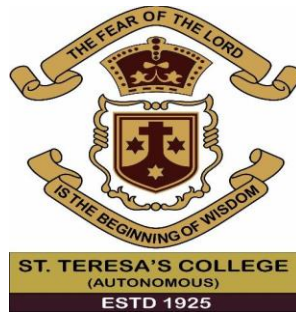# INTERRELATIONSHIP BETWEEN STRESS AND OBESITY AMONG ADULTS

DISSERTATION SUBMITTED

In Partial Fulfillment of the Requirement for the

Award of the Degree of

MASTER'S PROGRAMME

IN

CLINICAL NUTRITION AND DIETETICS

BY

SHANTHI KRISHNA J

(Register No: SM20MCN017)

DEPARTMENT OF CLINICAL NUTRITION AND DIETETICS

ST. TERESA'S COLLEGE (AUTONOMOUS)

WOMEN'S STUDY CENTER

ERNAKULAM

MARCH 2022

CERTIFIED AS A BONAFIED RESEARCH WORK

INTERRELATIONSHIP BETWEEN STRESS AND OBESITY AMONG ADULTS

DISSERTATION SUBMITTED

In Partial Fulfillment of the Requirement for the

Award of the Degree of

MASTER'S PROGRAMME

IN

CLINICAL NUTRITION AND DIETETICS

BY

SHANTHI KRISHNA J

(Register No: SM20MCN017)

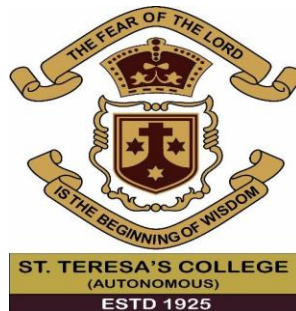## DEPARTMENT OF CLINICAL NUTRITION AND DIETETICS

ST. TERESA'S COLLEGE (AUTONOMOUS)

WOMEN'S STUDY CENTER

ERNAKULAM

MARCH 2022

CERTIFIED AS A BONAFIED RESEARCH WORK

Signature of HOD   **Signature of Guide**

INTERRELATIONSHIP BETWEEN STRESS AND OBESITY AMONG ADULTS

DISSERTATION SUBMITTED

In Partial Fulfillment of the Requirement for the

Award of the Degree of

MASTER'S PROGRAMME

IN

CLINICAL NUTRITION AND DIETETICS

BY

SHANTHI KRISHNA J

(Register No: SM20MCN017)

DEPARTMENT OF CLINICAL NUTRITION AND DIETETICS

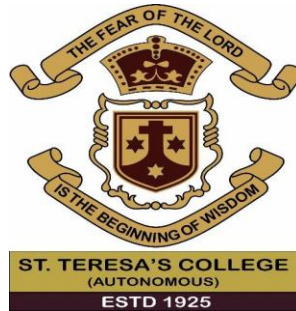## ST. TERESA'S COLLEGE (AUTONOMOUS)

WOMEN'S STUDY CENTER

ERNAKULAM

MARCH 2022

CERTIFIED AS A BONAFIED RESEARCH WORK

Signature of Internal   **Signature of External**

DECLARATION

I hereby declare that the matter in this thesis entitled "**INTERRELATIONSHIP BETWEEN STRESS AND OBESITY AMONG ADULTS**" submitted in partial fulfillment of the requirement for the award of the Degree of Master's Programme in Clinical Nutrition and Dietetics is a record of original researchwork done by me under the supervision and guidance of Ms.Surya M Kottaram, Assistant Professor, Department of Clinical Nutrition and Dietetics, St. Teresa's College(Autonomous), Ernakulam and that the thesis has not previously formed on the basis for the award of any degree/ diploma/ associateship/ fellowship or the similar title to any candidate of any other university.

Place:

Date:

SHANTHI KRISHNA J

CERTIFICATE

I hereby certify that the dissertation entitled "**INTERRELATIONSHIP BETWEEN STRESS AND OBESITY AMONG ADULTS**"submitted in partial fulfillment of the requirement for the award of theDegree of Master's Programme in Clinical Nutrition and Dietetics is a record oforiginal research work done by Ms. Shanthi Krishna Jduring the period of her studyunder my guidance and supervision.

Signature of the Guide   **Ms. Surya M. Kottaram**

Assistant Professor

Department of Clinical Nutrition and Dietetics,

St. Teresa's College,

Ernakulum

ACKNOWLEDGEMENT

ABSTRACT

There are several reasons why stress leads to obesity. Stress can activate a neural stress response network and trigger eating without hunger. Stress induces the secretion of glucocorticoids and insulin, leading to increased intake of comfort foods high in fat and sugar. Visceral obesity may represent a physiological adaptation to stress, and its possible mechanisms have been extensively studied in animals. However, there is also a possibility that stress can lead to reduced food intake and body weight loss. While stress can lead to under- or overeating, chronic life stress is more likely to be associated with a greater preference for foods high in sugar and fat. The present study was conducted in 200 adult males and females of the age group 30-59 in the Ernakulam district. Their demographic status, anthropometric profile, biochemical analysis, dietary intake,and stress was analysed using DASS-21. According to DASS 21 criteria was used to find out different types and levels of stress among the subjects. Their weight status was analysed using Body Mass Index (BMI). Almost 50 % of the samples were not having any levels of stress and reamining 50 % were having mild , moderate , severe and extremely severe levels of stress. The present study revealed that 42.7% were overweight and 17.6% were obese but that there is no significant relationship between stress and obesity .The study conducted showed that there is a negative correlation between stress and obesity. So one variable increases while the other decreases, and vice-versa. However, there remains little evidence of chronic stress associated with obesity in the general population.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

INTRODUCTION

1. INTRODUCTION

"Nothing is worth the health.Nothing is worth poisoning yourself into stress, anxiety

and fear" – Steve Maraboli

Stress is often defined as any sort of change that causes physical, emotional, or psychological strain. Stress is that the body's response to anything that needs attention or action. Stress is often short-term or long-term. Both can cause a spread of symptoms, but chronic stress can take a significant toll on the body over time and have long-lasting health effects. (Elizabeth Scott,2020)

Mental stress is distinct from the broad sort of psychological state conditions that are defined as illnesses, like depression or a post-traumatic stress disorder. Stress may be a more transient and focused circumstance, usually tied to well-defined and identifiable factors that are on the brink of the topic. Stress is additionally a definite psychological condition from anxiety, which may be a feeling of a scarcity of control over one's future circumstances. Stress is typically associated with the pending present event. (Ailsa Allaby,2022)

Mental stress within the pressure delivered to bear on the prevailing mental soundness or emotional equilibrium of any person; the symptoms of mental stress will most ordinarily be exhibited when the stress of a situations are seen as exceeding the private resources that the individual can bring back bear on them at that moment.(Elizabeth Scott, 2020)

Stress causes chemical changes within the body which will raise vital sign, pulse and blood glucose levels. It is going to cause feelings of frustration, anxiety, anger, or depression. Stress is often caused by normal life activities or by an occasion like trauma or illness. Long-term stress or high levels of stress may cause mental and physical health problems. (National Cancer Institute,2021)

Obesity may be a complex disease involving an excessive amount of body fat. Obesity is not just a cosmetic concern. It is a medical problem that increases the danger of other diseases and health problems, like heart condition, diabetes, high vital sign and certain cancers. (Goldman L, et al,2021)

Consistent with World Health Organisation (WHO), Overweight and obesity are defined as abnormal or excessive fat accumulation which will impair health.

Body mass index (BMI) may be a simple index of weight-for-height that's commonly wont to classify overweight and obesity in adults.

For adults, WHO defines overweight and obesity as follows:

- ❖ overweight may be a BMI greater than or adequate to 25; and
- ❖ obesity may be a BMI greater than or adequate to 30.

BMI provides the foremost useful population-level measure of overweight and obesity because it is that the same for both sexes and for all ages of adults. However, it should be considered a rough guide because it's going to not correspond to an equivalent degree of fatness in several individuals.(World Health Organisation,2004)

Obesity may be a chronic disease of multifactorial origin and may be defined as a rise within the accumulation of body fat. Fat isn't only a triglyceride storage organ, but studies have shown the role of white fat as a producer of certain bioactive substances called adipokines. Among adipokines, there are some inflammatory functions, like Interleukin-6 (IL-6) and other adipokines entail the functions of regulating food intake, therefore exerting an immediate effect on weight control. (Alba Fernández-Sánchez et al, 2011)

The prevalence of obesity has rapidly escalated and now represents a serious public health concern. Although genetic associations with obesity and related metabolic disorders like diabetes and disorder are identified, together they account for alittle proportion of the incidence of disease. Environmental influences like chronic stress, behavioral and metabolic disturbances, dietary deficiency, and infection have now emerged as contributors to the event of metabolic disease. (K. L. Tamashiro, 2011)

The prevalence of overweight and obesity has dramatically risen over the past few decades. Although the speed of increase has begun to slow (at least temporarily) within the US, approximately two thirds of the population is overweight, and nearly one third is obese.

Obesity may be a global public health challenge that increases the danger of varied diseases including type 2 DM, hypertension and cancer, and can within the future cause further increases within the incidence of chronic disease.(Alba Fernández-Sánchez et al ,2011)

Consistentwith World Health Organisation (WHO), the elemental explanation for obesity and overweight is an energy imbalance between calories consumed and calories expended. Globally, there has been:

❖ an increased intake of energy-dense foods that are high in fat and sugars; and

❖ a rise in physical inactivity because of the increasingly sedentary nature of the many sorts of work, changing modes of transportation, and increasing urbanization.

Changes in dietary and physical activity patterns are often the results of environmental and societal changes related to development and lack of supportive policies in sectors like health, agriculture, transport, urban planning, environment, food processing, distribution, marketing, and education.(World Health Organisation,2004)

Several etiological factors of obesity are identified. Obesity naturally features a multifaceted biological basis that has genetics, the biological factors associated with normal body growth, eating habits, energy expenditures, and fat function. Although overeating and sedentary lifestyle are the foremost frequently cited suspects, there are likely many other contributors to the surge in obesity and obesity-related illness, including cultural, industrial, and genetic factors.Many pathways connect stress and obesity, two highly prevalent problems facing society today. First, stress interferes with cognitive processes like executive function and self-regulation. Second, stress can affect behavior by inducing overeating and consumption of foods that are high in calories, fat, or sugar; by decreasing physical activity; and by shortening sleep. Third, stress triggers physiological changes within the hypothalamic-pituitary-adrenal axis, reward processing within the brain, and possibly the gut microbiome. Finally, stress

can stimulate production of biochemical hormones and peptides like leptin, ghrelin, and neuropeptide Y. (Tomiyama, 2018)

Chronic stress represents a protracted state of dyshomeostasis caused by intense and frequently imposed stressors. Obesity constitutes a chronic dysmetabolic state, leading progressively to a spectrum of metabolic complications, like diabetes, dyslipidemia, hypertension and related disorders. A growing body of evidence supports the existence of serious interactions between stress and obesity, with chronic stress promoting weight gain, and consequently excessive fat accumulation especially visceral fat, of these factors contributing to the event of a chronic stressful state. Maintaining body homeostasis may be a prerequisite for normal reproductive function, which is significant for the survival of the species and a crucial process of survival.(Ioannis Kyrou et al ,2011)

The strain system functions during a baseline circadian fashion and interacts with other systems of the organism to manage a spread of behavioral, endocrine, metabolic, immune and cardiovascular functions. The experience of perceived or real uncontrollable intense and/or chronic stress (distress) may cause several psychopathologic conditions, including anxiety, depressive and psychosomatic disorders, drug abuse, obesity and therefore the metabolic syndrome, and osteoporosis, also as impaired reproductive and immune functions.

When presented with a stressful situation, the body responds by calling for the release of hormones that provide a burst of energy. The hormones epinephrine (also known as adrenaline) and norepinephrine (also known as noradrenaline) are released

by the adrenal medulla. Epinephrine and norepinephrine increase blood glucose levels by stimulating the liver and skeletal muscles to break down glycogen and by stimulating glucose release by liver cells. Additionally, these hormones increase oxygen availability to cells by increasing the heart rate and dilating the bronchioles. The hormones also prioritize body function by increasing blood supply to essential organs such as the heart, brain, and skeletal muscles, while restricting blood flow to organs not in immediate need, such as the skin, digestive system, and kidneys. Epinephrine and norepinephrine are collectively called catecholamines.(Robert Wise*et al*,2016)

Long-term stress response differs from short-term stress response. The body cannot sustain the bursts of energy mediated by epinephrine and norepinephrine for long times. Instead, other hormones come into play. In a long-term stress response, the hypothalamus triggers the release of ACTH from the anterior pituitary gland. The adrenal cortex is stimulated by ACTH to release steroid hormones called corticosteroids. Corticosteroids turn on transcription of certain genes in the nuclei of target cells.

They change enzyme concentrations in the cytoplasm and affect cellular metabolism. There are two main corticosteroids: glucocorticoids such as cortisol, and mineralocorticoids such as aldosterone. These hormones target the breakdown of fat into fatty acids in the adipose tissue. The fatty acids are released into the bloodstream for other tissues to use for ATP production. The glucocorticoids primarily affect glucose metabolism by stimulating glucose synthesis. Glucocorticoids also have anti-

inflammatory properties through inhibition of the immune system. For example, cortisone is used as an anti-inflammatory medication; however, it cannot be used long term as it increases susceptibility to disease due to its immune-suppressing effects.Mineralocorticoids function to regulate ion and water balance of the body. The hormone aldosterone stimulates the reabsorption of water and sodium ions in the kidney, which results in increased blood pressure and volume.Hypersecretion of glucocorticoids can cause a condition known as Cushing's disease, characterized by a shifting of fat storage areas of the body. This can cause the accumulation of adipose tissue in the face and neck, and excessive glucose in the blood. Hyposecretion of the corticosteroids can cause Addison's disease, which may result in bronzing of the skin, hypoglycemia, and low electrolyte levels in the blood. (Connie Rye *et al*,2016)

Increased long-term cortisol levels, as measured in scalp hair, are strongly related to abdominal obesity and to specific mental disorders. However, not all obese patients have elevated cortisol levels. Possibly, the interindividual variation in glucocorticoid sensitivity, which is partly genetically determined, may lead to higher vulnerability to mental or physical stressors.(Fardet L*et al*,2014)

Obesity and its associated disorders are a growing epidemic across the planet. Many genetic, physiological, and behavioral factors play a task within the etiology of obesity. Diet and exercise are known to play a valuable role within the treatment and prevention of obesity and associated disorders like hypertension, heart condition ,and term stress and obesity. Chronic stress can cause "comfort eating," which frequently involves the

overeating of foods that are high in fat, sugar, and calories, which, in turn, can cause weight gain. (Sally Robertson,2021)

The prevalence of overweight and obesity has markedly increased during the past few decades. Stress has been suggested together environmental factor which will contribute to the event of obesity. The role that exposure to chronic stress may play within the development of obesity, with particular attention to the consequences of chronic psychosocial stress. The effect that social stress has on dietary preference, food consumption, and regional distribution of fat. There is a link between sympathetic systema nervosum and hypothalamic-pituitary-adrenal axis hyperactivity with visceral obesity, which stress tends to change the pattern of food consumption, and promotes craving of nutrient-dense "comfort foods."(Karen A. Scott, 2012)

According to the WHO World health statistics report 2012, globally one in six adults are obese and nearly 2.8 million individuals die each year due to overweight or obesity. The researchers found that over the past 33 years, worldwide overweight and obesity rates due to stress among adults have increased by 27.5%, while such rates among children and adolescents have increased by 47.1%. Collectively, the number of overweight and people with stress induced obesity worldwide have increased from 857 million in 1980 to 2.1 billion in 2013. The biggest increases in overweight and obesity rates occurred between 1992 and 2002, primarily among adults ages 20-40.Over the past two decades, Asia and the Pacific have not only experienced rapid growth, but in parallel saw a rapid increase in overweight people and obesity caused due to stress.

The latest available data indicated that over 40.9% of adults in the region are overweight compared to 34.6% in 1990.(Matthias Helble *et al* ,2017)

Prevalence of stress induced obesity in India is 40.3%. Zonal variations were seen as follows: south highest at 46.51% and east lowest at 32.96%. Obesity was higher among women than men (41.88% vs. 38.67%), urban than rural (44.17% vs. 36.08%), and over 40 than under 40 (45.81% vs. 34.58%). (Murali Venkatrao,2021)

There had been a great impact of working conditions over health. It was widely seen that because of the stress due to different working condition , there had been very less care towards the health and which became a leading cause to obesity and various other lifestyle diseases. Therefore in order to find out the prevalence of stress induced obesity among adults, the present study is considered for significant research.

In this context, the present study entitled 'Inter relationship between Stress and Obesity among adults' was carried out with following objectives:

- To assess the prevalence of obesity in adults in the age group of 30-59 years.
- To diagnose the level of stress using DASS-21 questionnaire.
- To check the interrelationship between stress and obesity in adults.
- To assess the nutritional status of the subjects.
- To conduct an intervention programme for the selected subjects

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

The review of literature pertaining to the study "Interrelationship between Stress and Obesity" is discussed under the following headings:

2.1 Mechanism of Stress and Obesity.

2.2 Interrelationship between Stress and Obesity.

2.3 Social Stress and Obesity.

2.4 Risk factors leading to Stress induced Obesity.

2.5 Complications of Stress and Obesity.

2.6 Prevention for Stress and Obesity.

2.1 Mechanism of Stress and Obesity.

Obesity may be a rapidly increasing pandemic with major consequences for public health. Within the past years, evidence is mounting that stress, and particularly, a rise of the glucocorticoid stress hormone cortisol plays a task within the development of obesity. However, it seems that not all individuals answer stress within the same way. Cortisol, a glucocorticoid (GC) hormone, is understood to cause a redistribution of white fat to the abdominal region and additionally increases appetite with a preference for energy-dense food ("comfort food"). Patients who are chronically exposed to high levels of glucocorticoids, like in Cushing's syndrome or when using high doses of exogenous GC, develop abdominal obesity, metabolic syndrome (MetS), and eventually cardiovascular diseases (CVD). In our modern society, the obesity pandemic coincides with a rise in factors that enhance cortisol

production, like chronic stress, consumption of food with a high glycemic index, and a reduced amount of sleep.

Stress, both physical and psychological, are often seen as a neighborhood of life that each individual will experience to some extent. Goldstein described stress as a condition during which expectations, whether genetically programmed, established by prior learning, or deduced from circumstances, don't match current or anticipated perceptions of the interior or external environment. This mismatch between what's observed or sensed and what's expected or programmed evokes patterned, compensatory responses. This assembly of responses is usually called the "stress response" and applies to mental stress. From a biological perspective, there also are other sorts of stressors, like sleep deprivation, pain, inflammation, or use of exogenous glucocorticoids (GCs), which may all elicit a stress response at the cellular level.(Elisabeth F. C. van Rossum,2018)

Stress is defined by the activation of the hypothalamic-pituitary-adrenal axis. However, the consequences of stress on appetitive profiles may differ with the sort and duration of stress. Whereas physical stress resulting from injury or infection can initiate the hormonal response will not to define stress, studies suggest that physical stressors (example: military combat, threat of electrical shock, or feeling ill) cause decreased instead of increased eating, conversely, psychological stress may be a hypothesized contributor to increased emotional eating and obesity . additionally , acute stress (short duration) typically activates hormonal events that restore homeostasis,whereas chronic stress (long duration) can overwhelm these homeostatic mechanisms and is of greater interest within the etiology of obesity and other metabolic illnesses .(Carla J. Moore,2017)

Stressful life experience can have significant effects on a spread of physiological systems, including the autonomic nervous system , the hypothalamic-pituitary-adrenal axis, and therefore the system . These relationships are often bidirectional; for instance , immune cell products can act on the brain, altering mood and cognition, potentially contributing to depression. Although acute physiological alterations could also be adaptive within the short term, chronic or repeated provocation may result in damage to health. The central dogma within the field of stress research assumes a stereotyped physiological response to all or any stressors (the generality model). However, increasing evidence suggests that specific stressful conditions and therefore the specific way an organism appraises these conditions can elicit qualitatively distinct emotional and physiological responses (the integrated specificity model). for instance , appraisals of threat (vs. challenge), uncontrollability, and negative social evaluation are shown to impress specific psychobiological responses. Emotional responses appear to possess specific neural substrates, which may end in differentiated alterations in peripheral physiological systems, in order that it's incorrect to presume a consistent stress response.(Margaret E. Kemeny , 2013)

Obesity has become a crucial public health challenge worldwide. Obesity increases morbidity and mortality and may be a major determinant for variety of chronic conditions including cardiovascular diseases, type 2 DM , and a few cancer types (Sassi, 2010). In response to obesity epidemic, various intervention programmes are developed, and that they mainly specialise in diet changes and physical activity promotions (Foss and Dyrstad, 2011, Holmes et al., 2010). Stress as a determinant of obesity, has recently received increased attention (Foss and Dyrstad, 2011, Holmes et al., 2010).

According to World Health Organisation(WHO),In 2016, quite 1.9 billion adults aged 18 years and older were overweight. of those over 650 million adults were obese.In 2016, 39% of adults aged 18 years and over (39% of men and 40% of women) were overweight.Overall, about 13% of the world's adult population (11% of men and 15% of women) were obese in 2016.The worldwide prevalence of obesity nearly tripled between 1975 and 2016.

Obesity is defined as having a high body-mass index. it's a risk factor for several of the world's leading causes of death, including heart condition , stroke, diabetes and various sorts of cancer. Obesity doesn't directly explanation for any of those health impacts but can increase their likelihood of occurring. within the chart we see that it's one among the leading risk factors for death globally.(Hannah Ritchie and Max Roser ,2017)

According to World Health Organisation(WHO), raised BMI may be a major risk factor for noncommunicable diseases like cardiovascular diseases (mainly heart condition and stroke), which were the leading explanation for death in 2012,diabetes,musculoskeletal disorders (especially osteoarthritis – a highly disabling condition of the joints),some cancers (including endometrial, breast, ovarian, prostate, liver, gallbladder, kidney, and colon).The risk for these noncommunicable diseases increases, with increases in BMI.

2.2 Interrelationship between Stress and Obesity.

Stress has lengthy been suspected to be interrelated to (stomach) weight problems. However, interindividual variations all through this complicated dating exist. Obesity can be a swiftly growing pandemic with fundamental outcomes for public health. inside the beyond years, proof is mounting that strain, and particularly, a upward thrust of the glucocorticoid strain hormone cortisol performs a assignment inside the improvement of weight problems.

However, plainly now no longer all people solution strain inside the equal manner.. Patients who're chronically uncovered to excessive degrees of glucocorticoids, like in Cushing's syndrome or whilst the usage of excessive doses of exogenous GC, expand stomach weight problems, metabolic syndrome (MetS), and subsequently cardiovascular diseases (CVD) Stress might also additionally play a severe position inside the improvement and upkeep of weight problems in people who've an multiplied glucocorticoid publicity or sensitivity. (Eline S. van der Valk , Elisabeth F. C ,2018)

Anxiety may play a role in certain issues that may eventually lead to the development of obesity. Increased cortisol levels, as the result of anxiety, cause fat to build up in the stomach and leads to an increase in weight. The longer that a person experiences stress and anxiety, the more weight he or she can potentially gain.Digestion changes, such as slowed digestion, often occurs in those who are anxious and, overtime, can lead to weight gain from the stress.

Anxiety can purpose multiplied fatigue and a trendy general loss of energy, which purpose a non-public to be much less active. Without everyday movement, the frame is not able to burn energy and whilst sufficient energy are not burned on an afternoon to day , it's going to purpose weight benefit.Certain tension medications, like Xanax and different antianxiety agents, can now and again cause fatigue and are related to next weight benefit.

Finally, it is pretty not unusual place for humans experiencing multiplied degrees of anxiety to expose to meals for consolation. Whether it is to fulfill an emotional want or performed as a manner of coping with internal turmoil, ingesting meals, even if one isn't always hungry, can arise whilst a character is aggravating. If this dangerous approach of coping arise regularly, weight benefit might be going to be the result.(Anne Kelly,2022)

Across studies, people in seniority positions attended have decrease strain degrees, more healthy ingesting styles, and decrease weight . Higher strain changed into associated with much less healthful nutritional behaviors and with better weight . These styles have been extra suggested in girls than in guys. the person of the strain–ingesting–weight problems dating is complicated.

(Carla J.Moore ,2017)

Higher strain changed into associated with decrease self-rated eating regimen quality, decrease fruit and vegetable intake, decrease compliance with the 2000 Dietary Guidelines for Americans, decrease chance of breakfast intake, better consumption of particular fatty meals ,better degrees of dangerous snacking ,and better occurrence of weight-reduction plan.In one study, better paintings strain changed into associated with better intake of particular fatty meals amongst guys however now no longer girls. Another article stated a large affiliation among strain and weight-reduction plan amongst adolescent ladies however now no longer boys.

Higher BMI changed into associated with decrease self-rated eating regimen quality,extra weight-reduction plan, decrease fruit and vegetable intake ,better intake of fried meals , and decrease nutritional fiber consumption , amongst each adult males and females; better BMI changed into associated with better intake of particular fatty meals in girls only ,and with better occurrence of weight-reduction plan amongst adolescent ladies however now no longer boys.

(Laitinen J , Hamaideh SH,2010)

2.3 Social Stress and Obesity.

Social pressure may be widely described as a state of affairs which threatens one's relationships, esteem, or experience of belonging inside a dyad, group, or large social context. Social pressure can emerge in some of the situations. Social pressure can stem from hard social interactions, for example, a conflictual or tumultuous marital or own circle of relatives relationship .Social pressure also can emerge withinside the context of evaluated overall performance situations, wherein others may be judgmental or crucial, or in contexts wherein one feels rejected, ostracized, or ignored .Social pressure also can be greater widely construed, representing perceptions of one's decrease position or status inside a set or community.Social pressure can result in quite a number observable and measurable responses associated with fitness outcomes.

(Juth V., Dickerson S, 2013)

The persistent, mild, social pressure function of the lives of many, and taking place in an surroundings of overnutrition, can be a crucial contributor to the weight problems epidemic in Western society. Clinical and animal research show that pressure outcomes in multiplied meals consumption. Recent epidemiological information from the Whitehall have a look at show an affiliation among persistent self-pronounced pressure and multiplied occurrence of each whole-frame weight problems and the metabolic syndrome described as 3 or greater of the following: excessive waist circumference, triglycerides, blood pressure, or fasting glucose, or low high density lipoprotein (HDL) cholesterol. Each element of the metabolic syndrome (such as principal weight problems) had a sturdy inverse affiliation with

18

employment grade . Employment grade is a degree of socioeconomic fame which is likewise inversely associated with physiological markers of pressure, and pressure levels(Carol A. Shively, Thomas B. Clarkson ,2019)

Obesity is a contemporary-day fitness pandemia. Determinants of this pathology are alternatively complicated and consist of genetic, developmental and environmental elements best in part disclosed. Stress associated neuroendocrine dysregulation and overconsumption of excessive palatable excessive caloric meals and are probably to make a contribution to this contemporary fitness threats. Despite the proof that psychosocial pressure is one of the most important reassets of pressure in people and can play a crucial position within side the improvement of the pressure disorders, such as weight problems and metabolic syndrome, animal fashions that specialize in the connection among persistent pressure and power homeostasis are scattered and maximum of them encompasses bodily in place of psychosocial pressure.(RobertoCoccurelloFrancesca R.D Amato , 2018)

Socioeconomic pressure related to economic and psychosocial pressure is full-size in society. A complete frame of studies shows that low socioeconomic fame and social pressure is related to a huge spectrum of fitness risks. Research suggests epidemiological proof demonstrating the affiliation among persistent social pressure and improvement of weight problems and signs main to metabolic syndrome. The cumulative consequences of socioeconomic pressure on fitness and nicely being are obvious during the lifespan, affecting children, adolescents, and adults. While the hyperlinks among pressure and metabolic disorder are documented, the mechanisms continue to be much less nicely understood. (Kellie L. K. Tamashiro, 2011)

Using the seen burrow system (VBS) version of social pressure researchers have started to study the short- and long-time period results of persistent social pressure on power homeostasis. It validated that social pressure has giant consequences on frame weight and frame composition such that subordinate rats step by step expand traits of weight problems and feature moreover decided that this occurs, in part, via adjustments in meals consumption quantity and behavior. Changes in frame weight and frame composition are comparable or extra while animals are maintained on a excessive fats weight loss program. These information advise that intake of a excessive-fats weight loss program at some stage in social pressure withinside the VBS, at the same time as it does now no longer seem to have an effect on improvement of a social hierarchy, complements the impact that persistent pressure has on frame composition and can be greater consultant of what takes place in people in cutting-edge society wherein the standard weight loss program has step by step moved closer to better calorie, excessive-fats foods. (Randall R.Sakai, Maria A.Hegeman , 2016)

2.4 Risk factors leading to Stress induced Obesity.

2.4.1 Eating

Individuals can consume extra or consume in a different way below strain, with maximum gravitating in the direction of palatable ingredients which are excessive in sugar, fat, and calories. Other survey research assist a widespread sample wherein people have interaction in unhealthy ingesting post-strain . For instance, a look at of a study of workplace strain confirmed that personnel mentioned better energy, saturated fat, and sugar consumption at some point of excessive-workload periods.Furthermore, human beings aren't the best animals to have interaction in strain-precipitated ingesting.

2.4.2 Physical activity

Stress can disrupt interest patterns, whether or not with the aid of using reducing bodily interest or with the aid of using growing sedentary behavior. In different words, humans can volitionally exercising much less because of pressure and concurrently or independently spend greater time being sedentary. the evidence is stronger for decreased physical activity. A survey of over 12,000 individuals located that better pressure become associated with much less common exercising, and similarly, a longitudinal look at of virtually 1,four hundred girls confirmed 3-year potential relationships among better perceived pressureand decrease leisure-time bodily interest

2.4.3 Sleep duration

According to a model by Patel and Hu (2008) based on the results of experimental sleep deprivation studies, four mechanisms link poor sleep to increased weight. The first is a direct physiological pathway, with shorter sleep reducing thermogenesis and thus lowering energy expenditure. Shorter sleep can also promote fatigue and further contribute to decreased energy expenditure through reduced physical activity and increased sedentary behavior. Shorter sleep times also lead people to report feeling hungrier,especially for high-fat and high-carb foods. This effect appears to be mediated by leptin and ghrelin, which are appetite-regulating hormones discussed in more detail below.Finally, those who sleep less are by definition awake longer, meaning they have more time to eat, although this pathway hasn't found much empirical support. Therefore, many signaling pathways link short sleep duration to obesity. (A. Janet Tomiyama,2019)

2.5 Complications of Stress and Obesity.

Obesity increases the risk of having excessive blood pressure andunusual LDL cholesterol levels, which can be danger elements for coronary heart sickness and strokes. Obesity can have an effect on the manner the frame makes use of insulin to manipulate blood sugar levels.This increases the risk of insulin resistance and diabetes. Obesity can also additionally boom the danger of most cancers of the uterus, cervix, endometrium, ovary, breast, colon, rectum, esophagus, liver, gall bladder, pancreas, kidney and prostate.Obesity will increase the chance of growing heartburn, gallbladder sickness and liver problems.People with weight problems are much more likely to have sleep apnea, a doubtlessly extreme sickness wherein respiratory again and again stops and begins offevolved all through sleep. Obesity will increase the strain located on weight-bearing joints, similarly to selling irritation withinside the frame. These elements can also additionally cause headaches inclusive of osteoarthritis. (Goldman L, et al , 2021) Overweight and weight problems are an increasing number of not unusualplace situations withinside the United States. They are due to the boom withinside the length and the quantity of fats cells withinside the frame. Body Mass Index (BMI) and waist circumference to display and diagnose obese and weight problems. Obesity is a extreme clinical circumstance which can reason headaches inclusive of metabolic syndrome, excessive blood strain, atherosclerosis, coronary heart sickness, diabetes, excessive blood LDL cholesterol, cancers and sleep issues.

(Leer en español, 2021)

It is thought that persistent strain is connected to numerous behavioral and neuropsychiatric situations. Regarding the precise pathophysiological mechanisms, now no longer simplest speculations had been made approximately the impact of CRH,however additionally it gives up product cortisol has been hypothesized to have a pathophysiological position in strain-associated intellectual issues inclusive of tension and depression. Currently, the rather novel approach of hair cortisol concentration (HCC) dimension has additionally been carried out in studies of intellectual issues and situations which might be associated with strain.

Research has proven that mental and socioeconomic traits aren't causes, however as a substitute the outcomes of weight problems; frame weight can also additionally have an effect on training and occupational opportunities, and stigmatization related to weight problems can also additionally cause better strain levels Increased lifespan and the getting old populace impose a first-rate task at the ever-growing occurrence of persistent diseases, especially cardiometabolic strain related to the pandemic weight problems in our contemporary-day society. Although obese and weight problems are related to incident cardiovascular diseases (CVD), such as coronary heart failure (HF), it satirically results in a greater favorable diagnosis in sufferers with persistent HF, a phenomenon normally described as "weight problems paradox".

(ShuyiWangJunRen,2018)

2.6 Prevention for Stress and Obesity

Stress is one of the contributing elements for weight problems. Effective counseling for control of strain allows to lessen weight problems and its associated headaches. Longitudinal research are needed, however, to assist inclusion of strain control or mindfulness strategies in

weight problems prevention efforts.(Pallavi Chitnis, 2013) Treatment for obese and weight problems relies upon at the purpose and severity of our condition. Possible remedies encompass wholesome life-style modifications, behavioral weightloss remedy programs, medicines, and probably surgery.We may want remedies for all the headaches we have. (Leer en español, 2021)

2.6.1 Lifestyle Intervention

Lifestyle interventions that produce negative energy balance form the basis of the treatment of overweight and obesity and are part of the standard recommendation. There are different lifestyle approaches, with diet, physical activity and behavior being the main components. By reducing energy intake and increasing physical activity, accompanied by behavior modification techniques, a daily energy deficit of around 500 kcal is recommended for weight loss. This energy deficit can result in modest weight loss over a year. Energy balance changes with weight loss, so it is necessary to adjust energy intake and expenditure during weight management.The energy balance is dynamic and weight loss leads to a new energy balance at a lower level. Adhering to a lifestyle intervention is a challenge for many overweight and obese people. In a systematic review and meta-analysis, three main factors were associated with better adherence to weight loss interventions: surveillance, social support, and focus on dietary interventions. Diet is the main factor of lifestyle. Therefore, nutritional aspects to reduce energy intake and support weight management are highlighted below.

2.6.2 Energy Intake

The key additives of energy stability consist of energy consumption, intake and storage. When energy consumption exceeds energy expenditure, increase of energy stability that will increase the body weight. The European Food Safety Authority (EFSA) recommends an each day nutritional reference consumption of 45% to 65% of general energy from carbohydrates, 20% to 35% from fats and 0. 83g protein/kg body weight. An each day electricity deficit of 500 kcal is usually recommended for weight reduction and may be executed through warding off hypercaloric foods.Fat is a high-energy macronutrient, supplying greater than twice the energy of carbohydrates or protein. Because of this, decreasing the each day fats consumption will assist lessen the each day calorie consumption. Fat consumption may be decreased through the usage of low-fats dairy merchandise like cheese and yogurt, lean meats, and warding off hidden fats.

2.6.3 Macronutrients

Studies have shown that it is not the macronutrient composition of the diet but the energy content that is relevant for weight control. Low-carb diets often contain about 40% of carbohydrates per day. Lower carb intake is part of a ketogenic diet, where the goal is to minimize carb intake as much as possible. Both low-carb and high-carb diets increase mortality risk. A low-carb diet includes fewer plant-based foods that have health-promoting effects.A meta-analysis of eight randomized controlled trials concluded that low-carbohydrate diets are superior to low-fat diets for fat metabolism in overweight and obese people.(Nahla Hwalla,2020)

Some sufferers with weight problems do now no longer reply to wholesome life-style modifications and medicines. When those sufferers expand positive weight problems-associated headaches, they'll be eligible for the subsequent surgeries.

Gastric bypass surgery where a small part of the belly is attached to the center a part of the intestine, bypassing the primary a part of intestine.This decreases the amount of meals we can devour and the amount of fat our body can absorb and store.Gastrectomy in which a massive part of the belly is eliminated to lower the quantity of meals .

Gastric banding where a hole band is located across the top a part of the belly developing a smaller belly. (Leer en español, 2021)

Some strategies for dealing with strain encompass:

• Understanding the symptoms and symptoms and symptoms: These symptoms vary, however if someone can apprehend their very own alerts of strain, they may be higher capable of manipulate them.

Speaking to people and family , they can offer emotional assist and the incentive to take action.Exercising regularly will increase the body's manufacturing of endorphins, that are chemical substances that increase the temper and decrease strain. Exercise can contain walking, cycling, running, running out, or gambling sports. People who exercise this shape of meditation use respiration and concept strategies to create an cognizance in their frame and surroundings. ResearchTrusted Source indicates that mindfulness will have a high quality effect on strain, anxiety, and depression. Improving sleep quality where Getting too little sleep or sleep of terrible high-satisfactory can make contributions to strain. Try to get as

a minimum 7 hours sleep each night, and set everyday instances for going to sleep and waking up. Avoid caffeine, eating, and excessive bodily hobby withinside the hours earlier than bed.(Jennifer Casarella , 2021)

METHODOLOGY

3.METHODOLOGY

The methodology pertaining to the study entitled "Interrelationship between stress and obesity" is discussed under the following headings :

3.1 Selection of area.

3.2 Selection of samples.

3.3 Selection of tools and technique.

3.4 Collection of data.

3.5 Development of intervention tool and conduct awareness program.

3.6 Analysis and interpretation of data.

3.1 SELECTION OF AREA.

The area selected for the study wasCochin Cooperation, Ernakulam District, Kerala. This area was selected because of the people in this area were under great stress due to professional and personal problems. Two hospitals were selected for conducting the study. Among them one was government hospital and the other was private hospital.

3.2 SELECTION OF SAMPLES.

A total of 200 subjects belonging to the age group of 30-59 years from the population were selected . Both male and female subjects were selected for the study .This age group was selected because the people between this age group are more prone to stress ,obesity and other lifestyle disorders. Among the 200 selected subjects, their stress levels were assessed using DASS 21criteria and level of overweight and obesity were also diagonosed using BMI and the number of obese patients were found out in each level of stress.

3.3 SELECTION OF TOOLS AND TECHNIQUE.

A questionnaire was designed to obtain the data.The questionnaire consisted of questions designed to elicit information about the subject's personal details, anthropometric measurements, biochemical measurements, familial history, medical history, clinical assessment,stress assessment(DASS 21), nutritional assessment, lifestyle patterns, food frequency consumption table and 24 hour recall of the samples. The questionnaires were distributed to the subjects who had no access to digital media and the rest were given the questionnaires as Google forms .The questionnaires were circulated and filled by the subjects through their mobile phones. The Depression, Anxiety and Stress Scale - 21 Items (DASS-21) is a set of three self-report scales designed to measure the emotional states of depression, anxiety and stress. The DASS-21 was developed by Lovibond and Lovibond (1995) and is widely used in different countries.

Questionnaire forms are the back bone of any survey and the success of the project lies in the designing of a questionnaire. A questionnaire is simply a list of mimeographed or printed questions that is completed by or for a respondent to give his opinion. A questionnaire is the main means of collecting quantitative primary data.In order to gather useful and relevant information it is essential that careful consideration is given to the design of the questionnaire. A well designed questionnaire require thorough effort and needs to be planned and developed in a number of stages. (Rani Menta Satya , 2012)

3.3.1 <u>Anthropometric measurements</u>

The parameters considered were height, weight, body mass index, waist hip ratio, waist circumference. The anthropometric data of the subjects were taken directly when they came for their consultation with the doctor.

3.3.1.1 <u>Height</u>

Subjects were asked to stand against wall with bare foot and with heel, buttocks and the back of the head touching the wall. The head was held comforting erect with the arm hanging free at the sides in a natural manner. The height of the subject were taken using a stadiometer.

3.3.1.2 <u>Weight</u>

The weight of the selected subject were recorded using a fat monitoring machine (Dr Trust 360 Body Fat Monitoring Machine) the subjects wereasked to stand on the weighing scale barefooted without touching anything, knees not bend and head straight and looking forward. The fat monitoring machine also showed the body weight,Body Mass Index (BMI),body fat,muscle mass,body water,bone mass,Basal Metabolic Rate (BMR),visceral fat and subcutaeneous fat .

3.3.1.3 <u>Body Mass Index</u>

The BMI was calculated by taking individuals weight in kg by the square of his or her height in meter. BMI are classified into different categories like underweight, normal, overweight, obesity. The BMI of the samples were computed and compared with the suggested classification of World Health Organisation(2003).

BMI	Nutritional status
Below 18.5	Underweight
18.5–24.9	Normal weight
25.0–29.9	Pre-obesity
30.0–34.9	Obesity class I
35.0–39.9	Obesity class II

Above 40	Obesity class III

3.3.1.4 <u>Waist Hip Ratio</u>

Waist hip ratio = waist circumference /hip circumference

Waist circumference was measured at the lowest value just below the last rib above the navel. The hip circumference was measured around the hip bone (protruding part of the ileac crust) which gives the largest value for the lower torso measured using fiber glass tape. In the most frequently used measure of adiposity which differentiates between (apple) and gynoid (pear) obesity. The normal WHR is 0.7. A waist hip ratio of 1 for men and 0.8 for women is suggestive for increased prevalence of obesity in adults. (World Health Organisation,2003)

3.3.2 <u>Biochemical Assessment</u>

Biochemical Assessment includes measuring a nutrient or its metabolite in blood, feces, or urine or measuring a variety of other components in blood and other tissues that have a relationship to nutritional status. Here in the present study, estimated the values of Fasting Blood Sugar, Serum Triglycerides andTotal Cholesterol in blood serum,.The biochemical values were collected from the laboratories of the selected hospitals.

3.3.3 <u>Biophysical Assessment</u>

The blood pressure of the subjects were taken using asphygmomanometer.

3.3.4 <u>Dietary Assessment</u>

In this study, frequency of food consumption was assessed using frequency of food consumption record coming under the four basic food groups. Along with this, also have included various yes or no questions to know their food habits.Dietary assessment is conducted with the help of interview schedule.

When a systematic enquiry into the food supplies and food consumption of individuals and population group is made, it is called a diet survey. Dietary assessment provides information about the dietary intake of individuals, several methods are used to collect dietary assessment. In this study itwas done by using 24 hour recall method, by asking some questions about their dietary intake. 0

3.4 COLLECTION OF DATA.

The questionnaire method was administered among 200 subjects and the data were collected and analyzed.

3.5 DEVELOPMENT OF INTERVENTION TOOL AND CONDUCT AWARENESS PROGRAM.

An intervention tool was made inorder to spread awareness about stress, obesity and how stress leads to obesity . It also included the measure to lower stress and the complications associated with it. It was being shared with the subjects collected as well as shared in the social media handles to make understand people about the severity of the problem.

3.6 ANALYSIS AND INTERPRETATION OF DATA.

The IBM SPSS Version 23 was used to carry out data analysis. Percentage ,Frequency ,Correlation were used to draw conclusion from the data collected. The result was then interpreted using the data analysed.

Plate 1 : Collecting general information

Plate 2 : Measuring the weight and body fat measurements using the body fat monitoring machine.

Plate 3: Measuring the height of the sample.

RESULTS AND DISCUSSION

3. RESULTS AND DISCUSSION

The results and discussion of the study entitled "**Interrelationship between Stress and Obesity**" was discussed under the following heads.

4.1 Assessment of demographic status and lifestyle of the subjects.

    4.1.1 Age profile .

    4.1.2 Socio-economic status.

    4.1.3 Personal habits.

4.2 Assessment of Anthropometric profile of the subjects .

    4.2.1 Weight.

    4.2.2 Body Mass Index (BMI) .

    4.2.3 Waist Hip Ratio (WHR).

4.3 Assessment of Biochemical status of the subjects .

    4.3.1 Percentage distribution of Fasting Blood Sugar among the subjects .

    4.3.2 Percentage distribution of Serum Triglycerides among the subjects .

4.4 Assessment of dietary intake of the subjects .

    4.4.1 Meal Pattern.

    4.4.2 Food Frequency Record.

4.5 Assessment of Stress among the subjects according to DASS-21.

    4.5.1 Percentage distribution of Depression among the subjects .

    4.5.2 Percentage distribution of Anxiety among the subjects .

    4.5.3 Percentage distribution of Stress among the subjects .

4.6 Correlationbetween Obesity and Stress among the subjects .

4.6.1 Percentage distribution of the subjects having Obesity and Depression.

4.6.2 Percentage distribution of the subjects having Obesity and Anxiety.

4.6.3 Percentage distribution of the subjects having Obesity and Stress.

4.1 Assessment of demographic status and lifestyle of the subjects

4.1.1 Age profile

Table 4.1.1 Distribution of participants based on age group

Age group	Frequency	Percentage (%)
30-35	10	5%
36-40	17	8%
41-45	27	13.6%
46-50	30	15.1%
51-55	42	21.1%
56-60	74	37.2%
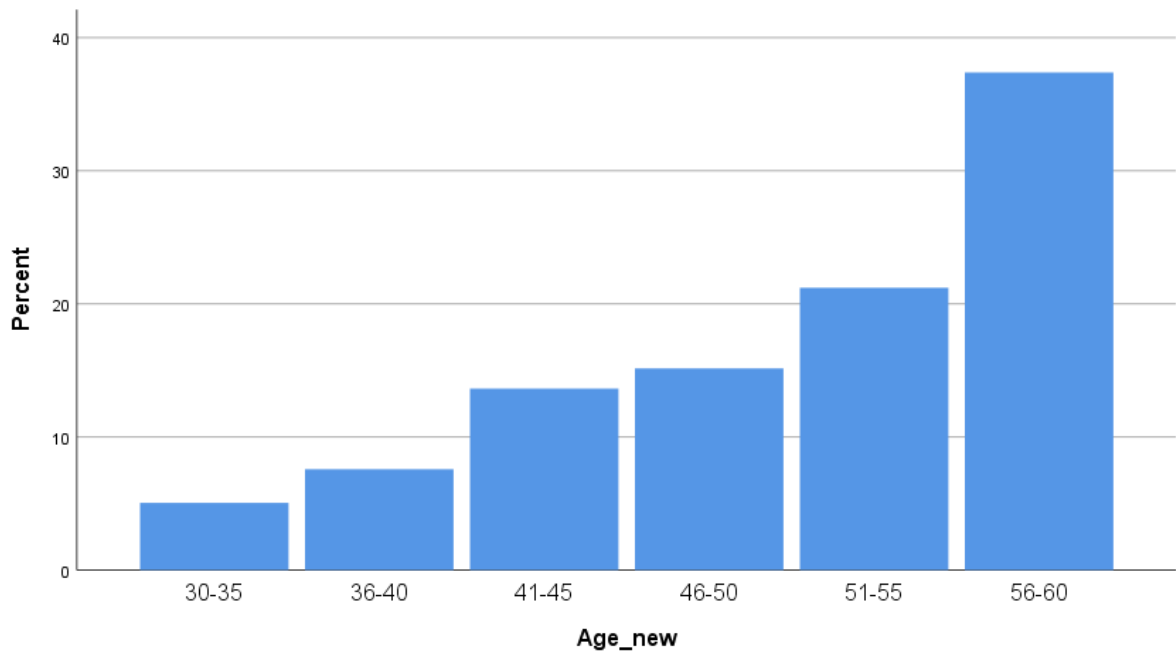
Figure 4.1.1 Distribution of participants by age group

It can be seen that the highest proportion of the selected subjects were from the age group of 56-60 years that is 37.2%, 21.1% werefrom the age group 51-55 years, 15.1% were from the age group 46-50, 13.6% were from the age group 41-45, 8% were from the age group 36-40 and the lowest was in the age group of 30-35 years that is 5%.

Older people who feel worried or anxious tend to produce larger amounts of stress hormones.Obesity can occur at any age, even in young children. But as age passes, hormonal changes and a less active lifestyle increase your risk of obesity. Kerala is well known for its better health at low cost. The state has succeeded in a great extent over infectious diseases but the prevalence of non communicable diseases is increasing (Alexander Perkelvald,2018)

4.1.2 Socio-economic Status

Table 4.1.2Distribution of participants based on income

Income	Frequency	Percentage (%)
5000-10000	13	6.5%
10000-20000	53	26.6%
20000-40000	131	65.8%
Greater than 40000	3	1.1%
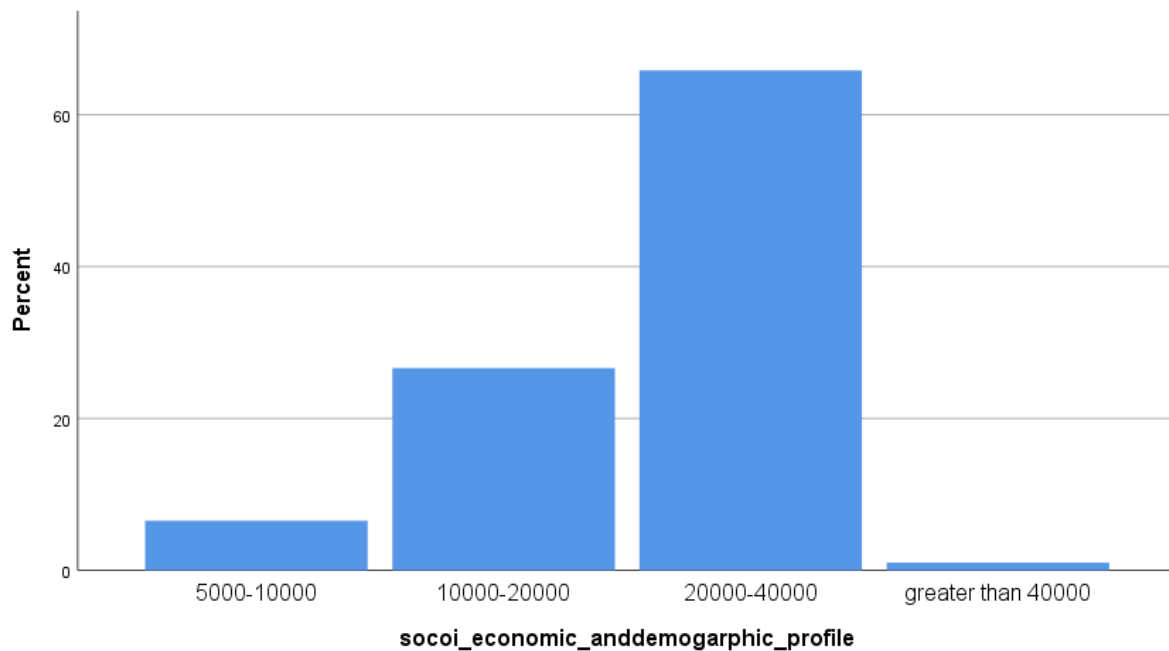
Figure 4.1.2 Distribution of participants based on monthly income

Out of 200 participants, 13 (6.5 %) have monthly income between 5000-10000 and 53 have 10000-20000. Only 3 participants have greater than 40000 monthly income. The highest numbers of participants have 20000-40000 income per month.

Higher socioeconomic status brings greater resources for health. Those with lower levels of socioeconomic status tend to have poorer health outcomes because they're less able to take were of their health and even afford health care, among other things. This contributes to greater levels of stress. (Elizabeth Scott,2020)

4.1.3 Personal habits

Table 4.1.3 Distribution of participants based on smoking and alcohol consumption

Personal habits		Frequency	Percentage (%)
Smoking	Yes	18	8.5%
	No	182	91.5%
Alcohol consumption	Yes	23	11.1%
	No	177	88.9%
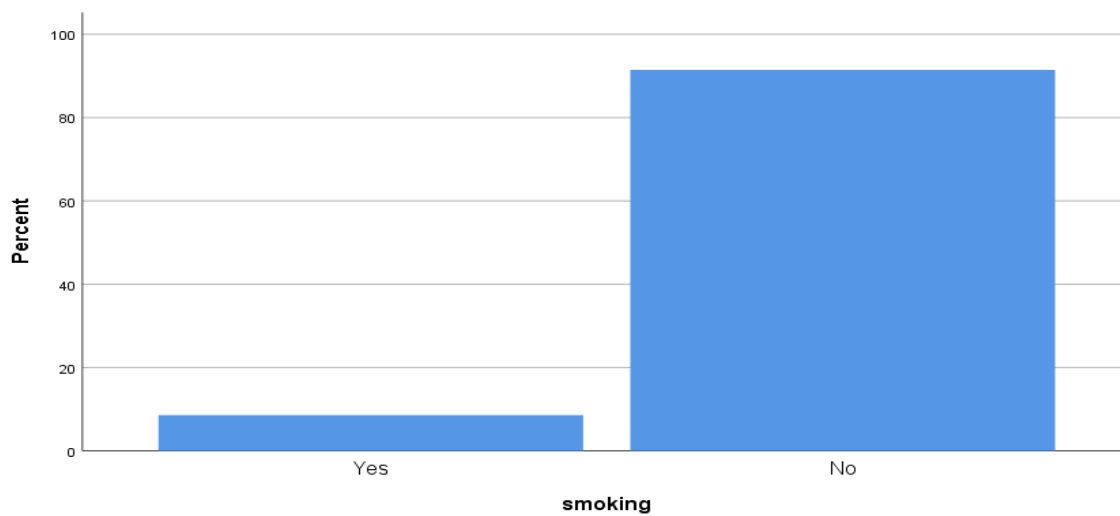
Figure 4.1.3 Percentage of participants based on smoking habits
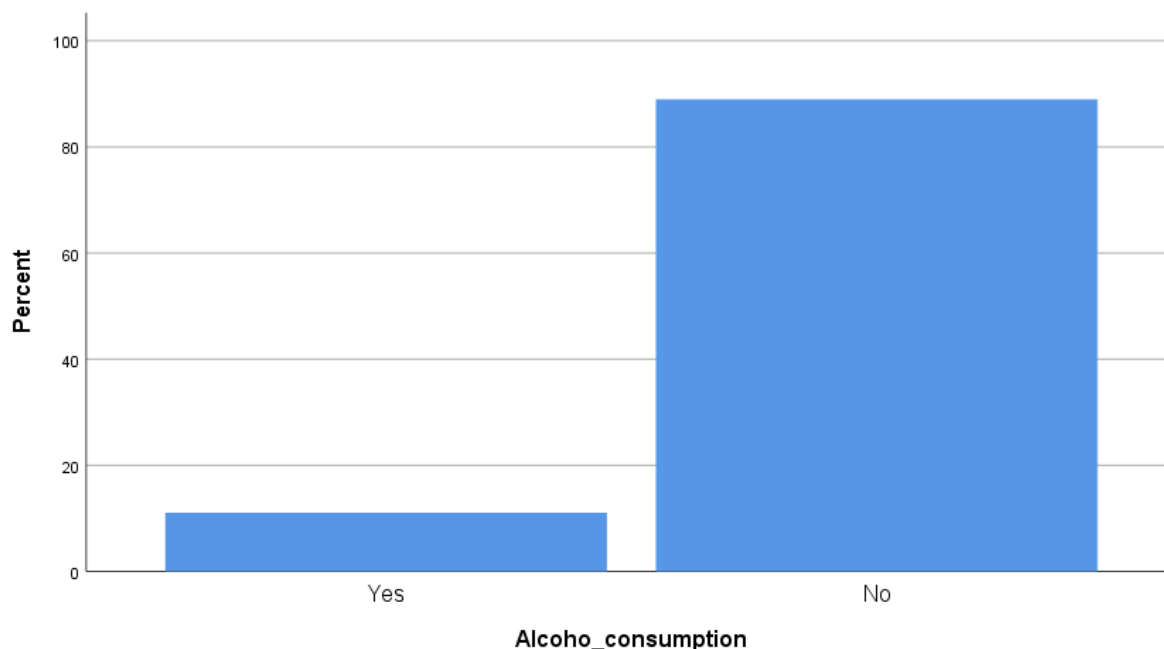
Figure 4.1.4 Percentage of participants based on alcohol consumption

Out of 200 participants, 8.5% were smokers and 91.5% were non-smokers. In the case alcohol consumption, 11.1% participants uses alcohol and 88.9% do not use alcohol.

Smoking and drinking were considered to have an indirect effect on health. Lifestyle diseases can be better managed by changing the personal habits like smoking, alcohol consumption, doing exercise and getting sufficient sleep.(Alexander Perkelvald,2018)

4.2 Assessment of Anthropometric profile of the subjects

Nutritional anthropometry is defined as the measurement of human body at various ages and levels of nutritional status. It is based on the concept that an appropriate body measurement reflects any morphological variation occurring due to a significant functional physiological change. It is an important component of any nutrition survey because it is simple and easy to measure by workers with limited educational qualifications and provides as much information on the nutritional status of individuals as biochemical parameters.(World Health Organisation,2003)

4.2.1 Weight

Table 4.2.1 Distribution of weight

Weight	Frequency	Percentage (%)
40-60	76	37.7%
Above 60	124	62.3%
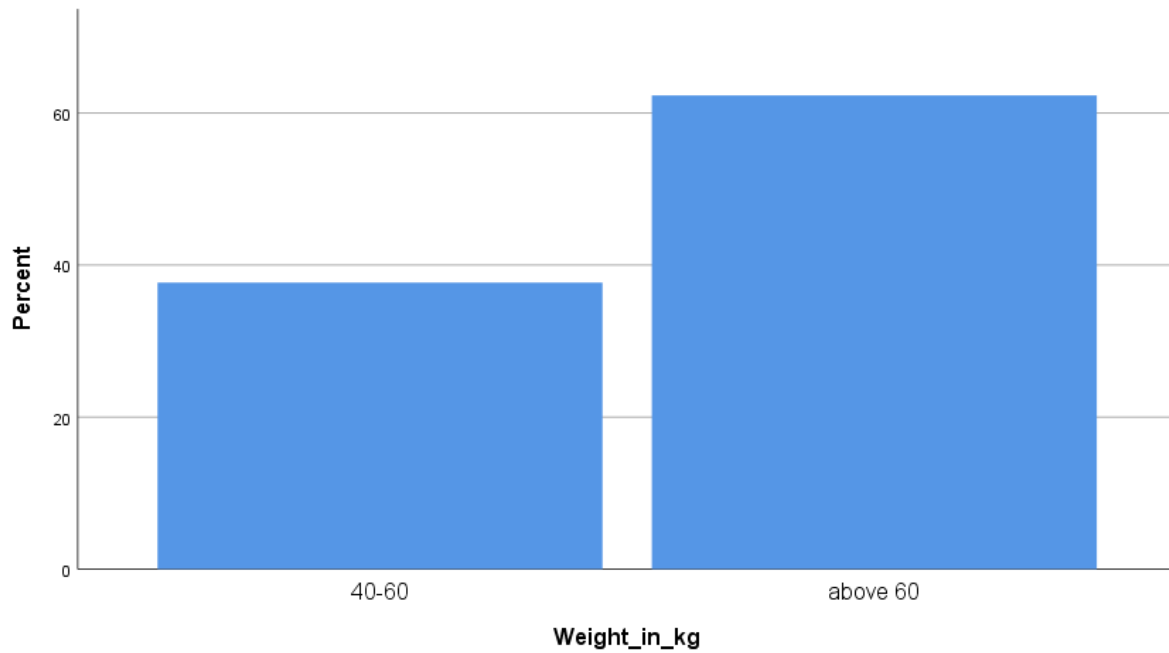
Figure 4.2.1 Percentage of participants based on weight

The weight from the selected subjects reveals that 37.7% of participants have weight between 40 -60 and 62.3% were above 60 kg.

4.2.2 Body Mass Index

Table 4.2.2 Distribution table based on BMI

BMI	Frequency			Percentage (%)
	Males	**Females**	**Total**	
Normal	45	35	80	39.7%
Over weight	22	63	85	42.7%
Obese	14	21	35	17.6%
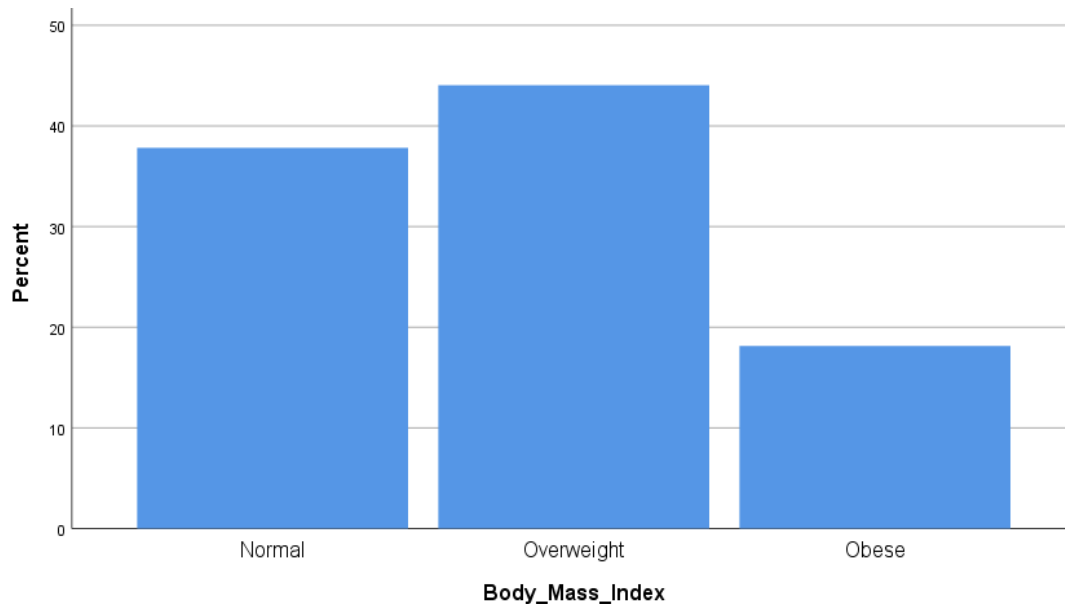
Figure 4.2.2 Percentage distribution of body mass index

According to body mass index 39.7% were normal, 42.7% were overweight and 17.6% were obese.Among normal subjects , 45 were males and 35 were females , among overweight subjects , 22 weremales and 63 were females and among obese subjects,14 were males and 21 were females.

The ratio of weight (in kg)/ Height (m) ^{2} is referred to as Body Mass Index (BMI). The BMI has a good correlation with fatness (overweight or obesity). In case of adults, the following classification suggested by World Health Organisation is extensively used at present.(D. Sarada ,2016)

4.2.3 Waist Hip Ratio

Table 4.2.32Distribution table based on WHR

WHR	Frequency			Percentage (%)
	Males	Females	Total	
0-1	16	20	36	17.6%
Above 1	65	99	164	82.4%
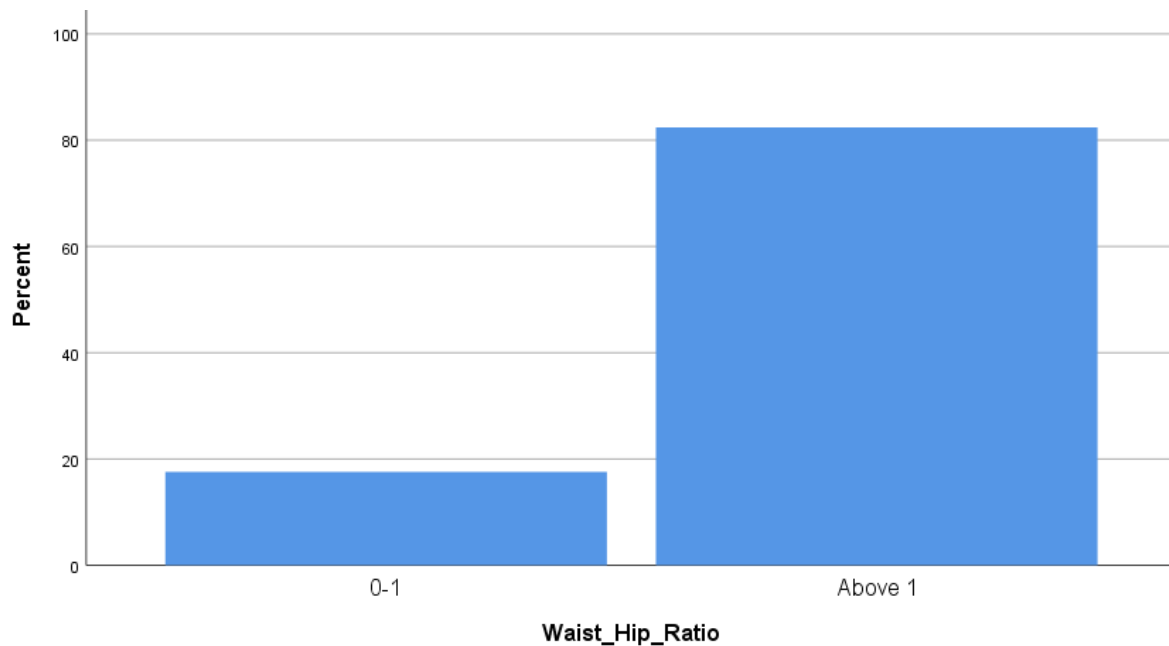
Figure 4.2.3 percentage distribution of WHR

The percentage of participants have WHR 0-1 is 17.6%. In addition, 82.4% have above 1 ratio. Among 17.6% of subjects 16 were males and 20 were females and among 82.4% , 65 were males and 99 were females.

WHO defines abdominal obesity in men as a waist-to-hip ratio of at least 0.90. For women, it's a ratio of 0.85 or more. A ratio higher than 1.0 for either sex means a much higher chance of health problems.

4.3 Assessment of Biochemical status of the subjects

4.3.1 Fasting Blood Sugar

Table 4.3.1 Percentage distribution of Fasting Blood Sugar among subjects

FBS	Frequency	Percentage(%)
Less than 100 mg/dL	64	31.7%
Greater than 100 mg/dL	136	68.3%
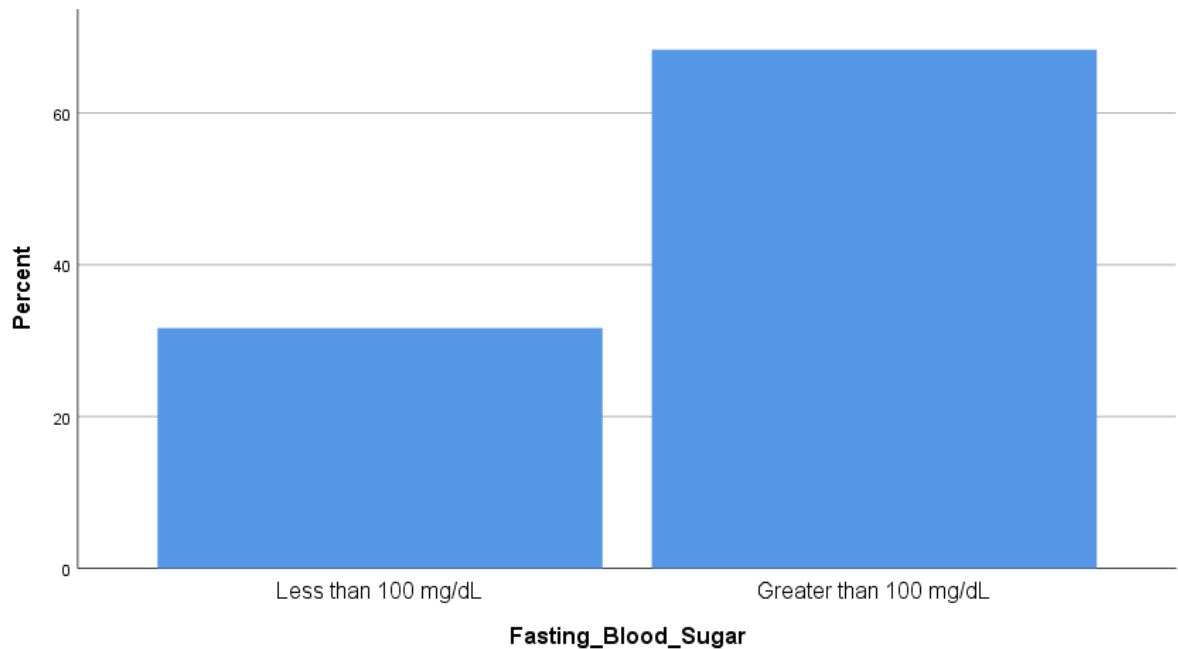
Figure 4.3.1 Percentage distribution of FBS

The percentage of participants have fasting blood sugar level less than 100mg/dL was 31.7% and greater than 100mg/dl was 68.3%.

In obese the values of FBS indicate the subjects were prone to develop cardiovascular & metabolic diseases. That has high morbidity and mortality. Therefore routine estimation of fasting blood sugar is important for prevention of complication related to obesity for leading a healthy life. (Akter R,2017)

4.3.2 Serum Triglycerides

Table 4.3.2 Percentage distribution of Serum triglycerides among subjects

Serum Triglycerides	Frequency	Percentage(%)
Less than 150 mg/Dl	163	81.9%
Greater than 150 mg/Dl	37	18.1%
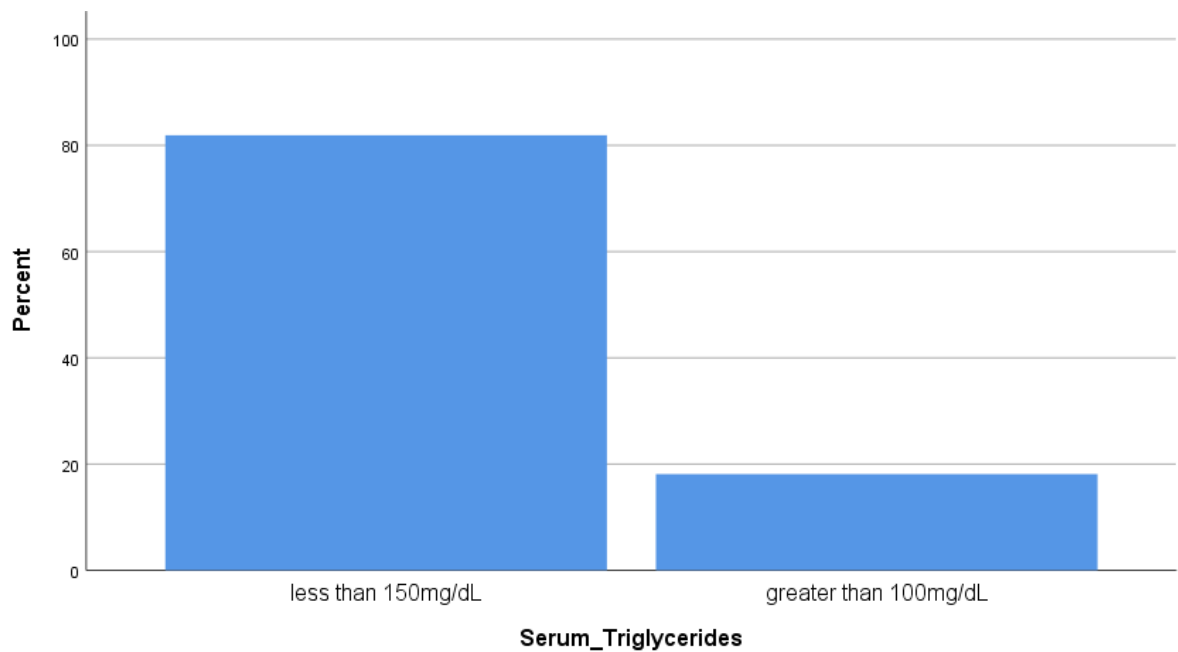
Figure 4.3.2 Percentage distribution of Serum triglycerides

The percentage of participants have serum triglycerides level less than 150mg/dl is 81.9% and greater than 150mg/dl is 18.1%.

Abnormalities in lipid metabolism were very commonly observed in patients who wereobese. Approximately 60-70% of patients with obesity were dyslipidemic. The lipid abnormalities in patients who were obese include elevated serum triglyceride, VLDL, apolipoprotein B, and non-HDL-C levels. (Kenneth R. Feingold,2020)

4.4 Assessment of dietary intake of the subjects

4.4.1 Meal pattern

Table 4.4.1 Distribution of meal pattern per day

Meal pattern	Frequency	Percentage(%)
2 meals	10	4.6%
3meals	178	89.4%
4 meals	12	6%
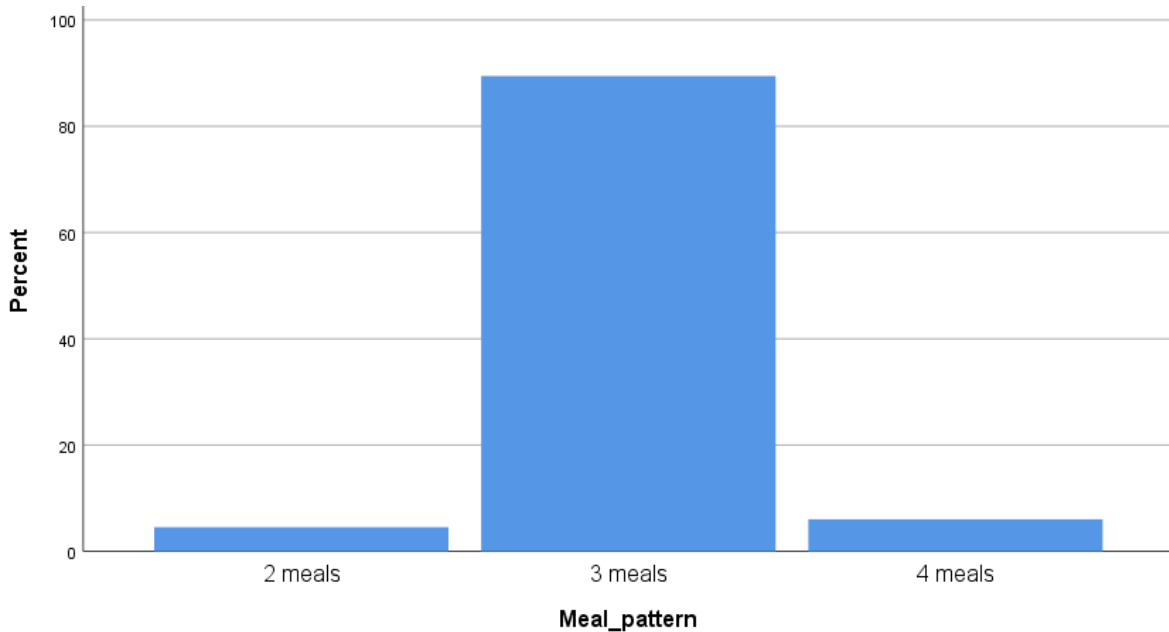
Figure 4.4.1Percentage distribution of meal pattern per day

As per the finding,89.4% of subjects took 3 meals per day and 6% of subjects had 4 meals per day. Only 4.6% of subjects were taken 2 meals per day.

Stress may promote irregular eating patterns and strengthen networks towards hedonic overeating; these effects may be exacerbated in overweight and obese individuals.(Minerva Endocrinol, 2013)

4.4.2 Food frequency record

Table 4.4.2 Distribution of Food frequency pattern among subjects

Sl No.	Food items	Daily	Weekly	Monthly	Occasionally
1	**Cereals**				
	Rice	98.5%	1.5%	0	0
	Wheat	35.2%	64.3%	0.5%	0
	Ragi	1.0%	37.7%	48.7%	12.1%
	Oats	2.5%	37.2%	11.6%	48.2%
	Pulses and Legumes				
2	Red gram	52.8%	19.1%	27.1%	0.5%
	Black gram	26.6%	39.7%	32.2%	0.5%
	Green gram	17.1%	50.3%	24.6%	6.5%
	Red gram dhal	13.1%	28.6%	33.2%	24.1%
	Black gram dhal	13.1%	29.1%	49.7%	7.0%
	Green gram dhal	12.6%	68.8%	14.6%	4.0%
	Horse gram	21.6%	29.1%	39.2%	10.1%
	Chick pea channa	18.6%	52.8%	22.6%	6.0%
	Rajmah	17.1%	36.7%	31.7%	14.6%
	Milk and Meat products				
	Milk	96.5%	2.0%	1.0%	0
	Curds	34.7%	60.8%	4.0%	0
	Butter milk	18.6%	32.7%	46.7%	1.5%
	Milk powder	5.0%	10.1%	17.6%	66.8%

	Cheese	3.0%	7.5%	21.1%	66.8%
	Chicken	10.6%	57.8%	18.1%	13.1%
	Beef	9.0%	45.2%	21.1%	23.1%
3	Pork	2.0%	31.7%	18.1%	47.7%
	Mutton	2.5%	36.2%	24.6%	35.7%
	Egg	13.6%	57.3%	14.1%	14.6%
	Fish	23.6%	47.7%	17.1%	10.6%
Vegetables and Fruits					
	Amaranth Redcheera	46.7%	21.6%	29.6%	1.0%
	Spinach Green cheera	14.6%	53.3%	31.7%	0.5%
	Chekkurmanis	11.6%	31.2%	49.2%	7.5%
	Drum stick leaves	7.5%	32.2%	31.2%	28.6%
	Cabbage	12.6%	40.7%	41.2%	5.0%
	Lettuce	6.0%	55.8%	20.1%	17.6%
	Ash gourd	23.6%	44.2%	29.1%	3.0%
	Beans	11.1%	58.8%	25.1%	4.0%
	Bitter gourd	11.1%	57.8%	29.6%	1.0%
	Brinjal	7.5%	48.2%	29.1%	14.1%
	Cauliflower	8.5%	48.2%	39.2%	4.0%
	Cucumber	9.0%	65.8%	22.1%	3.0%
	Ivy gourd kovai	21.1%	48.2%	27.1%	3.0%
	Ladies finger	11.1%	61.3%	25.1%	2.5%
4	Papaya	10.1%	50.8%	36.7%	2.5%
	Plantain	9.5%	50.8%	26.1%	13.1%
	Pumkin	10.1%	46.7%	37.7%	5.5%
	Bottle gourd	6.5%	62.3%	28.6%	2.5%
	Snake gourd	20.1%	49.7%	27.6%	2.5%
	Tomato green	12.6%	57.8%	27.6%	2.0%
	Jack fruit raw	8.5%	45.2%	25.6%	18.6%
	Bread fruit kadachakka	8.0%	43.7%	27.6%	20.6%
	Beetroot	10.6%	53.3%	30.7%	5%
	Carrot	12.1%	56.8%	27.1%	3.5%
	Onion	23.6%	48.7%	23.1%	3.5%
	Potato	20.6%	52.8%	23.1%	2.0%
	Tapioca	10.6%	53.3%	30.7%	5.5%
	Yam	9.0%	47.2%	34.2%	9.0%
	Colocassia	9.0%	44.7%	29.6%	16.1%
	Apple	14.1%	50.8%	29.1%	5.5%
	Amala	15.6%	50.8%	27.6%	6.0%

	Banana	15.6%	52.3%	28.1%	3.5%
	Dates	11.1%	43.7%	31.2%	14.1%
	Guava	12.1%	50.3%	26.1%	11.6%
	Jackfruit	8.0%	42.2%	29.6%	20.1%
	Litchi	12.1%	42.2%	25.6%	20.1%
	Musambi	9.5%	43.2%	31.7%	15.6%
	Watermelon	10.1%	45.7%	30.7%	13.6%
	Orange	7.5%	54.8%	28.1%	9.5%
	Papaya	9.0%	43.2%	38.7%	9.0%
	Passion fruit	9.5%	42.2%	31.2%	16.1%
	Pears	9.0%	46.2%	31.7%	13.1%
	Pineapple	7.5%	50.8%	30.2%	11.6%
	Pomgranate	10.1%	46.7%	30.7%	12.1%
	Sapota	6.5%	45.7%	32.7%	15.1%
	Tomato ripe	14.1%	41.2%	34.2%	10.1%
Oils and Sugars					
5	Butter	34.2%	15.1%	27.1%	23.6%
	Vanaspathi	8.5%	26.6%	31.2%	33.2%
	Ghee	20.6%	35.7%	21.6%	22.1%
	Cooking oil	87.4%	7%	3%	2%
	Sugar	77.4%	16.1%	4.5%	1%
	Honey	15.6%	55.3%	18.1%	10.6%
	Jaggary	14.6%	46.2%	27.1%	12.1%

Food Frequency Questionnaire was used to assess the dietary assessment of the subjects. The food groups were grouped into five food groups with processed and unprocessed food.

The consumption rate of cereals like rice nd wheat were high among the subjects .the consumption rate of Pulses and Legumes like red gram amnd black gram were high among the subjects .Milk , chicken and egg were taken daily by majority of the subjects.Leafy vegetables were taken by majority of the subjects on a daily basis well as cooking oil and sugar were consumed daily

4.5Assessment of Stress among the subjects according to DASS-21

4.5.1 Depression

Table 4.5.1 Distribution of Depression among the subjects

Depression	Frequency			Percentage(%)
	Males	Females	Total	
Normal	58	36	94	47.2%
Mild	30	32	62	31.2%
Moderate	19	21	40	20.1%
Severe	1	3	4	1.5%
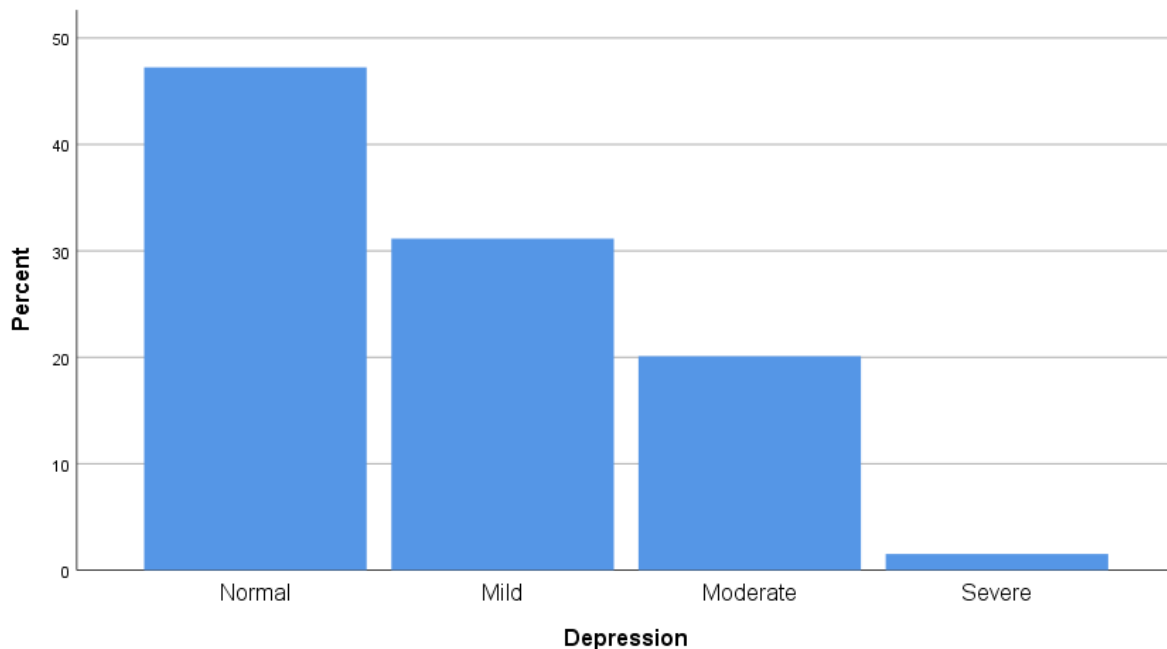
Figure 4.5.1Percentage distribution of Depression among the subjects

Out of 200 subjects 47.2% were normal, 31.2% were mild, 20.1% were moderate and 1.5% had severe depression.Among the level of depression, 58 males and 36 females were having normal level of depression, 30 males and 32 males were having mild level of depression, 19 males and 21 females were having moderate level of depression and 1 male and 3 females were having severe level of depression.

Depression is a common mental disorder. Globally, it is estimated that 5.0% of adults suffer from depression.Depression is a leading cause of disability worldwide and is a major contributor to the overall global burden of disease.There is effective treatment for mild, moderate, and severe depression.(World Health Organization , 2021)

4.5.2 Anxiety

Table 4.5.2 Distribution of anxiety among subjects

Anxiety	Frequency			Percentage(%)
	Males	**Females**	**Total**	
Normal	20	32	52	26.1%
Mild	13	7	20	10.1%
Moderate	25	74	99	49.7%
Severe	15	11	26	13.1%
Extremely severe	2	1	3	1%
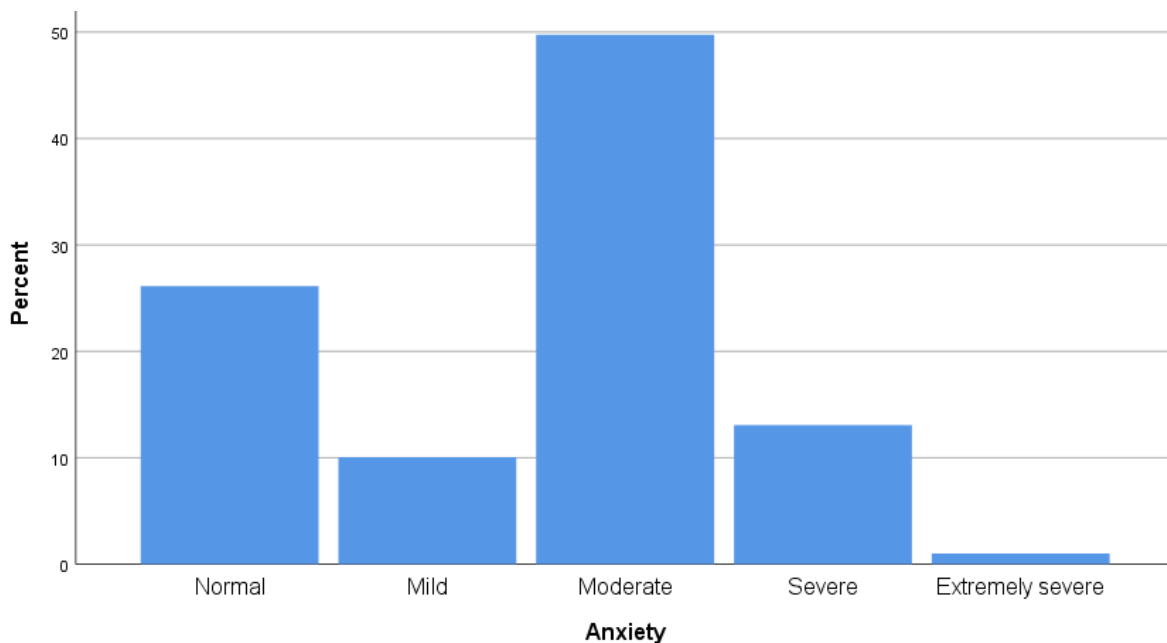
Figure 4.5.2 Percentage distribution of anxiety among subjects

Based on anxiety among subjects 26.1% were normal, 10.1% were mild, 49.7% were moderate, 13.1% were severe, and 1% is extremely severe.Among the level of anxiety, 20

males and 32 females were having normal level of anxiety, 13 males and 7 males werehaving mild level of anxiety, 25 males and 74 females were having moderate level of anxiety , 15 males and 11 females were having severe level of anxiety and 2 males and 1 female were having extremely severe level of anxiety.

Anxiety may be caused by a mental condition, a physical condition, the effects of drugs, stressful life events, or a combination of these.They were the most common form of mental illness in the United States, affecting nearly 1 in 5 adults.(Dan Brennan,2022)

4.5.3 Stress

Table 4.5.3Distribution of stress among subjects

Stress	Frequency			Percentage (%)
	Males	**Females**	**Total**	
Normal	63	88	181	91%
Mild	8	5	13	6%
Moderate	5	1	6	3%
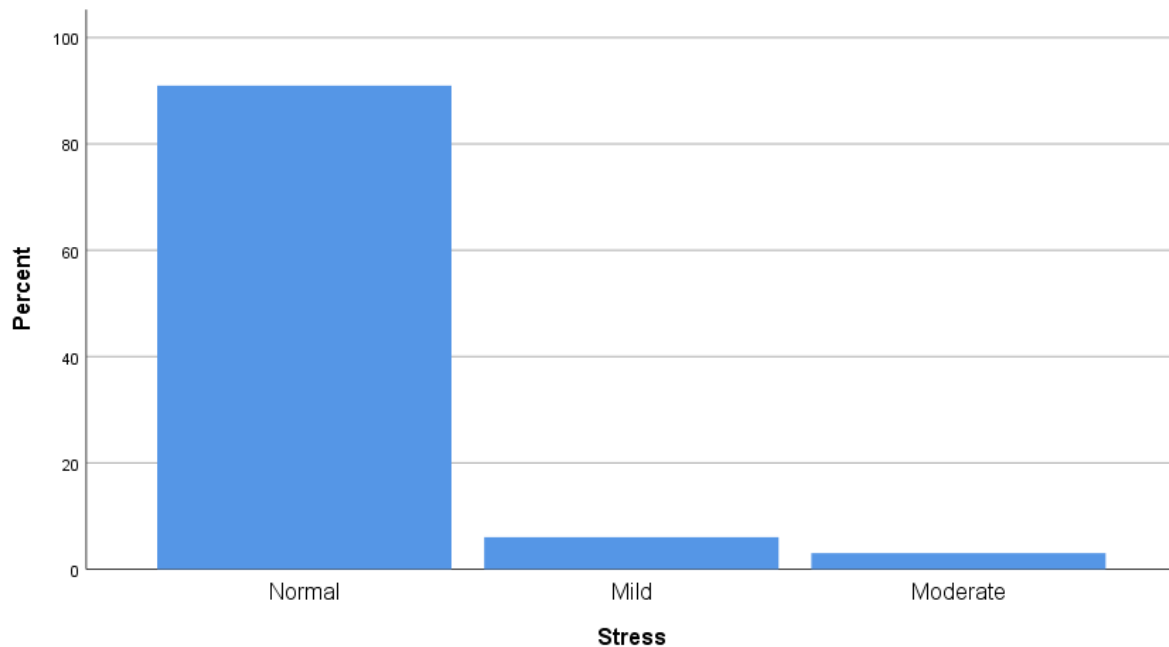
Figure 4.5.3 Percentage distribution of stress among subjects

Based on stress among subjects 91% of the subjects were normal, 6% were mild and 3% were moderate. Among the levels of stress, 63 males and 88 females were having normal level of stress, 8 males and 5 males were having mild level of stress, 5 males and 1 female were having moderate level of stress.

Stress is that the body's response to anything that needs attention or action. Stress were often short-term or long-term. Both can cause a spread of symptoms, but chronic stress can take a significant toll on the body over time and have long-lasting health effects.

(Mesut Savas,2018)

4.6 Correlation between Obesity and Stress among the subjects .

Table 4.6.1 Correlation of subjects with different level of depression and subjects with obesity

Correlations		BMI	Depression
BMI	Pearson Correlation	1	-.035
	Sig. (2-tailed)		.622
	N	200	200
Depression	Pearson Correlation	-.035	1
	Sig. (2-tailed)	.622	
	N	200	200
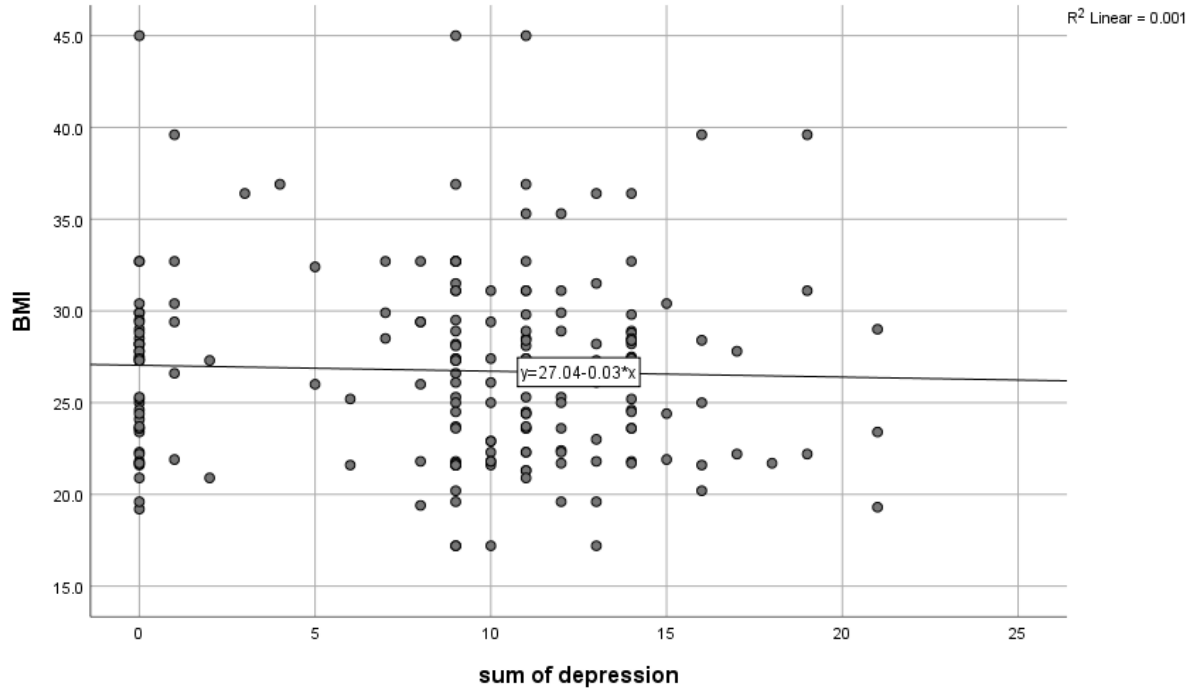
Figure 4.6.1 Scatter plot for relationship between BMI and depression

In the present study there is no significant relationship between obesity and depression. Here p value is 0.622, which is greater than critical p value.(ie., 0.622>0.01). The direction of the relationship is negative(r=-0.035) i.e., obesity and depression were negatively correlated. So one variable increases while the other decreases, and vice-versa.

Depression and obesity were two conditions with great impact over global health. This is mainly due to their high prevalence and the morbidity and mortality associated to both.Depression is a risk factor for obesity, especially atypical depression. Obesity is a risk factor for depression, especially in women and for recurrent depressive disorder. The comorbidity between obesity and depression is a risk factor for a bad prognosis illness. (Beatriz Villagrasa Blasco, 2020)

Table 4.6.2 Correlation of subjects with different level of anxiety and subjects with obesity

Correlations		BMI	Anxiety
BMI	Pearson Correlation	1	-.026
	Sig. (2-tailed)		.720
	N	200	200
Anxiety	Pearson Correlation	-.026	1
	Sig. (2-tailed)	.720	
	N	200	200
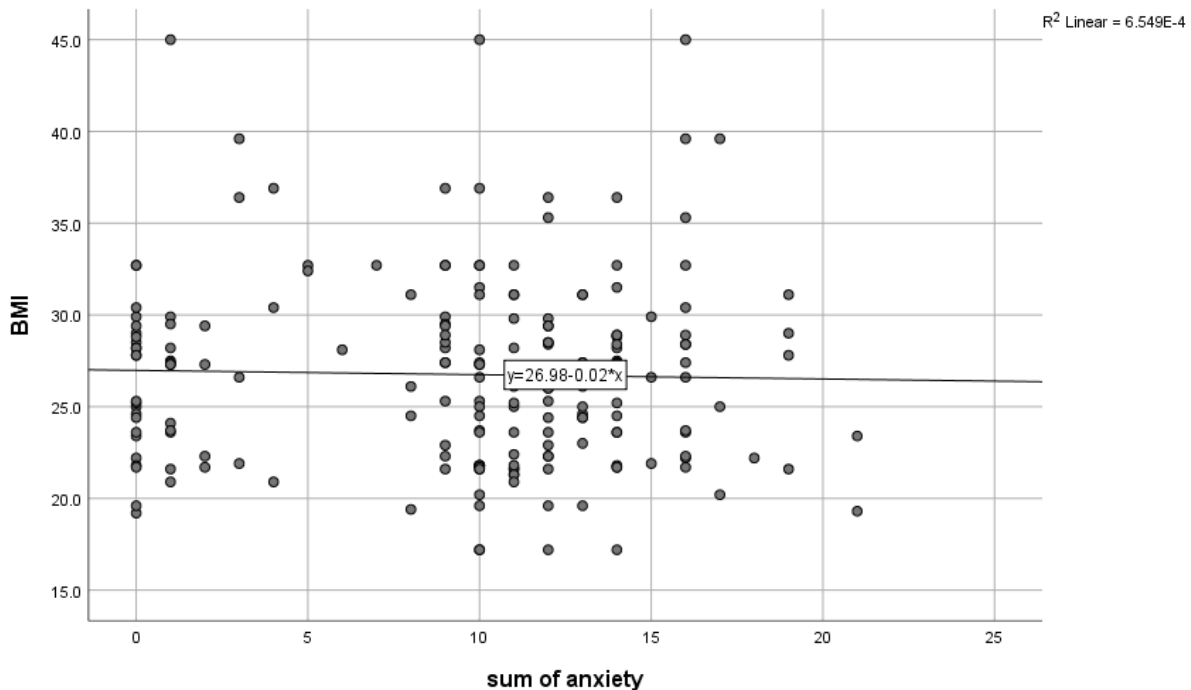
Figure 4.6.2 Scatter plot for relationship between BMI and anxiety.

There is no significant relationship between obesity and anxiety. Here p value is 0.720, which is greater than critical p value.(ie., 0.720>0.01). The direction of the relationship is negative(r=-0.026) i.e., obesity and anxiety were negatively correlated. So one variable increases while the other decreases, and vice-versa.

Obesity/overweight associated with the development of anxiety and depressive symptoms irrespective of sleep behavior. On the other hand, depression and anxiety were found to be the potential risk factors for developing obesity.(Sayedeh ElhamSharafi,2019)

Table 4.6.3 Correlation of subjects with different level of stress and subjects with obesity

Correlations		BMI	stress
BMI	Pearson Correlation	1	-.025
	Sig. (2-tailed)		.726
	N	200	200
Stress	Pearson Correlation	-.025	1
	Sig. (2-tailed)	.726	
	N	200	200
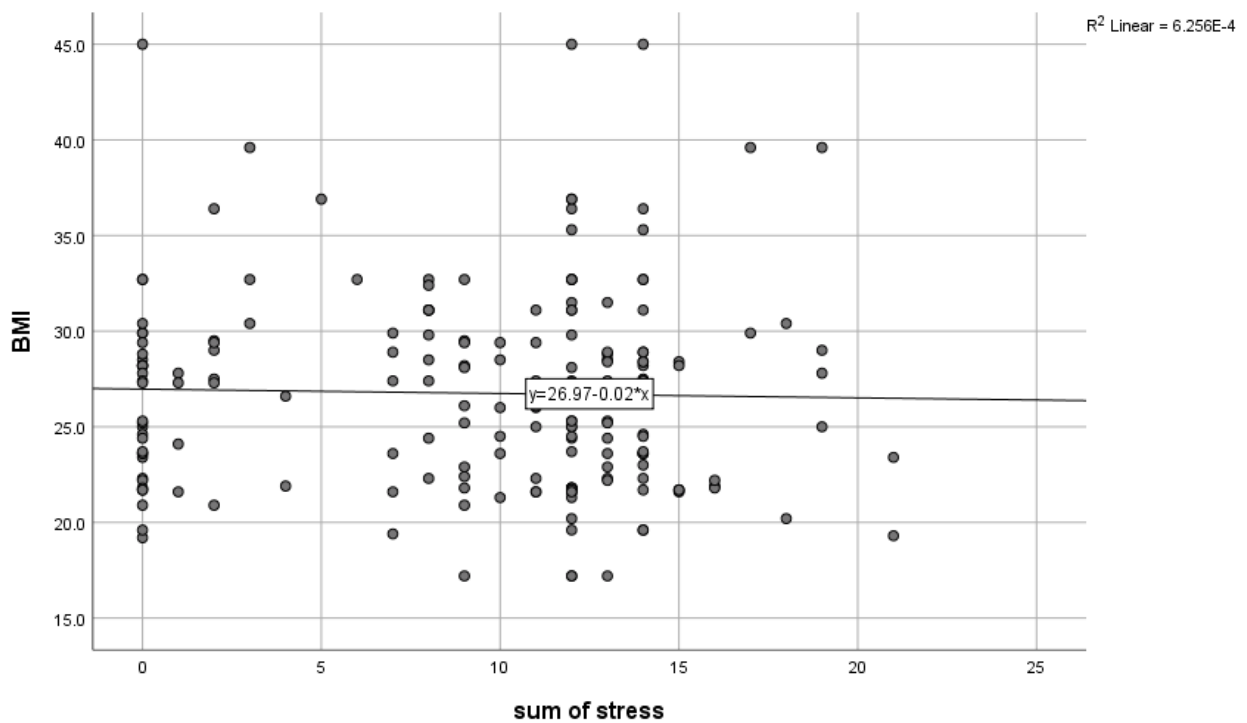
Figure 4.6.3 Scatter plot for relationship between BMI and stress

There is no significant relationship between obesity and stress. Here p value is 0.726, which is greater than critical p value.(ie., 0.726>0.01). The direction of the relationship is negative(r=-0.025) i.e., obesity and stress were negatively correlated. So one variable increases while the other decreases, and vice-versa.

Stress interferes with cognitive processes like executive function and self-regulation. Second, stress can affect behavior by inducing overeating and consumption of foods that were high in calories, fat, or sugar; by decreasing physical activity; and by shortening sleep. Third, stress triggers physiological changes within the hypothalamic-pituitary-adrenal axis, reward processing within the brain, and possibly the gut microbiome. Finally, stress can stimulate production of biochemical hormones and peptides like leptin, ghrelin, and neuropeptide Y. Obesity itself were often a stressful state thanks to the high prevalence of weight stigma.

(Janet Tomiyama ,2018)

3.7 Development of Intervention Tool and Conduct Awareness Program.

An intervention tool was made inorder to spread awareness about stress, obesity and how stress leads to obesity. It also included the measure to lower stress and the complications associated with it. It was being shared with the subjects collected as well as shared in the social media handles to make understand people about the severity of the problem.
The platform used for sharing was You Tube .

Link : **https://youtu.be/9to-L-Qrdu0**

SUMMARY AND CONCLUSION

4. SUMMARY AND CONCLUSION

The study entitled "Interrelationship between stress and obesity among adults" was carried out among 200 subjects aged between 30-59 years in a government hospital as well as in a private hospital , Ernakulam. The results of the current study summarises as follows:

- In the current study highest proportion of the selected subjects were from the age group of 56-60 years that is 37.2% . 74 subjects belong to the highest proportion of the age group.

- Socio-economic and demographic profile reveals thatout of 200 participants The highest numbers of participants have 20000-40000 income per month which comprises of 65.8% and 53 participants have 10000-20000 income per month. Only 3 participants have greater than 40000 monthly income.

- In the present study conducted shows that out of 200 participants, 8.5% were smokers and 91.5% were non-smokers. In the case alcohol consumption, 11.1% participants uses alcohol and 88.9% do not use alcohol.

- Anthropometric profile studied in the presentstudy reveals that   37.7% of participants have weight between 40 -60 and 62.3% were above 60 kg.

- According to body mass index studied under the present study shows that 39.7% were normal, 42.7% were overweight and 17.6% were obese. Among normal subjects , 45 were males and 35 were females , among overweight subjects , 22 were males and 63 were females and among obese subjects,14 were males and 21 were females.

62

- The percentage of participants have Waist Hip Ration (WHR) 0-1 is 17.6%. In addition, 82.4% have above 1 ratio. Among 17.6% of subjects 16 were males and 20 were females and among 82.4% , 65 were males and 99 were females.

- Fasting Blood Sugar studied reveals that out of 200 participants ,the percentage of participants have fasting blood sugar level less than 100mg/dL is 31.7% and greater than 100mg/dL is 68.3%.

- Serum Triglycerides in the present study shows that the percentage of participants have serum triglycerides level less than 150mg/dL is 81.9% and greater than 150mg/dL is 18.1%.

- As per the findingof dietary intake of the subjects ,89.4% of subjects take 3 meals per day and 6% of subjects take 4 meals per day. Only 4.6% of subjects take 2 meals per day.

- Food Frequency Questionnaire was used to assess the dietary assessment of the subjects. The food groups were grouped into five food groups with processed and unprocessed food. The consumption rate of cereals like rice and wheat were high among the subjects .the consumption rate of Pulses and Legumes like red gram amnd black gram were high among the subjects .Milk, chicken and egg were taken daily by majority of the subjects.Leafy vegetables were taken by majority of the subjects on a daily basis well as cooking oil and sugar were consumed daily.

- Based on assessment of depression to study ,out of 200 subjects 47.2% were normal and 52.8 % were having depression out of which 31.2% were mild, 20.1% were moderate and 1.5% were severe. Among the level of depression , 58 males and 36 females were having normal level of depression, 30 males and 32 males were having mild level of depression, 19 males and 21 females were having moderate level of depression and 1 male and 3 females were having severe level of depression.

- Based on anxiety studied among subjects 26.1% were normal and 73.9 % were having anxiety out of which 10.1% were mild, 49.7% were moderate,

13.1% were severe, and 1% is extremely severe.Among the level of anxiety, 20 males and 32 females were having normal level of anxiety, 13 males and 7 males were having mild level of anxiety, 25 males and 74 females were having moderate level of anxiety , 15 males and 11 females were having severe level of anxiety and 2 males and 1 female were having extremely severe level of anxiety.

- Based on stress studied among subjects 91% of the subjects were normal,and 9% were having stress out of which 6% were mild and 3% were moderate. Among the levels of stress, 63 males and 88 females were having normal level of stress, 8 males and 5 males were having mild level of stress, 5 males and 1 female were having moderate level of stress.

- In the present study, even 52.8 % of the selected subjects had different degrees of depression,there is no significant relationship between obesity and depression. Here p value is 0.622, which is greater than critical p value.(ie., 0.622>0.01). The direction of the relationship is negative(r=-0.035) i.e., obesity and depression were negatively correlated. So one variable increases while the other decreases, and vice-versa.

- Although, 73.9 % of the selected subjects had different degrees of anxiety,there is no significant relationship between obesity and anxietyin the current study. Here p value is 0.720, which is greater than critical p value.(ie., 0.720>0.01). The direction of the relationship is negative(r=-0.026) i.e., obesity and anxiety were negatively correlated. So one variable increases while the other decreases, and vice-versa.

- In the present study,there is no significant relationship between obesity and stress. Here p value is 0.726, which is greater than critical p value.(ie., 0.726>0.01). The direction of the relationship is negative(r=-0.025) i.e., obesity and stress were negatively correlated. So one variable increases while the other decreases, and vice-versa.

- An intervention tool was made inorder to spread awareness about stress, obesity and how stress leads to obesity. It also included the measure to lower stress and the complications associated with it. It was being shared with the

subjects collected as well as shared in the social media handles to make understand people about the severity of the problem.The platform used for sharing was You Tube .

CONCLUSION

There had been a great impact of stress over health. It was widely seen that because of the stress in life, there had been very less care towards the health and which became a leading cause to obesity and various other lifestyle diseases.

In the present study, 200 samples were selected and the data was collected using questionnaire and their stress was analysed using DASS 21. According to DASS 21 criteria was used to find out different types and levels of stress among the subjects. Their weight status was analysed using Body Mass Index (BMI). Almost 50 % of the samples were not having any levels of stress and reamining 50 % were having mild , moderate , severe and extremely severe levels of stress. The present study revealed that 42.7% were overweight and 17.6% were obese but that there is no significant relationship between stress and obesity and the relationship shows negative correlation. An intervention tool was made inorder to spread awareness about stress, obesity and how stress leads to obesity.

LIMITATIONS OF THE STUDY

- The sample size of the study was small.

- The result of the study did not come according to the hypothesis generated because of less sample size.

- Approaching the subjects were not easy because of the global pandemic COVID-19.

- Long term study is needed to identify and rectify their concerns.
- Case study will be beneficial.

RECOMMENDATIONS

- Further study on physical activity and obesity can be conducted.
- Select some more subjects for the study .
- Deep study about the problem may be done.
- A study on intake of calories and fat consumption can be carried out in the future.
- Suggestions on physical activity convenient with time and type of exercise should be given.
- Nutritional management for obesity should be suggested to the participants.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Alcock J, Maley CC, Aktipis CA. 2014. Is eating behavior manipulated by the gastrointestinal microbiota? Evolutionary pressures and potential mechanisms. BioEssays 36:940–49

2. Annual Review of Psychology Stress and Obesity A. Janet Tomiyama, 12 June 2018

3. Aschbacher K, Kornfeld S, Picard M, Puterman E, Havel PJ, et al. 2014. Chronic stress increases vulnerability to diet-related abdominal fat, oxidative stress, and metabolic risk. Psychoneuroendocrinology 46:14–22

4. Fardet L, Feve B. Systemic glucocorticoid therapy: a review of its metabolic and cardiovascular adverse events. *Drugs.* 2014;74(15):1731–1745

5. Harvard Medical School: "Exercising To Relax," Sleep and Mood," "Adopt Good Sleep Habits." Rakel, D. *Integrative Medicine,* 3rd edition, Elsevier, 2012. https://www.webmd.com/balance/stress-management/what-is-stress

6. KatsuyukiAndoToshiroFujita ,Metabolic syndrome and oxidative stress,Free Radical Biology and Medicine,Volume 47, Issue 3, 1 August 2009, Pages 213-218

7. Van der Valk, E. S., Savas, M., & van Rossum, E. (2018). Stress and Obesity: Are There More Susceptible Individuals? *Current obesity reports*, *7*(2), 193–203. https://doi.org/10.1007/s13679-018-0306-y

8. Koski M, Naukkarinen H: The Relationship between Stress and Severe Obesity: A Case-Control Study. Biomed Hub 2017;2:1-13. DOI: 10.1159/000458771

9.   Nathalie Michels *et al* ,Stress, emotional eating behaviour and dietary patterns in children,Appetite,Volume59,2012,Pages762-769,https://doi.org/10.1016/j.appet.2012.08.010.

10.   Abizaid,   A. Stress   and   obesity: The   ghrelin   connection. *J Neuroendocrinol*. 2019; 31:e12693. https://doi.org/10.1111/jne.12693

11.   Salari, N., Hosseinian-Far, A., Jalali, R. *et al.* Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic   review   and   meta-analysis. *Global   Health* 16, 57   (2020). https://doi.org/10.1186/s12992-020-00589-w

12.   A. Janet Tomiyama, Stress and Obesity, Annu. Rev. Psychol. 2019. 70:5.1–5.16

13.   Yue Chen, Lingjia Qian,Association between lifetime stress and obesity in Canadians,Preventive Medicine, Volume 55, Issue 5,2012,Pages 464-467

14.   Shuyi Wan *et al* ,Obesity Paradox in Aging: From Prevalence to Pathophysiology,Progress in Cardiovascular Diseases,Volume 61, Issue 2,2018

15. Overweight   and   obesity.   National   Heart,   Lung,   and   Blood   Institute. https://www.nhlbi.nih.gov/health-topics/overweight-and-obesity.   Accessed   May   3, 2021.

16. Goldman L, et al., eds. Obesity. In: Goldman-Cecil Medicine. 26th ed. Elsevier; 2020. https://www.clinicalkey.com. Accessed May 3, 2021.

17. Kellerman RD, et al. Obesity in adults. In: Conn's Current Therapy 2021. Elsevier; 2021. https://www.clinicalkey.com. Accessed May 3, 2021.

18. Feldman M, et al., eds. Sleisenger and Fordtran's Gastrointestinal and Liver Disease: Pathophysiology, Diagnosis, Management. 11th ed. Elsevier; 2021. https://www.clinicalkey.com. Accessed May 3, 2021.

19. Perrault L. Obesity in adults: Prevalence, screening and evaluation. https://www.uptodate.com/contents/search. Accessed May 3, 2021.

20. Melmed S, et al. Obesity. In: Williams Textbook of Endocrinology. 14th ed. Elsevier; 2020. https://www.clinicalkey.com. Accessed May 17, 2021.

21. Perrault L. Obesity in adults: Overview of management. https://www.uptodate.com/contents/search. Accessed May 3, 2021.

22. Healthy weight, nutrition and physical activity. Centers for Disease Control and Prevention. https://www.cdc.gov/healthyweight/index.html. Accessed May 3, 2021.

23. Carol A. Shively, Social stress, visceral obesity, and coronary artery atherosclerosis: product of a primate adaptation, 18 May 2009

24. Hewagalamulage, S. D., Lee, T. K., Clarke, I. J., & Henry, B. A. (2016). Stress, cortisol, and obesity: a role for cortisol responsiveness in identifying individuals prone to obesity. *Domestic animal endocrinology*, *56 Suppl*, S112–S120.

25. Venkatrao, M., Nagarathna, R., Majumdar, V., Patil, S. S., Rathi, S., & Nagendra, H. (2020). Prevalence of Obesity in India and Its Neurological Implications: A Multifactor Analysis of a Nationwide Cross-Sectional Study. *Annals of Neurosciences*, *27*(3–4), 153–161.

26. Organization., World Health WHO factsheet on obesity and overweight: World Health Organization fact sheet, 2020.

27. Bentham, J, Di Cesare, M, Bilano, V Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: A pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. *Lancet* December 16, 2017; 390(10113): 2627–2642.

28. Dan Brennan, Anxiety Causes and Prevention, April 24, 2022

29. Sayedeh Elham Sharafi, Gholamreza Garmaroudi, Prevalence of anxiety and depression in patients with overweight and obesity,Obesity Medicine,Volume 17,2020.

30. Ranabir, S., & Reetu, K. (2011). Stress and hormones. *Indian journal of endocrinology and metabolism*, *15*(1), 18–22. https://doi.org/10.4103/2230-8210.77573

31. Akter, R., Nessa, A., Husain, M. F., Wahed, F., Khatun, N., Yesmin, M., Nasreen, S., & Tajkia, T. (2017). Effect of Obesity on Fasting Blood Sugar. *Mymensingh medical journal : MMJ*, *26*(1), 7–11.

32. Yau, Y. H., & Potenza, M. N. (2013). Stress and eating behaviors. *Minerva endocrinologica*, *38*(3), 255–267.

33. Ogden CL, Carroll MD, Kit BK, Flegal KM. *Prevalence of Obesity in the United States.* National Center for Health Statistics, U.S. Department of Health and Human Services; 2012.

34. Volkow ND, Wang GJ, Fowler JS, Tomasi D, Baler R. Food and Drug Reward: Overlapping Circuits in Human Obesity and Addiction. In: Carter CS, Dalley JW, editors. *Brain Imaging in Behavioral Neuroscience.* Springer; Berlin Heidelberg: 2012. pp. 1–24.

35. "Mental Stress ." World of Sports Science. . Retrieved April 25, 2022 from Encyclopedia.com

APPENDIX

Metabolic Syndrome Questionnaire

Please fill the details for a research purpose.

* Required

1. Name *

    _____

2. Name of the student *

    Mark only one oval.

    ( ) Shanthi Krishna J

    ( ) Elizabeth Rani Philip

3. Whatsapp number *

    _____

4. 1. Age *

    _____

5. 2. Sex *

    Check all that apply.

    [ ] Male

    [ ] Female

6.   3. Marital status *

Check all that apply.

☐ Married
☐ Single
☐ Divorced/Separated
☐ Widow/Widower

7.   4. Religion *

Check all that apply.

☐ Christian
☐ Hindu
☐ Muslim
☐ Others

8.   5. Employment nature of the respondent *

Check all that apply.

☐ Full time
☐ Part time
☐ Retired
☐ Home maker
☐ Unemployed

9.   7. Education Qualifications of the Head of the family *

Check all that apply.

☐ Professional Degree
☐ Graduate or post graduate
☐ High school certificate
☐ Pre Degree or Plus Two
☐ Middle school certificate
☐ Primary school certificate
☐ Literate
☐ Illiterate

10.   8. Occupational status of the Head of the family *

Check all that apply.

☐ Professional
☐ Semi-professional
☐ Clerical/ Shop owner
☐ Skilled worker
☐ Semiskilled worker
☐ Unskilled worker
☐ Unemployed

11.   9. Monthly Income of family (in words): Rs. *

_____

12.   10. Assessment of Genetic Risk Factors *

Check all that apply.

	Obesity	Diabetes	Hypertension	High Cholesterol	Heart Disease	No disease
Father	☐	☐	☐	☐	☐	☐
Mother	☐	☐	☐	☐	☐	☐
Brother	☐	☐	☐	☐	☐	☐
Sister	☐	☐	☐	☐	☐	☐
Paternal Grandparents	☐	☐	☐	☐	☐	☐
Maternal Grandparents	☐	☐	☐	☐	☐	☐
Son	☐	☐	☐	☐	☐	☐
Daughter	☐	☐	☐	☐	☐	☐
Yourself	☐	☐	☐	☐	☐	☐

Assessment of Environmental Risk Factors

13.   Do you currently smoke?   *

Check all that apply.

☐ Yes
☐ No

14.   i. If Yes, How often?

Check all that apply.

☐ Daily
☐ Twice a week
☐ Weekly
☐ Rarely

15.   ii. How many cigarettes do you smoke per day?

_____

16.   iii. How long have you been a regular smoker?

_____

17.   iv. How often does anyone smoke inside your home?

Mark only one oval.

◯ Daily
◯ Weekly
◯ Monthly
◯ Never

Drinking Habit

18.   Currently, Do you take alcoholic drink?   *

Check all that apply.

☐ Yes
☐ No

19.   i. How often do you have a drink containing alcohol?

Check all that apply.

☐ Daily
☐ Twice a week
☐ Weekly
☐ Monthly

20.   ii. If Yes, How many drinks do you have on a typical day when you drink (peg)?

Mark only one oval.

◯ 1 to 5
◯ 5 to 10
◯ 10 to 15
◯ >15

21.   iii. How often do you have six or more drink on one occasion?

Check all that apply.

☐ Daily
☐ Twice a week
☐ Weekly
☐ Monthly

22.   iv. How long have you been an alcoholic?

Check all that apply.

☐ < 1 year
☐ 1 to 5 year
☐ 5 to 10 year
☐ >10 years

Other Habits

23.   c) How many cups of tea/ coffee do you drink daily: *

Check all that apply.

☐ Nil
☐ 1-3 cups
☐ >3cups

24.   d) How many hours do you sleep daily? *

Check all that apply.

☐ 8 Hours
☐ More than 8 Hours
☐ less than 8 Hours

Only for Female Participants

| Only female participants need to answer thses questions |

25.   Do you have children?

Mark only one oval.

◯ Yes
◯ No

26.   How many children do you have?

Mark only one oval.

◯ One

◯ Two

◯ Three

◯ More than Three

27.   Have you breast feed your baby?

Check all that apply.

☐ Yes

☐ No

28.   How long have you breast feed over your entire lifetime?

Check all that apply.

☐ <6 months

☐ 6- 12 months

☐ 12- 24 months

☐ More than 24 months

Physical Activity

29.   Time period for exercise *

Mark only one oval.

◯ Morning

◯ Afternoon

◯ Evening

◯ Any other time

30.   Type of Activity

Check all that apply.

☐ Indoor activity
☐ Walking
☐ Outdoor activity

31.   a) Do you exercise regularly?

Check all that apply.

☐ Yes
☐ No

32.   i. If Yes, how often?

Mark only one oval.

◯ Daily

◯ Alternate days

◯ 3 days/week

◯ 5 days/week

33.   ii.   If No, please mention the reason

Check all that apply.

☐ No time to do exercise
☐ Not interested
☐ Feeling lazy
☐ Health problem

34.   iii. How long do you exercise / play?

Check all that apply.

☐ More than 30 minutes
☐ 20 -30 minutes
☐ 10 – 20 minutes
☐ less than 10 minutes

35.   iv. What type of exercise are you involved in?

Check all that apply.

☐ Walking
☐ Cycling
☐ Jogging
☐ Workout at Gym
☐ Yoga
☐ Swimming
☐ Other outdoor activities

Stress Assessment

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There is no right or wrong answers. Do not spend too much time on any statement.
The rating scale is as follows:
0   Did not apply to me at all
1   Applied to me to some degree, or some of the time
2   Applied to me to a considerable degree or a good part of time
3   Applied to me very much or most of the time

36.   I found it hard to relax after stress *

Mark only one oval.

	0	1	2	3
	◯	◯	◯	◯

37.   I was aware of dryness of my mouth *

Mark only one oval.

	0	1	2	3
	⬭	⬭	⬭	⬭

38.   I couldn't seem to experience any positive feeling at all *

Mark only one oval.

	0	1	2	3
	⬭	⬭	⬭	⬭

39.   I experienced breathing difficulty (e.g. excessively rapid breathing,   *
       breathlessness in the absence of physical exertion).

Mark only one oval.

	0	1	2	3
	⬭	⬭	⬭	⬭

40.   I found it difficult to work up the initiative to do things *

Mark only one oval.

	0	1	2	3
	⬭	⬭	⬭	⬭

41. I tended to over-react to situations *

Mark only one oval.

0	1	2	3

42. I experienced trembling (e.g. in the hands) *

Mark only one oval.

0	1	2	3

43. I felt that I was using a lot of nervous energy *

Mark only one oval.

0	1	2	3

44. I was worried about situations in which I might panic and make a fool of myself *

Mark only one oval.

0	1	2	3

45. I felt that I had nothing to look forward to *

Mark only one oval.

	0	1	2	3
	⬭	⬭	⬭	⬭

46. I found myself getting agitated *

Mark only one oval.

	0	1	2	3
	⬭	⬭	⬭	⬭

47. I found it difficult to relax *

Mark only one oval.

	0	1	2	3
	⬭	⬭	⬭	⬭

48. I felt down-hearted and blue *

Mark only one oval.

	0	1	2	3
	⬭	⬭	⬭	⬭

49.   I was intolerant of anything that kept me from getting on with what I was doing *

Mark only one oval.

	0	1	2	3
	⬭	⬭	⬭	⬭

50.   I felt I was close to panic *

Mark only one oval.

	0	1	2	3
	⬭	⬭	⬭	⬭

51.   I was unable to become enthusiastic about anything *

Mark only one oval.

	0	1	2	3
	⬭	⬭	⬭	⬭

52.   I felt I wasn't worth much as a person *

Mark only one oval.

	0	1	2	3
	⬭	⬭	⬭	⬭

53.   I felt that I was rather touchy   *

Mark only one oval.

	0	1	2	3
	( )	( )	( )	( )

54.   I was aware of the action of my heart in the absence of physical exertion (e.g.   *
       sense of heart rate increase, heart missing a beat)

Mark only one oval.

	0	1	2	3
	( )	( )	( )	( )

55.   I felt scared without any good reason *

Mark only one oval.

	0	1	2	3
	( )	( )	( )	( )

56.   I felt that life was meaningless *

Mark only one oval.

	0	1	2	3
	( )	( )	( )	( )

Dietary Assessment

57.   Type of diet following: *

Check all that apply.

☐ Vegetarian
☐ Lacto vegetarian
☐ Ovo- lacto vegetarian
☐ Non vegetarian

58.   Do you have the habit to take food at regular time?

Check all that apply.

☐ Yes
☐ No

59.   Meal pattern per day *

Mark only one oval.

○ 2 meals
○ 3 meals
○ 4 meals
○ 5 meals

60.   Do you skip the meals? *

Mark only one oval.

○ Yes
○ No

61.   If Yes, Which meal?

Mark only one oval.

◯ Breakfast

◯ Lunch

◯ Dinner

62.   How do you compensate the skipped meal?

Mark only one oval.

◯ Tea

◯ Coffee

◯ Fried snacks

◯ Cakes/ Pastry

◯ Biscuits

◯ Vegetable salads

◯ sandwiches

◯ Fruits/ Fruits juices

◯ Any other foods

63.   Do you have good appetite? *

Mark only one oval.

◯ Yes

◯ No

64.   Where do you take food regularly? *

Mark only one oval.

◯ Home

◯ Hotel

◯ Canteen

◯ Mess

◯ Door delivery system

65.   Do you eat food from outside? *

Mark only one oval.

◯ Yes

◯ No

66.   How often you take the following foods *

Check all that apply.

	---------- times per week	---------- times per month	---------- times per year	Never
Fast Foods	☐	☐	☐	☐
Carbonated drinks	☐	☐	☐	☐
Fried foods	☐	☐	☐	☐
Sweets	☐	☐	☐	☐

67. What type of cooking methods regularly followed your family? *

Mark only one oval.

    ⬭ Boiling

    ⬭ Steaming

    ⬭ Frying

    ⬭ Roasting

    ⬭ Combination

68. Oils used for cooking: If one type, please specify *

_____

69. If Combination of oils, specify the oils *

_____

70. Oil consumption type: *

Mark only one oval.

    ⬭ Coconut Oil

    ⬭ Mustard oil

    ⬭ Palm oil

    ⬭ Sunflower oil

    ⬭ Groundnut oil

    ⬭ Soybean Oil

    ⬭ Rice bran Oil

    ⬭ Other

24 Hours Recall Method

Please give the food items you took 3 days (2 working day and 1 holiday

Working Day 1

If you are not taking anything in any time please give no.

71.   Breakfast *

_____

72.   Midmorning *

_____

73.   Lunch *

_____

74.   Evening time *

_____

75.   Dinner *

_____

76.   Bed time *

_____

77.   Any other time

_____

Working Day 2
If you are not taking anything in any time please give no.

78.   Breakfast *

_____

79.   Midmorning *

_____

80.   Lunch *

_____

81.   Evening time *

_____

82.   Dinner *

_____

83.   Bedtime *

_____

84.   Any other time

_____

Holiday (Nonworking day)

If you are not taking anything in anytime please put no.

85.   Breakfast *

_____

86.   Midmorning *

_____

87.   Lunch *

_____

88.   Evening time *

_____

89.   Dinner *

_____

90.   Bedtime *

_____

91.   Any other time

_____

Food Frequency Table

92.   Cereals *

Check all that apply.

	Daily	Weekly	Monthly	Occasionally
Rice	☐	☐	☐	☐
Wheat	☐	☐	☐	☐
Ragi	☐	☐	☐	☐
Oats	☐	☐	☐	☐

93.   Pulses and Legumes *

Check all that apply.

	Column 1	Daily	Weekly	Monthly	Occasionally
Row 1	☐	☐	☐	☐	☐
Red gram	☐	☐	☐	☐	☐
Black gram	☐	☐	☐	☐	☐
Green gram	☐	☐	☐	☐	☐
Red gram dhal	☐	☐	☐	☐	☐
Black gram dhal	☐	☐	☐	☐	☐
Green gram dhal	☐	☐	☐	☐	☐
Horse gram	☐	☐	☐	☐	☐
Chik pea (Channa)	☐	☐	☐	☐	☐
Rajmah	☐	☐	☐	☐	☐

94.   Milk and meat products *

Check all that apply.

	Column 1	Daily	Weekly	Monthly	Occasionally
Milk	☐	☐	☐	☐	☐
Curds	☐	☐	☐	☐	☐
Butter milk	☐	☐	☐	☐	☐
Milk powder	☐	☐	☐	☐	☐
Cheese	☐	☐	☐	☐	☐
Chicken	☐	☐	☐	☐	☐
Beef	☐	☐	☐	☐	☐
Pork	☐	☐	☐	☐	☐
Mutton	☐	☐	☐	☐	☐
Egg	☐	☐	☐	☐	☐
Fish	☐	☐	☐	☐	☐

95. Vegetables and Fruits *

Check all that apply.

	Column 1	Daily	Weekly	Monthly	Occasionally
Amaranth (Red cheera)	☐	☐	☐	☐	☐
Spinach (Green cheera)	☐	☐	☐	☐	☐
Chekkurmanis	☐	☐	☐	☐	☐
Drumstick leaves	☐	☐	☐	☐	☐
Cabbage	☐	☐	☐	☐	☐
Lettuce	☐	☐	☐	☐	☐
Ash gourd	☐	☐	☐	☐	☐
Beans	☐	☐	☐	☐	☐
Bitter gourd	☐	☐	☐	☐	☐
Brinjal	☐	☐	☐	☐	☐
Cauliflower	☐	☐	☐	☐	☐
Cucumber	☐	☐	☐	☐	☐
Ivy gourd (Kovai)	☐	☐	☐	☐	☐
Ladies finger	☐	☐	☐	☐	☐
Papaya	☐	☐	☐	☐	☐
Plantain	☐	☐	☐	☐	☐
Pumkin	☐	☐	☐	☐	☐
Bottle gourd	☐	☐	☐	☐	☐
Snake gourd	☐	☐	☐	☐	☐
Tomato green	☐	☐	☐	☐	☐
Jackfruit raw	☐	☐	☐	☐	☐
Breadfruit (Kadachakka)	☐	☐	☐	☐	☐
Beet root	☐	☐	☐	☐	☐

Carrot	☐	☐	☐	☐	☐
Onion	☐	☐	☐	☐	☐
Potato	☐	☐	☐	☐	☐
Tapioca	☐	☐	☐	☐	☐
Yam	☐	☐	☐	☐	☐
Colocassia	☐	☐	☐	☐	☐
Apple	☐	☐	☐	☐	☐
Amala	☐	☐	☐	☐	☐
Banana	☐	☐	☐	☐	☐
Dates	☐	☐	☐	☐	☐
Grapes	☐	☐	☐	☐	☐
Guava	☐	☐	☐	☐	☐
Jackfruit	☐	☐	☐	☐	☐
Litchi	☐	☐	☐	☐	☐
Musambi	☐	☐	☐	☐	☐
Water melon	☐	☐	☐	☐	☐
Orange	☐	☐	☐	☐	☐
Papaya	☐	☐	☐	☐	☐
Passion fruit	☐	☐	☐	☐	☐
Pears	☐	☐	☐	☐	☐
Pineapple	☐	☐	☐	☐	☐
Pomegranate	☐	☐	☐	☐	☐
Sapota	☐	☐	☐	☐	☐
Tomato ripe	☐	☐	☐	☐	☐

96. Oils and Sugars *

Check all that apply.

	Column 1	Daily	Weekly	Monthly	Occasionally
Butter	☐	☐	☐	☐	☐
Ghee	☐	☐	☐	☐	☐
Vanaspathi	☐	☐	☐	☐	☐
Cooking oil	☐	☐	☐	☐	☐
Sugar	☐	☐	☐	☐	☐
Honey	☐	☐	☐	☐	☐
Jaggary	☐	☐	☐	☐	☐

Sunlight exposure Questionnaire

97. Nature of work *

Mark only one oval.

◯ Table work

◯ Shop

◯ Field work

◯ Agriculture

◯ Retired

◯ Other

98.   For how long are you in direct sunlight. *

Mark only one oval.

⬭ Less than 15 min

⬭ 15- 30 min

⬭ 30 - 60 min

⬭ More than 60 min

99.   What is the length of your sleeves? *

Mark only one oval.

⬭ Half sleeves

⬭ Full sleeves

100.   Do you use sunscreen on your face/arm? *

Mark only one oval.

⬭ Yes

⬭ No

101.   How do you travel? *

Mark only one oval.

⬭ Walking

⬭ Two wheeler

⬭ Car

⬭ Car with sunscreens

⬭ Bus/Railway

⬭ Combination

⬭ Others

102.   Do you use helmet? (Mark only one) *

Mark only one oval.

◯ No

◯ Yes (head only)

◯ Yes (head and face)

◯ Sometimes

103.   Do you use cap? *

Mark only one oval.

◯ Yes

◯ No

◯ Sometimes

104.	Sun Exposure in minutes *

Check all that apply.

	0 minute	More than 15 minutes	15 - 30 minutes	30-45 minutes	More than 45 minutes	Activity	Dress pattern
5-5.59 am	☐	☐	☐	☐	☐	☐	☐
6-6.59 am	☐	☐	☐	☐	☐	☐	☐
7-7.59 am	☐	☐	☐	☐	☐	☐	☐
8-8.59 am	☐	☐	☐	☐	☐	☐	☐
9-9.59 am	☐	☐	☐	☐	☐	☐	☐
10-10.59 am	☐	☐	☐	☐	☐	☐	☐
11-11.59 am	☐	☐	☐	☐	☐	☐	☐
12-12.59 pm	☐	☐	☐	☐	☐	☐	☐
1-1.59 pm	☐	☐	☐	☐	☐	☐	☐
2-2.59 pm	☐	☐	☐	☐	☐	☐	☐
3-3.59 pm	☐	☐	☐	☐	☐	☐	☐
4-4.59 pm	☐	☐	☐	☐	☐	☐	☐
5-5.59 pm	☐	☐	☐	☐	☐	☐	☐

This content is neither created nor endorsed by Google.

Google Forms

DASS21

Name: Date:

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you **over the past week**. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

0   Did not apply to me at all
1   Applied to me to some degree, or some of the time
2   Applied to me to a considerable degree or a good part of time
3   Applied to me very much or most of the time

1 (s)	I found it hard to wind down	0	1	2	3
2 (a)	I was aware of dryness of my mouth	0	1	2	3
3 (d)	I couldn't seem to experience any positive feeling at all	0	1	2	3
4 (a)	I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5 (d)	I found it difficult to work up the initiative to do things	0	1	2	3
6 (s)	I tended to over-react to situations	0	1	2	3
7 (a)	I experienced trembling (e.g. in the hands)	0	1	2	3
8 (s)	I felt that I was using a lot of nervous energy	0	1	2	3
9 (a)	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
10 (d)	I felt that I had nothing to look forward to	0	1	2	3
11 (s)	I found myself getting agitated	0	1	2	3
12 (s)	I found it difficult to relax	0	1	2	3
13 (d)	I felt down-hearted and blue	0	1	2	3
14 (s)	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
15 (a)	I felt I was close to panic	0	1	2	3
16 (d)	I was unable to become enthusiastic about anything	0	1	2	3
17 (d)	I felt I wasn't worth much as a person	0	1	2	3
18 (s)	I felt that I was rather touchy	0	1	2	3
19 (a)	I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)	0	1	2	3
20 (a)	I felt scared without any good reason	0	1	2	3
21 (d)	I felt that life was meaningless	0	1	2	3

DASS-21 Scoring Instructions

The DASS-21 should not be used to replace a face to face clinical interview. If you are experiencing significant emotional difficulties you should contact your GP for a referral to a qualified professional.

Depression, Anxiety and Stress Scale - 21 Items (DASS-21)

The Depression, Anxiety and Stress Scale - 21 Items (DASS-21) is a set of three self-report scales designed to measure the emotional states of depression, anxiety and stress.

Each of the three DASS-21 scales contains 7 items, divided into subscales with similar content. The depression scale assesses dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest / involvement, anhedonia and inertia. The anxiety scale assesses autonomic arousal, skeletal muscle effects, situational anxiety, and subjective experience of anxious affect. The stress scale is sensitive to levels of chronic non-specific arousal. It assesses difficulty relaxing, nervous arousal, and being easily upset / agitated, irritable / over-reactive and impatient. Scores for depression, anxiety and stress are calculated by summing the scores for the relevant items.

The DASS-21 is based on a dimensional rather than a categorical conception of psychological disorder. The assumption on which the DASS-21 development was based (and which was confirmed by the research data) is that the differences between the depression, anxiety and the stress experienced by normal subjects and clinical populations are essentially differences of degree. The DASS-21 therefore has no direct implications for the allocation of patients to discrete diagnostic categories postulated in classificatory systems such as the DSM and ICD.

Recommended cut-off scores for conventional severity labels (normal, moderate, severe) are as follows:

NB Scores on the DASS-21 will need to be multiplied by 2 to calculate the final score.

	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Extremely Severe	28+	20+	34+

Lovibond, S.H. & Lovibond, P.F. (1995). Manual for the Depression Anxiety & Stress Scales. (2nd Ed.)Sydney: Psychology Foundation.