A SYSTEMATIC STUDY TO ASSESS THE EFFECT OF NUTRITIONAL AWARENESS PROGRAMME AND PREVALENCE OF OBESITY AND TYPE II DIABETES IN PRE AND POST-MENOPAUSAL WOMEN

DISSERTATION SUBMITTED

In Partial Fulfillment of the Requirement for the Award of the Degree of

MASTER'S PROGRAMME IN

CLINICAL NUTRITION AND DIETETICS

BY

ANNA SILLA PULIKAL JOSEPH

(Register No: SM20MCN006)

DEPARTMENT OF CLINICAL NUTRITION AND DIETETICS

ST.TERESA'S COLLEGE (AUTONOMOUS)

ERNAKULAM

MAY 2022

CERTIFIED AS BONAFIDE RESEARCH WORK

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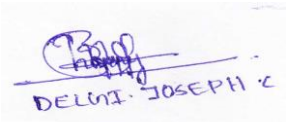

Signature of HOD **Signature of Guide**

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

DECLARATION

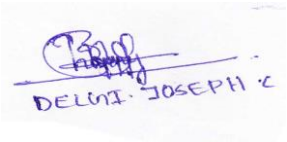
I, **Anna Silla Pulikal Joseph** hereby declare that the dissertation entitled ***"A Systematic Study to assess the Effect of Nutritional Awareness Programme and Prevalence of Obesity and Type II Diabetes in Pre and Post-Menopausal Women"*** submitted in partial fulfillment of the requirement for the award of the Degree of Master's Programme in Clinical Nutrition and Dietetics is a record of original research work done by me under the supervision and guidance of Ms. Delgi Joseph C Assistant professor , Department of Clinical Nutrition and Dietetics , St. Teresa's College, Ernakulam. This work has not been submitted in part or full or any other Degree/Diploma/Associate ship/Fellowship of this or any other University.

Place: Anna Silla Pulikal Joseph

Date:

CERTIFICATE

I hereby certify that the dissertation entitled ***"A Systematic Study to assess the Effect of Nutritional Awareness Programme and Prevalence of Obesity and Type II Diabetes in Pre and Post-Menopausal Women"*** 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 research work done by Ms. Delgi Joseph C during the period of her study under my guidance and supervision.



Signature of the HOD

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"Trust in the lord with all your hear and lean not on your own understanding; in all your ways acknowledge him, and he will make your path straight"

- Proverbs 3:5-6

I bow my head before God Almighty for the blessings, love and care and most importantly guiding me to work on the right path during my thesis work. Without his grace and blessings this thesis would not become a reality in life.

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ANNA SILLA PULIKAL JOSEPH

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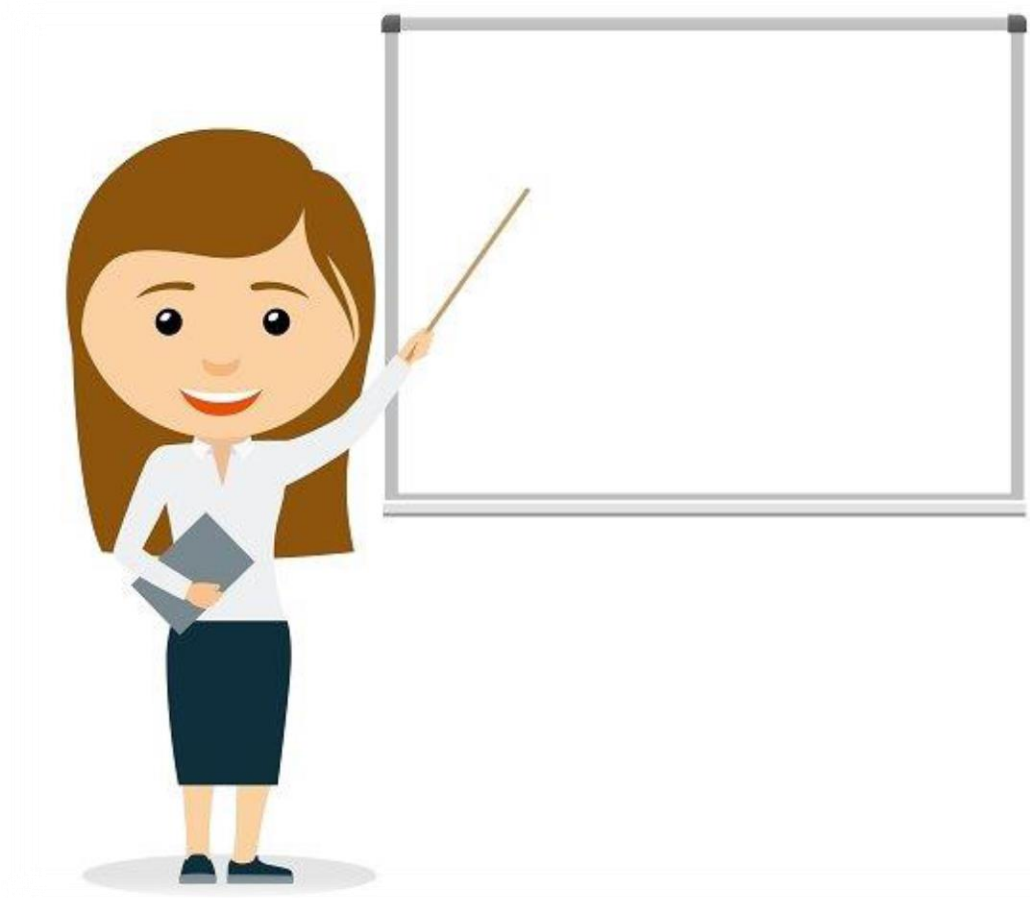
LIST OF ACRONYMS

MetS	**Metabolic Syndrome**
DM	**Diabetes Mellitus**
BMI	**Body Mass Index**
T2DM	**Type 2 Diabetes Mellitus**
WC	**Waist Circumference**
CVD	**Cardiovascular Diseases**
HDL	**High Density Lipoproteins**
LDL	**Low Density Lipoproteins**
GDM	**Gestational Diabetes Mellitus**
IDDM	**Insulin Dependent Diabetes Mellitus**
NIDDM	**Non- Insulin Dependent Diabetes Mellitus**
MODY	**Maturity-Onset Diabetes of the Young**
CAD	**Coronary Artery Disease**

DR	**Diabetic Retinopathy**
FFQ	**Food Frequency Questionnaire**
IR	**Insulin Resistance**
NCEPIII	**National Cholestrol Education Programme Third Report**
WHO	**World Health Organization**
NIN	**National Institute of Nutrition**
ICMR	**Indian Council of Medical Research**
HbA1c	**Haemoglobin A1c**
FAO	**Food and Agriculture Organization**
ADA	**American Diabetes Association**
NHANES	**National Health And Nutrition Examination Survey**
CURES	**Chennai Urban Rural Epidemiology**
SMBG	**Self-Monitoring of Blood Glucose**
NSSO	**National Sample Survey Office**
CDC	**Centre for Disease Control**

RDA	**Recommended Dietary Allowances**
IFCT	**Indian Food Composition Table**
SES	**SocioeEconomic Status**
TFA	**Trans Fatty Acids**

INTRODUCTION



CHAPTER-1

INTRODUCTION

"Today more than 95% of all chronic disease is caused by food choice, toxic food ingredients, nutritional deficiencies, and lack of physical exercise" – Mike Adams

Menopause is the permanent cessation of menstruation resulting in the loss of ovarian follicle development (Sherwin B, 2001). Menopause is defined as the cessation of a woman's menstrual period followed by a 12-month interval of amenorrhea. Post-menopause describes the period following the final menses (Soules *et al*, 2001).

Menopausal symptoms are linked to decreased ovarian function as a result of age, which results in lower oestrogen and other hormone levels. Menopause can cause vasomotor symptoms, somatic symptoms, sexual dysfunction, and psychological problems, all of which can affect one's quality of life. Among menopausal symptoms, vasomotor symptoms include hot flashes and night sweets are of great clinical importance and can affect women's quality of life (Melby *et al*, 2011).

Menopause is a risk factor for cardio metabolic diseases, including metabolic syndrome (MetS), type 2 diabetes, and cardiovascular diseases. Insulin resistance, abdominal obesity, dyslipidemia, and hypertension are all interrelated variables in MetS. The prevalence of MetS in post menopause is due to loss of the protective role of estrogens and increased circulating androgens resulting in changes to body fat distribution and development of abdominal obesity (Stefanska *et al*, 2015).

The prevalence of chronic, non-communicable diseases is rising at an alarming rate over the world. Every year, over 18 million people die from cardiovascular disease, with diabetes and hypertension being key risk factors. Diabetes and hypertension is the growing prevalence of overweight and obesity which have, during the past decade, joined underweight, malnutrition, and infectious diseases as major health problems threatening the developing world (Haslam and James, 2005).

Kerala, the diabetic capital of India, has a high obesogenic environment. This is evident from the fact that 73% of the study population with metabolic syndrome has obesity. Similar study in Kerala amongst first time diabetics showed a prevalence of 89.7% obesity among patients with metabolic syndrome. Possible etiological factors include sedentary lifestyle, high living standards, and unhealthy eating habits amongst Keralites (Sivasankaran and Thankappan, 2013) (Jacob *et al*, 2016).

Diabetes mellitus was described 3000 years ago by ancient Egyptians. Araetus of Cappodocia was the first to use the term "diabetes" (81-133AD). Later, the word mellitus (honey sweet) was added by Thomas Willis in 1675 after rediscovering the sweetness of urine and blood of patients.

In 1776, Dobson confirmed the presence of excess sugar in urine and blood as a cause of their sweetness (Ahmed M.A, 2002).

Diabetes mellitus is a metabolic disorder caused by a deficiency in insulin secretion, action, or both. Insulin deficiency causes chronic hyperglycemia, leading to problems with carbohydrate, lipid, and protein metabolism. It is the most common endocrine disorder, it is estimated that more than 300 million people worldwide will have diabetes mellitus by 2025 (B Salim, 2005).

Diabetes is a worldwide epidemic. The prevalence of diabetes has increased worldwide as a result of changing lifestyles and rising obesity rates. With an increase in age, the prevalence of DM also increases (Carrillo-Larco *et al*, 2019). Type 2 Diabetic Mellitus also known as non-insulin dependent diabetic mellitus, is the most common form of DM characterized by hyperglycemia, insulin resistance, and relative insulin deficiency (Maitra and Abbas, 2005).

Type 2 DM is due primarily to lifestyle factors and genetics (Ripsin *et al*, 2009). A number of lifestyle factors are known to be important to the development of type 2 diabetes mellitus such as physical inactivity, sedentary lifestyle, cigarette smoking and consumption of alcohol (Hu *et a*l, 2001).

Obesity contributes to approximately 55% of cases of type 2 diabetes mellitus (Centre for Disease Control and Prevention, 2004).

People who are overweight or obese have a substantially higher chance of getting type 2 diabetes than those who maintain a healthy weight. People with more of visceral fat, also called central obesity, belly fat, or abdominal obesity, are more prone. Being overweight or obese causes the body to release chemicals that can destabilize the body's cardiovascular and metabolic systems. Being overweight, physically inactive and eating the wrong foods all contribute to our risk of developing type 2 diabetes (Lal S.B, 2016).Genetic predisposition determines individual's susceptibility to type 2 diabetes mellitus, an unhealthy diet and a sedentary lifestyle are also important causes of diabetes (Zheng *et al*, 2018).

Diabetes patients have 2 to 4 fold increased risk of cardiovascular and cerebrovascular disorders, resulting in higher mortality rate among diabetic patients than the general population. Microvascular complications also occur, including retinopathy, nephropathy and neuropathy, and these can progress to the end-stage outcomes of blindness, renal failure, and amputation (UMHS Management of Type 2 Diabetes Mellitus, 2019).

Many cases of T2DM can be avoided by changing lifestyle, such as keeping a healthy weight, eating a balanced diet, staying physically active, avoiding smoking, and drinking alcohol in moderation (Zheng *et al*, 2018).

Diabetes mellitus is preventable with lifestyle intervention; moderate changes in diet and physical activity produce a reduction in the incidence of type 2 diabetes mellitus (Schwarz *et al*, 2012).

Successful management of type-2 diabetes mellitus involves targeting both glucose and non-glucose goals in order to achieve the greatest reduction in morbidity and mortality (Brunetti and Kalabalik, 2012). According to Priyadi *et al*, 2019, to reduce the complication and comorbidity caused by diabetes, healthcare providers should make use of some interventions like counselling, pharmaceutical care or disease management

Obesity is defined as an accumulation of excessive or abnormal fat which can be dangerous to health. According to World Health Organization, obesity is defined as body mass index (BMI) greater than or equal to 30 kg/m2 (Alam and Agrawal, 2015).

Waist circumference is used to assess the amount of abdominal fat which is highly correlated with intra- abdominal fat content. The International Diabetes Federation (IDF) consensus defined central obesity (also known as visceral, android, apple-shaped or upper body obesity) as a WC of ≥94 cm in men and ≥80 cm in non-pregnant women (Alberti *et al*, 2005).

The prevalence of overweight and obesity is more for women than that of men. Most women were housewives with sedentary life style and lack of awareness and it's the reason for high prevalence of obesity among women (Binu and Harnagale, 2014). In another study, prevalence of obesity was found to be high for females (31%), when compared to male (11.9%) (Carter *et al*, 2006).

Obesity is a major contributor to increased morbidity and mortality, mainly from cardiovascular disease (CVD) and diabetes, but also from cancer and chronic diseases like osteoarthritis, liver and kidney disease, sleep apnoea, and depression (Sunyer P.X, 2009).

High-energy-density diets, increased portion sizes, inadequate physical activity, sedentary lifestyle, as well as eating disorders, are all considered key risk factors for obesity (Branca *et al*, 2007).

Excessive food energy intake and a sedentary lifestyle account for most cases of overweight and obesity, also medical illness and drug treatment of medical illness can increase the risk of obesity and are amenable to treatment (Diabetes Prevention Programme, 2002).

Healthy nutrition is vital for disease prevention, maintenance, and promotion. Over the past few decades, various types of nutrients, such as fiber-rich carbohydrates, mono or polyunsaturated fatty acids, essential amino acids, and specific micronutrients, have been functionally proven and considered vital components of healthy nutrition (Botchlett and Wu, 2018).

Polysaccharides, oligosaccharides, lignin, and other plant components constitute dietary fibre. A diet rich in dietary fibre is a good way to maintain a healthy weight because it has a positive ripple effect throughout the gastrointestinal tract, starting with the release and management of satiety hormones and regulating metabolite levels such as HDL, LDL, and triglycerides (Cruz-Requena *et al*, 2016).

Cognitive behavioural therapy directly addresses behaviours that require change for successful weight loss and weight loss maintenance. Pharmacotherapy can help patients to maintain compliance and ameliorate obesity-related health risks. Surgery is the most effective treatment for morbid obesity in terms of long-term weight loss (Yumuk *et al*, 2015).

Backman *et al*, 2002 reported that dietary knowledge is a significant factor that influences dietary behaviours. Savoca and Miller, 2001 stated that patient's food selection and dietary behaviours are influenced by the strong knowledge about diabetic diet recommendations. Significant positive relationship was observed between knowledge regarding diabetic diet and the amount of calorie needs. The study concluded that knowledge regarding diabetic diet is essential and is needed to achieve better dietary behaviours (Primanda *et al*, 2011).

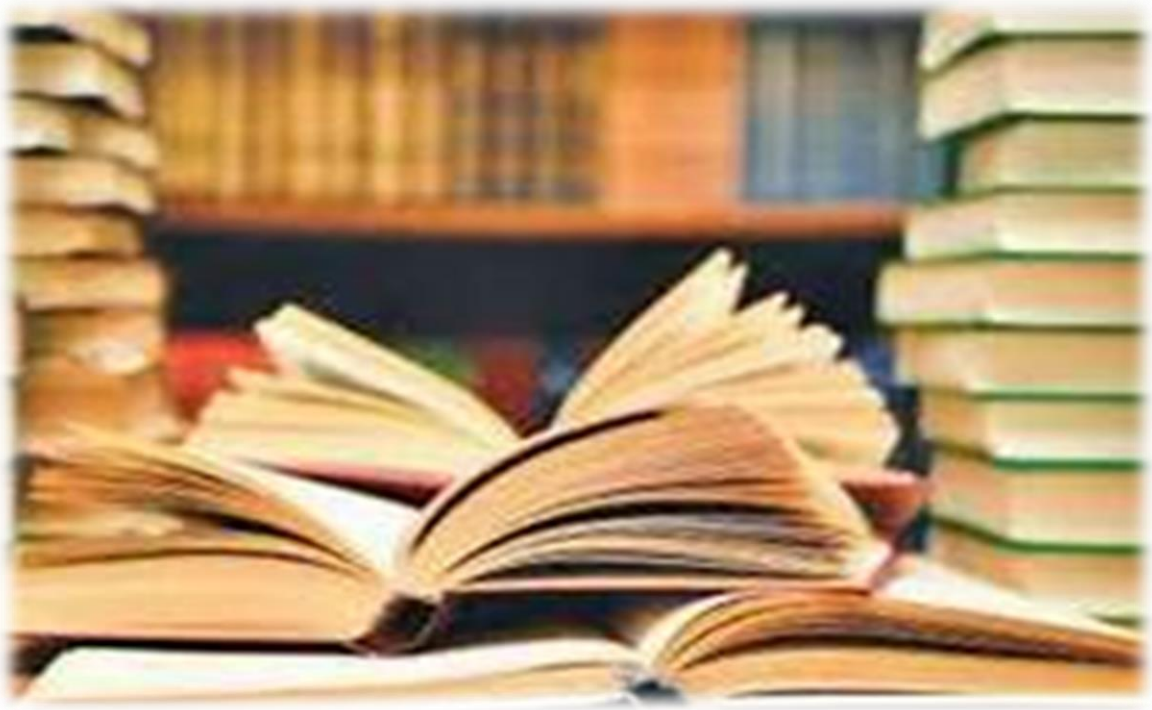
In a study done by Ginger *et al*, 2014 it was found that 10% of subjects had knowledge regarding obesity and its effects and 59.9% of them felt the importance to improve their knowledge on awareness through public education focused on the effects of obesity which may lead to behavior change, decrease of health risks and medical costs.

Deepam, 2016 conducted a study among urban women of South India to assess the awareness about consequences of obesity on health problems. The findings of the study revealed that 76% of them had an average knowledge and 24% of them had less knowledge about obesity and its consequences. It paves a way to create public awareness regarding ill effects of obesity and measures to overcome the consequences through health education and campaigns.

Based on the above factors in mind the present study ***"A Systematic Study to assess the Effect of Nutritional Awareness Programme and Prevalence of Obesity and Type II Diabetes in Pre and Post-Menopausal Women"*** was conducted with the following objectives,

- To assess the nutritional status of pre and post-menopausal women.
- To assess the blood glucose level and waist-hip ratio of pre and post-menopausal women.
- To ascertain the nutrition knowledge of pre and post-menopausal women.
- To determine the effect of nutrition education in the selected samples.
- To assess the prevalence of obesity and type 2 diabetes in pre and post-menopausal women.

REVIEW OF LITERATURE



CHAPTER 2

REVIEW OF LITERATURE

A review of literature involves the systematic identification, location, scrutiny and summary of written materials that contain information on a research problem identified (Polit & Beck 2010). A review of literature is a critical analysis of earlier scholarly work on a chosen topic. A literature review is a comprehensive summary of previous research on topic. The review of literature pertaining to the study entitled ***"A Systematic Study to assess the Effect of Nutritional Awareness Programme and Prevalence of Obesity and Type II Diabetes in Pre and Post-Menopausal Women"*** is discussed under the following headings.

2.1. MENOPAUSE AND ASSOCIATED HEALTH RISK

2.2. OBESITY IN MIDDLE AGED WOMEN

2.2.1. Prevalence

2.2.2. Etiology

2.2.3. Complications

2.2.4. Management

2.3. DIABETES MELLITUS IN MIDDLE AGED WOMEN.

2.3.1. Prevalence

2.3.2. Etiology

2.3.3. Complications

2.3.4. Management

2.4. NUTRITIONAL REQUIREMENT AND DIETARY HABITS.

2.5. IMPORTANCE OF NUTRITION EDUCATION.

2.1. MENOPAUSE AND ASSOCIATED HEALTH RISK

According to Beckar *et al* (2002) Menopause is defined as the cessation of menses, represents an important developmental milestone in a woman's life. Menopause usually occurs between the ages of forty-eight and fifty-two Extreme fatigue and drowsiness are also symptoms of type II diabetes in thirteen postmenopausal women. "High doses of oestrogen and progesterone require larger doses of insulin than low doses of oestrogen and progesterone". (Rosenthal, 2005).

Menstrual cycle irregularity occurs in over 50 per cent of women in the menopausal transition and is often associated with abnormal uterine bleeding

which may present as irregular, heavy or persistent menstrual flow (Arroyo and yeh, 2005).

The hot flush is described as a heat or warmth sensation of the skin, often accompanied by other symptoms such as sweating. The majority of both post-menopausal and perimenopausal women report hot flush symptoms. (Yonus *et al*, 2003).

The most common postmenopausal symptom was joint pain (92%) followed by physical and mental exhaustion (84%), depression (76%), irritability (73%), hot flushes, and night sweats (65%). There was a noteworthy positive correlation between age of the women, duration of life after menopause, and postmenopausal symptoms (Kulkarni *et al*, 2016).

Bindhu A,(2014) did a study on prevalence of common menopausal symptoms among rural menopausal women at Kerala. Findings revealed that, the most common symptoms found among the midlife population was hot flashes 40.9%, muscle and joint pain 35.9%, lack of energy 49.7%. The least common symptoms were headache 13%, night sweats 16.9%, palpitation 9%, and inner restlessness 15%.

In a survey done by Bansal and Thaker (2005), Out of 100 post-menopausal women 29.5% suffered from joint pain, poor memory and fatigue, 25% had irritability, 22.7% had urinary symptoms, 18.18 % had hot flushes, 6.81% dysparunia, 4.54% leucorrhoea and anxiety and 2.27% had post-menopausal bleeding.

The effects of physiological changes of menopause include vaginal changes (drying up and thinning of the mucus, dyspareunia, and an increase the chance of vaginal infection), bones' thinning (decrease in length and density of the bones and osteoporosis), behavioural changes (perspiration, irritable, depression, and low concentration), urinary changes (feeling pain or soreness during urination, urine leakage with cough, sneeze, and laugh), increase of body fat content around the waist (weight increase), and low desire for sexual activity(Hassanzadeh et al,2003).

Schindler et al (2009) found that incidence of thyroid disease is higher in a population of postmenopausal women, 73.8% are hypothyroid and 26.2% are hyperthyroid.

Menopause is a risk factor for cardiovascular disease (CVD) because estrogen withdrawal has a detrimental effect on cardiovascular function and metabolism. The menopause compounds many traditional CVD risk factors, including changes in body fat distribution from a gynoid to an android pattern, reduced glucose tolerance, abnormal plasma lipids, increased blood pressure, increased sympathetic tone, endothelial dysfunction and vascular inflammation (Rosano et al, 2009).

Hypertension is the main risk factor contributing to the increase in cardiovascular morbidity and mortality in postmenopausal women, with a prevalence of around 60% in women older than 65 years. The high prevalence of hypertension in older women is largely due to the progressive stiffening of

the arterial structure. Postmenopausal hypertension fosters the development of left ventricular hypertrophy and is the main factor contributing to coronary artery disease, chronic heart failure and stroke in older women (Taddei, 2009).

2. 2.2. OBESITY IN MIDDLE AGED WOMEN.

The prevalence of obesity has increased dramatically over the last 20 years and continues to do so, primarily as a result of changes in dietary intake and exercise patterns (Cannon et al., 2009).

Just over 10,000 years ago, obesity was non-existent in the human population. In the span of time since then, obesity has become the worst pandemic of the 21st century (Wharton, 2009; Chowbey et al, 2009).

According to Kopelman (2000), obesity has now become so common within the world's population that it is beginning to replace under nutrition and infectious diseases as the most significant contributor to the poor health.

Women are particularly susceptible to weight gain during midlife. weight gain during the menopausal transition is common and can be attributed to factors unique to this life phase including aging, hormonal changes, reduced physical activity, and changes in body composition, among others (Sternfed et al, 2009; Toth et al, 2000).

2.2.1. Prevalence

In developing countries, obesity is more common in middle aged women, people of high socio-economic status and those living in urban communities (Mungreiphy,2009).
Obesity is a major chronic disorder, affecting 20%-40% adults in India. The prevalence of obesity is higher among women and also in economically better off individuals and who live in urban areas.
Women in higher socio-economic status experience the greater risk for being pre-overweight, overweight and obese (Shukla et al., 2002; Subramanian and Smith, 2006; Nirmala, 2009).

The prevalence of overweight and obesity among the Tangkhul Naga women was found to be 27.1% when BMI was assessed using recommended cut-off points for Asians and when BMI was assessed using the WHO International Classification of adult overweight and obesity, the prevalence of obesity observed was 9.8%. In rural Kerala, 18 % of those in age 20-29 years were reported obese or overweight which raised to 41.7 % of 18 those in 40-49 years and 41.9 % of those in 50-59 years (Varghese and Vijayakumar, 2008).This shows that the prevalence of overweight and obesity in India is quite high.

According to Mohan and Deepa (2006), obesity is considered to be the link between insulin resistance (IR) and metabolic abnormalities inclusive of type 2 diabetes mellitus (T2DM), hypertension and dyslipidaemia, all of which are risk factors for coronary artery disease (CAD).

According to Ogden et al, 2007, obesity increases the risk of diabetes, CAD, fatty liver, gall stones, sleep apnoea, arthritis, and cancer and may shorten the lifespan.

Prevalence rates of overweight and obesity are steadily increasing in women. The estimated prevalence of obesity in women is 36.5% for ages 20 to 39 years, 44.7% for ages 40 to 59 years, and 43.1% for ages 60 years and older, based on the 2015 to 2016 National Health and Nutrition Examination Survey (Hales et al, 2018).

According to Haslam and James (2005) and Third Report of National Cholesterol Education Programme (NCEPIII, 2001), as part of the metabolic syndrome, hypertension and diabetes are closely associated with obesity and frequently occur together in an individual. But little information exists on the relationship of BP levels with the subsequent development of T2DM.

According to Sicree *et al.* (2006), T2DM, which is more prevalent (more than 90% of all diabetes cases) and the main driver of the diabetes epidemic, now affects 5.9% of the world's adult population with almost 80% of the total in developing countries.

Low weight, independent of menopausal status, leads to the typical gynoid pattern of fat distribution while excess weight and obesity result in the android pattern of distribution in pre- and postmenopausal women. (Kirchengast *et al* 2005).

Changes in the nutritional state of postmenopausal women indicated height decreased with age. Bigger skin fold thickness and larger waist and hip circumferences were observed among women at postmenopausal age compared to women aged 50 years. Changes in mean body mass and Body Mass Index (BMI) were found in the early postmenopausal stage between 50 and 60. Obesity was two times more prevalent among women aged 69-71 years than among women aged 50 years. Density of forearm bones decreased with age. (Chabros *et al* 2003).

The age of women who are overweight or obese is highest in Punjab (30%), followed by Kerala (28%) and Delhi (26%), all of which are relatively richer states. The prevalence of underweight and overweight among men shows similar variations by age, education and wealth index (National Family Health Service, 2012).

A study of 4032 women from Andhra Pradesh showed that large cities of the state had 37% of women overweight or obese (Griffiths and Bentley, 2001).

2.2.2. Etiology

Obesity is caused by genes, personal behavior and broader social and family environment and all these three interact. Differences in appetitive awareness are heritable (Tholin *et al*, 2005). According to WHO (2001) a significant number of subjects reported a family history of obesity at 5.4 percent. Those with a family history of obesity had higher BMI and were at increased risk of obesity.

Excess accumulation of adipose tissue is the common phenomena among all obese people. However, it should not be constricted to single symptom or disease but exceedingly it is a complex group of disease apparently which should be characterized by the syndrome. Identification of more than 300 genes and gene markers have been analysed which are associated with obesity (Atkinson, 2005).

The strongest evidence for an increased risk of obesity relates to diets that are high in dietary fat or low in fibre. There are multiple mechanisms by which obesity can occur including satiety, palatability, food availability or low-energy needs as a consequence of physical inactivity. Physical activity or other lifestyle traits are the other important covariates (Jebb, 2007).

Food environment factors hypothesized to increase energy intake were portion size, high fat, high energy density, high glycemic index, availability of soft drinks, sugar, high accessibility, low cost, great taste, variety, advertising and fast /convenient foods (Peters *et al*, 2002).

The genetic contribution to body weight is considered as a secondary cause. If both parents are obese, the possibility of obesity is approximately 80% in their offspring. If one is obese the probability of obese offspring falls to 10 % (Karam and McFarlane, 2007).

Dyck (2000) studied the consumption of high-fat diets appear to be strongly implicated in the development of obesity. Evidence that fat oxidation does not adjust 31 rapidly to acute increases in dietary fat, as well as a decreased capacity to oxidize fat in the postprandial state in the obese, suggest that diets high in fat may lead to the accumulation of fat stores.

A social factor that includes poverty and low level of education has been linked to obesity. Poverty may cause some people to buy high-calorie processed foods because they typically cost less than healthier foods. Exercise opportunities may be limited if the resources for recreation is unavailable in the neighborhood areas, if the area is considered unsafe or not conducive to activities like walking, jogging or if gym memberships are too expensive. Many studies indicate that too little sleep can affect the function of fat cells and increase the risk for weight gain and related conditions like type II diabetes (Misra and Khurana, 2008).

The demands of a busy life handling work and family leaves little time for many to cook at home. Many modern advances (cars, working from home, television and social media) have made people less active and lacking in regular exercise. Also many people feel comforted by food or they use eating as a way of dealing with stress (Patel *et al*, 2015).

According to World Health Organization, lifestyle factors are the root of developing non communicable disease crisis which is responsible for deaths every year. The common modifiable metabolic risk factors which underlie the major cardiovascular disease include harmful use of tobacco, alcohol, unhealthy diet and insufficient physical activity which causes raised blood pressure, increased blood glucose, elevated blood lipids and obesity (Yerpude and Jogdand , 2014).

When physical activities are reduced, food consumption must also be reduced. But the consumption pattern remains unchanged while activities are reduced which results in obesity. Obesity has taken a major position in the world and contributes to the development of large number of health problems, both independently and in association with other diseases including cardiovascular respiratory, gastrointestinal, renal, metabolic and neurological disorders, cancers and mental health problems (Larson, 2015).

Certain eating habits enable women to become obese as they nibble between meals, not wasting left out food, fast eating with less chewing time that contributes more intake, responding to external cues than internal hunger signals from stomach, attending business executives lunch or dinner at restaurants and outside eating with more junk foods, bakery products, sweets, oily foods, carbonated beverages, non-inclusion of fruits and vegetables (Che *et al*, 2012).

An individual's cultural background may also play a role in their body weight. For instance, foods that are specific to certain cultures was prepared with lot of fat or salt may hamper one's weight-loss efforts. Although one cannot change their genetic makeup, but can work on changing the eating habits, levels of physical activity, and other environmental factors (Bravis A.A, 2011).

2.2.3. Complications

The health problems and complications associated with obesity are numerous. Obesity is not just a cosmetic problem. It is a health hazard. Someone who is 40 per cent overweight is twice as likely to die prematurely as is an average weight person. This is because obesity has been linked to several serious medical conditions, including Heart disease and stroke, High blood pressure, Diabetes, Cancer, Gallbladder disease and gallstones, Osteoarthritis, Gout, Breathing problems, such as sleep apnoea and asthma.

Obesity negatively impacts the health of women in many ways. Overweight or obese increases the relative risk of diabetes and coronary artery disease in women. Women who are obese have a higher risk of low back pain and knee osteoarthritis. Obesity negatively affects both contraception and fertility as well (Haslam and James, 2005).

Overweight and obese patients are at an increased risk for developing numerous cardio metabolic complications, including hypertension, Type 2 diabetes mellitus, dyslipidaemia, and cardiovascular diseases, as well as different types of cancers. Owing to the major health risks and complications associated with obesity which negatively affect quality of life and reduce average life expectancy. Direct associations between obesity and several diseases, including diabetes mellitus, hypertension, dyslipidemia and ischaemic heart disease, are well recognized. A very high degree of obesity (BMI above 35 kg/m2) seems to be linked to higher mortality rates (Malnick and Knobler 2006).

Obesity has also been associated with an increased risk of mortality in women. Studies show a significant association between body weight or BMI and mortality (Gu *et al*., 2006).

A report by WHO (2004) reveals that lipid abnormalities related to obesity include an elevated serum concentration of cholesterol, low-density-lipoprotein cholesterol, very low density lipoprotein cholesterol, triglycerides and apolipoprotein B, as well as a reduction in serum high-density-lipoprotein cholesterol. There is strong correlation among hypertension, obesity, hyperlipidemia and hyperuricemia which are important risk factor for the cardiovascular disease.

Hypertension is an important risk factor for cardiovascular disease and it becomes even more important when associated with other risk factors like obesity and hyperlipidemia (Ahmed *et al*., 2009).

2.2.4. Management

Nutritious diet, regular exercise, spiritual growth (positive attitude) form the only remedy for a healthy and happy life free from all diseases and stress (Muesing *et al*, (2006).

Weight reduction through dietary modification and regular physical activity improves metabolism and control diabetes mellitus. Bhatnagar (2005) concluded that the chief tools in the treatment of obesity are diet, exercise, and suitable medication to keep the symptoms in check.

The main contributory factors for obesity and diabetes are life style, faulty dietary habits, lack of exercise, inheritance and environment. Among these, diet and life style have direct bearing on the onset of the disease. Diet management supported by suitable changes in lifestyle, plays a pivotal role in the prevention and control of obesity and diabetes (Lau *et al.,* 2007).

Successful weight loss depends on correction of energy imbalance through increased energy expenditure from physical activity, and changes in food habits to reduce overall energy intake. It is important to understand that a reduction in energy intake can be achieved through multiple strategies – not simply by reducing dietary fat (WHO, 2012).

According to Banerjee *et al*., (2004), although there are multiple factors that could contribute to obesity, the primary cause is due to an increase in the energy absorption: energy expenditure ratio. Therefore, limiting energy absorption is critical when treating obesity.

Reduction of energy intake is a key factor in weight loss, whereas the particular macronutrient composition of diets for weight loss is still being identified while much emphasis has been placed on very low carbohydrate diets for weight loss, their long term safety and effects on weight are in doubt (Strychar, 2006).

According to (WHO, 2012), to reduce energy intake, the key is to reduce consumption of energy dense (e.g. high fat, high sugar and high starch) foods and drinks (e.g. high sugar drinks) and consume mainly low energy dense foods (e.g. fruits and vegetables).

Tonsin *et al*, (2003) suggests that high fiber especially soluble variety and soluble fiber supplements may offer more improvement in carbohydrate metabolism, lower cholesterol and reduce the insulin demand. Slowly absorbed carbohydrates such as starches are preferable than rapidly absorbed carbohydrates.

Soluble food fibers have certain important physiological functions and metabolic consistent and curative health benefits, such as regulation of absorption and metabolism of sugar, control of lipid absorption, energy balance, control of weight (Jenkins, 2004).

Physical exercise is any bodily activity that enhances or maintains physical fitness and overall health and wellness. It is performed for various reasons including strengthening muscles and the cardiovascular system, strong athletic skills, weight loss or maintenance, as well as for the purpose of enjoyment. Frequent and regular physical exercise boosts the immune system, and helps to prevent the "diseases of affluence" such as heart disease, cardiovascular disease, Type 2 diabetes and obesity (Hu *et al*., 2001).

Physical activity also appears to have an independent effect on health-related outcomes when compared with body weight, suggesting that adequate levels of activity may counteract the negative influence of body weight on health outcomes. Thus, it is important to target intervention strategies to facilitate the adoption and maintenance of an adequate amount of physical activity to control body weight (Hainer *et al.*, 2008).

Physical exercise is important for maintaining physical fitness and can contribute positively to maintain healthy weight, building and maintaining healthy bone density, muscle strength, and joint mobility promoting physiological well-being, reducing surgical risks, and strengthening the immune system (Pedersen, 2013).

According to Bensimhon *et al*. (2006), physical activity is well established as a key component of any weight loss programme. Sufficient regular physical activity is crucial to prevent weight gain and successfully maintain weight loss.

Walking, running, and cycling are the most effective means of exercise to reduce body fat. Exercise affects macronutrient balance. During moderate exercise, equivalent to a brisk walk, there is a shift to greater use of fat as a fuel (Sahlin *et al.*, 2008).

According to Bray and Ryan (2012), Anti-obesity drugs can be useful adjuncts to diet and exercise for obese adults with a BMI greater than 30 kg/m2, who have failed to achieve weight loss goals through diet and exercise alone. A trial of drug therapy is also warranted in patients with a BMI of 27 to 29.9 kg/m2 with comorbidities, gastrointestinal bypass surgery is being considered.

The principles based on weight loss consist of two approaches first is to reduce the volume of the stomach (e.g.: by adjustable gastric banding and vertical banded gastroplasty), that hits the earlier sense of satiation, and reducing the duration of bowel that comes into contact with food (gastric bypass surgery), which directly leads to reduces absorption. As compared to bowel shortening operations, Band surgery is reversible. Some procedures can be performed laparoscopically (Gupta *et al.,* 2010).

2.3. DIABETES MELLITUS IN MIDDLE AGE WOMEN.

Diabetes Mellitus is one of the most burdensome chronic diseases that are increasing in epidemic proportion throughout the world. Death attributed to diet related non-communicable diseases in India is projected to increase from 31.6 to 43.3 percent of all deaths by 2020. (Popkin , 2001).

Diabetes results in abnormal levels of glucose in the bloodstream. This can cause severe short-term and long term consequences ranging from brain damage to amputations and heart disease (American Diabetes Association, 2007).

There are two main types of diabetes mellitus:

i. Type 1 diabetes, also called insulin dependent diabetes mellitus (IDDM), is caused by lack of insulin secretion by beta cells of the pancreas.
ii. Type 2 diabetes, also called non-insulin dependent diabetes mellitus (NIDDM), is caused by decreased sensitivity of target tissues to insulin.

Gestational diabetes mellitus (GDM) is defined as glucose intolerance of various degrees that is first detected during pregnancy. GDM is detected through the screening of pregnant women for clinical risk factors and, among at-risk women, testing for abnormal glucose tolerance that is usually, mild and asymptomatic (Buchanan and Xiang, 2005).

Maturity-onset diabetes of the young (MODY) is a group of inherited disorders of non-autoimmune diabetes mellitus which usually present in adolescence or young adulthood (Naylor, 2018).

The prevalence of diabetes is increasing rapidly worldwide and the World Health Organization (2003) has predicted that by 2030 the number of adults with diabetes would have almost doubled worldwide, from 177 million in 2000 to 370 million (Guyton and Hall, 2006).

Type 2 diabetes is the predominant form of diabetes and accounts for at least 90% of all cases of diabetes mellitus (Gonzalez *et al.,* 2009).

The increasing prevalence of diabetes is associated with increased rates of overweight and obesity and it has been estimated that 90% of T2DM is attributable to excess weight (Lipscombe and Hux, 2007; Hossain *et al.,* 2007). A positive association between obesity and the risk of developing T2DM has been consistently observed in many populations (WHO, 2000; Ramachandran et al., 2001).

In an estimate from the National Health and Nutrition Examination Survey (NHANES) conducted in 2003-2004, in United States, the prevalence of overweight (BMI≥ 25 kg/m2) in adults was found to be 66.3%, of which 32.2% were obese with BMI≥ 30 kg/m2 (Ogden *et al.*, 2006).

2.3.1 Prevalence

India is the diabetes capital of the world with 41 million Indians having diabetes, every fifth diabetic in the world is an Indian (Joshi, 2005).

Mohan and Pradeepa (2009) also confirmed the high prevalence of diabetes in urban south India.

The WHO criterion was used for diagnosis diabetes after an Oral Glucose Tolerance Test using capillary blood. The study showed that the age standardized prevalence of T2DM was 12.1%. The prevalence was the highest in Hyderabad (16.6%), followed by Chennai (13.5%), Bengaluru (12.4%), Kolkata (11.7%), New Delhi (11.6%) and Mumbai (9.3%) (Ramachandran *et al.*, 2001).

Prevalence of diabetes had increased from 2.2 to 6.3 per cent in a period of 14 yr. Important risk factors associated with this increase were lack of physical activity and increased upper body adiposity. (Ramachandran, 2004).

Sensitivity of waist circumference is an index of disease risk in postmenopausal women (Pelt *et al* 2001). The body fat distribution changes according to menopausal status, with central obesity more pronounced in postmenopausal women (Garauet, 2001).

Most women are diagnosed with type II diabetes over the age of forty. Postmenopausal women are diagnosed with type II diabetes because Lower levels of the hormones oestrogen and progesterone, and human growth hormone contribute to lower metabolism and obesity which is the major cause of type II diabetes. Menopause can also cause many other problems for women with type II diabetes. Post-menopausal women should be routinely screened for diabetes to allow facilitate early detection and treatment. (Revis and Keene, 2007).

Kutty *et al* (2000) reported 16.3 percent prevalence of diabetes mellitus among 322 adults aged 20 years or above in an urban settlement in Kerala.

In a study from southern Kerala, the prevalence of diabetes mellitus among urban residents was 12.7 percent compared to 2.7 percent prevalence among coastal residents (Menon *et al*, 2006).

The incidence of T2DM in Kerala is 21.9% and the incidence of prediabetes is 36.7% (Vijayakumar *et al*, 2019)

The a study from Neyyattinkara taluk of Southern Kerala, reported high prevalence of Type 2 Diabetes mellitus (27.11%) among adults above the age of 30 years. Prevalence of Pre Diabetes was found to be 22.67% (Jose *et al*,2013).

In a study done among 10,878 women, 2,340 (21.5%) had prediabetes and 246 (2.3%) had type 2 diabetes. Among the premenopausal women, only 69 (1.1%) had type 2 diabetes, whereas the prevalence rate was high at 3.8% in women after natural menopause and 4.0% after surgical menopause or menopause from other causes (Heianza *et al*,2013)

2.3.2 Etiology

The impairment of pancreatic β cell function shows progression over time in type 2 diabetes. Although aging, obesity, insufficient energy consumption, alcohol drinking, smoking, etc are independent risk factors of the pathogenesis of type 2 diabetes mellitus. Over eating, Smoking, increase in alcohol intake, disorders of nervous and endocrine systems, increase in cortisol, abnormality in sex hormone secretion, lowered energy consumption due to a lack of exercise and genetic factors such as aging can cause diabetes mellitus (Kaku K, 2010).

Factors such as aging, obesity, insufficient consumption of energy, smoking and alcohol drinking etc play important role in pathogenesis of type I or II diabetes mellitus (Ozougwu *et al*, 2013).

The role of stress in the etiology of diabetes is difficult to define and measure, but there is significant evidence of its metabolic consequences in individuals already suffering from chronic diseases, such as diabetes mellitus (Pilacinski *et al*, 2014).

Stress is often observed in conjunction with the diagnosis of diabetes and it alters the glucose metabolism and the immune response (Psychol, 2015).

Stress is linked to a higher risk of type 2 diabetes, especially in females (Premalatha *et al*, 2000).

Overweight and obese people have a much higher risk of developing type 2 diabetes compared to those with a healthy body weight. Being overweight, physically inactive and eating the wrong foods all contribute to our risk of developing type 2 diabetes (Lal SB, 2016).

Television viewing, video viewing, and cell phone usage are positively correlated with an increasingly sedentary lifestyle (Fennell *et al*, 2019).

Sedentary lifestyles have a major impact on the overall health of the global population. Many people worldwide engage in sedentary lifestyles, and the prevalence of relevant non-communicable diseases is on the rise. Physical inactivity is the fourth leading risk factor for global mortality, accounting for 6% of global mortality (WHO, 2010).

Certain genes are known to cause maturity-onset diabetes of the young (MODY) and Wolfram syndrome. Genes also contribute to other forms of diabetes, including types 1 and 2 (Riaz S, 2009).

2.3.3 Complications

The number of people with diabetes mellitus has quadrupled in the past three decades, and diabetes mellitus is the ninth major cause of death. About 1 in 11 adults worldwide now have diabetes mellitus, 90% of whom have type 2 diabetes mellitus (T2DM) (Zheng *et al*,2017).

The complications of diabetes mellitus account for most of the morbidity and mortality associated with type 2 diabetes. Glycaemic control and long duration of illness are the most important risk factors of these complications (Unnikrishnan *et al*, 2017).

More than 65% of patients with T2DM die of cardiovascular disease; of these, nearly 80% are attributable to coronary artery disease (CAD) (Ali *et al*, 2010).

The presence of T2DM seems to confer a 3–4 times higher risk of cardiovascular disease to Asian Indian individuals, even after adjusting for sex, age, smoking status, hypertension and obesity (Forouhi *et al*,2006).

Cardiovascular disease is the leading cause of death among diabetics. 70 per cent of people with diabetes die of blood coagulation and 65 per cent of diabetics from heart diseases and stroke. People with diabetes are twice as likely to suffer from a heart attack or a stroke, as compared to healthy individuals. Diabetes can damage nerves as well as blood vessels, so heart attack can be 'silent' (lacking the typical chest pain) (Mahadevan, 2015).

In Chennai Urban Population Study, a population-based study conducted in two residential colonies in Chennai, in South India, CAD had a prevalence of 21.4% among individuals with T2DM, compared with 9.1% among those with normal glucose tolerance and 14.9% among those with impaired glucose tolerance (Mohan et al, 2001).

2.3.4 Management

The major goal of type 2 diabetes management is prevention of complications, by lowering blood glucose levels and reducing the cardiovascular risks (Arend *et al*, 2000).

Diabetes is a metabolic disorder affecting food (carbohydrate, fat and protein) metabolism. Nutrition therapy should be an integral part of its management. Diet management is the corner stone in diabetes management. It is an effective tool in combination with physical exercise. Inappropriate nutrition can make best planned pharmacological intervention ineffective (Giri *et al*, 2007).

Exercise, dietary changes and medications are used in the management of type 2 diabetes. Exercise improves blood sugar control, decreases body fat content, improves the body's reaction to insulin and decreases blood lipid levels (Thomas *et al*, 2006).

Incidence of diabetes was reduced by 37% with exercise and diet. It also had favourable effects on body weight, waist circumference and blood pressure (Orozco *et al*, 2008).

Yoga is a complementary and alternative treatment for type 2 diabetes mellitus. Yoga based interventions for the prevention and treatment of type 2 diabetes mellitus hold much promise. Yoga is a cost-effective treatment that is free of negative side effects (Sharma and Knowlden, 2012).

Yoga is a nondrug, non-invasive, and cost-effective method which has therapeutic intervention and protective effects on blood sugar and lipid profile of elderly women. The beneficial effects of yoga on long-term basis would bring proper control of blood sugar and lipid profile level in elderly women with Type 2 Diabetes Mellitus (Mondal *et al*, 2018).

Self-monitoring of blood glucose (SMBG) is an integral part of a regular management of diabetes mellitus. Self-monitoring of blood glucose provides information regarding individual's dynamic blood glucose Profile. Proper monitoring of blood glucose level will help in scheduling of food, activity, and medication.

Self-monitoring of blood glucose is an essential tool for people with diabetes who are taking insulin or for those who experience fluctuations in their blood glucose levels, especially hypoglycaemia (Kirk and Stegner, 2010).

Foods rich in vegetable oils, including non-hydrogenated margarines, nuts, and seeds, should replace foods rich in saturated fats from meats and fat-rich dairy products (Risérusa *et al*, 2009).

Decreased physical activity increases the risk of diabetes mellitus by as much as 14%, while brisk walking at least 1hr per day decreases the risk of diabetes mellitus by 34% (Hu et al, 2003).

Lifestyle and behavioural factors play an important role in the development of diabetes mellitus, and lifestyle modification is crucial to successful management (Clark *et al*, 2004).

Life style modification in relation to obesity, eating habit and physical exercise can play a major role in the prevention of diabetes mellitus. Maintaining a balanced diet and physical exercise can have potential benefits in the prevention and control of complications from chronic diseases particularly cardiovascular risk and diabetes mellitus (Prabha and Laxmi, 2012).

2.4. NUTRITIONAL REQUIREMENTS AND DIETARY HABITS

Women should approach middle age with a good nutritional status and in good physical condition. A variety of foods should be consumed to meet nutritional requirements, and if the diet is restricted, supplements should be added. (Moghissi and Evans 2003).

National Sample Survey Office (NSSO), 2000 reports that all adult women in India consume cereals every day; their diets tend to be monotonous and there is very little dietary diversity. Fruits are eaten daily by only 8 percent of women and only one-third of women eat fruits at least once a week.

Almost one-third of women in India never eat chicken, meat or fish and very few women (only 6 percent) eat chicken, meat or fish every day. Eggs are consumed less often than chicken, meat or fish.

According to NSSO, 2000 Women in households belonging to low socio-economic group are less likely than other women to eat items from each type of food group listed and their diet is particularly deficient in fruits and milk or curd.

A study by Nemati and Baghi (2008) the mean of daily iron and vitamins intakes of post-menopausal women were adequate. However the mean of folate, vitamins B12 and B6, calcium, zinc, selenium and calorie intake were less than dietary reference intakes.

Fruits and vegetables could enhance satiety though their high water content and low energy density.Adding fruits and vegetables to the diet can reduce overall energy density and allow consumption of satisfying portions while reducing calories his strategy could play an important role in weight management especially for postmenopausal women (Rolls *et al* 2004).

Diets rich in wholegrains, fruits, vegetables, legumes, and nuts; moderate in alcohol consumption; and lower consumption of refined grains, red or processed meats, and sugar-sweetened beverages reduce the risk of diabetes and improve glycaemic control and blood lipids in patients with diabetes (Ley *et al*,2014).

Food is an important part in the management of diabetes. This has been realized for a long time as the cornerstone of diabetes management. Diabetes is a lifelong disease and hence, diet modification must be carried on for lifetime. Refined carbohydrates like glucose, sugar, sweets should be avoided. Fat and proteins can be consumed as usual unless restricted. Sufficient vegetables and fibers in diet are recommended. Suggested calorie distribution is 12-20% from protein, 50-60% from carbohydrate and 20-30% from fat (Giri *et al*, 2007).

Managing weight through regular exercise and a sensible diet helps in maintaining type 2 diabetes. It is also beneficial to control blood pressure and cholesterol, avoid smoking and restrict alcohol. People with risk factors for diabetes should be screened regularly with glucose tests. Early detection and treatment can avert many diabetic complications (Riaz S, 2009).

2.5 IMPORTANCE OF NUTRITION EDUCATION

Nutrition is considered to be one of the most essential areas that are associated with ones living; it is stated that a person is what he eats and the mind-set of an individual is made up of what he consumes as part of his nutritional requirements (Kapur R, 2018).

The importance of nutrition education has become increasingly now that there is consensus that peoples food choices, dietary practices and physical activity behaviors influence health. Increased risk of chronic diseases and concern

about high rate of obesity has added urgency to the need for nutrition education. Nutrition education can be delivered through multiple venues and its scope is broad (Contento IR, 2007).

Effective nutrition education and promotion comprises of numerous constituents: 1) skill building to make possible positive behaviour change; 2) environmental and policy changes to make the healthy choice the easy choice, and 3) incorporated schemes and social marketing to fabricate society and collective support (Nutrition Education and Promotion, 2010).

The high prevalence of nutrition-related chronic illnesses with obesity and overweight among the most challenging and steadily rising public health problems suggests that nutrition education needs to be a priority for adults and nutrition educators must be knowledgeable about diet and disease relationships specific to the population (Johnson *et al*,2008).

Effective nutrition interventions should have a behavioral focus that will reduce the targeted risk factors and comprise strategies that are developmentally and culturally appropriate (Shariff *et al,* 2008).

Barriers pertaining to health preventive behaviors along with the determinants of intake should be taken into account and solutions should be designed (Pollarad *et al,* 2009).

Baek *et al*, 2008 investigated the effects of the nutrition education on body weight, visceral fat and diet quality among postmenopausal women. Nutrition education consisted of counselling in portion control, food selection for low carbohydrate, high fiber food items and for the improvement in micronutrient intakes and diet quality. Results show that nutrition education program was an effective intervention measure for the reduction of body weight and visceral fat, blood pressure, glucose and lipid levels in the blood and also for the improvement of nutrient intake and diet quality in postmenopausal women who are overweight.

According to Rafique *et al*, (2006) Knowledge, beliefs and practices of diabetics were less than satisfactory among diabetics. Diabetes education programs should be conducted to empower diabetic patients with a view to enhance them to make decisions, ownership in managing and controlling their diabetes.

A cross sectional study was conducted to assess the knowledge, attitude and practice among patients with Type 2 diabetes mellitus in Karnataka. The study revealed that about 61% patients were not aware of the common symptoms of the disease and less than 20% knew about the complications also the attitude and practices towards prevention and control of diabetes among the respondents were not satisfactory (Satyanarayana and Mahendrappa, 2014).

METHODOLOGY

CHAPTER-3

METHODOLOGY

Methodology is a plan and procedure for carrying out the research. It refers to research techniques and strategies for obtaining valid information and it is an approach to understanding phenomenon. In short, methodology refers to philosophy on which research is based (Ahuja, 2005). Research methodology gives detail description about validation and reliability of the data. The methodology of the study entitled ***"A Systematic Study to assess the Prevalence of Obesity and Type II Diabetes in Pre and Post-menopausal Women"*** is given under the following heads.

3.1 Selection of Area

3.2 Selection of Samples

3.3 Selection of Tools for Data Collection

3.4 Assessment of Nutritional Status

3.5 Nutritional Education for Selected Samples

3.6 Assessment of Effect of Nutritional Education

3.7 Data Analysis

3.1. SELECTION OF AREA

Vypin is an island located 5 km from Ernakulam city in Kerala. In Kerala the prevalence of overweight and obesity has increased many folds in the past few decades, Among 44.6 per cent of the adult women population in Kochi faces burden of malnutrition in which 33.0 per cent were overweight or obese and 11.6 per cent were underweight (Isaac and Chandrashekar,2014).

A study done in southern Kerala looked at the variations in the prevalence of type 2 diabetes among different geographic divisions within a region. The prevalence of diabetes was the highest in the urban (12.4%) areas, followed by the midland (8.1%), highland (5.8%) and coastal division (2.5%) (Kutty VR *et al*, 2000). According to Menon VU *et al* (2006) The Amrita Diabetes and Endocrine Population Survey (ADEPS), a community based cross-sectional survey done in urban areas of Ernakulam district in Kerala has revealed a very high prevalence of type 2 diabetes mellitus (19.5%).

The Vypin Island of Ernakulam district was selected purposively for the study because it was convenient and the researcher had close access so that regular visits could be made for collection of data for the study.

The prevalence of obesity was found more in postmenopausal women as compared to premenopausal women according to Body Mass Index and Waist-Hip Ratio.

According to Body Mass Index, the prevalence was (70.30%) and 75.09% in pre-and postmenopausal women, respectively. According to Waist-Hip Ratio this prevalence was (74.54%) in premenopausal women and 87.92% in postmenopausal women (Khokhar, 2017).

3.2. SELECTION OF SAMPLES

A sample is a small set of data that a researcher chooses or selects from a larger population. Sampling is simply the process of learning about population on the basis of a sample drawn from it (Gupta, 2003).

A purposive sampling method was used to select the samples for the study. In this technique the researcher purposely choose the subjects, who are in his judgment about some appropriate characteristic required of the sample members, who are thought to be relevant to the research topic and who are easily available to him (Ahuja, 2005). One fifty middle-aged women of age 35-55 year were selected from the villages of Vypin, Ernakulam district Kerala (Seventy five pre-menopausal and seventy five post-menopausal middle aged women).

Overweight and obesity are defined as abnormal or excessive fat accumulation that presents a risk to health. In adults, a body mass index (BMI) over 25 is considered overweight, and over 30 is obese (WHO, 2021). Obesity has now become an epidemic across the world (Wilborn *et al*., 2005).

Women are more likely to be obese as compared to men especially abdominal obesity. Females are more prone to diabetes and hypertension as the central obesity assessed by waist circumference is statistically associated (Gothankar, 2011). In a study done by Nagarkar and Kulkarni (2018), 59.7% of middle age women had waist circumference above 80 cm. The study result shows that 38.9% of the women were overweight and 21.2% women were obese. Around 59% of middle –age women had attained menopause.

Diabetes Mellitus is a metabolic disorder characterised by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism, resulting defects in insulin secretion, insulin action or both (WHO, 2011). Among the various types of diabetes type 2 is the most common form affecting approximately 90 to 95 percent of diabetics worldwide and accounts for most of the public health burden attributable to diabetes (Tuomilehto, 2006; Cox *et al*, 2004).

Among the premenopausal women, only (1.1%) had type 2 diabetes, whereas the prevalence rate was high at 3.8% in women after natural menopause and 4.0% after surgical menopause or menopause from other cause (Heianza *et al*, 2013).)The prevalence of diabetes in Kerala is more than 17 percent (Kesavadev, 2006).

According to Soman (2007) the prevalence rate of diabetes, in rural Kerala, is similar to or higher than that reported from urban India elsewhere.

3.3. SELECTION OF TOOL FOR DATA COLLECTION

Research tools helps in measuring and guiding the researcher to collect data and analyze them. Selection of appropriate tool is necessary for collection of each information (Prabhat and Pandey, 2015).

3.3.1. Interview Schedule

The interview method of collecting data involves presentation of oral verbal stimuli and reply in terms of oral verbal responses. This can be used through personal interviews and also can be carried out in structured way (Kothari, 2003). According to Thanulingam (2000) interview schedule is a pro forma containing a set of questions and are very useful in gathering information.

An interview schedule is a written list of questions, open ended or closed, prepared for use by an interviewer in person-to person interaction (Kumar R, 2011). It is generally filled by the researchers or the ones who are specially appointed for the purpose. The schedule was developed in systematic order to find the socio economic information, personal characteristics, dietary patterns and physical activity of the subjects. A sample of the interview schedule and questionnaire used is included in appendix I. Samples were interviewed personally using a well-structured interview schedule in this present study.

3.3.2. Questionnaire

A questionnaire consists of a number of questions printed or typed in a definite order on a form or set of forms. The questionnaire is mailed to respondents who are expected to read and understand the questions and write down the reply in the space meant for the purpose in the questionnaire itself. The respondents have to answer the questions on their own (Kothari, 2003). The researcher uses a questionnaire to gather information from the respondents to answer the research questions.

A questionnaire is a very convenient way of collecting information from a large number of people within a period of time. Hence, the design of the questionnaire is of utmost importance to ensure accurate data is collected so that the results are interpretable and generalizable (Jenn, 2006).

Fifty closed end questions were included in the questionnaire which imparts different questions related to healthy eating habits and the lifestyle diseases. The questionnaire was distributed prior and after providing nutritional knowledge to the samples.

3.3.3. Pilot Study

To ensure the effectiveness of the schedule a pilot study was conducted. The tools were administered to a small group of samples 20 and it was found that certain modifications were needed in the schedule and accordingly the changes were made to make the schedule effective, meaningful and understandable.

3.4. ASSESSMENT OF NUTRITIONAL STATUS

Nutritional status is a global term that encompasses a number of specific components (August *et al*., 2002).

Nutritional assessment of groups and individuals is a prerequisite to planning for the prevention or solution of nutrition-related health problems (Brown, 2011). Proper nutrition is the single most important component of preventative health care. Heart disease, diabetes, and other ailments are all linked to dietary habits. Accurate nutritional assessment can be a matter of life or death (Routledge, 2018).

3.4.1. Anthropometric Measurements

Nutritional anthropometry is measurement of human body at various ages and levels of nutritional status and it is based on the concept that appropriate measurements should reflect any morphological variation occurring due to a significant functional physiological change (Rao and Vijayaraghavan, 2003).

According to NIN (2009) nutritional anthropometry is a measurement of human body at different age levels and degrees of nutrition. Growth retardation may be the first response of the body towards nutritional deficiencies while appearance of clinical signs may be the final stage. From the public health point of view identification helps to prevent milder cases going into severe forms with consequent risk of high mortality.

According to Kidy *et al*, (2017), one of the best clinical utilities of anthropometric data is to define obesity. Anthropometric includes measurement of BMI, waist circumference, waist-to-hip ratio, and waist-to-height ratio to determine obesity.

3.4.1.1. Height Measurements

The height of the individual is influenced both by genetic and environmental factors. Height is affected only by long term nutritional deprivation, so it is considered as an index of chronic or long duration malnutrition (Sreelakshmi, 2015).

Plate: 1 Measurement of Height.

Height (centimetres) of the subjects was measured in standing position to the nearest 0.1 cm using a non-stretchable steel tape. The subjects was made to stand erect, looking straight in front, buttocks, shoulders and head touching the wall, heels together, toes apart and hands hanging loosely by the sides.

3.4.1.2. Weight Measurements

Body weight is a sensitive indicator of obesity (Venkatalakshmi and Peramma, 2000). Height and Weight are useful in determining the nutritional status in all age group. Both should be measured, because there is a tendency to overestimate height and underestimate weight, resulting in under estimation of relative BMI (Tehard *et al*., 2002).

The weighing machine was used to weigh all the samples. The zero error of the weighing scale was checked before weighing each woman. The respondents were made to stand erect on the weighing scale, without footwear, not leaning against or holding anything and the weight was recorded in kilograms. Body weight gain was a quantifiable predictor of type 2 diabetes mellitus as well obesity in women (Kodama *et al*, 2013).
By measuring the height for age, weight for age, and weight for height, over time, anthropometric measurements can help identify inadequate growth patterns (Fryar,2016)

Plate: 2 Measurement of Weight.

3.4.1.3. Body Mass Index (BMI)

Body mass index (BMI) is a simple index that is commonly used to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m^2) (WHO, 2021). Body Mass Index (BMI) of each subject was calculated from the recorded height and weight measurement using the following formula (Park, 2017).

In comparison to women with normal BMI, overweight, obese class I and II ($30 \leq BMI < 39.99$), and class III ($BMI \geq 40$) individuals face increased risks of developing type 2 DM with 7.6%, 20.1% and 38.8% greater risk respectively (Hu *et al*,2002).

BMI, fat mass and waist circumference were significantly higher in postmenopausal women, whereas fat free mass was significantly lower compared to premenopausal women (Garaulet *et al*, 2002).

$$\textbf{Body Mass Index (BMI)} = \frac{\textbf{Weight (Kilograms)}}{\textbf{Height (metre square)}}$$

Table 1: Classification of Body Mass Index

Classification	BMI(kg/m^2)	
	Principal cut-off points	**Additional cut-off points**
Underweight	**<18.50**	**<18.50**
Severe thinness	<16.00	<16.00
Moderate thinness	16.00 - 16.99	16.00 - 16.99
Mild thinness	17.00 - 18.49	17.00 - 18.49
Normal range	**18.50 - 24.99**	**18.50 - 22.99**
		23.00 - 24.99
Overweight	**≥25.00**	**≥25.00**
Pre-obese	25.00 - 29.99	25.00 - 27.49
		27.50 - 29.99
Obese	**≥30.00**	**≥30.00**
Obese class I	30.00 - 34.99	30.00 - 32.49
		32.50 - 34.99
Obese class II	35.00 - 39.99	35.00 - 37.49
		37.50 - 39.99
Obese class III	≥40.00	≥40.00

Source adapted from WHO, 2004

3.4.1.4. Waist to Hip Ratio

A flexible, non-stretchable tape was used. The measurement was taken from the smallest circumference between the nipples and the top of the thighs. The hip circumference is defined as the largest circumference between the waist and the knees. The subject was asked to stand straight with her arms hanging loosely. The tape was wound around their waist gently, but firmly without pressing tightly (WHO, 2008).

Plate: 3 Measurements of Waist and Hip Circumference.

Waist-to-hip ratio is an indicator to complement the measurement of BMI, to identify individuals at increased risk of obesity related morbidity due to accumulation of abdominal fat Waist hip ratio (WHR) differentiates between android and gynoid obesity. A WHR of 0.85 or greater in women is indicative of android obesity and increased risk for obesity related diseases (WHO, 2000).

Waist-circumference or waist-to-hip ratio (WHR) can better reflect the accumulation of intra-abdominal fat and might be a better predictor than BMI of the risk of type 2 diabetes in women (Cheng et al, 2010).

$$\textbf{(Waist to Hip Ratio) WHR} = \frac{\textbf{Waist Circumference (Centimeters)}}{\textbf{Hip Circumference (Centimeters)}}$$

3.4.2. Biochemical Analysis

According to Gordon (2000), biochemical tests are the most objective and sensitive measures of nutritional status. Biochemical tests help to detect deficiencies before symptoms are clinically evident.

Biochemical estimation helps to confirm clinical and dietary data, so that diagnosis can be made and the nutritional and medical care can be planned and implemented effectively. Biochemical tests which can be conducted on easily accessible body fluids such as blood and urine can help to diagnose disease at the sub clinical stage, and confirm clinical diagnosis at the disease stage (Bamji, 2003).

The samples were tested for Fasting Blood glucose level. The test was done for all the samples with the help of a lab assistant.

3.4.2.1. Blood Glucose

Diabetes or elevated blood sugar levels are a common chronic morbidity experienced by women of reproductive ages (Centre for Disease Control, 2011). Glucose is a simple sugar that the body uses to provide the cells with energy. The body normally protects itself from the damaging effects of high glucose levels by neutralizing the glucose it does not need. Insulin is the main substance used to keep blood glucose levels from becoming too high, but people who have diabetes might either have a resistance to the effects of insulin or might not produce insulin at all. This is how diabetes and glucose are related (Hernandez, 2022).

Glucose is a type of sugar that serves as the main source of energy used by the body. Insulin is a hormone that helps the body's cells to use the glucose. Excess or shortage of insulin in the body causes an imbalance of the blood glucose in the body, leading to its severe drop or drastic increase in the blood. Blood glucose levels that remain high over time can cause damage to the eyes, kidneys, nerves and blood vessels. Chronic low glucose levels can lead to brain and nerve damage (Khanna et al., 2005).

The present study the fasting blood glucose level of all the respondents were estimated using the glucometer to compare the prevalence of diabetes among pre and post-menopausal women respectively, and were categorised as having normal sugar level, pre diabetic and diabetic as per the values suggested by WHO (2006a).

Table 2: Diagnostic Criteria for Diabetes

Parameter	**Normal**	**Pre-diabetes**	**Diabetes**
FPG (Fasting Plasma Glucose)	< 110 mg/dl	110-125 mg/dl	≥126 mg/dl

Source: ICMR, 2018

3.4.3. Dietary Assessment

Dietary assessment is an evaluation of food and nutrient intake and dietary pattern of an individual or individuals in the household or population group over a time.

It is one of the four approaches in nutrition assessment to evaluating the nutritional status of individuals. Selection of an appropriate method for dietary assessment depends on the purposes of the study, which may be to measure food consumption, nutrient intake or eating habits. (Food and Agriculture Organisation, 2018).

Diet surveys constitute an essential part of any complete study of nutritional status of individuals or groups, providing essential information on nutrient intake levels, sources of nutrients, food habits and attitudes (Swaminathan, 2004).

3.4.3.1. 24 Hour Recall

According to Garrow (2000) in diet recall the respondent is asked to recall the actual food and drink consumed on specified days, usually the immediate past 24 hours. Dietary assessment is an evaluation of food and nutrition intake and dietary pattern of an individual or individuals in the household or population group over time. It is one of the four approaches nutritional assessments to evaluating the nutrition status of individuals comprehensively (Gibson, 2005).

A 24-hour diet recall is a dietary assessment tool that consists of a structured interview in which participants are asked to recall all food and drink they have consumed in the previous 24 hours. It may be self-administered (Medanth, 2017). The food intake of all samples was recorded by 24hour diet recall method.

The subjects were asked to recall a day's food intake in terms of simple household measures. Nutritive value of food was computed using food consumption table given by Indian Food Composition Table (IFCT, 2017). From these data the mean food intake and nutrient intake were calculated and it was compared with Recommended Dietary Allowances (RDA) (NIN, 2020).

3.4.3.2. Food Frequency List

Food Frequency List consists of a list of food items with response categories to indicate the usual frequency of consumption over a certain time and estimated total energy and nutrient intakes are calculated by frequency of consumption of each food item, with consideration of portion size (Vijay *et al*, 2020).

In food frequency questionnaire, the respondents are presented with a list of foods and is required to say how often each item is consumed. Food frequency questionnaire [FFQs], in particular, are main research tools in nutritional epidemiological studies, and assessing their validity is an important requirement for their use in studies of diet-related disease risk (Hinnig *et al*, 2014).

3.5. NUTRITION EDUCATION FOR SELECTED SAMPLES

Nutrition education has been described as the process, which assists the public in applying knowledge from the nutrition science and the relationship between diet and health to their practices (Barasi, 2007).

Nutrition education is the process by which people gain knowledge of nutrition and are persuaded to bring about required changes in their food habits (Contento, 2010). Thus, nutrition education helps people gain knowledge of nutrition and persuades to bring about required changes in their food habits.

Nutrition education was imparted to all the selected samples by conducting nutritional education classes and creating you tube videos. The aspects covered were importance and functions of food, incidence of obesity and type2 diabetes in post-menopausal women, causes, risk factors, complications, management of obesity and type2 diabetes mellitus, nutritional goals and dietary requirements.

Speakman et al. (2005) hypothesised that the lack of education about energy content of food may contribute to the effects of social class on obesity. It is possible that more highly-educated people have the knowledge to develop healthy lifestyles and have more awareness of the health risks associated with being obese (Yoon, 2006).

Nutrition knowledge and skills enable individuals with type 2 diabetes (T2DM) to make food choices that optimise metabolic self-management and quality of life. In this present study nutrition education was imparted through various audio visual aids.

Plate: 4 Imparting Nutrition Education to the Subject

Plate: 5 Imparting Nutrition Education through YouTube videos

Plate: 6 Nutrition Education to Middle-age women.

3.6. DATA ANALYSIS

Data Analysis is a process of inspecting, cleansing, transforming and modelling data with the goal of discovering useful information, informing conclusions and supporting decision making. The process of performing certain calculations and evaluation in order to extract information from data is called data analysis. Analysis of data involves organizing data in a proper way (Ibrahim M, 2015). Data analysis can refer to a variety of specific procedures and methods. It includes ways of working with information (data) to support the work, goals and plans of the study (AED/TAC, 2006).

3.6.1 Analysis of Socio Economic Status

Socioeconomic status (SES) is defined as a measure of one's combined economic and social status and tends to be positively associated with better health (Baker H.E, 2014). According to Townsend et al, 2009, the ability of low-income women to purchase nutrient-dense foods can be undermined because of poor financial resources. The trend for being overweight and obesity, as seen in high-income countries, is now also emerging in low-income ones as a result of the observed shift from traditional diets to westernised diets and reduced levels of physical exercise (Martorell *et al*., 2000).

In addition, a rapid increase in the level of sedentary jobs has had a major role in the development of the current epidemic of being overweight or obesity (Brown *et al*., 2003).

3.6.2. Analysis of Food Frequency Score

Food frequency is defined as the frequency (consumption over a reference period) of a specific food item or food group is eaten at the household level (FCS, 2008).

Frequency of use was measured on 5 points. Food were classified into different groups and scored as follows

Daily	5
Alternate days	4
Twice in a week	3
Once in a week	2
Fortnightly	1
Never	0

The value obtained for the subjects in the table of frequency of use of different food item is multiplied by the respective scores given for the frequency and divided by 100. The value thus obtained for each food item is then added which gives the mean score of food item. The mean is then multiplied by 100 and divided by 5 which give the percentage score.

3.6.3. Analysis of Change in Food Consumption Pattern

Dietary practices and nutritional knowledge have a potential to affects a person's quality of life. Studies focussing on current dietary intake among rural postmenopausal women are scarce. Inadequate nutrient intake and poor knowledge about their nutritional requirement may impose a risk for affecting the health. Nutrition education and interventions on healthy eating, healthy life style which is necessary to promote and improve healthy ageing and to overcome the post-menopausal problem (Kashyab and Chhabra, 2019).

According to Jeewon and Bhurosy, (2013), Post-menopausal women adhered to more dietary guidelines than premenopausal women. This is supported by the high consumption of high-fat protein sources, fats, sweetened beverages and fast food meals among premenopausal women. Post-menopausal women adhere to better eating habits aiming to reduce the effects of physiological changes occurring during this life stage (Schoppen et al., 2005).

Post-menopausal women were more health-conscious), full-cream dairy products were largely preferred by them, demonstrating awareness for osteoporosis prevention (Pon et al., 2006). The food consumption pattern before and after nutrition education programme were conducted. A set of yes or no questions were given to samples and they were asked to answer.

The communication materials for nutritional education of selected samples were in the form of lectures and which contain the following topics-

- Balanced diet
- Healthy eating habits to maintain normal BMI
- Influence of diet pattern in the onset of Type II Diabetes Mellitus.
- Locally available foods in the control of Blood Glucose Level and body weight.

For the assessment of nutritional knowledge of samples, a questionnaire consisting of fifty objective type questions was formulated. The nutritional awareness among the selected subject was determined by a structured objective type questionnaire before the exposure of communication materials.

In this pre-test, one mark was given for each correct answer and zero mark for each wrong answer. The score gained in pre-test decides the level of nutrition knowledge among selected group of respondents. After the conduction of nutrition education, a post test was taken and the results were compared.

3.6.4. Statistical Analysis

Statistics is the field of science that involves the collection, analysis and reporting of information that has been sampled from the study (Smith, 2021).
According to statistics is a field of study whose objective is transformation of data (sets of numbers along with identifying characters) into information (set of graphs, tables) (Heiberger and Holland, 2001).
For the present study statistical analysis were done by using different tests.

RESULTS AND DISCUSSION

CHAPTER-4

RESULTS AND DISCUSSION

The results section reports the findings of the study based upon the methodology applied to gather information or simply state the findings of the research arranged in a logical sequence without bias or interpretation. The present study was conducted to assess the "***A Systematic Study to assess the Effect of Nutritional Awareness Programme and Prevalence of Obesity and Type II Diabetes in Pre and Post-Menopausal Women"*** in the women age group between 35-55 years. The sample population consist of 150 middle-age women was selected from residing areas of Vypin Island of Ernakulam district, Kerala.

4.1 Socioeconomic Details of The Subjects

4.2 Lifestyle Pattern of The Subjects

4.3 Medical History of The Subjects

4.4 Obstetrical Details of The Subjects

4.5 Anthropometric Measurement of The Subjects

4.6 Biochemical Measurements of The Subjects

4.7 Food Habits And Dietary Pattern of The Subjects

4.8 Effect of Nutrition Awareness

4.1. SOCIOECONOMIC DETAIL OF THE SUBJECTS

Socioeconomic status (SES) is the measurement of a person's economic and social status and it also results in better health (Baker, 2014). According to Anyanwu et al., 2010, there was an increase between obesity and high socioeconomic level among women in developing countries.

4.1.1 Personal Characteristics of the Subjects

To analyze the personal characteristics of the subjects, details regarding age marital status, type of family and family size were examined and presented in Table: 3

Marital status and the onset of metabolic changes are positively related (Mogre et al., 2014). The women are more likely to engage in less physical activity, have more stable dietary patterns, and are less active after marriage (Janghorbani et al., 2008).
In the present study 150 middle-aged women were examined. The martial status of the subjects revealed that 95.3 percent were married, 0.66 percent was single.

Family is a group of people afflicted by consanguinity, affinity and coresidence. It is the principle institution for the socialization of children. In

this generation, most of the families are trying to find a space for their own and to create an independent life style.

In the present study, 84.6 percent respondents belong to nuclear family and rest of them 15.3 percent belonged to joint family.

Majority of the families, 66 percent had one to four members and 33.3 percent had five to eight members. It was noted that only 0.66 percent of the families had more than eight members.

Table: 3 Personal Characteristics of the Subjects

Criteria	**Category**	**No. of Subjects**	**Percent**
Marital status	Single	1	0.66
	Married	143	95.3
	Divorced	0	0
	Prefer not to answer	6	4
	Total	**150**	**100**
Type of family	Nuclear	127	84.6
	Joint	23	15.3
	Total	**150**	**100**
Family size	1-4	99	66
	5-8	50	33.3
	More than 8	1	0.66
	Total	**150**	**100**

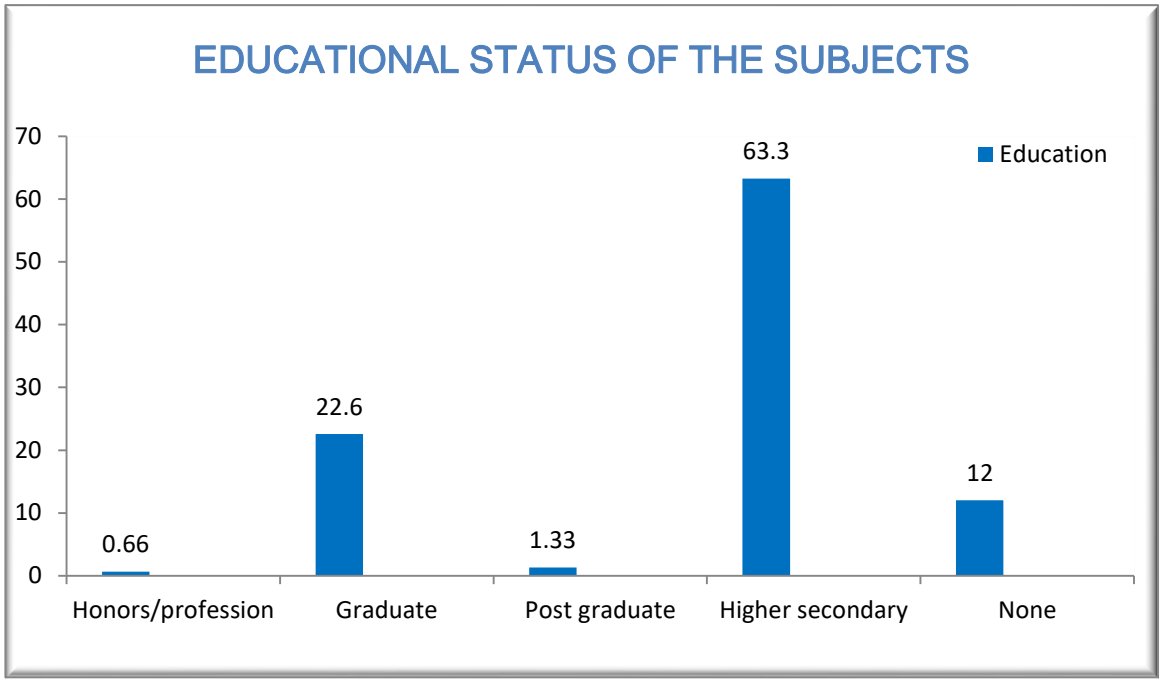
4.1.2. Educational Status of the Subjects

Education is a process in which knowledge, characters and behavior of the human being are shaped and developed. The purpose of education is not only self- realization of individuals but also to bring a potential in them.

According to Imam Ghazali, "Education is a process which a person enables to differentiate between good and bad, right and wrong, true and false". Education plays an important role in improving the standard of living among women.
According to Binod A, (2019), the literacy rate is greater in urban areas of Ernakulam district than the rural areas.
Figure 1, clearly depicts that majority (63.3%) had received high school education, 22.6% were graduates, 1.33% were post graduates and 12% of the subjects did not receive proper education.

Low and high education level was a strong determinant of obesity among women. Also, women with higher education had significantly lower BMI and WC (Shahraki et al., 2008).

Figure 1: Educational Status of the Subjects



4.1.3. Occupational Status of the Subjects

Occupation is that which occupies or engages the time, attention and the principal business of one's life. Occupation is considered as the main source of income and it also represents the socio economic status of the people.

Based on the Figure 2 the occupational status of the respondents revealed that majorities (87.3%) of the women were unemployed housewives and rest of them were engaged in income generated activities.

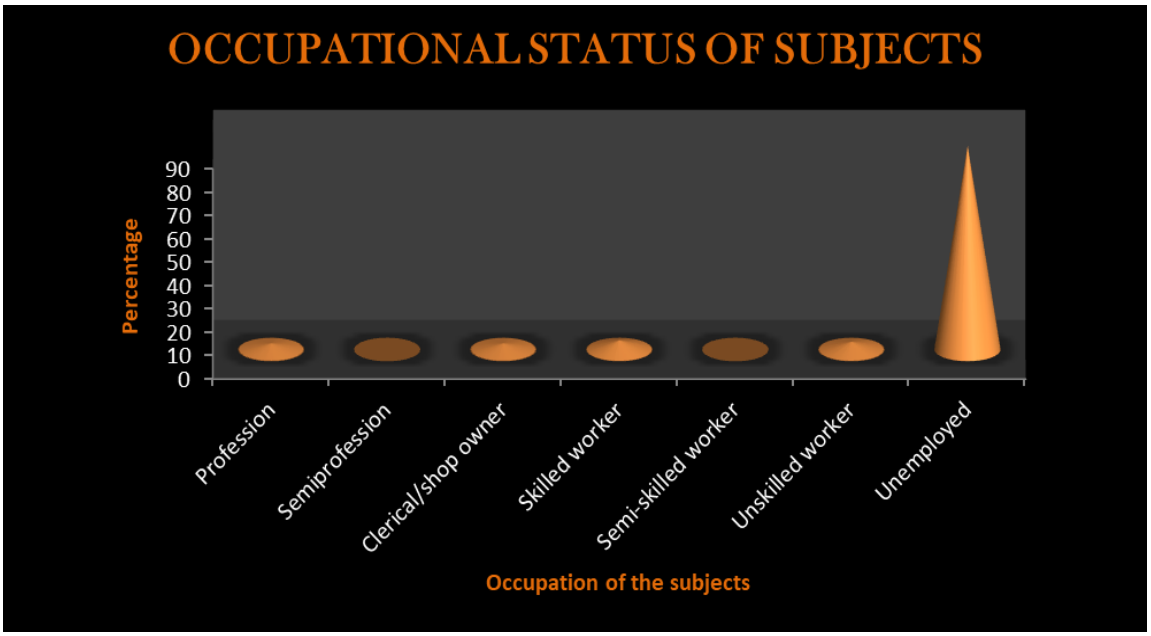
In employed women, majority (4%) were skilled workers and (3.33%) were unskilled workers. Three percent of respondents were professionals, clerical and shop owners.

Unemployment is endangering the socio-economic status of people, in spite of short-time unemployment benefits and is creating inequalities in health and serious social problems.

A long history of unemployment was associated with an increased risk of obesity among middle–age women (Laitinen *et al*, 2002).

In this present study, 98.6% of subjects were sedentary workers. Sedentary lifestyle is associated with a high incidence of chronic diseases such as cardiovascular disease, cancer and diabetes. Physical exercise is a powerful preventative and treatment intervention that is known to be effective in generating metabolic and immune health benefits (Huang *et al*, 2013).According to Blumel *et al*, 2015 obesity was observed among 18.5% of middle age women with sedentary lifestyle.

Figure: 2 Occupational Status of the Subjects

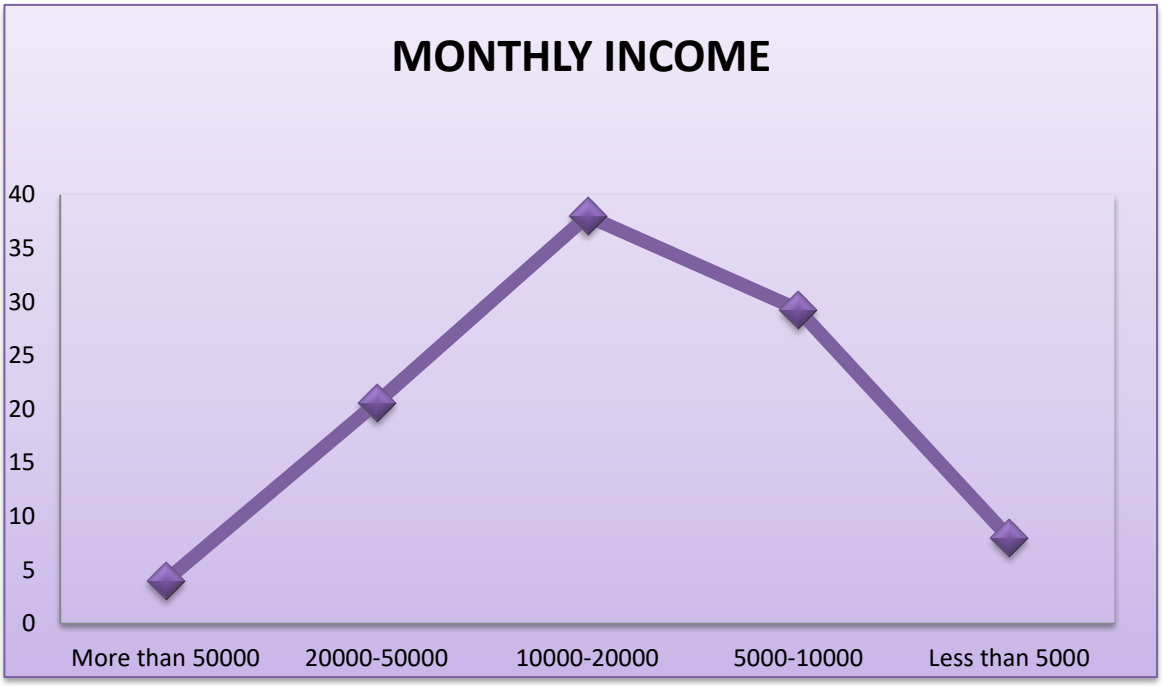


4.1.4. Monthly Income of the Subjects

Income is the consumption and savings opportunity gained by an individual within a specified time frame, generally expressed in monetary terms. On the basis of family income, the subjects in both the states were grouped into three categories, namely, the rich, consuming class and climbers (National Council of Applied Economic Research, 2007).

On the basis of monthly income 38 per cent of the families were earning about 10000-20000 Rupees whereas 29.3 per cent of them were able to earn 5000-10000 Rupees, 20.6 per cent earned 20000-50000, 8 per cent earned less than 5000 and only 4 per cent earned more than 50000.

Figure: 4 Monthly Income of the Subjects



4.2 LIFESTYLE PATTERN OF THE SUBJECT

Lifestyle is defined as a set of habits and customs that are influenced by the lifelong process of socialization, including social use of substances such as alcohol and tobacco, dietary habits, and exercise, all of which have important implications for health (Farlex Partner Medical Dictionary, 2012).

4.2.1 Duration of Sleep of the Subject

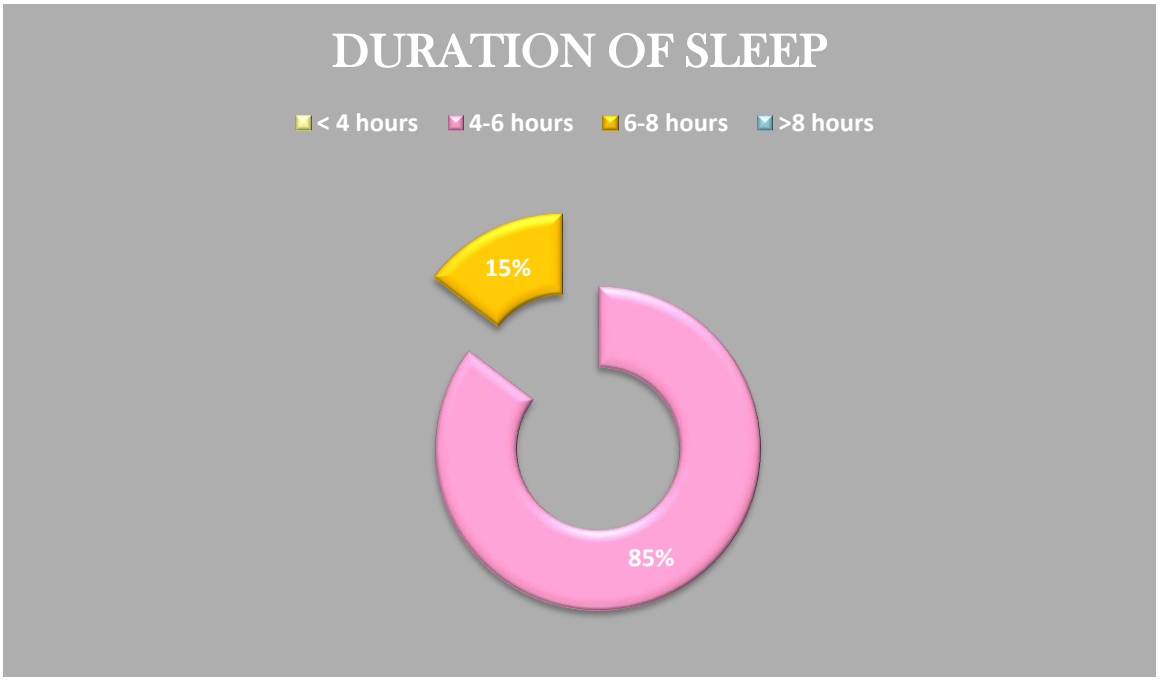
Sleep is an important modulator of neuroendocrine function and glucose metabolism and sleep loss has been shown to result in metabolic and endocrine alterations, including decreased glucose tolerance and alteration of appetite regulating hormone (Beccutia and Pannaina, 2011).

Sleep is important for health of the entire body. The decrease in sleep duration and increase in sleep complaints in modern society raise concerns for a negative impact of chronic sleep disturbances on health (Centre for Disease Control, 2011).

Sleep loss is a common condition in modern society, with evidence showing that we are sleeping on average only for 6.8 hours per night, which is 1.5 hour less than we did a century ago (National Sleep Foundation, 2003). According to Yaggi *et al*, 2006, Short and long sleep durations increase the risk of developing diabetes.

From figure 5 it was clear that 85 percent of the respondents sleep for 4-6 hours in a day and 15 percent respondents sleep for 6-8 hours per day.

Figure 5: Sleep Duration of the Subjects



4.2.2. Habit of Doing Exercise Regularly

Physical activity is defined as any bodily movement produced by skeletal muscles that result in energy expenditure. Exercise is a subset of physical activity that is planned, structured, and repetitive and has as a final or an intermediate objective the improvement or maintenance of physical fitness. Physical fitness is a set of attributes that are either health- or skill-related

Obese adults were predominantly physically inactive compared to healthy adults (Linder *et al*, 2021). A study showed that there was a significant difference seen among obese and non-obese individuals (Ramya *et al*, 2017). Women had high prevalence of low physical activity of 42.2% than men, and the low level of physical activity was associated with obesity (Costa *et al*, 2015).In the present study, only 13.3 percent of subjects were physically active. Out of this 13.3 percent, 65 percent of respondents did exercise for 1 hour and 10 percent for 2 hours.

Studies have indicated that brisk walking and aerobics are the best methods for controlling and reducing weight and body mass composition (Melam *et al*, 2016). According to Frank *et al*, 2003 Each 1 hour per day of brisk walking was associated with a 24 percent reduction in obesity and a 34 percent reduction in diabetes. 75 percent of subjects did brisk walking, 15 percent did aerobics and 10 percent did other type of exercises.

According to Souissi *et al*, 2002 group of people that was trained in the evening had greater improvements in anaerobic performance than them trained in the morning. Evening exercise is better than morning exercise (Chtourou *et al*, 2012 and Sedliak *et al*, 2008).Majority of the subjects (60%) did exercise in the evening whereas (30%) did exercise in the morning and rest of the subjects (10%) did exercise during other times of the day.

Table: 4 Habit of Doing Exercise Regularly

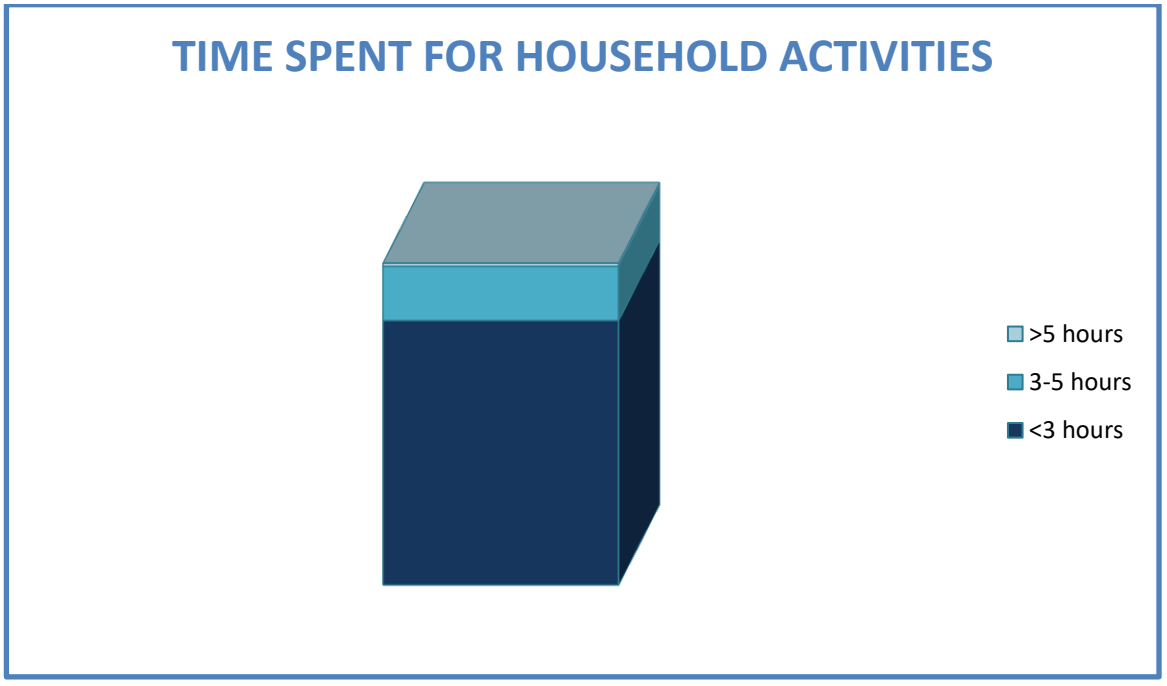
Criteria	Category	No.of Subjects	Percent
Do in regular exercise	Yes	20	13.3
	No	130	86.6
	Total	**150**	**100**
Time spend for exercise	<1 hours	5	25
	1 hour	13	65
	2 hours	2	10
	>2 hours	0	0
	Total	**20**	**100**
Type of exercise	Running	0	0
	Brisk walking	15	75
	Yoga	0	0
	Meditation	0	0
	Jogging	0	0
	Aerobics	3	15
	Other	2	10

	Total	**20**	**100**
Time preferred for exercise	Morning	6	30
	Evening	12	60
	Other	2	10
	Total	**20**	**100**

4.2.3 Time Spent for Household Activities

Household activities means essential household tasks that a person carries out as part of normal daily life including preparing meals, shopping, cleaning and laundry, and managing household finance.
Majority (83%) of subjects spent less than three hours a day for household activities whereas, (17%) spent 3-5 hours for doing household works.

Figure: 6 Time Spent for Household Activities



4.2.4 Leisure Time Activities of the Subjects

Entertainment provides fun, enjoyment and laughter. Entertainment is an activity which provides a diversion and permits people to amuse themselves in leisure time. It is generally passive. The type of screen time at home included watching television, cooking, reading, stitching etc.

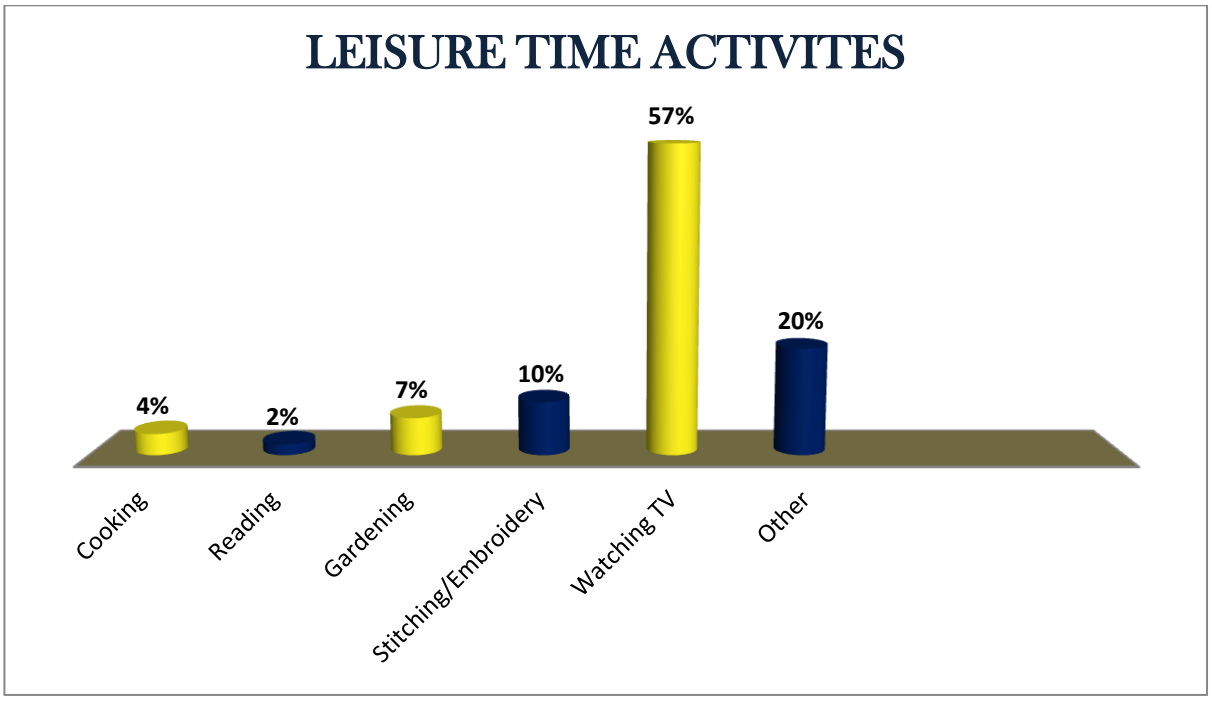
A randomized trial showed that reducing television viewing and computer use can decrease age-adjusted BMI; reduced calorie intake was thought to be the greatest contributor to the BMI decrease (Netto, 2008).

Duration of Watching TV is a significant factor for Overweight/ Obesity. Those who watch TV for 3-4 hours a day, 48 percent were overweight and 15 percent were obese, which is more than, who watch TV for 1-2 hours a day (Binu and Harnagle, 2014).

Women who spent more time watching TV tended to exercise less (Frank *et al*, 2003). TV watching results in increased food and total energy intake because individuals tend to eat while watching TV despite their low physical activity levels (Hu *et al*, 2001).

Figure 7 clearly depicts that 57 per cent of the respondents involved in watching TV, 20 per cent involved in other activities, 10 per cent in stitching/embroidery, 7 percent in gardening, 4 percent in cooking and 2 percent in reading.

Figure: 7 Leisure Time Activities of the Subjects



4.3 MEDICAL HISTORY OF THE SUBJECTS

Medical history includes an inquiry into the patient's medical history, past surgical history, family medical history, social history, allergies, and medications the patient is taking or may have recently stopped taking. Medical history includes a more in-depth inquiry into the patient's medical issues which includes all diseases and illnesses currently being treated, and those which have had any residual effects on the patient's health (Nichol *et al*, 2021).

4.3.1 Disease Details of the Subjects

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. The health of all peoples is fundamental to the attainment of peace and security and is dependent on the fullest co-operation of individuals and States (WHO, 2020).

Hereditary is an important factor of obesity. In this study, 80 percent of subject shows a family history of obesity. According to Sreelakshmi (2014) genetic inheritance probably influences 50-70 percent a person's chance of becoming fat more than any other factor. Within families the chance is 80 percent if both parents are obese and 50 percent if one parent is obese.

Table: 3 Medical History of the Respondents

Disease	**No.of Subjects**	**Percent**
Cardiovascular disease	6	4
Hypertension	63	42
Thyroid disorder	25	16.6
Diabetes	72	48
Deficiency disorder	12	8
PCOD	4	2.6
Hormonal problems	24	16

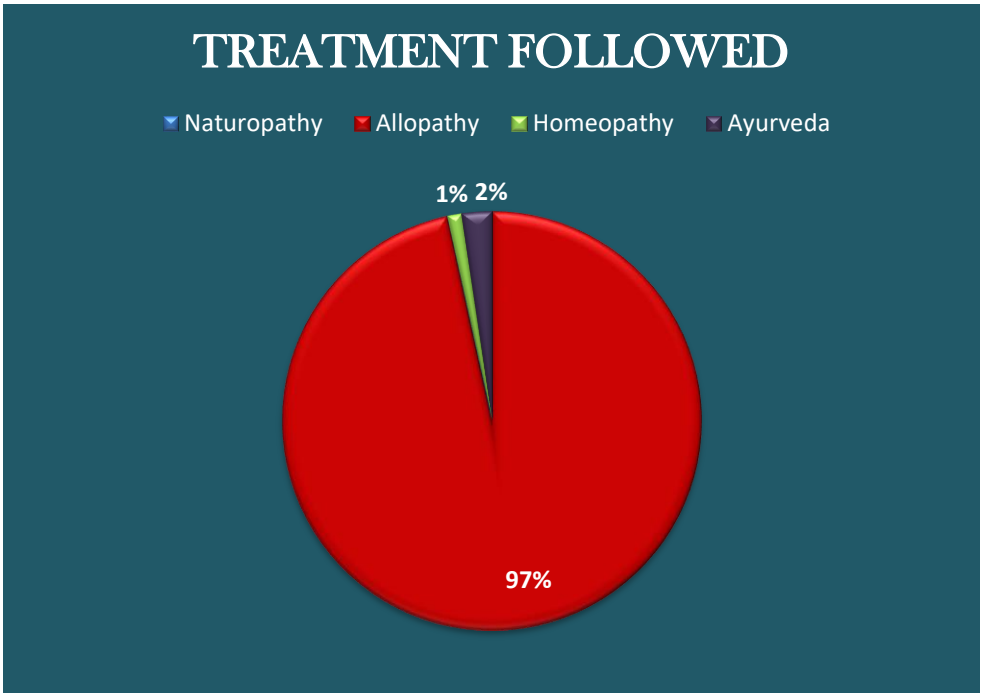
In this study, Majority of subjects were suffering from various diseases. Forty eight percent suffered from Diabetes mellitus, 42 percent had hypertension, 16.6 percent had thyroid disorder, 16 percent had hormonal problems, 8 percent had deficiency disorder, 4 percent had cardiovascular diseases and 2.6 percent suffered from Polycystic ovarian disorders.

4.3.2. Treatment They Followed

Majority of the subjects, Ninety seven percent followed allopathic treatment whereas only two percent followed ayurveda and one percent followed homeopathy.

Allopathy is essentially a piece of the western therapeutic framework and is spread everywhere throughout the world. Allopathy is basically a drug oriented methodology and relies on three things, hypothesis, experimentation, and the result of the Experiment.

Figure: 8 Treatment Followed By the Subjects



4.4 OBSTETRICAL DETAILS OF THE SUBJECTS

Obstetrics details of the subject includes age of menarche, menstrual problems and duration of menopause, age of marriage, details regarding the first pregnancy and type of delivery.

Table: 5 Obstetrical Details of the Subjects

Criteria	Category	No.of Subjects	Percent
Age of Menarche	8-11 years	90	61
	12-15 years	57	38
	>15 years	3	2
	Total	**150**	**100**
Duration of Menstruation	>7days	4	2.6
	5-7 days	115	76.6
	<5 days	31	20.6
	Total	**150**	**100**

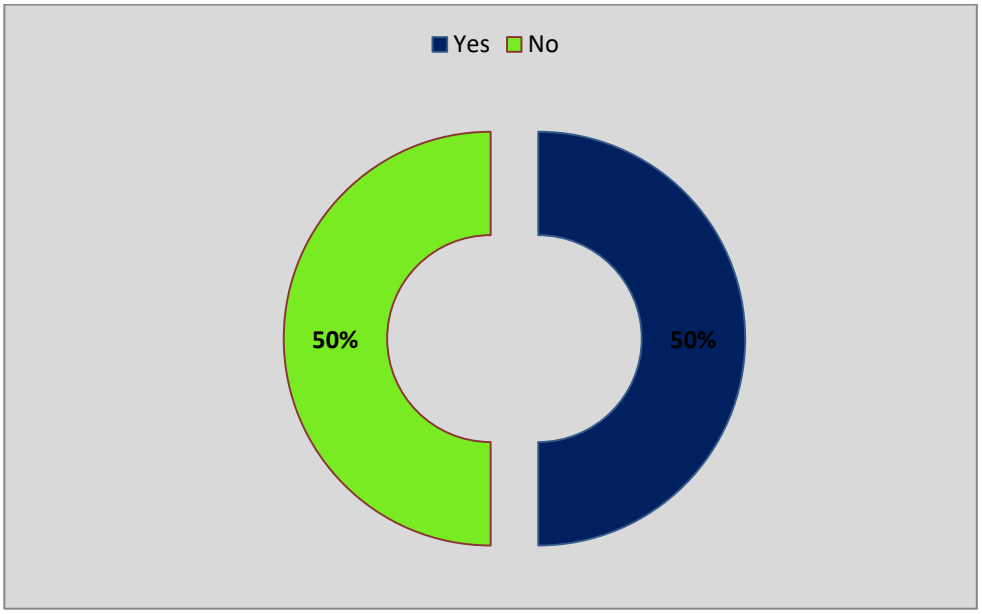
Age of Marriage	16-20	92	61.3
	21-25	54	36
	26-30	3	2
	>31	0	0
	None	1	0.66
	Total	**150**	**100**
Age of 1st Pregnancy	16-20	74	49.3
	21-25	65	43.3
	26-30	5	3.3
	>31	2	1.3
	None	4	2.6
	Total	**150**	**100**
Type of Delivery	Normal	116	77.3
	Caesarean	28	18.6
	None	6	4
	Total	**150**	**100**

Menopause stages were determined based on the regularity of menstrual cycles. Women who reported to have their monthly cycles were classified as pre-menopause, while who didn't get their cycles for 12 months or more were classified as Post menopause. The missing of cycles indicates the change in the cycle length. Studies from various regions of India indicate menopausal age to lie between 46 to 50years (Kripalini and Banerjee, 2005 and Ruma *et al*, 2012).

A similar age of menopause has been also reported from other developing countries (Peter et al, 2008 & Palacious *et al*, 2010).

In this present study, Fifty percent of the respondents attained menopause while other fifty percent are still in menstruation stage.

Figure: 9 Menopause Status of the Subjects



Menopause is associated with gradual reduction in hormone estrogen which causes hot flush, night sweat, sleep disturbances, weight gain, joint and muscle pain, vaginal dryness, painful sexual intercourse, loss of sexual interest, mood swings and anxiety (Shah *et al*, 2004).

The prevalence of commonly associated symptoms during menopause varies widely among individuals. There is a wide variation in the nature, severity and frequency of symptoms among the population of the same region.

The changes in hormonal profile commencing from mid years of women's life (45-50yrs) is associated to a variety of distress that are manifested into symptoms. These symptoms are referred to menopause symptoms. WHO regarded these symptoms occurring either singly or together as part of the menopausal stage.The symptoms related to vasomotor system were hot flashes, night sweats and insomnia.

According to Rokhande, 2014, Majority of subjects was experiencing insomnia, hot flashes and night sweats were also the most prominent symptoms of menopause with occurrence rate being 50-55%.

According to Bindhu, 2013 Most frequently occurring symptoms were feeling of fatigue (49.7%), irritation (41.1%), hot flushes (40.9%), muscle or joint pain (35.9%), night sweats (32.8%).More than 80% of postmenopausal women reported at least one menopausal symptom.

Table 4 clearly depicts that out of 75 respondents who attained menopause, 73.3% experience physical discomforts after menopause. Sixty three percent experience back pain/cramps, 32.7 percent experience hot flashes and 1.81 percent experience both night sweats and insomnia.

Table: 6 Physical Discomforts After Menopause

Criteria	Category	No.of Subjects	Percent
Physical Discomfort after Menopause	Yes	55	73.3
	No	20	26.6
	Total	**75**	**100**
Mention the discomforts	Back pain/Cramps	35	63.6
	Hot flashes	18	32.7
	Night sweats	1	1.81
	Insomnia	1	1.81
	Other	0	0
	Total	**55**	**100**

4.5 ANTHROPOMETRIC MEASUREMENTS OF THE SUBJECTS

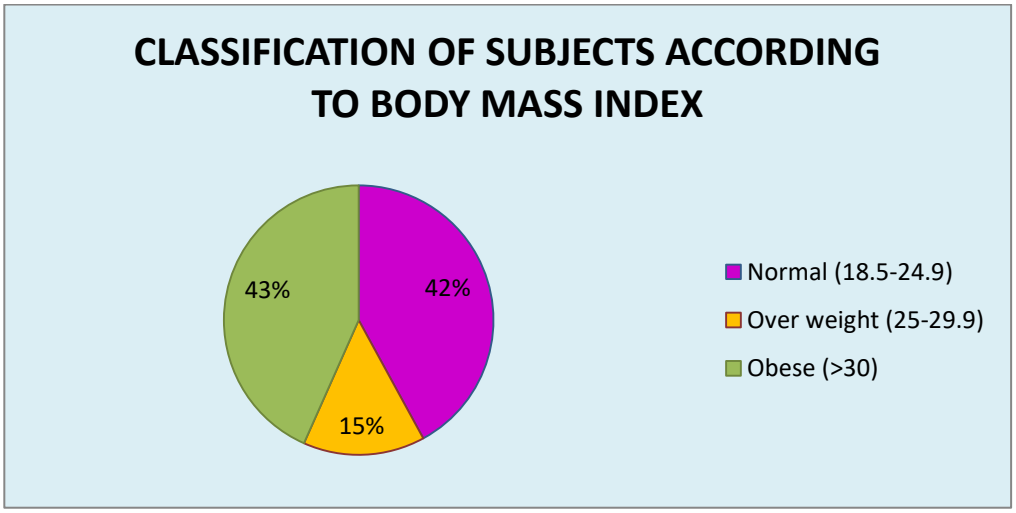
According to WHO (2012) anthropometry provides the single most portable, universally applicable, inexpensive and non-invasive technique for assessing the size, proportions and composition of the human body. It reflects both health and nutritional status and predicts performance, health and survival.

Anthropometry refers to the measurement of the human individual. Average height and weight of the peoples varies from country to country. From the study it is clear that average height of the respondents was 157 cm and their average weight was 50kg

4.5.1. Body Mass Index (BMI) of the Subjects

According to WHO, 2022 BMI is defined as a person's weight in kilograms divided by the square of the person's height in metres (kg/m2).
Along with BMI measurements, it is important to analyse the other anthropometrics for better risk assessment and by maintaining a healthy weight (Goh *et al*, 2014).

Figure: 10 BMI (Body Mass Index) Classifications of the Subjects



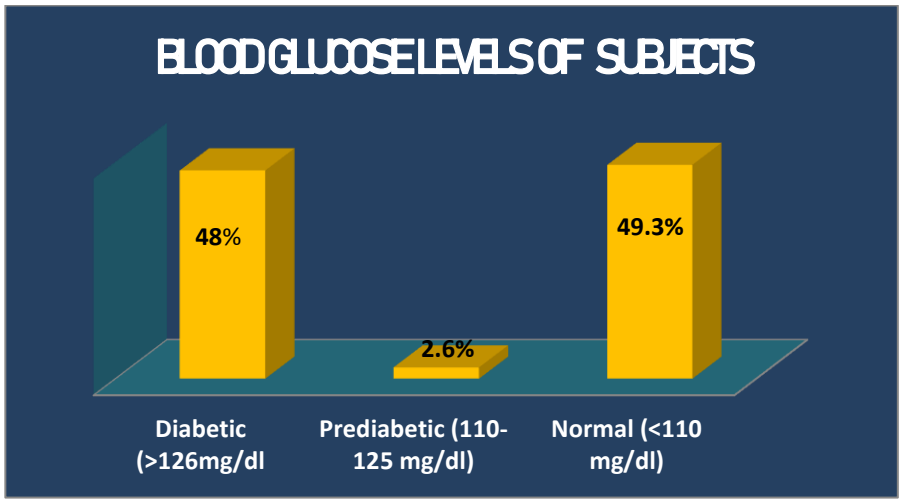
4.6 BIOCHEMICAL MEASUREMENTS OF THE SUBJECTS

The fasting blood sugar values among obese people were more prone to develop metabolic and cardiovascular diseases, resulting in high morbidity and mortality. The study also suggested regular fasting blood glucose estimation is essential to prevent obesity-related complications (Akter *et al*, 2017).

Obese people have significant high blood glucose levels compared to non-obese people (Chaudhari *et al*, 2020). The fasting insulin measurement has been long considered the practical approach and well correlated with insulin resistance (Goyal and Jialal, 2014).

Based on figure 11, 49.3% of respondents were diabetic, 48% non-diabetic and 2.6% comes under the category of prediabetic.

Figure: 11 Blood Glucose Levels of the Respondents



4.7 FOOD HABITS AND DIETARY PATTERN OF THE SUBJECTS

Dietary Habits are the habitual decisions of individuals or group of people regarding what foods they eat. Proper dietary choices require the consumption of vitamins, minerals, carbohydrates, proteins and fats. Dietary habits and choices play a significant role in human health

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems (Haslam and James, 2005). Increased fat intake is associated with body weight which can lead to obesity and other related metabolic diseases (Buettner *et al*, 2007).

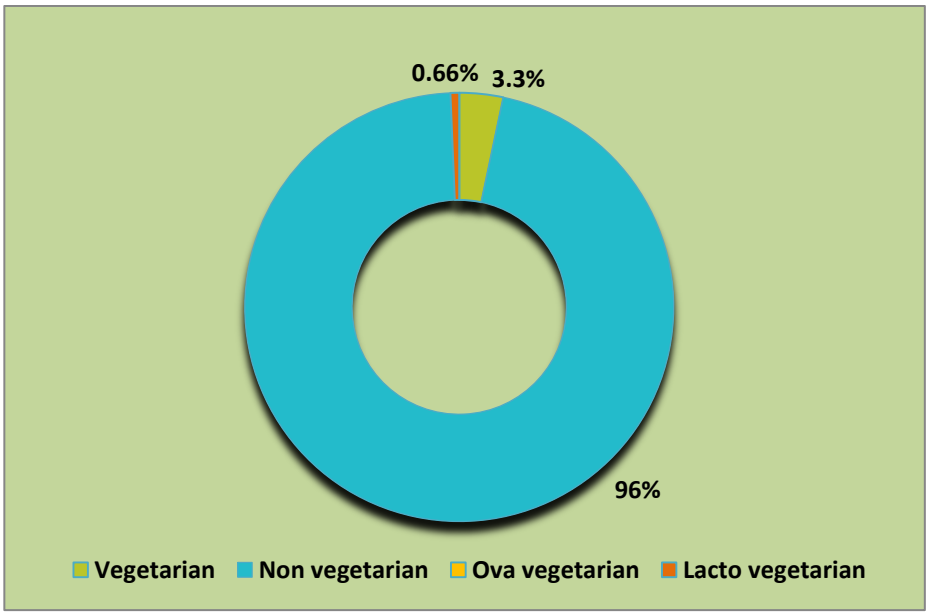
Type 2 diabetes mellitus is a chronic metabolic disorder in which prevalence has been increasing steadily all over the world (Olokoba *et al*, 2012). Diabetes mellitus (DM) is a disease of inadequate control of blood levels of glucose (Sapra and Bhandari, 2021).

4.7.1 Dietary Pattern of the Subjects

Details regarding the type of diet consumed, daily meal pattern, meal skipping habit and reason, habit of eating from outside, type of oils used in cooking and water intake of subjects are tabulated and discussed in the following pages.

Majority of the subjects (96%) were non-vegetarians whereas 3.3% were vegetarians and only 0.66% were lacto vegetarians.

Figure: 12 Dietary Patterns of the Subjects



The meal patterns adopted by the selected subjects revealed that great majority of subjects 92.6 percent consume meal 3 times a day.

Aparicio *et al* (2017) suggested that the frequency and timing of meal consumption should be considered to reduce obesity. A cross-sectional study concluded that higher meal frequency was positively associated with increased obesity and central obesity (Murakami and Livingstone, 2015).

Breakfast is the first meal taken after rising from a night's sleep, most often eaten in the early morning before undertaking the day's work. Skipping the main and first meal of the day has much ill effects in the overall development of the children. Research suggests that breakfast skippers are at greater risk for obesity and weight gain while breakfast eaters tend to have healthier weight (Pereira, 2005).

In this study, 64 percent of the samples did not skip any meal of the day whereas 23.3 percent skipped snacks, 13.3 percent skipped lunch, 8.6 percent skipped dinner and only a few percent of samples (4%) skipped breakfast.

Meal skipping is the omission or lack of consumption of one or more of the traditional main meals (breakfast, lunch or dinner) throughout the day (Dubois L *et al*, 2009).Lack of time is the main reason behind skipping meals, in general, lack of appetite, inability to cook, fasting/religion, and not being hungry (Mohiuddin ,2019).

Majority of respondents (68.5%) skipped meal due to their lack of interest while (12.9%) had busy time schedule, (9.25%) skipped meal to reduce weight, and (7.4%) had poor appetite and (1.85%) subjects had non availability of meals.

Table: 7 Meal Patterns of the Subjects

Criteria	**Category**	**No.of Subjects**	**Percent**
Meal Pattern	1 time	0	0
	2 times	2	1.3
	3 times	139	92.6
	4 times	9	6
	>5 times	0	0
	Total	**150**	**100**
Skipping Meal	Breakfast	6	4
	Lunch	20	13.3
	Snacks	35	23.3
	Dinner	13	8.6

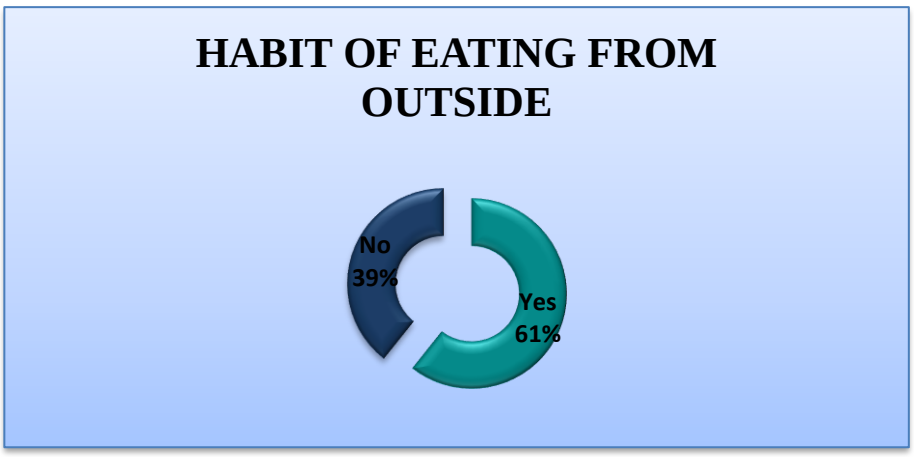
	None	96	64
	Total	**150**	**100**
Reason for Meal Skipping	Lack of appetite	4	7.40
	Busy time schedule	20	12.9
	Non availability	1	1.85
	Lack of interest	37	68.5
	To reduce weight	5	9.25
	Total	**150**	**100**

Eating habits refers to what food we eat, how we eat it and why we eat it. Eating habits are influenced by social, cultural, religious, economic and environmental factors. Basically, all people eat to stay alive, but they also eat to show belonging to family or other social groups. Economic factors such as the availability of food and its cost also affect food choices.

Eating out is no longer just for special occasions. It appears that modern living is causing people to eat out more and more and the energy and nutrient intake of individuals who frequently eat out (at restaurants, canteens, cafeterias, fast food outlets and similar establishments) may differ from that of individuals who generally eat at home (Srividhya , 2014).

From figure 13, it is clear that majority of the samples (61%) had the habit of eating from outside whereas (39%) of samples did not prefer to eat from outside

Figure: 13 Habit of Eating From Outside

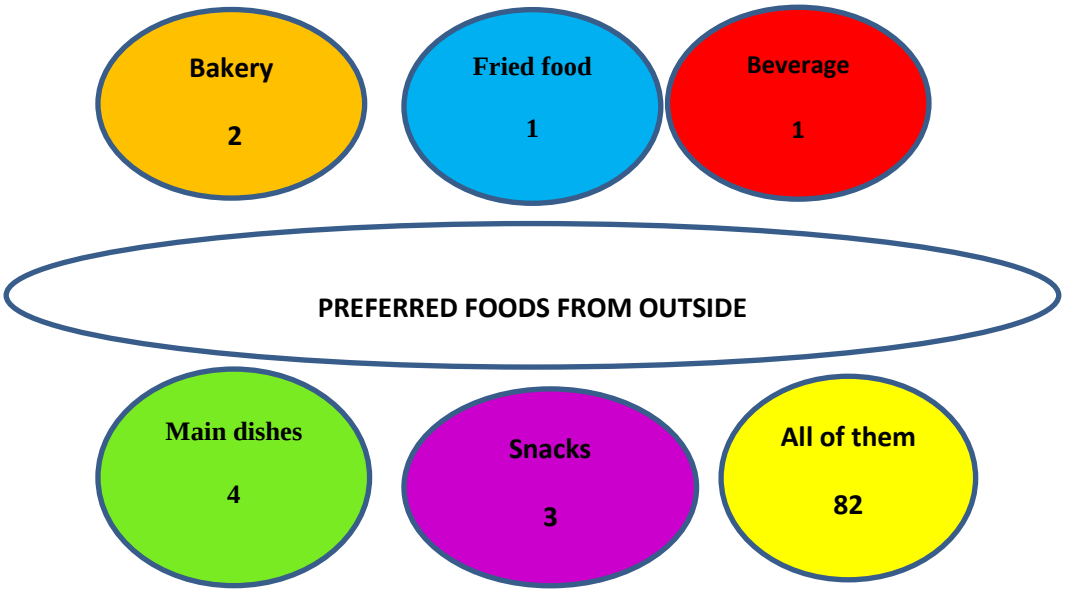


Majority (61%) of the respondents had the habit of eating from outside and it's important to point out that the majority of samples (90.1%) from this study

preferred all types of foods such as main dishes, snacks, fried foods, bakery and beverages.

This study also depicts that thirty one per cent of the subject had the habit of eating from outside once in a week. Taste of foods was the major influencing factor in the decision of eating from outside.

Figure: 14 Type of Food Preferred from Outside



Seventy seven per cent of the respondents were using coconut oil for cooking. Coconut oil is a low calorie fat and as such helps to control body weight. In addition, coconut oil stimulates metabolism to get itself metabolized fast to supply quick energy unlike all other fats. This also helps to control body weight (Rogo *et al*, 2012).

Figure:15 Oil Used for Cooking

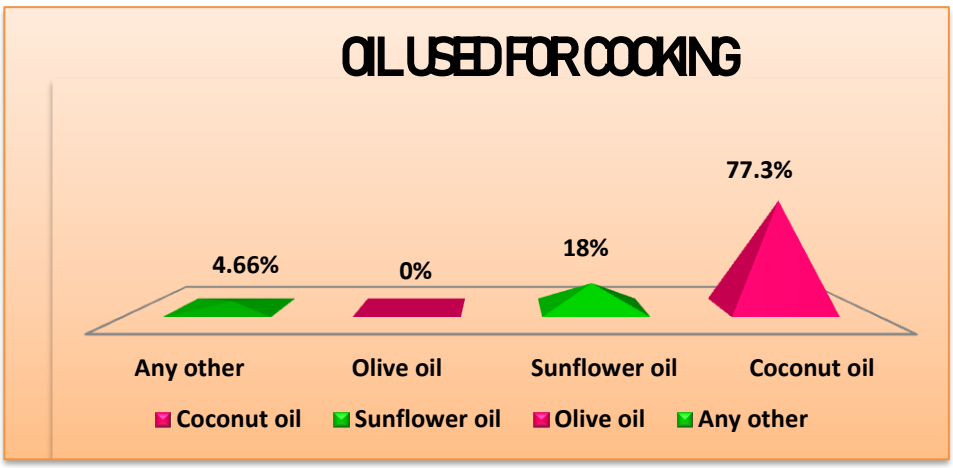
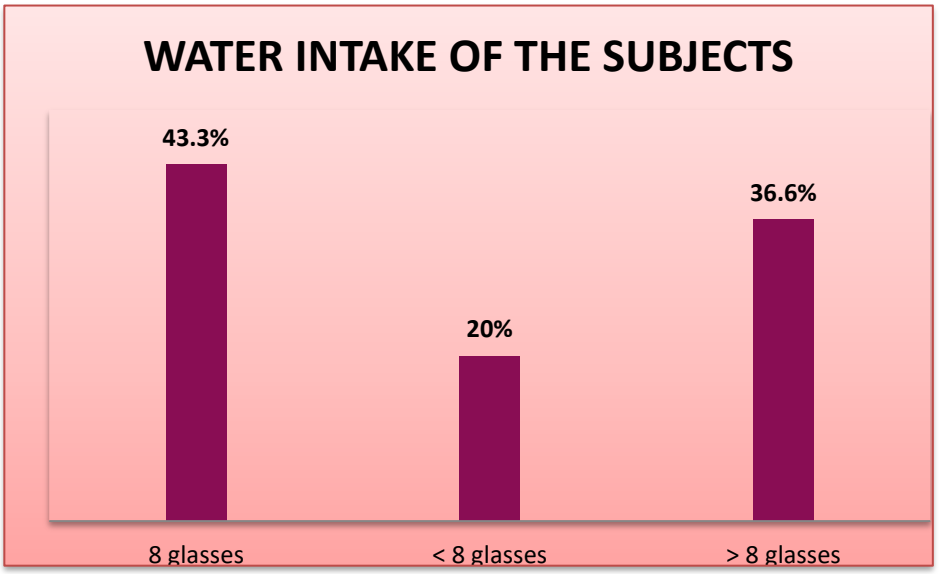


Figure : 16 Water Intake of the Subjects



Water is your body's principal chemical component and makes up about 50% to 70% of your body weight. Your body depends on water to survive. According to a study, drinking more water than usual correlated to a decrease in body weight and body composition scores. Chronic dehydration was associated with obesity, diabetes, cancer, and cardiovascular disease (Health line, 2017).

Forty three per cent of subjects drank about eight glasses of water, thirty six percent drank more than eight glasses of water and twenty per cent of subjects drank less than eight glasses of water.

4.7.2 Frequency of Use of Different Food Items by the Subjects

A food frequency score were employed to collect the details regarding the consumption of food items by the respondents. Frequency of consumption of different food materials can be used as an indicator of nutritional status. Data collected to assess the frequency of use of different food items is presented in table 8

Food group like cereals, fats and oils were consumed on a daily basis by the subjects. The staple food among Keralite is cereals. Increased intake of cereals, fats and oils were increasing the calorie intake and leads to weight gain and associated co- morbidities like obesity, dyslipidemia etc. 72 per cent of the subjects consumed pulses twice a week. These foods contain a lower quantity of protein than animal sources.

Fifty one percent of the subjects consumed green leafy vegetables once in a week. 49 percent of the subjects consumed roots and tubers twice a week. Majority of 37 percent subjects consumes fruits once a week. Reduced fruit and vegetable consumption is linked to poor health and increased risk of non-communicable diseases. Fruits and vegetables may also help to prevent weight gain and reduce the risk of obesity.

Dauchet *et al.* (2006) suggested that the fruit and vegetable consumption reduces risk of CVD remains scarce thus far and under rigorous, controlled experimental conditions, fruit and vegetable consumption is associated with decreased blood pressure and affects blood lipids or other cardiovascular risk factors.Ninety seven percent of the subjects consumed milk and milk products on a daily basis and it is helpful to maintaining the bone strength. 61 percent of the subjects consumed meat and meat products, 34 percent fish and 27 percent egg once a week. In appropriate amounts, animal source foods are valuable sources of complete, high-quality, easily digestible protein and many essential micronutrients such as iron, zinc, calcium, vitamin A and vitamin B12.

Table 8: Frequency of Use of Different Food Items by the Subjects

Food items	**Percentage of subjects and frequency of use**						**Total**
	Daily	Alternate days	Twice in a week	Once in a week	Fortnightly	Never	
Cereals & cereal products	148 (99)	1 (0.66)	-	1 (0.66)	-	-	150 (100)
Pulses	-	36 (24)	108 (72)	6 (4)	-	-	150 (100)
Green leafy vegetable	-	6 (4)	56 (37)	77 (51)	11 (7)	-	150 (100)
Fruits	6 (4)	29 (19)	41 (27)	55 (37)	18 (12)	1 (0.66)	150 (100)
Roots and tubers	-	11 (7)	73 (49)	63 (42)	4 (3)	-	150 (100)
Milk and milk products	145 (97)	-	1 (0.66)	1 (0.66)	2 (1)	1 (0.66)	150 (100)
Egg	1 (0.66)	13 (9)	89 (59)	41 (27)	-	6 (4)	150 (100)
Fish	6 (4)	29 (19)	56 (37)	51 (34)	1 (0.66)	7 (5)	150 (100)
Meat and meat products	2 (1)	5 (3)	13 (9)	91 (61)	31 (21)	8 (5)	150 (100)
Nuts and oil seeds	1 (0.66)	1 (0.66)	2 (1)	2 (1)	65 (43)	79 (53)	150 (100)
Fats and oils	148 (99)	-	2 (1)	-	-	-	150 (100)

The frequency of use of various food items were measured in 5 points scale. The score obtained for each items on the basis of frequency use. As per the table only three food items i.e. Cereals, fats and sugars were found to obtain a mean score of 5. Mean percentage score over total score for these foods was 100. There were fluctuations in the mean score obtained for each food article, depending on its frequency of use.

4.7.3 Nutrient Intake of the Subjects

Nutrients, consumed by the respondents were calculated using food composition tables (ICMR, 2020) and the results are presented in Table 6. Comparing the mean intake of different nutrients, consumed by the subjects, with the RDA values, it was observed that the consumption of nutrients like energy, carbohydrates and fat was found to be higher than RDA value.

On the other hand consumption of nutrients like protein, calcium and iron was found to be lower among the subjects than their recommended values. It has been claimed that people consuming energy rich foods were at a risk of developing overweight and obesity.

Table: 9 Nutrient Intakes of the Subjects

Nutrients	**RDA of sedentary women**	**Mean nutrient intake**
Energy (Kcal)	1160	1280.96
Protein (g)	45.7	43.11
Carbohydrates (g)	130	187.64
Fat (g)	20	38.95
Calcium (mg)	1000	215.56
Iron (mg)	*29*	*6.39*

Source: RDA, ICMR 2020

In the current study, an excessive energy supply from energy, fat and carbohydrates were observed. Excessive intake of fats and oils leads to increase body fat percentage and leads to increase the chances of CVD.

Atherosclerosis is a common cardiovascular disease, which occurs due to deposition of oxidized fatty acid to the arteries in the form of plaque. Approximately two-thirds of the serum cholesterol pool in a normal subject is low-density lipoprotein-cholesterol (LDL-C), which is believed to play an important role in the development of atherosclerosis (Shukla *et al*, 2011).

Total protein intake was found to be around normal. This was attributed to the high consumption of pulses, meat, fish and egg. Mikkelsen *et al* (2000) opined that the mechanisms by which higher protein intake may promote a negative fat balance and reduction of body fat stores are well established in short-term studies.The calcium intake was very poor as per the RDA as only few subjects were consuming milk and milk products. Low calcium intake may adversely affect bone health in adults. Many countries in Asia have average dietary calcium intake less than 500 mg/day (Balk *et al*, 2017).Only a very few subjects consume iron in their daily diet. According to iron intake in a population is considerably below the national recommended dietary allowance (20 mg/day) (Pynaert *et al*, 2007).

4.8 STATISCIAL ANALYSIS

4.8.1 Association between Age of Menarche and Age of Menopause

Menarche and menopause are milestones in a woman's reproductive life. Both age at menarche and age at natural menopause display considerable variation between women and may also vary across time periods (Parent *et al*., 2003; Dratva *et al*., 2009).

Table: 9 Association Between Age of Menarche and Age of Menopause

AGE OF MENARCHE	**AGE OF MENOPAUSE**			**TOTAL**
	45-48	**49-53**	**NO MENOPAUSE**	
8-11	13	21	56	**90**
12-15	23	16	18	**57**
> 15	1	1	1	**3**
TOTAL	**37**	**38**	**75**	**150**
Results of Fishers test				
Variables			**P value**	
Age of menarche and age of menopause			0.002	

Here, Fisher's exact test (chi square test) was used to find out the association between two categorical variables such as age of menarche and age of menopause. The null hypothesis was formulated for this verification was "there is no association between age of menarche and age of menopause. Fisher's exact test was performed and the p value obtained was 0.002. Here, the p value was less than 0.05. So, the null hypothesis was rejected. This test leads to the conclusion that there is an association between age of menarche and age of menopause.

4.8.2 Association between Fat Intake and Waist Hip Ratio

Waist to hip ratio is a simple measure of central obesity. Studies shows that fat is more closely related to waist to hip ratio or even waist circumference than to body mass index (Janssen, 2002).

According to (Lemos-Santos et al, 2004) waist circumference and waist-hip ratio was strongly correlated with percentage of body fat.

A study by Joseph (2016) on cardio metabolic risk factors in rural Kerala, India reported that 34.1% of the female subjects were overweight by their WHR values.

As Srikanthan et al (2009) cautioned waist circumference and waist-hip ratio are the measures of central adiposity which can predict cardiovascular and diabetes risk better than BMI.

Table: 10 Association between Fat Intake and Waist Hip Ratio

		WAIST HIP RATIO
FAT INTAKE	CORRELATION COEFFICIENT	-0.44192
	SIG. (2 TAILED)	0
	N	150

Statistical analysis revealed that there is correlation between fat intake and waist hip ratio. Here, Spearman correlation test was used and the test proved that there is association between fat intake and waist hip ratio.

4.8.3 Association between BMI and Fat Intake.

Table: 11 Association between BMI and Fat Intake.

		FAT INTAKE
BMI	CORRELATION COEFFICIENT	-0.38687
	SIG. (2 TAILED)	0
	N	150

Body Mass Index (BMI) is a person's weight in kilograms (or pounds) divided by the square of height in meters (or feet). A high BMI can indicate high body fatness (Centre for Disease Control and Prevention, 2022).

Koh-Baneree *et al* (2003) suggested that trans fatty acid (TFA) consumption promotes weight gain, particularly accumulation of abdominal fat. TFAs enhanced intra-abdominal deposition of fat, even in the absence of excess calorie, and leading to insulin resistance (Kavanagh *et al*, 2007).

Statistical analysis revealed that there is correlation between BMI and fat intake. Here, Spearman correlation test was used and the test proved that there is association between BMI and fat intake.

4.8.4 Association between Monthly Income and BMI

Table: 12 Association between Monthly Income and BMI

		MONTHLY INCOME					
	BMI	>50000	20000-50000	10000-20000	5000-10000	<5000	**TOTAL**
Pre-menopause	18.5-24.9 (Healthy)	3	15	24	11	3	**56**
	25-29.9 (Overweight)	2	1	4	1	2	**10**
	30 And Above (Obese)	2	3	2	1	1	**9**

Post-menopause	18.5-24.9 (Healthy)	1	1	2	1	2	**7**
	25-29.9 (Overweight)	1	2	1	7	1	**12**
	30 And Above (Obese)	1	9	18	23	5	**56**
TOTAL		**10**	**31**	**51**	**44**	**14**	**150**

Result of Fisher's exact test

Variables	**P value**
Monthly income and BMI	0.04

Obesity has increased at all levels of income during the past 3 decades (Chang and Lauderdale, 2005).

Income was the primary socio-economic indicator associated with adiposity in the developing countries, while it was an education in the developed countries (Subramanian *et al*, 2006).

Income is expected to have positive relationship with obesity. As the individual's income increases, they can afford excess food beyond the basic subsistence levels, which leads to higher nutrient intake and obesity (Grecu and Rotthoff, 2015).

According to Mendez *et al*, 2004, obesity levels in women were high among everyone and the income gradient was more moderate.

Melody *et al* (2015) showed that individuals belonging to higher income group (Rs.≥10000) significantly exhibited 3.44 times and 2.88 times higher odds ($p<0.01$) to being obese and overweight when compared with those belonging to lower income group (Rs.<10000) respectively.

Fisher's exact test was employed here to find out the association between two categorical variables such as monthly income and BMI.

The null hypothesis was formulated for this verification was "there is no association between monthly income and BMI. Fisher's exact test was performed and the p value obtained was 0.04. Here, the p value was less than 0.05. So, the null hypothesis was rejected. This test leads to the conclusion that there is an association between monthly income and BMI.

4.8.5 Association between Energy Intake and BMI.

Table: 13 Association between Energy Intake and BMI.

	t-test	**P -Value**
Pre- Menopause	-63.973	0.00001
Post- Menopause	63.73	< 0.00001
Results of t-test		
Variables	**P value**	
Energy intake and BMI	< 0.05	

Obesity is often considered to be a result of either excessive food intake or of insufficient physical activity.

Analysis of the National Health and Nutrition Examination Survey, 2012 (NHANES) data suggests that the average daily energy intake increased from 1971 to 2000. The average increase was 168 kcal/day for men and 335 kcal/day for women.

In a study done by Rouhani *et al*, 2016 Dietary energy density was directly associated with risk of excess adiposity, higher weight change, and BMI.

The null hypothesis formulated for this verification was "there is no association between energy intake and BMI. A t- test is performed and the p value obtained is < 0.05. So, the null hypothesis is rejected and it leads to the conclusion that there is an association between energy intake and BMI.

4.8.6 Association between Energy Intake and Blood Sugar Level

Type 2 diabetes is a major global public health problem, requiring concerted preventive efforts (Zhang *et al*, 2010). In adults, diets with high energy intake (Tinker *et al*, 2011 and Villegas *et al*, 2009) and high energy density (Mendoza *et al*, 2007) have been associated with type 2 diabetes risk. Specific aspects of dietary nutrient intakes (both macronutrients and micronutrients) have also been associated with increased diabetes risk (Harding *et al*, 2008 and Vessby *et al*, 2001)

In a study done by Donin *et al*, 2014, there is an association between energy intake and type 2 diabetes risk markers show a clear graded relationship. Higher total energy intake was strongly associated with high levels of insulin resistance and emerging type 2 diabetes risk. Here, Fisher's exact test was used to find out the association between energy intake and blood sugar level. The null hypothesis formulated for this verification was "there is no association between energy intake and blood sugar level.

Fisher's exact test was performed and the p value obtained was < 0.00001. Here, the p value was less than 0.05. So, the null hypothesis was rejected. This test leads to the conclusion that there is an association between energy intake and blood sugar level

Table: 14 Association Between Energy Intake And Blood Sugar Level

	ENERGY (RDA-2020)	**FBS**			**TOTAL**
Pre-Menopause		126 mg/dl or above/ Diabetic	110-125mg/dl/Prediabetic	Below 110mg/dl/Normal	
	<1660	1	1	70	**72**
	≥1660	1	1	1	**3**
Post-Menopause	<1660	68	1	2	**71**
	≥1660	2	1	1	**4**
TOTAL		**72**	**4**	**74**	**150**

4.9 EFFECT OF NUTRITION EDUCATION

Nutrition education has an important role in promoting health and reducing the risk of developing chronic diseases of lifestyle. Various sources are available for the communication of nutrition messages to the public, such as the mass media (articles in magazines, newspapers, media and television), health education materials and books, as well as through food labelling and food packaging.

Nutrition messages may also be delivered by means of individual counselling or health promotion activities provided by health professional, including dieticians, doctors, nurses and primary healthcare workers.

Table: 15 Nutritional Awareness of Subjects

Obesity can leads to disease like diabetes, B.P, CVD	**BEFORE**	**AFTER**	**TOTAL**
Correct Answer	111	148	259
Incorrect Answer	39	2	41
TOTAL	**150**	**150**	**300**

According to Fisher's exact test, awareness of selected subjects before and after the awareness class indicates that the result is significant at $p< 0.05$. The p value is < 0.00001.
Obesity, especially the central or visceral type, is a predisposing factor for the development of type 2 diabetes mellitus, hypertension, and cardiovascular disease (Sowers, 2003).

Dyslipidemia may be important in the relationship of BMI to increased risk of heart disease (Despres and Krausse, 2004).Blood pressure often is increased in overweight individuals. In the Swedish Obesity Study; hypertension was present at baseline in 44–51% of the subjects (Rocchini, 2004).

Table: 16 Nutritional Awareness of Subjects

Consumption of supplement and drugs to reduce weight gain is good	**BEFORE**	**AFTER**	**TOTAL**
Incorrect Answer	94	10	104
Correct Answer	56	140	196
TOTAL	**150**	**150**	**300**

According to Food and Drug Administration's Health Fraud Product Database turned up 1,068 unique dietary supplement products marketed between 2007 to 2021 that contained active ingredients found in prescription drugs or deemed too dangerous to be used in people.

Among the tainted dietary supplements identified, 54 percent were for sexual dysfunction and 35 percent were for weight loss (White,2022).

According to Fisher's exact test, awareness of selected subjects before and after the awareness class indicates that the result is significant at $p< 0.05$. The p value is < 0.00001.

Table: 17 Nutritional Awareness of Subjects

Roots and tubers are good for diabetes	**BEFORE**	**AFTER**	**TOTAL**
Incorrect Answer	26	2	28
Correct Answer	124	148	272
TOTAL	**150**	**150**	**300**

Food is an important part in the management of diabetes. This has been realized for a long time as the cornerstone of diabetes management (Giri *et al*, 2007). Roots and tubers are considered as the most important food crops after cereals. Cassava, potato, sweet potato and yam are considered the most important roots and tubers world-wide (Sharma and Kausal, 2016).

According to Fisher's exact test, awareness of selected subjects before and after the awareness class indicates that the result is significant at $p< 0.05$.The p value is < 0.00001.

Further analysis to know the extent of knowledge gain in different aspects covered under the education programme was done and presented in the table below.

Table: 18 Nutritional Awareness of Subjects

S:No	Statements	Pre-awareness		Post-awareness		Positive Deviation
		Positive Response	Negative Response	Positive Response	Negative Response	
1.	Avoiding fast foods is good for heath.	141	9	150	0	9
2.	Snacking is healthy.	88	62	149	1	61
3.	Preferred food should be consumed more.	50	100	150	0	100
4.	Drugs and Hormone intake may increase weight gain.	111	39	149	1	38
5.	Consuming alcohol is nothing to weight gain.	53	97	145	5	92
6.	Hereditary factors influence obesity.	102	48	150	0	48
7.	Eating the food fast can reduce weight gain.	56	94	139	11	83
8.	Regular exercise and dietary modification can bring healthy weight loss.	107	43	150	0	43
9.	Ideal measure to keep obesity off is healthy lifestyle practices.	104	46	148	2	44
10.	Excess sugar consumption will lead to obesity.	97	53	147	3	50
11.	Excess consumption of junk foods will lead to obesity.	106	44	148	2	42
12.	Raw salad intake helps to control weight.	102	48	147	3	45
13.	Skipping meals is a good	79	71	149	1	70

	method to control weight.					
14.	Both diet and exercise are important to control weight.	102	48	150	0	48
15.	Obesity needs treatment in adults only.	67	83	138	12	71
16.	Correcting obesity increases life expectancy.	107	43	146	4	39
17.	Can diabetic patients have Rice 3 times a day.	75	75	133	17	58
18.	Honey helps to reduce weight gain.	108	42	150	0	42
19.	Organ meats (liver, brain, and kidney) should be avoided by obese patients.	114	36	149	1	35
20.	Non- Obese adults are more active than Obese adults.	109	41	145	5	36
21.	Obesity can cause fertility problems.	91	59	135	15	44
22.	Consumption of cold drinks/ Carbonated drinks should be avoided by obese patients.	108	42	150	0	42
23.	Carbonated beverages are rich in nutrients.	125	25	150	0	25
24.	Surgical method is more useful than diet therapy for controlling obesity.	86	64	140	10	54
25.	Insulin is the hormone is responsible for maintaining blood sugar level.	105	45	149	1	44
26.	Obesity is a prevalent risk factor for the development of diabetes mellitus.	109	41	149	1	40

27.	Both blood and urine test can be used to detect diabetes.	104	46	149	1	45
28.	Untreated diabetes can lead to diabetes retinopathy, diabetes foot etc.	111	39	150	0	39
29.	Red meat should be avoided by obese diabetic patients and should be replaced with lean meat.	114	36	149	1	35
30.	Brown bread is more preferred than white bread for diabetic patient.	117	33	147	3	30
31.	Diabetic patients should carry sugar or sweet item with them always.	106	44	148	2	42
32.	Having fenugreek water early morning helps to lower glucose levels.	107	43	147	3	40
33.	Proper diet along with medication will help to control diabetes mellitus.	108	42	147	3	39
34.	Type 2 diabetes mellitus is hereditary.	109	41	148	2	39
35.	Ripe plantain should not be consumed by a diabetic patient.	100	50	138	12	38
36.	Foods rich in fibre should be avoided by diabetic patients.	95	55	140	10	45
37.	Fruit juices should be consumed by diabetic patients.	102	48	147	3	45
38.	Pastries and bakery items can be consumed by diabetic patients.	112	38	148	2	36
39.	Green leafy vegetables should be consumed more by diabetic patients.	111	39	144	6	33

40.	Diabetic patients should have food at regular time every day.	105	45	145	5	40
41.	Green leafy vegetables are low in calories and should be consumed more by obese patients.	114	36	147	3	33
42.	Chia seed drink will help to reduce weight.	108	42	148	2	40
43.	Egg whites are good protein sources for diabetic patients.	107	43	149	1	42
44.	Brown rice should be more preferred than parboiled white rice.	110	40	148	2	38
45.	Obesity can be reduced by intake of medicine and drugs.	99	51	148	2	49
46.	Ragi is rich in fibre and help to reduce glucose levels.	106	44	145	5	39
47.	Obese diabetic patients should do strenuous exercise.	125	25	149	1	24
TOTAL		**4772 x 5**	**2278 x 2**	**6886 x 5**	**164 x 2**	
		23860	**4556**	**34430**	**328**	

General concepts of obesity, risk factors, management of obesity and type 2 diabetes were the three major components dealt with in the programme. Views or opinion of the respondents on the statements related to the above components were procured before and after intervention for assessing knowledge regarding obesity and type 2 diabetes management.

As seen in the table, each positive response was given 5 points and negative response with 2 points. After calculating the total points, it was found that overall score obtained (34430 points) for positive response in post-awareness phase was greater than overall points (23860 points) received for pre-awareness phase.

There observed a tremendous improvement in the knowledge scores among the subjects who participated in the intervention. Hence, it is clear that nutrition intervention was effective and successful.

Mwangi et al. (2011) mentioned that a successful program to combat any disease in the community relies on the awareness of the community about that disease. They also suggested that the community must be aware of the problem and the efforts being taken to help it so that they can actively engage in health seeking behavior, such as coming for treatment.

One important pathway to dietary intervention is through nutrition education which can lead to development of sufficient and balanced nutrition habits and getting rid of the bad nutritional habits. Additionally, nutrition education will act as a basic precaution for mitigating and avoiding nutrition problems that may arise due to incorrect knowledge of women on healthy dietary practices (Cannoosamy et al., 2016).

In a study done by Ji et al, 2006 shows that there was significant decrease in body weight, BMI, fasting blood sugar and post prandial blood glucose level of the subjects who received nutrition education. Results also show that individual diabetes dietary education is a useful tool to make the subjects understand their diet prescription and is an effective intervention to control body weight and blood sugar level.

Mogra and Arora (2010) reported an increase in total knowledge scores and decrease in fasting blood glucose levels among diabetic patients after nutrition education for a period of ten days.

SUMMARY AND CONCLUSION

CHAPTER-5

SUMMARY AND CONCLUSION

The study was conducted among one fifty middle age women between the age group of 35-55 years. The subjects were selected using purposive sampling method from Vypin, Ernakulam District in Kerala. All the subjects were interviewed personally using a well- structured interview schedule. Through interview schedule details regarding socio-economic status, life style pattern, medical history, obstetrical details, complications and food habits of the subjects were collected. Basic anthropometric measurements like height, weight, waist circumference and hip circumference were assessed for all the subjects. Dietary assessment was done by food frequency score and 24 hour recall method. Questionnaire containing fifty questions were developed and distributed to one fifty subjects to assess their nutritional knowledge before and after providing nutritional awareness.

The findings of the study can be summarized as follows:

- Among the selected subjects, all of them were from the age group of 35-55 years. Marital status of the subjects revealed that (95.3%) were married, (0.66%) was single and 4 % prefer not to answer the question. Nuclear family system (84.6%) was prominent among the subjects. Majority of the subjects (66%) had one to four members whereas rest of them (33.3%) had more than five members in their family.

- Educational status revealed that, majority (63.3%) received high school education and occupational status proven 87.3 percent of the subjects was unemployed housewives and the rest of them were engaged in income generated activities. The subjects were categorized on the basis of monthly income and it depicted that 38 per cent of the families were earning from 10000-20000 Rupees.

- Life style pattern of the subjects revealed that eighty five per cent of the subjects had a poor quality of sleep, about 4-6 hours a day. Exercise pattern of the subjects depicted that only (13%) of the subjects were physically active and among them (65%) did exercise for 1 hour and (60%) did exercise in the evening. 85.6 percent of the subjects did household activities for less than 3 hours. Most of the subjects (57%) liked to spend their leisure times for watching TV.

- Medical history of the subjects showed that forty eight percent of subjects were suffering from Type II Diabetes Mellitus and forty three percent were suffering from obesity. Among the selected subjects, 97 percent of subjects were taking allopathic treatment. Majority (42 %) had the history of hypertension and 16.6 per cent had thyroid problems along with obesity and diabetes mellitus.

- Obstetrical details of the subjects showed that 50 per cent of the women attained menopause. Among them, 73.3% experience physical discomforts after menopause. 63.6 per cent of post- menopausal women experience back pain/cramps and rest all experience hot flashes, night sweats and insomnia. Majority (76.6%) of the respondents had showed 5-7 days of menstrual duration.

- Age at marriage of the subjects revealed that most of them (61.3%) were married between the age of 16- 20 years and first pregnancy of the majority (49.3%) were at the same age. In this study, 77.3 per cent of subjects had normal delivery and rest of them had caesarean delivery.

- Basic anthropometric measurements were assessed along with body mass index and it was clearly understood that 43 per cent respondents were coming under the category of obesity.

- Biochemical assessment reveals that 49.3 per cent of respondents were diabetic, 48 per cent were non-diabetic and 2.6 per cent comes under the category of prediabetic.

- Dietary habits of the respondents depicted that majority (96%) of them were non-vegetarian. Meal patterns of the subjects revealed that 92.6% consumed meal three times a day. Food habits of the subjects said that majority of the respondent (64%) does not skip food. 4 % were skipping breakfast, 13.3 % per cent were skipping lunch and 8.6% per cent were skipping dinner.

- Majority (61 %) of the subject had the habit of eating food from outside and it is important to point out that the majority of these obese persons preferred to consume all type of foods (90.1%) such as fried, bakery, main dishes, side dishes and beverages from outside.

- In this study, 77.3 per cent of subjects used coconut oil for cooking whereas only 18 per cent used sunflower oil and 4.6 per cent used other types of oil for cooking. Water intake of the subjects revealed that 43 per cent of subjects drank about eight glasses of water daily.

- Frequency of use of different food items was measured and it was observed that cereals and cereal products was most consumed by them. Cereals, other vegetables, fats and oils, milk and milk products were the most frequently used foods by the subjects while food items such as pulses, green leafy vegetables, roots and tubers, fish egg, meat and meat products were used moderately. Fruits, nuts and oil seeds were found to be less frequently used food items.

- Results of the 24 hour recall method depicted that nutrients such as energy, carbohydrates and fat were found to be above the RDA. The consumption of nutrients like calcium and iron was found to be very low among the subjects than their recommended values whereas, protein consumption among subjects was found to be normal.

- ❖ Statistical analysis revealed that there exist associations among age of menarche and age of menopause, fat intake and waist hip ratio, BMI and fat intake, monthly income and BMI, energy intake and BMI and energy intake and blood sugar level.

- ❖ Effect of nutrition awareness says that the effect of awareness program is verified using Fisher's Exact Test. The responses of the experimental group pre and post awareness program were collected. It was found that the score received post awareness was higher than pre awareness. So the awareness program was effective for the selected subjects.

The present investigation was concluded that prevalence of obesity and type 2 diabetes was high among post-menopausal women. Nutrition awareness is found to be beneficial to enhance the nutrition knowledge among middle age women. Awareness about nutrition can make a lot of difference in the health of the society and country as a whole.

In light of the findings of this study, the researcher wishes to propose the following suggestions:

- ✓ Creating awareness and making them self-sufficient in modifying food behavior and life style pattern within their accessible environment, it should be included as an intervention strategy in the regional programmes.

- ✓ Formulation of appropriate programmes and strategies are essential but effective implementation is the key to success.

- ✓ Efforts are necessary for exploring non nutritional avenue such as imparting knowledge about nutritional needs during non-communicable diseases and creating nutritional and health awareness among young adults to ensure a better quality of life for the next generation.

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APPENDIX

APPENDIX-I

INTERVIEWSCHEDULE

I.SOCIOECONOMIC BACKGROUND

1. Name:
2. Age:
3. Place:
4. Phone no:
5. Marital status: □ Single □ Married□ Divorced □None
6. Type of family: □ Nuclear □ Joint family
7. Family size:□1-4 □ 5-8 □>8
8. Number of male adults:
9. Number of female adults:
10. Number of children:
11. Education: □ Honors &Profession□Graduate□PostGraduate□Higher Secondary □ None
12. Occupational status: □ Profession□ Semi-profession□ Clerical, shop owner□ Skilled worker□ Semi-skilled worker□ Unskilled worker□ Unemployed
13. Main occupation of the head of the family:
14. Type of occupation: □ Heavy□ Moderate □Sedentary
15 Alternate source of income if any: □Yes □No
16 How many members are employed:
17. Monthly income (Rs/-):□More than 50000 □ 20000-50000 □ 10000- 20000 □5000-10000□Lessthan5000

II. LIFESTYLE PATTERN

18. Duration of sleep: □<4 hrs □4 – 6 hrs□.6 – 8 hrs□.>8 hrs.
19. Do you have the habit of doing exercise regularly: □Yes □No
20. If yes, time spends for exercise:□ Less than1 Hour□1-2 hours□More than 2 hours
21. If you are doing exercise,what type do you prefer: □Running□Briskwalking□Yoga□Meditation□Jogging□Aerobics□Any other.
20. At what time you used to do your exercises :□Morning □Evening □Other

21. Time spends for house hold activities: □<3 hrs. □3 – 5 hrs.□>5 hrs.

22. How do you utilize your leisure time?:□Cooking□Reading□ Gardening□Stitching/embroidery□Watching TV□Others

III. MEDICAL HISTORY

23. Do you suffer from any diseases: □Yes □No

24. How long have you been suffering from the disease:□1yr □1-5 yrs. □6-10 yrs. □11-15 yrs.

25. Have you followed any treatment:□ Yes □ No

26. If yes specify: □Naturopathy□Allopathic□Homeopathy□Ayurveda

27. Whether the subject having history of:

Disease	**Yes**	**No**
Cardiovascular disease		
Hypertension		
Thyroid disorder		
Diabetes		
Deficiency disorders		
PCOD		
Hormonal problems		
Hypercholesterolemia		
Others? Specify		

28. Whether any of your family members had any one of the diseases

mentioned above: □Yes □No

IV. OBSETERICAL DETAILS

29. Age of menarche:□ 8-11 □12-15□ >15

30. Duration of menstruation: □More than 7 days□ 5-7days□Less than 5 days

31. Any menstrual problems: Yes/ No

32. Age of marriage:□16-20 □21-25 □26-30 □ >31

33. Age of 1st pregnancy: □16-20 □21-25 □26-30 □>31

34. Type of delivery:□Normal □ Caesarean

35. If any complications occur during delivery: Yes / No

36. No: of pregnancies:

37. Had any miscarriage occurred:Yes / No

38. Have you attained menopause:Yes/ No

39. If Yes, Age of menopause:

40. Do you experience any physical discomfort after menopause:Yes/No

41. If Yes, Mention:□Back pain/cramps □Hot flashes □Night sweats

□Insomnia□Others

V ANTHROPOMETRIC MEASUREMENTS

42. Height:

43. Weight:

44. IBW:

45. BMI(body mass index):

46. Waist circumference :

47. Hip circumference:

48. Waist to hip ratio:

VI.BIOCHEMICAL MEASUREMENT

49. Random blood glucose level: □200 mg/dL or above (diabetes) □140-199 mg/dL(pre-diabetes)□Below140mg/dl(normal)

VII. DIETARY/EATING PATTERN

50. Type of dietary pattern followed by the subject:□ Vegetarian □Non vegetarian □ Ova vegetarian □ Lacto vegetarian

51.How many meals do you have per day:□ 1 □ 2 □ 3 □ 4 □ More than 4

52. Do you have the habit of skipping meals: □Breakfast □Lunch □Snacks □ Dinner □ None

53. Choose the appropriate reason for skipping meal:□ Lack of appetite □ Busy time □ Non availability □ Lack of interest □To reduce weight.

54. Among these which food do you prefer more: □Convenient foods □ Homemade foods □ Fast foods

55. Do you have habit of eating from outside:Yes/ No

56. If Yes, What type of foods:□ Bakery Items □Fried foods □Beverages □Main Dishes □Snacks □All of them

57. When all do you eat out:□Daily □Once in two days □Once in a week □Once in a month □ Never

58. If you eat out, what influences your decision to eat out most: □Its more convenient □ Lack of time □ Tastes better □ None of above

59. Do you eat foods rich in Sugar:□ Yes □No

60. If yes, What types of foods: □Pastries and Cakes □Cookies and Biscuits □ Chocolates □ Jams and jellies □ None of above

61. Do you snack often: □ Yes □ No

62. Which foods do you snack often:□ Bakery items □Fried items □Ice creams □Steamed foods

63. Which oil do you use for cooking: □Coconut oil □Sunflower oil

□Olive oil □Any other(mention)

64. Do you reuse oil:□Yes □No

65. Water intake in a day: □8 glass □Less than 8 glass □More than 8 glasses.

VIII. FOOD FREQUENCY PATTERN

Food item	Daily	Alternat ive Days	Twice a Week	Once in a Week	Fortnightly	Never
Cereals & cereal product						
Pulses						
Green leafy vegetables						

Fruits						
Roots &tubers						
Milk &milk products						
Egg						
Fish						
Meat&meat products						
Nuts &oil seeds						
Fats &oils						

IX. 24 HOUR DIETARY RECALL

Time	**Place**	**Meal**	**Food /beverage item**	**Ingredients**	**Quantity**
Early Morning					
Breakfast					
Mid - morning					
Lunch					
Mid - Evening					
Dinner					
Bed time					

APPENDIX-II

QUESTIONNAIRE

1. Avoiding fast foods is good for heath Yes/No
2. Snacking is healthy. Yes/No
3. Preferred food should be consumed more. Yes/No
4. Drugs and Hormone intake may increase weight gain. Yes/No
5. Consuming alcohol is nothing to weight gain. Yes/No
6. Hereditary factors influence obesity. Yes/No
7. Eating the food fast can reduce weight gain. Yes/No
8. Regular exercise and dietary modification can bring healthy weight loss. Yes/No
9. Ideal measure to keep obesity off is healthy lifestyle practices. Yes/No
10. Consumption of supplements and drugs to reduce weight gain is good. Yes/No
11. Excess sugar consumption will lead to obesity. Yes/No
12. Excess consumption of junk foods will lead to obesity. Yes/No
13. Raw salad intake helps to control weight. Yes/No
14. Skipping meals is a good method to control weight. Yes/No
15. Both diet and exercise are important to control weight. Yes/No
16. Obesity can leads to diseases like diabetes, B.P and CVD. Yes/No
17. Obesity needs treatment in adults only. Yes/No
18. Correcting obesity increases life expectancy. Yes/No
19. Can diabetic patients have Rice 3 times a day. Yes/No
20. Honey helps to reduce weight gain. Yes/No
21. Organ meats (liver, brain, kidney) should be avoided by obese patients Yes/No
22. Non- Obese adults are more active than obese adults Yes/No
23. Obesity can cause fertility problems Yes/No
24. Consumption of cold drinks/ carbonated drinks should be avoided by obese patients Yes/No
25. Carbonated beverages are rich in nutrients .Yes/No
26. Surgical method is more useful than diet therapy for controlling obesity. Yes/No

27. Insulin is the hormone is responsible for maintaining blood sugar level. Yes/No

28. Obesity is a prevalent risk factor for the development of diabetes mellitus Yes/No

29. Both blood and urine test can be used to detect diabetes Yes/No

30. Untreated diabetes can lead to diabetes retinopathy, diabetes foot etc. Yes/No

31. Red meat should be avoided by diabetic patients and should be replaced with lean meat Yes/No

32. Brown bread is more preferred than white bread for diabetic patient Yes/No

33. Diabetic patients should carry sugar or sweet item with them. Yes/No

34. Roots and tubers are good for diabetes mellitus. Yes/No

35. Having fenugreek water early morning helps to lower glucose levels. Yes/No

36. Proper diet along with medication will help to control diabetes mellitus. Yes/No

37. Type 2 diabetes mellitus is hereditary. Yes/No

38. Ripe plantain should not be consumed by a diabetic patient. Yes/No

39. Foods rich in fibre should be avoided by diabetic patients. Yes/No

40. Fruit juices should be consumed by diabetic patients. Yes/No

41. Pastries and bakery items can be consumed by diabetic patients. Yes/No

42. Green leafy vegetables should be consumed more by diabetic patients.Yes/No

43. Diabetic patients should have food at regular time every day. Yes/No

44. Green leafy vegetables are low in calories and should be consumed more by obese patients Yes/No

45. Chia seed drink will help to reduce weight loss Yes/No

46. Egg whites are good protein sources for diabetic patients Yes/No

47. Brown rice should be more preferred than parboiled white rice

Yes/No

48. Obesity can be reduced by intake of medicine and drugs Yes/No

49. Ragi is rich in fiber and help to reduce glucose levels Yes/No

50. Obese diabetic patients should do strenuous exercises Yes/No