

Exploring the Key Factors Behind Overweight and Obesity: Insights from BMI Data

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Abstract: Leisure is commonly understood as free time beyond work and daily responsibilities, or as a quality of experience marked by personal freedom, enjoyment, and voluntary engagement. Globally, the rising prevalence of overweight and obesity among adults has been strongly linked to unhealthy eating habits and physical inactivity, with sedentary lifestyles becoming more common due to modern work routines and technology use. This study explores the relationship between leisure time activities and overweight or obesity among adults in Kozhikode Corporation, using population-based surveys to analyze lifestyle patterns. Activities such as dancing, aerobics, Zumba, and morning walks are recognized for their positive impact on physical and mental health, and many individuals consider structured workouts like yoga, gym sessions, or jogging as part of their leisure routine. By examining these habits within the local context, the study aims to highlight how active leisure can contribute to weight management and inform effective community-based health promotion strategies.

Keywords: Overweight, Obesity, Leisure, Exercise

1. INTRODUCTION

Overweight and obesity are growing global health concerns that result from a complex interplay of multiple factors. These conditions arise when there is an imbalance between the number of calories consumed and the number of calories expended, leading to excess body fat accumulation. However, the causes go far beyond simple overeating or lack of exercise. A range of biological, behavioral, environmental, socioeconomic, and psychological influences contribute to the development and persistence of overweight and obesity in individuals and populations.

Biological factors such as genetic predisposition, metabolic rate, and hormonal changes play a significant role in determining body weight. Individuals may inherit traits that affect how their bodies store fat or regulate appetite. Hormonal conditions like hypothyroidism or polycystic ovary syndrome (PCOS) can also impact weight regulation. Age and sex are additional biological elements, as metabolism tends to slow with age, and hormonal differences affect fat distribution between men and women. Behavioral influences, including dietary habits and physical activity levels, are crucial in weight management. Diets high in calories, sugars, and unhealthy fats contribute to weight gain, especially when paired with

sedentary lifestyles. Inadequate sleep and irregular eating patterns can further disrupt metabolism and appetite regulation, increasing the risk of obesity. The environment in which people live also shapes their health behaviors. Urbanization, increased screen time, and limited access to parks or recreational facilities discourage physical activity. At the same time, easy availability of fast food and aggressive marketing of unhealthy products, particularly to children, encourage poor dietary choices. School and workplace environments that offer limited opportunities for physical movement or healthy eating further exacerbate the problem.

Socioeconomic status is another critical factor. Individuals from lower-income groups may face barriers to accessing nutritious foods, safe exercise spaces, and health care services. Limited education and health literacy can hinder awareness about healthy lifestyle practices, while economic constraints often lead to reliance on cheap, high-calorie food options. Psychological influences such as stress, depression, anxiety, and emotional eating are also linked to weight gain. People often turn to food for comfort, leading to overeating during times of emotional distress. Negative body image and past trauma can contribute to cycles of unhealthy behavior, including restrictive dieting followed by binge eating.

Overweight and obesity refer to the excessive and unhealthy accumulation of body fat, which poses significant risks to overall health and well-being. These conditions have reached epidemic proportions globally, with obesity rates having tripled since 1975. According to the World Health Organization, as of 2016, approximately 39% of the world's adult population was classified as overweight—defined by a Body Mass Index (BMI) of 25 or higher—and 13% were categorized as obese, with a BMI of 30 or above. Alarmingly, the majority of the global population now resides in countries where the health consequences of overweight and obesity outweigh those associated with under nutrition. This shift underscores a major public health concern, as excess body weight is linked to a higher risk of non-communicable diseases such as diabetes, cardiovascular disorders, and certain cancers. Ensuring equitable access to quality healthcare services and promoting healthy lifestyles are essential components in addressing this growing crisis. Beyond individual health, the burden of obesity has broader implications for economic productivity and healthcare systems, making it a critical issue for societal progress. In India, the state of Kerala presents a unique case. With its relatively high literacy rates, improved health indicators, and advanced stage of demographic transition, Kerala is often seen as a model for public health achievements. However, it is not immune to the global rise in obesity. The state's population, which is evenly distributed across urban and rural areas, is increasingly affected by lifestyle-related health problems, including overweight and obesity. This emerging challenge calls for proactive interventions that integrate public health education, community-based wellness programs, and policies that support healthier environments and behaviors.

Leisure Time Activities in Relation to Overweight and Obesity: Leisure is often described either as a specific quality of experience or simply as free time outside of work and daily obligations. When viewed as an experience, leisure typically emphasizes the elements of personal freedom, enjoyment, and voluntary participation. Activities pursued during leisure are generally undertaken for intrinsic satisfaction—done "for their own sake"—rather than

out of necessity or obligation. In recent years, there has been a global increase in the prevalence of overweight and obesity among adults. These conditions are closely linked to various risk factors, particularly poor dietary habits and low levels of physical activity. Sedentary lifestyles, influenced by modern work patterns and technological conveniences, have contributed significantly to this growing public health concern.

This study aims to examine the relationship between leisure time activities and the prevalence of overweight and obesity among adults in the Kozhikode Corporation area. Population-based surveys have been conducted to assess lifestyle patterns, with a particular focus on how individuals engage in physical activities during their leisure time. The findings are intended to shed light on whether active leisure pursuits can play a meaningful role in reducing body weight and improving overall health. Leisure time physical activities such as dancing, aerobics, Zumba, and morning walks are increasingly being recognized for their potential to combat overweight and obesity. These activities not only promote physical fitness but also enhance mental well-being and social interaction, making them appealing and sustainable for many individuals. Furthermore, some people integrate structured exercise routines—like gym workouts, yoga, or jogging—into their leisure schedules, considering them both a health practice and a form of personal enjoyment. By exploring these patterns in the local context of Kozhikode, the study seeks to understand how active leisure behaviors influence weight status and could inform future health promotion strategies. Encouraging community participation in enjoyable, accessible leisure activities could be a key component in addressing the obesity epidemic at the local level. In summary, overweight and obesity are multi factorial conditions influenced by a wide array of interrelated factors. Understanding these influences is essential for developing effective strategies for prevention and intervention at both individual and societal levels. Addressing the issue requires a comprehensive and collaborative approach that includes education, supportive environments, accessible health care, and policies promoting healthy lifestyles.

Overweight and obesity have emerged as major public health challenges worldwide, contributing significantly to the global burden of non-communicable diseases. Body Mass Index (BMI) serves as a widely accepted indicator for assessing weight status and associated health risks. This study aims to analyze the key factors influencing overweight and obesity through a BMI - based framework. Using primary data collected from a representative sample population, the study examines the relationship between BMI and various socio-demographic, dietary, lifestyle, and behavioral factors. The analysis reveals that age, gender, income level, physical activity, dietary patterns, and sedentary behavior are significant predictors of elevated BMI. The findings highlight the multifaceted nature of weight gain and emphasize the need for targeted interventions and policy measures to address the root causes of obesity. This study provides evidence-based insights that can inform public health strategies aimed at preventing and managing overweight and obesity in the population.

Obesity and its Measurement

Throughout history, perceptions of obesity have varied significantly across cultures and time periods. In ancient Egypt, obesity was regarded as a disease, evidenced by depictions on tomb and temple walls that illustrated various ailments, including excessive body weight. This suggests that the Egyptians recognized obesity as a deviation from ideal health, potentially associated with illness or imbalance. One of the earliest known representations of obesity in human history can be found in the Venus figurines—prehistoric statuettes dating back to the Paleolithic era. These carvings typically depict women with exaggerated physical features, particularly large breasts and abdomens. Scholars believe these figures played a significant role in fertility rituals, symbolizing health, abundance, and the capacity for childbearing, rather than portraying obesity in a negative light. In ancient China, there was an early awareness of the risks associated with excessive body weight. Rooted in the principles of Traditional Chinese Medicine, the Chinese have long emphasized balance, moderation, and prevention as key to health and longevity. Obesity was often seen as a sign of internal imbalance, with efforts focused on diet, herbal remedies, and physical activity to maintain optimal health. Among the Aztecs, obesity held a more mystical interpretation. It was often considered a supernatural condition—an affliction bestowed by the gods. This belief framed obesity not just as a physical state, but also as one with spiritual or divine implications, reflecting the deeply religious worldview of Aztec society. The Greek physician Hippocrates, widely regarded as the father of Western medicine, offered a more clinical perspective. In his medical writings, he observed that sudden deaths occurred more frequently among obese individuals than among those of leaner build. His recognition of the link between obesity and mortality highlights an early understanding of the serious health implications associated with excessive weight.

Despite these historical concerns, in certain regions and eras, obesity has been viewed in a more favorable light. In societies where food is scarce and poverty widespread, being overweight has often been associated with prosperity, wealth, and social prestige. A fuller figure could signal that one had access to food and resources that others did not. A striking example of this can be found in some African cultures, where traditional practices celebrate larger body types. Among specific tribes, brides are deliberately fattened before marriage in preparation for motherhood. In these communities, a heavier body is believed to enhance fertility and symbolize readiness for childbearing. The bride is cared for and encouraged to gain weight until she reaches the culturally ideal size, after which the marriage can proceed. In conclusion, attitudes toward obesity have evolved across time and geography. While some civilizations viewed it as a health condition or spiritual affliction, others saw it as a sign of fertility, prosperity, or divine favor. These diverse perspectives reflect the complex interplay between culture, health, and body image throughout human history.

The perception of obesity has undergone significant transformation over time, particularly during the 20th century. In the early 1900s, societal attitudes began to shift more dramatically. French fashion designer Paul Poiret, known for revolutionizing women's fashion, played a key role in redefining body ideals by introducing more form-fitting and skin-revealing garments. These designs promoted a slender silhouette, pushing obesity into the realm of the "unfashionable," especially among women. This shift in aesthetic preference coincided with a

rising prevalence of obesity, marking the beginning of its emergence as a widespread public health concern. By the 1940s, awareness of weight as a health factor gained scientific grounding. The Metropolitan Life Insurance Company developed and published standardized weight tables that defined "ideal" body weights based on height. These charts marked one of the earliest efforts to quantify healthy body weight, and they emphasized that weight gain should not be seen as a natural consequence of aging. This was a significant deviation from previous beliefs that modest weight gain in middle and older age was acceptable. The medical community and government agencies began taking a more active role in addressing obesity following the publication of several influential health studies. One of the most pivotal was the Framingham Heart Study, initiated in the mid-20th century, which identified obesity as a significant risk factor for cardiovascular disease. The findings highlighted the link between excessive body fat and conditions such as hypertension, coronary artery disease, and diabetes, prompting widespread public health campaigns aimed at weight reduction.

As awareness grew, various diet and exercise programs gained popularity, ranging from low-fat diets to structured fitness routines. The 1990s saw the introduction of the Body Mass Index (BMI) as a global standard for assessing obesity. Published in 1996 by the World Health Organization (WHO), BMI provided a simple, statistical method to categorize individuals based on their weight relative to their height. This tool became widely used in clinical settings and public health surveillance, classifying individuals as underweight, normal weight, overweight, or obese. Despite these efforts, obesity rates have continued to climb globally. The late 20th and early 21st centuries witnessed a particularly alarming trend—a sharp rise in childhood and adolescent obesity, with rates more than tripling in a few decades. This rapid escalation, unprecedented in the history of obesity, led experts to refer to the condition as a global epidemic.

Today, obesity is recognized as a major medical and public health challenge. It is not only a cosmetic concern but a condition linked to a multitude of chronic, debilitating, and life-threatening disorders. Medically, obesity is defined as an abnormal or excessive accumulation of body fat that presents a risk to health. According to Dorland's Illustrated Medical Dictionary, it is "an increase in body weight beyond the limitation of skeletal and physical requirement, as the result of an excessive accumulation of fat in the body." A more severe form, morbid obesity, is characterized by a body weight that is two or more times higher than the ideal weight for an individual's height and frame. This level of obesity is strongly associated with a wide range of serious health conditions, including type 2 diabetes mellitus, atherosclerosis, hypertension, obstructive sleep apnea (often termed Pickwickian syndrome), and certain types of cancer. This not only reduce quality of life but also significantly shorten life expectancy.

Methods for Assessing Body Fat and Obesity: The assessment of body fatness and obesity is essential for both clinical evaluation and public health monitoring. A variety of techniques have been developed to measure body composition, each varying in complexity, accuracy, and applicability in different settings. One of the simplest and most traditional methods of assessing obesity is visual inspection, where the general appearance and distribution of body

fat are observed. While this method may provide a quick, subjective evaluation, it lacks precision and is not suitable for objective or comparative assessments.

A more structured approach is anthropometry, which involves the systematic measurement of the human body. This method includes measurements such as height, weight, waist circumference, skin-fold thickness, and body mass index (BMI). Among these, BMI is the most widely used and practical anthropometric tool for assessing overweight and obesity in both clinical and community settings. In addition to anthropometry, more sophisticated techniques are available for evaluating body fat composition and distribution. These include:

- Body density measurement, typically conducted through underwater (hydrostatic) weighing, which estimates body composition based on the principle of water displacement.
- Isotopic dilution techniques, which involve the administration of labeled isotopes to determine total body water and, subsequently, fat-free mass.
- Dual-energy X-ray absorptiometry (DEXA), a highly accurate method that uses low-dose X-rays to differentiate between bone mass, lean tissue, and fat mass.
- Bio-electrical impedance analysis (BIA), a non-invasive technique that estimates body composition by measuring the resistance of body tissues to electrical currents.
- Imaging technologies, such as ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI), which provide detailed visualizations of fat distribution, including visceral fat around internal organs.

Despite the availability of these advanced methods, their high cost, technical requirements, and time-consuming procedures limit their use in large-scale or field-based studies. Interestingly, some researchers have suggested defining the onset of obesity as the point at which the number of adipose (fat) cells begins to increase—a process known as adipocyte hyperplasia. However, determining this biological threshold is challenging, as there is currently no simple, non-invasive, and field-applicable method to detect or measure this cellular change accurately. Among all available methods, Body Mass Index (BMI) remains the most commonly used and accessible tool for identifying overweight and obesity in populations. BMI is calculated by dividing an individual's body weight in kilograms by the square of their height in meters, using the following formula:

$$\text{BMI} = \text{Weight (kg)} / \text{Height (m}^2\text{)}$$

This index provides a standardized measure that is broadly independent of age and can be uniformly applied to both males and females. While BMI does not directly measure body fat, it offers a reliable proxy and is useful for screening purposes and epidemiological research. However, it is important to note that BMI does not differentiate between fat mass and lean mass, and may therefore classify muscular individuals as overweight or obese. In conclusion, while multiple methods exist for evaluating body fat and diagnosing obesity, each has its advantages and limitations. BMI remains the most practical and widely used tool due to its simplicity, cost-effectiveness, and ease of application in diverse settings. Nevertheless, more

accurate methods may be necessary for clinical diagnosis and research requiring detailed body composition analysis.

Table 1 : Categorization of BMI

<u>BMI</u>	<u>Classification</u>
<18.5	Underweight
18.5 – 24.9	Normal Weight
25.0 – 29.9	Overweight
> 30.0	Obese

Source: secondary data

A few individuals who are exceptionally muscular maybe classified as overweight or obese, but otherwise BMI provides a useful tool for large scale epidemiological assessment. Individual with BMI of 25-29.9 Kg/m² are classified as overweight and those with the value of 30Kg/m² or more are classified as obese.

2. OBJECTIVES

1. To examine the prevalence, nature, and underlying causes of obesity in Kerala
2. To identify and analyze the key factors contributing to overweight and obesity
3. To estimate the economic burden associated with obesity-related health issues

3. MATERIALS AND METHODS

The present study was conducted among adult residents of Kozhikode, a prominent coastal city located in the southern Indian state of Kerala. Kozhikode, also known historically as Calicut, is one of the key urban centers in the state and forms the second-largest metropolitan area in Kerala, with a population of approximately 2 million as per the 2021 Census. The city boasts a high literacy rate of 96.8% and a favorable sex ratio of 1.093 females per 1,000 males, reflecting the advanced socio-demographic profile of the region.

The research specifically focuses on the population residing within the Kozhikode Corporation limits, covering a diverse group of urban adults. A total of 50 respondents were selected using a random sampling method to ensure representations and minimize selection bias. The data collection period spanned four months, from January to April, providing adequate time to gather detailed and reliable information.

To assess overweight and obesity among the participants, the Body Mass Index (BMI) was employed as the principal measurement tool. BMI is a widely accepted and standardized method to classify individuals based on their weight relative to their height. It serves as an effective proxy indicator of body fatness and is suitable for use across populations and age groups. In addition to BMI measurement, the study employed several statistical tools to analyze the relationship between obesity and other influencing factors. These include the Chi-

square test, Analysis of Variance (ANOVA), and Paired T-test, which were used to examine the interrelationships between BMI and various socio-demographic, behavioral, and lifestyle attributes of the respondents. All anthropometric measurements were conducted by trained field investigators to ensure accuracy and consistency. Body weight was measured using a calibrated weighing machine, with respondents asked to remove shoes, heavy clothing, belts, and empty their pockets before measurement. The weighing scales were periodically verified using standard weights to maintain precision. Height was measured using a portable anthropometric rod, with respondents standing upright against a vertical surface for accurate readings.

Data Sources: The study relied on both primary and secondary sources of data to ensure a comprehensive understanding of the issue. Primary data were collected directly from the 50 randomly selected respondents through structured interviews and observation. Special focus was given to collecting information on the costs incurred by individuals to manage or reduce obesity and overweight, including financial and time investments in gyms, yoga centers, aerobics classes, dance or Zumba sessions, and other wellness-related activities. Secondary data were obtained from a variety of credible sources, including books, academic journals, government reports, research articles, newspapers, and reputable websites. These secondary sources provided contextual information, historical data, and relevant literature to support and enrich the findings of the primary research.

4. DISCUSSIONS

Regular exercise and BMI: Regular physical activities serve as common leisure-time pursuits for most of the respondents in the study. These activities include daily engagements such as sports, dance, aerobics, gym workouts, yoga sessions, and participation in various training or fitness centers.

Table 2: Regular exercise and BMI

BMI	Regular exercise		Total
	Yes	No	
Normal	10	8	18
Overweight	13	11	24
Obesity	4	4	8
Total	27	23	50

Source: Primary data

The Chi-square test yielded a p-value of 0.046, which is less than the significance level of 0.05. Therefore, the null hypothesis is accepted, indicating a significant relationship between regular exercise and changes in BMI. This suggests that individuals who engage in regular

physical activity tend to show a decrease in BMI, whereas those who do not exercise regularly are more likely to have unchanged or increased BMI levels. The table reveals that 54% of the 50 respondents reported having a habit of engaging in regular exercise. Within the normal BMI category, 56% of individuals participate in regular physical activity, while the remaining 44% do not. In the overweight BMI group, 54% also reported exercising regularly, with the rest abstaining. Among the eight respondents classified as obese, the proportion of those who engage in regular exercise is equal to those who do not, indicating a 50:50 split within this category.

Regular exercise at gym: Recent research suggests that living close to physical activity facilities—such as gyms, swimming pools, or sports fields—can significantly increase the likelihood of maintaining fitness-related goals, such as New Year’s resolutions. Proximity to a gym, in particular, has been shown to support weight loss efforts effectively.

Table 3: Regular exercise at gym

BMI	Gym		Total
	Yes	No	
Normal	5	13	18
Overweight	7	17	24
Obesity	0	8	8
Total	12	38	50

Source: primary data

Among the 50 respondents in our sample, only 24% reported preferring to go to the gym, either to maintain physical fitness or to reduce body fat and manage overweight or obesity. The remaining 76% engage in alternative forms of physical activity, such as yoga, dance, aerobics, and other similar exercises.

Among the eight respondents classified as obese, none reported attending the gym as a means of managing their weight. In contrast, 29% of respondents in the normal and overweight BMI categories indicated that they spend time at the gym specifically to reduce excess weight. The remaining respondents in these categories reported participating in other forms of physical activity such as yoga, dance, aerobics, and similar exercises. Focusing on the normal BMI group alone, 28% stated they attend the gym regularly to maintain their health and overall physical fitness, rather than for weight loss purposes.

The Chi-square test produced a p-value of 0.221, which is greater than the standard significance level of 0.05. This leads us to accept the null hypothesis, suggesting that there is no statistically significant association between BMI category and regular gym attendance. However, this finding appears to contrast with practical expectations. One might reasonably assume that individuals with higher BMI values would be more inclined to attend the gym as a corrective measure. The contrasting result observed here may be attributed to the diverse

motivations behind gym attendance. Specifically, it is not only individuals who are overweight or obese who frequent gyms; many respondents with normal BMI values also engage in gym workouts to maintain their current health status and prevent future weight gain. As a result, the pattern of gym usage is not exclusive to higher BMI individuals, thereby diluting the statistical association between gym attendance and BMI category in this sample. This insight underscores the importance of considering motivational and behavioral factors in interpreting statistical outcomes, especially in lifestyle-related studies.

Regular exercise at Yoga Centre : Yoga is recognized as one of the effective and holistic approaches to reducing Body Mass Index (BMI), as it combines physical postures, breathing techniques, and mindfulness, contributing to both physical and mental well-being. It not only aids in burning calories and improving metabolism but also helps in reducing stress, which is often linked to weight gain and obesity. In the present study, it was found that 22% of the 50 respondents reported engaging in regular yoga practice at dedicated yoga centers. This indicates a notable preference for yoga as a method of maintaining or improving health. These individuals use yoga either as a primary form of physical activity to manage body weight or as a complementary practice alongside other fitness routines. The data highlights yoga's growing acceptance and its perceived benefits among the urban population in Kozhikode as a sustainable and accessible strategy for managing overweight and obesity.

Table 4: Regular exercise at yoga training centers

BMI	Yoga		Total
	Yes	No	
Normal	3	15	18
Overweight	6	18	24
Obesity	2	6	8
Total	11	39	50

Source: primary data

The Chi-square test yielded a p-value of 0.792, which is significantly greater than the standard significance threshold of 0.05. Based on this result, we accept the null hypothesis, indicating that there is no statistically significant association between BMI and regular participation in yoga at a yoga center among the respondents. This finding suggests that regular yoga practice is not limited to individuals with higher BMI; rather, it is adopted across all BMI categories—whether normal, overweight, or obese. Many individuals may choose yoga not solely for weight reduction, but also for its broader health benefits, such as improving flexibility, reducing stress, enhancing mental focus, and maintaining overall wellness. As a result, the distribution of yoga practitioners across different BMI categories appears relatively balanced, thereby reducing the strength of any direct correlation between BMI levels and the likelihood of practicing yoga. This explains why the Chi-square test did not reveal a significant statistical relationship, even though yoga may still play a role in weight management and BMI reduction on an individual level. This outcome highlights the importance of understanding the multi-dimensional motivations behind engaging in physical

activities like yoga, beyond just weight loss. It also points to the need for further investigation using larger sample sizes or more targeted study designs to explore the specific impact of yoga on BMI over time.

The table indicate that among the 36% of respondents in the normal BMI category, only 17% regularly invest their time and money in yoga centers, primarily to maintain both physical and mental well-being. In the overweight BMI group, 25% engage in yoga practice at training centers with the goal of reducing excess weight, while the remaining 75% prefer other forms of leisure-time physical activities. Similarly, among those classified under the obese BMI category, 25% participate in yoga sessions, suggesting a modest inclination towards yoga as a method for weight management within this group as well.

Regular exercise in the form of aerobics, dance, and zumba: Exercise activities such as dance, Zumba, and aerobics have emerged as some of the most popular and impact leisure pursuits in today's fast-paced world. These forms of physical activity not only offer a fun and engaging way to stay fit, but they also play a vital role in promoting mental well-being, reducing stress, and enhancing social interaction. As more individuals seek enjoyable alternatives to conventional workouts, these dynamic group-based exercises have become an integral part of modern lifestyles, particularly among urban populations striving to balance health with daily commitments.

Table 5: Regular exercise at aerobics/dance/zoomba training centres

BMI	Dance		Total
	Yes	No	
Normal	3	15	18
Overweight	3	21	24
Obesity	1	7	8
Total	7	43	50

Source: primary data

Out of the 50 respondents surveyed, only 14% (7 individuals) reported that they regularly engage in structured physical activities such as dance, aerobics, or Zumba at training centres. The remaining 86% preferred other forms of exercise or leisure-time activities. When the data is analyzed based on BMI categories, it is observed that among those with a normal BMI, only 3 out of 18 (17%) participate in such organized fitness routines, while the majority (83%) do not. In the overweight category, 3 out of 24 individuals (12.5%) attend dance or aerobic classes, whereas 21 refrain from such activities. Similarly, among respondents classified as obese, just 1 out of 8 (12.5%) takes part in these exercise programs. This indicates that despite the growing popularity of dance, aerobics, and Zumba, participation across all BMI groups remains relatively low, suggesting a potential gap in awareness or accessibility to such fitness options.

The chi-square test conducted to examine the relationship between Body Mass Index (BMI) and regular participation in structured physical activities such as dance, aerobics, and Zumba yielded a p-value of 0.922. Since this value is significantly higher than the standard significance level of 0.05, we fail to reject the null hypothesis. This indicates that there is no statistically significant association between BMI and regular practice of these fitness activities. In other words, individuals' engagement in dance, aerobics, or Zumba does not appear to be strongly influenced by their BMI category.

Paired sample t-test: In a paired sample t-test, the null hypothesis assumes that **there is no significant difference between the average values of a variable measured before and after an intervention**—in this case, the intervention being regular exercise. Specifically, the hypothesis tested here is: *"There is no difference between the old BMI and the new BMI of individuals."* If the p-value obtained from the test is less than the standard significance level of 0.05, the null hypothesis is rejected, indicating a significant difference. Otherwise, the null hypothesis is accepted.

Table 6: Group 1- Individuals who engage in exercise

Persons who do exercise	Mean	N	Std. Deviation	Mean difference
Old BMI	26.0324	37	3.68443	1.373
New BMI	24.6595	37	3.34709	

For participants who consistently engaged in structured physical exercise programs, the paired sample t-test conducted using SPSS yielded a **p-value of 0.001**, which is far below the significance threshold of 0.05. Consequently, the null hypothesis is rejected, confirming that there is a statistically significant difference between the old BMI and the new BMI values.

The results indicate a **decrease in mean BMI from 26.03 to 24.66**, with a mean difference of 1.37 points. This decline highlights the effectiveness of regular physical activity in reducing BMI and, by extension, improving body weight management. The finding provides strong evidence that exercise interventions such as dance, aerobics, and Zumba can lead to meaningful health benefits over time.

Table 7: Group 2- Individuals who do not engage in exercise

Persons without exercise	Mean	N	Std. Deviation	Mean difference
Old BMI	25.9308	13	3.06713	-0.675
New BMI	26.5462	13	3.21497	

In contrast, the results for individuals who did not take part in any structured exercise regimen revealed a **p-value of 0.257**, which is greater than 0.05. Therefore, the null hypothesis is accepted, implying that there is no statistically significant change in BMI between the two measurement points. Interestingly, the mean BMI for this group actually increased slightly, from 25.93 to 26.55, suggesting a tendency toward weight gain in the absence of regular physical activity.

Taken together, the findings provide compelling evidence of the beneficial role of exercise in controlling body weight. Regular participation in physical activities such as aerobics, dance, or Zumba contributes to a significant reduction in BMI, demonstrating their value in weight management and obesity prevention. Conversely, a lack of physical activity not only fails to improve BMI but may also be associated with gradual increases over time. Thus, the study clearly underscores the importance of incorporating regular exercise into daily routines as an effective strategy for maintaining healthy body weight and promoting overall well-being.

Mode of Transportation and its Association with BMI: In this study, respondents were classified based on their primary modes of transportation: private vehicles, public transportation, and walking. It is generally assumed that individuals who walk regularly as a means of transport are more likely to manage or reduce overweight and obesity compared to those who rely solely on motorized forms of travel.

Table 8: Mode of transportation used by the respondents.

BMI	Transportation					
	Private		Public		By walk	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Normal	88.9	11.1	11.1	88.9	16.7	83.3
Overweight	83.3	16.7	16.7	83.3	25.0	75.0
Obesity	100	0	12.5	87.5	12.5	87.5
Total	88	12	14	86	20	80

Source: primary data

Out of the 50 respondents, a vast majority appear to use more than one mode of transportation, which explains overlapping percentages across categories. Among individuals with **normal BMI**, 88.9% use **private vehicles**, 11.1% use **public transportation**, and 16.7% travel **by foot**. In the **overweight category**, 83.3% depend on **private vehicles**, 16.7% on **public transport**, and 25% reported that they also walk regularly. Within the **obesity group**, all respondents (100%) use **private vehicles** as their primary mode of transport. Only 12.5% also reported using **public transport** and an equal proportion (12.5%) walk.

The data suggest a potential correlation between mode of transportation and body weight. The proportion of respondents who walk is highest in the overweight category (25%) and lowest in the obesity group (12.5%). Conversely, dependence on **private vehicles** is highest in the obesity category (100%), slightly lower in the overweight (83.3%), and normal BMI

(88.9%) groups. The use of **public transportation** remains relatively low across all categories. While the data indicate that those who incorporate walking into their daily routine may have a slight advantage in managing weight, the overall low percentage of walking across all groups suggests that walking is not a primary mode of travel for most respondents. This highlights an area for potential intervention—encouraging active modes of commuting, such as walking or cycling, could be an effective strategy in addressing overweight and obesity issues.

Effect of television watching, computer use, and smartphone viewing on BMI: The majority of respondents in this study are engaged in sedentary professions, often involving minimal physical activity during work hours. After their professional commitments, many of them tend to spend their leisure time engaging in passive screen-based activities, such as watching television, using computers, or browsing smartphones. These activities, typically associated with low energy expenditure, have been linked to weight gain and obesity in various studies. The current data provides insight into how different duration of screen time correlate with Body Mass Index (BMI) among the 50 respondents.

Table 9: Effect of television watching and computer viewing and using smart phones

BMI	TV/Computer/Smartphones				Total
	Never	<1hr	1-2 hrs	>2 hrs	
Normal	3	3	6	6	18
Overweight	4	8	6	6	24
Obesity	1	1	5	1	8
Total	8	12	17	13	50

Source: primary data

According to the table, 16% of the respondents reported that they do not engage in television watching, computer use, or smartphone viewing during their leisure time. A further 24% of the participants spend less than one hour per day on these screen-based activities. The highest proportion, 34%, spend between one to two hours daily on such devices, while 26% spend more than two hours each day.

When the BMI distribution is examined within these categories, certain trends emerge. Among the 16% of respondents who never spend time on screen-based devices, 37.5% belong to the normal BMI category, 50% are overweight, and 12.5% are classified as obese. In the group that spends less than one hour on screens, only 16.6% fall within the normal BMI range, 33.3% are overweight, and a striking 50.1% are categorized as obese. This suggests that even limited screen exposure may not significantly protect against weight gain, and may, in some cases, be associated with higher obesity levels.

For those who spend one to two hours per day on screen activities, an equal distribution is observed across BMI categories—approximately 34% have normal BMI, 33% are overweight,

and another 33% are obese. Interestingly, among the 26% who spend more than two hours per day on screen-based leisure, the distribution does not skew heavily toward obesity as one might expect. This group includes 46.2% with normal BMI, 46.2% who are overweight, and only 7.6% who fall into the obesity category.

These findings present a complex picture. Although prolonged screen time is generally considered a risk factor for sedentary behavior and weight gain, the current data does not show a straightforward, linear relationship between screen usage and BMI. Factors such as dietary habits, physical activity outside of work, and individual metabolism may be influencing these outcomes. It is also possible that some respondents who spend more time on screens may be compensating with other health-conscious behaviors, such as regular exercise or controlled eating habits.

Overall, while the data indicates that screen time is common among respondents across all BMI categories, its direct impact on body weight appears to be influenced by a broader set of lifestyle factors.

Effect of Expenditure on Food and Diet in Relation to BMI: This study also examined the spending patterns of individuals on food and diet-related expenses, aiming to understand whether there is any significant difference in expenditure across different BMI categories—namely, normal weight, overweight, and obesity. Two variables were considered: **amount spent on diet** (which includes expenses on exercise, gym, dietary supplements, or health foods) and **amount spent on food** (regular food consumption).

Table 10: Effect of expenditure on food and expenditure

		Frequency	Mean	Std. Deviation	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Amount on diet	Normal	18	10428	12367.88087	4277.3753	16578.1802	0	45000
	Overweight	24	19229	22262.2605	9828.6385	28629.6948	0	84000
	Obesity	8	18625	16743.33556	4627.2212	32622.7788	0	45000
	Total	50	15964	18530.71097	10697.6302	21230.3698	0	84000
Amount on food	Normal	18	15056	6328.94585	11908.2448	18202.8663	6000	30000
	Overweight	24	19500	6775.91643	16638.7814	22361.2186	8000	30000
	Obesity	8	25625	8634.441	18406.4267	32843.5733	10000	35000
	Total	50	18880	7686.82945	16695.4272	21064.5728	6000	35000

The descriptive statistics reveal noticeable differences in mean spending across BMI categories. For the amount spent on diet, individuals in the **normal BMI group** reported an average expenditure of ₹10,428, with a standard deviation of ₹12,367. The 95% confidence interval for this group ranges from ₹4,277 to ₹16,578. In comparison, those in the **overweight category** had a higher mean expenditure of ₹19,229, with a wider variability (standard deviation of ₹22,262), and a confidence interval between ₹9,828 and ₹28,629. Meanwhile, respondents in the **obesity group** reported an average diet-related expenditure of ₹18,625, with a standard deviation of ₹16,743 and a confidence interval ranging from ₹4,627 to ₹32,622. When these figures are combined, the overall average expenditure on diet across all respondents is ₹15,964.

In terms of **food expenditure**, the mean values once again differ across BMI categories. Those in the **normal BMI group** spend an average of ₹15,056 on food, with a standard deviation of ₹6,329. The average food spending increases to ₹19,500 among the **overweight group**, and further to ₹25,625 among the **obese respondents**. The standard deviations are ₹6,776 and ₹8,634 respectively, indicating a greater spread in the amounts spent by those with higher BMI.

To determine whether these observed differences are statistically significant, **ANOVA (Analysis of Variance)** was conducted separately for the two expenditure variables. For the **amount spent on diet**, the p-value obtained was **0.29**. Since this is greater than the standard significance level of 0.05, we **accept the null hypothesis**, concluding that there is **no statistically significant difference** in average diet-related expenditure among individuals in the normal, overweight, and obese BMI categories. This suggests that regardless of their weight status, individuals appear to spend relatively similar amounts on exercise or diet-related needs. In contrast, the ANOVA test for the **amount spent on food** yielded a **p-value of 0.003**, which is well below the 0.05 threshold. Therefore, we **reject the null hypothesis** and conclude that there is a **significant difference** in the average food expenditure among the three BMI groups. The results indicate that as BMI increases, so does the average amount spent on food, with the obese group spending the most. This may reflect higher food intake or different dietary patterns that could be contributing to weight gain. Overall, while spending on diet and exercise does not vary significantly across BMI groups, **food expenditure shows a clear and significant association with BMI**, underscoring the importance of dietary behavior in weight management.

5. CONCLUSION

The primary objective of this chapter was to examine the relationship between respondents' expenditure on food consumption and the amount they invest in institutions offering regular exercise facilities. The analysis clearly indicates that there is a **significant reduction in BMI values** among individuals who actively spend on fitness centres, gyms, or other structured programs aimed at addressing overweight and obesity. This suggests that financial investment in regular exercise is positively associated with improved health outcomes, particularly in terms of weight management and overall fitness.

Conversely, the study also reveals that **higher expenditure on food is correlated with an increase in BMI**. Respondents who spend more on food tend to exhibit higher body mass index values, indicating that increased food spending—possibly reflecting higher intake or consumption of calorie-dense items—may contribute to weight gain.

In conclusion, the findings suggest a dual pattern: while investment in exercise-related institutions can effectively support weight reduction and fitness maintenance, excessive spending on food, especially without corresponding physical activity, may lead to increased BMI and associated health risks. These insights underline the importance of balanced lifestyle choices involving both controlled dietary habits and regular physical exercise.

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