (75.5)
>8	81 (20.3)

Values in parenthesis indicate percentages

Figure 4.2: Number of Food groups consumed (N=400)
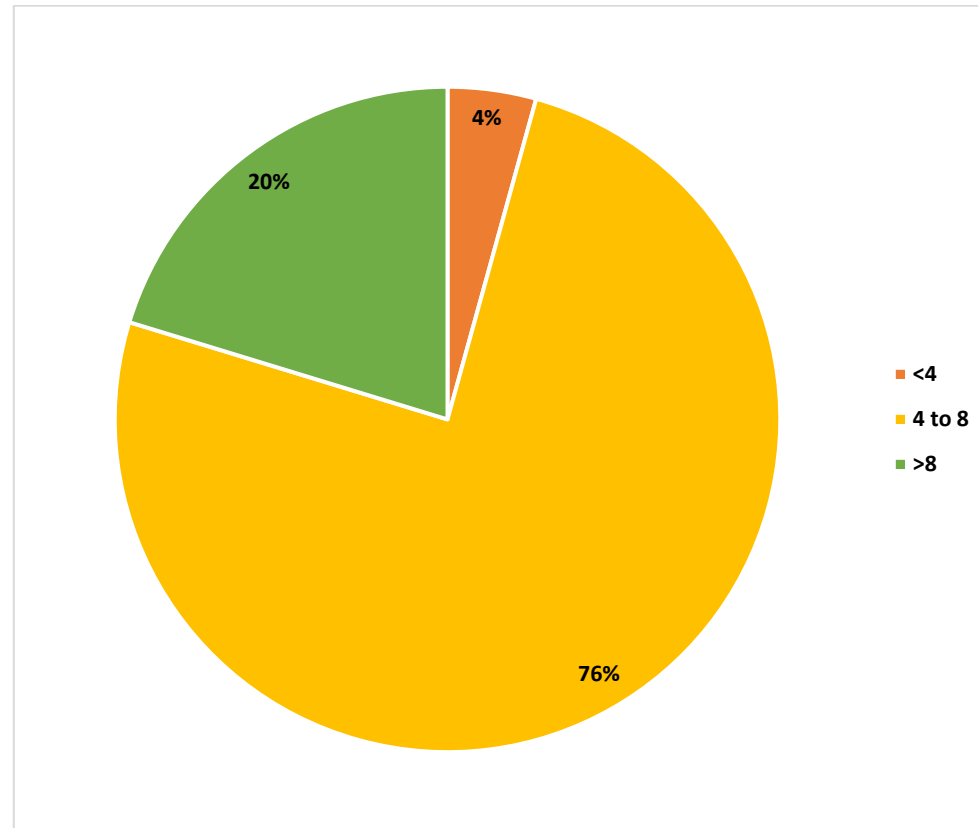
FOOD PURCHASING BEHAVIOURS

- Food Purchasing behaviours
- Understanding of Food Labels
- Consumption of PPFs
- Food Perception and Awareness
- Barriers in purchasing Healthy Foods

Table 4.8 illustrates the purchasing habits, consumption trends, and factors that influenced the choices related to packaged and processed foods. An overwhelming majority (99%) of participants reported purchasing packaged or processed foods, with only 1% indicating that they did not engage in such purchases. Most purchases were intended for both the individual and their family (40.8%), while 22% were for personal consumption only. Almost half (46%) of the respondents had reported their weekly expenses as less than ₹500, further 32.8% allocated between ₹500-₹1000, with a smaller group spending higher amounts on purchasing PPFs. Street food (27.8%) and Punjabi cuisine (24%) were the top choices when dining out followed by others. Most respondents ate out occasionally (60.8%), with 18.8% doing so bi-weekly and 13% weekly. The majority (54.8%) of participants put most money on local street foods. Considerable spending was also noted on chips and snacks (29.8%) and fast foods (11.3%). Family members exerted the most significant influence (84.3%), followed by friends (13.3%). This dataset offered important insights into the food purchasing behaviors in urban areas, highlighting the considerable impact of brand loyalty, a tendency to favor local street food, and the notable role of family in shaping dietary choices.

Frequency of purchase of Processed Packaged Foods (PPFs)

A significant number of respondents had reported that they bought these products every month (30.5%) or occasionally (33.8%). A smaller segment purchased them weekly (21.8%), daily (3.8%), or 2-3 times a week (10%). Brand loyalty was a primary influencing factor (46%) as shown in table 4.8.1.

Table 4.8: Food Purchasing behaviours of subjects (N=400)

Variable	Response	n (%)
Purchase packaged/ processed/ ultra-processed foods	No	4 (1.0)
	Yes	396 (99.0)
	Occasionally	135 (33.8)
Intended recipient of the purchase	Self and family both	163 (40.8)
	Self and friends both	36 (9.0)
	Friends	12 (3.0)
	Guests/visitors	15 (3.8)
	Your children	49 (12.3)
	Your family	37 (9.3)
	Yourself	88 (22.0)
Weekly expenditure on packaged/processed food	Less than Rs 500	184 (46.0)
	More than 2500	21 (5.3)
	Rs 1000-2500	64 (16.0)
	Rs 500-1000	131 (32.8)
Type of foods preferred while eating out	Chinese	34 (8.5)
	Gujarati	89 (22.3)
	Italian	19 (4.8)
	Jain	1 (0.3)
	Kathiyawadi	6 (1.6)
	Maharashtrian	2 (0.5)
	Non veg	19 (4.9)
	Punjabi	96 (24.0)
	Rajasthani	8 (2.1)
	South Indian	15 (3.8)
	Street food	111 (27.8)
Frequency of eating out	Fortnightly	75 (18.8)
	Occasionally	243 (60.8)
	Once a week	52 (13.0)
	Twice a week	30 (7.5)
Types of food on which major expenses occured	Chips and snacks	119 (29.8)
	Fast foods (burger, pizza, and other)	45 (11.3)
	Local street foods (dabeli, vada-pao, momos, chowmein)	219 (54.8)
	N/A	1 (0.3)
	Sugar beverages	10 (2.5)
	Sweets and desserts	6 (1.5)
People influencing food habits	Family members	337 (84.3)
	Friends	53 (13.3)
	Other	8 (2.0)
	Relatives	1 (0.3)
	Social media	1 (0.3)

Values in parenthesis indicate percentages

Table 4.8.1: Frequency of purchase of processed packaged foods (PPFs)

Variable	Response	n (%)
Frequency of purchasing	Daily	15 (3.8)
	2-3 times a week	40 (10.0)
	Once a week	87 (21.8)
	Monthly	122 (30.5)
	Occasional	135 (33.8)
	Never	1 (0.3)

Figure 4.3: Frequency of purchase of PPFs (N=400)
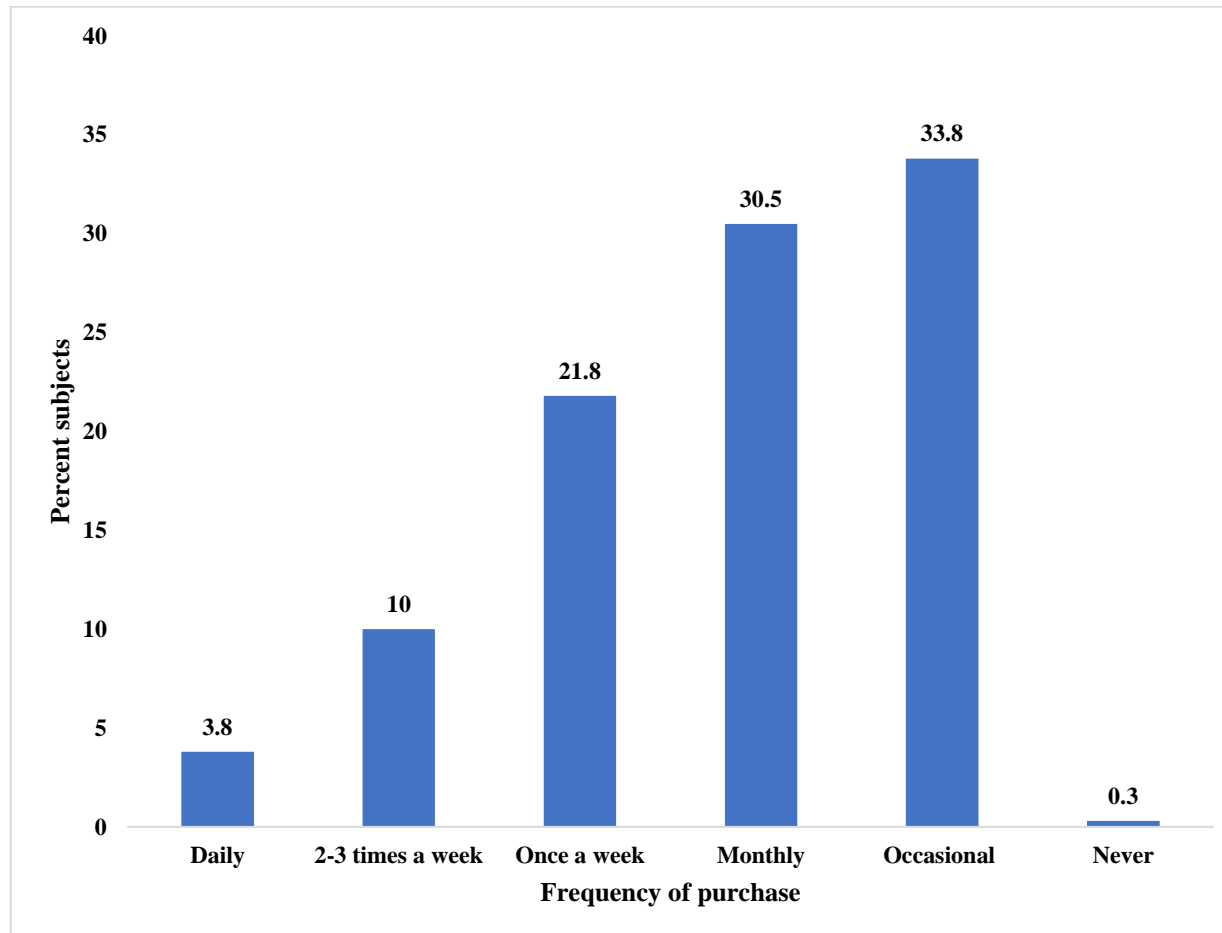
The table 4.8.2, presents the association between the frequency of processed packaged food (PPFS) purchases and age, with highly significance 'p' value <0.001. Among the participants, only a small percentage reported purchasing PPFs daily, with 3.0% of younger adults and 0.8% of older adults engaging in this behaviour. Similarly, 10.0% of the total sample reported purchasing PPFs 2–3 times a week, with 8.3% younger and 1.8% of older adults falling into this category. A considerable proportion of participants reported purchasing PPFs once a week (21.8%), with younger adults (13.5%) slightly outnumbering older adults (8.3%). In contrast, monthly purchases were more prevalent among older adults (18.5%) compared to younger adults (12.0%), representing 30.5% of the total sample. The most frequently reported purchasing pattern was "occasionally," with 33.8% of the total sample indicating this pattern. Older adults (20.8%) were more inclined to report occasional purchases than younger adults (13.0%). Remarkably, very few participants claimed to never purchase PPFs, with only one younger adult (0.3%) reporting this behavior.

Overall, the findings suggested significant differences in the frequency of PPFs purchases across different age groups, with occasional and monthly purchases being the most prevalent. The results highlighted age-based variations, with older adults showing a higher tendency for less frequent but occasional purchases, while younger adults demonstrated a slightly greater likelihood of more frequent PPFS consumption.

The socio-economic status of the respondents in relation to how frequently they bought PPF revealed that the upper-middle class respondents purchased PPF more often and at regular intervals. Though there were differences in purchase frequency among different socio-economic classes, differences were not significant at the statistical level (see table 4.8.3). Table 4.8.4, displayed the relationship between the frequency of PPFs purchases with different stages of hypertension where p <0.001%, indicating a statistically high significant association between these variables. Daily PPFs purchases were reported by 3.8% of the total participants, with the highest proportion among those with normal blood pressure (2.0%), followed by subjects with hypertension stage II (0.8%) and hypertension stage I (0.3%) engaged in this behavior. Purchasing PPFs 2–3 times a week was reported by 10.0% of participants, with the majority having normal blood pressure (7.5%). Small percentage of individuals with any hypertension (2.6%) also exhibited this purchasing pattern. Weekly PPFs purchase were observed in 21.8% of subjects, with the highest proportion found among individuals with normal blood

pressure (12.8%), followed by stage II and stage I hypertension subject engaging in this purchasing pattern, while those in hypertensive crisis accounted for only 0.3%. Monthly PPFS purchases were reported by 30.5% of the participants, making it the second most common purchasing frequency. This behavior was most prevalent among individuals with normal blood pressure (17.8%), followed by those with hypertension stage I (6.3%) and hypertension stage II (5.5%). Occasional PPFs purchase were the most common pattern, accounting for 33.8% of the total sample. Participants with normal blood pressure (14.0%) showed the same trend with this behaviour being more dominant followed by hypertension stage II in this category (10.3%), and with hypertension stage I (7.5%). A very small fraction of participants (0.3%) reported never purchasing PPFs, with only one individual from the normal blood pressure group falling into this category. In summary, the findings indicated a notable relationship between hypertension status and the frequency of PPFs purchases. Individuals with normal blood pressure were more inclined to make monthly or occasional purchases, whereas those with more severe hypertension displayed varied range of purchasing behaviors.

Table 4.8.4, presented frequency of PPF purchase and meal skipping with respect to gender. Among males, 2.3% skipped meals on daily basis, while only 0.5% of those who purchased daily did not skipped meals. Females reported only 1.0% of skipped meals and no case reported for skipping meals who were purchasing daily. Hence, daily purchase was more often associated with meal skipping. 5.0% of males who purchased PPFs 2-3 times a week were skipping meals, whereas 3.3% of females reported skipping meals while making a purchase.

Although 1.0% of males and 0.8% of females who did not skipped meal, but purchased PPFs 2-3 times a week. For males, 9.3% who purchased PPFs on weekly basis did skipped meals while 2.0% did not skipped any meal. For females, 8.0% skipped meals and also reported purchasing weekly. For monthly purchase, males who skipped meals were reported to be 6.0% while 5.3% did not skipped meal but was actively indulging in monthly purchase. Females who skipped meals and made a monthly purchase were about 11.8% whereas 2.5% of those did not skipped meal. The highest frequency was reported to be occasionally purchase of PPFs, where males who were skipping meals were found to be 10.8% and for female it was 9.8%. Only 0.3% of the total population reported to never purchase PPFs but they were still skipping meals. In case of males, skipping of meal and purchase of PPFs were found to be statistically significant with

15.645 where 'p' value <0.01. This result indicated that people who were skipping meals were more prone to indulge in purchasing of PPFs which eventually is linked to an irregular eating pattern or reliance on readily available foods.

Table 4.8.2: Frequency of PPFs purchase- Agewise

Variables	20-39 years	40-59 years	Total	Chi-square value
Daily	12 (3.0)	3 (0.8)	15 (3.8)	41.028***
2-3 times a week	33 (8.3)	7 (1.8)	40 (10.0)	
Once a week	54 (13.5)	33 (8.3)	87 (21.8)	
Monthly	48 (12.0)	74 (18.5)	122 (30.5)	
Occasionally	52 (13.0)	83 (20.8)	135 (33.8)	
Never	1 (0.3)	0 (0.0)	1 (0.3)	

Values in parenthesis indicate percentages (***- Significant at $p<0.001$)

Table 4.8.3: Association between frequency of PPFs and socio-economic status

Variables	Daily	2-3 times a week	Once a week	Monthly	Occasionally	Never	Chi-square
Upper	1 (0.3)	2 (0.5)	1 (0.3)	4(1.0)	18 (4.5)	0 (0.0)	30.338
Upper middle	10 (2.5)	15 (3.8)	34 (8.5)	56 (14.0)	52 (13.0)	1 (0.3)	
Upper lower	3 (0.8)	6 (1.5)	22 (5.5)	19 (4.8)	22 (5.5)	0 (0.0)	
Lower middle	1 (0.3)	17 (4.3)	30 (7.5)	43 (10.8)	42 (10.5)	0 (0.0)	
Lower	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)	0 (0.0)	

Table 4.8.4: Frequency of purchase according to stage of hypertension

Variables	Hypotension	Normal BP	Elevated BP	HTN stage I	HTN stage II	Hypertensive crisis	Total	Chi-square
Daily	2 (0.5)	8 (2.0)	1 (0.3)	1 (0.3)	3 (0.8)	0 (0.0)	15 (3.8)	47.523***
2-3 times a week	0 (0.0)	30 (7.5)	1 (0.3)	5 (1.3)	4 (1.0)	0 (0.0)	40 (10.0)	
Once a week	1 (0.3)	51 (12.8)	3 (0.8)	15 (3.8)	16 (4.0)	1 (0.3)	87 (21.8)	
Monthly	0 (0.0)	71 (17.8)	2 (0.5)	25 (6.3)	22 (5.5)	2 (0.5)	122 (30.5)	
Occasionally	1 (0.3)	56 (14)	5 (1.3)	30 (7.5)	41 (10.3)	2 (0.5)	135 (33.8)	
Never	0 (0.0)	1 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)	

Values in parenthesis indicate percentages (***- Significant at p<0.001)

Figure 4.4: Association between frequency of purchase and SES
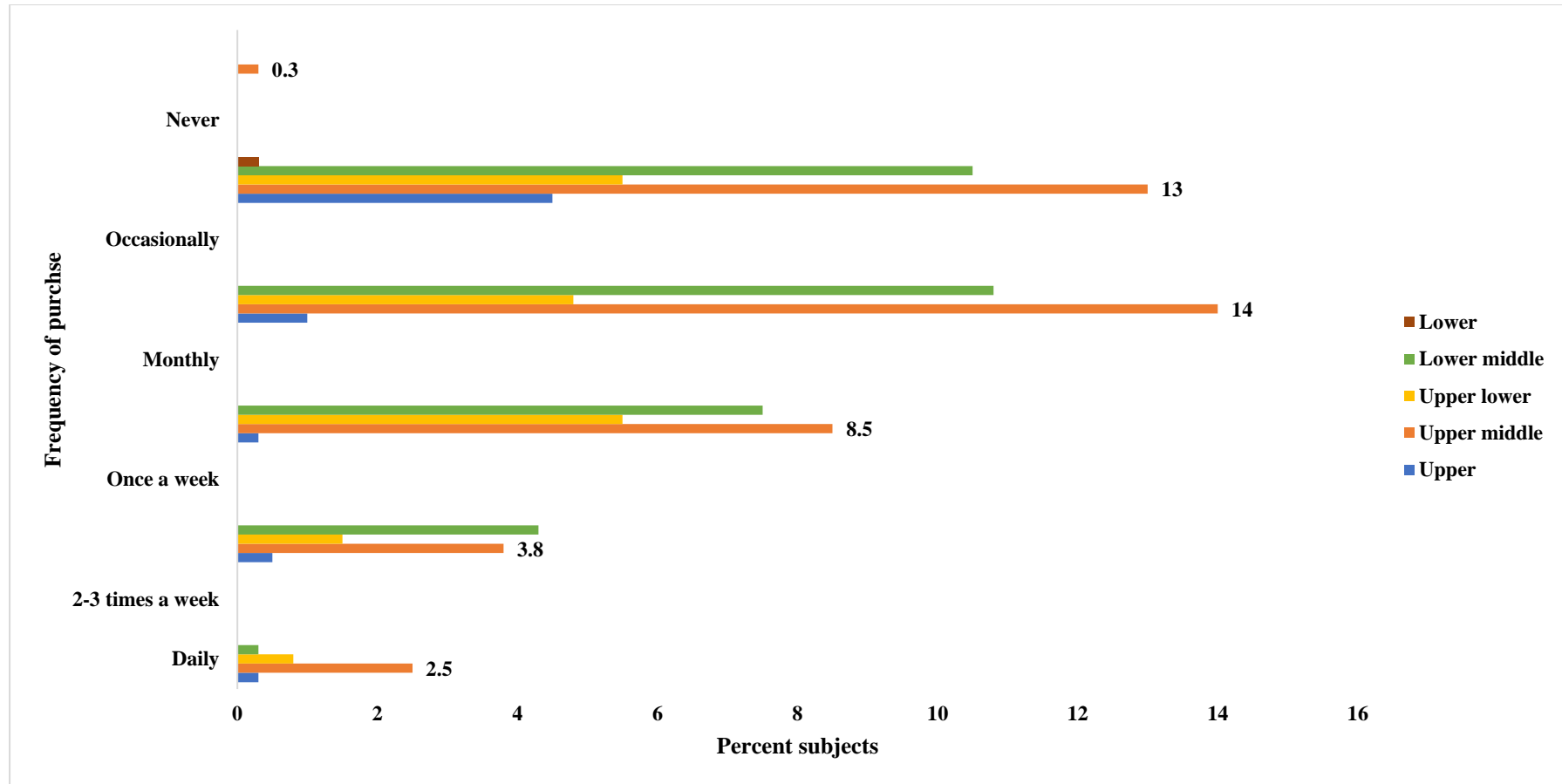
The table 4.8.5, presents an association between the frequency of PPFs purchase and body fat percentage, and the p value was found to be $p < 0.001$ indicating a statistically significant association between the frequency of PPFs purchases and the body fat percentage. Daily PPFs purchases were primarily noted among consumers with normal, high, and very high fat content of the body. Specifically, 1.3%, 1.5% and 1.0% subjects with normal, high, and very high body fat content respectively reported daily purchase. Notably, there were no reports of daily purchases of people with low body fat percentage. In terms of purchasing PPFs 2-3 times a week, 4.5%, 3.3%, and 2.0% subjects with very high, normal and high body fat percentage respectively reported the 2-3 times a week pattern of purchasing PPFs with only 0.3% reported following the same trend in low-fat. A comparable trend was observed for weekly purchases, with 3.3%, 5.5%, 13.0% with normal, high, very high fat percentage respectively following a weekly buying pattern for PPFs. Again, there were no reports of weekly purchases from people having a low body fat percentage. Monthly purchases were similar to the weekly purchase pattern where the highest frequency of purchase was reported to be done by very high body fat percentage subjects, followed by high and normal with 22.5%, 3.0%, and 2.0% respectively. The most followed purchasing pattern among the sample group was found to be occasional, where also a similar pattern was observed, with 22.8% of subjects from very high fat category reported this behaviour, followed by 7.8%, and 3.3% from high and normal body fat percentage respectively. Only 1 individual (0.3% of the total sample) reported never purchasing PPFs. The data indicated that as the frequency of purchasing PPFs increased, so did the risk of higher body fat percentage among individuals.

Table 4.8.6, illustrates the association between the frequency of PPFs and visceral fat levels, which showed a statistically significant relation which 'p' value <0.001%. Among those who purchased PPFs daily, 13 participants (3.3%) maintained normal visceral fat levels, while 2 (0.5%) had high visceral fat, and none reached very high levels. Subjects who purchased PPFs 2 to 3 times a week, 32 participants (8.0%) exhibited normal visceral fat, while 6 (1.5%) had high levels, and 2 (0.5%) were having very high levels. Participants who bought PPFs on a weekly basis i.e., 13.8% of subjects falling into normal level category, followed by 5.5% with high levels and 2.5% with very high levels. Similarly, among those who purchased PPFs monthly, 13.5% had normal visceral fat, 10.8%, and 6.3% were categorized as having very high levels from

the total of 30.5%. Occasional purchasers showed the highest prevalence totaling 33.8%, from which 16.5%, 11.5%, and 5.8% was found to be normal, high and very high level of visceral fat among individuals. Only one participant (0.3%) reported never buying PPFs and had normal visceral fat levels.

Overall, the data revealed that subjects engaging in monthly and occasional purchases of PPFs showed significantly higher proportion of high and very high visceral fat levels.

The table 4.8.7, illustrates the association between the frequency of PPFs purchase and waist circumference, with statistically significant difference between the two categorical variables, with 'p' value <0.001. Those who purchased PPFs daily, 3.0% maintained a normal waist circumference, while 0.8% were identified as centrally obese. For those who purchased PPFs 2 to 3 times per week, 5.8% had a normal waist circumference, and 4.3% were centrally obese. Subjects who bought PPFs once a week, found that more were centrally obese with 13.3%, whereas 8.5% exhibited a normal waist circumference. Likewise, among those who purchased PPFs monthly, 7.5% had a normal waist circumference, while 23.0% were centrally obese. Individuals who occasionally purchased PPFs showed the highest prevalence, with 12.5% having a normal waist circumference, compared to 21.3% who were centrally obese. Notably, only one participant (0.3%) reported never purchasing PPFs, and had a normal waist circumference.

Table 4.8.8, highlights some of the important considerations of food that influence purchasing included brand (46.0), taste (19.8%), price (12.3%), and convenience (9.8%). Factors such as nutritional value, packaging, advertising, and availability had a lesser impact.

Table 4.8.9, illustrates the association between factors that influence the food purchasing behaviour with age. Brand trust and loyalty was the most influential factor

Table 4.8.5: Association between PPFs purchase and meal skipping

Variables	Male		Female	
	Meal skipping			
	Yes	No	Yes	No
Daily	9 (2.3)	2 (0.5)	4 (1.0)	0 (0.0)
2-3 times a week	20 5.0)	4 (1.0)	13 (3.3)	3 (0.8)
Once a week	37 (9.3)	8 (2.0)	32 (8.0)	10 (2.5)
Monthly	24 (6.0)	21 (5.3)	47 (11.8)	30 (7.5)
Occasionally	43 (10.8)	31 (7.8)	39 (9.8)	22 (5.5)
Never	1 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)
Chi-square	15.645**		6.570	

Values in parenthesis indicate percentages (**- Significant at p<0.01)

Table 4.8.6: Association between PPFs purchase and fat percentage

Variables	Low	Normal	High	Very high	Total	Chi-square
Daily	0 (0.0)	5 (1.3)	6 (1.5)	4 (1.0)	15 (3.8)	58.188***
2-3 times a week	1 (0.3)	13 (3.3)	8 (2.0)	18 (4.5)	40 (10.0)	
Once a week	0 (0.0)	13 (3.3)	22 (5.5)	52 (13.0)	87 (21.8)	
Monthly	0 (0.0)	8 (2.0)	12 (3.0)	102 (25.5)	122 (30.5)	
Occasionally	0 (0.0)	13 (3.3)	31 (7.8)	91 (22.8)	135 (33.8)	
Never	0 (0.0)	0 (0.0)	1 (0.3)	0 (0.0)	1 (0.3)	

Values in parenthesis indicate percentages (***- Significant at p<0.001)

Table 4.8.7: Association between PPFs purchase and visceral fat

Variables	Normal	High	Very high	Total	Chi-square
Daily	13 (3.3)	2 (0.5)	0 (0.0)	15 (3.8)	27.988***
2-3 times a week	32 (8.0)	6 (1.5)	2 (0.5)	40 (10.0)	
Once a week	55 (13.8)	22 (5.5)	10 (2.5)	87 (21.8)	
Monthly	54 (13.5)	43 (10.8)	25 (6.3)	122 (30.5)	
Occasionally	66 (16.5)	46 (11.5)	23 (5.8)	135 (33.8)	
Never	1 (0.3)	0 (0.0)	0 (0.0)	1 (0.3)	

Values in parenthesis indicate percentages (***- Significant at p<0.001)

Table 4.8.8: Association between PPFs purchase and waist circumference

Variables	Normal	Central obese	Total	Chi-square
Daily	12 (3.0)	3 (0.8)	15 (3.8)	28.834***
2-3 times a week	23 (5.8)	17 (4.3)	40 (10.0)	
Once a week	34 (8.5)	53 (13.3)	87 (21.8)	
Monthly	30 (7.5)	92 (23.0)	122 (30.5)	
Occasionally	50 (12.5)	85 (21.3)	135 (33.8)	
Never	1 (0.3)	0 (0.0)	1 (0.3)	

Values in parenthesis indicate percentages (***- Significant at p<0.001)

Table 4.8.9: Factors that influence the purchase of the subjects (N=400)

Variable	Response	n (%)
Factors influencing purchasing	Brand	184 (46.0)
	Taste	79 (19.8)
	Price	49 (12.3)
	Convenience	39 (9.8)
	Nutritional value	14 (3.5)
	Packaging	14 (3.5)
	Advertising	13 (3.3)
	Easily available	6 (1.5)
	Other	2 (0.5)

Values in parenthesis indicate percentages

Table 4.8.10: Factors influencing food purchase - Agewise

Variables	20-39 years	40-59 years	Total	Chi-square
Brand	79 (19.8)	105 (26.3)	184 (46.0)	16.136*
Taste	50 (12.5)	29 (7.3)	79 (19.8)	
Price	26 (6.5)	23 (5.8)	49 (12.3)	
Convenience	17 (4.3)	22 (5.5)	39 (9.8)	
Nutritional value	9 (2.3)	5 (1.3)	14 (3.5)	
Packaging	5 (1.3)	9 (2.3)	14 (3.5)	
Advertising	10 (2.5)	3 (0.8)	13 (3.3)	
Easily available	3 (0.8)	3 (0.8)	6 (1.5)	
Others	1 (0.3)	1 (0.3)	2 (0.5)	

Values in parenthesis indicate percentages (*- Significant at p<0.05)

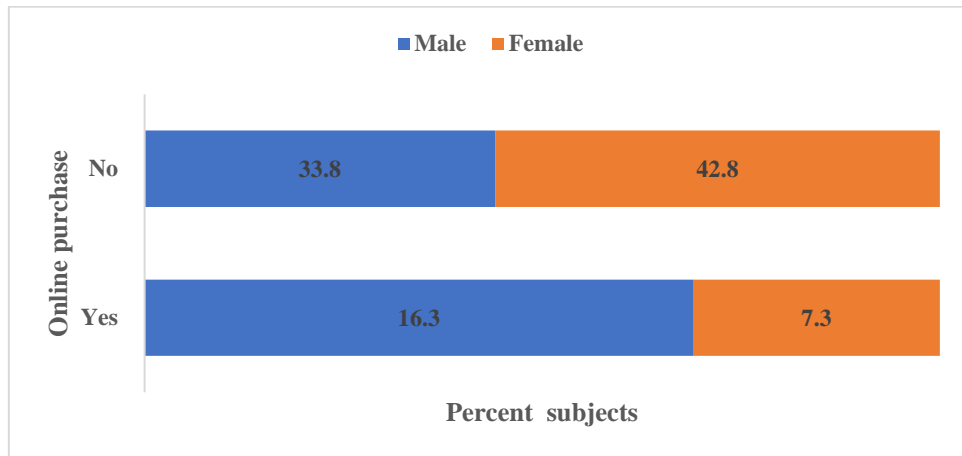**Figure 4.5: Online purchase across gender**

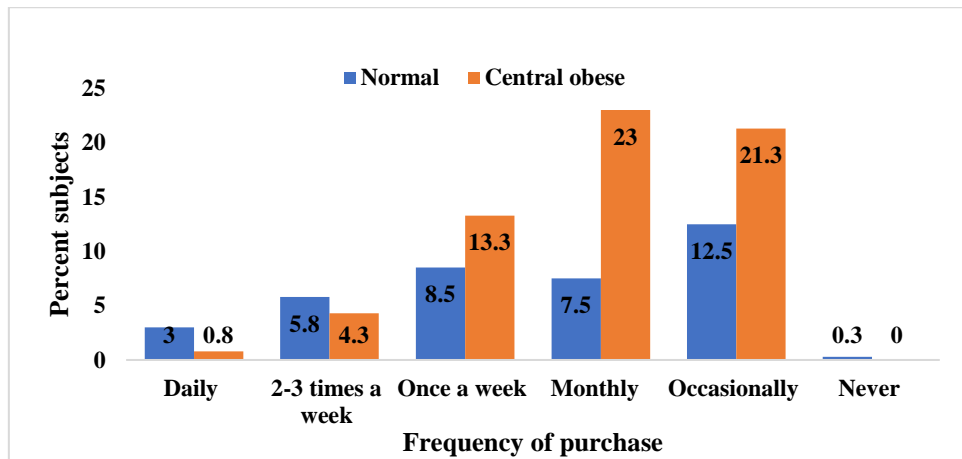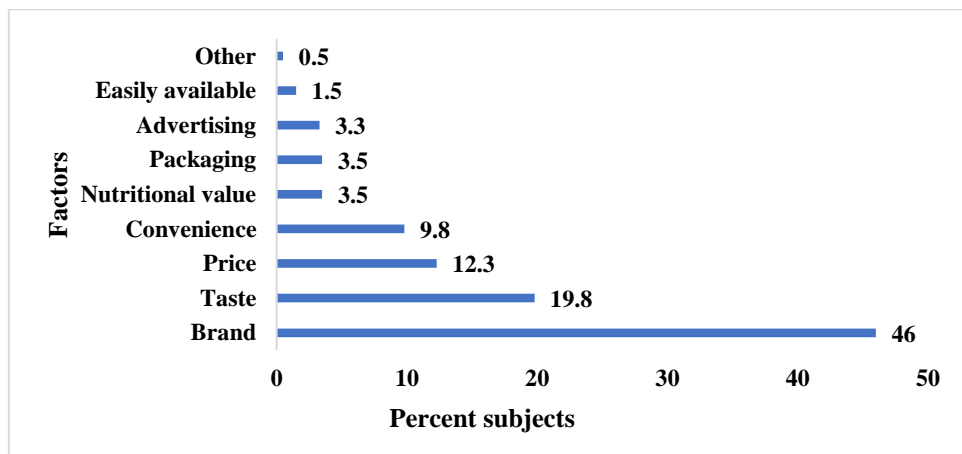**Figure 4.6: Prevalence of abdominal obesity with purchase**

Figure 4.7: Factors influencing purchase of PPFs (N=400)

across both the age groups. Around 19.8% from 20-39 years category and 26.3% from a 40-59 years, considered brand as one of the most important aspects. Almost half of the study population prioritized brand while purchasing; followed by taste which was given more significance in younger age group than in older means taste play a larger role in influencing food purchases among younger individuals, with 12.5% and 7.3% of the total population respectively. 6.5% and 5.8% of younger and older adults focused on prize while purchasing food. Convenience influenced 4.3% and 5.5% of the younger and older adults; followed by other factors like nutrition value, packaging advertising, availability of food comprises of significantly smaller proportion of people whose purchasing decision has been influenced by such factors. This difference in age groups as per the factors that influence purchasing had a statistically significant association with p value being <0.05.

As seen in table 4.8.10, the majority of purchases occurred in the evening (74.8%), followed by night (14.3%) and afternoon (9.5%).

As discussed in table 4.8.11, the relationship between the timing of the purchase and gender. Around 8.3% and 2.8% of males and females purchased PPFs in the morning or afternoon time. While 41.8% and 47.3% of males and females reported purchasing time as evening or night, totaling 89.0% of the total population suggested that majority of subjects preferred evening or night shopping across both genders. The difference in the timing across both the genders showed statistically significant association between the two variables (timing of purchase and gender) with the value of 12.805 and 'p' value <0.001.

Table 4.8.12, shows the association between the timing of PPFs purchase and age groups. Subjects from 20-39 age group seen to be undertaking larger purchases morning/afternoon compared to that of 40-59 adults with 6.3% and 4.8% respectively. Whereas, the reverse in trend was followed for people preferred evening/night time of shopping. Here the older adults reported to have a higher frequency of purchase during night compared to the young adults i.e., 45.3% and 43.8% respectively. Though there was a difference in the frequency of timing of purchase, but that difference was not statistically significantly. Therefore, both the age group exhibited almost similar purchasing behaviour in terms of timing.

Table 4.8.11: Timing of purchasing PPFs

Variable	Response	n (%)
Time of buying PPFs	Afternoon	38 (9.5)
	Evening	299 (74.8)
	Morning	6 (1.5)
	Night	57 (14.3)

Values in parenthesis indicate percentages

Table 4.8.12: Timing of purchase- Genderwise

Variables	Male	Female	Total	Chi-square
Morning/ afternoon	33 (8.3)	11 (2.8)	44 (11.0)	12.805***
Evening/ night	167 (41.8)	189 (47.3)	356 (89.0)	

Values in parenthesis indicate percentages (***- Significant at p<0.001)

Table 4.8.13: Timing of purchase- Agewise

Variables	20-39 years	40-59 years	Total	Chi-square
Morning/ afternoon	25 (6.3)	19 (4.8)	44 (11.0)	5.901
Evening/ night	175 (43.8)	181 (45.3)	356 (89.0)	

Values in parenthesis indicate percentages

Table 4.8.14: Online purchasing behaviour of the subjects (N=400)

Variable	Response	n (%)
Online purchasing	No	306 (76.5)
	Yes	94 (23.5)

Values in parenthesis indicate percentages

Besides that, table 4.8.13 showed a significant portion (76.5%) did not participate in online food shopping, while only 23.5% of participants accessed online platforms for purchase of any processed/ ultra-processed food.

Table 4.8.14, showed the association between online purchasing behaviour and gender, which was found to be statistically significant with 'p' value <0.001. 16.3% of males reported making online purchases which was more than double the percentage of females who made such purchases i.e., 7.3%. 23.5% of the total population across both the genders engaged in online purchasing, indicated that only smaller proportion of population prefers this mode of shopping for food items.

The association between online purchasing behaviour and age also showed a highly significant difference with p value <0.001. Total 23.5% of subjects were found to be doing online shopping. 15.5% from which were belonging to the younger age group and merely, 8.0% were from the olde age group. This data, suggested that age played an important role in influencing the type of shopping or might be due to the tech inspired generation, younger adults were more inclined in making online purchase. Their preferred mode of shopping was online even for food items (table 4.8.15).

A mere 19.5% of the participants consistently paid attention to food labels, whereas 13.5% did not consider them at all. The majority engaged with labels sporadically, with 22.5% often reviewing them, 22.5% rarely, and 22% sometimes while only 19.5% of respondents always examined labels before making a purchase, a notable 25.3% did so frequently. Expiration date was the most frequently checked item, with 62.8% of respondents prioritizing it. Other elements of interest included nutritional information (18.3%) and ingredient lists (15%). Very few individuals paid attention to allergens (0.5%), and 3.7% did not check labels at all. When discussed about the credibility of health claims, the predominant viewpoint was neutral, held by 42.5% of respondents. Additionally, 26.3% found health claims somewhat credible, while 20% regarded them as somewhat untrustworthy. A small fraction perceived them as very trustworthy (1.5%) or completely untrustworthy (9.8%). It was obvious from this finding that people did make informed choices as half of the respondents (50.5%) had chosen not to buy a product after reviewing its label, while 49.5% had not been influenced in this way (Table 4.9.1).

The results indicated that although many consumers considered food labeling important, though the degree of influence varied. Expiration dates were the most scrutinized information, while other factors, such as allergens, received little attention. Trust in health claims remained moderate to low.

Habit of label reading

Table 4.9.2, illustrates that 4% of subjects never checked labels before purchasing PPFs, while 26.3%, 25.3%, 25% did so sometimes, often, and rarely respectively. Apart from this, subjects prioritizing reading labels always were merely 19.5%.

Table 4.9.3, showed the association between the label reading habits among gender with p < 0.01, showing the significant difference. Among participants who indicated they "Always" read labels, 43 were female, representing 10.8% of the total sample, while 35 were male, accounting for 8.8% of the total. Conversely, in the "Often" category, the trend shifted, with 39 females (9.8%) and 62 males (15.5%) reporting this frequency. The "Sometimes" category displayed a more balanced distribution, with 52 females (13.0%) and 53 males (13.3%). A notable difference was again observed in the "Rarely" category, where 61 females (15.3%) reported this behavior, compared to 39 males (9.8%). Lastly, in the "Never" category, there were 5 females (1.3%) and 11 males (2.8%) of the total sample.

In conclusion, the analysis highlighted a significant correlation between gender and label reading habits. The findings indicated that females were more inclined to report "Always" and "Rarely" reading labels, whereas males were more likely to indicate "Often" reading labels. The "Sometimes" category exhibited a relatively equal distribution across genders. These results imply potential gender-specific differences in consumer engagement with product labels.

The table 4.9.4, presented relationship between age categories and the frequency of label reading with p <0.01, signifying a statistically significant correlation between these two variables. Among participants aged 20 to 39 years, 12.5% indicated that they "always" read labels, in contrast to only 7.0% of those in the 40 to 59 age range. The percentage of individuals who "often" read labels was marginally higher in the younger group (13.3%) compared to the older group (12.0%). Likewise, 13.3% of the younger participants reported reading labels "sometimes," while 13.0% of the older participants

Table 4.8.15: Online PPFs purchase- Genderwise

Variables		Male	Female	Total	Chi-square
Online purchase	Yes	65 (16.3)	29 (7.3)	94 (23.5)	18.023***
	No	135 (33.8)	171 (42.8)	306 (76.5)	

Values in parenthesis indicate percentages (***- Significant at p<0.001)

Table 4.8.16: Online purchase Vs age

Variables		20-39 years	40-59 years	Total	Chi-square
Online purchase	Yes	62 (15.5)	32 (8.0)	94 (23.5)	12.516***
	No	138 (34.5)	168 (42.0)	306 (76.5)	

Values in parenthesis indicate percentages (***- Significant at p<0.001)

Table 4.9: Understanding of food labels of the subjects (N=100)

Variables	Response	n (%)
Consideration of food label	Always	78 (19.5)
	Often	90 (22.5)
	Sometimes	88 (22.0)
	Rarely	90 (22.5)
	Never	54 (13.5)
Commonly focused component of the label	Allergens	2 (0.5)
	Expiration date	251 (62.8)
	Ingredient list	60 (15.0)
	Nutritional facts (calories, sugar etc.)	73 (18.3)
	None	14 (3.7)
Trustworthiness of health claims	Neutral	170 (42.5)
	Somewhat trustworthy	105 (26.3)
	Somewhat untrustworthy	80 (20.0)
	Untrustworthy	39 (9.8)
	Very trustworthy	6 (1.5)
Impact of Labels on Purchase Decisions	No	198 (49.5)
	Yes	202 (50.5)

Values in parentheses indicate percentages

Table 4.9.1: Reading of food labels among the subjects (N=400)

Variables	Response	n (%)
Reading label before purchasing	Always	78 (19.5)
	Often	101 (25.3)
	Sometimes	105 (26.3)
	Rarely	100 (25.0)
	Never	16 (4.0)

Values in parenthesis indicate percentages

fell into this category. On the other hand, a larger percentage of older participants (15.3%) stated that they "rarely" read labels, compared to 9.8% of the younger cohort. Furthermore, a greater proportion of individuals aged 40 to 59 years (2.8%) reported that they "never" read labels, as opposed to 1.3% of those aged 20 to 39 years.

In summary, the results indicated that younger individuals were more inclined to read labels frequently, whereas older participants exhibited a higher likelihood of rarely or never engaging in label reading. The statistically significant chi-square value reinforced the presence of a relationship between age and label-reading habits.

Table 4.10 gives insights into food consumption habits of processed packaged foods (PPFs). Majority (81.5%) of subjects primarily consumed home-cooked meals. In contrast, a minor segment (2.8%) mainly opted for processed foods, while 15.8% had a combination of both home-cooked and processed meals. Nearly one-fourth of respondents reported to never substitute healthy foods with processed alternatives. Conversely, one-third reported occasionally and 10.5% frequently replaced healthy meals with packaged or processed options, indicating a significant shift towards increased processed food consumption. The results recommended that while most individuals favored home-cooked meals, there was a tendency to occasionally replace them with processed foods. Awareness of the health risks associated with PPFs was prevalent, with many respondents linking them to weight gain and health problems.

Table 4.10.1 suggests that 38.0% of males had home cooked meals whereas there was a slight increment in percent of females mostly having home cooked meals i.e., 43.5%, most of the participants belonged to this group. Twice the percent of females were found to be replacing their meals with processed foods in case of males i.e., 10.8%. The data reflected a greater reliance on processed foods among males compared to females. As discussed earlier in table 4.8.11, the males were found to purchase PPFs during the day time as majority of them skip breakfast. This replacement of healthy food with processed foods was statistically different across the gender with 'p' <0.01, signifies that individuals' consumption patterns of home-cooked meals compared to processed foods are shaped by their gender.

Table 4.9.2: Food Label reading - Genderwise

Variables	Female	Male	Total	Chi-square
Always	43 (10.8)	35 (8.8)	78 (19.5)	13.158**
Often	39 (9.8)	62 (15.5)	101 (25.3)	
Sometimes	52 (13.0)	53 (13.3)	105 (26.3)	
Rarely	61 (15.3)	39 (9.8)	100 (25.0)	
Never	5 (1.3)	11 (2.8))	16 (4.0)	

Values in parenthesis indicate percentages (**- Significant at p<0.01)

Table 4.9.3: Food Label reading- Agewise

Variables	20-39 years	40-59 years	Total	Chi-square
Always	50 (12.5)	28 (7.0)	78 (19.5)	13.552**
Often	53 (13.3)	48 (12.0)	101 (25.3)	
Sometimes	53 (13.3)	52 (13.0)	105 (26.3)	
Rarely	39 (9.8)	61 (15.3)	100 (25.0)	
Never	5 (1.3)	11 (2.8)	16 (4.0)	

Values in parenthesis indicate percentages (**- Significant at p<0.01)

Table 4.10: Replacement of home cooked/ Healthy meals (N=400)

Variable	Response	n (%)
Consumption of home vs packaged/processed food	Half home-cooked, half processed	63 (15.8)
	Mostly home-cooked meals	326 (81.5)
	Mostly processed foods	11 (2.8)
Replacement of healthy food with packaged/processed food	Never	74 (18.5)
	Often	42 (10.5)
	Rarely	151 (37.8)
	Sometimes	133 (33.3)

Values in parenthesis indicate percentages

Table 4.10.1: Replacement of home cooked/ Healthy meals – Genderwise (N=400)

Variables	Male	Female	Total	Chi-square
Mostly home-cooked meals	152 (38.0)	174 (43.5)	326 (81.5)	9.972**
Half home cooked, half processed	43 (10.8)	20 (5.0)	63 (15.8)	
Mostly processed foods	5 (1.3)	6 (1.5)	11 (2.8)	

Values in parenthesis indicate percentages (**- Significant at p<0.01)

As shown in table 4.10.2, largely individuals from both the age groups were having home-cooked food and not substituting it with processed one i.e., 35.0% and 46.5% for younger and older adults, indicated that the older adults had a preference to eat at home than the younger age group. Total 15.8% of subjects were replacing home-cooked with processed food, 12.5% from younger age group and only 3.3% from the older adults, suggested that as individual age the dependency on processed food tends to decrease. Although this difference of replacing home cooked meal to processed food according to age was found to be statistically significant with the 'p' value <0.001.

The data on perceptions/awareness regarding processed packaged foods (PPFs) where the majority (58.8%) of subjects strongly believed that PPFs were linked to weight gain and various health issues. Additionally, 22% agreed with this perspective, while 15.5% remained neutral. Only a small minority (3.8%) disagreed with the viewpoint. Alongside that approximately 37.5% of respondents considered it as a "very high" risk, and 27.5% consider it "high". Meanwhile, 24.3% perceived a moderate risk, with a small percentage (10.3%) considered it as low or very low (0.5%). Most subjects (66.8%) asserted that health claims did not affect their perceptions. However, 33.3% acknowledged being influenced by such claims (Table 4.11).

Nevertheless, a significant portion of respondents were swayed by health claims, highlighting the necessity for clearer food labeling and enhanced public education regarding the risks of processed food consumption.

Table 4.12 focuses on barriers faced by the respondents in accessing healthy foods and products. A significant majority (92.3%) reported no difficulties in accessing healthy foods, while a minor segment (7.8%) experienced challenges in obtaining those products. Talking about the proximity of markets a large portion of respondents (59.5%) had markets situated within 1-3 kilometers from their homes. Additionally, 38.5% lived less than 1 kilometer away from markets, indicating relatively straightforward access. Only 2.0% travelled between 3-5 kilometers to reach markets, highlighting minimal geographic barriers. Further, one of the major factors that act as barrier in choosing healthy food options was found to be busy lifestyle with 20.5% subjects reported it being the major reason because of which they find it difficult to manage healthier lifestyle. Some of the other factors were cravings followed by irregular working hours, willpower, social outings, taste preferences, and limited

Table 4.10.2: Replacement of home cooked/ Healthy meals – Agewise (N=400)

Variables	20-39 years	40-59 years	Total	Chi-square
Mostly home-cooked meals	140 (35.0)	186 (46.5)	326 (81.5)	35.585***
Half home cooked, half processed	50 (12.5)	13 (3.3)	63 (15.8)	
Mostly processed foods	10 (2.5)	1 (0.3)	11 (2.8)	

Values in parenthesis indicate percentages (***- Significant at p<0.001)

Table 4.11: Perceptions and awareness regarding PPFs (N=400)

Variable	Response	n (%)
PPFs contribute to weight gain/ health issues	Agree	88 (22.0)
	Disagree	15 (3.8)
	Neutral	62 (15.5)
	Strongly agree	235 (58.8)
Risk of consuming PPFs regularly	Very high	150 (37.5)
	High	110 (27.5)
	Moderate	97 (24.3)
	Low	41 (10.3)
	Very low	2 (0.5)
Health claims influence your perception	No	267 (66.8)
	Yes	133 (33.3)

Values in parenthesis indicate percentages

Table: 4.12 Barriers in purchasing healthy foods among subjects (N=400)

Variables	Response	n (%)
Face issues in accessing healthy foods	No	369 (92.3)
	Yes	31 (7.8)
Distance to market	Less than 1 km	154 (38.5)
	1-3 km	238 (59.5)
	3-5 km	8 (2.0)
Factors acting barrier in choosing healthy options	Busy lifestyle	82 (20.5)
	Cravings	70 (17.5)
	Irregular working hours	61 (15.3)
	Willpower	49 (12.3)
	Social outings	36 (9)
	Taste preference	22 (5.5)
	Limited cooking time	11 (2.8)
	Lengthy preparation	6 (1.5)
	Unappealing foods	4 (1.0)
	Price of healthy products	2 (0.5)
	Healthy options are not readily available as unhealthy	1 (0.3)
	Healthy option is perishable	1 (0.3)
	Lack of storage facilities	1 (0.3)
	Laziness	1 (0.3)
	N/A	7 (1.8)

Values in parenthesis indicate percentages

Figure 4.8: Factors affecting healthy food options
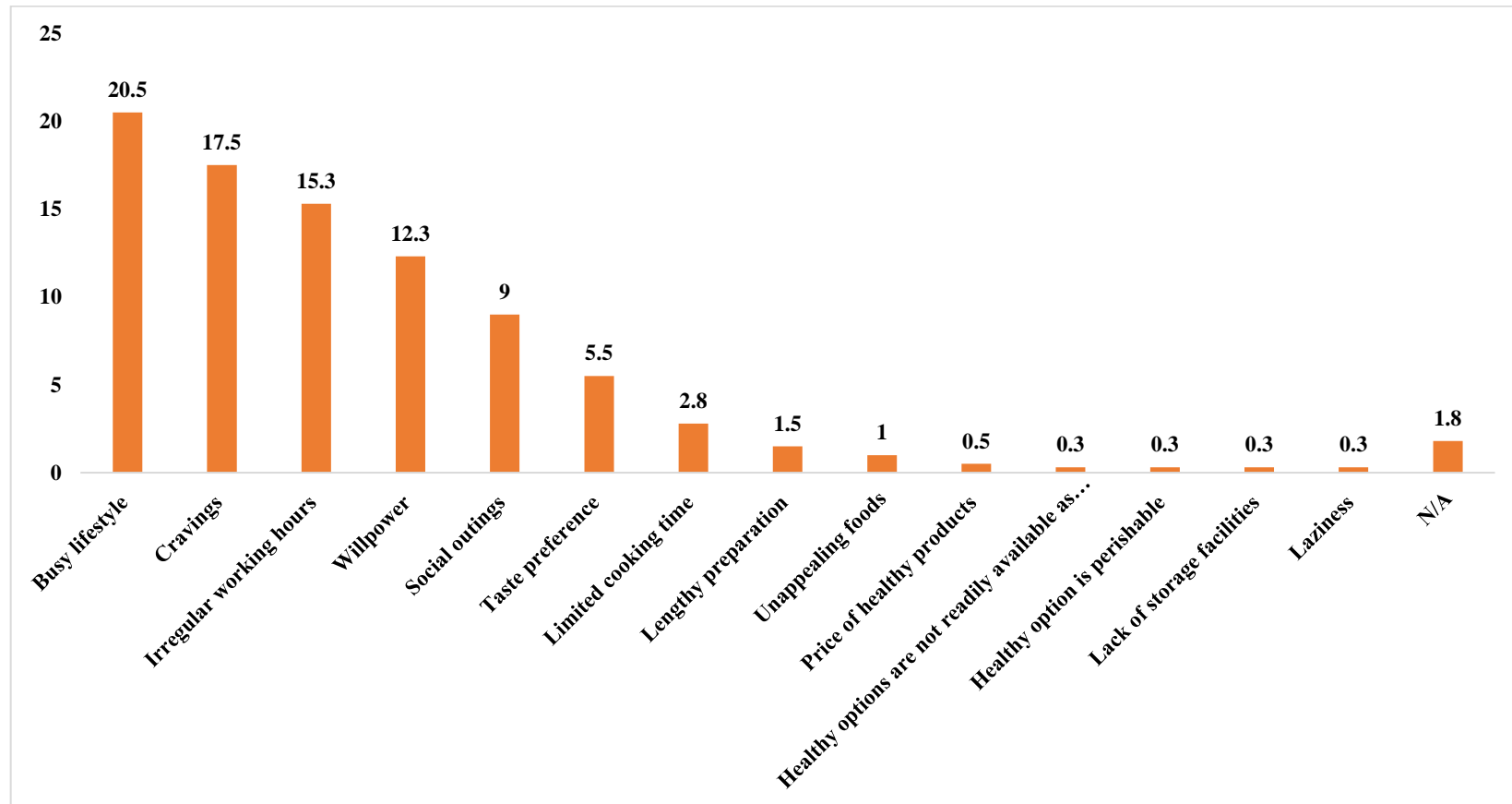
cooking time with 17.5%, 15.3%, 12.3%, 9.0%, 5.5% and 2.8%. Other factors did act as barrier.

The results suggested that physical accessibility was not a major obstacle for most respondents in acquiring healthy foods, as markets were typically located at short distances. Nevertheless, a small fraction continued to encounter difficulties.

DISCUSSION

Urban consumption of fast and processed foods is a threat to nutrition security (C. d'Amour et al., 2020). Urbanization in India has brought a dramatic change in eating habits, where there is a growing dependence on packaged-processed foods (PPFs) and foods high in fat, sugar, and salt (HFSS) content. Economic growth, urban migration, and changing work cultures have taken a toll on busyness, leaving little time for cooking at home. Therefore, consumption of convenience foods, ready-to-eat meals, and fast food has increased significantly over time, especially in urban cities (Popkin, 2017). The diet change was stimulated by higher disposable incomes, aggressive promotions of food products, and convenient availability of PPFs at retail outlets, small shops, and internet-based delivery websites (Basu et al., 2022).

Research has shown that Indian populations in urban areas are increasingly having fewer traditional meals prepared at home and more PPFs, hence higher obesity and non-communicable diseases like diabetes and high blood pressure (Imamura et al., 2015). The rising appetite for eating outside and the upsurge of food delivery also increases the reliance on PPFs. Evidence also points out that though healthy eating awareness has increased, behavioral change was slow because of the convenience and taste of HFSS foods (Singh et al., 2020). This dietary change emphasized the imperative for policy action, such as tighter labeling controls, taxation on unhealthy food, and community-level health programs to encourage dietary diversity and balanced eating.

Hence, the present study was carried out to elicit the information regarding the food purchasing behaviour of packaged processed foods high in fat, sugar and salt amongst adults aged 20- 59 years. For the study, 400 subjects were enrolled from 4 administrative zones of Vadodara. A detailed questionnaire was formulated to assess the food purchasing behaviour among the adults residing in urban Vadodara. Data was collected for Background information, Socio-Economic Status, Medical and family history, Anthropometry measurements, Biophysical measurements, Body composition analysis, Dietary patterns, Food Purchasing behaviour, Food Frequency questionnaire, 3 days (2 working and 1 weekend), 24-hour dietary recall.

In the present study, the mean age of the subjects was 38.9 ± 12.4 and 39.1 ± 12.4 for males and females. The majority of the subjects belonged to upper-middle socio-economic strata, where most families either owned shops or ran businesses.

The obese people are at risk of developing NCDs, particularly if there is a history of the same in the family. It has been found that the risk of developing hypertension has

been estimated to be four times higher than normal. Likewise, the risk of developing diabetes, dyslipidemia also increases, subject to a strong family history (van der Sande et al., 2001).

In the present study, the prevalence of self-reported hypertension (8.5%) was highest, followed by diabetes (6.5%). The prevalence of hypo/hyperthyroidism for self-reported was found to be 3.8%. The mean weight of the subjects was 66.01± 13.12 kg with the mean height 161.45 ± 9.10 cm, making the mean BMI shit towards the higher side with 25.4 ± 4.78 kg/m2 falling more than half of the population in the obese category as per the Asia Pacific classification. There was a statistically significant association between gender and BMI, with a higher proportion of females being obese compared to males (33.3% vs. 20.3%). The mean waist circumference of 89.3 ± 11.2 cm; however, the mean waist circumference values were higher in males than in females, with the mean waist hip ratio of the subjects being 0.887 ± 0.08. Around 54% of the subjects were found to be obese, and 16% were overweight.

Obesity is a significant public health problem, crossing both developed and developing societies. It raises the risk for heart disease, stroke, certain cancers, and type II diabetes. While individual behaviors are significant risk factors, the effects of the urban physical and social environment on obesity and overweight (Congdon, 2019). The ICMR-INDIAB survey was carried out in urban and rural settings of 31 states, union territories, and the National Capital Territory. The findings of the ICMR-INDIAB study suggest that diabetes and other metabolic non-communicable diseases (NCDs) are far more prevalent in India than previous estimates. Though the epidemic of diabetes is flattening in more advanced states, it is on the increase in many other places. The weighted prevalence rates overall were calculated to be 11.4% for diabetes, 35.5% for hypertension, 28.6% for general obesity, 39.5% for abdominal obesity, and 81.2% for dyslipidaemia. All metabolic NCDs except prediabetes were more prevalent in urban versus rural locations (Anjana et al., 2023).

Abdominal obesity means an excessive accumulation of fat in the abdomen. This condition is common among South Asians and is correlated with a lower risk of non-communicable diseases (NCDs). It differs from body mass index and is measured by a higher waist circumference, as ≥90 cm for males and ≥80 cm for females (Dhawan & Sharma, 2020). The prevalence of abdominal obesity was found to be 62.5% in the present study. Waist circumference also showed a significant association with gender,

with a higher proportion of females having abdominal obesity (38.3% vs. 24.3% in males).

The mean systolic blood pressure of the subjects was 125 ± 20.1 mm Hg and diastolic blood pressure 85 ± 12.3 mm Hg. Around 42% of the subjects were found to be hypertensive. Around 3% of the subjects were found to be pre-hypertensives, indicating that they had a risk of developing hypertension shortly. A highly significant association between gender and BP showed males exhibited higher blood pressure levels than females. Blood pressure also tended to increase with age, indicating a higher risk of hypertension among older individuals. The study findings show that hypertension exists in 22.6% of the Indian population, and the prevalence is higher among men at 24.1% than among women at 21.2%. Hypertension rose with increasing age, peaking at 48.4% among persons aged 60 years and above. Another study reported that the prevalence of HTN was marginally higher in urban areas (25%) than in rural areas (21.4%), reflecting a pervasive increase in hypertension among all sectors of the population (Mohammad & Bansod, 2024).

The mean body fat percentage of the subjects was 31.46 ± 7.83, with the mean fat percentage for males and females being $26.126 \pm 6.30\%$ and $36.864 \pm 5.04\%$, which indicated a higher fat percentage among females. The mean percentage of visceral fat was found to be slightly higher in males than in females, i.e., $9.533 \pm 5.49\%$ and $9.138 \pm 5.41\%$. Mean skeletal muscle was higher in males than in females, which was reported to be $30.52 \pm 3.56\%$ and $22.61 \pm 2.21\%$, respectively. Similar results were found in a study where women had a higher proportion of body mass in the form of fat and tended to store fat subcutaneously and in the lower body. Men tend to store fat in the abdominal region. A surplus of adipose tissue in the abdominal region, especially visceral fat, is associated with higher health risks (Power & Schulkin, 2008). A significant association was found between the mean difference of actual age and body age with gender.

Diet acts as one of the important modifiable risk factors in developing obesity and other co-morbidities. The dietary data of the subjects in the present study showed that the majority of them were vegetarian (53.5%). Most of them followed the three-meals pattern (61.5%), and over one-fourth of the subjects consumed at least 2 meals daily. Skipping meals was observed in around 32% of the subjects. A similar study concluded that not eating breakfast had a more pronounced effect on waist circumference and BMI (Watanabe et al., 2014).

The mean intake of energy, carbohydrate, protein, and fat was 1086.39 ± 295.75, 132.94 ± 38.96, 31.98 ± 16.28, and 45.17 ± 17.008. The macronutrient intake showed a declining trend with increasing age, which was found to be significant. The majority of subjects reported consuming 4-8 food groups in a day, falling into a moderate diversity, indicating a reasonably diverse dietary pattern incorporating balanced nutrient intake. It was found that 60.8% preferred eating out occasionally, followed by 18.8% of the subjects who preferred eating out fortnightly. Whereas 13% reported to dine out once a week, while a small proportion, i.e., 7.5 preferred eating out every three days. Dining out refers to the eating of food in a location away from home. Over the last decade, both the frequency and the pattern of dining out changed dramatically. People are attracted to eating out for its affordability, convenience, taste, and, above all, the massive promotional campaign that identifies it as being more social in nature (T. Ravi, 2018). Around 85% of the subjects reported that family members exerted the most significant influence, followed by 13% of subjects who reported friends being influenced their food habits the most in the present study.

Our findings align with studies from other urban Indian populations, which also highlighted brand being the major reason of PPFs and UPFs purchase. In the present study, 46%, almost half the population, also showed a bias or trust for the regionally reputed brands. There is an indication that supports the link between brand sponsorship and purchasing behavior. A brand image emerged from endorsements. Endorsements support a product if they are favorable, and they were able to a positive impact on consumers' purchasing intentions. In particular, in the food industry, brand sponsorship can contribute to more purchases, bringing about an element of trust among consumers (Baskar & Sundaram, 2014). Other factors like taste, price, and convenience have a significant role in shaping the purchasing behavior of an individual. These factors had an association with age, notably 26% of older adults gave more importance to brands emphasizing that they believe in brand loyalty, while younger adults were more influenced by taste and price of the food product. The small proportion of subjects also reported packaging, advertising, and availability as some of the factors that influence their purchasing behaviour.

An attempt was also made to understand the purchasing practices of subjects based on the time of PPFs purchase. Nearly three-fourths of the total population opted for evening as the best time to purchase PPFs; when seen alongside gender was found that more females (47.3%) were actively purchasing PPFs, which can be due to cravings.

The majority of female subjects were reportedly homemakers. While males reported a high frequency of purchase in the morning. This finding was aligned with the study using point-of-sale data analysis indicated that consumers tend to consume more unhealthy products in the evening. Two laboratory experiments further substantiated this behavior by suggesting that lower self-control in the evening is a major driver of consumers purchasing more unhealthy products during this time (Yang et al., 2022).

The data on food purchasing habits via online platforms revealed that one-fourth of the subjects actively use the technology and look at the variety of foods high in fat, sugar and salt while sitting leisurely. Among them, the majority (15.5%) were young adults, and 16.3% of males constituted more than double the proportion of females who were using online platforms for purchasing processed packaged foods.

Information was compiled regarding the tendency to consider food labels while purchasing. This emphasized that 22.5% of individuals take labels into account frequently, whereas 19.5% do consider labels. The most commonly focused component of the label was the expiry date, with 62.8% at least checking the expiry date, followed by 18.3% of the subjects focusing on nutritional facts (calories, sugars, total fats). The present study measured the percentage of subjects reading labels before purchasing. It was found that 26.3% of subjects sometimes give attention to the labels from purchasing, followed by 25.3% of total subjects often reading labels before purchasing food, and 25% of subjects reported never reading any label. 19.5% of subjects go through the label beforehand. The younger adults reported to focus more on the labels than the older adults, with younger adults mainly paying attention to often/sometimes and always frequency, while older adults focus on labels rarely. The study conducted in India assessing the demographic influence on preference for food labels was found to be harmonized with our findings, which showed that females often focus on the labels compared to males. or in which the studies reported that gender variations did occur, with men emphasizing more on expiry dates and brand name, while women focused more on storage conditions, nutritional values, and ingredients' details (Chitrambigai et al., n.d.). Another study also reported that women prioritize nutrition and reliability more than men (Sanlier & Seren Karakus, 2010).

SUMMARY AND CONCLUSIONS

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The significant dietary and lifestyle changes in the 20th and 21st centuries, marked by higher reliance on processed foods, higher food consumption away from home, and higher levels of sedentary behavior, have led to an increase in non-communicable diseases (NCDs) such as obesity, diabetes, and hypertension. This shift is driven by a range of factors such as urbanization, globalization, technological advancements, and transformations in food processing and marketing. This increased prevalence of NCDs, driven by these factors, highlights the very critical significance of studying food purchasing behaviour since they are influenced by personal preferences, cultural forces, social contacts, economic considerations, and the overall food environment.

With this background, the present study was designed to understand the purchasing pattern of foods high in fat, sugar and salt in amongst adults between 20- 59 years. The aim of this study was to explore the adults' food purchasing behaviours residing in urban Vadodara, in light of the increasing prevalence of non-communicable diseases (NCDs) linked with poor dietary choices. A cross-sectional study design was adopted, using snowball sampling to gather a sample of 400 participants from four wards of Vadodara. Data was collected through semi-structured questionnaires, anthropometric measurements, body composition assessments, biophysical parameters, and dietary pattern analysis. Ethical clearance for the study was provided by The Faculty of Family and Community Sciences at Maharaja Sayajirao University of Baroda.

1. **Background Information, Socio-economic Status, Family and Medical history**

   The background information, socio-economic status, family and medical history of the subjects was assessed using pre-tested, semi-structured questionnaire.

   BACKGROUND INFORMATION
   - The mean age of the subjects was 39 ± 12.4 years.
   - The subjects were found to be distributed (200 males and 200 females)
   - Majority of subjects lived in nuclear housing setting (65%).
   - A greater proportion of sample were married (72.5%).

SOCIO-ECONONIC STATUS

- Most of the study population were from upper middle strata which consisted of 42%, then 33.3% of the subjects belonged to lower middle economic class.

FAMILY AND MEDICAL HISTORY

- Family history was highest for diabetes and hypertension, even smaller proportion reported hyperlipidemia.

- The self-reported medical history was highest prevalence of hypertension i.e., 8.5%, followed by 6.5% of individuals being diabetic, and 3.8% reported hypo/hyperthyroidism.

2. **Anthropometric and Biophysical measurements**

- The mean height of the subjects was 161.45 ± 9.10 cm while the average weight was 66.01± 13.12 kg.

- The average BMI was found to be 25.4 ± 4.78 kg/m^2.

- The prevalence of obesity was significantly higher in the study population with 53.5% being obese, followed by 15.5% overweight as per Asia-Pacific criteria.

- The prevalence of overweight was found to be significantly higher in males (9.3%) than in females (6.3), whereas more of females (33.3%) were found to be obese.

- The people belong from older age group showed the higher BMI.

- The mean value for parameters assessing abdominal obesity like WC was 89.3 ± 11.2 cm and WHR was 0.887 ± 0.08.

- The abdominal obesity measured by WC and WHR revealed that around 65% of the subjects had measurements higher than the normal.

- The prevalence of hypertension was found to be 41.8%, whereas only 8.5% reported the history of hypertension for self, indicating people were not aware about the condition. And 3% was falling under pre-hypertensive state.

- The mean systolic blood pressure was found to be 125 ± 20.1 mm Hg, while mean diastolic blood pressure was 85 ± 12.3 mm Hg.

- The prevalence of hypertension was more prevalent in older adults.

3. **Body Composition analysis**

- The analysis revealed that 56.3% of the subject were having very high body fat percentage, followed by 17.3% having high fat percentage.

- The majority of subjects found to have a normal visceral fat percentage (55.3%), followed by 29.8% having high percentage of abdominal fat.

- 29.3% of younger adults reported to have a low skeletal muscle, followed by 20.6% having normal skeletal muscle percentage.

- For older adults, almost everybody showed low skeletal muscle (48.9%) suggesting the age-related muscle deterioration.

- The variation in mean body age was found to be 4.415 ± 9.53 and 11.705 ± 8.57 in males and females, respectively, showing that the females possess significantly greater body age compared to males, which might be because of the inflammation in body, chronic diseases, genetic predisposition, and poor lifestyle.

4. **Dietary habits and consumption of HFSS foods among subjects**

    The information was gathered for dietary habits, consumption of HFSS foods, and household dietary diversity.

- Most of the subjects adhered to the vegetarian diets (53.5%), followed by 38% reported following non-vegetarian diet.

- About 62% of the subjects follow three meals pattern, followed by 30.8% consuming at least two meals a day.

- More than half of the subject reported skipping of meals i.e., 67.3%, with breakfast being mostly ignored among the sample (46%).

- The average intake of energy, CHO, protein, and fat was found to be 1086.39 ± 295.75 kcal, 132.94 ± 38.96 g, 31.98 ± 16.28 g, and 45.17 ± 17.008 g respectively.

- Males exhibited higher intake of energy and other macronutrient than females.

- Across the age group the intake significantly showed a decline in intake of energy and other macronutrients with increase in age. The difference in the intake of energy, CHO, and fat was found to be statistically significant too.

- The consumption of high-fat foods was mostly occasional. Wafers were consumed once a week by 17.5% of participants, while 14.3% consumed samosas and 12.3% ate panipuri at the same frequency.

- Nearly one-third, 22.8% of subjects reported fortnightly consumption of Vadapav, followed by Sevusal (18.0%), and kachori (15.5%).

- The intake of sweet foods was mostly occasional. Cola was the most commonly consumed sweet drink, with 28.3% of participants consuming it occasionally and 7.5% consuming it once every 10 days. Moreover, 90.3% of participants rarely consumed energy drinks, and 87.5% reported rarely consuming alcoholic drinks.

- The frequency of consumption of foods rich in salt was found very minimum. 5.0% of subjects reported to have papad once a week along with their meals. With monthly consumption of soup and oats reported was 27% and 8.3%.

- Consumption of foods with high fat and sugar was indicated to be occasional. Only 4.3% of respondents used to have ice cream every week, followed by 4.0% chocolate. Pudding was eaten by 76.8% of respondents, 32.2% occasionally, and 34.8% at least monthly.

- The majority consumption of traditional Gujrati snacks like gathiya, papdi, chawanu, sev etc. was found to be weekly by 32.3%, 27.8%, 27.5% and 35.3% respectively.

- The participants exhibited a lower consumption of homemade snacks with 8.5% reported having chikki once a week, and 12.8% reported consuming kachariyu pak at least once a month.

- The HDDS revealed that 75.5% of the population had moderate dietary diversity with the consumption of 4 to 8 food groups. Moreover, 20.3% exhibited high diversity, involving over 8 food groups for nutrient adequacy. Conversely, 4.3% manifested low dietary diversity with the intake of less than 4 food groups, with the possibility of causing nutrient deficiencies.

5. **Food purchasing behaviour of the subjects**
   - An overwhelming number of subjects (99%) reported purchasing PPFs.
   - Those 99% reported that the 40.8% of the total purchase was intended for both family and self, followed by 12% purchasing only for themselves and 12.3% purchasing or only their children.
   - The majority of subjects (60.8%) occasionally dined out, then 18.8% dined out once every 15 days, 13% once a week, and 7.5% twice a week. Also,

46% of them spent up to ₹500 on PPFs, 32.8% spent ₹500–₹1,000, and 5.3% spent more than ₹2,500 per week.

- The most preferred cuisine while eating out was found to be street food with 29.8%, followed by 24% choosing Punjabi, Gujrati, Chinese, Non-veg, Italian, and south Indian with 22.3%, 8.5%, 4.9%, 4.8%, and 3.8%. some other responses were Rajasthani, Kathiyawadi and Jain.

- Total 33.8% of participants had purchased PPFs occasionally, 30.5% had bought them monthly, 21.8% bought them weekly, 10% bought them 2–3 times a week, and 3.8% bought them daily. Purchase frequency was highly different between age groups, with younger adults purchasing PPFs more often, while older adults had mostly bought them on a monthly or occasional basis.

- Meal skipping was correlated with purchase frequency. Males skipped meals and bought PPFs more often, with 9.3% doing so on a weekly basis, whereas the majority of females had a monthly pattern (11.8%).

- Purchase frequency was statistically significant with stages of hypertension. People with normal BP were more likely to make a purchase, whereas those with hypertension had varied purchasing patterns.

- There was a positive relationship between body fat percentage and visceral fat and the purchase frequency of PPF. Total body fat percentage was highest for people who bought monthly (25.5%), followed by those who bought occasionally (22.8%) and weekly (13%).

- Subjects with high percentage constituted a larger group than subjects with very high and normal percentage. 11.5% of those buying occasionally were reported to have high visceral fat, followed by 10.8% of those buying monthly and 5.5% weekly. 1.5% of those buying PPFs 2-3 times a week were found to have high risk of NCDs.

- Nearly, one-fourth (23%) of individual making monthly purchase was found to have an abdominal obesity, followed by 21.3% purchasing occasionally.

- Brand (46%) was found to be the most influencing factor among both the age group, which can be due to the safety or trust in the quality of the product, followed by taste, and price.

- 74.8% of subjects purchasing PPFs during evening, followed by 14.3 at night. The timing of purchase was significant across age with males purchasing more during day time while females did so at night.

- Online food purchasing was reported by 23.5% of the subjects. More of males (16.3%) reported doing online food shopping than females (7.3%), and across age groups, younger adults reportedly doing online purchase.

- 19.5% of subjects always consider food labels and 13.5% never doing so; 62.8% off subjects commonly focused on expiry date followed by 18.3% reported for focusing on nutritional facts.

- Around one-fourth (25.3%) reported reading label before purchasing, and 19.5% doing it regularly. 10.8% of females were reported always focusing more on labels than males (8.8%) and younger adults focusing more on labels than the older adults.

- Previously, 81.5% said they mostly ate home-cooked food, while 15.8% said they ate both home-cooked and processed food. 43.5% of women reportedly ate more home-cooked food, while 10.8% of men ate half home-cooked and half processed food. Young adults had a trend toward eating half home-cooked and half processed or mostly processed food, while older adults had more home-cooked food (46.5%).

- 58.8% of the subjects disagreed strongly that PPFs caused weight gain or other health conditions, while 15.5% of them were neutral and 3.8% disagreed. 37.5% of the respondents scored the risk of frequent consumption of PPFs as very high, while 27.5% scored as high.

- The larger percentage of the sample (92.3%) did not experience any issues in getting healthy food, whereas 7.8% reported still experiencing issues. Busy lifestyle was one aspect that served as a barrier in opting for healthy choices, with 20.5% of the sample citing it as a typical feature, followed by cravings (17.5%), irregular working schedules (15.3%), and willpower (12.3%). These were the only factors which significantly caused hindrance in selecting healthy food options.

CONCLUSIONS

The results of the present study indicate a higher prevalence of hypertension and obesity, with obesity being more prevalent in older adults. It was found that older adults spent more money while making purchases, which signifies that monetary independence plays an important role in influencing the food purchasing behaviours of individuals.

Furthermore, the research demonstrates higher consumption of both i.e. home-cooked meals and PPFs, indicating that people are consuming more calories at a time, increasing the risk of being obese and thereby leading to the development of NCDs. The younger generation was found to be frequent consumers of packaged processed foods or foods high in fat, sugar and salt, indicating a need to create awareness on healthy eating behaviours as they are going to be the productive workforce of the country in the future. Also, obesity was found to be significantly higher among individuals who were not reading labels. This calls for raising consumer awareness regarding food labels through various strategies, which would enable the population at large to make healthier food purchases.

RECOMMENDATIONS

- There is an urgent need to undertake long-term research to investigate the change in food purchasing habits over time and their impact on NCD development.
- Additionally, focus on educational components of behavioral interventions, e.g., nutrition education interventions, can be rolled out in the curriculum.
- Furthermore, the study on the evaluation of the effect of current government regulations, i.e., the Food Safety and Standards Authority of India (FSSAI) regulations for labeling and advertising, on consumer preference in different states can be done to identify the best practice.

LIMITATIONS

- Due to time constraints, only the assessment of purchasing behaviours could be done.
- Assessment of physical activity levels for the subjects was not considered.

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APPENDICES

APPENDIX: I
ETHICAL CERTIFICATE

Institutional Ethics Committee for Human Research (IECHR)

FACULTY OF FAMILY AND COMMUNITY SCIENCES
THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA

Ethical Compliance Certificate 2024-2025

This is to certify Ms. Neha Upadhyay study titled; "Exploratory study on the food purchasing behaviours amongst adults in Urban Vadodara." from Department of Foods and Nutrition has been approved by the Institutional Ethics Committee for Human Research (IECHR), Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda. The study has been allotted the ethical approval number IECHR/FCSc/M.Sc./10/2024/36.

Prof. Komal Chauhan
Member Secretary
IECHR

Prof. Mini Sheth
Chairperson
IECHR

Chair Person
IECHR
Faculty of Family & Community Sciences
The Maharaja Sayajirao University of Baroda

INFORMED CONSENT

Title of the Study: Exploratory study on Food Purchasing Behaviours amongst Adults in Urban Vadodara.

Investigators

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Purpose of the Study

Present research study is aimed at understanding the food purchasing behaviours of adults. This study seeks to explore factors influencing purchasing decisions, consumption patterns, food labeling awareness, and overall attitudes towards consumption of processed foods. The information gathered will be used to better understand consumer behaviours towards purchasing of processed/ultra-processed foods.

Protocol for the study

If you agree to participate in this study, data will be obtained from you on anthropometric measurements, background information, purchasing habits related to processed and ultra-processed foods, awareness and understanding of food labeling, consumption patterns and your perceptions and attitudes towards consumption of processed and ultra-processed foods. Completing the questionnaire will take approximately 15-20 minutes.

Voluntary Participation

Your participation in this research is entirely voluntary. You are free to withdraw at any time without any consequences or explanation. If you choose not to participate or withdraw from the study, this will not affect you in any way possible.

Confidentiality

The information you provide will be kept confidential. All data collected from this study will be anonymized, meaning that your responses will not be linked to your name or any personal identifiers. Only the research team will have access to the data, and it will be stored securely to ensure your privacy. Your responses will be used solely for academic and research purposes.

Potential Risks and Benefits

There are no known risks associated with participating in this study. Although participating in this study offers you the opportunity to receive detailed information about your anthropometry and body composition (such as weight, body mass index, body fat percentage, etc.). This data can be valuable for managing your lifestyle and improving your overall health and well-being. You may use this information to make

informed decisions about your diet, physical activity, and lifestyle choices. Your responses will contribute to a broader understanding of purchasing behavior toward processed foods.

Compensation

This study requires only your time and co-operation. There is no financial compensation for your participation in this study.

Contacts

If you have any questions about the study or your rights as a participant, you are encouraged to contact the investigators for further clarification.

Informed Consent

By signing below, you indicate that you have read and understood the purpose and procedures of this study. You are aware that your participation is voluntary and that you can withdraw at any time. There is no financial compensation for your participation and you agree to participate in this study.

Participant's Name: _____

Participant's Signature: _____

Contact Number: _____

Date: _____   Place: _____

QUESTIONNAIRE

Section 1: Background information
1) Name
2) Date of Birth
3) Age
4) Contact number
5) Address/ Area of residence

6) Gender
   a. Male
   b. Female
   c. Other

7) Type of Family
   a. Nuclear
   b. Joint
   c. Extended

8) Marital status
   a. Married
   b. Unmarried
   c. Engaged
   d. Widow

Section 2: Socio-Economic Status
1) Education of the head of the family
   a. Professional degree
   b. Graduate
   c. Intermediate/ diploma
   d. High school
   e. Middle school
   f. Primary school
   g. Illiterate

2) Occupation of the head of the family
   a. Legislators, senior officials, managers
   b. Professional
   c. Technicians/associate professionals
   d. Clerk
   e. Skilled worker, shop and market sales workers
   f. Skilled agricultural and fishery workers
   g. Craft and related trade workers
   h. Plant and machine operators and assemblers
   i. Elementary occupation
   j. Unemployed

3) Monthly income of the family
a. ≥ 146,104
b. 109,580- 146,103
c. 73,054- 109,579
d. 68,455- 73,053
e. 63,854- 68,454
f. 59,252- 63,853
g. 54,651- 59,251
h. 45,589- 54,650
i. 36,527- 45,588
j. 21,914- 36,526
k. 7,316- 21,913
l. ≤7,315

Section 3: Anthropometry measurements

S/N	Parameters
1	Weight (kg)
2	Height (cm)
3	BMI (kg/m^2)
4	Waist circumference (cm)
5	Hip circumference (cm)
6	Waist Hip Ratio
7	Body composition
	Body fat percentage
	Visceral fat
	Resting metabolism
	Body age
	Subcutaneous fat whole body
	Skeletal muscle whole body

Section 4: Biophysical measures
Hypertension
Systolic (mm Hg)
Diastolic (mm Hg)

Section 5: Medical History

Type	Self	Mother	Father	Siblings	Grandparents
Diabetes					
Hypertension					
Coronary heart diseases					
Hyperlipidemia					
Stroke					
Hypo/hyperthyroidism					
Asthma					
Cancer					
Other (please specify)					

Section 6: Dietary Assessment
   1) Food habit
   a. Vegetarian
   b. Non-vegetarian
   c. Ovo-vegetarian
   d. Vegan

   2) Any food allergy
   a. Yes
   b. No

   3) Do you take any dietary supplements
   a. Yes
   b. No
   4) How many meals do you consume in a day
   a. 1
   b. 2
   c. 3
   d. 4
   e. >4

   5) How many meals in a day are cooked at home
   a. All
   b. 3 meals
   c. 2 meals
   d. 1 meal

   6) Do you skip any of the meals?
   a. Yes
   b. No

   7) If yes, which meal do you skip majorly
   a. Breakfast
   b. Lunch
   c. Dinner
   d. None

Section 7: Food purchasing habits
   1) Do you purchase packaged/processed/ultra-processed foods?
   a. Yes
   b. No

   2) How often do you purchase processed/processed/ultra-processed foods (e.g., ready-to-eat snacks, sugary beverages etc.)?
   a. Daily
   b. 2-3 times a week
   c. Once a week
   d. Occasionally
   e. Never

3) Where do you most often purchase packaged/processed foods?
a. Supermarkets
b. Convenience stores
c. Local shops
d. Online retailers
e. Street vendors
f. Others

4) What are the main factors influencing your purchasing decision for Processed/ processed/ultra-processed foods (rank order)?
a. Price
b. Brand
c. Taste
d. Convenience
e. Packaging
f. Nutritional value
g. Discounts/offers
h. Easily available
i. Advertising
j. Peer group
k. Other (specify)

5) Do you use online platform or apps to purchase processed/ultra-processed foods?
a. Yes
b. No

6) Where do you get the money?
a. Pocket money
b. Earnings
c. Savings
d. Other (specify)

7) On an average, how much pocket money do you receive every month? Not applicable to people who choose option b/c in the previous question
a. <1000
b. 1000- 2000
c. >2000
d. No pocket money

8) What do you spend your pocket money on?
a. Shopping
b. Food
c. Album/magazines
d. Travelling
e. Movies/concert
f. Gym supplements
g. Protein powder
h. Other (specify)

9) Who do you buy packaged/processed food for?
a. Yourself
b. Your family
c. Your children
d. Your friends
e. Guests/visitors
f. a and b both
g. a and d both

10) How much do you typically spend on packaged/processed foods per week?
a. Less than Rs 500
b. Rs 500- 1000
c. Rs 1000-2500
d. More than Rs 2500

11) What kind of food do you generally eat out?
a. Gujrati
b. Punjabi
c. South Indian
d. Italian
e. Mexican
f. Street food
g. Other (specify)

12) What type of fast-food items you put your money on the most?
a. Chips and snacks
b. Sugar beverages
c. Fast foods (burgers, pizza, and other)
d. Local street food (dabeli, vada pao, momos, chowmein)
e. Sweets and desserts
f. Other (specify)

13) How frequently you eat out?
a. Once a week
b. Twice a week
c. Fortnightly
d. Occasionally

14) What time of the day do you most often buy processed/ultra-processed foods?
a. Morning
b. Afternoon
c. Evening
d. Night

15) Rank who influences your food choices, or dietary habits the most
a. Family members
b. Relatives
c. Friends
d. School teacher

e. Social media
f. Famous figure
g. Other (specify)

Section 7.1: Understanding Food labels
1) How often do you read food labels before purchasing packaged or processed/ultra-processed foods?
a. Always
b. Often
c. Sometimes
d. Rarely
e. Never

2) Which of the following information do you find most important when reading food labels?
a. Ingredient list
b. Expiration date
c. Nutritional facts (calories, sugar etc.)
d. Health claim (low fat, gluten free etc.)
e. Allergens

3) How trustworthy do you find health claims on processed/ultra-processed food packaging?
a. Very trustworthy
b. Somewhat trustworthy
c. Neutral
d. Somewhat untrustworthy
e. Very untrustworthy

4) Do you consider food labels before buying a new product for the first time?
a. Always
b. Sometimes
c. Rarely
d. Never

5) Have you ever chosen not to purchase a product based on what you read on its label?
a. Yes
b. No

Section 7.2: Consumption patterns of processed/ultra-processed foods
1) Which processed/ultra-processed foods do you consume most frequently?
a. Sugary beverages
b. Snack foods (chips, cookies etc.)
c. Ready-to-eat meals (frozen foods, microwavable)
d. Breakfast cereals
e. Instant noodles/soups
f. Baked goods (pizza, bread)
g. Other (specify)

2) How frequently do you eat meals prepared at home versus packaged/processed foods?
a. Mostly home cooked meals
b. Half home-cooked, half processed
c. Mostly processed foods

3) How often do you replace a healthy meal with a processed/ultra-processed alternative?
a. Often
b. Sometimes
c. Rarely
d. Never

Section 7.3: Food perception and awareness
1) Do you believe processed/ultra-processed foods contribute to weight gain and other health issues?
a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

2) How do you perceive the health risks of consuming processed/ultra-processed foods regularly?
a. Very high
b. High
c. Moderate
d. Low
e. No risk

3) Do you think health labels (such as low fat, sugar-free) influence your perception of a food's healthiness?
a. Yes
b. No

Section 7.4: Barriers in buying healthy options
1) Please select three of the following factors you believe are major barriers towards consuming a diet which is considered healthy. Rank these factors from 1 to 3, with 1 being most significant
a. Irregular working hours
b. Busy lifestyle
c. Willpower
d. Limited cooking time
e. Healthy option is perishable
f. Lengthy preparation
g. Lack of storage facility
h. Price of healthy foods
i. Unappealing foods

j. Taste preferences

k. Cravings

l. Healthy options are not readily available

m. Healthy foods do not satisfy hunger

n. Social influences (outing, friends)

o. Other (specify)

2) Do you find it difficult to access healthy food options in your neighbourhood?

a. Yes

b. No

3) How far do you typically travel to buy healthy foods (e.g., fresh fruits, vegetables, whole grains)?

a. Less than 1 km

b. 1-3 km

c. 3-5 km

d. More than 5km

4) What do you think would help you overcome the barriers to eating a healthier diet? (select all that apply)

a. More affordable healthy food options

b. Better access to healthy foods

c. Education and how to cook healthy meals

d. More time or meal planning/preparation

e. Support from friends/family

f. Other (specify)

APPENDIX: IV
24 HOUR DIETARY RECALL (3 consecutive days; 2 Work days, 1 Holiday)

Meal	Name of the food stuff	Ingredients	Raw amount used for family (gm) [A]	Cooked volume for family (ml) [B]	Volume consumed by subject (ml) [C]	Raw amount consumed by subject [D] D=A×C/B
Morning						
Mid-morning						
Lunch						
Evening Tea						
Dinner						
Bedtime						

Frequency of consumption of the following food items

S/n	Food items	Daily	4-5 Times a week	Thrice a week	Once a week	Once in 10 days	Once in 15 days	Once a month	Occasionally	Never
Foods high in fats										
1	Puff									
2	Samosa									
3	Vada pav									
4	Frankie									
5	Sandwich (cheese)									
6	Sabudana vada									
7	Panipuri									
8	Chaat									
9	Sevusal									
10	Kachori									
11	Dabeli									
12	Chinese									
13	Pasta									
14	Pav bhaji									
15	Egg items									
16	Bhajiyas									
17	Bataka vada									
18	Puri									
19	Wafers									
20	Pune missal									

21	Bread (brown)									
22	Bread (white)									
Foods high in sugar and fat										
23	Gulab jamun									
24	Kala jam									
25	Bundi									
26	Ladoo									
27	Peda									
28	Rasgulla									
29	Rasmalai									
30	Rabdi									
31	Jalebi									
32	Basundi									
33	Ice cream									
34	Chocolates									
35	Puddings									
36	Bun									
37	Cakes									
38	Pastry									
Foods high in sugar										
39	Colas									
40	Fruit syrups									
41	Fruit drinks (Mazza, slice)									
42	Fruit juices (Tropicana)									
43	Fruit crush/sherbets									

	(Mapro, mala)								
44	Tang								
45	Red bull								
46	Alcoholic beverages								
47	Ketchups								
48	Jam								
49	Breakfast cereals								
50	Sweet pickle								
51	Sweet chutney								
Foods high in salt and fat									
52	Noodles (Maggie/yippee/chings)								
53	Mayonnaise								
54	Cheese spread								
55	Other sauces								
56	McCain (frozen foods)								
57	Fryums								
58	Biscuits (salty/cream)								
59	Fries								
60	Chips								
61	Kurkure								
62	Khakhra								
63	Soya sticks								
64	Gathiya								
65	Papdi								
66	Chawanu								

67	Sev								
68	Sev mamra								
69	MCD burger								
70	Pizza								
71	Subway								
72	Fafda								
73	Khaman								
74	Sour pickle								
75	Chinese food								
Foods high in salt									
76	Soups								
77	Oats								
78	Papad								
79	Masala mixes								
80	Rasoi magic								

APPENDIX: VI
HDDS QUESTIONNAIRE

Now I would like to ask you about the types of foods that you or anyone else in your household ate yesterday during the day and at night.

1) Any [(Dhokla, fafda, gathiya, thepla, sev, muthiya), bread, rice noodles, biscuits, or any other food made from millet, bajra, ragi, sorghum, maize, rice, wheat]?
   a. Yes
   b. No

2) Any potatoes, yams, manioc, cassava or any other foods made from roots and tubers?
   a. Yes
   b. No

3) Any vegetables?
   a. Yes
   b. No

4) Any fruits?
   a. Yes
   b. No

5) Any beef, pork, lamb, goat, rabbit wild game, chicken, duck, or other birds, liver, kidney, heart, or other organ meats?
   a. Yes
   b. No

6) Any eggs?
   a. Yes
   b. No

7) Any fresh or dried fish or shellfish?
   a. Yes
   b. No

8) Any foods made from beans, peas, lentils, or nuts?
   a. Yes
   b. No

9) Any cheese, yogurt, milk or other milk products?
   a. Yes
   b. No

10) Any foods made with oil, fat, or butter?
   a. Yes
   b. No

11) Any sugar or honey?
   a. Yes
   b. No

12) Any other foods, such as condiments, coffee, tea?
   a. Yes
   b. No