A COMPARATIVE STUDY ON PREVALENCE OF OVERWEIGHT AND OBESITY IN VARIOUS INCOME GROUP FEMALES OF HATHRAS CITY

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Dedicated
to
My Beloved
Parents

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Chapter ɪ INTRODUCTION

Obesity is a state in which there is a generalised accumulation of excess adipose tissue in the body leading to more than 20 per cent of desirable weight. Obesity invites, disability, disease and premature death. Excess body weight is a hindrance, leading to breathlessness on moderate exertion and predisposes a person to disease, like atherosclerosis, high blood pressure, stroke, diabetes, gall bladder diseases and osteoarthritis of weight bearing joints and varicose veins. Usually obesity is due to positive energy balance. That is the intake of calories is more than the expenditure of calories, Srilakshmi (2005).

Obesity is a medical condition is which excess body fat has accumulated to the extent that it may have an adverse effect on health leading to reduce life expectancy, WHO (2000) and James (2005). Body mass index BMI, which compares weight and height is used to define a person as overweight (pre-obese) when their BMI is between 25 kg/m^2 and 30 kg/m^2 and obese when it is greater than 30 kg/m^2, WHO (2000).

Obesity is associated with many diseases particularly heart disease, type II diabetes, breathing difficulties during sleep, certain types of cancer, and osteoarthritis, James (2005). Obesity is most commonly caused by a combination of excessive dietary calories, lack of physical activity, and genetic susceptibility, though a limited number of cases are due solely to genetics, medical reasons or psychiatric illness. The World Health Organization, in 1998 designated obesity as globaldemic, WHO (1998).

The primary treatment for obesity is dieting and physical exercise. If this fails, anti-obesity drugs may be taken to reduce appetite or inhibit fat absorption. In severe cases, surgery is performed or an intragastric balloon is placed to reduce stomach volume and or bowel length, leading to earlier satiation and reduced ability to absorb nutrients from food, Nice (2006) and Imaz *et al.* (2008).

Obesity is a leading preventable cause of death worldwide, with increasing prevalence in adults and children, and authorities view it as one of the most serious public health problems of the 21st century, Barness *et al.* (2007). Obesity is a stigmatized in the modern western word, though it has been perceived as a symbol of wealth and fertility at other times in history, and still is in many parts of Africa, James (2005) and Woodhouse (2008).

It is an ironic and rather sad fact that the two major nutritional problems that presently face the world are that 600 million people face severe energy deficits and starvation while at the same time, 310 million people face a problem of chronic energy surplus and obesity. In some cases, these problems exist alongside one another but obesity is predominantly a problem of westernized societies. In the last few years it has become an increasing problem throughout most of the world. By 2000, the obesity problem had already

grown to such an extent that the World Health Organization declared it was the greatest health threat facing the west. Obese people carry around excessive amount of fat, which in the absence of more direct measures is generally estimated by combining measures of height and weight. The most common method of combining these measures is to divide body weight in kilograms (w) by the height in meters (h) multiplied by itself (i.e. w/h^2). This is called the body mass index (BMI). On the BMI scale, people with an index > 25 but < 30 are said to be overweight, and people with an index > 30 are defined as obese. Although these definitions have been adopted by the WHO, there are several well-recognized problems with the index. In particular, it does not reflect body fatness changes very well when a person is also changing his or her height over time. Consequently, BMI can not be used to reliably gauge the body fatness of children. In addition, body builders and some athletes, who have developed large amounts of muscle tissue, many also be misclassified as obese. Generally, however, in most adults, BMI correlates reasonably closely to body fatness (which is measured by more sophisticated scanning and imaging devices), particularly if combined with measures such as the waist circumference, Speakman (2004).

The increasing prevalence of overweight and obesity is a critical public health problem for women of childbearing age. Obesity has been associated with both short and long-term health effects for women as well as for their offspring. Existing research supports a link between obesity and conditions that impair a women's ability to conceive and increase her risk for an adverse pregnancy outcome. Furthermore, this chronic condition has been linked to the development of diabetes and cardiovascular disease later in life. Clinical decision making and public health policy and education are driven in part by the prevalence of the condition in the general population, Anjel Vahratian (2009).

Compared to men, women suffer a disproportionate burden of disease attributable to overweight and obesity. Female obesity is defined as an excessive amount of body fat, keeping in mind the body mass index ratio of the women concerned. Women with body weight measuring up to 30 per cent more than that of the ideal are known as obese. The body mass index (BMI), is the most popular and effective way of calculating female obesity.

Body mass index (BMI) is a statistical measurement that compares a person's weight and height. Though it does not actually measure the percentage of body fat, but it is a useful tool to estimate a healthy body weight based on a person's height. Due to ease of measurement and calculation, it is a widely used diagnostic tool to identify obesity problems within a population. However, it is not considered appropriate to use as a final indication for diagnosing individuals. BMI was invented between 1830 and 1850 by the Belgian Polymath Adolphe Quetlet during the course of developing "Social physics". Body mass index is defined as the individual's body weight divided by the square of his/her height.

More and more studies reveal that female obesity is fast becoming a dreaded factor in US. The prevalence of obesity among women has increased by almost 15 % in the last decade. Nearly 50 % of all Hispanic American and African American women are overweight. The link between diabetes and obesity is particularly pronounced in women, and during the past 10 years there has been 32 % increase in women with diabetes. Women suffering from obese conditions are also prone to social and psychological issues that also lead to depression.

It is believed that female obesity has increased by 15 % in the past decade and as a result, women have become prone to diseases like diabetes, high BP etc. women who have a hereditary problem of obesity need to be very careful about their food and exercise quotient. Often women find it difficult to shed post pregnancy weight, which in turn leads to life long obesity for them.

Types of female obesity

Female obesity may be broadly categorized into –

- Type I obesity -   BMI of 30-34.9
- Type II obesity   -   BMI of 35-39.9
- Type III obesity   -   BMI of 40 and higher.

Type I female obesity is mostly a result of excessive and binge eating habits apart from a lack of physical activity that should compliment one's eating habits.

Type II of female obesity accounts for less than 1 % of the obesity cases registered is a result of health related problems. In such cases, the patient witnesses abnormal weight gain in spite of a regulated lifestyle. These patients should be treated by doctors and dietitians. Although they appear to be in good health, they have reduced tolerance to exercise with shortness of health on exertion and they are unduly fatigued. This is due to the burden of increased weight they carry always and reduced capacity of the circulatory and respiratory systems that are handicapped by masses of internal fat and fatty infiltration of muscle, for mechanical and metabolic reasons these patients are at increased risk of diabetes, atherosclerosis, hypertension, fatty liver, gall bladder diseases, osteoarthritis, hernias and varicose veins. Mortality rate also increases.

Type III of female obesity patients are in pathetic-condition. Their day-to-day activities are restricted due to their enormous mass and more susceptible to diseases mentioned in type II. They are susceptible to atherosclerosis prone to accidents and have serious psychological disturbances-Srilakshmi (2005).

A. Simple obesity

This type of obesity is caused by ingesting too much heat energy, while consuming less energy and thereby, storing too much fat. Most obese people belong to this category. Simple obesity has two types.

1) *Constitutional obesity or from infancy type obesity*

This type of obesity starts from infancy continues to adulthood. Usually the person has a family history of obesity. They have a very good appetite from half a year offer birth and their body fat cell number begins to increase. Their metabolism is slow and synthesis exceeds catabolism. There will be poor cure effect by limiting diet and strengthening exercise. They are not sensitive to insulin.

2) *Acquired obesity, or from adult type obesity and diet induced obesity*

This is caused by intentionally or unintentionally eating too much, called surfeit obesity. They usually begin to gain weight from early adult times and gain weight mainly on limbs.

B. Secondary obesity

This type of obesity usually has some primary disease associated with it. The primary diseases are Cushing's syndrome, metabolic obesity, hypothalamic obesity, polycystic ovary syndrome, insulin tumour etc. The primary disease must be cured before it is possible to lose weight. There are various other types of female obesity that have been identified, these are:-

Android, Gynoid and a Mixed Variety

√ Gynoid is a type of female obesity where the lower part of the body is more affected and puts on more flesh and weight in comparison to the others. Gynoid type of female obesity sees flabby abdomen, added weight in the buttocks and legs area too. The face and neck mostly give a normal appearance. In some persons, the cheeks may be drawn too. As these persons grow old the whole figure assumes a stooping posture and the spine is never erect due to the heavy hips and thighs. This vital organs affected mostly are the kidney, uterus, intestines, bladder and bowels. But, the functions of these organs some times have a direct effect on the heart. In this type of obesity, exercises or dieting will not help appreciably in reducing weight.

√ Android type of female obesity is likened to the shape of an apple. The shoulders, face, arms, neck, chest and upper portion of the abdomen are bloated. The stomach gives stiff appearance, as well as the arms, shoulders and breasts. The back seems to be erect but the neck is compressed and there will be a protruding chest because of the bulk in the stomach. The lower portion of the body the hips, thighs and legs are thinner beyond proportion in comparison with the upper part. In these persons the vital organs affected will be mostly the heart, liver, kidney and lungs. Though this type of obesity is found more in males, it is common in females too. Those females, who are under hormone treatment for their menstrual abnormalities or after childbirth, are more prone to this type of obesity. It occurs in females around menopause too due to thyroid gland's functional disturbance. In this type, the excess

flesh is less likely to reduce especially in female than males. Android type of obesity is a major risk for heart damage and heart disease due to high cholesterol.

√ The third type of female obesity is a mixed bag of the other types. There are some people who do not fit into any of the above types of obesity. In this type of female obesity, their whole body from head to toe look like a barrel and movement is restricted. Their gait is more to rolling rather than walking. The fat tissues in their body hinder the movement of all the internal organs and consequently affect their brisk functioning. For them any exercise is different due to the enormous size of body. So, such person should follow a strict diet and do plenty of exercise.

Causes of obesity

When food energy intake exceeds energy expenditure, fat cells (and also to some extent muscle and liver cells) throughout the body take in the energy and store it as fat. So when the energy consumption exceeds the requirement, it causes obesity.

Additional factors causing obesity

- Genetic disorders
- Underlying illness (such as hypothyroidism)
- Eating disorders (Such as Binge eating disorder)
- Certain medications (Such as anti psychotics)
- Sedentary life style
- A high glycemic diet
- Insufficient sleep
- Stress
- Sudden smoking cessation
- Weight cycling-repeated attempts to do dieting to lose weight.

Genetic factors play an important role in determining the traits of obesity. Some genes play the role to telling the body how to metabolize food and to use extra calories or stored fat. Obesity runs in families as generally families eat similar foods, have similar lifestyle, habits and thinking patterns, such as that children should eat more to become big and healthy.

Certain illness like *thyroid gland problems* or genetic run in families. Some eating disorder like *Binge eating disorder* affect a person's diet as he eats more and repeatedly often in binges. These people generally lack the developed eating patterns learned in childhood.

It is also to be remembered that obesity is not the result of momentary overeating. It is a long-term phenomenon because people tend to overeat over long periods of time.

Emotions can fuel obesity, as people tend to eat more when they are upset, anxious, sad, stressed or even bored. Afterwards they feel bad about eating more, and later to relieve this stress, they may eat even more.

Sedentary lifestyle is another important factor as people tend to eat more when they are doing nothing and just sitting idly watching TV or video games. Cars dominate our life and we seldom walk or exercise. There is less time to cook healthy food and we often tend to eat fast foods.

Research shows that female obesity is result of several factors culminated together. Most of the time weight is gained by intake of more calories than what the body actually needs. Obesity is a chronic disease with a strong genetic component. Fast food also causes obesity, and American obesity has been linked scientifically to the typical American diet that is high in fats, salt and sugar, and is dominated by over-sized portions.

In addition to an unhealthy diet, other factors leading to obesity are:

- Low levels of physical activity, either in the form of exercise or day to day activities may also lead to obesity.

- Factors like the body composition of the women or even genetic factors like other family members having obesity, may contribute to developing one.

- Aging and other socio-economic factors, aligned with the mental state of a persons mind are important in causing female obesity.

- Endocrine factors often contribute to excess weight in the body. it has been observed that the fat content accumulated in women is twice the amount found in men of the same age.

- It has been observed that factors like changes in the body of the women also often lead to female obesity. Body and mental changes during pregnancy, puberty, or menopause can often lead to female obesity.

- Some other noted causes of obesity are neurological problems leading to weight gain, depression, intake of oral contraceptives, steroids, phenothiazines and insulin too.

Objective of the study

The objectives of the study are as follows:

1. To find out the effect of income on overweight and obesity.

2. To study the effect of age on overweight and obesity.

3. To study the effect of number of parity and marital status on overweight and obesity.

4. To study the influence of eating habit and type of food consumed on overweight and obesity.

5. To find out the effect or working mode on overweight and obesity.

6. To design simple nutrition education packages on low calorie diet.

7. To implement the nutrition education packages.

8. To evaluate the effect of package for recording feedback.

Hypothesis

In view of the aforesaid objectives following hypotheses were framed. On the basis of the findings of the present study, the hypothesis will be accepted or by providing proper justification for the same.

1. Income has no significant effect on the prevalence of overweight and obesity.

2. Prevalence of overweight and obesity increases with the advancement of age of the subjects.

3. Number of parity in the females is responsible to enhance the prevalence of overweight and obesity.

4. The marital status has no positive role to effect overweight and obesity.

5. Eating habit significantly influences the prevalence of overweight and obesity.

6. Consumption of extra energy by the irresponsible to cause overweight and obesity.

7. Working mode or physical activity has significant impact on overweight and obesity.

8. Nutrition education has significant impact on physical exercise, food habits, and knowledge of nutrients.

Rational of the study

Overweight and obesity are form of malnutrition arising due to excess fat deposition. Today these are increasing public health problem of global significance. It is a major focus of attention in India. Improved health facilities, increase in income and availability of food and decrease in physical activity have contributed to this epidemic form of overweight and obesity especially in urban areas of the country. It is a key factor in the natural history of chronic non-communicable diseases such as diabetes mellitus, coronary heart disease, hypertension, arthritis and gallstone.

It is an already known fact that obesity is more prevalent in well affluent societies but in case of females, overweight and obesity are public health problems in both lower income group and high income group. Though the rate of prevalence may vary because studies have shown that in case of females factors other than eating habits and physical inactiveness such as hormonal changes, parity etc. are also responsible for obesity.

Hathras being a newly constructed city, various information regarding health parameters and health services are not available. Till date no survey has been conducted to

acquire these information's in order to administer than for the better of the lives of the beneficiaries. In this respect the present work.

So the present study "A comparative study on prevalence of overweight and obesity in various income group females of Hathras City" will throw light on prevalence rate of overweight and obesity in various groups as well as on different causal factors of the same. Since, in this study, nutrition education packages will be provided to the clients and the effect of the packages will be evaluated, this study would be useful for society for overcoming obesity, which is root cause of many health problems. Again, this study would be more useful for lower income group females who are unaware of the causes, ill effects and management of overweight and obesity, also unable to join any health club or fitness centers. So there is a great need of such projects which can focus the different dimensions of obesity, either it is biological, psychological or social and can be useful for treatment of obesity in effective and economic way. The present study is a little step towards the solutions of this universal public health problem.

Further the findings received from the study will work as a guideline for the future research, academic activities and implementing public health programmes in the beneficiaries.

Limitations of the study

1) In the present study carried out in lower middle and higher income group females. Generalisations can be made about the city as whole. In fact it was an attempt to have selective screening of obesity among females of the lower, middle and higher income group females, the section of society suspected to be affected most by the problem.

2) The study did not include males, because

   (a) available literature suggests that the prevalence of obesity is higher in females, thus giving a better yield of cases necessary for studying the determining factors,

   (b) being a field study the possibility of males remaining outdoors during study visits was very high,

   (c) it would have been inconvenient for the female researcher to examine and measure the items like skinfold thickness at different sites among male subjects.

3) The present study has used 24-hour food recall methods of one day diet survey only for studying daily nutrient intakes. The 7-days diet survey would have given more representative picture about diet, by covering day-to-day variations in the family menu.

4) Some obese women who were conscious about their problem were already on reduced dietary intake, thus causing bias in examining the dietary factors. Such problems are inherent in a cross-sectional study design.

5) The study did include an intervention package for weight reduction among those who were found to be obese.

Chapter II   REVIEW OF LITERATURE

The available literature on overweight and obesity has been reviewed in the following pages under the headings given below:

1.   **THEORIES ON THE CAUSES OF OBESITY**

2.   **ASSESSMENT OF OBESITY AND ITS GRADES**

    1.   Weight Height Indices

    2.   Skin fold thickness as a measure of body fat.

3.   **PREVALENCE OF OBESITY**

4.   **FACTORS INFLUENCING OBESITY**

    1.   Biological Factors

    2.   Social Factors

    3.   Dietary Habits and Nutritional Factors

    4.   Endocrine Factors

    5.   Obesity and Chronic Diseases

    6.   Psychological Factors.

5.   **MANAGEMENT OF OBESITY**

    1.   Dietary Management

    2.   Physical Activity and Practice of Yoga and Pranayam

    3.   Psychotherapy

    4.   Behaviour Modification

    5.   Drugs

    6.   Surgery.

1.   **THEORIES ON THE CAUSES OF OBESITY**

1.   *The settling point theory as a cause of obesity*

This theory claims that "overeating" during childhood stimulates the body's production of more fat cells for the storage of excess fats. As a person grows to adulthood, the fat cells continue to store more fats making adipose tissues become more massive. The theory says that compared to people of a healthy weight, obese people possess more fat cells, which increase their capacity to store fats.

The theory of the cause of obesity adds that the body mechanisms of obese people to inhibit fat intake (if there is already enough fats ingested) and to relieve hunger (if the person is already full) is slow. The body mechanisms might involve the brain's delay or failure to send signals to the 'hunger center' of the brain to 'tell' the person that he is already full. The consequence of this problem is that the excess fats ingested are deposited to fat cells in adipose tissues.

Furthermore, the theory claims that the weight of obese people has a 'settling point' that any deviation from it is prevented by physiological means. The 'settling point' is comparable to the 37 degrees Celsius constant body temperature of human. This can be observed when an obese person's metabolic rate drops as that person loses weight through diet. We know that low metabolic rate inhibits fat burning; this makes the diet futile. When an obese person then begins to gain weight his metabolic rate soars up and his appetite is enhanced. The lost in weight is regained three times faster until the 'settling point' is reached Marieb, (2006).

2. *Fuel efficiency theory as a cause of obesity*

This theory claims that obese people are 'more fuel efficient' and better 'fat stores' Marieb (2006). Perhaps everybody has the notion that an obese people eat more food than normal persons that is why their body 'ballooned'. This is not totally correct because some people who are considered obese actually eat less food than normal weight people.

Molecular observation on the fat cells of obese people reveals that they (fat cells) extend more alpha receptors from their plasma membranes than what is observed in normal persons. This alpha receptors are the sites where fatty acid and glycerol molecules bind, they are also responsible in transferring these molecules toward the cytoplasm. Therefore, the more alpha receptors, the more efficient are the entry of fats towards the cell's cytoplasm. Furthermore, fat cells of obese people secrete high amount of lipoprotein lipase enzymes responsible in unloading fats from the blood towards fat cells. The effect is again more fat deposition to fat cells.

3. *Genetic predisposition theory as a cause of obesity*

This theory of the cause of obesity is based on genetics: the study of heredity, genetically obese parents can transfer their obesity genes to their children. When the obesity genes are expressed, the tendency for the obese person is that any excess calorie he consumed is deposited as fat instead of being processed for the formation of muscles (as observed in a normal person). Scientists have already identified 250 obesity genes in mice and men (Foster, 2008) but their modes of expression are not yet understood. However, they believe that the environment has a strong influence in activating these genes to be expressed. One case study that supports this theory is an adopted child who grows to be like his obese parents even though his 'legal parents' did not fail to guide his eating habits. The child did inherit his 'real' parents' obesity genes.

ASSESSMENT OF OBESITY AND ITS GRADES

Deurenberg and Yap, (1999) fat is a normal component of the human body that is stored in adipose tissue. Obesity can be defined as a condition of excessive fat accumulation to the extent that health and well-being are affected. Body fat can be determined in vivo in different ways, using rather accurate laboratory techniques or using simple estimation techniques that can also be applied in field conditions. For population studies, the World Health Organization defines cut-off values for obesity based on the body mass index (BMI): weight/height squared (kg/m^2). Generally, for adults, if the BMI exceeds 25 kg/m^2, a subject is considered to be overweight, and if the BMI exceeds the value of 30 kg/m^2, a subject is considered obese.

1. *Weight Height Indices*

Many indices of obesity (weight/height, weight/height^2, weight /cube of height, cube root of weight/height etc.) have been used in the past.

The Quetlet's Index or Obesity Index or Body Mass Index [weight (kg)/ Height in meter^2] has been found to be the most appropriate one. Body Mass Index or BMI is simple and widely used method for estimating body fat mass Mei *et al.* (2002). BMI was developed in the 19th century by the Belgian statistician and anthropometrist Adolphe Quetelet, (Quetelet, 1871). BMI is an accurate reflection of body fat percentage in the majority of the adult population. It however is less accurate in people such as body builders and pregnant women. A formula combining BMI, age and gender can be used to estimate a person's body fat percentage to an accuracy of 4%.

BMI is calculated by dividing the subject's mass by the square of his or her height, typically expressed either in metric or US 'customary' units.

Metric: BMI = Kilogram/meters^2

US/Customary and imperial: BMI = Lb 703/in^2

Where Lb is the subjects weight in pounds and is the subjects height in inches.

The most commonly used definitions, established by the World Health Organization (WHO) in 1997 and published in 2000, provide the values lists in the table WHO, (2000).

BMI	Classification
< 18.5	Underweight
18.5-24.9	Normal weight
25.0-29.9	Overweight
30.0-34.9	Class I obesity

35.0-39.9	Class II obesity
> 40.0	Class III obesity

Some modifications to WHO definitions have been made by particular bodies. The surgical literature breaks down.

Class III obesity into further categories (Gabriel, 2006).

- Any BMI > 40 is severe obesity
- A BMI of 40.0-49.9 is morbid obesity
- A BMI of > 50 is super obese.

As Asian populations develop negative health consequences at a lower BMI than Caucasians, some nations have redefined obesity. The Japanese have defined obesity as any BMI greater than 25, Kanazawa *et al.* (2002) while China uses a BMI of greater than 28, Bei-Fan (2002).

BMI is considered as a better index for assessing obesity because it does away with the need of height weight tables and is not dependent upon type of obesity frame.

In various studies, BMI has been used as screening method for obesity, but different authors have used different cut-off points, for screening purposes.

Authors	Year	Cut-off points
Sood	1982	≥ 25
National Centre for Health Statistics, USA.	1983	≥ 28
Young and Sevenhyen	1989	≥ 26

2. *Skin fold thickness as a measure of body fat*

The measurement of skin fold thickness using specially designed calipers offers a more direct assessment of fatness. Durnin and Womersley (1974) have measured skin fold thickness at 4 sites (biceps, triceps, suprailliac, and subscapular) and correlated it with total body fat as measured by under water weighting. The interpretation of the sum of skin fold measurement at four sites is as follows:

Sum of 4 sites skin fold	Interpretation
Up to 40 mm	Upper limit of normal

40 to 59.9 mm	Above normal
60 to 79.9 mm	Substantial excess of fat, equivalent to overweight (defined as body weight 110% or more)
80 mm and above	Markedly excess fat equivalent to obesity (defined as body weight 120% or more)

The measurement of the skin fold thickness can provide a useful technique for evaluating total body fat. Because the thickness of skin from site to site, usually varies from 0.8 mm to 1.1 mm. The most of the distance below a fold of skin represents subcutaneous fat. By measuring this, one can estimate body fat by consulting appropriate tables for Children, Seltzer and Mayer (1965) for adults, Durnin and Womersley (1974).

Study done by Khalid and Mohd. Yunus (2005) on the 'prevalence of obesity in urban population based on Triceps skin-fold thickness in relation to body weight' that showed that prevalence of obesity among male and female bases on triceps skin fold thickness using Seitzer and Meyer criterion was 2.2% and 10.4% respectively. Sood found the prevalence of obesity using same criterion in females and females to be 2.1% and 10.04% respectively. Sood found prevalence of obesity in males to be 9.4% according to relative body weight criterion, which was higher as compared to prevalence of 8.0% in the study. No significant difference was found in prevalence of obesity using triceps skin fold thickness in this study when compared with Sood. Prevalence of obesity was significantly higher by relative body weight than by triceps skin fold thickness in both males and females and this was consistent body weight criterion (metropolitan standard) is better tool for assessing the prevalence of obesity as compared to triceps skin fold thickness (Seltzer Mayer Criterion).

2.   PREVALENCE OF OBESITY

Prevalence of obesity varies according to age, sex and region. It is more common in adults than in children and in females than in males. Though it is much more common in the west, its prevalence is gradually increasing the developing countries also. There are different method like weight/height, cube root of weight/height; estimation of total body fat and skin fold measurement for assessing obesity and different researchers have used different anthropometric criteria for this purpose.

Sahay *et al.* (1991) carried out on 236 female hostlers of B.H.U. campus aged 15-55 years excluding pregnant and lactating women with the aim to find out the extent of obesity in the study group. Height weight, skin fold thickness (biceps, triceps, suprailliac, subscapular) were measured. Prevalence of obesity by two criteria was 11.4% and 26.3%,

respectively. Since on two method of obesity determinative give comparable results, it is datable as to which method should be chosen for screening of obesity in the community.

Gopinath *et al.* (1994) studied urban women of Delhi and reported the prevalence rate of obesity as 33.4%. The nutrition foundation of India has just completed a study on the prevalence of obesity in urban Delhi and reported the prevalence rate of overweight (BMI 25^+) and obesity (BMI > 30) as 50% and 14%, respectively, Gopalan (1998). The observations regarding the European populations reduce that WHO MONICA study, (1989) the prevalence of obesity and overweight is in the range of 50-70% in people aged between 35-64 years. The prevalence of overweight and obesity in the urban middle class women of Punjab as revealed from the data of the present study is no doubt less than what has been reported for the industrialized western countries.

Wang (2001) reported the prevalence of obesity and overweight was high in the US combined prevalence was (25.4%) low in China (combined prevalence, 16.0). These clearly suggest that national socio-economic development levels influence the epidemic of obesity. The prevalence of obesity and overweight and the combined prevalence of obesity and overweight by age, sex and SES groups. In the US prevalence of obesity and overweight among American adolescents was lowest in the high income group. By contrast, in China the high income groups generally were at a higher risk of obesity. The prevalence of obesity was higher in rural areas in Russia but higher in urban areas in China. Interestingly, in both Russia and China, but not in the US, the prevalence of obesity and overweight was higher among children than among adolescents. The difference was especially remarkable for obesity.

Sidhu and Tatla (2002) on the 'prevalence of overweight and obesity among adult urban females of Punjab: A cross sectional study' the prevalence rate of malnutrition was calculated according to the critical limit of BMI as recommended by WHO (1998) out of 1000 females, only 45 females (4.5%) are underweight and 502 (50.2%) are normal while 200 females (20%) are overweight but 121 (12.1%) are in obesity grade I, 80 (8%) in obesity grade II and 52 (5.2%) are in obesity grade III or in other words, the prevalence of overweight and obesity in the present sample 20% and 25.3%, respectively. Thus, it is apparent from the present study that nearly half of the females belonging to upper middle class in Punjab are currently, overweight/obese.

Subramanyam *et al.* (2002) the prevalence of obesity and overweight in adolescent girls between 10-15 years of age, among the affluent families of Chennai-two studies are compare using body mass index (BMI) as a parameter. The first study done in the year 1981 (Group I) was compared with the second study in 1998 (Group II). Group I had 707 and group II had 610 girls. Overweight and obesity were denoted by BMI above 85th and 95th percentile respectively. Results showed a 9.6% prevalence of overweight and 6% prevalence of obesity in both studies. It was also observed that the BMI for the same age in the two study periods showed an increase from 1981 to 1998. BMI approximated the International reference value for BMI at age 13 years in the year 1998.

Mohammad Ali and Lindstrom (2005) studies 17.5% proportion of the women, aged 18-34 years were underweight (BMI < 20.0), 18.4% overweight, and 7.0% obese. The prevalence of underweight according to BMI < 18.5 definition was 5.8% among women aged 18-34 years, women who were overweight/obese were unemployed, had low education, low social participation, low emotional and instrumental support, were daily smokers, had a sedentary life style, had poor self reported global health, and had lack of internal locus of control compared with normal weight women.

Sidhu and Prabjot (2005) the prevalence of overweight and obesity was assessed during a community based epidemiological survey on a randomized sample of 1700 (900 urban and 800 rural) adult Punjabi females in the age group from 20-45 years. For the assessment of overweight and obesity, height and weight measurements were taken on each subject. The prevalence rate of malnutrition was calculated according to the critical limits of body mass index (BMI). The observations show that the combined overall prevalence rate of overweight/obesity in the present study is 43.88% and 22.26%, respectively for urban and rural females. The frequency of overweight and obesity is more among urban females than in their rural female counterparts.

Cynthia *et al.* (2006) in 2003-2004, 17.1% of US children and adolescents were overweight and 32.2% of adults were obese. Tests for trend were significant for male and female children and adolescents, indication an increase in the prevalence of overweight in female children and adolescents from 13.8% in 1999-2000 to 16.0% in 2003-2004 and an increase in the prevalence of overweight in male children and adolescents from 14.0% to 18.2%. Among men, the prevalence of obesity increased significantly between 1999-2000 (27.5%) and 2003-2004 (31.1%). Among women, no significant increase in obesity was observed between 1999-2000 (33.4%) and 2003-2004 (33.2%). The prevalence of extreme obesity (body mass index-40) in 2003-2004 was 2.8% in men and 6.9% women. In 2003-2004 significant differences in obesity prevalence remained by race ethnicity and by age. Approximately 30% of non-Hispanic white adults were obese as were 45.0% of non-Hispanic black adults and 36.8% of Mexican Americans. Among adults aged 20 to 39 years, 28.5% were obese, while 36.8% of adults aged 40 to 59 years and 31.9% of those aged 60 years or older were obese in 2003-2004.

Toryila *et al.* (2009) the prevalence of overweight and obesity in Zaria, Kaduna state, Northern Nigeria and to establish the relationship between overweight and obesity with age, sex and blood pressure. 3250 healthy adults Nigerian civil servants were used in the study. The population composed of 1750 male and 1500 female with age range from 25 to 65 years, were examined for overweight and obesity using body mass index (BMI) and waist hip ratio, BMI was calculated as weight (kg) divided by height (m^2). Blood pressure was measured by using sphygmomanometer. Pregnant women and all ill health persons were excluded from the study. The prevalence rate of overweight and obesity in Zaria was 29.6% (964). The prevalence rate of overweight and obesity was higher in female 16.1%

(523), than in male 13.5% (441). The mean BMI was found to increase with age. The mean waist to hip ration was 1.08 for men and 0.967 for women.

3. FACTORS INFLUENCING OBESITY

Obesity is a multifactorial health problem. These factors are biological, social, dietary and nutritional, endocrine and psychological.

1. *Biological factors*

Biological factors may be described in terms of heredity, age, sex, parity, and also in terms of certain events in life of women such as pregnancy and menopause may be associated with weight gain.

<u>Heredity</u>

WHO (2000), the profile of fat distribution is also characterized by a significant heritability level of the order of about 50 per cent of the total human variation. Recent studies have shown that the amount of abdominal fat was influenced by a genetic component accounting for 50-60 per cent of the individual differences.

Joshi (2002) studies although genetically the child is not determined to be obese yet obesity in parents influences obesity in children since the food habits of parents mould those of the child.

Other genetically associated factors are the activities of the child such as fidgeting which is an important way of burning up calories. Some people who squirm and wriggle use up calories, which equal to those burnt on jogging several miles every day.

Dolson (2003-04) studied to a large extent, the weight are genetically determined probably more accurately, the weight range we can comfortably be in unless other factors intervene, is genetically determined. Before recent developments in DNA research, we don't know much about which genes were contributing. We did know by looking at twin, sibling and adoption studies that genetics plays a dominant role, for example, in general adoptive children have weights more similar to their biological than their adoptive parents, no matter how different the environments are. Identical twins reared a part can have vastly different environments vis-à-vis food and activity level, but often end up looking almost similar in most cases, including weight.

Like height, weight is heritable, one recent review suggests that twin and adoption studies point to a genetic contribution for BMI of 40-70%. Farooqi (2005), while a more extensive, but earlier, review of familiar resemblance suggests that genetic factors explain 50-90% of BMI. Maes, Neale and Eaves (1997). The results of genetic studies, where presented separately for males and females, appear broadly similar, overall, the finding of such studies mean that genetic factors, determine individual susceptibility of gain weight. Such 'thrifty' genes provide an evolutionary advantage in time of famine when humans

have to stockpile energy to survive, but a disadvantage when food is plentiful, Lev-Ran (2001). However, as several authors point out, while the propensity for obesity may have existed for a long time, the recent rapid rise in rates demonstrates the central role of environmental factors, Rennie *et al.* (2005).

Now, however, the actual genes involved in obesity are being identified and the situation is incredibly complex. Weight is determined by many genes-some more important that others. More than 300 genes (so far) have been linked with obesity. Where our fat is deposited, how insulin is regulated, how much of various hormones our bodies secrete, and many, many more, for most of them, we don't understand the mechanisms yet. The next few years will be most interesting in that regard.

Clayson (2007) studied but let's focus on one of the less obvious aspects of childhood obesity for a minute while the causes of obesity are well reported –namely lack of exercise and bad eating habits-there are also familiar and hereditary instances of obesity that are less often analyzed. Children whose parents are obese have a much greater chance of becoming obese themselves. Perhaps this has to do with genetic factors, but more often that not it has to do with the families sedentary lifestyle and eating habits. If parents do not take proper care of themselves, then their children can be born obese.

Michaellucas (2008) before commencing on the role of genetic obesity one must keep in mind that only a small percentage of children carry genetic defects for obesity and the factors other than genetic play a key role in making a child obese. Unfortunately, most of the people don't realize the bad influence of these factors and keep emphasizing upon the genetic factors responsible for childhood obesity.

Age

The prevalence of obesity is linked with the age of the population studied and all statistics show that it increases with age.

International Children's Centre, Paris (1984) reported that a study in USA to gain most weight between age of 29 and 35 years, while women gain most between 45 and 49 years of age.

Padma Kumari (1990) reported that prevalence of obesity increased with age. In her study, they found the maximum prevalence of obesity in women was seen between the age group of 40-49 year (66.7%) whereas in another study the prevalence of obesity was about 90% among the women in the age group of 45-55 years, Young and Sevenhuayen (1989).

Brays (1994) shows that for a man aged 45 and increase of 12 kg above standard weight reduces his life expectancy by 25 per cent. The relative risk associated with obesity decrease with age over 75 years.

Seidell (1997) increasing with age atleast up till age 50-60 years in man and women.

Asthana *et al.* (1999) studies a direct relationship is observed between age and obesity. The prevalence of obesity showed an increasing trend over the successive age

period, increasing from eight per cent in the age groups 15 to 20 years to 50 per cent in women aged 50 years and above. The mean age of obese and non-obese women was also calculated and it was significantly higher in obese (30.91 yrs.). This could be because of cumulative effect evident in late adulthood as compared to adolescent or early adulthood periods. In a study, Padma Kumari (1990) found maximum prevalence of obesity (66.77%) in women 40-49 years, so increase in the prevalence of obesity by age.

Park (2005) obesity can occur at any age, and generally increased with age, infants with excessive weight gain have one increased of obesity in later life. About one third of obese adult have been so since childhood. It has been well established that most adipose cells are formed early in life and the obese infant lays down more of these cells (hyperplastic obesity) than the normal infant. Hyperplastic obesity in adults is extremely difficult to treat with conventional method.

Haslam (2007) it was not until the 20th century that it became common, so much so that in 1997 the WHO formally recognized obesity as a global epidemic Caballero (2007). As of 2005 the WHO estimates that at least 400 million adults (9.8%) are obese with higher rates among women than men WHO (2009). The rate of obesity also increases with age at least up to 50 or 60 year old. once considered a problem only of high-income countries obesity rates are rising world wide. These increases have been most dramatically in urban setting WHO (2009). The only remaining region of the world where obesity is not common is sub-sahara, Africa, James (2005).

Anjel Vahratian (2009) includes prevalence data on body mass for our study population, stratified by both age and race and Hispanic origin, overall, 24.5% of women 20-44 years of age were overweight and 23.0% were obese. Among those who were obese, 10.3% met the criteria for class II or III obesity. The prevalence of both overweight and obesity increase with age, the prevalence of overweight ranges from 20.4% in 20-29 years olds to 26.9% in 40-44 year olds. Similarly, the prevalence of obesity increased across age ranging from 19.1% in 20-29 year olds to 25.6% in 40-44 year olds. When stratified by race and Hispanic origin the prevalence of overweight and obesity respectively was highest among non-Hispanic black women (30.0% and 34.1%), followed closely by Hispanic (29.7% and 22.2%), non-Hispanic white (22.8% and 21.4%) and non-Hispanic other women (17.4% and 15.2%). Age trends persisted in this stratified analysis.

Sex

International Children's Centre, Paris (1984) reported that women generally have higher rate of obesity than men, although men may have higher rates of overweight.

Kelly *et al.* (1984) examined the prevalence of obesity in males and females that 9% of male subject and 16% of female subjects aged 21 years or over were obese. The prevalence and degree of obesity were both greater in females than in males.

Sood *et al.* (1984) examined 509 males and 517 females of Delhi. They reported that 38.7% of male and 72.7% females were classified as obese on the basis of per cent body fat.

Such high rates may be due to the equation use to calculate body density being derived from measurement on subject with different racial and ethnic backgrounds.

Retner *et al.* (1991) reported that current recommendation for appropriate weight gain in pregnancy suggest an optimum of 120% of ideal weight at delivery. This represents an increase of approximately 24 pounds in the normal weight women, and even the obese patients were observed to gain 16 pounds.

Women's BMI increases with successive pregnancies. The recent evidence suggested that this increase is likely to be on an average about 1 kg per pregnancy. On the other hand, in many developing countries consecutive pregnancies at short intervals are often associated with weight loss rather than weight gain WHO (2000).

Lobstein and Frelut (2003) the review of surveys conducted within Europe in the 1990s found the number of countries with higher prevalence for overweight and obesity among females was almost the same as that with higher prevalences for males. It is possible that gender differences may emerge in future, a study conducted in the US found significantly greater increases in rates among males between 1986-98 Strauss and Pollack (2001). It has therefore been suggested that prevalence estimates for both males and females should always be presented Reilly (2005).

Schwarz (2007). Body fat percentage is total body fat expressed as a percentage of total body weight. It is generally agreed that men with more than 25% body fat and women with more than 33% body fat are obese.

Menopause

Weight gain might also be associated with menopause (Asthana *et al.*, 1999) whether the women tend to gain weight near menopausal phase of life the prevalence of obesity was calculated around pre-menopausal age period. It is clearly evident that prevalence of obesity was high (46.84%) between 40 to 45 years age period and continues to remain high beyond 45 years (48.08%) as compared to 21.39 per cent under the age of 33 years and overall prevalence of 30.24 per cent. Thus, it could be clearly missed that prevalence of obesity started increasing after 35 years of age but become more pronounced after 40 years. Though no hormonal estimates were done, but one can speculate that these changes in the increased prevalence of obesity could be due to hormonal changes that occur in this period of women's life.

Parity

Swaminathan (1988) has quoted that a healthy women gain on an average about 12.5 kg weight during pregnancy and about half of this consists of body fat stored in adipose tissue. The association between parity and obesity could be explained terms of certain hormonal changes in women during pregnancy like secretion of leutinising hormone coupled with possible energy imbalance and mood variations, which may lead to deposition of adipose tissue and resultant obesity.

Asthana and Gupta (1999) studies the prevalence of obesity was found to be higher (51.28%) in women with parity more than three as compared to prevalence of 32.12% in women with parity three and less (P<0.01) high prevalence of obesity was associated with parity.

Alessandra *et al.* (2007) studied frequency of obesity was 28.4% a higher than the frequency of obesity observed in other Brazilian population samples. After multivariate adjusted, compared with women with less than 3 child births women with 3 childbirths or more were more overweight [odds ratio (OR) 3.4, 95%, confidence interval 95% Cl, 1.2-9.6] and more obese [OR, 53, 95% Cl, (1.3-17.5)]compared to black women, white women were also more obese (OR, 9.9, 95% Cl, 1.5-64.6). In the sample of low income women, parity and race were the most important factors associated with obesity.

Koch *et al.* (2008) in MLAR (Multiple Linear and Logistic regression models) a modest parity-related increment in BMI and practically null increment in WC, WHR and WHIR was observed. Covariates that showed a statistically significant association with anthropometric measures of adiposity were age, law education, marital status, employment, smoking, smoking cessation, hypertension, diabetes, dislipidaemia, parent's obesity. Menarche and fetal macrosomia. Crud Odds ratio (OR) showed a strong association between parity and anthropometric markers of obesity. All the measures of abdominal obesity related to parous women showed OR smaller than 1 (95% confidence intervals 0.57 to 0.96) parity can increase adiposity but not necessarily following an abdominal patterns.

Pregnancy can have a significant impact on women's long term weight and risk of being overweight nulliparous women tend to be less overweight compared to multiparous women, and there is a dose-response effect the more children a women has the more likely she is to be overweight. In the past the primary focus of prenatal nutrition counseling was to prevent deficiencies. Today the growing epidemic of obesity and associated chronic illness has drawn attention to the problem of over nutrition during pregnancy.

2. *Social factors*

Socio-economic factors have a strong influence on the prevalence of obesity.

Gupta *et al.* (1998) study from Jaipur showed that among 237 children (13-17 years of age) from middle and upper middle class, 24 (10.1%) were obese as defined by BMI above the 95th percentile.

Martikainen and Marmot (1999). The increase in overweight and obesity has been extensively documented in industrialized societies, showing over the last quarter of a century a transition from a positive to a negative association between income and obesity. A similar phenomenon is new emerging in developing countries. Monteiro *et al.* (2000) and Vauy *et al.* (2001) and in some Latin American middle income countries, where greater levels of obesity among the poor are observed, especially in urban areas, conversely, less developed, societies and rural environment tend to display a more positive association between overweight and social status.

Reilly, Martorell (2000) and Bundred *et al.* (2001) studies based on relationship between obesity and socio-economic status have been conducted the world over. A rapid increase in the prevalence of obesity in children has been seen in England and United States of America and around the world.

Pena and Bacallao (2000), Latin America is in the middle of an epidemic of obesity that transcends socio-economic boundaries and affects the highest socio-economic level as well as the most disadvantaged.

Wang (2001) shows that child and adolescent obesity is related to SES, although the relationship differ among these three populations. We used family income as a primary indicator of SES, while rural urban residence might serve as an additional indicator. In the US low SES groups had a higher risk of obesity. By contrast in China high SES groups were at an increased risk. In Russia a transitional society that has experienced economic difficulties since the early 1990's, both low income and high income groups were at an increased risk of obesity compared to the medium income group. One possible explanation for the different SES obesity relationship is developed countries such as the US and developing countries such as China is that the influence of SES on people's lifestyles such as diet and physical activity may differ. Take food consumption patterns as an example. In China richer people have better access to meal and other energy-dense foods (which are much more expansive than other foods such as vegetables) than the poor. While is US higher SES groups usually consume more vegetables and fruits, which are less energy dense than low SES groups.

Ball *et al.* (2002) results demonstrated associations for women, after controlling for age between the employment domain and body mass index and waist to hip ratio. Low status employed women were 1.4 times as likely to be overweight as high status employed women. There were less consistent relationships observed among these factors for men, relationships between family unit and indicators of body weight and body fat distribution were observed for both men and women with those who were married.

Penny Gordon *et al.* (2003) keeping adolescents in their same environments and changing only family income and parental education had a limited effect of the disparities in overweight prevalence. Ethnicity-SES overweight differences were greater among females than males. Given that overweight prevalence decreased with increasing SES among white females and remained elevated and even increased among higher SES African-American females. African American/white disparity in overweight prevalence increased at the highest SES. Conversely, disparity was lessened at the highest SES for white, Hispanic and Asian females, Among males disparity was lowest at the average, SES level.

Mohammad Ali and Lindstrom (2005) obesity is a growing health problem in many countries. In Sweden an increase in the obesity prevalence was observed during the 1980's and 1990's in all socio-economic groups. Obesity is a risk factor for hypertension, cardiovascular diseases, diabetes, and total mortality. Obesity (BMI 30.0 or more) and

overweight (BMI 25.0-29.9) are positively associated with increasing age, low level of leisure time physical activity, and in some groups differing dietary habits. In Sweden obesity and overweight are associated with lower levels of education and low socio-economic status.

In respect of socio-economic status (SES), studies suggest higher rates of obesity among low income groups in richer countries and high income groups in poorer ones (Lobstein *et al.*, 2004). It is suggested that this is because in developing nations, higher SES individuals have become globalized, with easy access to relatively cheap, calories dense foods, while those of lower SES remain localized and undernourished. Sobal (2001) within the US, increases have also been greatest among children and adolescents from the lowest income families, so increasing SES disparities. Strauss and Pollack (2001) however, not all studies in developed countries find SES differences. Saxena *et al.* (2004) and Taylor (2005) and among those that report separately, there is some evidence that SES differences may be clearer among females than males Wardle *et al.* (2006).

Kaneria *et al.* (2006) study, it was observed that there has been a significant increase in overweight (4.85%) and obesity (3.73%) in children belonging to affluent and upper middle class income group. In affluent group children prevalence of overweight was relatively higher in the age group 14 and 16, but obesity was greater in 16 and 17 years age groups. Hence the present study has highlighted that obesity is an emerging health problem in adolescent children belonging to affluent families in Udaipur.

McLaren (2007), the correlation between social class and BMI varies globally. A review in 1989 found that in developed countries women of high social class were less likely to be obese. No significant differences were seen among men of different social classes. In the developing world, women, men, and children from high social classes had greater rates of obesity. Sobal and Stunkard (1989) an update of this review carried out in 2007 found the same relationships, but they were weaker. The decrease in strength of correlation was felt to be due to the effects of globalization.

Many explanations have been put forth for associations between BMI and social class. It is thought that in developed countries, the wealthy are able to afford more nutritious food, they are under greater social pressure to remain slim, and have more opportunities along with greater expectations for physical fitness. In undeveloped countries the ability to afford food, high energy expenditure with physical labour, and cultural values favoring a larger body size are believed to contribute to the observed patterns (Mclaren, 2007). Attitudes towards body mass held by people in one's life may also play a role in obesity. A correlation in BMI changes overtime has been found between friends, siblings and spouses (Christakis and Fowler, 2007).

Marital status

Asthana and Gupta (1999) analysis of marital status with reference to obesity was done to verify thus association. If this association is true then prevalence of obesity should

be low in unmarried women as compared to married and widow women. Age adjusted prevalence rates were calculated. The result showed that age adjusted prevalence was lowest among unmarried (6.24%) as compared to married (35.28%) and widow (33.92%) women. The possible reasons for higher prevalence of obesity in married women could be intake of calorie dense food during each pregnancy and lactational period. Weight gain during each pregnancy, half of which is constituted by body fat and stress and strain of pregnancy and feeling of insecurity among widows, leading to anxiety, depression and stress. All these situations start then to eat more in frequency and quantity, either to reduce tension or as a substitute gratification when more pertinent and realistic gratifications are unavailable.

Woaj Leug *et al.* (1999) higher educational level seems to be connected with a lower risk of being overweight, but this is only seen in women, according to research into the influence of marital status and education on consumption pattern of food groups, nutrient intake, blood pressure, waist-hip ratio and other laboratory parameters among Hong Kong Chinese subjects. Higher levels of education appear to be linked with a healthier dietary pattern in relation to chronic diseases. It is clear that there is a needed to consider the impact of individual socio-economic factors on dietary intake and cardiovascular risk factors.

3.   *Dietary habits and nutritional factors*

Blundell *et al.* (1996) study dietary energy intake and excess body weight are positively associated. Among the various dietary factors, dietary fat and fiber have opposite effects. Dietary fat with high energy density and palatability with poor appetite control signals tends to increase energy intake and body fat, while the fiber limits energy intake by reducing density of fats. Subjects on high fat diet generally tend to over consume energy 'passive over consumption'.

In Indian diet, the contribution of saturated fats like vanaspati and ghee to total fats is generally small. NFI, (1999) scientific report-15 study, the mean frequency of intake of refined oil, the most common cooking oil medium, was found to be significantly high among the overweight section. There was significant direct relationship with tertiles of BMI and WHR especially in the males and BMI in females. However, it is difficult to draw meaningful conclusions from the frequency of food intake data alone without taking into consideration the actual quantity consumed. A positive trend of more frequent intake of 'rich' foods in subjects with higher tertiles of BMI and WHR may account for fat accumulation.

Srilakshmi (2005) nibbling between meals is common among housewives and is a potential cause for obesity and some may eat faster taking less time for chewing, therefore thy tend to consume more food or sometimes housewives who do not want leftover foods to be thrown out may consume forcibly and put on weight WHO (2000). Nowadays television and print media is playing an important role in energy-dense micronutrient poor food and beverages (usually classified under the 'eat least', category in diet guidelines) of

multinational corporations, which influence the daily eating habits. The consumer demand by itself may be influenced by advertising marketing, culture, fashion and convenience.

Regular consumption of high energy-dense fast foods and sugary drinks which are associated with less satiation and so insufficient compensation via subsequent reductions in intake, increased portion size, eating outside the home and snacking have been particularly implicated in promoting weight gain. This is especially the case among older children, who are less influenced by biological cues of satiety, Agras and Mascola (2005).

Obesity is related to an imbalance between energy input and output, the size of which may be very small if over a long period. Reilly (2007) one review suggests that in children, an imbalance of around 2%, which is the equivalent of around 30 calories or 15 minutes of TV instead of play a day, may lead to obesity, Goran (2001). Behavioural determinants therefore include excess energy intake and inadequate energy expenditure. Prentic and Jebb (1995) although the emphasis given to these 'Big Two, and the neglect of other plausible contributors to the secular increase in obesity has recently been questioned, Keith *et al.* (2006).

Duvigneaud *et al.* (2007) gives an overview of the difference in plausible dietary intake between BMI and WC (waist circumference) groups in women. Significantly higher values for carbohydrates, starch, fibre, fat (saturated, mono and polyunsaturated) and total energy intake were observed in overweight and obese women compared to normal weight women. Obese women also reported significantly higher intake of protein, sugar and iron intake than their normal weight counterparts. Similar findings were observed between the WC groups. Women with high risk abdominal obesity reported a significantly higher cholesterol intake and higher energy intake from alcohol compared to women with normal WC or moderate risk for abdominal obesity.

The widespread availability of nutritional guidelines have done little to address the problems of overeating and poor dietary choices, Marantz *et al.* (2008). In the period of 1971-2000, obesity rates in the United States increased from 14.5% to 30.9%, Flegal *et al.* (2002). During the same time period, an increase occurred in the average amount of calories consumed. For women, the average increase was 335 calories per day (1542 calories in 1971 and 1877 calories in 2004), while for men the average increase was 168 calories per day (2450 calories in 1971 and 2618 calories in 2004). Most of these extra calories come from an increase in carbohydrate consumption rather than an increase in fat consumption, Wright *et al.* (2004). The primary sources of these extra carbohydrates are sweetened, beverages, which now accounts for almost 25 per cent of daily calories in young adults in America, Caballero (2007). Consumption of sweetened drinks is believed to be contributing to the rising rates of obesity, Malik *et al.* (2006) and Olsen *et al.* (2009).

A comparison of a cheeseburger 20 years age (left) which had 333 calories with a modern cheese burger right contains 590 calories.

As societies become increasingly reliant an energy dense, large portion, fast food meals, the association between fast food consumption and obesity becomes more concerning, Rosenheck (2008). In the United States consumption of fast food meal has tripled and calorie intake from fast food has quadrupled between 1977 and 1995.

4   *Endocrine factors*

Michaellucas (2008) studies that it must be keen in mind that all the genes for controlling different factors leading to obesity are mostly recessive and hence, express themselves intensely if they do so at all any how the most common hormonal cause hyperthyroidism in which thyroxin is not secreted profusely by the thyroid gland and the blood thyroxin level decreases which causes obesity. Another important hormonal cause is the Hypocartisolism, which is characterized by 24-hour free urinary cartisol level. This in turn leads to obesity primary Hyperinsulinism is still another hormonal cause of obesity due to genetic defects, which expresses itself. When plasma insulin increases in blood. This very factor increases the C-peptide level of the victim. Moreover pseudo hypothyroidism involves the increased PTH (Parathyroid Hormone) level in the blood which causes the malfunctioning of many body organs and systems. All this leads to obesity.

5   *Obesity and Chronic diseases*

Obesity increases the risk of many physical and mental conditions. These co-morbidities are reflected predominantly in metabolic syndrome, James (2005). Metabolic syndrome being a combination of medical disorders, which includes diabetes mellitus type 2, high blood pressure, high blood cholesterol, and high triglyceride levels, Grundy (2004).

Hypertension and obesity

Aneja *et al.* (2004) study obesity is a common problem in much of the western world today in that is linked directly with several disease processes, notably, hypertension. It is becoming clear that the adipocyte is not interact with each other and may result in elevated blood pressure. Of particular importance is the putative role of leptin in the causation of hypertension via an activation of the sympathetic nervous system and a direct effect on the kidneys, resulting in increased sodium re-absorption leading to hypertension.

Bethesda (2004) study with the significant rise in obesity in this last decade comes a corresponding increase in the prevalence of hypertension. Almost 29 per cent of population is hypertensive. The relationship between obesity and BP appears to be linear and exists throughout the non-obese range. But the strength of the association of obesity with hypertension varies among different racial and ethnic groups. Generally, risk estimates suggest that approximately 75 and 65% of the cases of hypertension in men and women, respectively, are directly attributed to an overweight condition and obesity. It is important to recognize that long-duration obesity does not appear necessary to elevate BP, as demonstrated by obesity in children without a condition of hypertension.

Obesity-related hypertension is commonly associated with further elements of the metabolic syndrome, such as insulin resistance and glucose intolerance. In particular, one should be aware that diabetes *de novo* occurs in 2% of treated hypertensive patients per year, Verdecchia *et al.* (2004).

The relevance of both hypertension and obesity, as important public health challenges, in increasing worldwide, compared with the year 2000, the number of adults with hypertension is predicted to increase by 60% to a total of 1.56 billion by the year 2025, Kearney *et al.* (2005). The growing prevalence of obesity is increasingly recognized as one of the most important risk factors for the development of hypertension. This epidemic of obesity and obesity-related hypertension is paralleled by an alarming increase in the incidence of diabetes mellitus and chronic kidney disease. This editorial examines the evidence liking obesity with hypertension.

Excess body weight is the sixth most important risk factor contributing to the overall burden of disease worldwide, Haslam and James (2005). Obesity and in particular central obesity have been consistently associated with hypertension and increased cardiovascular risk. Based on population studies, risk estimates indicate that at least two-third of the prevalence of hypertension can be directly attributed to obesity, Krause *et al.* (1998). Apart from hypertension, abdominal adiposity has also been implicated in the pathogenesis of coronary artery disease, sleep apnoea, stroke and congestive heart failure, Haslam and James (2005). There is increasing evidence that obesity contributes to the development as well as to the progression of chronic kidney disease, De Jong *et al.* (2002).

Obesity is associated with an increased risk of cardiovascular, but this requires that obesity is combined with hypertension. In overweight and obese subjects, the cardiovascular risk is not significantly increased unless hypertension is present, Thomas *et al.* (2005). This observation underscores the role of hypertension as mediator through which obesity may cause cardiovascular disease while obese subjects are prone to hypertension, hypertensive subjects also appear to be prone to weight gain. Both the Framingham and Tecumseh studies have shown that future weight gain is significantly greater in hypertensive patients than in normotensive subjects, suggesting that even normal weight hypertensive are at a high risk of developing obesity, Julius *et al.* (2000). Therefore, the relationship between obesity and hypertension might be described as a 'two way street'. Julius *et al.* (2000) implying individual susceptibility to both conditions or common environmental factors. It is clear that obesity related hypertension is a multifactorial disorder. At this time, it is not possible to identity one single mechanism as the dominant a etiological factor. Genesis and evolution of obesity related co-morbidity presumably depend on several genetic and environmental factors. It is likely that obesity, hypertension and metabolic abnormalities interact and potentiate their individual impact on cardiovascular risk, Keller *et al.* (2003).

Rahmouni *et al.* (2005) study obesity is strongly associated with hypertension and cardiovascular disease. Several central and peripheral abnormalities that can explain the development or maintenance of high arterial pressure in obesity have been identified. These

include activation of the sympathetic nervous system and the renin-angiotensn-aldosterone system. Obesity is also associated with endothelial dysfunction and renal functional abnormalities that may play role in the development of hypertension. The continuing discovery of mechanisms regulating appetite and metabolism is likely to lead to new therapies for obesity-induced hypertension.

Diabetes Mellitus and Obesity

Increased risk posed by intra-abdominal fat for diabetes and other metabolic disease could be related to higher fat cell number in the abdominal adipose tissue, higher blood flow, increased receptors for cortisol and testosterone and greater catecholamine-induced lipolysis when compared with the subcutaneous adipose tissue, Must *et al.* (1992). In addition there is a marked increase in flux of non-esterified fatty acids to the liver in abdominally obese subjects. There is sufficient evidence to show that abdominal obesity causes insulin resistance and it is a key component of the metabolic syndrome. Racial susceptibility to insulin resistance and metabolic syndrome has been demonstrated and Indians are highly susceptible to both, Snehlata *et al.* (1999).

Banerjee and Chandalia *et al.* (1999) reported that a cluster of risk factors co-exists with central obesity including glucose intolerance, obesity, hyperinsulinaemia, hypertriglyceridaemia and hypertension, all of these are important risk factors for CHD. Studies in migrant Asians comparing body fat topography with that in Caucasians have confirmed similar findings. Mc Keigue *et al.* (1991) reported that in Asian Indian every 0.04 unit increase in WHR was associated with 4-fold increase in diabetes (20% in Asians, 5% in Europeans), 2-fold higher post glucose insulin levels (41 μu/ml in Asians *Vs.* 19 μu/ml in Europeans) and significantly higher triglycerides and low high density lipoprotein (HDL).

A positive association between overweight and obesity and risk of type 2 diabetes has been established repeatedly in many cross-sectional and prospective studies, WHO (2000) and Ramchadran (2001). It was shown that the risk conferred by obesity for developing diabetes was higher by 40 times in obese women compared to those who remained slim, and the risk would be reduced significantly weight loss. The association of obesity with type 2 diabetes is complex and compounded by many heterogeneous factors. Obesity not only is a risk factor for development of diabetes, but also complicates the management of the disease.

Asian Indians generally have lower BMI than many other races but the association of BMI with glucose intolerance is as strong as in any other population, Ramchandran *et al.* (2001). It was shown for urban Indian population that at a BMI of $> 23\text{kg/m}^2$ the risk for diabetes was significant for both genders, Snehlata *et al.* (2003). Therefore the healthy BMI for an Indian is definitely below 23 kg/m^2. This has been confirmed by studies from other parts of India. Banerjee and Chandalia *et al.* (1999) and also from other Asian populations. According to the WHO recommendations, a BMI of 18.5-22 kg/m^2 has been considered as healthy for Asian populations.

6 *Psychological factors*

Psychological factors in the development of obesity are widely recognized. Ryden (1981) found that obesity tended to occur in subject with elevated levels of anxiety, tension, impulsiveness and aggression. Flangan *et al.* (1991) also indicated that obese subjects showed more anxiety than did control subjects.

Black *et al.* (1992) examined the prevalence of mental disorder in morbidly obese women. The morbidly obese subjects were more likely than the non-obese group to have a lifetime history of mood disorders, anxiety disorders, and tobacco dependency. The morbid subjects were also more likely to meet diagnostic criteria for one or more personality disorders.

Overweight people generally consume more calories than people of normal weight but this does not mean they are overeating, as they are consuming an appropriate amount of calories for their height body weight (assuming weight stability). This distinction is important, as the idea that obese individuals bring about or maintain their obesity by inappropriate overeating underlies many of our cultures negative stereotypes about obesity. Obese patient who reported recurrent uncontrolled binge eating. Many of these patients would meet the criteria for binge eating disorder, regular binge eating in the absence of the extreme weight loss behaviour characteristic of bulimia nervosa. Compared with non-binge eaters eat significantly more food in laboratory studies when instructed to binge or eat normally, report an earlier onset of obesity and greater percentage of lifetime on a diet; overeat more in response to negative emotional states report lower levels of self-esteem, and display significantly greater levels of psychopathology, especially, depression and personality disorders, Kuehnel, Waddden (1994) and Mussell *et al.* (1996).

Another abnormal eating pattern that exist most commonly in obese individuals has become known as the "night eating syndrome". First described in 1955, its key features are morning anorexia, evening hyperphagia and insomnia. More recent clinical reports have suggested that many of these patients suffer from sleep disorders such as somnambulism, restless syndrome, and obstructive sleep apnea, Schenck and Mahowald (1994) and the most patients report some degree of amnesia for the eating episode, Winkelman (1998). In addition, night eating syndrome is associated with neuro-endocrine abnormalities including attenuated nocturnal rise in leptin and melatonin increased plasma

Simon (2004) a psychiatrist and researcher at the University of Washington's Center of Health Studies-Group Health, said in an interview. However, the association appears to be generally stronger for women than for men, he pointed out. Indeed, in his own recent study of some 2,300 women, which he reported at APA's 2005 annual meeting in May, he found that major depression was twice as prevalent among women with a body mass index (BMI) greater than 30 than in women with a BMI less than 30. A BMI of 30 or more indicates obesity.

Treichel (2005) study the obesity epidemic is firing scientist up to learn more about the psychological ramifications of obesity. This is an area that psychologists, and particularly psychiatrists, did not pay much attention to until the past decade or so, 'Grow told psychiatric News'. "In the field of psychiatry we have really started to get the message about this epidemic and are working to try to understand it'. 'I know that researchers are looking a lot more at the psychological aspects of not just binge eating disorder, but of obesity in general'.

5   MANAGEMENT OF OBESITY

The goal of any reducing programme should not be merely to lose weight but to maintain normal limit once it is achieved. The role of diets or calories restriction, physical exercise and yoga, psychotherapy, behaviour modification, drugs and surgery are described below.

1.   *Dietary management*

Diets to promote weight loss are generally divided into four categories, low fat, low carbohydrate, low calorie, and very low calorie, Strychar (2006). A meta-analysis of six randomized controlled trials found no difference between the main diet types (low calorie, low carbohydrate and low fat), with a 2-4 kilogram (4.4-8.8 lb) weight loss in all studies, Strychar (2006). A two years, all diet methods resulted in similar weight loss irrespective of the macronutrients emphasized, Sacks *et al*. (2009).

Low fat diets

Samaha *et al.* (2003) provided 33% of total calories intake as fat, which is more than the 20-30% energy intake normally indicative of a low fat diet. In addition, dietary compliance was not assessed by Foster *et al.* (2003). The three studies are important, but are not evidence that low carbohydrate diet in the long term are superior to the energy restricted low fat diet.

Strychar (2006) studies low fat diets involve the reduction of the percentage of fat in one's diet. Calorie consumption is reduced but not purposely so, diets of this type include NCEP step I and II. A meta analysis of 16 trials of 2-12 months' duration found that low fat diets resulted in weight loss of 3.2 kg (7.1 lb) over eating as normal.

Low carbohydrate diets

Bravata *et al.* (2003) studied how carbohydrate diet such as Atkins and protein power are relatively high in fat and protein. They are very popular in the press but are not recommended by American Heart Association. A review of 107 studies did not find that low carbohydrate diets cause weight loss, except when caloric intake was restricted, Hession *et al.* (2009). No adverse effects from low carbohydrate diets were detected.

Daniels (2003) the conventional dietary approach for obesity is high carbohydrate, low fat, energy deficient diet but weight loss is not substantial as processed starchy foods

and sugars in these diets prevent effective weight loss. Low carbohydrate diets have been popular since 1860 when William Barting claimed to lose weight without feeling hunger, Krauss *et al.* (2000) and Freedman *et al.* (2001). The most popular diet among them is Atkins diet which is the most widely prescribed low carbohydrate diet. Whereas the Atkins diet permits no more than 5-10% of calorie intake from carbohydrate, Wilett's new food pyramid (with which the Atkins diet is often confused) allow 40-45% of calorie intake from wholegrain foods, fruit, and vegetables.

ATKINS NEW DIET REVOLUTION-Atkins (2004)

Eating plan in new diet revolution describes not simply a diet but a 'Lifetime nutritional philosophy' with vitamin and mineral supplementation and regular exercise. It consists of four phases:

1) *Induction*

In induction phase there is carbohydrate restriction to 20 gm/day in from of salads and non-starchy vegetable.

2) *Ongoing weight loss*

Calories are added in from of nutrient dense and fiber rich food by increasing carbohydrate to 25 g/day for first week, 30 g/day next week and so on until weight loss stops then subtract 5 g from the earlier so that continued sustained moderate weight loss occurs.

3) *Pre-maintenance*

Transfer from weight loss to weight maintenance phase. Increase intake in 10 g increment each week till gradual weight loss is maintained.

4) *Life time maintenance*

Select from wide variety of food while controlling carbohydrate to ensure weight maintenance and sense of well being.

Putative mechanism of weight loss on low carbohydrate diet Krauss *et al.* (2000). A systematic review of low carbohydrate diet reported that the weight loss is associated with only the duration of diet and restriction of energy intake, not with carbohydrate restriction itself. Bravata *et al.* (2003) on review of 107 articles prior to 2003 of it was found that only 56 studies had follow up to more than 90 days and none were randomized control trials and had no control group. This constituted insufficient evidence to make recommendations.

Samaha *et al.* (2003) studies 132 severely obese individuals (39% had type 2 diabetes, and 43% had metabolic syndrome) were randomized to either an ad-libitum low carbohydrate diet or an energy restricted low-fat diet for 6 months. Those on the low carbohydrate diet had lost 3-9 kg more weight after 6 months (95% Cl 1-6 to 6-3 kg) but at 12 months the difference was no longer significant, (1.9 kg-1.0 to 4.9) Stern *et al.* (2004). In another 6 month study, 53 obese women were again randomized to comparative diets Foster

et al. (2003), and the low carbohydrate group again lost more weight [8.5 (SD 1.00) *Vs.* 3.9 (SD 1.0) kg after 6 months].

Low calorie diets

Strychar (2006) studies that low calorie diet usually produce an energy deficit of 500-1000 calories pre day, which can result in a 0.5 kilogram (1.1 Lb) weight loss per week. They include the DASH diet and weight watcher among others. The National Institutes of Health reviewed 34 randomized controlled trials to determine the effectiveness of low-calorie diet. They found that these diets lowered total body mass by 8% over 3-12 months.

Very low calorie diets

Strychar (2006) very low calorie diets provide 200-800 Kcal/day, maintaining protein intake but limiting calories from both fat and carbohydrates. They subjects the body to starvation and produce an average weekly weight loss of 1.5-2.5 kg (3.3 -5.5 lb). These diets are not recommended for general use as they associated with adverse side effects such as loss of lean muscle mass, increased risk of gout, and electrolyte imbalances. People attempting these diets must be monitored closely by a physician to prevent complications.

2. *Physical activity and practice of Yoga and Pranayam*

Physical activity

Ferro-Luzzi and Martino (1996) in the present study, obese individuals were engaged in sedentary occupations. However, it is difficult to draw conclusions as to cause and effect relationship between BMI and physical activity. It is difficult to indicate whether individuals prefer desk jobs because of their obesity or the more sedentary work style caused the obesity. More prospective data will help to clarify this relationship. The assumption that the sedentary life style is the case of overweight, however, seems to be justified and reasonable.

WHO (1998) physical activity levels (PAL) are the universally accepted way of expressing energy expenditure. In this study, the obese with desk jobs and with higher BMI and WHR were found to take regular walking exercise. In this case exercising was apparently restored to as a way-albeit inadequate-of combating the obesity that has already set in. Relatively less obese individuals were involved in household chores like cleaning, cooking, marketing and gardening. People may be likely to overestimate their physical activity levels and this may be even more true for overweight individuals, Waish *et al.* (2004).

This could lead to results suggesting that obesity is more important than physical activity as a cause of chronic disease due to the misclassification of physical activity. Using the objective measure of cardio-respiratory fitness probably lead to less misclassification and results in finding stronger associations with health outcomes we found that measured cardio-respiratory fitness predicted mortality better than self reported physical activity, Wei *et al.* (2000).

NFI (1999)- Scientific Report-15 traditional lifestyles are generally associated with gain in body weight with age. However, modernization apparently has profound effects on body weight. Rapid urbanization and industrialization change in lifestyles and eating habits, and sedentary occupations contribute to energy imbalance. Easily availability of processed, ready to eat fast foods, which tend to be relatively less in complex carbohydrates, high in fat, and rich in sugars and cream, increase energy intake. Thus social and economic pressure in the environment contribute to obesity through changes in dietary habits and physical activities.

Both work time and leisure time activity may change considerably throughout the world due to modern gadgets such as computers and television. A sedentary lifestyle, therefore, favour a positive energy balance and weight gain. The relationship between physical inactivity and obesity however complex, several confounders are likely to complicate the picture such as physical fitness, opportunities for exercise, diet and temporal relationships between exercise and meals. It is yet not clear whether long-term low-cost activity is superior to short-term high cost activity in the maintenance of energy balance.

A sedentary lifestyle plays a significant role in obesity Seidell (2005) worldwide there has been a large shift towards less physically demanding work. WHO (2009) and Ness-Abramof or Apovian (2006) and currently at least 60% of the world's population does not get sufficient exercise. This is primarily due to increasing use of mechanized transportation and a greater prevalence of labour saving technology in the home, WHO (2009) and Aramof or Apovian. World trends in active leisure time physical activity are controversial. The World Health Organization indicates that worldwide people are taking up less active recreation pursuits however a study from Finland, Barodulin *et al.* (2008) found an increase and a study from the United States found leisure time physical activity has not changed significantly, Brownson *et al.* (2005).

With use, muscles consume energy derived from both fat and glycogen. Due to large size of leg muscles, walking, running, and cycling are the most effective means of exercise to reduce body fat. Exercise affects macronutrient balance. During moderate exercise, there is a shift to greater use of fat as a fuel, Sahlin *et al.* (2008).

A meta-analysis of 43 randomized controlled trials by the Cochrane collaboration with diet, however, it resulted in a 1 kilogram weight loss over dieting alone. A 1.5 kilogram (3.3 lb) loss was observed with a greater degree of exercise Shaw *et al.* (2006). Even though exercise as carried out in the general population has only modest effects, a dose response curve is found, and very intense, exercise can lead to substantial weight loss. During 20 weeks of basic military training with no dietary restriction, obese military recruits lost 12.5 (27.6 lb) Lee, Kumar and Leong (1994). High levels of physical activity seems to be necessary to maintain weight loss, Bessesen (2008).

A systematic review found that people, who use pedometers during an average an 18-week period, increased their physical activity by 27% and subsequently decreased their BMI by 0.38, Bravata *et al.* (2007).

Practice of Yoga and Pranayam

Yoga is gentle way to bring a balanced attitude to all aspects of life. Yoga can help you control your weight more effectively, whether you need to lose weight or to gain it.

Many a times the glands are sluggish in our body. These sluggish glands are stimulated by Yoga asana to increase their hormonal secretions. Especially the thyroid glands pays important role in our weight because it affects body metabolism, Alan *et al.* (2006).

Mandlik and Dorle (2008) study Yoga has considered all aspects of obesity (Physical, emotional and mental).

- Regular practice of yoga and controlled life style reduces obesity (weight is reduced).

- Yoga makes human being agile, efficient and slim.

- Yoga is suitable for people in any age group.

- Yoga helps achieve control over mind and behaviour (one can easily control food habit and change life style to reduce the obesity).

- Yoga has different effect on obesity, which is permanent in nature than other techniques for obesity reduction. Weight loss is permanent but one needs to practice few important techniques regularly.

Mandlik and Dorle (2008) study practice of yoga and various exercises.

- Regular exercise like running, swimming etc.

- Yogasanas like Paschimotannasana; Saral Hasta Bhujangasana, Sarvangasna, Halasana, Dhanurasana, Veerasana, Trikonasana, Arotha Matsyendrasana etc.

- Along with yogasanas Sun salutation is very effective for obesity reduction, also pranayama, cleansing processes like agnisar, Uddiyan bandha etc helps.

Regular practice of yoga can certainly reduce the obesity and weight loss, but one needs to learn specific yoga techniques, which are more effective for reducing the weight, we will be studying such techniques in this article, Yoga Vidya Dham has a separate obesity reduction program, more than 5000 people have been benefited by this program.

Hunger and thirst control by Yoga asana and Pranayama?

According to Alan *et al.* (2006)- Yes; Hunger, thirst, sleep, behaviour, thought can be control by yogasanas and pranayama.

Bhujangasana reduces hunger and Shalabhasana increases hunger.

By practicing both these one after the other hunger can be equipoise practicing Shitali and Shitkari pranayama, one can live with least consumption of food, water and sleep.

Many a times the glands are sluggish in our body. These sluggish glands are stimulated by yoga asana to increase their hormonal secretions. Especially the thyroid glands pays important role in our weight because it affects body metabolism.

In asanas like the shoulder stand and the fish posture thyroid gland is stimulated. It also increases fat metabolism so the fat is burnt and energy results in to better muscle tone and a higher vitality level.

Pranayama increases the oxygen intake to the body cells, including the body cells. This causes increased oxidation or burning up of fat cells. Yogic exercise induce more continuous and deeper breathing which gradually burns, sometimes forcefully, many of the calories already ingested.

The relaxation and meditation aspect of yoga has a broad spectrum. Regular practice of meditation improves concentration and will power. Meditation also may help stimulate insight into the unconscious motivators of your eating behaviour. So the yogic practices reduce anxiety tend to reduce anxious eating. When under nervous strain we tend to gulp our food without attaining much genuine satisfaction.

The weight you gain will be healthy firm tissue, not fat. That is, yoga will tend to produce the ideal weight for you. This is due to yoga's effect of 'normalizing' glandular activity, Alan *et al.* (2006).

3. *Psychotherapy*

Psychotherapy should not be considered a primary treatment for obesity. However, this does not mean that psychotherapy has no role. Both cognitive behavioral therapy and interpersonal therapy have been found to be effective in normalizing eating and reducing distress in obese patients with binge eating disorder, although neither intervention is associated with significant weight loss Devlin (1996). Psychotherapy may be helpful in enhancing self-acceptance in obese patient who have learned to feel ashamed about their weight and may help patients to cope with the effects of prejudice and 'weightism' that are pervasive in our culture often greater self-acceptance and resulting increase in overall self-esteem are key steps in developing motivation for working toward a heal their lifestyle and/or for undertaking weight control treatment, Wilson G.T. (1996). Body image therapy programs have been developed to help obese individual alter the way they perceive and evaluate their bodies Rosen *et al.* (1995). These interventions are crucial for many obese patients. Even after successful weight loss treatment remain at a higher than normal weight. Self help organizations that promote size acceptance provide recognition and support for obese individuals and serve as a forum for addressing determination and altering harmful cultural stereotypes.

Marian Tanofsky *et al.* (2007) studies the most prevalent disordered eating pattern described in overweight youth is loss of control (LOC) eating, during which individuals experience an inability to control the type or amount of food they consume LOC eating is associated cross-sectionally with greater adiposity in children and adolescents and seems to predispose youth to gain weight or body fat above that expected during normal growth, thus likely contributing to obesity in susceptible individuals. No prior studies have examined whether LOC eating can be decreased by interventions in children or adolescents without full syndrome eating disorders or whether programs reducing LOC eating prevent inappropriate weight gain attributable to LOC eating. Interpersonal psychotherapy, a form of therapy that was designed to treat depression and has been adopted for the treatment of eating disorders, has shown efficacy in reducing binge eating episodes and inducing weight stabilization among adults diagnosed with binge eating disorder. In this paper, author propose a theoretical model of excessive weight gain in adolescents at high risk for adult obesity who engage in LOC eating and associate overeating patterns. A rational is provided for interpersonal psychotherapy as an intervention to slow the trajectory of weight gain in at risk youth, with the aim of preventing or ameliorating obesity in adulthood.

Becker *et al.* (2007) study obesity is a serious chronic disease, associated with severe sequelae and increased mortality rates, and therefore requires long-term care. This article gives an overview of the current state of research on psychotherapeutic treatment of obesity, focusing on behavioral approaches. Systematic well controlled studies on humanistic and psychodynamic therapies are not available. A small number of studies on psychotherapy-related approaches, e.g.- relaxation therapy or hypnotherapy, failed to demonstrate any decisive positive outcomes, while weight loss programs using methods of behaviour therapy and lifestyle modification approaches result, on the average in a short-term weight loss of 10% of the initial weight, long term effects of such programs are disappointing. Further evidence suggests, however, that long term maintenance programs may facilitate lasting behavioral changes of patients in their daily lives and work against weight regain. More research on effective maintenance programs is called for to further improve care of obese patients, it should lay stronger emphasis on internet-based weight maintenance programs.

Menard (2007) reported that empirical evidence and anecdotal clinician reports clearly suggest that negative affects is a primary trigger for binge eating and that repetitive binging can result in obesity. Many interventions, therefore appropriately target both negative affect and associated negative cognitions (thoughts). In fact, cognitive behavioral therapy (CBT) one of the most ubiquitous and well supported psychological approaches for treatment of obesity and binge eating focuses on correcting negative and or distorted cognitions. This general treatment approach can be challenging, however, when clinicians are presented with a vastly different set of triggers.

This case study present just such a scenario-that of a 'happy eater' unlike patients who use food to manage, stress, distress, loneliness or boredom, this subgroup of the

clinical population eats out of joy and identifies, food, eating and overeating with community, family, love and well being, often, there is a cultural emphasis on the importance of food and this trends to impact motivation, likewise, the happy eater tends to experience little distress and few negative cognitions.

Happy eaters typically have strong incentives-both external (family pressure) and internal (positive-affect)-to maintain their eating behaviors despite desiring weight loss. Treatment providers will find this type of patient present unique challenges and ultimately, considerable rewards.

4.   *Behaviour modification*

Viegener *et al.* (1990) testes whether the efficiency of behaviour therapy for obesity might be improved by the use of an intermittent, low fat, low calorie diet. In a study, 60 obese women were arranged either to (i) behaviour therapy plus continuous 1200 calorie per day balance deficit diet, or (ii) behaviour therapy plus an intermittent low fat, 800 calorie per day diet, used 4 days per week. Subjects in intermittent diet condition demonstrated significantly greater weight losses than subjects in the standard treatment.

Behavioral treatment combined with a very low calorie diet of up to 800 Kcal/day, often in the form of a liquid nutritional supplement, was highly touted and widely used several years ago. Typical programs used a very low calorie diet for 12-16 weeks, followed by reintroduction self selected 1000-1500 Kcal/day diet. This approach produces more rapid weight loss initially but relapse occurs more quickly, so that treated individuals, after 1 year, show similar weight regain to those on more moderate calorie restriction, National Task Force (1993).

A comprehensive behavioral weight control program, comprising components of improved eating habits, lifestyle change, and increased exercise, is widely viewed as the treatment of choice for overweight and moderately obese individuals, with 5 months of treatment, behavioral treatment combined with moderate dietary restriction e.g. 1000-1500 Kcal/day (self selected foods) results in a mean weight loss of 15-20 pounds Wing (1998). Behavioral weight loss programs are also associated with significant decreases in depression and body image dissatisfaction, together with increases in self-esteem and interpersonal functioning French and Jeffery (1994) problem is that these treatment effects are not maintained overtime.

Swaminathan (2002) investigated that overweight can be prevented excessively by avoiding excessive and frequent eating of food rich in a calories *viz.* fried, nuts, sweets etc. and by taking mild and moderate exercise daily. The body weight should be maintained constant at the normal level by adjusting the calorie intake. Fiber diet and green leafy vegetable should be taken.

Srilakshmi (2005) diet therapy is one of the most important strategies for weight loss and weight maintenance. The person should be put in negative energy balance ideally 500-1000 calories less than recommended daily allowance. And ideal reduction of 500gm-

1000gm per week is approved once the target is fixed progress should be checked once a month usually 3 kg are lost is the first month largely due to utilization of carbohydrate store and water. Reducing diet should provided adequate amounts of proteins, vitamins and minerals. Reducing excessive food sources of fat and sugars can dramatically reduce calories for many overweight people and general guidelines to accomplish such as change may be as effective as a specific meal plan. Regardless of the method chosen to produce weight loss, the patient must eventually learn to eat a healthy diet to maintain body weight. This is when behaviour modification techniques and exercise programmes are useful.

4.   *Drugs*

Only two anti-obesity medications are currently approved by FDA for long term use. One is *orlistat* (Xenical), which reduces intestinal fat absorption by inhibiting pancreatic lipase the other is sibutramine (Meridia), which acts in the brain to inhibit deactivation of the neuro-transmitters norepinephrine, serotonin, and dopamine very similar to some (anti depressants), therefore decreasing appetite. Rimonabant (Acomplia), a third drug, works via a specific blockade of the endocannabinoid system. It has been developed from the knowledge that cannabis smokers often experience hunger, which is often referred to as 'the munchies'. It has been approved in Europe for the treatment of obesity has not yet received approval in the United States or Canada due to safety concerns. Food and Drug Administration (2007).

Weight loss these drugs is modest, over the longer term, average weight loss an orlistat is 2.9 kg (6.4 lb), sibutramine is 4.2 kg (9.3 lb) and rimonabant is 4.7 kg (10.4 lb). Orlistat and rimonabant lead to a reduced incidence of diabetes, and all three drugs have some effect on cholesterol. There is however little data on how these drugs affect the longer-term complications or outcomes of obesity, Rucker *et al.* (2007).

Certain drugs are useful depending on the comorbities present. Metformin (Glucophage) is preferred in overweight diabetics as it may lead to mild weight loss in comparison to sulfonylureas or insulin (UKPDS) Group (1998). The thiazolidinediones, on the other hand, may cause weight gain, but decrease central obesity. Fonseca (2003) diabetics also achieve modest weight loss with fluoxetine (prozac), orlistat and sibutramine over 12-57 weeks.

Health effects of appetite suppressants may include, headache or dizziness, restlessness tremors, nervousness or anxiety, insomnia, dry mouth, diarrhoea or constipation. There have been cases of raised blood pressure, seizures, strokes and heart-damage but these are rare events. Side effects of lipase-inhibitors such as xenical® include unpredictable and increased bowel movement. However, since all obesity drugs are subject to stringent testing prior to launch, and because after (approval) their health effects are carefully recorded by manufactures and the FDA, side effects are typically well publicised.

6   *Surgery*

Bariatric surgery (Weight loss surgery) is use of surgical interventions in the treatment of obesity. As every operation may have complications, surgery is only recommended for severely obese people (BMI > 40), who have failed to lose weight with dietary modification and pharmacological treatment. Weight loss surgery relies on various principles, the most common approaches area reducing the volume of the stomach, producing an earlier sense of satiation (e.g. by adjustable gastric banding and vertical banded gastro-plasty) and reduce the length of bowel that food will be in contact with, directly reducing absorption (gastric bypass surgery). Band surgery is reversible, while bowel shortening operations are not. Some procedures can be performed laparoscopically. Complications from weight loss surgery are frequent, Encinosa *et al.* (2006).

Surgery for severe obesity is associated with long-term weight loss and decreased overall mortality. One study found a weight loss of between 14% and 25% at 10 years depending on the type of procedure performed and a 29% reducing in all cause mortality when compared to standard weight loss measures Sijostrom *et al.* (2007). A marked decrease in the risk of diabetes mellitus, cardiovascular disease and cancer has also been found after bariatric surgery Sijostrom and Adams *et al.* (2007) weight loss is marked in the first few months after surgery and is sustained in the long-term. In one study there was an unexplained increase in death from accidents and suicide but this did not outweigh the benefit in terms of disease prevention. Adams *et al.* (2007) when the two main techniques are compared gastric bypass procedures are found to lead to 30% more weight loss than banding procedures one year after surgery, Tice *et al.* (2008).

The effects of liposuction on obesity are less well determined. Some small studies show benefits Giugliano *et al.* (2004) while others show none. Klein *et al.* (2004). A treatment involving the placement of an intragastric balloon via gastroscopy has shown promise. One type of balloon lead to a weight loss of 5.7 BMI units over 6 months or 14.7 kg (32.4 lb). Regaining of lost weight is however, common after removal and 4.2% of people were intolerant of the device Imaz *et al.* (2008).

Chapter III MATERIAL AND METHODS

General characteristics of the study area

Hathras is one of the prehistoric city of India. Archeological excavations witnessed its origin from *Mauryan Period*, while the time excavated on the idols of *Hathrasi Devi* behind *Lord Shiva-temple*, proved its inheritance since sixth and seventh B.C. Presence of *Hathrasi Devi* (a form of goddess Parvati) evoked it the religious soil of *Lord Shiva's* roaming. The pious *Braj Mandal* starts from here, and thereby it is recognized as the gate-way of *Braj-Culture*. Existence of half a dozen Krishna-Baldeva's temples provide evidence of being it the gate way of *Braj-Mandal*. Administrative name of Hathras district is *Mahamaya Nagar. Mahamaya* was the Lord Krishna's sister. This name inherited the origin of the city to *Maha Bharat* period, Sharma (2006).

Topography

It is situated on the western side of Uttar Pradesh on cross roads of national highways Agra-Aligarh and Mathura-Bareilly at 31^0 and 27^0 eastern longitude and latitude. It's height from the sea level is 179.07 meters. It is 54 km away from Agra and 33 km from Aligarh, Kanpur Delhi Railway line passes through Hathras junction, 10 km away from the city; but a railway link line leads to Hathras kila station adjoins the city with the rail route. In addition Mathura-Bareilly meter guage line passes through Hathras city railway station situated in middle of the city. Its neighbouring districts are Aligarh; Etah; Agra and Mathura which form its north; east; south and western boundaries, respectively.

The rivers flowing in the district are *Saravan* and *Saingar*.

Administrative Division of the District and Population

This district is divided into four tahsils, namely Hathras; Sadabad; Sikandararau and Sasani. Overall there are saven development blocks such as Hathras; Sadabad; Sikandararau; Sahapau; Hasayan; Mursan and Sasani. There are 673 villages in the district where in 657 villages are inhabited.

According to census 2001, the area of the district is 1800.1 square kilometer and the total population is 13,33,372 in which the males and females are 7,18,288 and 6,15,084 respectively. The population density in the district is 740.72 persons per square kilometer and the male/female ratio is 856 females per 1000 males. Majority of the population lives in the villages (80.12%), while nearly one-fifth population (19.88%) lives in the city. The overall literacy in the district is 51.73%. Of this literacy, the male and female literacy are 63.18% and 38.36%, respectively.

Main Industries

Main industries of the district are readymade garments; chemical, carpets; preparation of artificial beads and pearls; manufacture of bangle; preparation of asafoetida; handicraft; brass hardware and art ware; beverage drinks; preparation of edible oils; Ayurvedic medicines; dal mills; colour and gulal; pickles and jam; preparation of scissors and knife; handloom clothes; stationary; rose and lotus scent; rose water and lotus water; gardening and seeds.

The preparation of various materials show that Hathras is prominent industrial city. In ancient days, it was next to Kanpur city in industry in whole of Uttar Pradesh.

The milk dairy are functioning one co-operative basis. The milk men are encouraged for increasing milk and milk products through Gokul Prize Planning.

Educational Facilities

There is a wide network of educational facilities in the district. There are 883 Primary Schools; 233 Junior High School; 107 High Schools; 58 Intermediate Colleges and 6 Degree and Post graduate Colleges in the district. In addition there is one polytechnique and one ITI for technical education to the students.

Medical and Health Facilities

In addition to governmental medical and health institutions, there are many private nursing homes and clinics. Overall there are 35 allopathic hospitals; 5 homoeopathic hospitals and 17 Ayurvedic and Unani health care institutions. The birth rate and death rate in the district are 40.8 and 12.6 per thousand population, respectively.

Tools and Techniques

The informations of the present study were collected with the help of 'Questionnaire cum Interview Technique'.

Sample size and selection of the subjects/respondents

In view of the constraints like, money, material and time, it was initially decided to select 300 overweight and obese females aged 30 to 50 years. Consequently one hundred overweight and obese females from each of the high, middle and low income groups were purposely selected. In order to strictly abiding the characteristics of representativeness of the samples four areas namely, Mursan Gate, Vidayapati Nagar, Awas-Vikash colony and Delhi wala chowk were randomly selected from the list of Mohallas provided by the district administrative authority (Information and Public Relation Department, Mahamaya Nagar; Hathras). Accordingly for the sake of equal number of subjects 25 overweight and obese females aged 30 to 50 years, each were interviewed from high, middle and low income groups of the above mentioned four areas.

Sample size and selection of the respondents

Sample size: Overweight and obese- 300
Normal - 409

Normal-86	Normal-98	Normal-130	Normal-95
Mursan Gate (75)	Awas-Vikas (75)	Vidyapati Nagar (75)	Delhi Wala chowk (75)
High → 25	High → 25	High → 25	High → 25
Middle → 25	Middle → 25	Middle → 25	Middle → 25
Low → 25	Low → 25	Low → 25	Low → 25
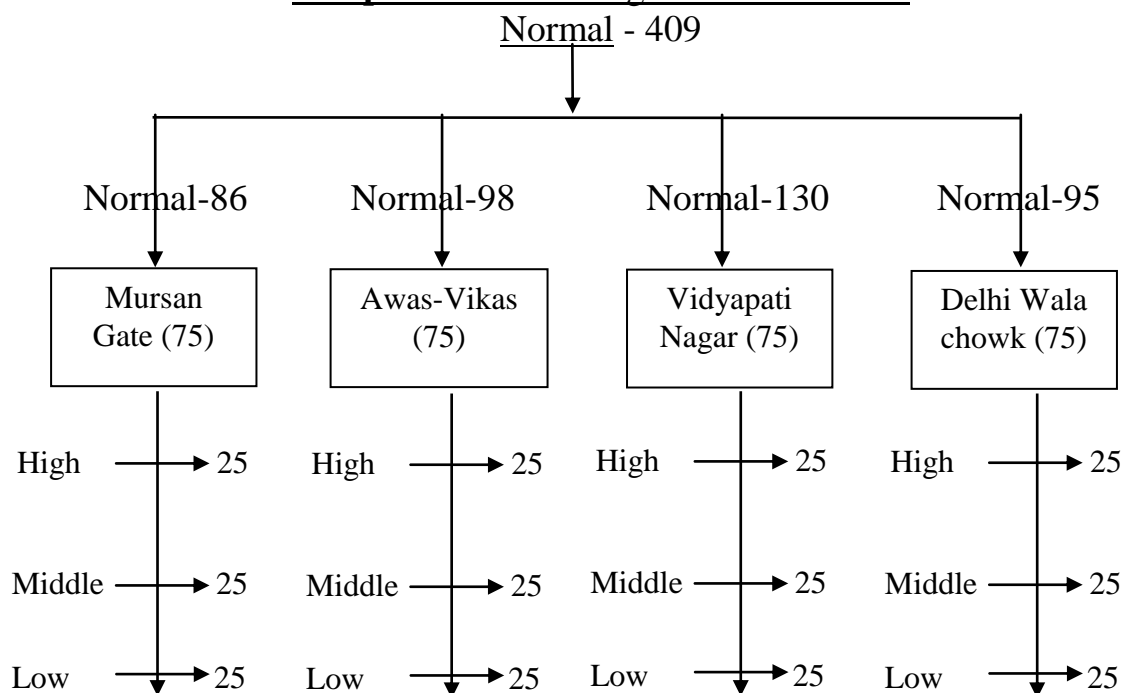
Due to absence of any sampling frame of overweight and obese females, it was decided to conduct a door to door survey of all the four areas. Two guiding charts related to income category (Kumar, P, 1993) and BMI (Quetlet Index) (for the identification of overweight and obese females) were used for the selection of the desired females for taking interview.

In order to attain sample target of overweight and obese females with respect to income and area 161; 205; 173; and 170 females aged 30 to 50 years were interviewed from the areas Mursan Ghat, Vidyapati Nagar, Awas-Vikas colony and Delhi Wale chowk respectively. As such there were 409 normal and 300 overweight and obese females of the total 709 females surveyed. The females with normal BMI were interviewed for getting only general information, while all the general and specific informations enlisted in the questionnaire were obtained from the overweight and obese females (age 30 to 50 years) only.

Structure of the questionnaire

Initially the informations regarding "Overweight and Obesity" were gathered from various libraries of Varanasi city; mainly the library of Institute of Medical Sciences, Banaras Hindu University, AIIMS (All India Institute of Medical Science),

New Delhi, National Health Library, New Delhi. The medline services available in the aforesaid library simplified the tedious job of allocation of related literature. In addition Internet services also helped a lot in the collection of related review of the literature. The subject contents consulted were definition of overweight and obesity; effect of age, marital status, number of parity, income, working mode and eating habit on overweight and obesity. Knowledge of the subjects regarding nutrients and types of food were obtained. Further informations regarding nutrition education, various anthropometric measurements related to overweight and obesity and package on low calorie diet with tips for reducing overweight and obesity were also ascertained.

Keeping in view our objectives a comprehensive questionnaire was prepared on the basis of informations acquired from various sources. The reliability of the questionnaire was tested in the same community from where the data was obtained.

Standardization of the questionnaire

The vague questions which were not responded by the subjects were deleted from the questionnaire, whereas other questions which were felt important in the study according to the community situation were added to the questionnaire and finally a standard questionnaire was worked out. In this manner the questionnaire was standardized.

The standardized questionnaire has the following structure (vide Appendix A). It is divided in four parts: (A) General Information, (B) Specific Information, (C) Anthropometric measurements, and (D) Food consumption by 24 hours food recall.

(A) General Information

It deals with general characteristics of the surveyed subjects, e.g., name of the respondents, age, literacy status, her occupation, main occupation of the family, caste structure, religion, total annual income, monthly income, per capita monthly income, family structure, total members in the family, marital status and if married, number of children.

(B) Specific Information

Specific informations included were knowledge of the subjects regarding overweight and obesity (Yes/No), if 'yes' what do you know? Have you any problem with obesity (Yes/No), if 'yes' type of problem faced, various diseases like obesity, diabetes, hypertension, coronary heart disease, disease of the bile duct and others from paternal and maternal sides, total working hours, total hours of relaxation or rest and type of work (sedentary, moderate and heavy), performance of physical exercise and its frequency per week, type of physical exercise liked by the subject and place of exercise, participation in any kind of sports, hours of TV viewing were included.

This section also included food habit and food consumption practices of the subjects such as are you vegetarian or non-vegetarian? Do you take meal after feeling

hungry, do you feel hunger during tension, frequency of drinking tea or coffee, habit of eating sweets, use of cold drink and its' type, habit of nibbling between meals, taking meal out side of the house, participation in lunch party out side of the house, member of any professional society, participation in the kitty-party, use of left out food items, speed of taking meal, companion or family members taking meal together, knowledge of nutrients, name of the nutrients, use of salad in the diet, liking for fruits and its' consumption frequency, habit of taking breakfast and its' menu and number of taking meal in a day.

In addition type of restrictions followed to reduce overweight and obesity, problem of thyroid and its' test, habit of any kind of addiction and frequency were also incorporated in this section.

(C)   Anthropometric Measurements

In this section (C) the anthropometric measurements such as height, weight and skin fold thickness taken at four sites i.e. biceps, triceps, suprailliac and subscapular were enlisted.

(D)   24 Hours Food Recall Table

Various food items consumed by the subjects during breakfast, lunch, evening tea and dinner were carefully documented with their actual measurements in this section.

Operational definition of the terms

Comparative

Bhargawa's dictionary defines the word 'comparative' as estimated by comparison, where comparison is used for simile or similar or equivalent to. As such the word 'comparative' provides similarity or differentiation between two or more subjects or things.

Study

The word study means careful reading (Bhargawa's dictionary, 2005).

Prevalence

The term 'disease prevalence' refers specially to all current cases (old and new) existing at a given point in time or over a period of time in a given population. A broader definition of prevalence is as follows:

The total number of all individuals who have an attribute or disease at a particular time (or during a particular period) divided by the population at risk of having the attribute or disease of this point in time or mid way through the period, Park (2005).

Overweight

The term 'overweight' means a weight in excess of the average for a given sex, height and age. Overweight is usually due to obesity but it can arise from other causes such as abnormal muscle development or fluid retension (Park, 2005).

Obesity

Obesity may be defined as an abnormal growth of the adipose tissue due to an enlargement of fat cell size or an increase in fat cell number or a combination of both. Obesity is often expressed in terms of BMI (Park, 2005).

BMI (body mass index)

BMI (body mass index) is expressed as a quotient of body weight (in kg) divided by square of the height presented in meter.

$$\text{BMI} = \text{Wt. (kg)}/\text{ht}^2 \text{ (m)}$$

The BMI twenty-five or more, indicates overweight and obesity.

Income

It is a periodical profits from one's business etc. (Bhargawa's Dictionary).

Group

As a noun, it means as a collection or a class (Bhargawa's Dictionary).

Income group

Three distinctive groups have been considered in the present study. These groups are high, middle and low presenting socio-economic status of the subjects under study. High, middle and low socio-economic status have been considered in view of current price index (Year, 2007).

Measurement of variables

Weight

Standard weighing machine was used to measure the weight of each respondent. Each subject was asked to stand erect and without shoes or sleeper on the machine with arms hanging by the side, the hand together, the head held straight. The subjects were weighted with minimum clothing. The weight was measured in kg. Accuracy of weighing machine was checked with standard weights periodically (Photograph 1).

Height

Anthropometric rod (Photograph 2) was used for measuring height of the subjects. Each subject was asked to stand erect against the vertical rod on surface.

Measurement was taken without shoes, the feet placed parallel and heals, buttocks, shoulders and back of the head touching the measuring rod. The head was held comparatively erect. The horizontal head piece (a metal bar) gently lowered. Crushing the hairs and making contact with top of the head and the corresponding value visible on the scale of vertical rod was recorded. The presences of unusually thick hair if present were accounted for. The height was measured nearest to 0.50 cm on the scale.

Skinfold thickness (SFT)

The Lange caliper (Cambridge Scientific Industries Inc. Cambridge, Maryland, USA) was used to measure skinfold thickness

Photograph 1

Researcher measuring weighing of the female

Photograph 2
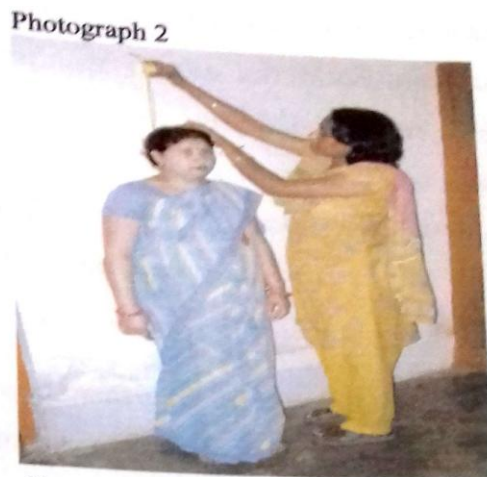
Researcher measuring the height of the female

Photograph 3a

Researcher measuring the biceps skinfold thinkness of the female

Photograph 3b

Researcher measuring the triceps skinfold thinkness of the female

(SFT) at four sites (biceps, triceps, subscapular, and suprailliac). Using standard technique as described by Jellife (1966). Skin of each site was pinched between the thumb and forefinger of the left hand and the thickness of such projected fold was measured by the Lange caliper. The procedure was repeated thrice on each subject and the mean value was taken as the actual measurement. The SFT was measured nearest to 0.5 mm. Measurement techniques at four sides are described below:

Biceps skinfold thickness

The biceps skinfold thickness was measured half way between the tip of the acromian and olecranion process of the ulna while the arm was hanging loosely by the side (Photograph 3a).

Triceps skinfold thickness

The triceps skinfold thickness was measured at the point equidistant from the acromian process of the scapula and the olecranon process of ulna. The measurement was made with the arm hanging relaxed at the sides. The skinfold parallel to the long axis was pinched up between the thumb and forefinger of the left hand, clearing the underlying muscle (Photograph 3b).

Subscapular skinfold thickness

The subscapular skinfold thickness was measured just below and lateral to the angle of the left scapula (Photograph 3c). The fold was a line running at approximately 45^0 to the spine. This measurement was taken with the women in standing position.

Photograph 3c

Researcher measuring the subscapular skinfold thickness of the female

Photograph 3d

Researcher measuring the suprailliac skinfold thickness of the female

Suprailliac skinfold thickness

 The suprailliac skinfold thickness measured over the illiac crest in the mid axillary line (Fig. 3d).

Assessment of nutrients consumed by the subjects

 Nutrients consumed by the subjects were assessed with the help of 24 hours' food recall method. It included the information regarding daily intake of the respondents. The technique adopted for recording the dietary intake was 24 hour food recall method. Standardized utensils picked up from local milieu, were used for approximating weight of the food item consumed. The I.C.M.R. (2004) reference standard daily allowances were used for comparing data. The yield of nutrients from the total food consumed by the females on previous day was calculated by referring to standard food tables from nutritive value of Indian Food, Gopalan *et al.* (2004). The nutrient worked out were calorie, protein, fat, carbohydrate, iron and calcium.

Categorization of the information

 Various information's were categorized as follows:

Age structure

 The age was recorded in completed years. The subjects were enquired to tell their age. The ages were also verified with the help of their family members. The ages of the illiterate respondents were verified on the basis of the age at their marriage or consummation, age of the first child, age of the youngest child and number of the children born and the consecutive difference between two children.

 The class interval of the age was assigned 5 years such as 30 to 35; 35 to 40; 40 to 45 and 45 to 50 years.

Educational status of the subjects

 Formal education possessed by the subjects were mentioned. The respondents who had no knowledge of reading and writing were considered as illiterates, whereas the subjects having 1 to 5; up to 10 class education were included in primary and secondary education respectively. Any kind of technical or professional education was taken in professional category. The respondents having any kind of degree (graduate or post-graduate) were included in University education.

Family income and socio-economic status

 Total family income from all sources (primary and secondary) were collected. The collection of data regarding income was a very tedious problem, but it was solved by informal interview with the informants with the help of various querries related to employment status, revenue from house rent or agriculture and sell of any commodity produced or prepared by the subjects or by their family members and overall ensuring them not to use these informations other then research, helped the investigator to take

the correct information. The annual income was finally converted in monthly income. Further per capita monthly income was ascertained by dividing total monthly income with the number of total family members.

Thereafter present socio-economic status of the subjects was assessed with the help of 'basic classification of socio-economic status' (1960) and current price index (PI) as suggested by Kumar (1993). Kumar suggested a multiplier factor of (current PI x 4.93)/100 to get the socio-economic status on current price of the commodities.

Example:

Price Index (PI) during year 2007 = 605

$$\text{Multiplier factor} = \frac{\text{Current PI} \times 4.93}{100}$$

$$= \frac{605 \times 4.93}{100} = 29.83 \simeq 30$$

Basic socio-economic category (1960)

Category			Per capita monthly income (Rs.)
I.	Upper	…………	Rs. 100 +
II.	Upper-middle	…………	Rs. 50 to 99
III.	Middle	…………	Rs. 30 to 49
IV.	Lower-middle	…………	Rs. 15 to 29
V.	Lower	…………	< Rs. 15

I.	Upper	…………	Rs. 3000 + Upper (High)
II.	Upper-middle	…………	Rs. 1500 to 2999
III.	Middle	…………	Rs. 900 to 1499 ⎫ Middle
IV.	Lower-middle	…………	Rs. 450 to 899
V.	Lower	…………	< Rs. 450 …….. Low

In the present study socio-economic categories accepted are high, middle and low. Accordingly per capita incomes e.g., Rs. 3000 plus; Rs. 450 to Rs. 1500 and less than Rs. 450 were categorized as high, middle and low, respectively.

Food habit

Two types of food habit e.g., vegetarian and non-vegetarian were considered. The subjects consuming any kind of meat and or eggs at least once a week were considered as non-vegetarian. Other subjects excluding non-vegetarians were accepted as vegetarian. The vegetarians use to consume cereal, pulses, legumes, nuts, vegetables, fruits and milk.

Following category of BMI was accepted.

index (BMI) **WHO (1998)**

BMI	Category
< 18.5	Under weight
18.5 – 24.9	Normal weight
25.0 – 29.9	Over weight
30.0 – 34.9	Class-I Obesity
35.0 – 39.9	Class-II Obesity
> 40	Class-III Obesity

Category of skinfold thickness (SFT)

SFT was measured in mm.

(A)   *Biceps*

The categories of biceps were taken as up to 5; 6 to 10; 11 to 15; 16 to 20; 21 to 25 and 26+.

(B)   *Triceps*

The same classification of biceps was also accepted for triceps measurement.

(C) *Suprailliac*

The groups accepted for suprailliac measurement were up to 15 mm; 16 to 20; 21 to 25; 26 to 30; 31 to 35; 36 to 40 and 41 to 45 mm.

(D) *Subscapular*

The groups of subscapular measurement were exactly similar to iliac.

Total skinfold thickness based on the measurement of skinfolds at four sites as referred above was also used as a measure of obesity. This measurement was documented by Durmin and Womersley (1974).

Range of SFT	Category of obesity
< 40 mm	Normal
40 to 59.9	Above normal
60 to 79.9	Overweight
≥ 80.0	Obese

Measurement of nutrients

Main nutrients considered for the present study were protein, fat, carbohydrate, calorie (energy), calcium and iron. The amount of these nutrients were assessed with the help of "Recommended Dietary Intakes for Indians (ICMR, 2004).

The nutrient protein was measured in gm and the classifications taken for its measurement were 41 to 60; 61 to 80; 81 to 100; 101 to 120 and 120 to 140 gms.

Similarly nutrient fat was measured in gm and the classifications taken were 21 to 40; 41 to 60; 61 to 80; 81-100; 101-120 and more than 120 gms. The measurement unit of carbohydrate was also gm and then classifications under taken were less than and equal to 300; 301 to 400; 401 to 500; 501 to 600; 601 and above. Further calorie (energy) was measured in Kcal (kilo-caloric) and the classifications accepted were less than and equal to 1750; 1751 to 2000; 2001 to 2250; 2251 to 2500; 2501 to 2750; 2751 to 3000; 3001to 3250; 3251 to 3500; 3501 to 3750 and more than 3750 Kcal.

Further again consumption of minerals like calcium and iron were measured in mg. The classifications for calcium were 201 to 400; 401-600; 601 to 800; 801 to 1000; 1001 to 1200; 1201 to 1400; 1401 to 1600; 1601 to 1800 and 1801 to 2000 mg,

while the classifications for iron was less than and equal to 20; 21-30; 31-40; 41-50; 51 to 60 and 61 mg onwards.

i)   **Nutrition Education**

Inspite of large number of nutrition education programs going on in our country. The nutrition and health status of our population in general and particularly in overweight and obese females are unsatisfactory requiring special attention in order to achieve utmost well being of the desired subjects.

The present study highlighted that the obesity and overweight females were ignored about the need of nutritious diet for themselves. Generally females did not cook special low calorie and low fat diet, but they use to take a portion of food from the meals cooked for the whole family.

Further these females were unaware about the detrimental effects of unbalanced and insufficient food intake. It was interesting that the females knew about the fatty food but still they were not accustomed about the correct method of preparation of zero oil and low calorie recipe. Which is most necessary in the preparation of recipes for the ultimate reduction of fat in the body.

The above mentioned facts motivated the researcher to realize the need for a special organized nutrition education program for the mothers to create awareness for improving their attitude toward a better nutritional management to themselves.

The feasibility of planning the design of nutrition education program was first discussed by the researcher with V.L.C.C (Vandana Luthra curve and curl), Lucknow especially with the dietitian of the centre.

The next step was selection of the target sample followed by designing, implementation and evaluation of the nutrition education package as given below.

ii)   **Selection of the target sample**

Out of total sample of 300 respondents, a target number of 150 females matched for their demographic characteristics were randomly selected from all the four areas. The number of respondents in the target sample was reduced from 300 to 150 because it was not possible to get al the females actually covered in the baseline survey due to various difficulties such as migration, unwillingness, and lack of time. Since the target sample was drawn from the original sample covering all the four colonies, it was considered a representative group of the total sample studied. The follow up study was conducted after two months of the base line survey.

iii)   **Designing and implementation of the nutrition education package**

The nutrition education packages were designed on the basis of the information collected by baseline survey. First of all, three components were

identified from the findings of the baseline survey. In identifying these components the positive and effective procedures were adopted in view of following facts:

(1)   Nutrients

(2)   Cooking demonstration

(3)   Diet chart according to BMI on low fat, low carbohydrate and low calorie diet.

iv)   Techniques of nutrition education package

(1)   Diet chart according to BMI

The diet charts provided to the subjects were 1000 Kcal; 1200 Kcal, 1400 Kcal and 1600 Kcal as per suitability to the subjects in view of their BMI.

(2)   Health and fitness tips

Tips given are the easiest, most effective, simplest and the most economical method to impart education from person to person particularly to the smaller groups. Some tips were also given to them.

a)   Low priced and foods without oil should be taken

b)   Brisk walking for 45 minutes should be followed in the morning or evening

c)   Performing 5 days physical exercises in a week

d)   Use of unripe vegetables and salad in the meal

e)   Use of roasted red gram whole

f)   Use of foods with fibre like flour with choker and green leafy vegetables

g)   ½ teaspoon fenugreek dipped in water during night should be used in the morning before breakfast

h)   Drinking of milk should be avoided before sleeping in the night

i)   Use of oil and ghee should be restricted, if necessary refined oil or mustard oil should be used

j)   Use of rice, sugar and potato should be minimized

k)   Drink one glass of water before taking meal. Minimum 7 to 8 glass of water should be taken in a day.

(3)   Cooking demonstration of low calorie and zero-oil recipes

Photograph 4

Cooking demonstration of low calorie and zero-oil recipes

For organizing the cooking demonstration, some desirous females were involved in preparing the list of target sample females (Photograph 4). These females were grouped in batches of 5-10, and the venue was also decided for administering the nutrition education. The places finally chosen were colonies. The time of demonstration was decided according to convenience of the females keeping in views of their occupation in the office, college, field and their routine domestic chores.

The cooking demonstration was finally prepare after consulting supervisor and the subject experts. Some other relevant material and books are mentioned here:

1꠰ जीरो ऑयल 151 नाश्ते (नमकीन) (डॉ विमल छाजेड़, एम.डी.)

2꠰ लो–कैलोरी शाकाहारी खाना (संजीव कपूर)

3꠰ गृहलक्ष्मी प्रस्तुति फिट फॉर लाइफ (संतुलित और पौष्टिक व्यंजन पुस्तक) (कोमल तनेजा)

Statistical analysis of the data

The informations were presented in the form of tables showing number and percentage of the attributes. Incase of frequency distribution of quantitative data mean and standard deviation (SD) were also worked out. Finally the results were inferred with suitable statistical tools Gupta & Srivastava (998); Fisher & Yates (1963).

(1) Percentage $= \dfrac{\text{Number of specific characteristic}}{\text{Total number of observations}} \times 100$

(2) Mean $= \dfrac{\Sigma f_i x_i}{N}$

Where,

Σ is sum of

f_i is frequency of ith column

χ_i is mid value of ith class

N is total number of observations.

(3) Sum of square $= \Sigma f_i x_i^2$ with usual meaning

(4) Corrected sum of square $= \Sigma f_i x_i^2 - \dfrac{(\Sigma f_i x_i)^2}{N}$

$= \dfrac{N\Sigma f_i x_i^2 - (\Sigma f_i x_i)^2}{N}$ with usual meaning

$= \dfrac{\text{Corrected sum of square}}{N}$

But, in usual practice, N is replaced by N-1 in order to remove any kind of biased ness in the sample.

(5) Variance = It measures variability of the characteristics

i.e. Variance $= \dfrac{\text{Corrected sum of square}}{N-1}$

(6) Standard deviation (SD) $= \sqrt{\text{Variance}}$ with usual meaning

(7)   Null hypothesis

The 'null' hypothesis was formulated that there was no difference between two attributes, or no association between two or more than two attributes, or no difference between two means or no difference between two proportions.

(8)   Chi-square (χ^2-test) = It was applied to see association between two or more attributes.

$$\chi^2 = \sum \left[\frac{\left(O_{ij} - E_{ij}\right)^2}{E_{ij}} \right]$$

Where O_{ij} is observed frequency in ith column and jth row

and, E_{ij} is expected frequency in ith column and jth row.

8.1: In case of Dichotomous table (2 x 2) the χ^2-test was used as follows:

$$\chi^2 = \frac{|ad - bc|^2 \times G}{T_1.T_2.T_3.T_4}$$

Where,

a, b, c, and d are cell frequencies,

T_1, T_2, T_3 and T_4 are marginal totals, and

G is Grand total

(9)   Students' t-test= It was applied to see difference between two means

$$\text{i.e., } t = \frac{\text{Mean difference}}{\text{PooledStandard Error of means}}$$

(i)   Standard Error of mean (SE) $= \dfrac{SD}{\sqrt{n}}$

(ii)   Pooled SE of means $= \sqrt{\dfrac{SD_1{}^2}{n_1} + \dfrac{SD_2{}^2}{n_2}}$

Where, SD_1 = Standard deviation of first sample

n_1 = No. of observations in first sample

SD_2 = Standard deviation of second sample

n_2 = No. of observations in second sample

(iii)   Mean difference $= \left| \overline{X_1} - \overline{X_2} \right|$

Where $| \ |$ is modulus sign showing only positive value of the difference.

(10)   Normal distribution test: It is known as proportion test and shown with letter-Z.

(i) $Z = \dfrac{\text{Difference of two proportions}}{\text{Pooled standard Error of proportions}}$

(ii)   Difference of proportions $= \left| p_1 - p_2 \right|$

(iii) Proportion $(\text{Þ}) = \dfrac{\text{No. of positive characteristics}}{\text{total number of positive \& negative characteristics}}$

(iv)   Standard Error of proportion (SE) $= \dfrac{\text{Þq}}{n}$ where Þ is +ve and q is $-$ve (1- Þ).

(v)   Square of pooled SE of proportions $= \dfrac{\text{Þ}_1 q_1}{n_1} + \dfrac{\text{Þ}_2 q_2}{n_2}$

Where $\dfrac{\text{Þ}_1 q_1}{n_1}$ is SE of proportion is first sample and $\dfrac{\text{Þ}_2 q_2}{n_2}$ is SE of proportion in second sample.

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$$\text{(vi)} \quad \text{Pooled SE of proportions} = \sqrt{\frac{\text{P}_1 q_1}{n_1} + \frac{\text{P}_2 q_2}{n_2}}$$

(11)   Degree of freedom (df): It shows free movement of the statistics. It is generally one less than the number i.e., df = n-1.

(i)   df for paired t-test = n-1

(ii)   df for student's t-test = $n_1 + n_2 - 2$

(iii)   df for χ^2-test = (c-1) (r-1) where c is number of columns r is number of rows.

(iv)   There is no degree of freedom for Z-test.

(12)   Probability level (Þ)

Measurement of chance factor was expressed in percent or per unit. The probability level was determined on the basis of value of a statistic and the related degree of freedom with the help of 'Reference-Table' provided for the same purpose, Fisher & Yates (1963).

When the chance factor was more than 5% (written as p>0.05), the 'null hypothesis' was accepted and the inference was drawn regarding the non-significant association of the attributes or non-significant difference between two means or proportions. On the other hand, in case of rejection of null hypothesis (p<0.05) significant inference was established. For the sake of convenience following probability levels were only mentioned in the text.

(i)   p>0.05: Symbolically expressed as NS meaning statistically <u>not</u> <u>significant</u> or <u>insignificant</u>

(ii)   p<0.05: Symbolically marked with one star (*) meaning statistically just significant.

(iii)   p<0.02 or p<0.025 or p<0.01: Symbolically marked with two stars (**) meaning <u>statistically moderately significant.</u>

(iv)   p<0.001: Symbolically marked with three stars (***) meaning <u>statistically</u> <u>highly significant.</u>

(13)   Graphical presentation of data

The informations were also presented by <u>Graph</u> where ever felt necessary.

(14)   Rates of Nutrient consumption

Where ever needed, the mean nutrient consumptions were expressed in terms of RDA (recommended daily allowance). The contribution of individual nutrient consumption was also shown with respect to some specific standard or RDA.

Example

(i)   Mean ± SD consumption of protein by the subjects = 73± 10.78 gm

RDA of protein for the female subjects (ICMR, 2004) = 50 gm given

Mean consumption of protein with respect to RDA = $\dfrac{73}{50} \times 100 = 146\%$.

(ii)   RDA of energy consumption for females (moderate working) = 2225 Kcal given.

Mean ± SD consumption of energy by the females = 2652.5 ± 508.63 Kcal given.

Mean energy consumption with respect to RDA = $\dfrac{2652.5}{2225} \times 100 = 119.21\%$.

(iii)   Mean ± SD consumption of carbohydrate = 432 ± 90.22 gm.

Energy gained by mean consumption of carbohydrate = 432 x 4 Kcal = 1728 Kcal.

RDA of energy for moderate working females = 2225 Kcal given.

Energy gained by mean consumption of CHO with respect to   RDA = $\dfrac{1728}{2225} \times 100 = 77.66\%$.

Chapter IV   RESULTS

General characteristics of the surveyed females

Table 1.1: Age structure of the surveyed females according to overweight and obesity

S. No.	Age (yrs.)	Category of female					
		Normal		Overweight		Obese	
		No.	%	No.	%	No.	%
1	30-35	70	17.11	1	14.29	33	11.26
2	35-40	41	27.14	1	14.29	73	24.92
3	40-45	61	14.92	2	28.57	48	16.38
4	45-50	167	40.83	3	42.86	139	47.44
Total		409	100	7	100	293	100
Mean ± SD		41.47 ± 5.76		42.5 ± 5.77		42.5 ± 5.43	

Statistical significance:

1. Normal *Vs.* Over weight   - $t = 0.468$, $df = 414$, $p = 0.05$ NS.
2. Normal *Vs.* Obese   - $t = 2.416$, $df = 700$, $p = 0.02^{**}$.
3. Overweight *Vs.* Obese- $t = {}^{**}$, $df = {}^{***}$, $p = {}^{****}$.

Comment

- More than two-fifth females from all the categories belonged to age group 45-50 years.
- The mean ± SD ages of the normal, overweight and obese females were accounted 41.47 ± 5.76; 42.50 ± 5.77 and 42.50 ± 5.43 years, respectively.
- The mean age of the obese females was found statistically higher ($t = 2.416$, $p < 0.02^{**}$) than the normal females.
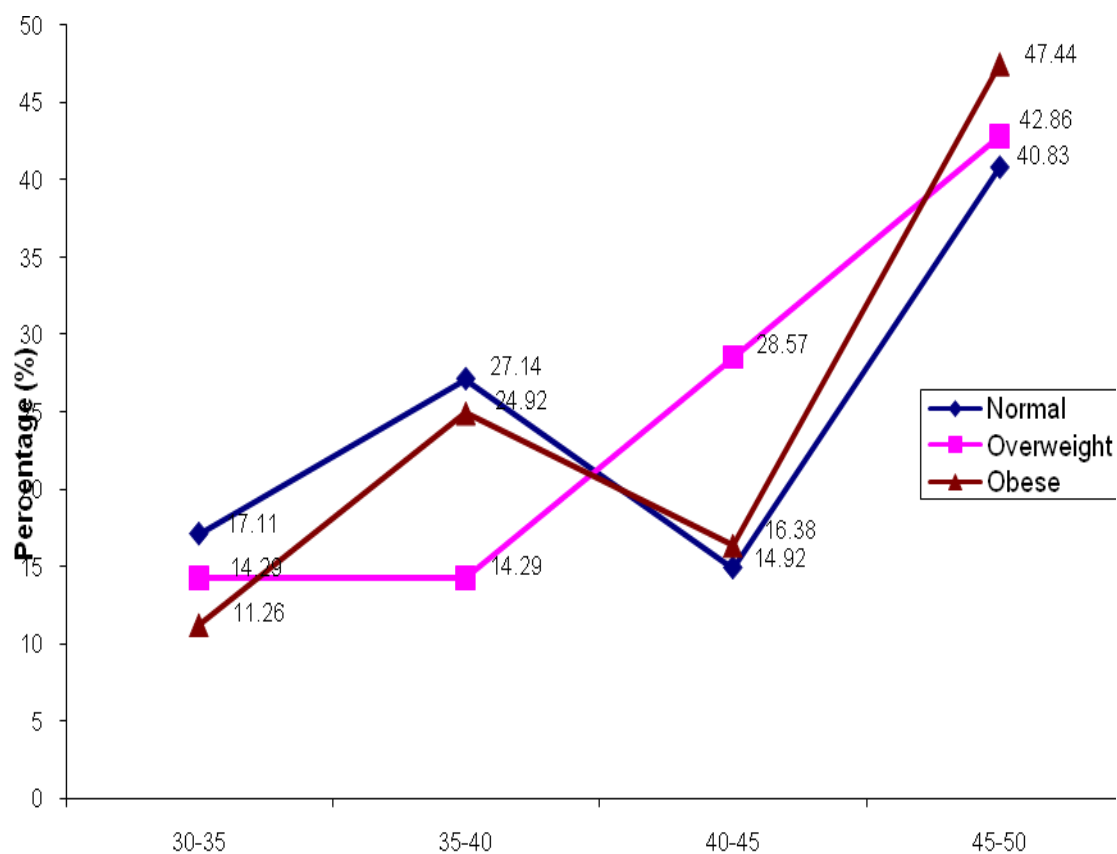
Fig.1.1: Age structure of the surveyed females according to
overweight and obesity

Table 1.2: Educational status of the surveyed females according to overweight
and obesity

S. No.	Educational status	Category of female					
		Normal		Overweight		Obese	
		No.	%	No.	%	No.	%
1	Illiterate	64	15.65	-	-	30	10.24
2	Primary	80	19.56	1	14.29	57	19.45
3	Secondary	125	30.56	2	28.57	110	37.54
4	University	135	33.01	4	57.14	93	31.74

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5	Professionals	5	1.22	-	-	3	1.02
	Total	409	100	7	100	293	100

Statistical significance: $\chi^2 = 8.854$, df = 8, þ > 0.05 NS.

Comment

- Nearly three-fifth (57.14%) overweight females possessed University education, whereas 37.54% obese and 33.0% normal females were Secondary and University educated ,respectively.

- There was no significant association between educational status and category of the females ($\chi^2 = 8.854$, þ > 0.05 NS).
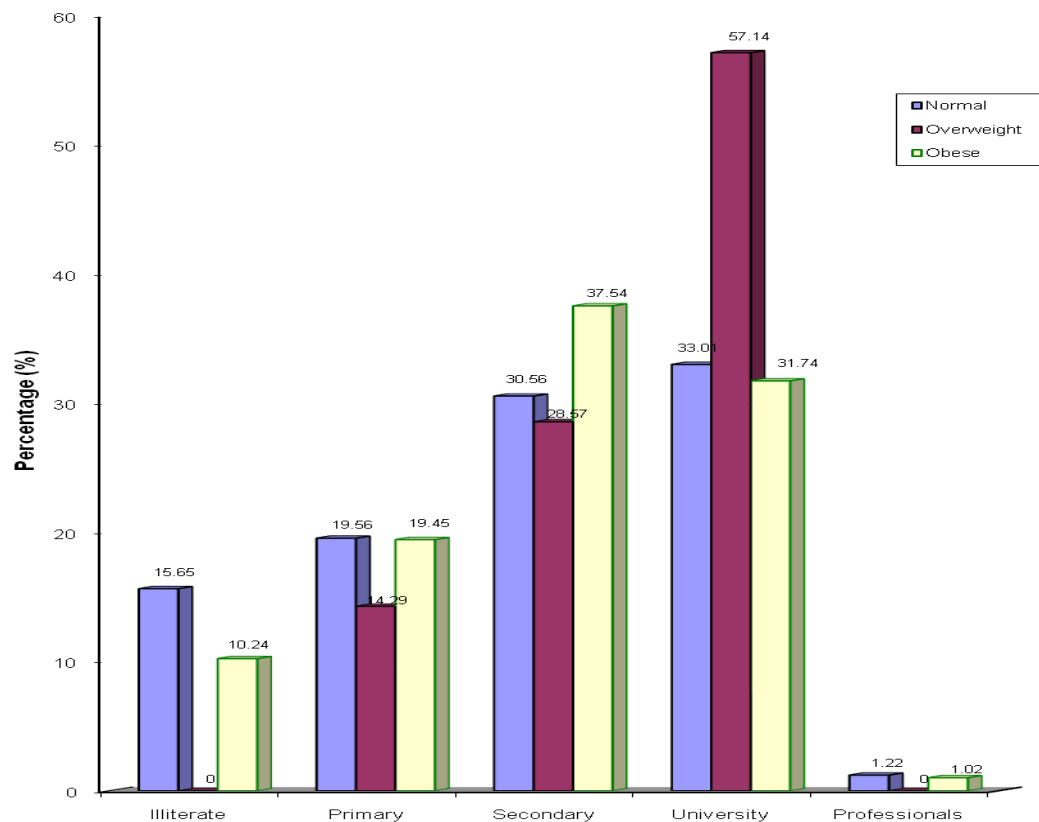
Fig.1.2: Educational status of the surveyed females according to overweight and obesity

Table 1.3: Occupational status of the surveyed females according to overweight and obesity

S. No.	Type of occupation	Category of female					
		Normal		Overweight		Obese	
		No.	%	No.	%	No.	%
1	House wife	371	90.71	2	28.57	260	88.74
2	Service	34	8.31	1	14.29	30	10.24
3	Business	4	0.98	4	57.14	3	1.02
	Total	409	100	7	100	293	100

Statistical significance: $\chi^2 = 142.846$, df = 4, $p < 0.001^{***}$.

Comment

- Majority of the normal (90.71%) and obese (88.74%) females were house wife, while 57.14% overweight females belonged to business class.

- There was no significant association between type of occupation and category of the females.
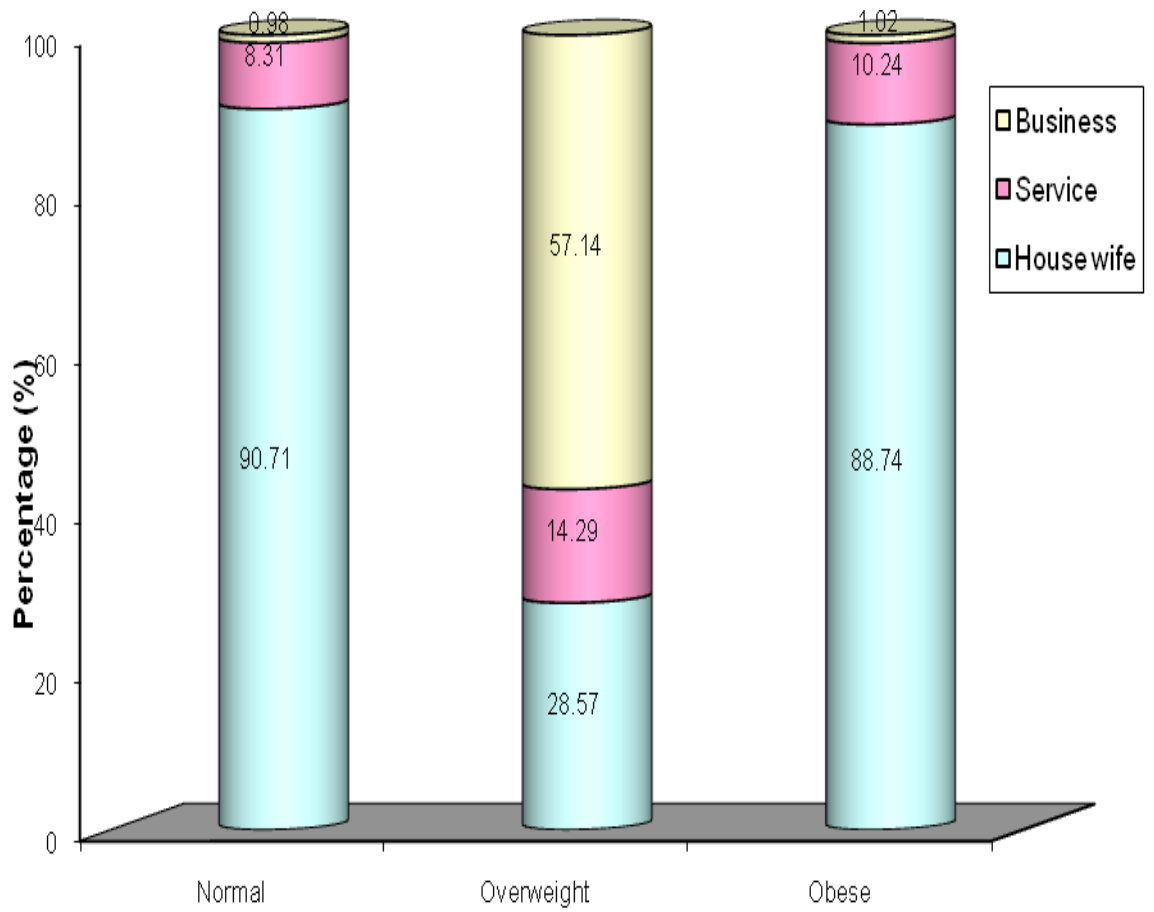
Fig. 1.3: Occupational status of the surveyed females according to overweight and obesity

Table 1.4: Main occupation of family according to category of the surveyed females

S. No.	Main occupation	Category of female					
		Normal		Overweight		Obese	
		No.	%	No.	%	No.	%
1	Business	214	52.32	5	71.43	179	61.09
2	Service	158	38.63	1	14.29	107	36.52
3	Others	37	9.05	1	14.29	7	2.39
	Total	409	100	7	100	293	100

Statistical significance: $\chi^2 = 16.479$, df = 4, þ < 0.01[***].

Comment

- Most of the surveyed females belonged to business class.

- There was significant association between main occupation of the family and category of the females ($\chi^2 = 16.479$, þ < 0.01[***]).
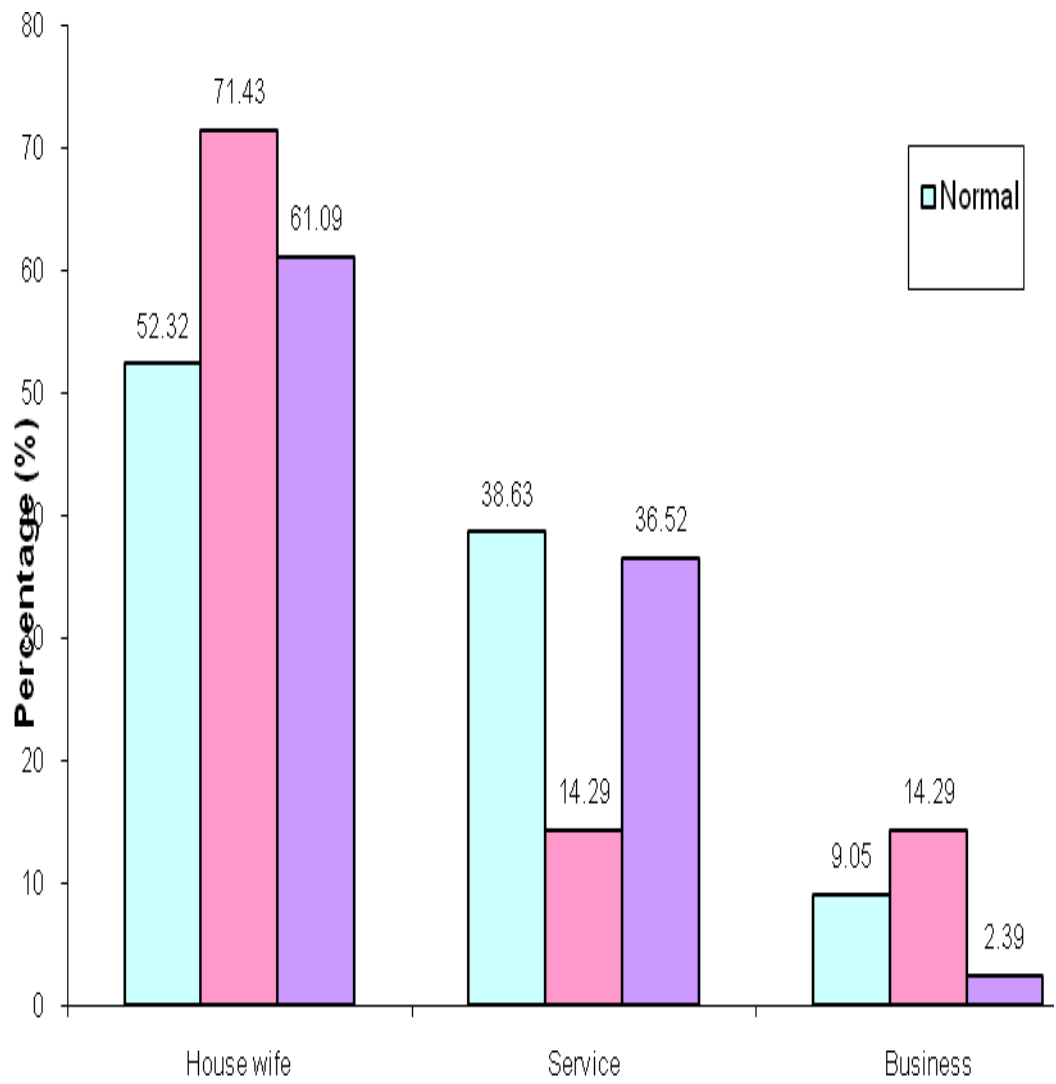
Fig. 1.4: Main occupation o family according to category of the surveyed females

Table 1.5: Religion of the surveyed females

S. No.	Religion	Category of female					
		Normal		Overweight		Obese	
		No.	%	No.	%	No.	%
1	Hindu	406	99.27	7	100.00	291	99.32
2	Muslim	3	0.73	-	-	2	0.68
	Total	409	100	7	100	293	100

Statistical significance: $\chi^2 = 0.011$, df = 1, þ > 0.05 NS.

Comment

- Majority of the females belonged to Hindu religion.

- There was no significant association between religion and category of the females ($\chi^2 = 0.011$, þ > 0.05 NS).
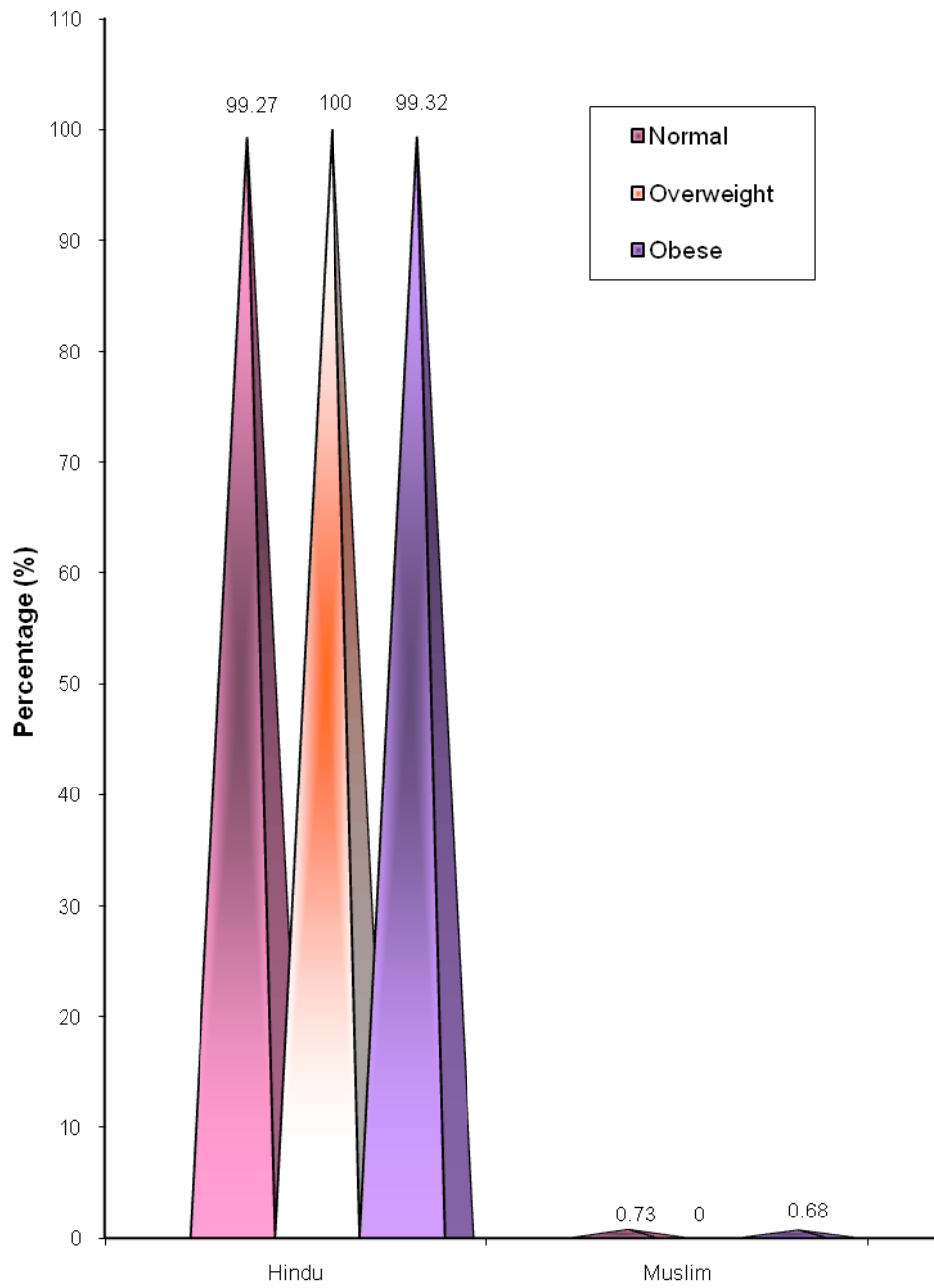
Fig. 1.5: Religion of the surveyed females

Table 1.6: Socio-economic status (income group) of the surveyed females

S. No.	Social-economic status	Category of female					
		Normal		Overweight		Obese	
		No.	%	No.	%	No.	%
1	Low	212	51.83	3	42.86	97	33.10
2	Middle	118	28.85	2	28.57	98	33.45
3	High	79	19.32	2	28.57	98	33.45
	Total	409	100	7	100	293	100

Statistical significance: $\chi^2 = 32.444$, df = 4, $p < 0.001$[***].

Comment

- There was significant association between socio-economic status and category of the females ($\chi^2 = 32.444$, $p < 0.001$[***]).
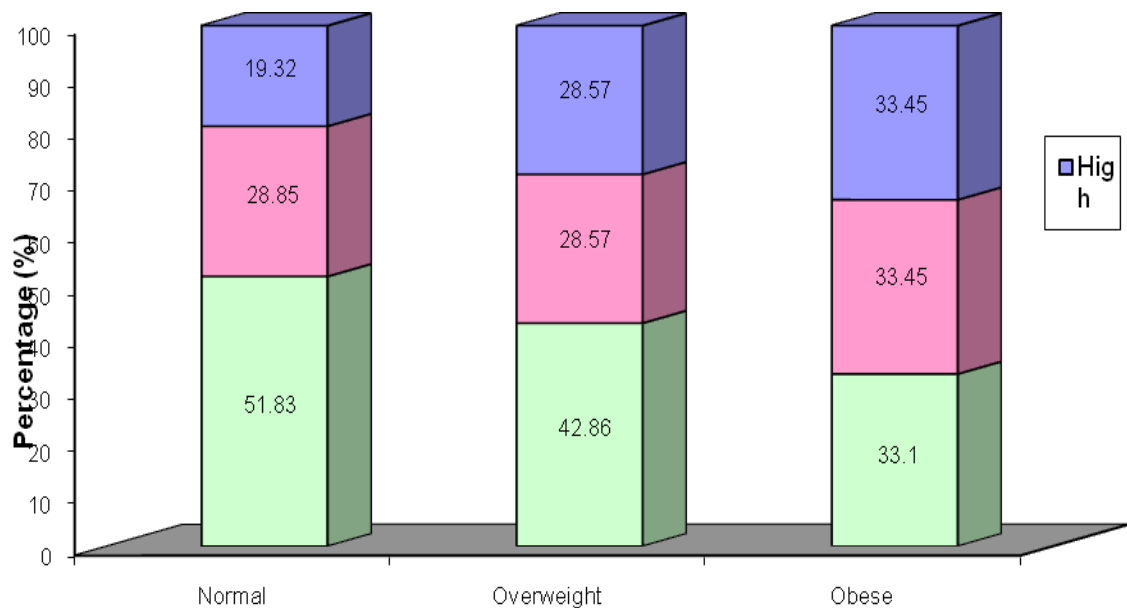
Fig. 1.6: Socio-economic status (income group) of the surveyed females

Table 1.7: Family structure of the surveyed females according to their category

S. No.	Type of family	Category of female					
		Normal		Overweight		Obese	
		No.	%	No.	%	No.	%
1	Nuclear	322	78.73	5	71.43	224	76.45
2	Joint	87	21.27	2	28.57	69	23.55
	Total	409	100	7	100	293	100

Statistical significance: $\chi^2 = 0.673$, df = 2, þ > 0.05 NS.

Comment

- Majority of the females in all the categories belonged to nuclear families.
- There was no significant association between type of family and category of the females ($\chi^2 = 0.673$, þ < 0.05 NS).
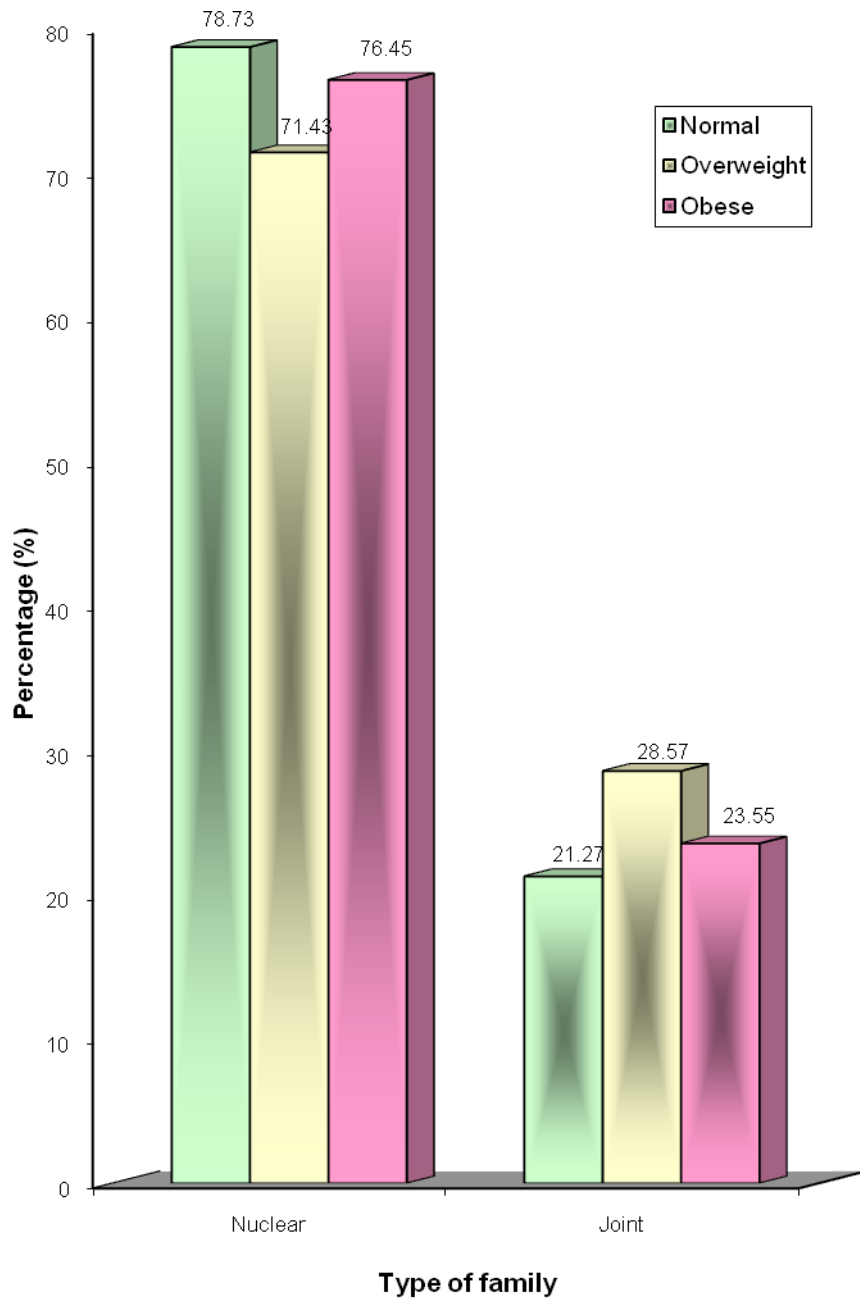
Fig. 1.7: Family structure of the surveyed females according to their category

Table 1.8: Marital status of the surveyed females according to their category

S. No.	Marital status	Category of female					
		Normal		Overweight		Obese	
		No.	%	No.	%	No.	%
1	Unmarried	2	0.49	-	-	1	0.34
2	Married	372	90.95	7	100.00	272	92.83
3	Widow	35	8.56	-	-	20	6.83
	Total	409	100	7	100	293	100

Statistical significance: $\chi^2 = 0.965$, df = 1, þ > 0.05 NS.

Comment

- Majority of the females from all the categories were married.

- There was no significant association between marital status and category of the females ($\chi^2 = 0.965$, þ > 0.05 NS).
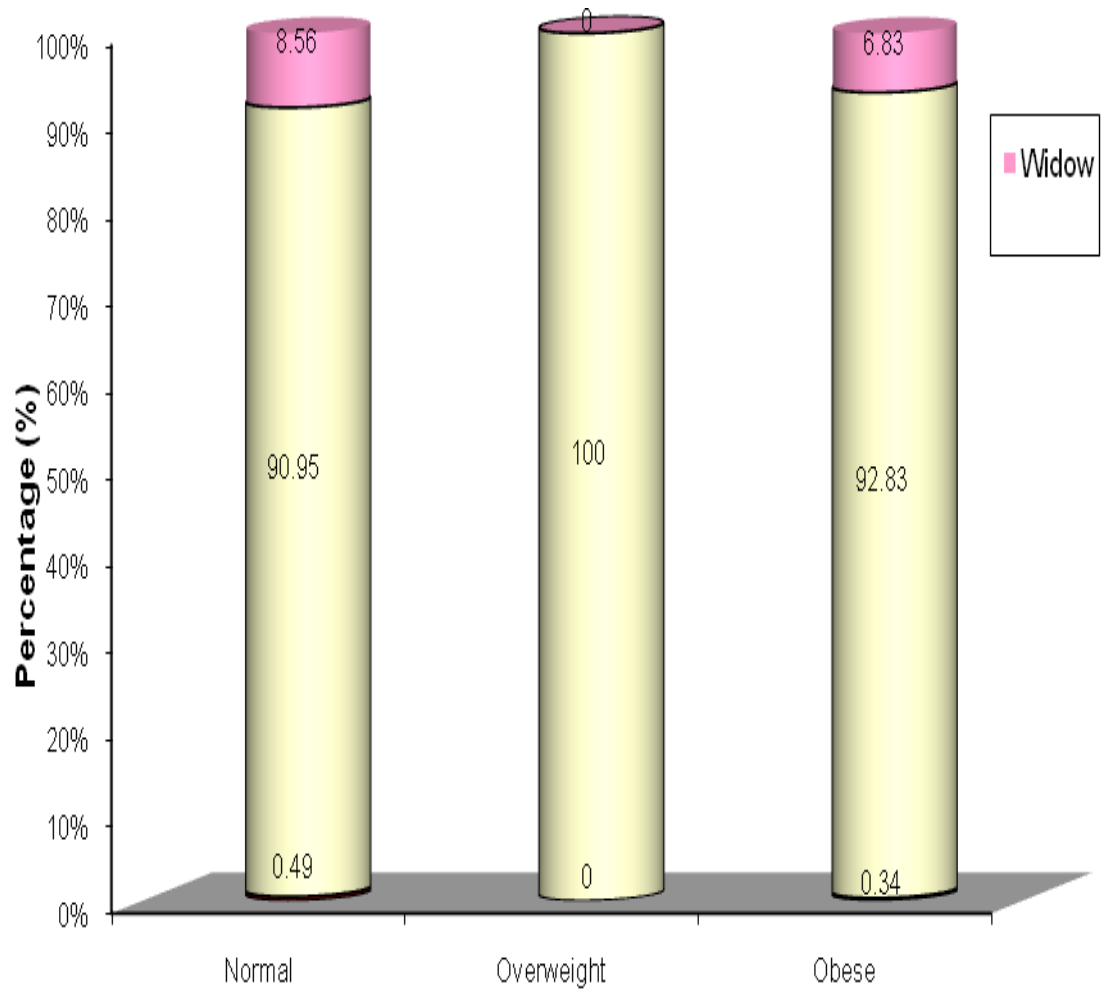
Fig. 1.8: Marital status of the surveyed females according to their category

Table 1.9: Number of members in the family according to category of the surveyed females

S. No.	No. of family member	Category of female					
		Normal		Overweight		Obese	
		No.	%	No.	%	No.	%
1	1-3	52	12.71	-	-	36	12.29
2	4-6	311	76.04	7	100.00	213	72.70
3	7-9	39	9.54	-	-	36	12.29
4	≥ 10	7	1.71	-	-	8	2.73
Total		409	100	7	100	293	100
Mean ± SD		5.01± 1.62		5.00 ± 0		5.16 ± 1.78	

1. Normal *Vs.* Obese   - $t = 1.142$, $df = 700$, $p > 0.05$ NS.

2. Normal *Vs.* Overweight   - $t = 0.125$, $df = 414$, $p > 0.05$ NS.

3. Overweight *Vs.* Obese- $t = 1.538$, $df = 298$, $p > 0.05$ NS.

Comment

- Majority of the females from all the categories belonged to 4 to 6 member's families.

- The mean ± SD family size of normal, overweight and obese females were assessed 5.01± 1.62; 5.00 ± 0 and 5.16 ± 1.78, respectively.

- Mean family sizes were found statistically similar for all the categories of the females ($p > 0.05$ NS).
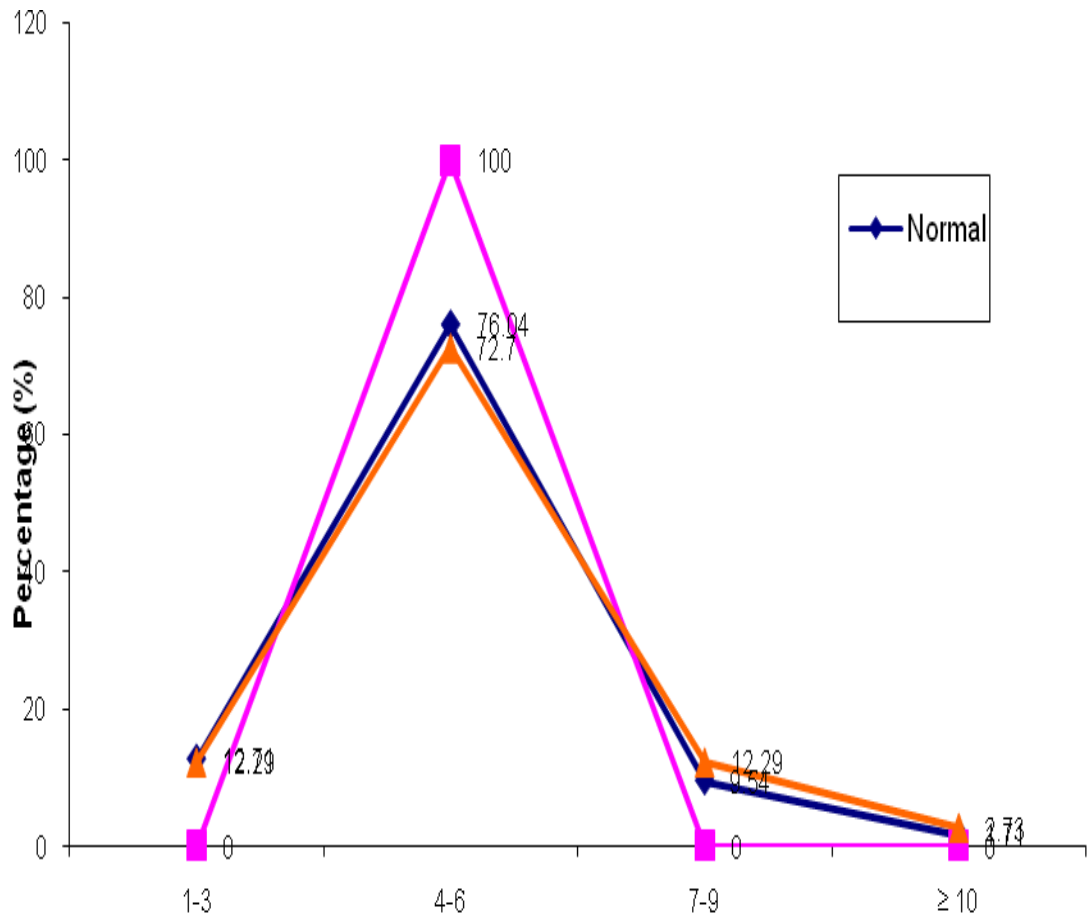
Fig. 1.9: Number of members in the family according to category
of the surveyed females

Table 2.1: **Prevalence of overweight and obesity in the surveyed areas**

S. No.	Area surveyed	No. of females surveyed	Overweight		Obese		Overweight and Obese combined	
			No.	Prev. (%)	No.	Prev. (%)	No.	Prev. (%)
1	(A) Mursan Gate	161	1	0.62	74	45.96	75	46.58
2	(B) Awas Vikash Colony	173	2	1.16	73	42.20	75	43.36
3	(C) Vidyapati Nagar	205	2	0.98	73	35.61	75	36.59
4	(D) Delhi wala Chowk	170	2	1.18	73	42.94	75	44.12
	Total	709	7	0.99	293	41.33	300	42.31
	Statistical significance:		$\chi^2 = 0.333$, df = 3, þ> 0.05 NS		$\chi^2 = 4.427$, df = 3, þ> 0.05 NS		$\chi^2 = 4.262$, df = 3, þ> 0.05 NS	

Comments

- The prevalence of overweight ranged from 0.62% to 1.18% in different surveyed areas.

- The maximum prevalence of obesity (45.96%) was observed in area Mursan Gate; followed by area Delhi Wala Chowk and Awas Vikash colony (42.20%).

- The prevalence's of overweight and obesity were found statistically similar in all the surveyed areas (þ> 0.05 NS).
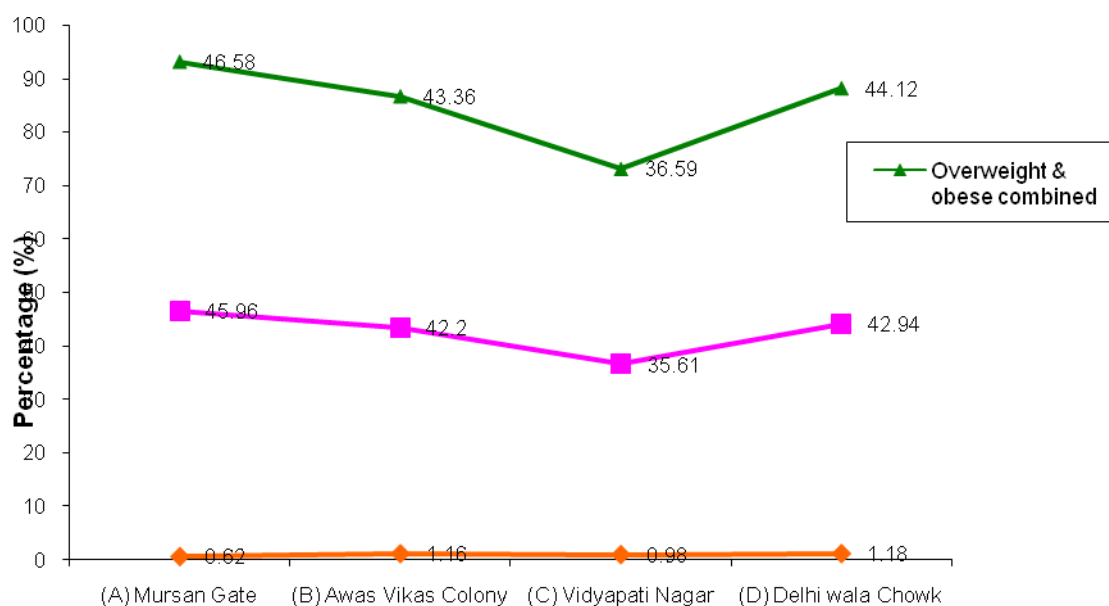
Fig. 2.1: Prevalence of overweight and obesity in the surveyed areas

Table 2.2: **Prevalence of overweight and obesity according to age of the surveyed females**

S. No.	Age (yrs.)	No. of females surveyed	Overweight		Obese		Overweight and Obese combined	
			No.	Prev. (%)	No.	Prev. (%)	No.	Prev. (%)
1	30-35	104	1	0.96	33	31.73	34	32.69
2	35-40	185	1	0.54	73	39.46	74	40.00
3	40-45	111	2	1.80	48	43.44	50	45.94
4	45-50	309	3	0.97	139	44.98	142	45.95
	Total	709	7	0.99	293	41.33	300	42.31
	Statistical significance:		$\chi^2 = 1.130$, df $= 3$, þ> 0.05 NS		$\chi^2 = 6.088$, df $= 3$, þ> 0.05 NS		$\chi^2 = 6.367$, df $= 3$, þ> 0.05 NS	

Comments

- The prevalence of overweight and obesity (combined) ranged from 32.69% to 45.95% in different age groups.

- The prevalence of overweight and obesity were found statistically similar in all the age groups (NS) and the differences observed were due to chance factor.

Fig. 2.2: Prevalence of overweight and obesity according to age of the surveyed females

Table 2.3: Prevalence of overweight and obesity according to educational status of the surveyed females

S. No.	Educational status	No. of females surveyed	Overweight		Obese		Overweight and Obese combined	
			No.	Prev. (%)	No.	Prev. (%)	No.	Prev. (%)
1	Illiterate	94	-	-	30	31.91	30	31.91
2	Primary	138	1	0.72	57	41.30	58	42.02
3	Secondary	237	2	0.84	110	46.41	112	47.25
4	University	232	4	1.72	93	40.09	97	41.81

5	Professionals	8	-	-	3	37.50	3	37.50
	Total	709	7	0.99	293	41.33	300	42.31
Statistical significance:		$\chi^2 = 1.701$, df = 2, þ> 0.05 NS			$\chi^2 = 6.159$, df = 4, þ> 0.05 NS		$\chi^2 = 6.642$, df = 4, þ> 0.05 NS	

Comments

- The minimum prevalence of overweight and obesity combined was observed in illiterate females (31.91%), while it was highest in Secondary educated (47.25%) females.

- The prevalence of overweight and obesity were found statistically similar in all the education groups (þ> 0.05 NS).

Fig. 2.3: Prevalence of overweight and obesity according to educational status of the surveyed females

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Table 2.4: **Prevalence of overweight and obesity according to occupational status of the surveyed females**

S. No.	Occupation	No. of females surveyed	Overweight		Obese		Overweight and Obese combined	
			No.	Prev. (%)	No.	Prev. (%)	No.	Prev. (%)
1	House wife	633	2	0.32	260	41.07	262	41.39
2	Service	65	1	1.54	30	46.15	31	47.69
3	Business	11	4	36.36	3	27.27	7	63.64
	Total	709	7	0.99	293	41.33	300	42.31
Statistical significance:			$\chi^2 = 143.043$, df = 1, þ< 0.001[***]		$\chi^2 = 1.537$, df = 2, þ> 0.05 NS		$\chi^2 = 3.040$, df = 2, þ> 0.05 NS	

Comments

- The prevalence of overweight and obesity was found maximum (63.64%) in business class and minimum in house wives (41.39%).

- The prevalence of overweight was found significantly associated with occupation of the females ($\chi^2 = 143.043$, þ < 0.001[***]). But, considering overweight and obese combined the association was found statistically insignificant ($\chi^2 = 3.040$, df = 2, þ > 0.05 NS).

Fig. 2.4: Prevalence of overweight and obesity according to occupational status of the surveyed females

Table 2.4.1: **Prevalence of overweight and obesity according to type of work performed by females**

S. No.	Type of work	No. of females surveyed	Overweight		Obese		Overweight and Obese combined	
			No.	Prev. (%)	No.	Prev. (%)	No.	Prev. (%)
1	Sedentary	52	4	7.69	27	51.92	31	59.62
2	Moderate	545	3	0.55	252	46.23	255	47.79
3	Heavy	112	-	-	14	12.50	14	12.50
	Total	709	7	0.99	293	41.33	300	42.31
Statistical significance:			$\chi^2 = 25.808$, df = 1, þ> 0.001[***]		$\chi^2 = 46.212$, df = 2, þ> 0.001[***]		$\chi^2 = 51.635$, df = 2, þ> 0.001[***]	

Comments

▪ The prevalence of obesity was found highest in sedentary workers (51.92%), while it was least in hard worker females (12.50%).

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- The prevalence of overweight and obesity were found significantly associated with type of work (þ < 0.001***).
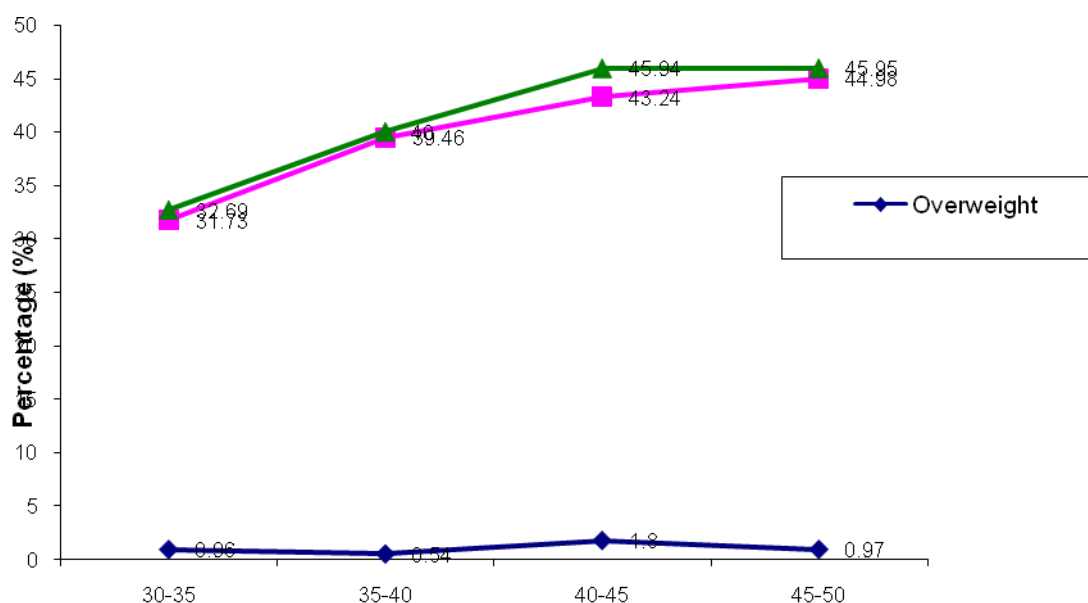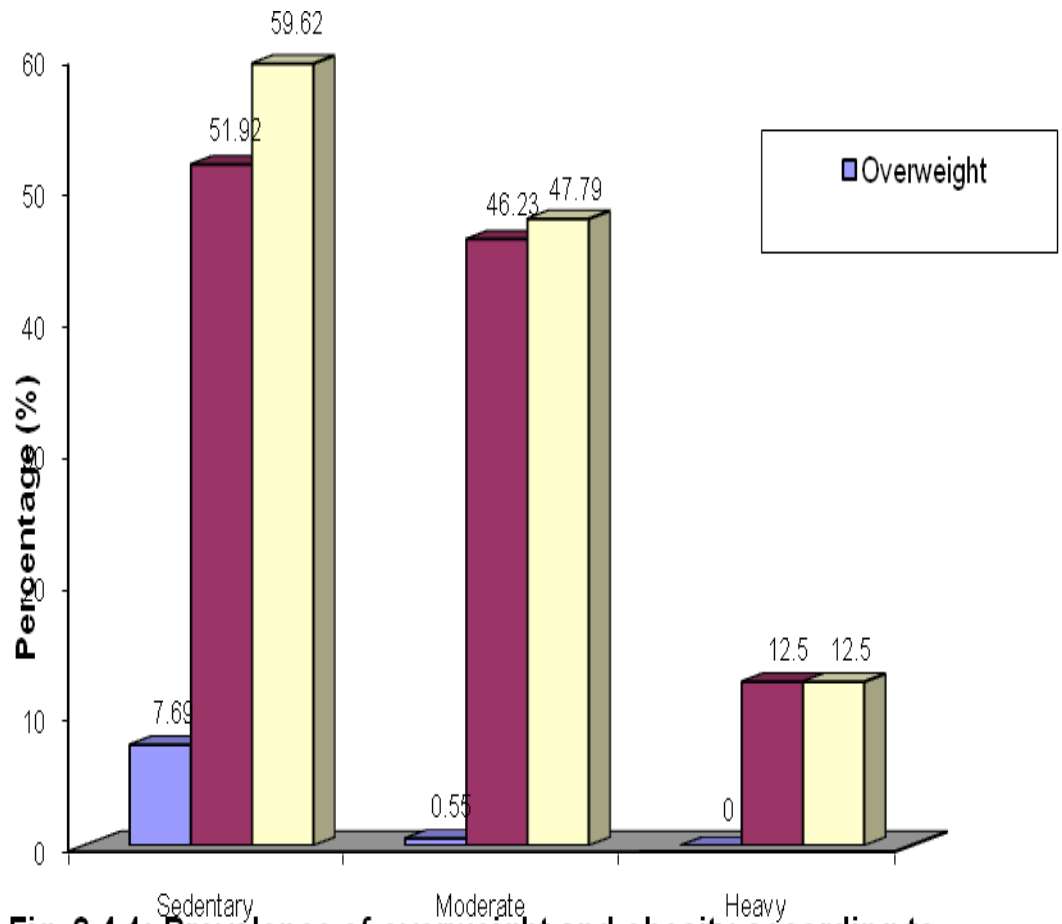

Fig. 2.4.1: Prevalence of overweight and obesity according to type of work performed by females

Table 2.5: Prevalence of overweight and obesity according to religion of the surveyed females

S. No.	Religion	No. of females surveyed	Overweight		Obese		Overweight and Obese combined	
			No.	Prev. (%)	No.	Prev. (%)	No.	Prev. (%)
1	Hindu	704	7	0.99	291	41.34	298	42.33
2	Muslim	5	-	-	2	40.00	2	40.00
	Total	709	7	0.99	293	41.33	300	42.31
Statistical significance:			-		$\chi^2 = 0.001$, df = 1, þ> 0.05 NS		$\chi^2 = 0.004$, df = 1, þ> 0.05 NS	

Comments

- The prevalence of overweight and obesity combined was found 42.33% and 40.00% in Hindu and Muslim females, respectively.

- There was no significant association between religion and overweight and obesity of the females ($\chi^2 = 0.004$, þ > 0.05 NS).
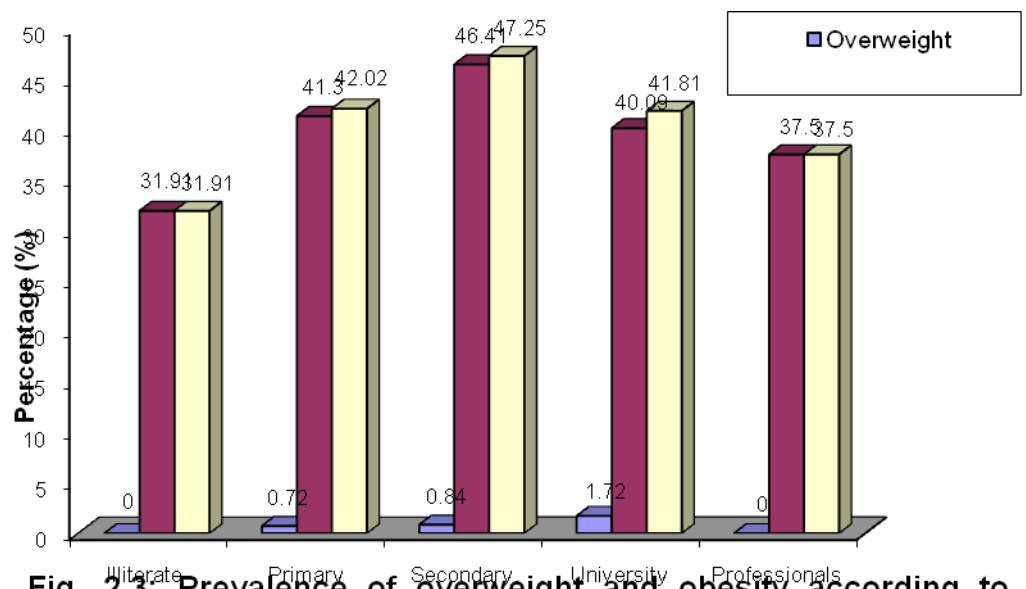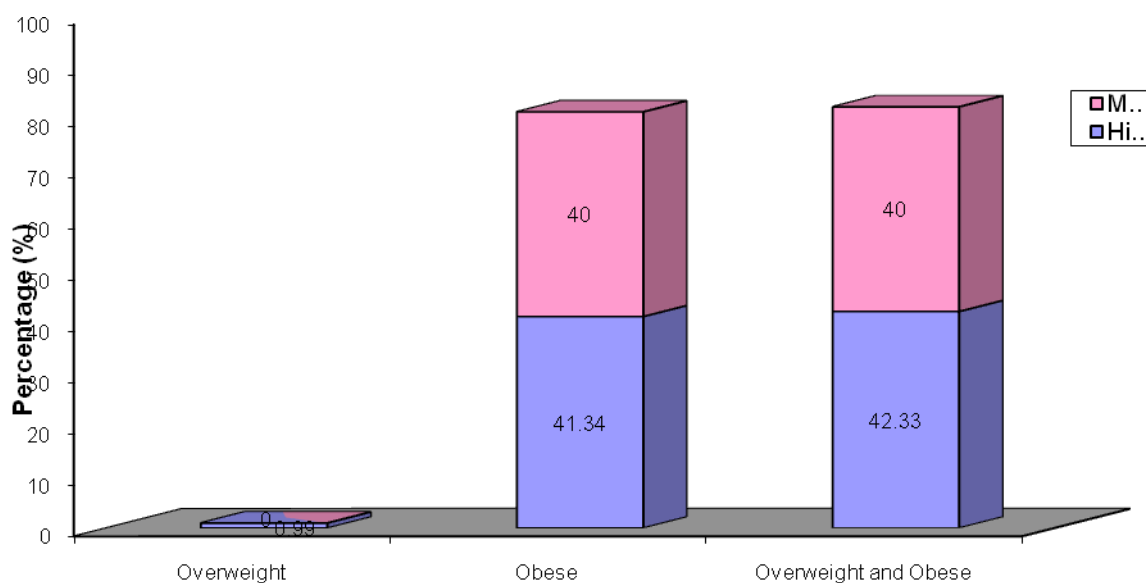
Fig. 2.5: Prevalence of overweight and obesity according to religion of the surveyed females

Table 2.6: **Prevalence of overweight and obesity according to income group of the surveyed females**

S. No.	Income group	No. of females surveyed	Overweight		Obese		Overweight and Obese combined	
			No.	Prev. (%)	No.	Prev. (%)	No.	Prev. (%)
1	Low	312	3	0.96	97	31.09	100	32.05
2	Middle	218	2	0.92	98	44.95	100	45.87
3	High	179	2	1.12	98	54.75	100	55.87
	Total	709	7	0.99	293	41.33	300	42.31
Statistical significance:			$\chi^2 = 0.044$, df = 2, þ> 0.005 NS		$\chi^2 = 27.965$, df = 2, þ< 0.001***		$\chi^2 = 28.061$, df = 2, þ< 0.001***	

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Comments

- The prevalence of overweight and obesity combined was observed minimum (32.05%) in low income group, while it was highest in high income (55.87%) females.

- There was significant association ($\chi^2 = 28.061$, $p<0.001^{***}$) between income and overweight and obesity of the females.
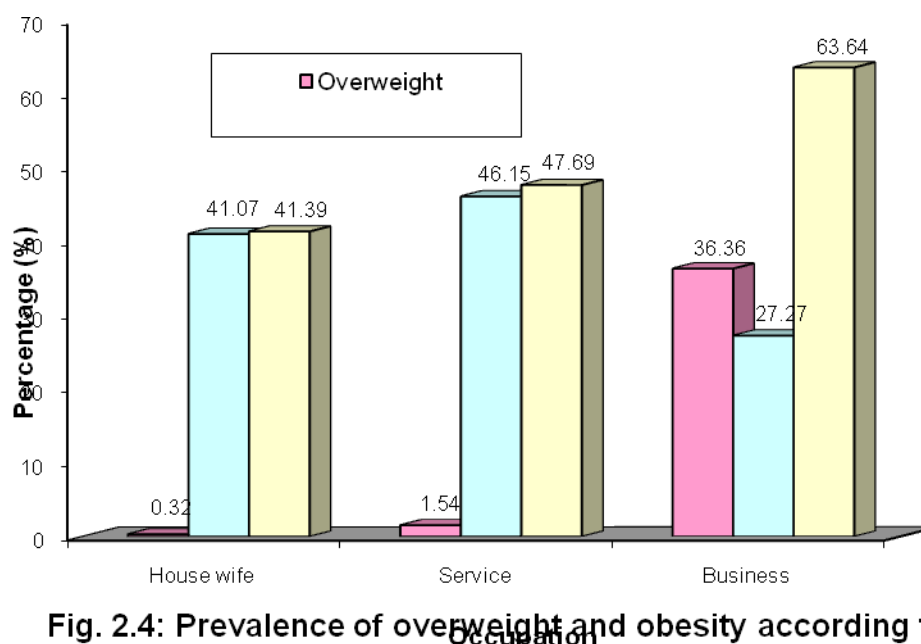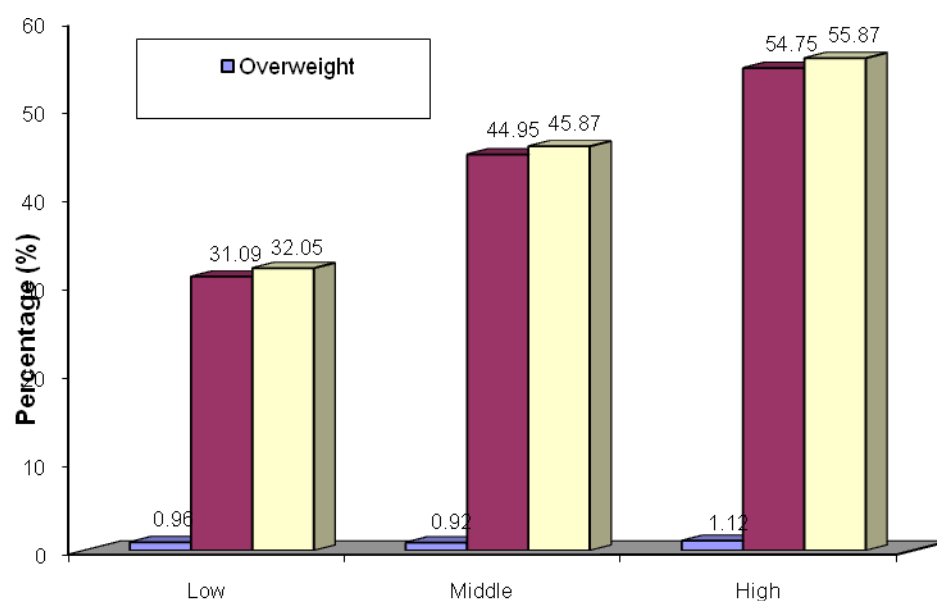

Fig. 2.6: Prevalence of overweight and obesity according to income group of the surveyed females

Table 2.7: **Prevalence of overweight and obesity according to family structure of the surveyed females**

S. No.	Family structure	No. of females surveyed	Overweight		Obese		Overweight and Obese combined	
			No.	Prev. (%)	No.	Prev. (%)	No.	Prev. (%)
1	Nuclear	551	5	0.91	224	40.65	229	41.56
2	Joint	158	2	1.27	69	43.67	71	44.94

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Total	709	7	0.99	293	41.33	300	42.31
Statistical significance:	$\chi^2 = 0.161$, df $= 1$, þ> 0.05 NS			$\chi^2 = 0.461$, df $= 1$, þ> 0.05 NS		$\chi^2 = 0.573$, df $= 1$, þ> 0.05 NS	

Comments

- Though prevalence of overweight and obesity were observed lowest in nuclear families and highest in joint families, but the association was not statistically established significant (NS).

Fig. 2.7: Prevalence of overweight and obesity according to family structure of the surveyed females

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Table 2.8: **Prevalence of overweight and obesity according to total family members with surveyed females**

S. No.	No. of family members	No. of females surveyed	Overweight		Obese		Overweight and Obese combined	
			No.	Prev. (%)	No.	Prev. (%)	No.	Prev. (%)
1	1-3	88	-	-	36	40.91	36	40.91
2	4-6	531	7	1.32	213	40.11	220	41.43
3	7-9	75	-	-	36	48.00	36	48.00
4	≥ 10	15	-	-	8	53.33	8	53.33
	Total	709	7	0.99	293	41.33	300	42.31
	Statistical significance:				$\chi^2 = 2.598$, df = 3, þ> 0.05 NS		$\chi^2 = 1.980$, df = 3, þ> 0.05 NS	

Comments

- Highest prevalence overweight and obesity was observed in large families with more than 10 family members (53.33%), while it was lowest (40.11%) in 4 to 6 members' families.

- There was no significant association between number of family members and prevalence of overweight and obesity in females   ($\chi^2 = 1.980$, þ> 0.05 NS).

Fig. 2.8: Prevalence of overweight and obesity according to total family members with surveyed females

Table 2.9: **Prevalence of overweight and obesity according to marital status of the surveyed females**

S. No.	Marital status	No. of females surveyed	Overweight		Obese		Overweight and Obese combined	
			No.	Prev. (%)	No.	Prev. (%)	No.	Prev. (%)
1	Un-married	3	-	-	1	33.33	1	33.33
2	Married	651	7	1.08	272	41.78	279	42.86
3	Widow	55	-	-	20	36.36	20	36.36
	Total	709	7	0.99	293	41.33	300	42.31
	Statistical significance: (Married *Vs.* Others)		-		$\chi^2 = 0.683$, df = 1, þ> 0.05 NS		$\chi^2 = 0.976$, df = 2, þ> 0.05 NS	

Comments

- The prevalence of overweight and obesity was found least in un-married (33.33%) females and highest (42.86%) in married females.

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- There was no significant association between prevalence of overweight and obesity and marital status of the females ($\chi^2 = 0.976$, þ> 0.05 NS).
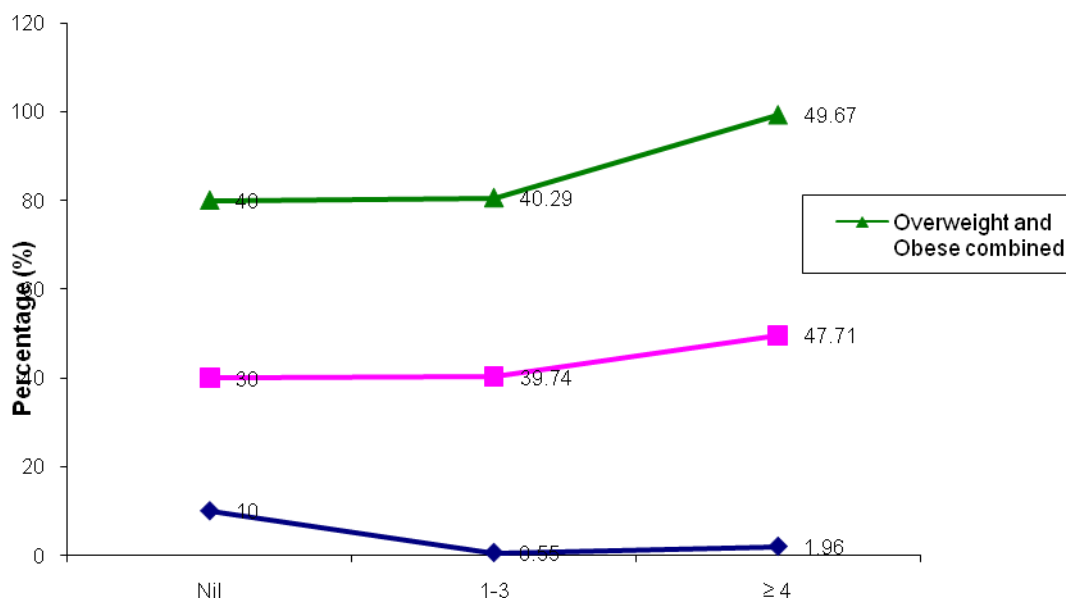
Fig. 2.10: Prevalence of overweight and obesity in surveyed females according to parity

Table 2.10: **Prevalence of overweight and obesity in surveyed females according to parity**

S. No.	No. of parity	No. of females surveyed	Overweight		Obese		Overweight and Obese combined	
			No.	Prev. (%)	No.	Prev. (%)	No.	Prev. (%)
1	Nil	10	1	10.00	3	30.00	4	40.00
2	1-3	546	3	0.55	217	39.74	220	40.29
3	≥ 4	153	3	1.96	73	47.71	76	49.67
	Total	709	7	0.99	293	41.33	300	42.31

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Statistical significance (Comparison between up to three *Vs.* more)	$\chi^2 = 1.891$, df = 1, þ> 0.05 NS	$\chi^2 = 3.282$, df = 1, þ> 0.05 NS	$\chi^2 = 4.330$, df = 2, þ> 0.05 NS

Comments

- Highest prevalence overweight and obesity (49.67%) was observed in parity more than and equal to four.

- There were no significant association between parity and overweight and obesity (þ> 0.05 NS).
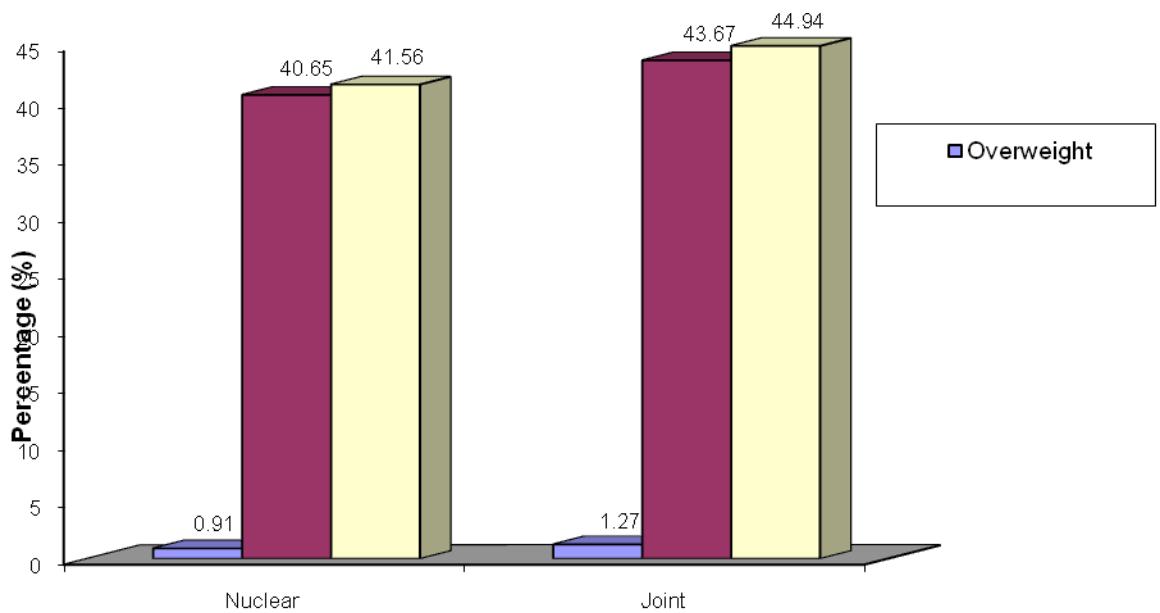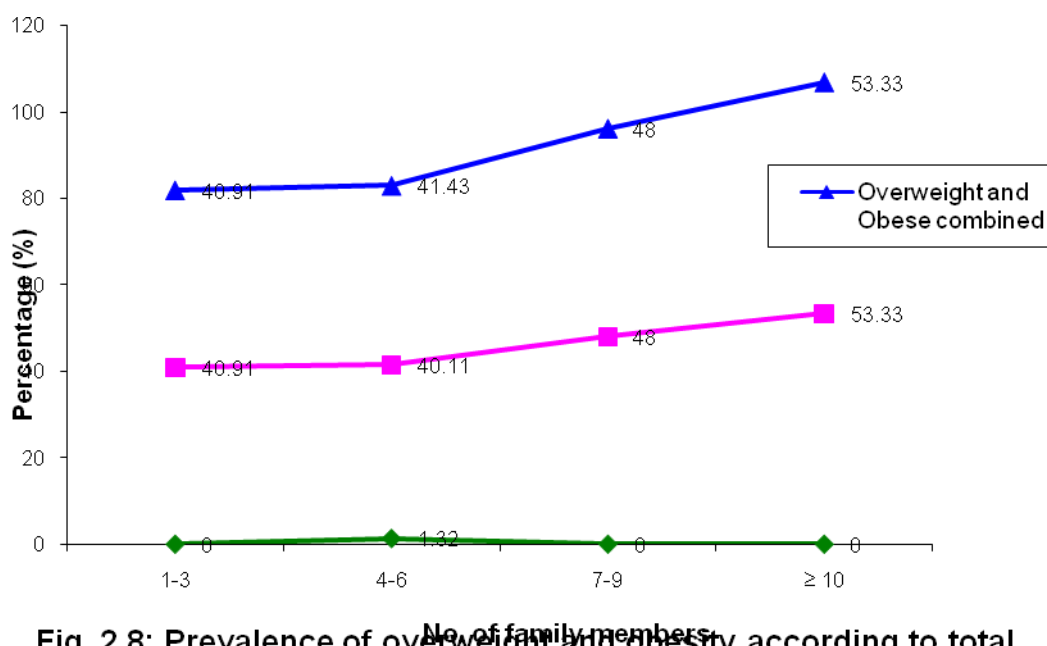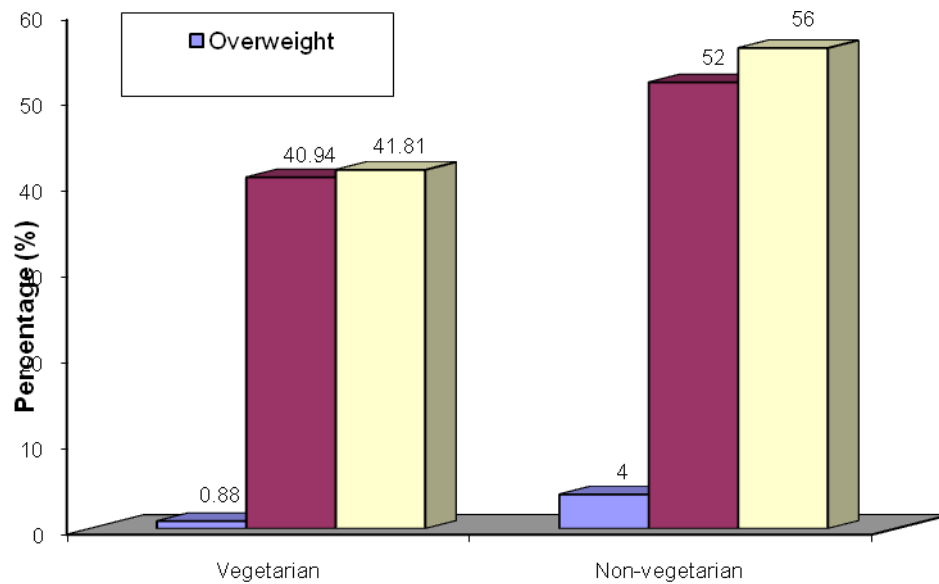

Fig. 2.11: Prevalence of overweight and obesity according to food habit of the surveyed females

Table 2.11: **Prevalence of overweight and obesity according to food habit of the surveyed females**

S. No.	Food habit	No. of females surveyed	Overweight		Obese		Overweight and Obese combined	
			No.	Prev. (%)	No.	Prev. (%)	No.	Prev. (%)
1	Vegetarian	684	6	0.88	280	40.94	286	41.81
2	Non-vegetarian	25	1	4.00	13	52.00	14	56.00
	Total	709	7	0.99	293	41.33	300	42.31
	Statistical significance		$\chi^2 = 2.406$, df = 1, þ> 0.05 NS		$\chi^2 = 1.218$, df = 1, þ> 0.05 NS		$\chi^2 = 1.989$, df = 1, þ> 0.05 NS	

Comments

- Though prevalence of overweight and obesity were found higher in non-vegetarian females but it was not statistically established (þ> 0.05 NS) significant.

3. Specific information regarding overweight and obese females before providing nutrition education

Table 3.1: Knowledge of overweight and obese females regarding overweight and obesity according to income group

S. No.	Knowledge	Income group			Total (300)	
		Low (100)	Middle (100)	High (100)		
		No. & %	No. & %	No. & %	No.	%
1	Knowledge of the disease	66	83	84	233	77.67
	$\chi^2 = 11.801$, df = 2, þ< 0.01**					
2	Consequences					
	• Seems aged	16	19	11	46	15.33
	• More weight in comparison to height	14	13	19	46	15.33
		13	19	23	55	18.33
	• 10 to 20% more	23	32	32	86	28.67

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	weight than normal					
	• All above					
3	Problem ‡					
	• Problem in working and walking	59	29	23	111	37.00
	• Pain in joints	26	30	30	86	28.67
	• High breathing	18	18	13	49	16.33
	• Others	8	6	18	32	10.67

‡Multiple responses were obtained

Comments

- Majority of the overall females (77.67%) had knowledge of overweight and obesity.
- There was significant association between knowledge of the disease and income of the females ($\chi^2 = 11.801$, þ< 0.01^{**}).

Table 3.2: Positive family history according to income group of the females

S. No.	Family history		Income group			Total (300)	
			Low (100)	Middle (100)	High (100)		
			No. & %	No. & %	No. & %	No.	%
1	Obesity	Maternal	20	41	30	91	30.33
		Paternal	15	44	20	79	26.33
2	Diabetes	Maternal	11	12	16	39	13.00
		Paternal	11	16	8	35	11.67
3	Hypertension	Maternal	11	37	30	78	26.00
		Paternal	10	43	16	69	23.00
4	Coronary heart disease	Maternal	1	2	1	4	1.33
		Paternal	1	1	2	4	1.33
5	Others	Maternal	10	1	1	12	4.00
		Paternal	7	1	-	8	2.67

Comments

- Obesity and hypertension were more common (nearly one-fourth) family history either in maternal or paternal side.
- Coronary heart disease was least prevalent family history is maternal or paternal side).
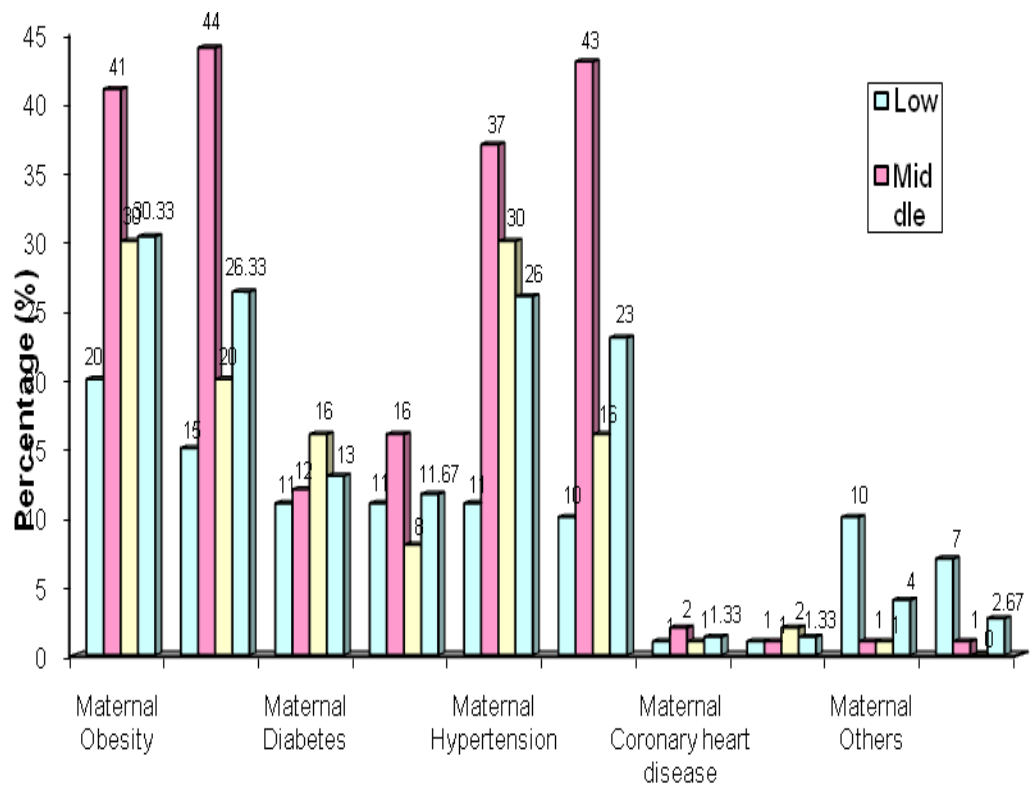
Fig. 3.2: Positive family history according to income group of the females

Table 3.3: Type and frequency of physical exercise practiced by the females according to income group

S. No.	Type/Frequency	Income group			Total (300)	
		Low (100)	Middle (100)	High (100)		
		No. & %	No. & %	No. & %	No.	%
1. Type ‡						
1.1	Walking	19	23	27	69	23.00
1.2	Sports and Playing	-	-	5	5	1.67
1.3	Dancing	-	1	-	1	0.33
1.4	Yoga	26	15	31	72	24.00
1.5	Cycling and Gym.	-	1	2	3	1.00

2. Frequency						
2.1	Daily	32	26	35	93	31.00
2.2	5 days in a week	-	1	1	2	0.67
2.3	2 days in a week	5	8	15	28	9.33
2.4	Never	63	65	49	177	59.00

‡ Multiple responses were obtained

Comments

- Nearly one-quarter overall females (24.00%) practiced yoga; followed by walking (23.00%).
- Only one female participated in dancing.

- It is very disappointing that nearly three-fifth overall females (59.00%) never performed any kind of physical exercise, while 31.00% females were participating daily.

Fig. 3.3a: Type of physical exercise practiced by the females according to income group

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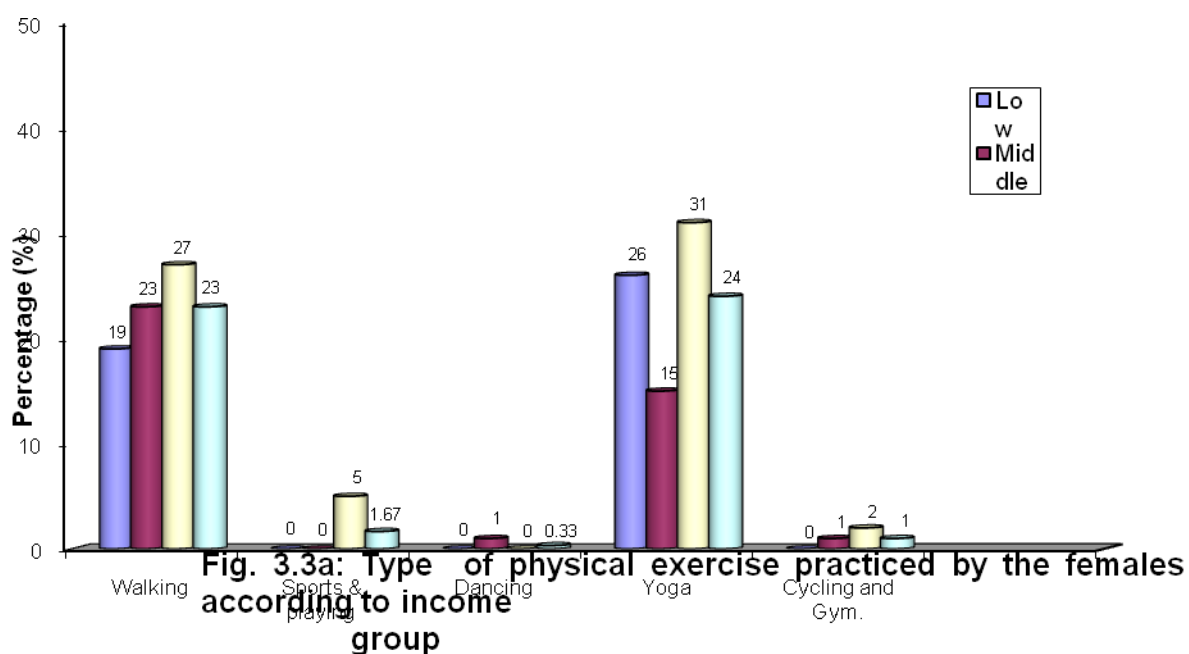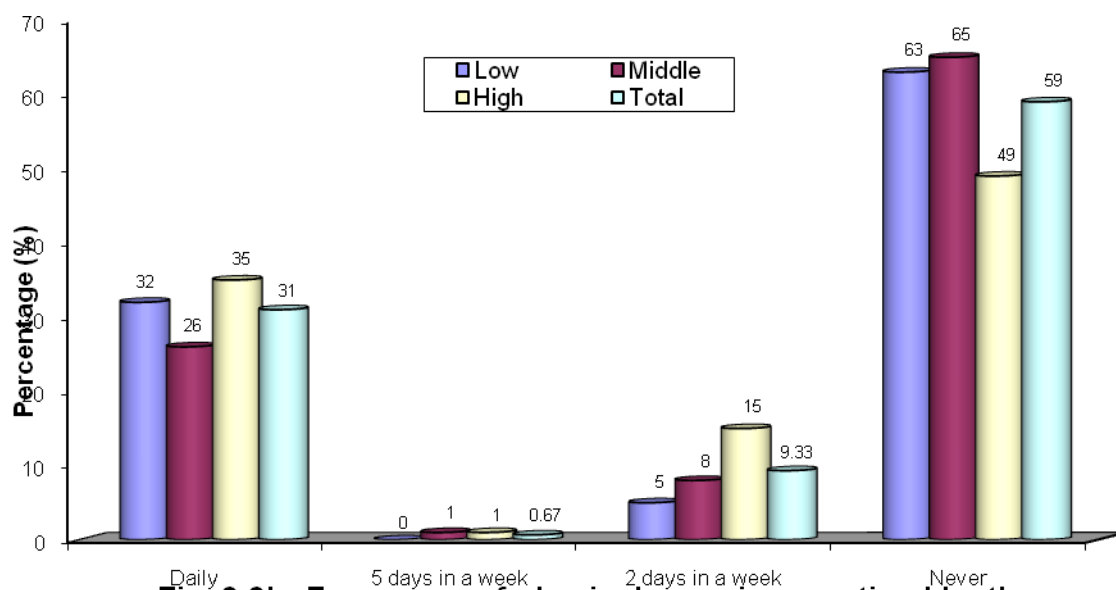
Fig. 3.3b: Frequency of physical exercise practiced by the females according to income group

Table 3.4:   Habit of TV viewing by the females according to income group

S. No.	Habit & Hour of TV viewing	Income group						Total	
		Low		Middle		High			
		No.	%)	No.	(%)	No.	(%)	No.	(%)
1	Nil	21	21.00	11	11.00	-	-	32	10.67
2	< 4 hrs.	46	46.00	67	67.00	83	83.00	196	65.33
3	4 hours	32	32.00	19	19.00	9	9.00	60	20.00
4	> 4 hours	1	1.00	3	3.00	8	8.00	12	4.00
	Total	100	100	100	100	100	100	300	100
	Mean ± SD	2.49 ± 1.46		2.60 ± 1.18		2.88 ± 0.89		2.65 ± 1.21	

Statistical significance

1. Comparison between low and middle income: t   =
    0.586, df = 198, þ > 0.05 NS.

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2. Comparison between low and high income: $\qquad$ t = 2.281, df = 198, þ < 0.05*.

3. Comparison between middle and high income: $\qquad$ t = 1.894, df = 198, þ > 0.05 NS.

Comment

- Majority of the females (65.33%) viewed TV for less than four hours. The overall mean ± SD time of TV viewing was computed 2.65 ± 1.21 hours.

- There was significant difference in mean time of TV viewing by the low and high income group females (t = 2.281, þ < 0.05*).
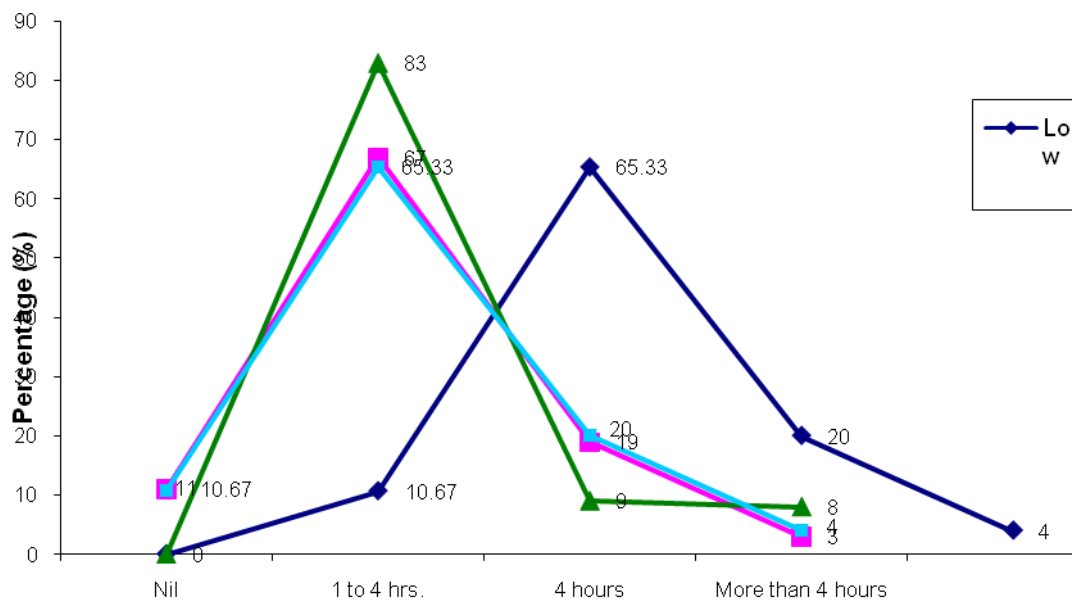
Fig. 3.4: Habit and Hours of TV viewing by the females according to income group

Table 3.5: Food habit of the overweight and obese females according to income

S No.	Food habit	Income group			Total (300)		Statistical significance
		Low (100) %	Middle (100) %	High (100) %	No	%	
1	Vegetarian	97	95	94	286	95.33	$\chi^2 = 1.048$, df = 2, þ> 0.05 NS
2	Non-vegetarian	3	5	6	14	4.67	
3	Meal requirement after feeling hungry	96	93	87	276	92.00	$\chi^2 = 5.706$, df = 2, þ> 0.05 NS
4	Feeling hungry during tension ■ Absolutely no ■ Less hunger ■ More hunger	78 13 19	68 11 21	64 10 26	200 34 66	66.67 11.33 22.00	$\chi^2 = 20.973$, df = 4, þ< 0.001[***]
5	Drinking tea/coffee ■ Once daily ■ Twice daily ■ More than two times daily	30 58 12	15 60 25	11 61 28	56 179 65	18.67 59.67 21.67	$\chi^2 = 17.502$, df = 4, þ< 0.001[***]
6	Use of cold drink Kind ■ Mathha/Lemon water ■ Soft drink Frequency ■ Nil ■ Once a day ■ Twice a day	25 - 75 17 8	11 27 62 28 10	- 34 66 27 7	36 61 203 72 25	12.00 20.33 67.67 24.00 8.33	$\chi^2 = 4.954$, df = 4, þ> 0.05 NS

Comment

- Majority of the females were vegetarian (95.33%).
- Overwhelming majority of the females (92.00%) required meal after feeling hungry, while two-third females (66.67%) did not feel hungry during tension.
- Feeling hungry during tension and drinking tea or coffee were found significantly associated with income group (þ < 0.001[***]).

Table 3.6: Knowledge and practice of diet and nutrient by the females according to income group

S No.	Knowledge and practice	Income group			Total (300)	
		Low (100) No. & %	Middle (100) No. & %	High (100) No. & %	No	%
1	**Knowledge of nutrients**	11	36	45	92	30.67
	Statistical significance: χ^2 = 29.189, df = 2, þ < 0.001***					
	▪ Protein	5	33	45	83	27.67
	Statistical significance: χ^2 = 42.104, df = 2, þ < 0.001***					
	▪ Carbohydrate	3	21	30	54	18.00
	Statistical significance: χ^2 = 25.610, df = 2, þ < 0.001***					
	▪ Fat	4	32	45	81	27.00
	Statistical significance: χ^2 = 44.546, df = 2, þ < 0.001***					
	▪ Vitamins	3	25	38	66	22.00
	Statistical significance: χ^2 = 36.480, df = 2, þ < 0.001***					
	▪ Minerals	2	14	17	33	11.00
	Statistical significance: χ^2 = 12.870, df = 2, þ < 0.001**					
2	**Use of salad**	56	65	83	204	68.00
	Statistical significance: χ^2 = 17.371, df = 2, þ < 0.001***					
3	**Liking and use of fruit**					
	▪ Daily	-	24	46	70	23.33
	▪ Twice a week	-	2	35	37	12.33
	▪ Once a week or sometimes	55	53	19	127	42.33
	▪ Never	45	21	-	66	22.00
	Statistical significance: χ^2 = 173.474, df = 8, þ < 0.001***					
4	**Habit of taking breakfast**					
	▪ Daily	1	20	62	83	27.67
	▪ Sometime	13	74	38	125	41.67
	▪ Never taking	86	6	-	92	30.67
	Statistical significance: χ^2 = 265.889, df = 4, þ < 0.001***					

Note: All the females except 5% of HIG, practiced taking meal two times a day, while 5% HIG females used to take meal three times in a day.

Table 3.7: Type of restriction practiced by the females according to income group

S. No.	Restriction	Income group			Total (300)	
		Low (100) No. & %	Middle (100) No. & %	High (100) No. & %	No.	%
1	**Type of restrictions**					
	▪ Fatty diet	23	29	42	94	31.33
	▪ Fried items	-	-	7	7	2.33
	▪ Sweets	4	7	-	11	3.67
	▪ Rice & cold items	-	6	2	8	2.67
	▪ None	73	58	49	180	60.00
	Statistical significance: $\chi^2 = 12.250$, df = 2, þ < 0.01[**]					
2	**Use of medicine**					
	▪ Modern medicine	-	-	5	5	1.67
	▪ Indigenous	-	1	-	1	0.33
	▪ Homeopathic	-	3	-	3	1.00
	▪ Ayurvedic	-	2	6	8	2.67
	Total	-	6	11	17	5.67

Comments

- Overall three-fifth females (60.00%) did not practice any kind of restrictions, while 31.33% females avoided fatty diet, followed by sweets (3.67%).

- Only 5.67% females used any kind of medicine for the treatment of overweight and obesity.

- There was significant association between restriction and income group of the females ($\chi^2 = 12.250$, þ < 0.01[**]).

Table 3.8: Problem of thyroid according to income group of the females

S. No.	Problem of Thyroid	Income group			Total (300)	
		Low (100) No. & %	Middle (100) No. & %	High (100) No. & %	No.	%
1	Yes	8	16	17	41	13.67
2	No	92	84	83	259	86.33
	Total	**100**	**100**	**100**	**300**	**100**

Statistical significance: $\chi^2 = 4.124$, df = 2, þ > 0.05 NS

Comments

- In majority of the subjects (86.33%), there was no problem of thyroid. There were only 13.67% females who faced problem of thyroid.

- There was no significant association between problem of thyroid and income group of the females ($\chi^2 = 4.124$, þ > 0.05 NS).

Table 3.9: Habit of addiction by the females and their family members according to income group

S. No.	Addiction	Income group			Total (300)	
		Low (100) No. & %	Middle (100) No. & %	High (100) No. & %	No.	%
1. Type of addiction used by the females						
▪ Betel leaf		-	2	2	4	1.33
▪ Tobacco		13	10	-	23	7.67
▪ Rajnigandha		-	3	9	12	4.00
▪ Nil		87	85	89	261	87.00
Statistical significance: $\chi^2 = 0.707$, df = 2, þ > 0.05 NS.						
2. Addiction by other family members						
▪ Yes		41	45	49	135	45.00
▪ No		59	55	51	165	55.00
Statistical significance: $\chi^2 = 1.293$, df = 2, þ > 0.05 NS.						

Comments

- ▪ Majority of the females (87.00%) were not addicted with any kind of addiction, there were only 13.00% females who were addicted with some kind of addiction.

- ▪ On the other hand, more than two-fifth females (45.00%) family members were addicted with some kind of addiction.

- ▪ Practicing of addiction by the females or their family members was found insignificantly associated by their income group ($p > 0.05$ NS).

4. Anthropometric measurements

Table 4.1: Distribution of females according to body mass index (BMI) and income group before nutrition education

S. No.	BMI measurement	Income group			Total (300)	
		Low (100) No. & %	Middle (100) No. & %	High (100) No. & %	No.	%
1	25.0-29.9 (Overweight)	3	2	2	7	2.33
2	30.0-34.9 (Obese-I)	43	39	49	131	43.67
3	35.0-39.9 (Obese-II)	50	54	39	143	47.67
4	≥ 40.0 (Obese-III)	4	5	10	19	6.33
	Total	100	100	100	300	100
	Mean ± SD	35.20 ± 3.13	35.55 ± 3.08	35.30 ± 3.50	35.35 ± 3.23	

Statistical significance:

1. Low *Vs.* Middle $t = 0.797$, $df = 198$, $p > 0.05$ NS.

2. Low *Vs.* High $t = 0.213$, $df = 198$, $p > 0.05$ NS.

3. Middle *Vs.* High $t = 0.536$, $df = 198$, $p > 0.05$ NS.

Comment

- Nearly half of the obese (47.67%) belonged to obese-II category; followed by obese-grade I (43.67%).

- The mean values of BMI were found statistically similar in all the income groups (þ > 0.05 NS).
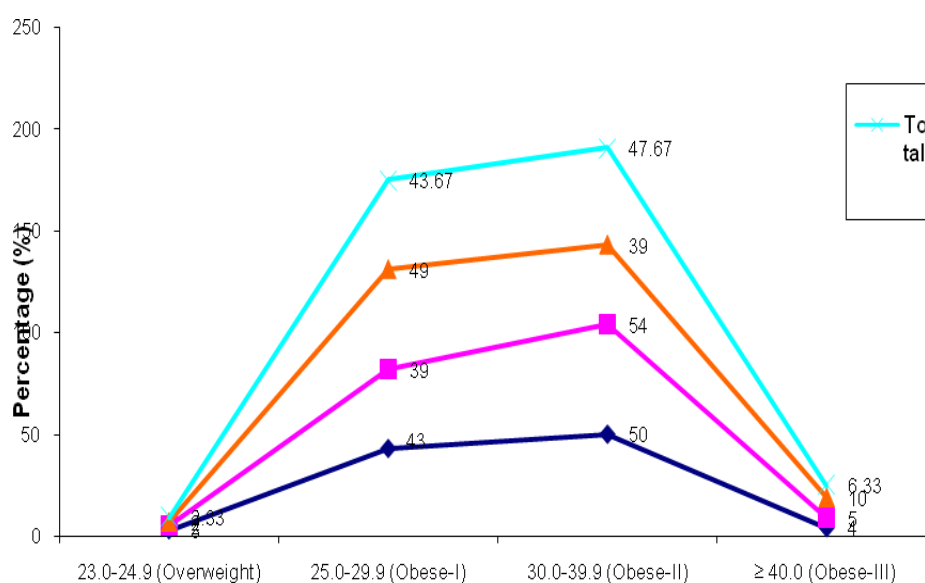
Fig. 4.1: Distribution of females according to body mass index (BMI) and income group before nutrition education

Table 4.2: Biceps measurement of the females according to income group

S. No.	Biceps measurement (mm)	Income group			Total (300)	
		Low (100) No. & %	Middle (100) No. & %	High (100) No. & %	No.	%
1	≤ 5	6	6	7	19	6.33
2	5-10	18	17	17	52	17.33
3	10-15	40	41	39	120	40.00
4	15-20	22	23	22	67	22.33

5	20-25	11	11	10	32	10.67
6	25-30	3	1	5	9	3.00
7	30-35	-	1	-	1	0.33
Total		100	100	100	300	100
Mean ± SD		13.65 ± 5.72	13.65 ± 5.66	13.80 ± 6.06	13.70 ± 5.80	

Statistical significance:

1. Low *Vs.* Middle   t = 0.
2. Low *Vs.* High   t = 0.180, df = 198, þ > 0.05 NS.
3. Middle *Vs.* High   t = 0.181, df = 198, þ > 0.05 NS.

Comment

- Two-fifth overall females (40.00%) possessed biceps measurement from 10 to 15 mm; followed by 15 to 20 mm (22.33%).

- The overall mean ± SD of biceps measurement was computed 13.70 ± 5.80 mm and mean biceps measurements of the females were found statistically similar for all the income groups (þ > 0.05 NS).
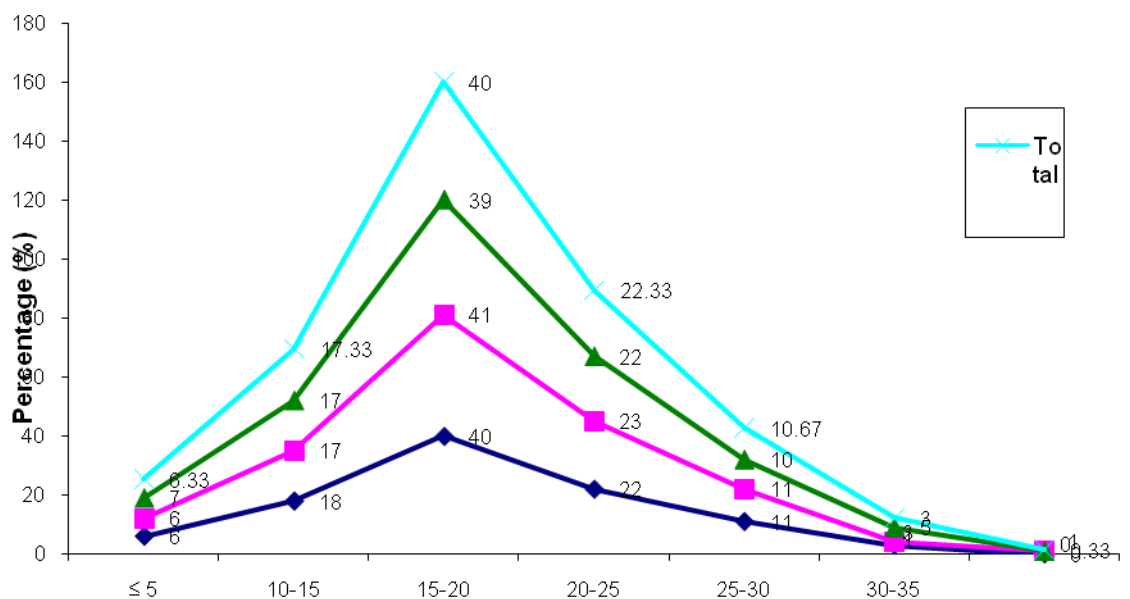

Fig. 4.2: Biceps measurement (mm) of the females according to income group

Table 4.3: Triceps measurement of the females according to income group

S. No.	Triceps measurement (mm)	Income group			Total (300)	
		Low (100) No. & %	Middle (100) No. & %	High (100) No. & %	No.	%
1	≤ 5	5	1	-	6	2.00
2	5-10	7	7	5	19	6.33
3	10-15	23	20	18	61	20.33
4	15-20	22	32	39	93	31.00
5	20-25	22	23	22	67	22.33
6	25-30	15	10	9	34	11.33
7	30-35	6	7	7	20	6.67
	Total	100	100	100	300	100
	Mean ± SD	18.40 ± 7.60	18.85 ± 6.66	19.15 ± 6.12	18.80 ± 6.80	

Statistical significance:

1. Low *Vs.* Middle $t = 0.445$, $df = 198$, $p > 0.05$ NS.
2. Low *Vs.* High $t = 0.769$, $df = 198$, $p > 0.05$ NS.
3. Middle *Vs.* High $t = 0.332$, $df = 198$, $p > 0.05$ NS.

Comment

- Nearly one-third overall females (31.00%) had triceps measurement from 15 to 20; followed by 20 to 25 mm (22.33%) and 10 to 15 mm (20.33%).

- The overall mean ± SD of triceps was assessed 18.80 ± 6.80 mm and mean triceps measurements were found statistically similar for all the income groups ($p > 0.05$ NS).

Fig. 4.3: Triceps measurement (mm) of the females according to income group

Table 4.4: Suprailliac measurement of the females according to income group

S. No.	Suprailliac measurement (mm)	Income group			Total (300)	
		Low (100) No. & %	Middle (100) No. & %	High (100) No. & %	No.	%
1	≤ 15	11	12	9	32	10.67
2	15-20	25	21	16	62	20.67
3	20-25	33	24	43	100	33.33
4	25-30	28	23	18	69	23.00
5	30-35	3	18	10	31	10.33
6	35-40	-	2	4	3	2.00
	Total	100	100	100	300	100
	Mean ± SD	21.85 ± 5.21	23.50 ± 6.70	23.30 ± 6.03	22.88 ± 6.03	

Statistical significance:

1. Low *Vs.* Middle   t = 1.944, df = 198, þ > 0.05 NS.

2. Low *Vs.* High   t = 1.821, df = 198, þ > 0.05 NS.

3. Middle *Vs.* High   t = 0.222, df = 198, þ > 0.05 NS.

Comment

- Suprailliac measurement was found 20 to 25 mm in one-third overall females; followed by 25 to 30 mm (23.00%).

- The overall mean ± SD suprailliac measurement was assessed 22.88 ± 6.03 mm.

- There were no significant differences in mean values of suprailliac measurement of females related to there income groups (þ > 0.05 NS).
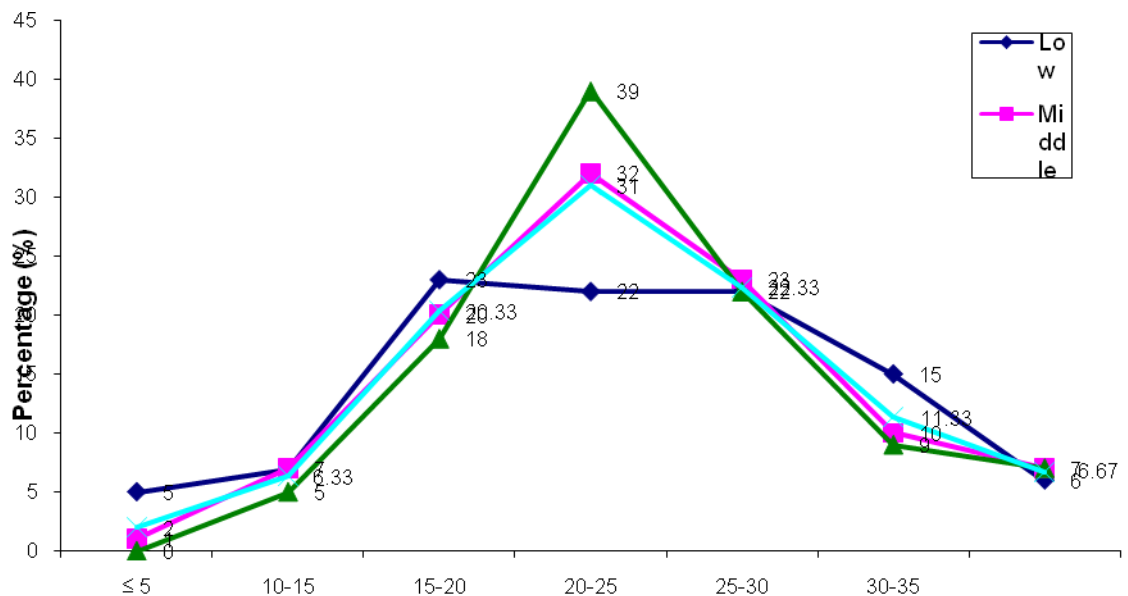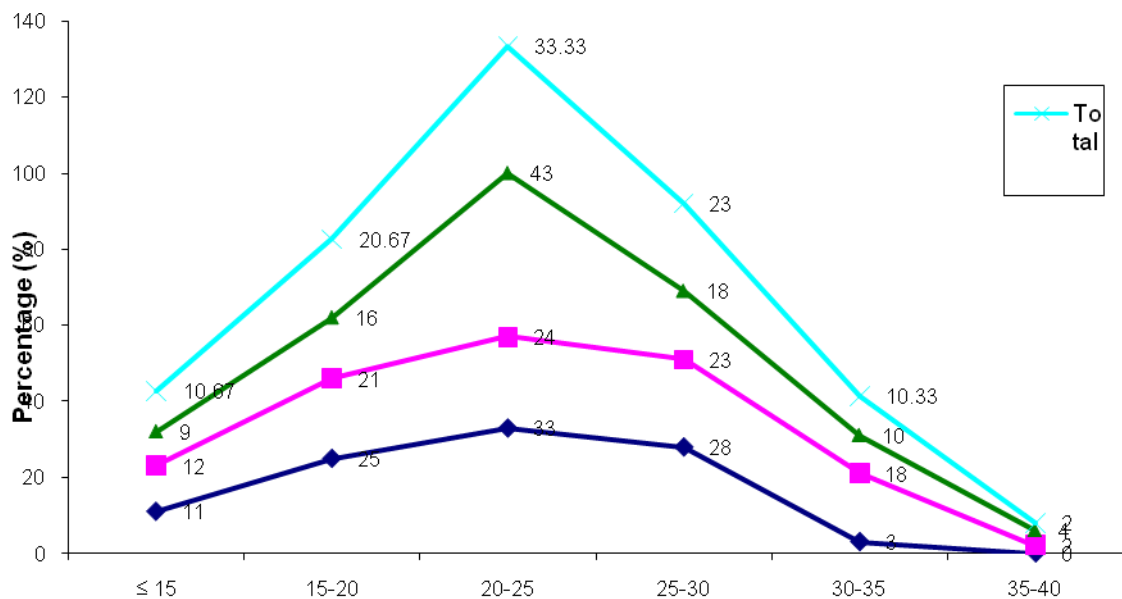

Fig. 4.4: Suprailliac measurement (mm) of the females according to income group

Table 4.5: Subscapular measurement of the females according to income group

S. No.	Supscapular measurement (mm)	Income group			Total (300)	
		Low (100) No. & %	Middle (100) No. & %	High (100) No. & %	No.	%
1	≤ 15	3	2	2	7	2.33
2	15-20	12	5	7	24	8.00
3	20-25	17	21	24	2	20.67
4	25-30	36	33	35	104	34.67
5	30-35	26	25	22	73	24.33
6	35-40	6	13	8	27	9.00
7	40-45	-	1	2	3	1.00
	Total	100	100	100	300	100
	Mean ± SD	26.90 ± 5.96	28.35 ± 5.99	27.45 ± 5.99	27.58 ± 5.99	

Statistical significance:

1. Low *Vs.* Middle $t = 1.716$, df = 198, $p > 0.05$ NS.

2. Low *Vs.* High $t = 0.651$, df = 198, $p > 0.05$ NS.

3. Middle *Vs.* High $t = 1.062$, df = 198, $p > 0.05$ NS.

Comment

- Subscapular measurement of the more than one-third females (34.67%) was assessed 25 to 30 mm; while 24.33% females possessed 30 to 35 mm measurement of subscapular position.

- Overall mean ± SD measurement of subscapular was computed 27.58 ± 5.99 mm and there were no significant differences in females of low, middle and high income groups (groups ($p > 0.05$ NS).
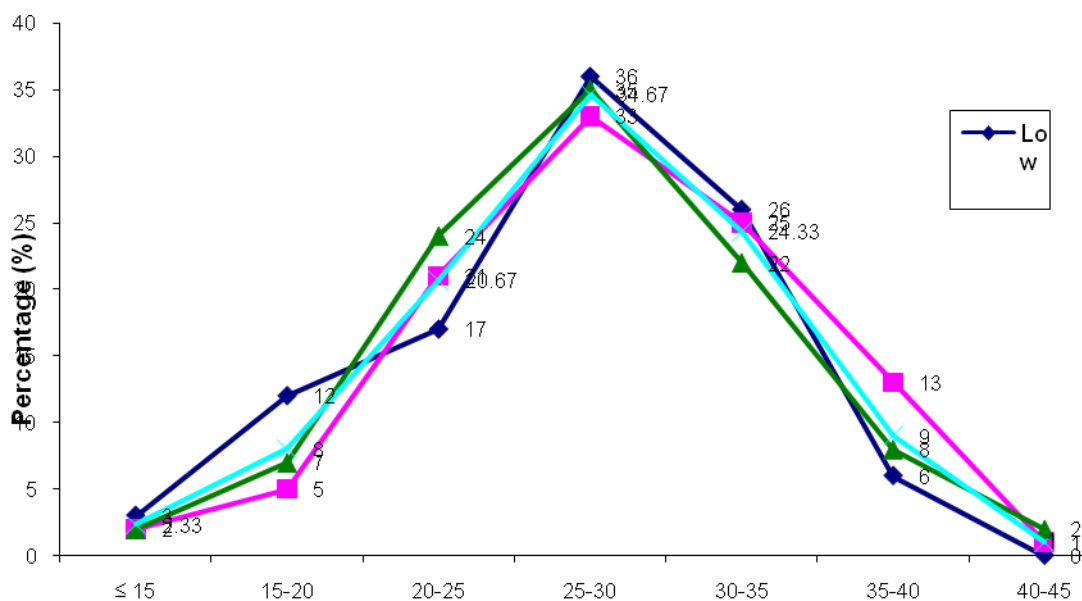
Fig. 4.5: Supscapular measurement (mm) of the females according to income group

Table 4.6: Skin fold thickness of the females according to income group

S. No.	SFT measurement (mm)	Income group			Total (300)	
		Low (100) No. & %	Middle (100) No. & %	High (100) No. & %	No.	%
1	40-59.9 above Normal	12	9	6	27	9.00
2	60-79.9 Overweight	18	34	23	75	25.00
3	≥ 80.0 Obese	70	57	71	198	66.00
	Total	100	100	100	300	100
	Mean ± SD	81.55 ± 13.98	79.55 ± 13.17	82.95 ± 11.85	81.35 ± 13.06	

Statistical significance:

1. Low *Vs.* Middle $\quad$ $t = 1.041$, $df = 198$, $p > 0.05$ NS.

2. Low *Vs.* High $\quad$ $t = 0.764$, $df = 198$, $p > 0.05$ NS.

3. Middle *Vs.* High $\quad$ $t = 1.919$, $df = 198$, $p > 0.05$ NS.

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Comment

- According to SFT criteria (Durnin and Womersley, 1974) overall 9% females were categorized as in 'above normal' group, while 25.0% females were overweight.

- There were only 66.0% females as obese.

- The mean ± SD measurement of overall females was computed 81.35 ± 13.06 mm. Further there were no significant differences between mean SFT measurements of the females in two income groups.
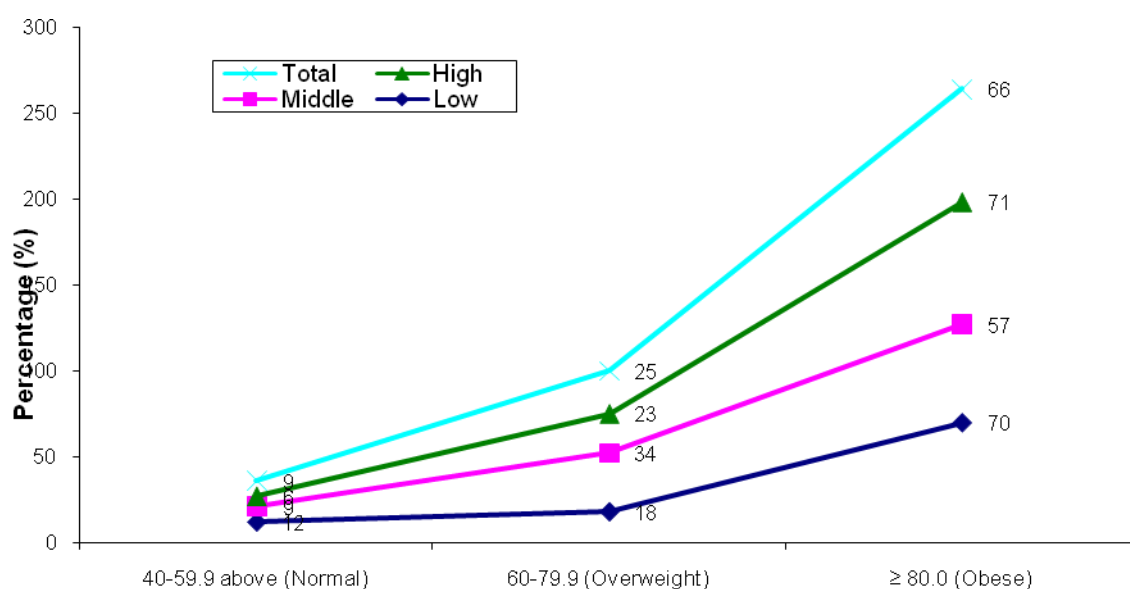
Fig. 4.6: Skin fold thickness of the females according to income group

5. Consumption of nutrient by the overweight and obese females before implementation of nutrition education

Table 5.1: Consumption of protein by the females according to income group

S. No.	Amount of protein (g) (RDA = 50 g)	Income group			Total (300)	
		Low (100) No. & %	Middle (100) No. & %	High (100) No. & %	No.	%
1	40-60	8	3	1	12	4.00
2	60-80	69	28	3	100	33.33
3	80-100	23	54	45	122	40.67

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4	100-120	-	14	47	61	20.33
5	120-140	-	1	4	5	1.67
Total		100	100	100	300	100
Mean ± SD		73.00 ± 10.78	86.40 ± 14.87	98.40 ± 16.13	83.67 ± 24.54	
% RDA		146.00%	172.80%	196.80%	167.34%	

Statistical significance:

1. Low *Vs.* Middle   t = 7.296, df = 198, þ < 0.001[***].
2. Low *Vs.* High   t = 13.092, df = 198, þ < 0.001[***].
3. Middle *Vs.* High   t = 5.470, df = 198, þ < 0.001[***].

Comment

- More than two-fifth overall females (40.67%) consumed 80 to 100gm protein daily; followed by 60 to 80 g (33.33%).

- The consumption of protein was found significantly increasing (þ < 0.001[***]) with increase in income. The mean ± SD consumptions of protein were assessed 73.00 ± 10.78 gm for low; 86.40 ± 14.87 gm for middle and 98.40 ± 16.13 gm for high income groups.

- In all the income categories, overweight and obese females were consuming protein more than the RDA (ICMR, 2004).

Fig. 5.1: Consumption of Protein by the females according to income group

Table 5.2: Consumption of Fat by the females according to income group

S. No.	Amount of Fat (gm) (RDA= 20 gm)	Income group			Total (300)	
		Low (100) No. & %	Middle (100) No. & %	High (100) No. & %	No.	%
1	20-40	5	-	-	5	1.67
2	40-60	38	11	1	50	16.67
3	60-80	57	35	9	101	33.67
4	80-100	-	47	45	92	30.67
5	100-120	-	7	37	44	14.67
6	120-140	-	-	8	8	2.67
	Total	100	100	100	300	100
	Mean ± SD	60.40 ± 11.88	80.00 ± 15.70	98.40 ± 16.13	79.60 ± 21.35	
	% RDA	302.00%	400.00%	490.00%	398.00%	

Statistical significance:

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1. Low *Vs.* Middle   t = 9.955, df = 198, þ < 0.001[***].

2. Low *Vs.* High   t = 18.969, df = 198, þ < 0.001[***].

3. Middle *Vs.* High   t = 8.174, df = 198, þ < 0.001[***].

Comment

- Nearly one-third overall females (33.67%) used 60 to 80 gm fat daily; followed by 80 to 100 gm (30.67%).

- The overall consumption of fat was assessed 79.60 ± 21.35 gm. Lowest and highest fat consumptions were accounted for the females related to low and high income groups, respectively.

- There were significant differences between mean consumptions of fat by the two income groups females (þ < 0.001[***]).

- Daily fat consumption by the overweight and obese females were more than 3 times; 4 times and 5 times respectively of the RDA in low; middle and high income categories.
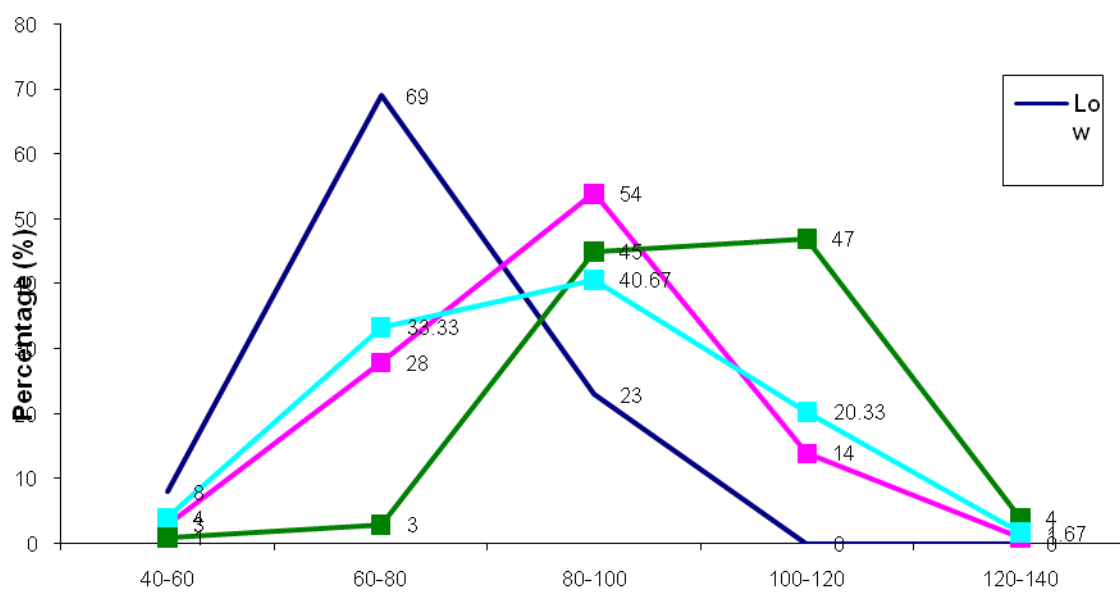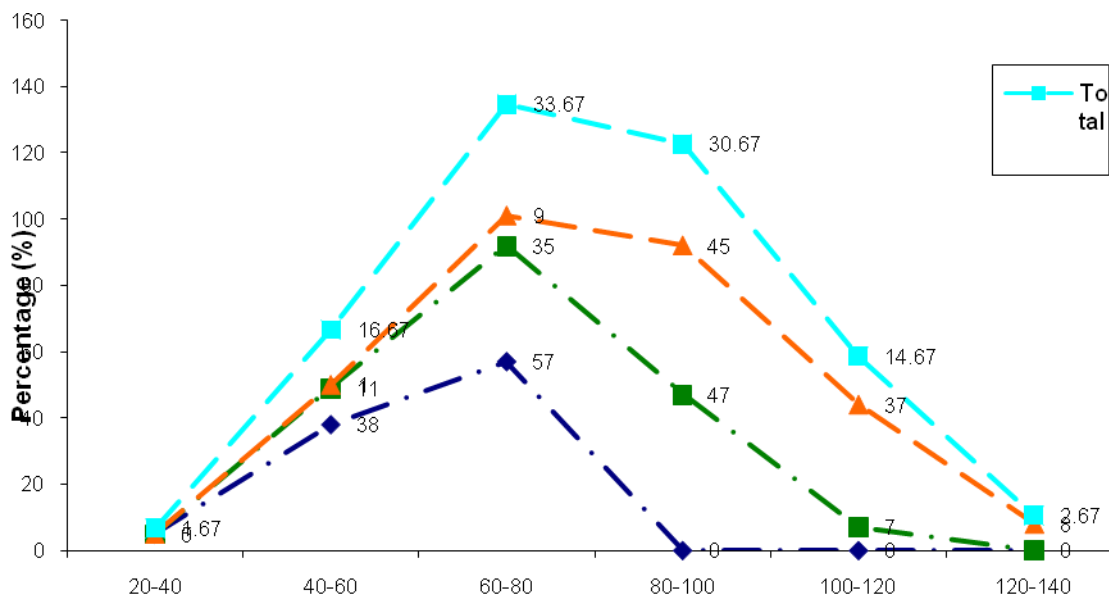

Fig. 5.2: Consumption of Fat by the females according to income group

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Table 5.3: Consumption of Carbohydrate by the females according to income group

S. No.	Amount of Carbohydrate (gm)	Income group			Total (300)	
		Low (100) No. & %	Middle (100) No. & %	High (100) No. & %	No.	%
1	≤ 300	1	3	7	11	3.67
2	300-400	26	31	30	87	29.00
3	400-500	49	45	37	131	43.67
4	500-600	15	18	26	59	19.67
5	≥ 600	9	3	-	12	4.00
	Total	100	100	100	300	100
	Mean ± SD	455.00 ± 90.31	437.00 ± 84.88	432.00 ± 90.32	441.33 ± 88.79	
	Calorie equivalent	1820 Kcal	1748 Kcal	1728 Kcal	1765.32 Kcal	

Statistical significance:

1. Low *Vs.* Middle   t = 1.452, df = 198, $p > 0.05$ NS.
2. Low *Vs.* High t = 1.801, df = 198, $p > 0.05$ NS.
3. Middle *Vs.* High   t = 0.403, df = 198, $p > 0.05$ NS.

Comment

- More than two-fifth overall females (43.67%) consumed 400 to 500 gm carbohydrate in a day; followed by 300 to 400 gm (29.00%).

- Mean ± SD consumption of carbohydrate by the overall females was accounted 441.33 ± 88.79 gm per day.

- Mean consumption of carbohydrate by the females of three income groups were found statistically similar ($p > 0.05$ NS).

- The energy fulfillment with carbohydrate diet was 77.45%; 74.38% and 73.53% in the females related to low; middle and high income categories.
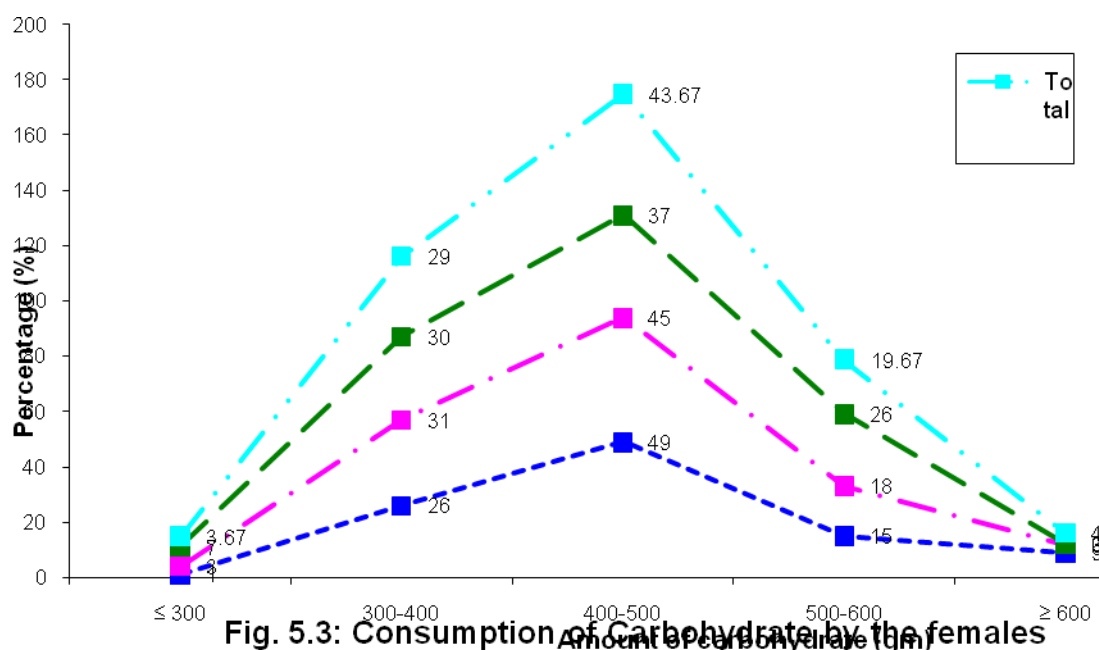
Fig. 5.3: Consumption of Carbohydrate by the females according to income group

Table 5.4: Consumption of Calorie by the females according to income group

S. No.	Amount of Calorie (Kcal) (RDA = 2225 Kcal for moderate workers)	Income group			Total (300)	
		Low (100) No. & %	Middle (100) No. & %	High (100) No. & %	No.	%
1	≤ 1750	4	1	-	5	1.67
2	1750-2000	5	3	-	8	2.67
3	2000-2250	12	9	7	28	9.33
4	2250-2500	22	18	17	57	19.00
5	2500-2750	15	19	25	59	19.67
6	2750-3000	15	19	17	51	17.00
7	3000-3250	13	11	13	37	12.33
8	3250-3500	11	11	12	34	11.33
9	3500-3750	1	5	5	11	3.67
10	3750-4000	2	4	4	10	3.33
Mean ± SD		2652.50 ± 508.63	2787.50 ± 550.52	2845.00 ± 452.66	2761.67 ± 492.92	
% RDA		119.21%	125.28%	127.87%	124.12%	

Statistical significance:

1. Low *Vs.* Middle   t = 1.801, df = 198, þ > 0.05 NS.
2. Low *Vs.* Hight = 2.827, df = 198, þ < 0.01[**].
3. Middle *Vs.* High   t = 0.869, df = 198, þ > 0.05 NS.

Comment

- Nearly one-fifth overall females (19.67%) used to consume 2500 to 2750 Kcal in a day; followed by 2250 to 2500 Kcal (19.00%).

- Overall mean ± SD consumption of energy by the females were computed 2761.67 ± 492.92 Kcal.

- There was significant differences between mean consumptions of energy by the females in high and low income groups (t = 2.827; þ < 0.01[**]).

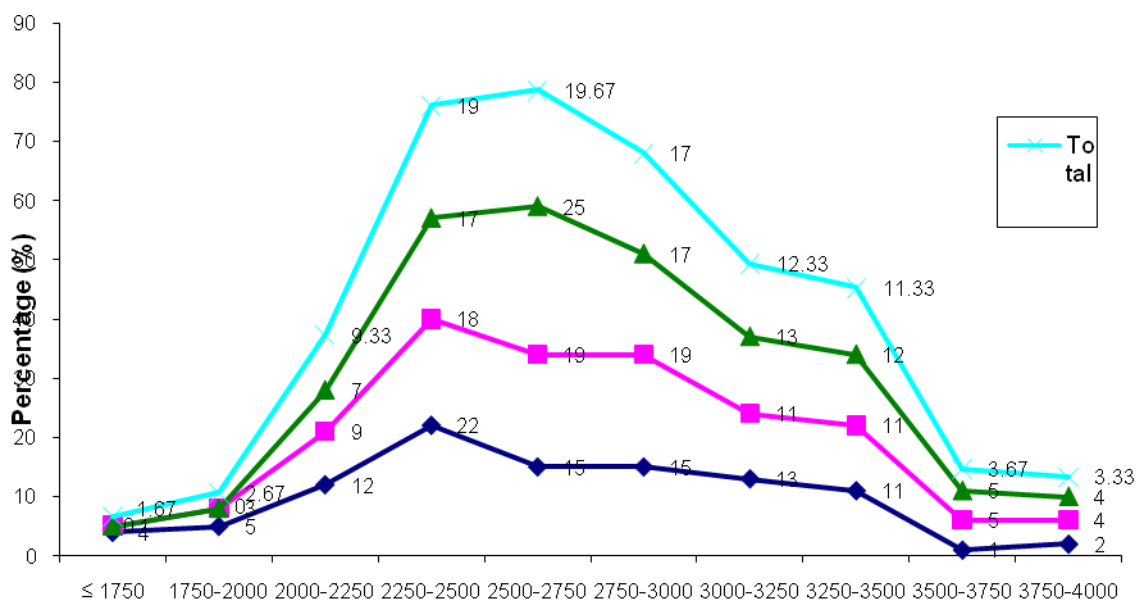- The calorie intake of the females was 19.21% to 27.87% higher than the RDA (ICMR, 2004).

Fig. 5.4: Consumption of Calorie by the females according to income group

Table 5.5: Consumption of Calcium by the females according to income group

S. No.	Amount of Calcium (mg) (RDA = 400 mg)	Income group			Total (300)	
		Low (100) No. & %	**Middle (100) No. & %**	**High (100) No. & %**	**No.**	**%**
1	≤ 400	7	6	-	13	4.33
2	400-600	25	25	5	55	18.33
3	600-800	33	15	23	71	23.67
4	800-1000	12	15	23	50	16.67
5	1000-1200	13	14	15	42	14.00
6	1200-1400	10	14	11	25	8.33
7	1400-1600	-	5	12	17	5.67
8	1600-1800	-	3	5	8	2.67
9	1800-2000	-	3	6	9	3.00
	Mean ± SD	758.00 ± 283.26	902.00 ± 405.51	1080.00 ± 380.85	913.33 ± 336.15	
	% RDA	189.50%	225.50%	270.00%	228.33%	

Statistical significance:

1. Low *Vs.* Middle $\quad$ t = 2.911, df = 198, $p < 0.01^{**}$.
2. Low *Vs.* High $\quad$ t = 6.784, df = 198, $p < 0.001^{***}$.
3. Middle *Vs.* High $\quad$ t = 3.200, df = 198, $p < 0.01^{**}$.

Comment

- More than one-fifth overall females (23.67%) used to consume 600 to 800 mg calcium in a day; followed by 400 to 600 mg (18.33%).

- The mean ± SD consumption of calcium by the females was assessed 913.33 ± 336.15 mg.

- The mean consumptions of calcium by the females in different income groups were found statistically different ($p < 0.001^{***}$).

- The overall females were consuming calcium more than two-times of the RDA (ICMR, 2004).
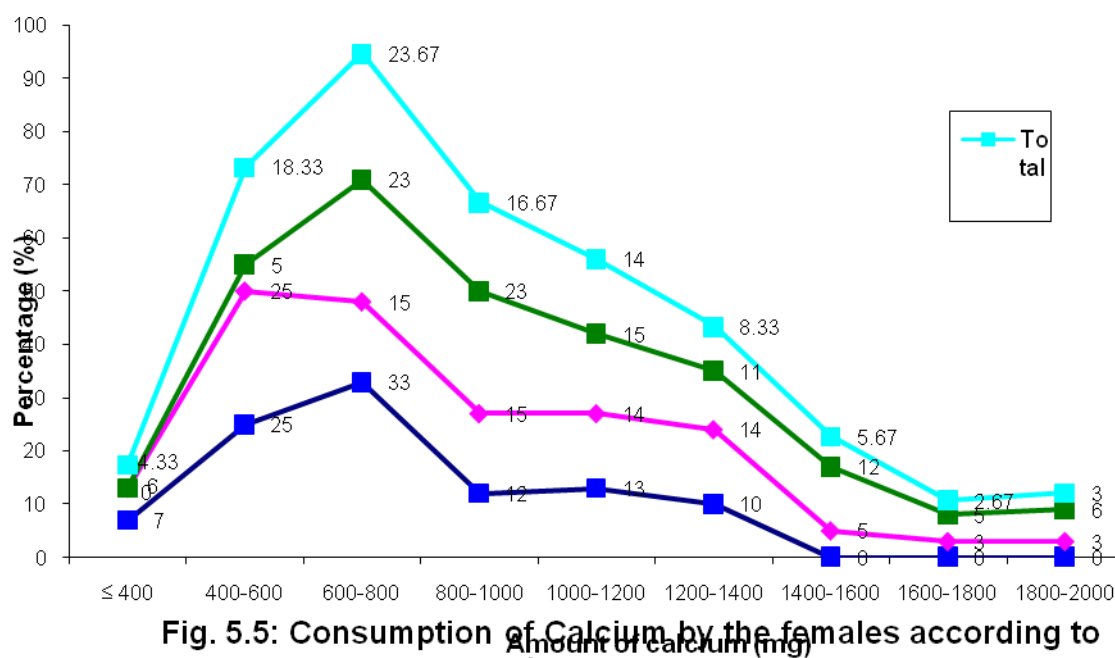
Fig. 5.5: Consumption of Calcium by the females according to income group

Table 5.6: Consumption of Iron by the females according to income group

S. No.	Amount of Iron (mg) RDA = 30mg	Income group			Total (300)	
		Low (100) No. & %	Middle (100) No. & %	High (100) No. & %	No.	%
1	10-20	5	4	-	9	3.00
2	20-30	43	25	22	90	30.00
3	30-40	34	23	32	89	29.67
4	40-50	9	23	17	49	16.33
5	50-60	9	21	22	52	17.33
6	60-70	-	4	7	11	3.67
Mean ± SD		32.40 ± 10.11	39.40 ± 12.90	41.00 ± 12.47	37.60 ± 12.43	
% RDA		108.007%	131.33%	136.67%	125.33%	

Statistical significance:

1. Low *Vs.* Middle $t = 4.271$, df = 198, $p < 0.001$[***].
2. Low *Vs.* High $t = 5.606$, df = 198, $p < 0.001$[***].
3. Middle *Vs.* High $t = 0.892$, df = 198, $p < 0.05$ NS.

Comment

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- Nearly one-third overall females (30.00%) consumed 20 to 30 mg iron in a day; followed by 30 to 40 mg (29.67%).

- Mean ± SD consumption of iron by the overall females was accounted 37.60 ± 12.43 mg per day.

- Mean consumption of iron by the females related to middle and high income groups were found statistically similar (t = 0.892,   þ > 0.05 NS), while the differences between other two groups were found statistically different (þ < 0.001^{***}).

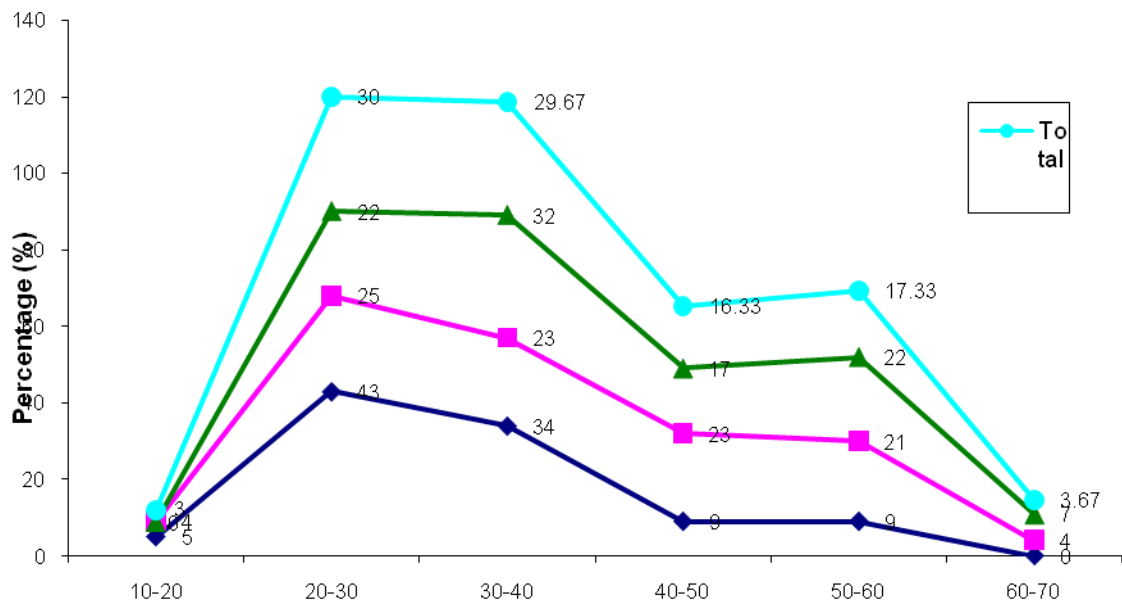- The mean iron consumption by the females was 8.00% to 36.67% higher than the RDA (ICMR, 2004).

Fig. 5.6: Consumption of iron by the females according to income group

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6. Effect of nutrition education package

Table 6.1: Type and Frequency of Physical exercise practiced by the females during pre and post period of implementation of nutrition education package

S. No.	Type & frequency of physical exercise ‡	Period of nutrition package				Total (450)	
		Pre (300)		Post (150)		No	%
		No	%	No	%		
Type							
1	Walking	69	23.00	40	26.67	109	24.22
2	Yoga	72	24.00	58	38.67	130	28.89
3	Cycling & Gym.	3	1.00	4	2.67	7	1.56
4	Sports	5	1.67	2	1.33	7	1.56
5	Dancing	1	0.33	-	-	1	0.22
6	None	177	59.00	68	45.33	245	54.44
Frequency							
8	Daily	93	31.00	57	38.00	150	33.33
9	Five days in a week	2	0.67	8	5.33	10	2.22
10	Two days in a week	28	9.33	17	11.33	45	10.00
11	Never	177	59.00	68	45.33	245	54.44

‡ Multiple responses were obtained

Number of subjects is given within brackets.

Statistical significance:

1. Type ………$\chi^2 = 7.531$, df = 1, $p < 0.01^{**}$
2. Frequency….$\chi^2 = 15.101$, df = 3, $p < 0.01^{**}$

Comment

- Physical exercises and their frequencies were found significantly increased after implementation of nutrition education package ($p < 0.01^{**}$).

Fig. 6.1a: Type of Physical exercise practiced by the females during pre and post period of implementation of nutrition education package

Fig. 6.1b: Frequency of Physical exercise practiced by the females during pre and post period of implementation of nutrition education package
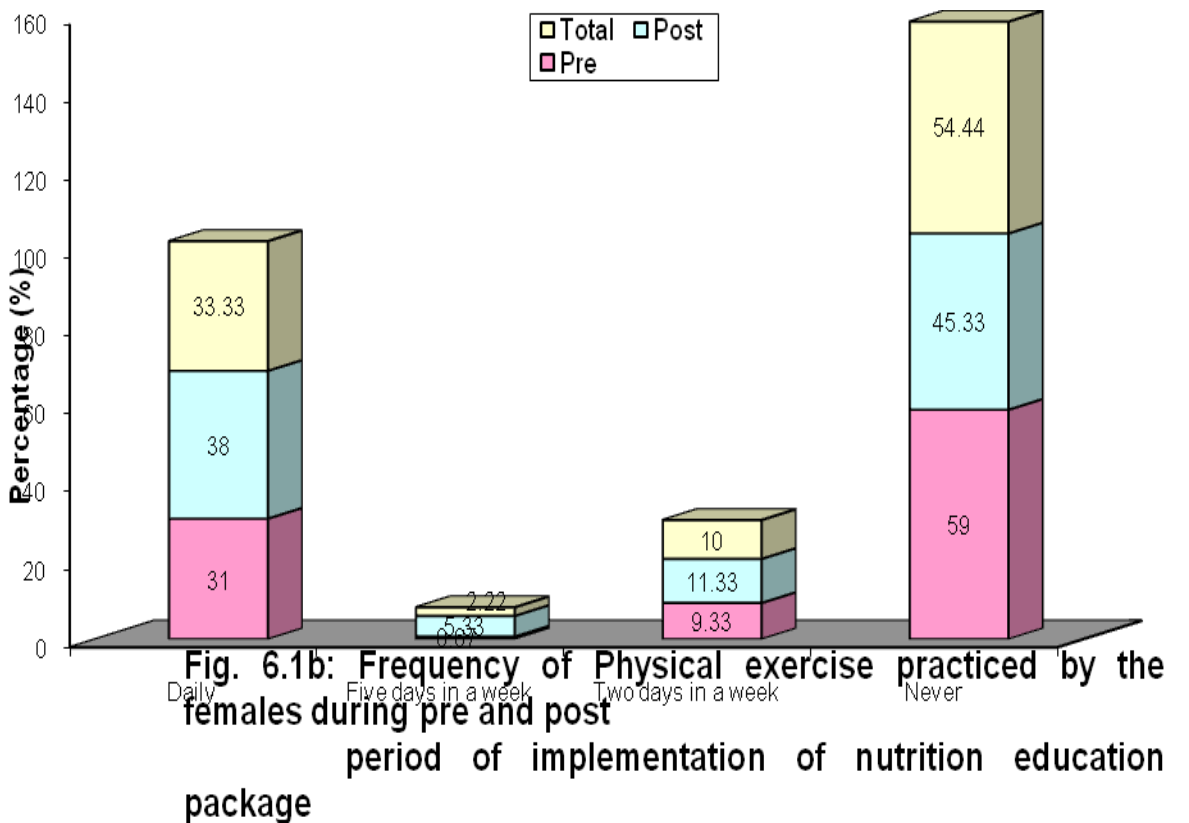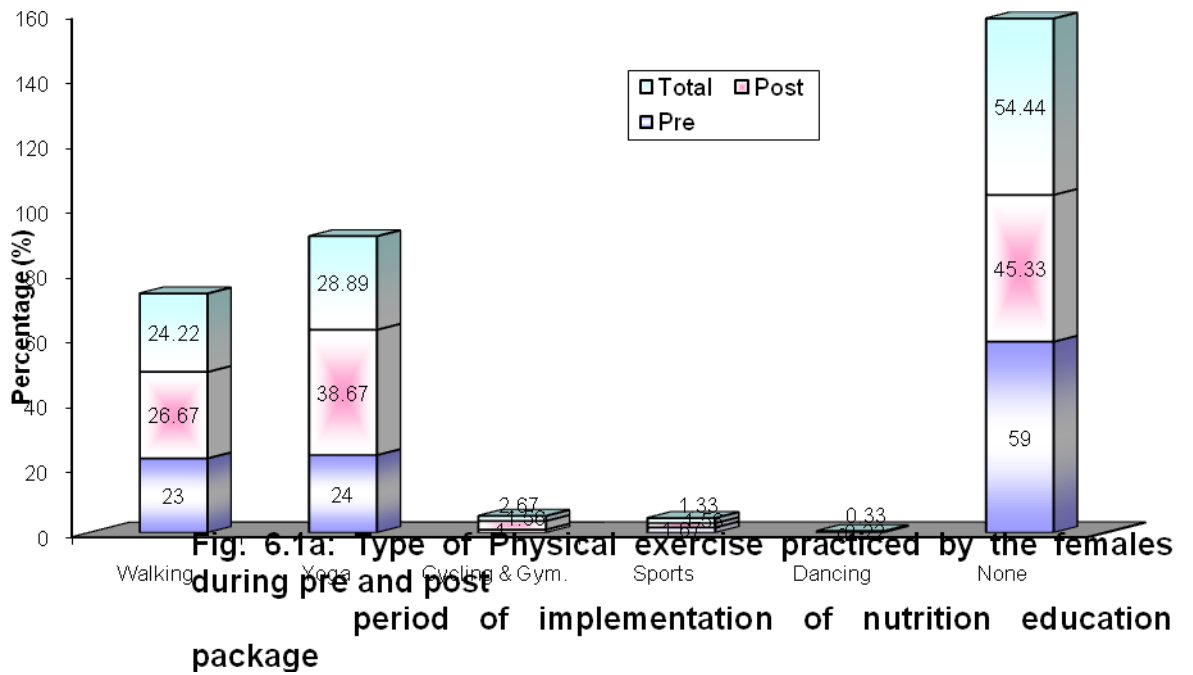
Table 6.2: Habit of TV viewing by the females during pre and post implementation period of nutrition education package

S. No.	Habit & hour of TV viewing	Period of nutrition package					
		Pre (300)		Post (150)		Total (450)	
		No	%	No	%	No	%
1	Nil	32	10.67	22	14.67	54	12.00
2	< 4 hours	196	65.33	97	64.67	293	65.11
3	4 hours	60	20.00	22	14.67	82	18.22
4	> 4 hours	12	4.00	9	6.00	21	4.67
	Total	300	100	150	100	450	100
	Mean ± SD	2.65 ± 1.21		2.53 ± 1.34		2.61 ± 1.25	

Statistical significance: t = 0.924, df = 448, þ > 0.05 NS.

Comment

- Majority of the overall females (65.11%) used to view TV for less than 4 hours.
- Mean ± SD values of TV viewing were assessed 2.65 ± 1.21 and 2.53 ± 1.34 hours at before and after the implementation of nutrition education package.
- Though period of TV viewing was slightly reduced after nutrition package, but it was statistically not witnessed (t = 0.924, þ > 0.05 NS) significant.
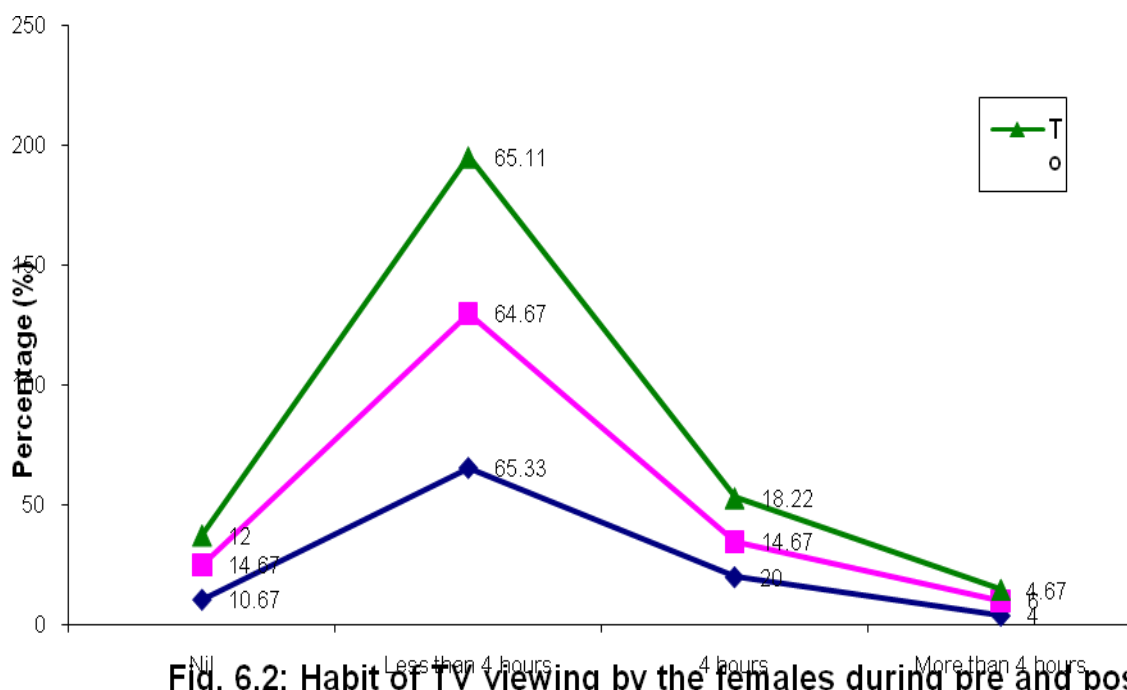
Fig. 6.2: Habit of TV viewing by the females during pre and post implementation period of nutrition education package

Table 6.3: Food habit of the females during pre and post implementation period of nutrition education package

S. No.	Food habit	Period of nutrition education package					
		Pre (300)		Post (150)		Total (450)	
		No	%	No	%	No	%
1	Vegetarian	286	95.33	140	93.33	426	94.67
2	Non-vegetarian	14	4.67	10	6.67	24	5.33
	Statistical significance: $\chi^2 = 0.792$, df = 1, p < 0.05 NS						
3	Meal requirement after feeling hungry	276	92.00	146	97.33	422	93.78
	Z =2.605, p < 0.01[**]						
4	Feeling hunger during tension	200	66.67	99	66.00	299	66.44
	• Absolutely no	34	11.33	31	20.67	65	14.44
	• Less hunger	66	22.00	20	13.33	86	19.11
	• More hunger						
	Statistical significance: $\chi^2 = 9.968$, df = 2, p < 0.001[**]						
5	Drinking tea or coffee						
	• Once daily	56	18.67	37	24.67	93	20.67
	• Twice daily	179	59.67	99	66.00	278	61.78
	• More than two times in a day	65	21.67	14	9.33	79	17.56
	Statistical significance: $\chi^2 = 11.056$, df = 2, p < 0.01[**]						

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6	Liking for sweets						
	• No	112	37.33	70	46.67	182	40.44
	• Sometimes	104	34.67	59	39.33	163	36.22
	• Once a week	58	19.33	19	12.67	77	17.11
	• Twice a week	26	8.67	2	1.33	28	6.22
Statistical significance: $\chi^2 = 13.996$, df = 3, $p < 0.01$[**]							
7	Use of cold drink						
	• Mattha or lemon water	36	12.00	21	14.00	57	12.67
	• Soft drink	61	20.33	13	8.67	74	16.44
	• Nothing	203	67.67	116	77.33	319	70.89
Statistical significance: $\chi^2 = 9.911$, df = 2, $p < 0.05$[**]							

S. No.	Food habit	Period of nutrition education package					
		Pre (300)		Post (150)		Total (450)	
		No	%	No	%	No	%
8	Frequency of cold drink						
	• Nil	203	67.67	116	77.33	319	70.89
	• Once a day	72	24.00	26	17.33	98	21.78
	• Twice a day	25	8.33	8	5.33	33	7.33
Statistical significance: $\chi^2 = 4.586$, df = 2, $p < 0.05$ NS							
9	Nibbling between meals	98	32.67	11	7.33	109	24.22
Statistical significance: $\chi^2 = 34.965$, df = 1, $p < 0.001$[***]							
10	Taking meal outside of the house	88	29.33	4	2.67	92	20.44
Statistical significance: $\chi^2 = 43.721$, df = 1, $p < 0.001$[***]							
11	Participation in lunch party outside of the house						
	• Professional/service related	31	10.33	Nil		31	6.89
	• Kitty party	12	4.00	Nil		12	2.67
12	Use of left out food						
	• Eat	121	40.33	12	8.00	133	29.56
	• Thrown away	104	34.67	16	10.67	120	26.67
	• Give to others	75	25.00	122	81.33	197	43.78
Statistical significance: $\chi^2 = 129.468$, df = 2, $p < 0.001$[***]							
13	Speed of taking meal						
	• Fast	130	43.33	39	26.00	169	37.56
	• Slow	170	56.67	111	74.00	281	62.44
Statistical significance: $\chi^2 = 12.811$, df = 1, $p < 0.001$[***]							
14	Companion during taking meal						
	• Alone	135	45.00	62	41.33	197	43.78
	• With family members	141	47.00	84	56.00	225	50.00
	• During viewing TV	24	8.00	4	2.67	28	6.22
Statistical significance: $\chi^2 = 6.499$, df = 2, $p < 0.05$[*]							

Table 6.4: Consumption of salad and fruits by the females during pre and post implementation period of nutrition education package

S. No.	Consumption of salad & fruits	Period of nutrition education package					
		Pre (300)		Post (150)		Total (450)	
		No	%	No	%	No	%
1	Consumed salad	204	68.00	118	78.67	322	71.56
2	Did not consume salad	96	32.00	32	21.33	128	28.44
	Statistical significance: $\chi^2 = 5.590$, df = 1, þ < 0.025[**]						
3	Use of fruit						
	• Daily	70	23.33	39	26.00	109	24.22
	• Twice a week	37	12.33	102	68.00	139	30.89
	• Once a week or some time	127	42.33	6	4.00	133	29.56
	• Never	66	22.00	3	2.00	69	15.33
	Statistical significance: $\chi^2 = 176.428$, df = 3, þ < 0.001[***]						

Comment

- Consumption of salad was found significantly increased due to implementation of nutrition education ($\chi^2 = 5.590$, þ < 0.025[**]).

- In addition use of fruit and its frequency were also increased due to education ($\chi^2 = 176.428$, þ < 0.001[***]).

Table 6.5: Knowledge of nutrients by the females during pre and post implementation period of nutrition education package

S. No.	Knowledge of nutrients	Period of nutrition education package					
		Pre (300)		Post (150)		Total (450)	
		No	%	No	%	No	%
1	Known	92	30.67	61	40.67	153	34.00
2	Unknown	208	69.33	89	59.33	297	66.00
	Statistical significance: $\chi^2 = 4.456$, df = 1, þ < 0.05[*]						
3	Type of nutrients known						
	• Protein	83	27.67	66	44.00	149	33.11
		54	18.00	44	29.33	98	21.78

	• Carbohydrate	81	27.00	58	38.67	139	30.89
	• Fat	66	22.00	55	36.67	121	26.89
	• Vitamins	33	11.00	32	21.33	65	14.44
	• Minerals						

Statistical significance:

- Protein ………….. $\chi^2 = 12.045$, df = 1, þ < 0.001[***].
- Carbohydrate………….. $\chi^2 = 7.540$, df = 1, þ < 0.01[**].
- Fat ………….. $\chi^2 = 6.376$, df = 1, þ < 0.025[**].
- Vitamins ………….. $\chi^2 = 10.942$, df = 1, þ < 0.001[***].
- Minerals ………….. $\chi^2 = 8.640$, df = 1, þ < 0.01[**].

Comment

- Nearly one-third overall females (34.00%) had knowledge of various kinds of nutrients.

- After nutrition education programme, the knowledge of the females was found significantly increased ($\chi^2 = 4.456$, þ < 0.05[*]). This included significant increase in knowledge of protein, carbohydrate, fat, vitamins and minerals.
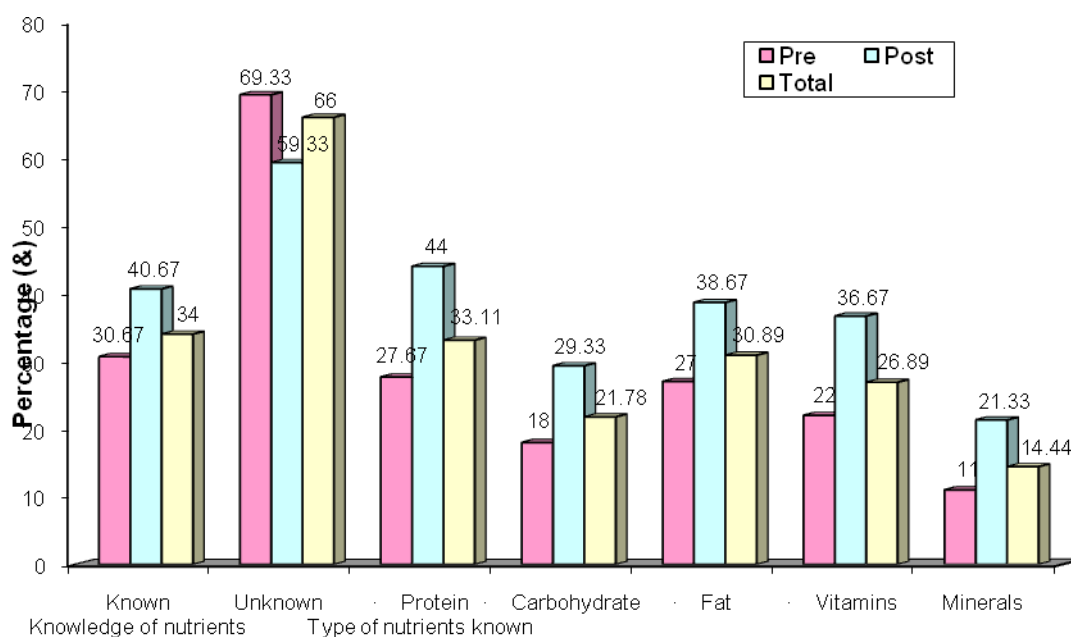

Fig. 6.5: Knowledge of nutrients by the females during pre and post implementation period of nutrition education package

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Table 6.6: Habit of taking breakfast by the females during pre and post implementation period of nutrition education package

S. No.	Habit of taking breakfast	Period of nutrition education package					
		Pre (300)		Post (150)		Total (450)	
		No	%	No	%	No	%
1	Daily	83	27.67	44	29.33	127	28.22
2	Some times	125	41.67	94	62.67	219	48.67
3	Never	92	30.67	12	8.00	104	23.11
	Total	300	100	150	100	450	100

Statistical significance: $\chi^2 = 31.392$, df = 2, $p < 0.001^{***}$

Comment

- Habit of taking no breakfast reduced to 8.00% from 30.67% of after the implementation of nutrition education package.

- There was significant changes in habit taking breakfast before and after the implementation of nutrition education package ($\chi^2 = 31.392$, $p < 0.001^{***}$).
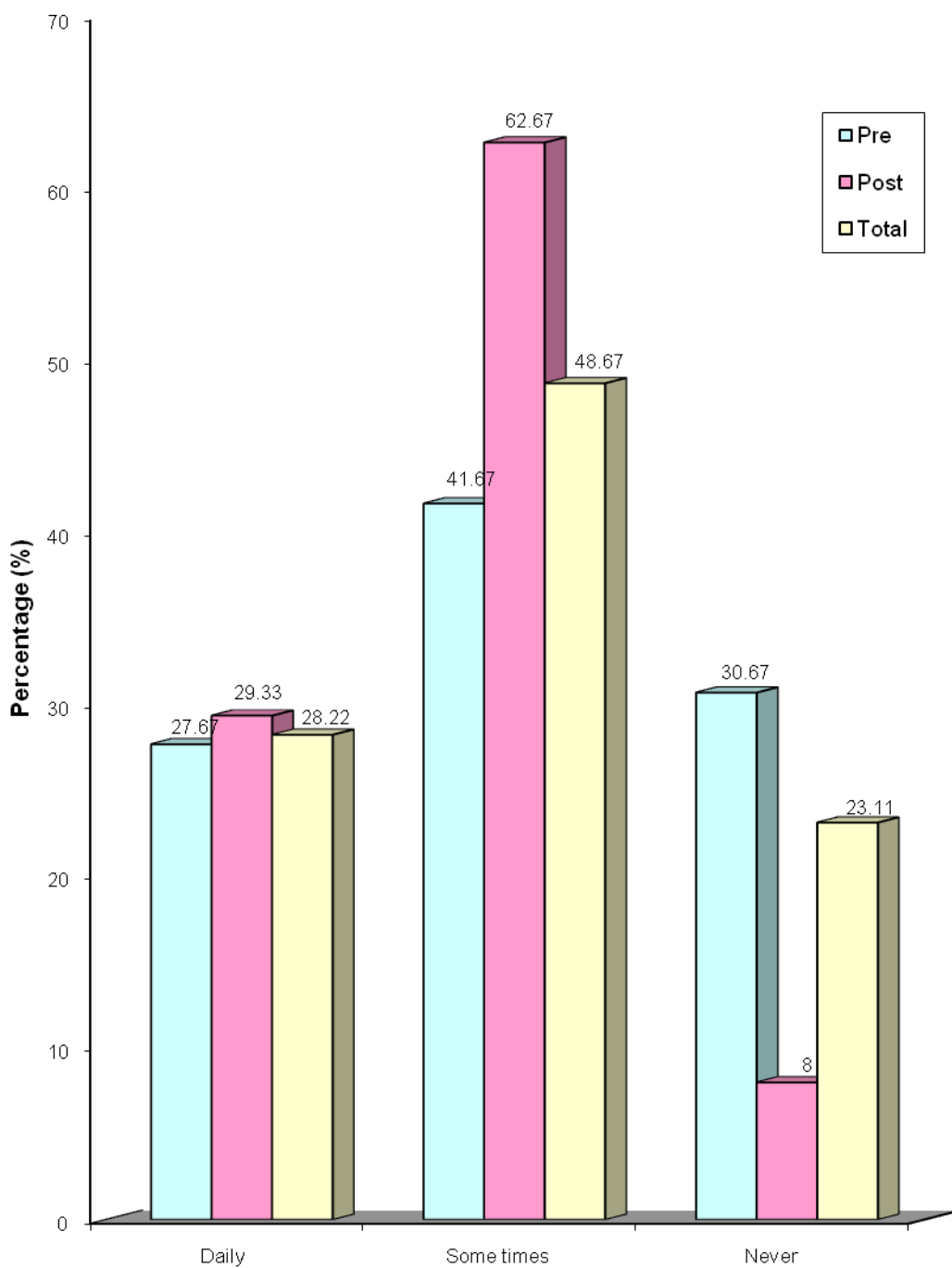
Fig. 6.6: Habit of taking breakfast by the females during pre and post implementation period of nutrition education package

Table 6.7: Frequency of taking meal by the females during pre and post implementation period of nutrition education package

S. No.	Frequency of taking meal	Period of nutrition education package					
		Pre (300)		Post (150)		Total (450)	
		No	%	No	%	No	%
1	Two times daily	295	98.33	129	86.00	424	94.22
2	Three times daily	5	1.67	21	14.00	26	5.78
	Total	300	100	150	100	450	100

Statistical significance: $\chi^2 = 27.941$, df = 1, þ < 0.001[***]

Comment

- Initially 98.33% females followed two times taking meal system and only 1.67% females used to take three times meal daily.

- After implementation of nutrition education package there was significant change towards frequency of meal system (χ^2=27.941, þ<0.001[***]).

Table 6.8: Type of restriction practiced by the females during pre and post implementation period of nutrition education package

S. No.	Restriction	Period of nutrition education package					
		Pre (300)		Post (150)		Total (450)	
		No	%	No	%	No	%
1	Fatty items	94	31.33	64	42.67	158	35.11
2	Fried items	7	2.33	4	2.67	11	2.45
3	Sweets	11	3.67	13	8.67	24	5.33
4	Gaseous and cold items	8	2.67	4	2.67	12	2.67
5	None	180	60.00	65	43.33	245	54.44
	Total	300	100	150	100	450	100

Statistical significance: $\chi^2 = 13.494$, df = 4, þ < 0.01[**].

Comment

- Initially majority of the females (60.00%) did not avoid any kind of food items, while 31.33% females avoided fatty items (31.33%); followed by sweets (3.67%); gaseous and cold items (2.67%).

- There was significant change in habit of following restrictions of food items before and after implementation of nutrition education package (χ^2 = 13.494, þ<0.01[**]).
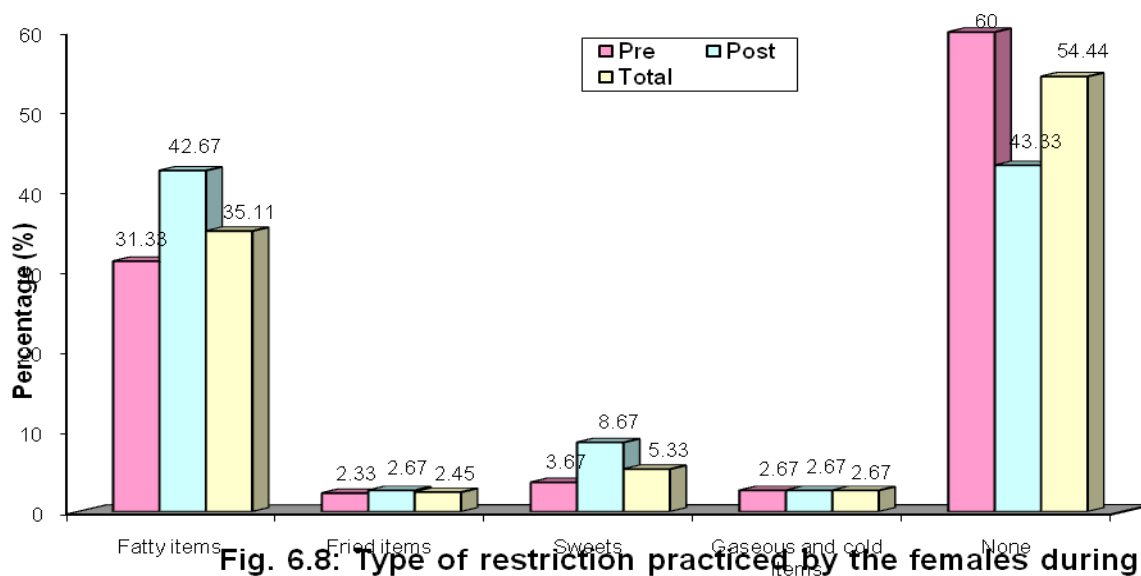

Fig. 6.8: Type of restriction practiced by the females during pre and post implementation period of nutrition education package

Table 6.9: Addiction habit by the females and their family members during pre and post implementation period of nutrition education package

S. No.	Addiction habit	Period of nutrition education package						Statistical significance
		Pre (300)		Post (150)		Total (450)		
		No	%	No	%	No	%	
1	By self • Yes • No	39 261	13.00 87.00	21 129	14.00 86.00	60 390	13.33 86.67	χ^2 = 0.086, df=1, þ > 0.05 NS
2	By family members • Yes • No	135 165	45.00 55.00	68 82	45.33 54.67	203 247	45.11 54.89	χ^2 = 0.004, df=1, þ > 0.05 NS

Comment

- There was no significant change in addiction habit of the females and their family members after the implementation of nutrition education package (þ > 0.05 NS).
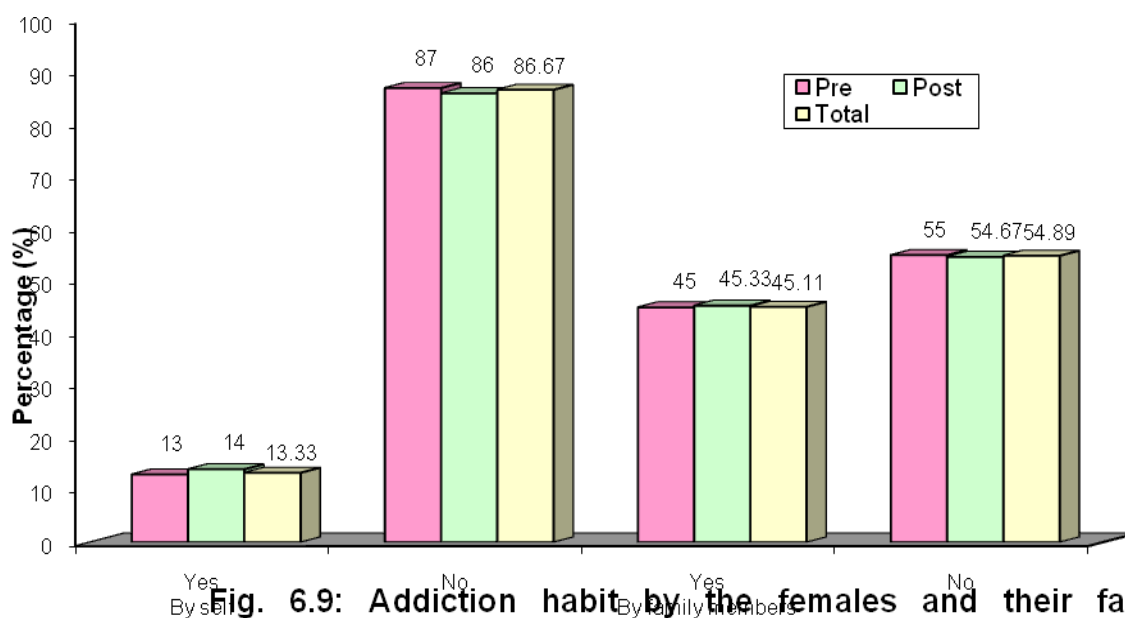

Fig. 6.9: Addiction habit by the females and their family members during pre and post implementation period of nutrition education package

Table 6.10: Measurement of Body Mass Index (BMI) of the females during pre and post implementation period of nutrition education package

S. No.	BMI measurement	Period of nutrition package					
		Pre (300)		Post (150)		Total (450)	
		No	%	No	%	No	%
1	25.0-29.9 (Overweight)	7	2.33	2	1.33	9	2.00
2	30.0-34.9 (Obese-I)	131	43.67	90	60.00	221	49.11
3	35.0-39.9 (Obese-II)	143	47.67	58	38.67	201	44.67
4	≥ 40.0 (Obese-III)	19	6.33	-	-	19	4.22
	Total	300	100	150	100	450	100
	Mean ± SD	35.35 ± 3.23		34.32 ± 2.56		35.01 ± 3.06	

Statistical significance: t = 3.677, df = 448, þ < 0.001[**] .

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Comment

- The mean values of BMI were assessed 35.35 ± 3.23 and 34.32 ± 2.56, respectively before and after implementation of nutrition education.

- There was significant reduction in BMI measurement of the females after due to nutrition education (t = 3.677, $p < 0.001^{**}$).
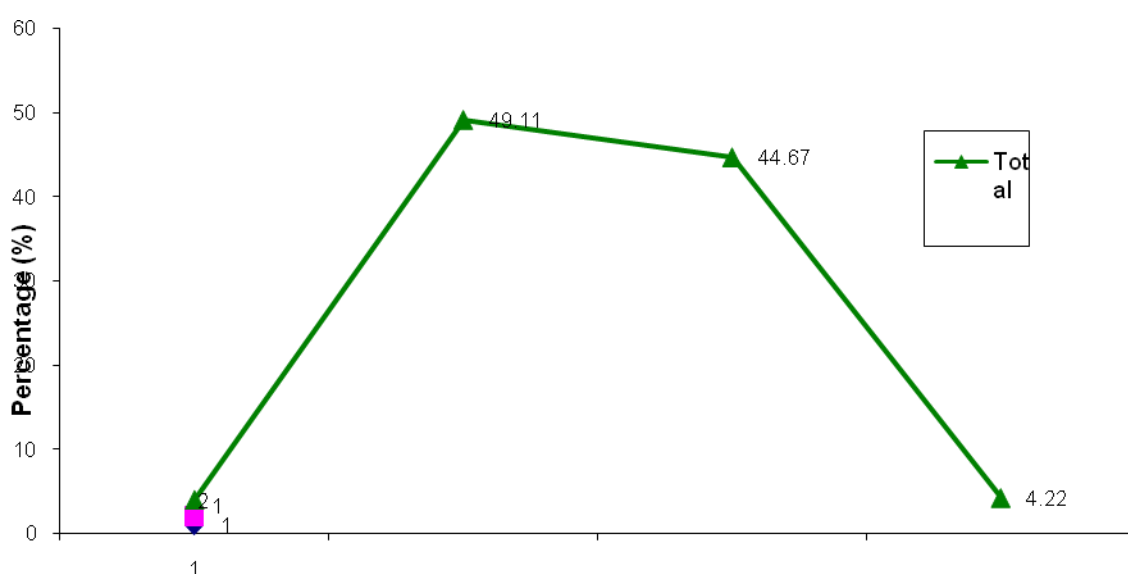

Fig. 6.10: Measurement of body mass index (BMI) of the females during pre and post implementation period of nutrition education package

Table 6.11: Measurement of SFT of the females during pre and post implementation period of nutrition education package

S. No.	SFT measurement (mm)	Period of nutrition education package					
		Pre (300)		Post (150)		Total (450)	
		No	%	No	%	No	%
1	40-59.9 (Above normal)	27	9.00	6	4.00	33	7.33
2	60-79.9 (Overweight)	75	25.00	74	49.33	149	33.11
3	≥ 80 (Obese)	198	66.00	70	46.67	268	59.56
	Total	300	100	150	100	450	100

Mean ± SD	81.35± 13.06	78.47± 11.43	80.39±12.60

Statistical significance: t = 2.392, df = 448, þ < 0.02[**] .

Comment

- The mean ± SD values of SFT measurement were assessed 81.35 ± 13.06 and 78.48 ± 11.43, respectively before and after implementation of nutrition education.

- There was significant reduction in SFT measurement of the females due to importing nutrition education (t = 2.392, þ < 0.02[**]).
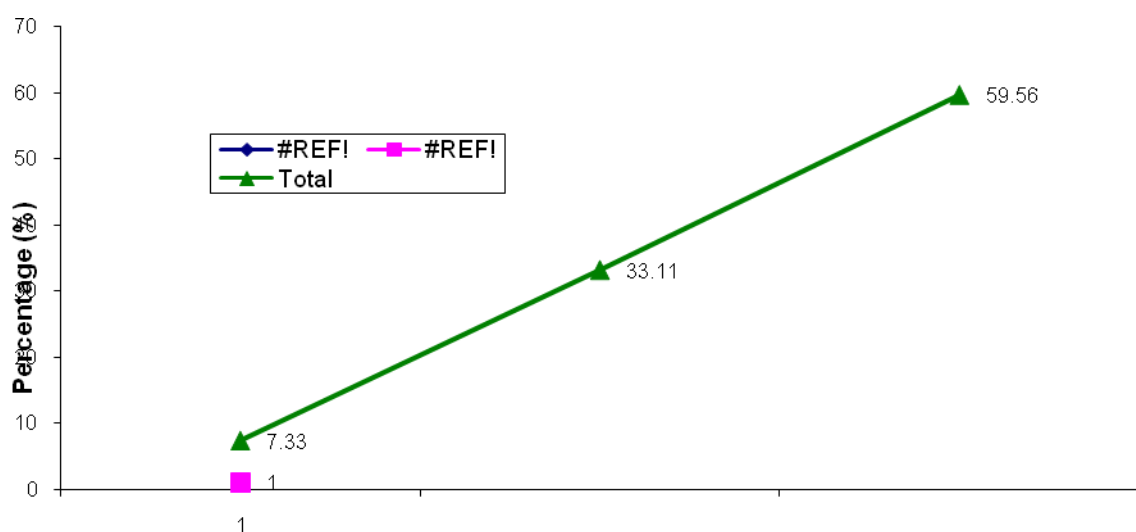

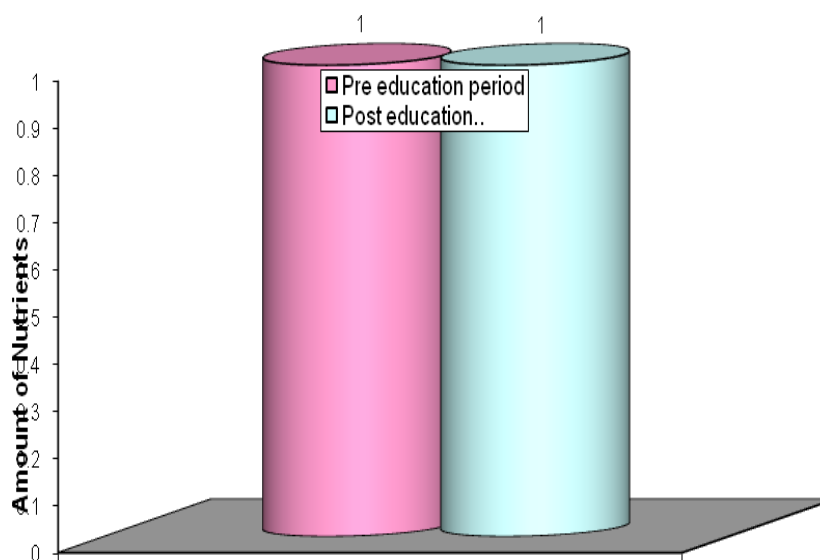Fig. 6.11: Measurement of SFT of the females during pre and post implementation period of nutrition education package

Table 6.12: Consumption of nutrients by the overweight and obese females at pre and post implementation periods of nutrition education package

S. No.	Nutrients	Mean ± SD amount of nutrients		% reduction in mean value	Statistical significance
		Pre implementation period (N = 300)	Post implementation period (N = 150)		

1	Protein (gm)	83.67 ± 24.54	67.17 ± 13.19	19.72%	t = 9.271, df = 448, þ < 0.001[***]
2	Fat (gm)	79.60 ± 21.25	47.83 ± 13.64	39.91%	t = 19.173, df = 448, þ < 0.001[***]
3	Carbohydrate (gm)	441.33 ± 88.79	352.50 ± 73.70	20.13%	t = 11.237, df = 448, þ < 0.001[***]
4	Energy (Kcal)	2461.67 ± 492.92	2007.17 ± 373.96	27.32%	t = 18.076, df = 448, þ < 0.001[***]

Comment

- The nutrition education package was found highly significant (þ < 0.001[***]) to reduce consumption of fat, energy, carbohydrate and protein by 39.91%, 27.32%, 20.13% and 19.72, respectively.

Fig. 6.12: Consumption of nutrients by the overweight and obese females at pre and post implementation periods of nutrition education package

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Chapter V DISCUSSION

The results of the present study have been documented in an earlier chapter. In the current chapter findings have been broadly discussed in view of various situations and simultaneously compared with other studies conducted in the country and abroad, if otherwise available. In addition, findings were supported with suitable statistical tools. The flow of the discussion is in accordance to the sequence of the findings shown in tables.

General characteristics of the surveyed females

In view of selecting 300 overweight and obese females, aged 30 to 50 years, 709 females of this specific age group were contacted. Accordingly there was presence of 409 normal females in addition to 300 overweight (07) and obese (293) females. Consequently these numbers provide base for the computation of the figures related to general characteristics (Table 1.1 through Table 1.9) and prevalence of overweight and obesity (Table 2.1 through Table 2.11). Thereafter details of 300 overweight obese subjects are given as per requirement of the questionnaire.

Table 1.1 reflects the age structure of the surveyed females according to overweight and obesity. It was observed that more than two-fifth normal females belonged to age group 45 to 50 years; followed by 35 to 40 years (27.14%) and 30 to 35 years (17.11%). Further nearly half of the obese females belonged to age group 45 to 50 years; followed by 35 to 40 years (24.92%) and 40 to 45 years (16.38%), on the other hand more than two-fifth overweight females (42.86%) are of 45 to 50 years' age group; followed by 40 to 45 years' age group (28.57%). Accordingly, mean and standard deviation (SD) age regarding of the surveyed females was computed 41.47 ± 5.76 years of normal; 42.5 ± 5.77 years for overweight and 42.5 ± 5.43 years for obese females. The statistical analysis suggested that the mean ages of the normal and obese females differed significantly (t = 2.416; df = 700, $þ < 0.02^{**}$), whereas mean ages of the other groups were found statistically similar (þ > 0.05 NS).

Educational status of the surveyed females has been displayed according to overweight and obesity in Table 1.2. It is evident from the table that nearly one-third of the normal females (33.01%) possessed University education; followed by Secondary (30.56%) and Primary (19.56%) education. In case of obese females, more than one-third females (37.54%) were Secondary educated; followed by University (31.74%) and Primary (19.45%) education. The role of University educated females was 57.14% in the sample; followed by Secondary (28.57%) and Primary (14.29%) education. The statistical analysis conveyed insignificant association ($\chi^2 = 8.854$, df = 8, þ > 0.05 NS) between educational status and category of the females.

Table 1.3 illustrates occupational status of the surveyed females according to overweight and obesity. In the present study three occupation categories of the females e.g. exclusive house wife; service and business have been presented. The females engaged in indoor domestic chores have been designated as exclusively house wife; while the females employed in outdoor activities in government or semi-government or private institutions have been considered in service category. Other females employed in selling and purchasing activities with transaction of money and commodities were included in business category.

In the present study majority of the normal females (90.71%) were house wives; followed by service (8.31%) and business (0.98%) class. Similarly majority of the obese females (88.74%) were house wife; followed by service (10.24%) and business (1.02%) class. On the other hand more than half of the overweight females (57.14%) were related to business category; followed by house wife (28.57%) and service (14.29%) class. The statistical analysis witnessed significant association between type of education and category of the females (χ^2 = 142.846, df = 4, þ > 0.001***). The significant behaviour of the date has no valid scientific reason behind it as most probably it happened due to small sample of overweight females.

Main occupation of the family has been displayed in Table 1.4. Business and service categories have been used in the similar sense as mentioned in Table 1.3, while 'others' category included various occupations like; electricians, T.V. and electronic mechanics, tailors, automobile workers, rikshaw and auto drivers, rajmistri including carpenter and blacksmith or welders and labour engaged in various activities, the persons included in this category were performing hard physical activities.

It is evident from the table 1.4 that more than half of the normal females (52.32%) belonged to business class; followed by service (38.63%) and 'others' category (9.05%). Similarly more than three-fifth obese females (61.09%); followed by 36.52% and 2.39% were related with business; service and other occupations categories, respectively.

The statistical analysis evidenced significant association between main occupation of the family and category of the females under study (χ^2 = 16.479, df = 4, þ > 0.01**). This finding explicitely explores differences in main occupations of the family in view of the category of the surveyed females.

Religion status of the surveyed females has been displayed in Table 1.5. This table shows that majority of the females in all the categories, such as normal (99.27%), obese (99.32%) and overweight (100.00%) belonged to Hindu religion, while the contribution of Muslim females is very small. The Muslims contribute 0.73% in normal and 0.68% in obese category. The statistical analysis emphasized

insignificant association between religion and category of the females ($\chi^2 = 0.011$, df = 1, þ > 0.05 NS).

Further, socio-economic status of the surveyed females has been illustrated in Table 1.6. Three categories of socio-economic status (low, middle and high) have been considered in view of the present day price index, detailed description of the socio-economic status has already been documented.

It was observed that more than half of the normal females (51.83%) were related with low socio-economic status; followed by middle (28.55%) and high status (19.32%). Likewise more than two-fifth females (42.86%) belonged to low category, while remaining females equally contributed (28.57%) from middle and high categories. So far as obese females were concerned 33.45% each were from middle and high categories while 33.10% females belonged to low category. There was found significant association ($\chi^2 = 32.444$, df = 4, þ > 0.001***) between socio-economic status and category of the females.

Table 1.7 reflects information on family structure of the surveyed females according to their category. It is observed that majority of the females in normal (78.73%); obese (76.45%) and overweight (71.43%) categories were related to nuclear families, whereas, contribution of joint families was found 28.57%, 23.55% and 21.27% in overweight; obese and normal categories, respectively. The statistical analysis conveyed non-significant association ($\chi^2 = 0.673$, df = 2, þ > 0.05 NS) between type of family and category of the females.

Further marital status of the surveyed females according to their categories has been portrayed in Table 1.8. It is observed that all the overweight females (100.00%) were married. In addition, majority of the obese females (92.83%) were also married; followed by widow (6.83%) and unmarried (0.34%). Similarly, majority of the normal females (90.95%) were married; followed by widow (8.56%) and unmarried (0.49%). The statistical analysis witnessed insignificant association between marital status and category of the surveyed females ($\chi^2 = 0.965$, df = 1, þ > 0.05 NS). This finding suggested similar distribution of various marital status in all the categories of surveyed females.

Family size is a prime factor in consumption of food items and dietary requirements in order to maintain proper health and standard of living. As such family size has direct impact on food consumption and thereby on health and standard of living.

In the present study all the overweight females (100.00%) were related to 4 to 6 family size. Further more than three-quarter normal females (76.04%) were also from the 4 to 6 family size; followed by 1 to 3 (12.71%) and 7 to 9 (9.54%) family size. Similarly nearly three-quarter obese females (72.70%); followed by 12.29% of them were related to family size 4 to 6; 7 to 9 or 1 to 3 size, respectively. The mean ±

SD family sizes were enumerated 5.16 ± 1.78 for obese; 5.01 ± 1.62 for normal and 5.00 ± 0 for overweight females respectively. It was further evidenced that the mean sizes of the family members were found statistically similar in all the categories of the females (þ > 0.05 NS).

Prevalence of overweight and obesity in the surveyed areas

In the present study four area (a) Mursan Gate (b) Awas Vikas colony (c) Vidyapati Nagar and (d) Delhi wala chowk were purposely selected from four quarters of Hathras City. As per our protocol of selecting 75 overweight and obese females aged 30 to 50 years from each quarter of the city, 161; 173; 205 and 170 females of the specific age group were interviewed from the selected areas e.g. (a) Mursan Gate (b) Awas Vikas colony (c) Vidyapati Nagar and (d) Delhi wala chowk respectively (Table 2.1).

It is evident from the table that the prevalence of overweight was to the tune of 1.18% in over D; followed by over B (1.16%); C (0.98%) and A (0.62%). The statistical analysis conveyed insignificant association between area and prevalence of overweight ($\chi^2 = 0.333$, df = 3, þ > 0.05 NS).

So far as prevalence of obesity is concerned, it was evaluated 45.96% for Mursan Gate; 42.94% for Delhi wala chowk; 42.20% for Awas Vikas colony and 35.61% for Vidyapati Nagar, respectively. The overall prevalences of overweight and obesity for Hathras city were assessed 0.99% and 41.33%, respectively. Further statistical analysis witnessed similar rate of obesity prevalence in four quarters of the city ($\chi^2 = 4.427$, df = 3, þ > 0.05 NS). The figures of the present study are in lines with the rates quoted by Sidhu and Tatla (2002). These authors quoted rates in Delhi urban females as 33.4%; in Hyderabad urban females as 36.3% and in Delhi urban females as 48.6%.

When the same date is presented according to present age of the surveyed females (Table 2.2), it was observed that the prevalence of obesity and overweight respectively were evaluated 31.73% and 0.96% for 30 to 35 years; 39.46% and 0.54% for 35 to 40 years; 43.24% and 1.80% for 40 to 45 years and 44.98% and 0.97% for 45 to 50 years age group. Though there is an increasing trend of obesity prevalence with respect to present age of the surveyed females, but it could not be statistically established and the variations in obesity prevalence were found due to chance factor ($\chi^2 = 6.088$, df = 3, þ > 0.05 NS). Similarly there was no significant association between present age of the females and prevalence of overweight ($\chi^2 = 1.130$, df = 3, þ > 0.05 NS). Hence our hypothesis 'Prevalence of overweight and obesity increases with the advancement of age of the subjects' is accepted, but it is statistically not significant.

Further prevalence of overweight and obesity were considered according to educational status of the surveyed females (Table 2.3). It is evident from the data that

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the prevalences of overweight were 0.72% for Primary, 0.84% for Secondary and 1.72% for University educated females. Though prevalence of overweight seems increasing with advancement of educational status, but it was statistically insignificant (χ^2 = 1.701, df = 2, þ > 0.05 NS). The differences observed are due to chance factor.

It is further evident from the table that prevalence of overweight and obesity combined were assessed 31.91% for illiterate; 42.02% for Primary and 47.25% for Secondary educated females. This rate in Secondary educated females was maximum and there after deterioration in prevalence was observed and it comes to 41.81% level in University educated females and 37.50% in professional females. The statistical analysis witnessed non-significant association between prevalence of overweight and obesity combined and educational status of the females (χ^2 = 6.642, df = 4, þ > 0.05 NS). In other studies, Mohammad Ali and Lindstrom (2005) and Vahratian (2009) have also reported increase in obesity up to 12 standard of education. The reason of this variation is un-explainable. That is why statistical analysis suggested the role of chance factor.

Again further, the same data has been illustrated according to occupation of the surveyed females (Table 2.4). It was observed that the prevalence of overweight and obesity combined was minimum (41.39%) in house wives and maximum (63.64%) in business category females, while 47.69% females in service category were found overweight and obese. Though a wide variation in prevalence of overweight and obesity was seen in various occupation categories but the association was found statistically insignificant (χ^2 = 3.040, df = 2, þ > 0.05 NS). In a study held in Australia, Ball, Mishra and Crawford (2002) documented lowest obesity in the professionals working for the longer duration. In an Indian study NFI (1999): Scientific Report 15 desk worker females were more involved in obesity in comparison to their counterparts in non-desk working females and the difference was formed statistically significant (þ > 0.04).

A sedentary life style plays a significant role in obesity. Heavy activities are liable to burn extra calorie consumption but in case of sedentary life style extra calorie is not burnt and the carbohydrate/glucose are deposited in the body causing obesity. In the present study the type of work performed by the females is considered (Table 2.4.1). It was observed that the prevalence of obesity and overweight in the females involved in heavy activities was only 12.50%, while it was 47.79% in the moderate working females and highest (59.62%) in sedentary working females. These was significant association between type of work and prevalence of overweight and obesity (χ^2 = 51.635, df = 2, þ > 0.001***). Hence, the hypothesis "Working mode or physical activity has significant impact on overweight and obesity" is accepted.

The works conducted in various parts of the world WHO, 2009; and Ness-Abramof and Apovian, (2006) have mentioned increasing use of mechanized transportation and a greater presence of labour saving devices in home are responsible

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for sedentary working of the house wives and ultimate increase in obesity tremendously.

It has been generally observed that the food consumption practices in different religious are different due change in climatic conditions and availability of food-products to the consumers. Religions bindings are also responsible for their food habits. In this perspective, the prevalence of overweight and obesity was considered (Table 2.5). In the present study, the prevalence of overweight and obesity were observed 42.33% and 40.00% respectively in Hindu and Muslim females. The statistical analysis evidenced non-significant association between religion and prevalence of overweight and obesity ($\chi^2 = 0.004$, df = 1, þ > 0.05 NS). The number of Muslim females is very small as such the inference drawn by this data is not rational. In a study held in Varanasi, Asthana nee Sahay (1993) has also reported similar prevalence of overweight and obesity in Hindu and Muslim females.

Wang (2001) has quoted that sobal and stunkard, after examining over 140 published studies, they concluded inverse relationship between SES and obesity among women in developed societies. In contrast, in developing countries a strong relationship exists between SES and obesity among men, women and children. In the present study, prevalence of overweight and obesity is presented in Table 2.6. It is evident that combined prevalence of overweight and obesity is 32.05% in low and 45.87% in middle and 55.87% in high socio-economic groups. The statistical analysis emphasized significant association between income/socio-economic group and prevalence of overweight and obesity ($\chi^2 = 28.061$, df = 2, þ < 0.001[***]). Hence, the hypothesis "income or socio-economic status has no significant effect on the prevalence of overweight and obesity" is out rightly rejected. It is further observed that obesity alone is also associated with the socio-economic status ($\chi^2 = 27.965$, df = 2, þ < 0.001[***]) of the females, but it is disheartening that overweight alone was not associated with the socio-economic status (þ > 0.05 NS). Most probably it is due to small sample of overweight females as 7 only.

In a study held in Varanasi Asthana nee Sahay (1993) has reported insignificant association between income and obesity in an affluent society. The study was conducted in the same group with respect to variation in income. The study subjects were living similar life style and consumption pattern of food items was also similar. In the studies held in abroad Wang (2001) has also reported high prevalence of obesity in high income groups of China. Further Penny Gordon-Larsen *et al.* (2003) mentioned that overweight prevalence decreased with increasing SES among white females and remained elevated and even increased among higher SES African-American females. African-American/white disparity in overweight prevalence increased at the highest SES. Conversely disparity was lessened at the highest for white, Hispanic and Asian females.

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Family structure is also an important facet in occurrence of overweight and obesity. It is considered that the persons living in different family structure spent different types of life style. A change in life style causes difference in the prevalence of overweight and obesity. If the life style is same in both types of families, it is expected similar rates of prevalence of overweight and obesity.

In the present study prevalence of overweight and obesity has been displayed in Table 2.7. It is observed that the combined prevalences of overweight and obesity were assessed 41.56% and 44.94% respectively in nuclear and joint families. The statistical analysis witnessed insignificant association between type of family and prevalence of overweight and obesity ($\chi^2 = 0.573$, df = 1, $p < 0.05$). This result shows similar rate of prevalence in nuclear and joint families. Further the result concludes that the females living in nuclear and joint families are spending similar life style and their food consumption pattern is most probably similar. In a study held in Varanasi Asthana nee Sahay (1993) has also reported slight higher prevalence (30.83%) in joint families in comparison to nuclear families (28.7%), but the difference was found statistically insignificant.

Increasing number of members in the family reduces percapita income and simultaneous reduction in percapita income is responsible for low consumption of nutrients and availability of other necessities. In the present study it is observed that the lowest prevalence (40.91%) of overweight and obesity existed in 1 to 3 family members category (Table 2.8), while the females related with crowded members' family had highest prevalence (53.33%). The females related with families having 4 to 6 and 7 to 9 family members respectively encountered with 41.43% and 48.00% prevalence of overweight and obesity. Though the prevalence is found increasing with the increase of members in the family, but it was found statistically insignificant for obesity ($\chi^2 = 2.598$, df = 3, $p < 0.05$ NS) and for overweight and obesity combined ($\chi^2 = 1.980$, df = 3, $p < 0.05$ NS). The result showed that the variation in prevalence was due to chance factor.

There are several events in the life of a woman, which may be associated with weight gain. These include marriage (the initiation of treatment with oral contraceptives), pregnancy and menopause. Lowe and Gibson (1955) observed that at the same ages married woman without children are heavier that single women (unmarried). Pregnancy increases the weight gain of many women who experienced large weight gains during pregnancy. In this work he described weight gain varying from 28 pounds (12.7 kg) to 110 (50 kg). Mekeown and Record (1957a, b, c) re-examined the change in body weight of women who delivered babies between April 1949 and March, 1950. Maternal weights were obtained early in pregnancy and corrected to the 124th day of gestation. It was apparent that substantial weight gain (over 50 pounds) in pregnancy occurred was less than 1 per cent f the sample.

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In the present study, the prevalence of overweight and obesity (Table 2.9) was observed 33.33%; while it was 36.36% in widow and 42.86% in married females. Though a wide variation in prevalence of overweight and obesity was present, but the association of prevalence with marital status was found statistically insignificant ($\chi^2 = 0.976$, df = 2, þ < 0.05 NS). High prevalence of obesity in married women is fully in accordance with the statements quoted by Lowe and Gibson (1955); In a study held in Varanasi Asthana nee Sahay (1993) noticed significantly higher prevalence in obesity in married women (36.60%) in comparison to unmarried girls (9.68%). In this respect the hypothesis 'The marital status has no positive role to effect overweight and obesity' is rejected.

Obesity is mainly dominant due to viscious circle of physical activity and extra consumption of energy causing deposition of unwanted fat in the body. Any activity related to these factors directly or indirectly affects overweight and obesity. Likewise the number of children a person has is related to their risk of obesity. A woman's risk increases by 7% per child, while a man's risk increases by 4% per child Weng *et al.*, (2004). This could be partly explained by the fact that having dependent children decreases physical activity in western parents Bellows-Riecken & Rodes, (2008).

In the present study (Table 2.10), the prevalence of obesity was observed 30.00% in nil parity, 39.74% in 1 to 3 parity and 47.71% in more than four parity. Similarly, combined prevalence of overweight and obesity was accounted 40.00% in nil parity; 40.29% in 1 to 3 parity and 49.67% in more than four parity. Though increasing trend in prevalence is observed with the advancement of parity, but the association between prevalence of overweight and obesity and number of parity was found statistically insignificant ($\chi^2 = 4.330$, df = 2, þ < 0.05 NS) and the variation observed was due to chance factor. As such the hypothesis 'Number of parity in the females is responsible to enhance the prevalence of overweight and obesity' is accepted, but it is not statistically significant suggesting that the study be carried out taking a large sample size.

Prevalence of overweight and obesity was worked out according to food habit of the females in term of vegetarian and non-vegetarian. In the present study (Table 2.11) the prevalence of obesity was accounted 40.94% for vegetarians and 52.00% for non-vegetarians. Further, the combined prevalence of obesity and overweight was assessed 41.81% in vegetarian females and 56.00% in non-vegetarians. The statistical analysis conveyed non-significant association between food habit and prevalence of obesity ($\chi^2 = 1.218$, df = 1, þ < 0.05 NS) and overweight combined ($\chi^2 = 1.989$, df = 1, þ < 0.05 NS). This result is indication of similarity in vegetarian and non-vegetarian diet. Actually, in practical sense, vegetarians and non-vegetarians used to consume similar diets. Non-vegetarian diets are usually expansive and they are very rarely used by the consumers; normally used once or twice in a month. In view of strict

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definition, these non-vegetarians are practically vegetarian. In her study Asthana nee Sahay (1993) has also mentioned similarity in the diets of vegetarians and non-vegetarians because for all practical purposes, the non-vegetarians were vegetarian food consumers. As due to rising cost of non-vegetarian food items, small quantity of these items is purchased for the family leaving very little for an individual and too little for females, who eats in the last, according to our social milieu.

Specific information regarding overweight and obesity before providing nutrition education

Knowledge status of the overweight and obese females regarding this disease has been shown in Table 3.1 overall more than three quarters of the subjects (77.67%) had knowledge of this disease. According to income, it was found 66% in low, 83% in middle and 84% in high income groups. There was an increasing trend in knowledge status with the advancement of income ($\chi^2 = 11.801$, df = 2, þ < 0.01^{**}).

So far as consequences of this disease are concerned, 15.33% females reiterated as they seem aged and they have acquired more weight with respect to their height. Further 18.33% females understood that their weight was 10 to 20% more than the normal weight, while more than one-quarter females (28.67%) had knowledge of all the above consequences.

Various problems occurred in the subjects due to presence of this disease. Nearly two-fifth females (37.0%) said that they felt problem in working and walking, while 28.67%, 16.33% and 10.67% females encountered with pain in joints; high breathing and other, respectively.

Bloom and Eidex (1967) found that obese subjects spent more time in activities that required little energy than did lean subjects. The obese tended to spend more time in bed, and when out of bed, to spend more time sitting than did lean people. Further Durnin *et al.* (1957) found that the obese women spent 5% less time in moderate activities and 5% were time sitting than the lean women. Mayers *et al.* (1956) reported that body weight was significantly related with activity choice, with obese subject choosing escalator over stairs more frequently than overweight and normal weight subjects.

Positive family history

In human beings possible role of genetics was first brought into light by the studies of Von Verachuer (1927), who in a study of twins found body weight to be contrast from twin to twin. In a series of 250 obese patients studied by Rony in Chicago (1940) 69 per cent had one or both parents obese. In a recent study Farooqui (2005) reported resemblance of BMI in 50 to 90 % of the offsprings or borns of latter generations.

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It is well known fact that hormones play an important role in the deposition of fat. These are several endocrine abnormalities which can cause mild or moderate degree of obesity Bray (1974c). The obese state in addition to including certain metabolic abnormalities, also results in a number of physiological alterations. Obesity is identified as a risk factor for diseases like hypertension, diabetes, coronary heart disease, gall stones and contributed to reduced life expectancy.

In view of the above mentioned consequences, the females were interrogated regarding family history of these diseases from the maternal and paternal sides (Table 3.2). It is observed that the obesity; diabetes; hypertension; coronary heart disease and others in maternal sides were present in 30.33%; 13.00%; 26.00%; 1.33% and 4.00% subjects respectively. On the other hand, towards paternal side these diseases were present in 26.33%; 11.67%; 23.00%; 1.33% and 2.67% families, respectively. The figures showed that obesity and hypertension had leading role in positive family history either in maternal or paternal side. Further coronary heart disease has been found least occurred as positive family history.

Exercise practiced

Activity is very important facet for any therapeutic programme to the obese patients. Studies have shown that obese persons are less active than their lean counterparts Braunstein, (1975) and that this inactivity does play a significant role in their positive calorie or energy balance. A significant loss of energy can be induced by encouraging increased physical activity in obese patients. This increase in activity can be in the form of brisk walking or engaging in sports such as swimming, golf, and tennis. But, it should be emphasized that any programme of activity should began with a small increase over the usual activity pattern and a gradual activity pattern and a gradual progressive increase to the desired amount Braunstein, (1975).

In the present study, nearly three-fifth females (59.00%) (Table 3.3) did not practice any kind of physical activities. Among the physical activity practitioners, nearly one quarter females (24.00% were engaged in yoga practices; followed by walking (23.00%). In addition, 1.67%; 1.00% and 0.33% females participated in sports and playing; cycling or gym exercises and dancing respectively.

So far as frequency of these activities is concerned, nearly one-third females (31.00%) participated in these activities daily; followed by twice a week (9.33%) and 5 days in a week (0.67%). The income has no significant bearing on the physical activities performed by the females.

In a study held in USA, Simoes *et al.* (2006) have quantified physical activities and described associations of physical activity and BMI. These authors mentioned that significantly more of those respondents who were classified as obese reported functional limitation (43.3%) than did those classified as overweight or underweight/normal. Obese individuals had a higher percentage of dependency as

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measured by ADL (activity of daily living), and IADL (instrumental activities of daily living) (21.5%) than did those underweight or normal or overweight. Compared to those who were physically active, the physically inactive had a higher percentage of dependency in ADL (10.0%), or IADL (28.8%) and functional limitation (44.5%). Leisure time physical activity (LPA) was initially assessed by past month participation in any physical activities or exercise such as running, golf, gardening or walking for exercise. Activities of daily living (ADLs) are basic activities that include bathing, dressing, toileting, transfer and feeding. Persons are limited in an ADL, if they are unable to perform the activity, use active help, use equipment, or require standby help.

Habit of TV viewing by the females has been presented in Table 3.4. It is observed that more than three-fifth overall females (65.33%) viewed TV for less then one to four hours; followed by four hours (20.00%). Mean $\pm$ SD period of TV viewing was estimated 2.65 ± 1.21 hours. According to income group minimum mean $\pm$ SD (2.49 ± 1.46 hours) period was accounted for low income and highest (2.88 ± 0.89 hours) for high income. There was significant difference in mean periods between high and low income ($t = 2.281$; $df = 198$, $p < 0.05^{*}$) categories, but there was no significant difference in mean TV viewing periods of two consecutive groups, i.e. between middle and low; and between high and middle income groups ($p < 0.05$ NS).

Jacoby *et al.* (2003) have also reported that obese women and those in the high income group tended to watch more TV; while men in the high income group were those who spent less time infront of TV sets. The finding also showed a significant positive correlation between hours reported sitting and watching television and physical activity in both men and women ($p < 0.01^{***}$). Among men and women who reported sitting and watching more than 4 hours of television per day, more than half of men and women were categorized into lower levels of physical activity. Speakman (2004) mentioned high rate of obesity in persons watching TV for more than four hours in a day. The author remarked that television viewing is negatively associated with engagement in physical activity. Tucker and Bagwell (1991); Gortmaker *et al.* (1996); Vioque *et al.* (2000) and Ezekiel (2008) have also mentioned an association between the number of hours of television watched and the prevalence of obesity.

Obesity can occur only as a result of energy intake in excess of energy expenditure. If an individual ingests and stores 100 kcal more than is required/day, then 36500 excess kcal will accumulate during the course of one year and this will result in a weight gain of 46 kg in one year. There are many factors which influence food intake and energy output.

Food habit and consumption practices of food items have been shown in Table 3.5 and Table 3.5.1. It was observed that overwhelming majority of the females (95.33%) were vegetarian, while only 4.67% females were regular non-vegetarian.

According to income category, there was no significant association between vegetarian/non-vegetarian food habits and income of the females ($\chi^2 = 1.048$, df = 2, þ < 0.05 NS). Further 92.00% overall females reiterated meal requirement after feeling hungry. Though meal requirement after feeling hungry was found deteriorated with the advancement of income, but its association with income was found statistically insignificant ($\chi^2 = 5.706$, df = 2, þ < 0.05 NS).

It is satisfactory that two-thirds overall females did not feel hungry during tension, but 22.00% and 11.33% females felt more and less hunger respectively. The association was found statistically significant ($\chi^2 = 20.973$, df = 4, þ < 0.001^{***}). Further nearly three-fifths overall females used to drink tea or coffee twice daily; followed by more than two times (21.67%) and once daily (18.67%). The drinking habit of tea or coffee was found significantly increasing with increase of income ($\chi^2 = 17.502$, df = 4, þ < 0.01^{***}). Due to economic constraints the low income persons avoid more drinking of tea or coffee. On the other hand, more frequency of drinking tea or coffee in high income families is status symbol. In addition 20.33% and 12.00% overall females liked soft drinks and mattha or lemon water respectively. More then one-fifth (24.00%) over all females used to drink cold drinks once a day; followed by twice a day (8.33%). The frequency of drinking cold drink was found insignificantly associated with income category ($\chi^2 = 4.954$, df = 4, þ < 0.05 NS) i.e. use of cold drink was found similar in all the income categories.

It is a known fact that consumption of sweets is responsible for accumulation of extra energy in the body. In the present study (Table 3.5.1) more than three-fifth overall females used to consume sweets. Of these more than one-third of them (34.67%) consumed sweets irregularly; while 19.33% and 8.67% females utilized sweets once or twice in a week. The figures showed that there was significant association between liking of sweets and income of the subjects ($\chi^2 = 39.279$, df = 6, þ < 0.001^{***}). The use of sweets was found increasing with the increase in income. The use of sweets has also become a status symbol, and thereby the persons in high income category have much liking for sweet dishes. Sweet dishes along with presence of sugar are also rich in dried fruits having excess nutrients causing obesity and other related diseases to the consumers.

Some persons are habitual to take snacks, biscuits and petty food in terms in between two meals. This habit of nibbling between meals, though in small quantity, is also responsible for consumption of extra energy and thereby accumulation of fat in the body. In the present study 5%; 31% and 62% females respectively from low; middle and high income groups were habitual for nibbling habit was found significantly increasing with increase in income ($\chi^2 = 74.041$, df = 2, þ < 0.001^{***}).

Present day taking meal out of the home has become a fashion and status symbol of affluent society. In the present study too (Table 3.5.1), 65% females in high income group along with 23% females in middle income category against none in the

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low income category used to take out side of the house. This habit has positive association with income category (χ^2 = 104.82, df = 2, þ < 0.001[***]). Further speed of taking meal is also responsible for ingestion and proper digestion of meal. The food items taken fastly are generally undigested while slow habit of taking meal helps in proper digestion. It is satisfactory that more than half of the overall females (56.67%) consumed meal slowly and there was also significant association between speed of taking meal and income of the subjects (χ^2 = 63.558, df = 2, þ < 0.001[***]).

Other habits such as comparison during taking meal; participation in lunch party outside of the house and use of left out foods have also positive bearing on consumption of extra energy and thereby accumulation of extra fat in the body. Habit of taking meal during watching TV is responsible to consume more food than required. In the present study this has been found significantly associated (χ^2 = 70.675, df = 4, þ < 0.001[***]) with income. Further there were only 14.33% subjects who either were participating in professional lunch party or as a member of kitty party. In the modern culture, participation in lunch party is also increasing day by day in view of gratifying status symbol. Our hypothesis that 'eating habit significantly influences the prevalence of overweight and obesity' is absolutely accepted in view of the aforesaid statements regarding various characteristics of eating habits of the females in the study.

The knowledge of the nutrients (Table 3.6) was only known to 30.67% overall females still a significant increasing trend in knowledge (χ^2 = 29.189, df = 2, þ < 0.001[***]) status was obtained. In the present study 11% low; 36% middle and 45% high income category females had proper knowledge of the nutrients. Consequently, in 27.67%; 27.00%; 22.00%; 18.00% and 11.00% females respectively had correct knowledge of protein; fat, vitamins; carbohydrate and minerals and the knowledge of these nutrients were significantly associated with the income category (þ < 0.001[***]). There was increasing trend in knowledge status with the advancement of income.

The knowledge of nutrients was found responsible to increase use of salad (68.00%); liking and consumption/intake of fruits (78%) and taking breakfast (69.33%). These habits are good and fulfil RDA requirement of the subjects. But due to economic constraints these habits of using salad (χ^2 = 17.371, df = 2, þ < 0.001[***]); liking and taking of fruit (χ^2 = 173.474, df = 8, þ < 0.001[***]) and habit of taking break fast (χ^2 = 265.889, df = 4, þ < 0.001[***]) were not similarly followed by the females in all income categories. In a recent study Duvigneaud *et al.* (2007) mentioned that in women, the intake of carbohydrates; starch, sugars and fibres were found to be positively related with overweight and obesity.

Though three-fifth overall females (60.00%) did not adhere restriction, still 31.33%; 3.67%; 2.67% and 2.33% overall females were habituated to restrict fatty diets; sweets; rice and cold items and fried food items respectively. The significant restriction by the subjects in high income category is applaudable as they consume

extra nutrients for the sake of high standard of living and maintaining status quo. There were very few subjects (5.67%) (Table 3.7) taking some kinds of medical treatment for the elimination and prevention from overweight and obesity.

No other endocrine gland has been so implicated in obesity as the thyroid. Obesity can result from hypothyroidism because of decreased calorie need. Thyroid function studies in obese have shown variable results. Thyroid functions are depressed in obese subjects as reported by Koltz (1970), where as study done by Glennon and Herch (1965) reports contrary to this, i.e. the level of circulating hormone and radio active iodine uptake was more or less normal. Bray *et al.* (1973) suggested that administration of thyroid hormone to obese patients may result in a loss of lean body mass exceeding loss of fat, and an increased appetite. In the present study (Table 3.8), overall 13.67% subjects faced problem of thyroid and this problem was found statistically similar ($\chi^2 = 4.124$, df = 2, þ > 0.005 NS) in all the income categories.

Addiction habit is injurious and detrimental to the health as it affects directly or indirectly to the appetite and consumption of varied quantity of the nutrients. In the present study, (Table 3.9) only 13.00% subjects were habituated with some sorts of addiction of these 7.67%; 4.00% and 1.33% subjects were tobacco; rajanigandha or betel leaf users. On the other hand more than two-fifths of family members were also involved in taking some sorts of addiction. The addiction habits either for the subjects or for family members were found statistically similar (þ > 0.05 NS) in all the income categories. Large scale American and European studies have found that mortality risk varies with BMI; the lowest risk is found at a BMI of 22.5 to 25 kg/m^2 in non-smokers (Whitlock, 2009) and at a BMI of 24 to 27 kg/m^2 in current smokers mortality increases with changes in either direction Calle, (1999); Pischon *et al.*, (2008).

Assessment of obesity

For routine use, anthropometric measurements are the most practical tools for diagnosis obesity. Broadly, anthropometry aims at measurement of weight and measurement of subcutaneous fat. Some commonly quoted anthropometric indices are weight and height relationship; weight as percent of reference weight; weight-height indices; skin fold thickness as a measure of body fat and per cent body fat. In the present study, BMI and SFT (skin fold thickness) have been considered for measuring subcutaneous fat.

Table 4.1 presents distribution of the subjects according to BMI and income group before implementation of nutrition education. It was observed that nearly half of the overall subjects (47.67%) were obese grade II (35.0-39.9); followed by obese grade-I (30.0 to34.9) (43.67%). In addition 6.33% and 2.33% overall females were obese grade-III and overweight, respectively. The mean ± SD BMI was enumerated 35.35 ± 3.23. According to income of the subjects, the mean ± SD values of BMI

were assessed 35.20 ± 3.13 for low; 35.55 ± 3.08 for middle and 35.30 ± 3.50 for high income groups. The statistical analysis witnessed that the mean values of BMI were similar in all the income groups and the differences between two mean values were due to chance factor (þ > 0.05 NS).

Further biceps measurement of these females has been shown in Table 4.2. It was observed that the biceps measurement two-fifth subjects was 10 to 15 mm; followed by 15 to 20 mm (22.33%) and 5 to 10 mm (17.33%). In addition biceps measurement of 10.67%; 6.33%; 3.00% and 0.33% subjects were recorded 20 to 25 mm; 25 to 30 mm and 30 to 35 mm, respectively. The mean ± SD biceps measurement was assessed 13.70 ± 5.80 mm. According to income group of the subjects, the mean ± SD values of biceps measurement were ascertained 13.65 ± 5.72 mm; 13.65 ± 5.68 mm and 13.80 ± 6.06 mm for low; middle and high income groups. Further there were no significant differences between means (þ > 0.05 NS) and further the mean difference between two groups was due to chance factor.

So far as triceps measurement of the subjects was concerned, mean ± SD value was obtained 18.80 ± 6.80 mm for overall females, while the values for low; middle and high income groups were 18.40 ± 7.60 mm; 18.55 ± 6.66 and 19.15 ± 6.12 mm, respectively (Table 4.3). The mean values of triceps measurements were found statistically similar for three income groups (þ > 0.05 NS). Slusser *et al.* (2004) mentioned ≥ 95th percentile TSF value as a criterion for obesity. Study done by Khalid *et al.* (2005) on the prevalence of obesity in urban population based on triceps skin-fold thickness in relation to body weight showed prevalence of obesity in males and females (based on triceps skin fold thickness using Seitzer and Mayer criterion) as 2.2% and 10.4%, respectively.

Again further mean ± SD value of suprailliac measurement of the subjects was accounted 22.88 ± 6.03 mm. According to income group the measurements were 21.85 ± 5.21 mm for low, 23.50 ± 6.70 mm for middle and 23.30 ± 6.02 mm for high income group females. These mean values of suprailliac measurements were found statistically similar for all income groups (þ > 0.05 NS) and the differences observed between two means were due to chance factor (Table 4.4).

Distribution of subcapular measurement is shown in Table 4.5. It was observed that the subcapular measurement in more than one-third overall females was 25 to 30 mm; followed by 30 to 35 mm (24.33%) and 20 to 25 mm (20.67%). The mean ± SD value of subcapular measurement was computed 27.58 ± 5.99 mm for overall subjects, while these values for low; middle and high income groups were 26.90 ± 5.96 mm; 28.35 ± 5.99 mm and 27.45 ± 5.99 mm, respectively. The mean values were found statistically similar for all income groups (þ > 0.05 NS).

BMI is not an exact measure of body fat. BMI for age based standards such as that of Must *et al.* (1991) or Cole *et al.* (2000) appear to be more preferable to use

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than the WHO criteria (which are based on both BMI and skin fold). Skin fold thickness measurements are subject to considerable inter and intra user error, whereas measures based on height and weight are simple to obtain in wide variety of settings and reliable Himes, (1989). This is particularly relevant to developing countries, where people lightly skilled in skin fold measurement are scarce. The high subcutaneous fat in adolescents suggested by the high percentage of obese boys and girls identified using the composite BMI and skin fold criteria (i.e. WHO recommended criteria) is a cause of concern since it is known that the reliability of skin fold measurement decreases as body fat increases. Furthermore, the use of a BMI reference such as that of Must *et al.* (1991) or Cole *et al.* (2000) would allow ease of comparison with corresponding studies from other countries in the world.

Sum of SFT at four sites included the biceps, triceps, sub scapular and supra iliac. This criteria of classification has been used by Durnin and Womersley (1974). According SFT based on four sites was considered normal from 40 to 59.9 mm; overweight from 60 to 79.9 mm and ≥ 80.0 mm as obese, respectively.

In the present study (Table 4.6), according to SFT criteria 66.00% females were detected obese; whereas 25.00% and 9.00% females were overweight and above normal, respectively. On the basis of BMI criteria 2.33% females were overweight and remaining 97.67% females were obese grades I, II and III (Table 4.1). It is evident that 9.00% females which were detected above normal by SFT criteria and further by using BMI criteria they had been recognized falsely as obese Must *et al.* (1991) and Cole *et al.* (2000) have rightly mentioned that BMI is not an exact measure of obesity and consequently they recommended to use WHO criteria, which are based on both BMI and skin fold.

Table 4.6 further showed that mean ± SD of SFT measurement of overall females was accounted 81.35 ± 13.06 mm. According to income group, the mean ± SD values of SFT measurement were worked out 81.55 ± 13.98 mm for low; 79.55 ± 13.17 mm for medium and 82.95 ± 11.85 mm for high income group. The statistical analysis emphasized insignificant difference in mean values of different income groups, i.e. the mean SFT values in all the income groups were statistically similar (þ > 0.05 NS).

Consumption of nutrient by the overweight and obese females before implementation of nutrition education

The higher intake of energy by the overweight and obese subjects could be one of the factors contributing to their energy intake. In a study Shah and Robert (1991) examined the studies that investigated food intake, physical activity, basal metabolic rate and thermogenesis etiology. Energy intake appears to be only weakly related to obesity, but diet contribution, especially dietary fat may make significant

contribution to body weight. Welle *et al.* (1992) reported that overweight women tended to expend more energy in terms basal metabolic rate.

For maintaining good health and physical efficiency the nutrients should be taken in correct proportion and in adequate amounts. The excess of proximate principles leads to over nutrition. However, their requirements vary according to nature of work and energy output of an individual. Thus it is the balance between energy intake and energy output which is an important deciding factor. The daily requirements of different nutrients have been recommended by various national and international bodies, like (a) Nutrition Expert Committee ICMR, India (1981); (b) Food and Nutrition Board, National Research Council, USA (1980) and (c) Human Nutritional Requirements, FAO/WHO (1974).

In the present study a dietary survey was conducted to study the food behaviour of the subjects. For this purpose oral questionnaire method for 24 hours' food recall was used. The nutrient intakes worked out were matched against the recommended allowances given by ICMR (2004).

Protein consumption by the females has been illustrated in Table 5.1. It is evident that more than two-fifth over all females (40.67%) consumed 80 to 100 gm protein per day; followed by 60 to 80 gm (33.33%) and 100 to 120 gm (20.33%). In addition 4.00% and 1.67% overall females used to take 40 to 60 gm and 120 to 140 gm protein in a day, respectively. . The mean ± SD amount of protein consumption was assessed 83.67 ± 24.54 gm per day. According to income category the mean ± SD consumptions of protein were obtained 73.00 ± 10.78 gm for low; 86.40 ± 14.87 gm for middle and 98.40 ± 16.13 gm for high income group. The statistical analysis envisaged that the protein consumption was significantly increasing with the increase in income ($p < 0.001$[***]).

Indian Council of Medical Research (2004) recommends 50 gm RDA of protein to the females employed in sedentary moderate or heavy activities. In view of this recommendation only 20% overall females were consuming proper quantity of the protein, whereas majority of them (98.00%) were taking protein more than their requirements. According to income category, 96.0% low; 98.5% middle and 99.5% high income females consumed more than the recommended amount of protein. This high consumption of protein is one of the vital cause of overweight and obesity in them.

In a study held in Varanasi Asthana nee Sahay (1993) have also reported high protein consumption in comparison to RDA by the obese females. Mikkelson *et al.* (2000) mentioned that high protein diet might increase 24-hours energy expenditure by 2 to 3%, such on effect can not account for more than a small fraction of the observed weight loss, while Porrini *et al.* (1997) expressed that high protein content induces a stronger satiating effect than fat and carbohydrate.

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Further, consumption of fat by the females has been shown in Table 5.2. It is observed that more than one-third overall females (33.67%) consumed 60 to 80 gm fat in a day; followed by 80 to 100 gm (30.67%); 40 to 60 gm (16.67%) and 100 to 120 gm (14.67%). The mean ± SD daily consumption of fat by these females was computed 79.60 ± 21.35 gm. According to income category, the females related to low; middle and high categories consumed fat 60.40 ± 11.88 gm; 80.00 ± 15.70 gm and 98.40 ± 16.13 gm, respectively. The statistical analysis suggested that the mean consumption of fat is significantly increasing with income ($p < 0.001^{***}$) i.e. the consumption of fat is directly dependent on income status of the subjects.

The RDA of fat consumption has been mentioned 20 gm in a day for the non-pregnant females (ICMR, 2004). In this perspective, the over weight and obese females in every income category consumed more and more than the recommended allowance. The fat consumption in the study subjects are more than three to five times of the RDA (ICMR, 2004).

The findings of the present study has full agreement with the figures of fat consumption reported by Asthana nee Sahay (1993) in a study conducted in Varanasi. In her study, the researcher has mentioned beyond 30 gm of fat consumption by all the obese subjects.

Consumption of carbohydrate has been presented in Table 5.3. It is observed that more than two-fifth overall females consumed 400 to 500 gm of carbohydrate in a day; followed by 300 to 400 gm (29.00%) and 500 to 600 gm (19.67%). The mean ± SD consumption was assessed 441.33 ± 88.79 gm. According to income category, the mean ± SD consumptions were obtained 455.00 ± 90.31 gm for low; 437.00 ± 84.88 gm for middle and 432.00 ± 90.32 gm for high income category. The statistical analysis conveyed that similar mean amount of carbohydrate is consumed by the females in all the three income categories ($p > 0.05$ NS).

When the calorie equivalence is determined by the mean consumption of carbohydrate it was assessed that 77.45%; 74.38% and 73.53% RDA requirement of the calorie is fulfilled in the females related to income groups low, middle and high respectively. This finding shows that the diet in the present study is mainly based on carbohydrate sources. Duvigneaud *et al.* (2007) have also reported significantly higher percentages of energy from protein, carbohydrate and fibre, and lower percentage of energy intake from fat. Similar observations were also reported by Flegal *et al.* (2002) and Wright (2004).

So far as energy consumption is concerned (Table 5.4), it was observed that nearly one-fifth overall females (19.67%) consumed 2500 to 2750 Kcal per day; followed by 2250 to 2500 Kcal (19.00%); 2750 to 3000 Kcal (17.00%) and 3000 to 3250 Kcal (12.33%). The overall mean ± SD amount of calorie consumption was accounted 2761.67 ±492.92 Kcal and this mean amount is equivalent to 124.12% of

the RDA. According to income category, the mean ± SD amounts of energy consumption were obtained 2652.50 ± 508.63 Kcal for low; 2787.50 ± 550.52 Kcal for middle and 2845.00 ± 452.66 Kcal for high income category. These mean amounts are equivalent to 119.21%; 125.28% and 127.87% of the RDA in low; middle and high income groups. High energy intake by the obese subjects has also been reported in an earlier study held in Varanasi (Asthana nee Sahay, 1993). These findings confirmed our hypothesis 'Nutrients are responsible to cause over weight and obesity'. The over weight and obese females in the present study consumed more amounts of protein fat carbohydrate and energy than the RDA.

Excess calcium consumption in obese women has been documented by the earlier workers Duvigneaud *et al.*, (2007). These authors reported that women with abdominal obesity showed a significantly higher calcium intake compared to lean women, but this trend was not significant in men.

In the present study (Table 5.5), more than one-fifth overall females (23.67%) consumed 600 to 800 mg of calcium in a day; followed by 400 to 600 mg (18.33%); 800 to 1000 mg (16.67%) and 1000 to 1200 mg (14.00%). The mean ± SD amount of calcium intake was assessed 913.33 ± 336.15 mg. In view of recommended allowance, the mean consumption of calcium is 228.33% of the RDA. The recommended daily allowance of calcium is 400 mg (ICMR, 2004). According to income category, the mean ± SD amounts of calcium were ascertained 758.0 ± 283.26 mg; 902.00 ± 405.51 mg; and 1080.00 ± 380.85 mg for the females related to low; middle and high income groups, respectively. It is very interesting that the consumption of calcium is significantly increasing with the advancement of income ($p > 0.05$ NS). This finding established that the females in the present study were consuming calcium nearly two times or more than two times of the RDA.

So far as consumption of iron is concerned, the daily recommended allowance is 30 mg in Indian women (ICMR, 2004) involved in sedentary works. In the present study (Table 5.6), nearly one-third overall females (30.00%) consumed 20 to 30 mg of iron; while 29.67%; 16.33% and 17.33% overall females were consuming 30 to 40 mg; 40 to 50 mg and 50 to 60 mg of iron in a day. The mean ± SD amount iron consumption was computed 37.60 ± 12.43 mg, and this mean amount was 125.33% of the RDA (ICMR, 2004). According to income category, the mean ± SD amounts of iron consumption were assessed 32.40 ± 10.11 mg; 39.40 ± 12.90 mg and 41.00 ± 12.47 mg, respectively for the females related to low; middle and high income categories. The females in middle ($t = 4.271$, df = 198, $p < 0.001$[***]) and high income ($t = 5.606$, df = 198, $p < 0.001$[***]) categories consumed quantity of iron more than the amount of iron consumed by the females in low income group. In other studies, more consumption of iron than the RDA was also reported Duvigneaud *et al.*, (2007) in obese women.

Effect of Nutrition Education Package

Effect of nutrition education has been evaluated in order to provide feed back to the beneficiaries and in accordance suggestions were given. The information of the post nutrition education period was compared with pre-education period and the effect of nutrition education programme was worked out.

Table 6.1 illustrates type and frequency of physical exercise practiced by the overweight and obese females at pre and post experimentation periods. It was observed that initially 59.00% females did not perform any kind of physical exercise, while after nutrition education 14.00% more females were encouraged to perform some sorts of physical exercise. Consequently at post implementation period, walking, yoga and cycling and Gym were performed by 26.67%; 38.67% and 2.67% females in comparison to 23.00%; 24.00% and 1.00% females at pre experimentation period. The statistical analysis evidenced that there was significant increase in physical activities due to implementation of nutrition education programme (χ^2 = 7.531, df = 1, þ < 0.01^{**}).

Even the frequency of physical activities were also found increased (χ^2 = 15.101, df = 3, þ < 0.01^{**}). The frequency of physical activities at post experimentation reached to 38.00% for daily; 5.33% for five days in a week and 11.33% for two days in a week from 31.00%; 0.67% and 9.33%, respectively at pre experimentation period.

At present television viewing has become an essential part of the modern life. It has become a prime source of entertainment, information and education and mostly the people are attached with television programmes. Initially 10.67% females did not view TV and after the education programme there was an increase of 4% in this behaviour. The mean ± SD period of TV viewing was computed 2.65 ± 1.21 hours at pre implementation of the nutrition programme and it reduced to 2.53 ± 1.34 hours at post implementation period. Though there was reduction of 0.12 hours in the period of TV viewing, but the mean difference of TV viewing was found statistically insignificant (t = 0.924, df = 448, þ > 0.05 NS).

Change in Food Habit (Table 6.3)

As majority of the females (95.3%) were vegetarian at the initial phase of the study, but this habit was not changed at the final stage (93.33%). The nutrition education has no impact to change the food habit of the females (χ^2 = 0.792, df = 2, þ > 0.05 NS). It was observed that there was change in meal requirement of the females. There were 97.33% females at post experimentation period against 92.00% at pre experimentation phase who required meal after feeling hungry. The change was found statistically significant (Z = 2.605, þ < 0.01^{**}). In addition feeling hunger during tension was significantly deteriorated (χ^2 = 9.968, df = 2, þ < 0.01^{*}); drinking tea or coffee was reduced (χ^2 = 11.056, df = 2, þ < 0.01^{**}); liking for sweets (χ^2 = 13.996, df = 3, þ < 0.01^{**}); use of cold drink (χ^2 = 9.911, df = 2, þ < 0.025^{**}); nibling between

meals (χ^2 = 34.965, df = 1, þ < 0.001***); participation in lunch party out side of the house and taking meal outside of the house (χ^2 = 43.731, df = 1, þ < 0.001***) were significantly changed after the nutrition education. Further habit of taking meal slowly (χ^2 = 12.811, df = 1, þ < 0.001***); and taking meal with family members (χ^2 = 6.499, df = 2, þ < 0.05*) were significantly enhanced. Instead of throwing left out foods, it was given to needy and hungry poor persons (χ^2 = 129.468, df = 2, þ < 0.001***) and it was the best utilization of the left out foods.

Above mentioned good practices regarding food consumption were developed in the subjects due to nutrition education provided to them.

Further use of salad (Table 6.4) increased significantly from 680.00% to 78.67% after the education programme (χ^2 = 5.590, df = 1, þ < 0.025**). Even the use of fruits daily (26.00%) or twice a week (68.00%) elevated to this level from 23.33% (daily) and 12.33% (twice a week), respectively. This finding showed significant change in the habit of using fruits (χ^2 = 176.428, df = 3, þ < 0.001***). Srivastava and Madhu (2005) suggested low carbohydrate diet in management of obesity by providing adequate quantity of salads and non-starchy vegetables. Duvigneaud *et al.* (2007) mentioned that energy content of fibre per unit weight food is low. Consequently, inclusion of fibre in a diet reduced energy density. Dietary fibre tends to reduce dietary intake by slowing digestion and absorption of nutrients, and by increasing the production of gut hormones enhancing satiety feeling. Moreover, some types of fibre reduce the overall absorption of fat and protein.

The proper knowledge of the nutrients (Table 6.5) enhances their consumption subject of availability and approachability depending on purchasing power of the beneficiary. The nutrition education programme was found successful to increase significantly the knowledge of the nutrients, like, protein; carbohydrate; fat; vitamins and minerals (χ^2 = 4.456, df = 1, þ < 0.05*). This finding is fully in accordance with the hypothesis that nutrition education enhances knowledge of the nutrients significantly.

Initially, nearly one-third females (30.67%) were not taking breakfast (Table 6.6), but this habit was reduced to 8.00% at post phase of the nutrition education, more than three-fifth females (62.67%); followed by 29.33% used to take breakfast frequently or daily instead of 41.67% and 27.67%, respectively from the initial phase (χ^2 = 31.392, df = 2, þ < 0.001***). Huenemann *et al.* (1966) noted a reduction in the number of breakfast eaten by the obese boys and girls.

The frequency of food consumption plays an important role in the genesis of obesity. It is known that taking one meal per day opposed to two or three has metabolic consequences independent of calorie intake. Epidemiological studies have shown a clear negative correlation between number of meals and obesity, therefore the meals, the greater the tendency towards obesity Fabray *et al.*, (1966). The

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frequency of eating also changes the metabolism of glucose and concentration of cholesterol. Cohn (1964) found that when normal volunteers ate several small meals a day, they had lower concentrations of cholesterol than when the same total intake was eaten in a few large meals. This reduction of cholesterol with frequent ingestion of small meals has been confirmed in other studies Yong *et al.*, (1972). Glucose tolerance curves were also improved when eating three or more meals as compared with one or two large meals. In brief, it can be said that frequency of eating is inversely related with obesity.

In the present study (Table 6.7), it was observed that overwhelming majority of the overweight and obese females (98.33%) consumed meal two times in a day; followed by three-times in a day before implementation of the nutrition education. There after providing nutrition education to these females 14.00% of them used to take meal three-times daily. The figures showed that 12.33% more females adopted three-times meal pattern instead of two-times a day. This quality of meal diversion is found statistically significant ($\chi^2 = 27.941$, df = 1, þ < 0.001^{***}). This habit will certainly prove a green signal towards improvement of obesity in the females.

It has already been mentioned that overweight and obese women reported a higher consumption of fats and proteins, whereas their energy percentages from carbohydrates and fibres were lower compared to their normal weight counterparts. It is therefore, for the sake of restricting overweight and obesity, more consumptions of protein, fat and sugar be avoided and on the other hand the energy intakes from carbohydrates and fibres should be encouraged. In the present study (Table 6.8), nearly one-third females (31.33%) restricted fatty food items before implementation of education programme. In addition 3.67%, 2.67% and 2.33% females also avoided intakes of sweets; gaseous and cold items, and fried items. After providing nutrition education to the females, 42.67%, 8.67% and 2.67% and again 2.67% of them started restriction of fatty items; sweets, fried items and gaseous and cold items, respectively. The restriction was found significantly associated with the nutrition education ($\chi^2 = 13.494$, df = 4, þ < 0.01^{**}). This finding suggested that there was significant change in habit of following restrictions of food items like, fatty, fried, sweets, gaseous and cold items before and after implementation of nutrition education package.

It has already been mentioned that every type of addiction is injurious and detrimental to health as this habit is directly or indirectly responsible to appetite and consumption of the nutrients. Various workers like, Calle (1999); Pischon *et al.* (2008) and Whitlock (2009) reported higher mortality in obese persons with smoking habit; while the mortality in non-smoking overweight and obese persons was normal. In the present study, the overweight and obese subjects (Table 6.9) were cautioned with the harmful consequences of the addiction, still only one percent subjects and 0.33% family members of the subjects left addiction habit. These changes are statistically insignificant (þ < 0.05 NS). This result showed that the nutrition

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education programme was unable to change the addiction habit of either of the subjects or of their family members. It is evident from the table that 13.00% subjects and 45.00% family members of the subjects were habituated with same sorts of addiction in the pre-experimental phase of the nutrition education programme. Further these figures reached to 14.00% (the subjects) and 45.33% (the family members of the subjects) after providing nutrition education to the subjects. Actually the nutrition education was not provided to the family members and they were indirectly educated through the overweight and obese subjects of the family, participating in the nutrition education programme. Change in addiction habit requires strong will power to leave it. Though through media and other communication sources, government and non-government agencies are trying their best to educate the people against addiction habit, still a high positive result is awaited.

A nutrition package for weight loss of the desired subjects was introduced according to calorie reduction schedule. The details are given elsewhere. The BMI of the subjects were worked out at two phases i.e. one before implementation of the nutrition package and second after the programme (Table 6.10). It was observed that initially 47.67% and 43.67% subjects were related to BMI categories 35.0 to 39.9 and 30.0 to 34.9, respectively. In addition 6.33% and 2.33% subjects belonged to BMI categories ≥ 40.0 and 25.0 to 29.9, respectively. It is applaudable that there were no subjects belonging to BMI category ≥ 40, after the implementation of the nutrition package. Majority of the subjects (80.0%), followed by 38.67% switched back to BMI categories 30.0 to 34.9 and 35.0 to 39.9, respectively. The mean $\pm$ SD values of BMI were ascertained 35.35 ± 3.23 and 34.52 ± 2.56 at pre and post phases of the programme. A reduction of 1.03 kg/m^2 has been found statistically significant (t = 3.677, df = 448, $p < 0.001$[***]). It is inferred that the nutrition package provided to the subjects was fully successful towards its role.

It has already been mentioned that skin-fold thickness (SFT) technique was also employed as an alternative method of obesity measurement. Accordingly, the SFT measurement of the subjects as per criteria documented by Durmin and Womersley (1974) was followed at beginning and after the implementation of nutrition package (Table 6.11). It was observed that initially 66.00% subjects were obese according to this procedure and remaining 25.00% and 9.00% subjects belonged to overweight (60 to 79.9 mm) and above normal (40 to 59.9 mm) categories. After providing nutritional package to the desired subjects, 49.33% were over-weighted (SFT: 60 to 79.9 mm); while 46.67% and 4.00% females were obese (SFT: ≥ 80 MM) and above normal (SFT: 40 to 59.9 mm), respectively. The mean $\pm$ SD values of SFT were assessed 81.35 ± 13.06 mm; and 78.48 ± 11.43 mm, respectively at pre and post phases of the nutrition education. An absolute reduction in SFT amounting 2.87 mm (mean difference of SFT assessed at pre and post phases) was found statistically significant (t =2.392, df = 448, $p < 0.02$[**]).

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Consumption of nutrients by the overweight and obese females at pre and post implementation periods of nutrition education package (Table 6.12).

Diet therapy is one of the most important strategies for weight loss and weight maintenance. The person should be put in negative energy balance, ideally 500 to 1000 Kcal less than RDA. An ideal reduction of 500 to 1000 gm per week is approved once the target is fixed, progress should be checked once a month. Reducing excessive food sources of fat and sugars can dramatically reduce calories for many overweight people (Srilakshmi, 2005).

In the present study (Table 6.12), the mean ± SD amounts of nutrients such as protein, fat, carbohydrate and energy were ascertained 83.67 ± 24.54 gm, 79.60 ± 21.25 gm, 441.33 ± 88.79 gm and 2761.67 ± 492.92 Kcal, respectively at pre implementation of the nutrition education. Further, mean ± SD values of these nutrients were reduced to 67.17 ± 13.19 gm, 47.83 ± 13.64 gm, 352.50 ± 73.70 gm and 2007.17 ± 373.96 Kcal at post education phase, respectively. It was further assessed that there was 19.72% reduction in mean amount of protein (t = 9.271, df = 448, þ < 0.001[***]); 39.91% reduction in mean amount of fat (t = 19.173, df = 448, þ < 0.001[***]); 20.13% reduction in mean amount of carbohydrate (t = 11.237, df = 448, þ < 0.001[***]) and 27.32% reduction in mean amount of energy (t = 18.076, df = 448, þ < 0.001[***]). The reductions in the nutrients due to nutrition education were found statistically significant.

It is reported that in low carbohydrate diet, the weight loss is associated with only the duration of diet and restriction of energy intake, not with carbohydrate restriction itself. Those on the low carbohydrate diet had lost 3 to 9 kg more weight after six months, but at 12 months the difference was no longer significant Stern *et al.*, (2004). Foster *et al.* (2003) mentioned the Atkins diet or an energy restricted diet with an energy content of 25% fat, 15% proteins, and 60% carbohydrate for reduction in weight. After 6 months the low carbohydrate group did better, with a weight loss of 7.0% (SD = 6.5) *Vs.* 3.2% (SD = 5.6, þ = 0.02), but after 12 months the difference between the groups was again no longer significant (4.4% *Vs.* 2.5%) (SD = 6.3). Astrup (2008) was also of the view that low carbohydrate diet is not a palatable diet in the long-run. The author described that the combination of reduction of dietary fat and energy, and increased physical activity has been shown to reduce the incidence of diabetes by 58% and reduction in dietary fat and increase in fibre were the strongest predictors of weight loss.

In the nutshell, the role of nutrition education was found significantly effective to enhance physical exercise (regular walking and practicing yoga); practicing good food habits along with adequate use of salad; fruits and green leafy vegetables (subject to availability and approachability); habit of taking breakfast regularly and required quantity of diets in more frequencies; avoiding sweet dishes; fatty-fried items

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and cold drinks; knowledge of nutrients and reduced period of TV viewing. In view of these findings the nutrition education has significant impact on food habit is accepted.

Chapter VI SUMMARY AND CONCLUSIONS

The present study entitled "A comparative study on Prevalence of Overweight and Obesity in various Income Group Females of Hathras City" was carried out with the following objectives:

$\Rightarrow$ To find out the effect of income on overweight and obesity.

$\Rightarrow$ To study the effect of age on overweight and obesity.

$\Rightarrow$ To study the effect of number of parity and marital status on overweight and obesity.

$\Rightarrow$ To study the influence of eating habit and type of food consumed on overweight and obesity.

$\Rightarrow$ To find out the effect of working mode on overweight and obesity.

$\Rightarrow$ To design simple nutrition education packages of low calorie diet.

$\Rightarrow$ To implement the nutrition education packages.

$\Rightarrow$ To evaluate the effect of package for recording feedback.

For the fulfilment of aforesaid objectives, the hypotheses framed were, (i) Income has no significant effect on the prevalence of overweight and obesity, (ii) The prevalence of overweight and obesity increases with the advancement of age of the subjects, (iii) Number of parity in the females is responsible to enhance the prevalence of overweight and obesity, (iv) The marital status has no positive role to effect overweight and obesity, (v) Eating habit significantly influences the prevalence of overweight and obesity, (vi) Consumption of extra energy by the nutrients is responsible to cause overweight and obesity, (vii) Working mode or physical activity has significant impact on overweight and obesity, and (viii) Nutrition education has significant impact on physical exercise, food habits and knowledge of nutrients.

Material and Methods

The informations were collected with the help of questionnaire cum interview technique. A pre-tested and pre-designed questionnaire having all relevant informations was used for this purpose. The study was conducted on 300 overweight and obese women aged 30 to 50 years from high, middle and low income groups of the study area considering equal number, i.e. one hundred from each group. Purposing sampling technique was employed for the selection of the overweight and obese subjects. The samples were taken from four areas namely, Mursan gate, Vidyapati nagar, Awas-Vikas colony and Delhi-wala chowk. From each area 75 subjects were selected. Various measurements on obesity were recorded. Twenty-four hours food

recall method was employed to assess the consumption of the nutrients by the overweight and obese females. The consumption of the nutrient was compared with RDA (ICMR, 2004) and the inference regarding its adequacy or surplus consumption was documented accordingly. Further, nutrition education package on "Low-calorie-diet" was provided to 150 subjects purposely selected from the previous sample. After a specific period, the informations were again recorded and finally compared with the initial informations gathered from the 300 overweight and obese subjects, in order to ascertain the impact of nutrition education.

In view of selecting 300 overweight and obese females, aged 30 to 50 years, 709 females of this specific group were contacted. Accordingly there was presence of 409 normal females in addition to 300 overweight (7 in number) and obese (293 in number) females. Consequently these numbers provide base for the computation of the figures related to general characteristics and prevalence of overweight and obesity. There after details of 300 overweight and obese subjects were considered as per requirement of the questionnaire.

The results were presented in the form of tables showing number and percentage of the variables. In case of frequency distribution of the quantitative data, mean ± SD were also worked out. Finally the results were inferred with the help of suitable statistical tools.

Results

More than two-fifth females from all the categories belonged to age group 45-50 years and the mean ± SD values of the age were assessed 42.5 ± 5.77 years for overweight; 42.5 ± 5.43 years for obese and 41.47 ± 5.76 years for normal females. The mean age of the obese females was found significantly more than the normal counterparts. Nearly three-fifth overweight females (57.14%) possessed university education, whereas 37.54% obese and 33.01% normal females were secondary and university educated, respectively. Majority of the normal (90.71%) and obese (88.74%) females were housewife, while more than half (57.14%) overweight females belonged to business class. Majority of the subjects were Hindu. Majority of the females in all the categories belonged to nuclear families. There was significant association between socio-economic status and category of the females. Married females prevailed in all the categories. The mean ± SD family size of normal, overweight and obese females were assessed 5.01 ± 1.62; 5.00 ± 0 and 5.16 ± 1.78, respectively and they were found statistically similar.

The overall prevalence of overweight and obesity in Hathras city was observed 42.31%. According to age structure overweight and obesity combined was 45.95% in 45-50 years; 45.04% in 40 to 45 years; 40.00% in 35 to 40 years and 32.69% in 30 to 35 years age group. The prevalence of overweight and obesity was found statistically similar in all the age groups. The minimum prevalence of

overweight and obesity occurred in illiterate females (31.91%), while it was highest in secondary educated females (47.25%). Similarly it was highest in business class (63.64%) and lowest in housewives (41.39%). The prevalence of disease was only 12.50% in hard working females; while 59.62% females with sedentary working were involved with the disease. The association was found statistically significant. Further the prevalence was found significantly increasing with their income. Family structure and family size could not influence the disease. Though the prevalence of the disease was high in married females and high parity, but these findings could not be statistically evidenced. Obesity and hypertension were more common family history either in maternal or paternal side.

It was observed that nearly half of the overall subjects (47.67%) were obese grade II (35.0 to 39.9); followed by obese grade I (30.0 to 34.9) (43.67%). In addition 6.33% and 2.33% overall females were obese grade III and overweight, respectively. As BMI is not an exact measure of body fat; and therefore SFT based on four sites (suggested by Durnin and Womersley, 1974) was also considered. Accordingly normal SFT measured from 40 to 59.9 mm; overweight from 60 to 79.9 mm and $\geq$ 80.00 as obese subjects. According to these criteria 66.00% females were detected obese; whereas 25.00% and 9.00% females were overweight and above normal respectively.

Consumption of nutrients by the subjects

For maintaining good health and physical efficiency, the nutrients should be taken in correct proportion and in adequate amounts. In the present study a dietary survey was conducted to study the food behavior of the subjects. For this purpose oral questionnaire method for 24 hours' food recall was used. The nutrient intakes worked out were matched against the RDA recommended by the ICMR (2004).

The mean $\pm$ SD amount of protein consumption was assessed 83.67 $\pm$ 24.54 gm per day. According to income category, the mean $\pm$ SD consumptions of protein were obtained 73.00 $\pm$ 10.78 gm for low; 86.40 $\pm$ 14.87 gm for middle and 98.40 $\pm$ 16.13 gm for high income group. The statistical analysis evidenced that the protein consumption was significantly increasing with the increase in income. In view of ICMR (2004) recommendation majority of the overweight and obese females (98.00%) consumed more than the recommended amount of 50 gm protein.

Similarly mean $\pm$ SD amount of fat consumption by the subjects was assessed 79.60 $\pm$ 21.35 gm According to income category, the females related to low; middle and high categories consumed 60.40 $\pm$ 11.88 gm; 80.00 $\pm$ 15.70 gm and 98.40 $\pm$ 16.13 gm fat, respectively. The fat consumption was also found significantly increasing with the advancement of income of the subjects. The RDA of fat consumption has been mentioned 20 gm in a day for the non-pregnant females (ICMR, 2004). In this perspective the overweight and obese females in every income category, consumed

more and more than the recommended allowance. The present fat consumption is more than three to five times of the RDA. So far as carbohydrate consumption by the subjects was concerned, it was assessed 441.33 ± 88.79 gm per day. According to income category, the mean $\pm$ SD consumptions of carbohydrate were obtained 455.00 ± 90.31 gm for low; 437.00 ± 84.88 gm for middle and 432.00 ± 90.32 gm for high income category. The statistical analysis conveyed that similar mean amount of carbohydrate is consumed by the subjects in all the three income categories.

When the calorie equivalence is determined by the mean consumption of carbohydrate, it was assessed that 77.45%; 74.38% and 75.53% RDA requirement of the energy is fulfilled in the subjects related to low; middle and high categories, respectively. This finding shows that the diet in the present study is mainly based on carbohydrate sources.

The overall mean $\pm$ SD amount of calorie consumption was accounted 2761.67 ± 492.92 Kcal by the protein; fat and carbohydrate sources and this mean amount is equivalent to 124.12% of the RDA. According to income category, the mean $\pm$ SD amounts of energy consumption were obtained 2652.50 ± 508.63 Kcal for low; 2787.50 ± 550.50 Kcal for middle and 2845.00 ± 452.66 Kcal for high income category. These mean amounts are equivalent to 119.21%; 125.28% and 127.87% of the RDA in low; middle and high income groups. The extra consumptions of the fat, protein; carbohydrate and energy by the subjects were responsible for causing overweight and obesity in them.

Impact of Nutrition Education Package

Effect of nutrition education has been evaluated in order to provide feed back to the beneficiaries and in accordance suggestions were given. The information of the post nutrition education period was compared with pre education period and the effect of nutrition education programme was worked out.

It was observed that initially 59.00% females did not perform any kind of physical exercise, while after nutrition education 14.00% more females were encouraged to perform some sorts of physical exercise. Consequently at post implementation period, walking, yoga and cycling or gym. was performed by 26.67%; 38.67% and 2.67% females in comparison to 23.00%; 24.00% and 1.00% females at pre experimentation period. The statistical analysis evidenced that there was significant increase in physical activities due to implementation of nutrition education programme. On the other hand period of TV viewing was found reduced.

Change in food habit

There were 97.33% females at post experimentation period against 92.00% at pre experimentation phase who required meal after feeling hungry. In addition feeling hunger during tension was significantly deteriorated; drinking tea or coffee was reduced; liking for sweets; use of cold drink; nibling between meals; participation in

lunch party out side of the house and taking meal were significantly changed after the nutrition education. Further habit of taking meal slowly and taking meal with family members were significantly enhanced. As best utilization of the left out foods, instead of throwing it, it was given to needy and hungry poor persons. Further use of salad increased significantly after the education programme. Even the use of fruits daily or twice a week elevated.

Above mentioned practices regarding food consumption were developed in the subjects due to nutrition education provided to them. Further the programme was found successful to increase significantly the knowledge of nutrients like; protein; carbohydrate; fat; vitamins and minerals. There was significant change in meal frequency; habit of following restrictions of food items like, fatty, fried, sweets (sugar), gaseous and cold items before and after implementation of nutrition education. These findings are fully in accordance with the hypothesis that nutrition education enhances knowledge status of the subjects.

Change in anthropometric measurements

The mean ± SD values of BMI were ascertained 35.35 ± 3.23 and 34.32 ± 2.56 at pre and post phases of the programme. A reduction of 1.03 kg/m^2 has been found statistically significant. Skin-fold thickness technique was also employed as an alternative method of obesity measurement. It was observed that initially 66.00% subjects were obese according to this procedure and remaining 25.00% and 9.00% subjects belonged to overweight (60.0 to 79.0 mm) and above normal (40 to 59.9 mm) categories. After providing nutrition education to the subjects, 49.33% were overweight (SFT: 60 to 79.9 mm); while 46.67% and 4.00% females were obese (SFT: ≥ 80.00 mm) and above normal (SFT: 40 to 59.9 mm), respectively. The mean ± SD values of SFT were assessed 81.35 ± 13.06 mm; and 78.48 ± 11.43 mm; respectively at pre and post phases of the nutrition education. A reduction in SFT amounting 2.87 mm (mean difference of SFT assessed at pre and post phases) was found statistically significant. It is inferred that the nutrition package provided to the subjects was fully successful towards its role.

Consumption of nutrients by the overweight and obese subjects at pre and post phases of nutrition education

Diet therapy is one of the most important strategies for weight loss and weight maintenance. The person should be put in negative energy balance, ideally 500 to 1000 Kcal less than RDA. The mean ± SD amounts of nutrients such as, protein; fat; carbohydrate and energy were ascertained 83.67 ±24.54 gm; 79.60 ± 21.25 gm; 441.33 ± 88.79 gm and 2761.67 ± 492.92 Kcal, respectively at pre implementation phase of the nutrition education. Further, mean ± SD values of these nutrients were reduced to 67.17 ± 13.19 gm; 47.83 ± 13.64 gm; 352.50 ± 73.70 gm and 2007.17 ± 373.96 Kcal respectively at post education phase. It was observed that there was

19.72% reduction in mean amount of protein; 39.91% in fat; 20.13% in carbohydrate and 27.32% reduction in mean amount of energy. The reductions in the nutrients due to nutrition education were found statistically significant.

In a nutshell, the role of nutrition education was found significantly effective to enhance physical exercise (regular walking and practicing yoga); practicing good food habits along with adequate use of salad; fruits and green leafy vegetables; habit of taking breakfast regularly and required quantity of diet in more frequency; avoiding sweet dishes; fatty-fried items and cold drinks, knowledge of nutrients and reduced period of TV viewing. In view of these findings the nutrition education has significant impact on food habit is accepted.

Chapter VII   RECOMMENDATIONS

In view of the results of the present study, following recommendations are being given:

(1)   It is necessary to improve the knowledge of the females regarding basic nutrients and their importance in the diet. This should be provided to them through various educational methods, e.g., low calorie diet chart cooking demonstration of low calorie and zero-oil recipes.

(2)   The females belonging to obese grade I, II and III need to acquire more education regarding low calorie diet recipes, physical activities like exercise cycling, walking, dancing and yoga. Besides the education packages designed and used in the present study the researcher has a specific suggestion for an additional programme of better nutrition education of the females through a cooking demonstration of zero-oil recipes. This demonstration should be aimed at giving knowledge about the low fat in the diet needed for overweight and obese females in comparison to the normal weight females. The participation of females in the demonstration of getting low calorie and zero-oil recipe will probably yield better result.

(3)   Promotion of using salad and raw vegetable and fruits such as cucumber, spinach, tomato, etc. for reducing fat in the body for the overweight and obese females should be organized to get better nutrition education package.

(4)   As regards overweight and obesity different types and effective education technique are needed to change the standing tradition of taking milk at night instead of encouraging the females for taking milk in the morning or evening.

(5)   In the present study after giving nutrition education package none of the females from various demographic characteristics favoured to accept low calorie diet according to BMI and demonstration of zero-oil recipes, such as suji ka upma, sprouted moong chaat one of the main reason responsible for this finding was their low economic status. It is therefore recommended that in order to bring change in selection of recipes income raising activities are needed to enhance the financial status of the family.

(6)   In respect of the component of obesity management, the finding of the present study indicated that females were highly knowledgeable about causes, prevention of the obesity, physical activity, low calorie and zero-oil recipes in the correct method of preparation. Therefore in order to promote obesity management through walking in fast 45 minutes, low fat content physical activity, change the dietary pattern including discouraging the consumption of fast foods (fatty, fried

and junk foods as well as cold drinks including beverages). Females are required to be given live demonstration for home.

(7)   Reduction in TV viewing and media use should be encouraged.

(8)   In addition the females should be encouraged to monitor their life style.

(9)   Nutrition education package-After going through the experience of collection of information to get an idea about the demographic characteristics and to identify the components where nutrition education was needed and consequently designing, implementing and evaluating the nutrition packages, the following recommendations have emerged out:

a)   It is necessary to critically study and assess the existing material, modify it, if necessary or prepare absolutely new educational material keeping in mind the existing problems of nutrition and the latest developments in the field of nutrition. During the initial designing, care should be taken to prepare simple, easily understandable and effective nutrition education packages.

b)   The comprehension, capability and literacy status of a particular group of females for whom the program is to be designed, should be found out, otherwise the packages may not be effective.

c)   The nutrition education packages should go through a constant monitoring and assessment process to get the desired results.

d)   The educators who implement the nutrition education packages in the field should be first of all willing and interested in the programs. They should also have a thorough knowledge of the packages and the community.

e)   In order to get lasting results conduction of nutrition education programs once or twice is not enough, but persistent and continuously repeated efforts will be needed to bring about a change in the practices of the females.

f)   Generally nutrition education is neglected in the low income group of females and therefore this programme should compulsorily be operated in this group.

g)   Majority of the high income females suffering with hypertension, coronary heart disease and diabetes due to overweight and obesity are at the stake of mortality, need this type of nutrition education programme. Nutrition education may be done through a series of education by training program; conducted by dietitians and home-scientists. This should be carried out through community participation by involving V.L.C.C. (Vandana Luthara Curve and Curl) slimmer centre, Gym and other interested volunteers. An all round participatory approach on the part of the education may lead to beginning of a new nutritional revolution in our country.

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APPENDIX – A

Questionnaire for Baseline Information and post evaluation

(1)

A. General Information :-

उत्तरदायी का नाम –

उत्तरदायी की आयु (वर्ष में)–

उत्तरदायी का शिक्षा का स्तर–   अशिक्षित / प्राइमरी / सेकेन्डरी / टेक्नीकल / विश्वविद्यालय / अन्य

व्यवसाय–   गृहणी / नौकरी / व्यापार

परिवार का मुख्य व्यवसाय–

जाति–   सामान्य / अनुसूचित जाति / अनुसूचित जनजाति / अन्य

धर्म–   हिन्दू / मुस्लिम / सिक्ख / ईसाई

परिवार की कुल मासिक आय–

प्रति व्यक्ति आय–

परिवार की संरचना–   संयुक्त / एकांकी

परिवार के सदस्यों की कुल संख्या–

B. Specific Information :-

वैवाहिक स्थिति–   अविवाहित / विवाहित / विधवा

यदि विवाहित हैं तो बच्चों की संख्या–

सबसे छोटे बच्चे की आयु–

सबसे बड़े बच्चे की आयु–

1. क्या आप अधिक भारिता और मोटापा के बारे में जानती हैं ?

   (i) हाँ   (ii) नहीं

2. यदि हाँ तो क्या जानती हैं ?

   (i) उम्र से अधिक लगना   (ii) लम्बाई के अनुसार वनज का ज्यादा होना

   (iii) सामान्य वजन से 10 और 20 प्रतिशत ज्यादा होना   (iv) उपर्युक्त सभी

3. क्या आपको मौटापे से कोई परेशानी होती हैं ?

   (i) हाँ   (ii) नहीं

4. यदि हाँ तो किस प्रकार की परेशानी होती हैं ?

   ....

   ....

5. आपके परिवार में माता या पिता की ओर से कोई व्यक्ति निम्न बीमारियों से ग्रसित है।

बीमारियाँ	मातृपक्ष	पितृपक्ष
1. मोटापा		
2. मधुमेह		
3. उक्त रक्तचाप		
4. कोरोनरी हृदय सम्बन्धी बीमारी–		
5. पित्ताशय		
6. कोई अन्य		

6. आप दिन भर में कितने घण्टे काम करती हैं ?

7. आप दिन भर में कितने घण्टे आराम करती हैं ?

8. आप घर में किस तरह का काम करती हैं ?

Activity Pattern Work	Time in Minutes
1. खाना बनाना	....
2. सफाई करना	....
3. बर्तन साफ करना	....
4. कपड़े धोना	....
5. जानवरों की देखभाल	....
6. गोबर उठाना	....
7. सोना	....
8. नहाना	....
9. टी.वी. देखना	....
10. रेडियो सुनना	....
11. पढ़ना (अखबार आदि)	....
12. अन्य	....

9. क्या आप व्यायाम करती हैं ?

(i) प्रतिदिन   (ii) सप्ताह में 5 दिन   (iii) सप्ताह में दो दिन   (iv) कभी नहीं

10. आप कौन सा व्यायाम करना पसन्द करती हैं

(i) टहलना   (ii) खेलना   (iii) नृत्य करना   (iv) योगा   (v) साइकिलिंग और जिम

11. आप व्यायाम कहाँ करती हैं और क्या–क्या करती हैं ?

      (i) Health Club   (ii) Fitness Centre (iii) Home

(a)   ....

(b)   ....

(c)   ....

(d)   ....

(e)   ....

12. आप किसी प्रकार के खेलकूद में भाग लेती हैं ?

  (i) बास्केट बाल   (ii) बालीबाल   (iii) बैडमिन्टन (iv) अन्य

13. आप कितने घण्टे बैठकर टी.वी. देखती हैं

  (i) 4 घण्टे   (ii) उससे भी ज्यादा   (iii) उससे कम

14. आप शाकाहारी हैं या मांसाहारी या केवल अण्डे का सेवन करती हैं।

15. आप अच्छी तरह भूख महसूस होने पर ही भोजन करती हैं।

  (i) हाँ   (ii) नहीं

16. क्या आपकों तनाव के समय भूख लगती हैं ?

  (i) बहुत ज्यादा भूख   (ii) कम भूख का लगना   (iii) बिल्कुल भूख नहीं लगती है

17. आप चाय, काफी दिन में कितनी बार लेती हैं ?

  (i) एक बार   (ii) दो बार   (iii) या उससे ज्यादा

18. आप मिठाईयाँ पसन्द करती हैं ?

  (i) हाँ   (ii) नहीं

19. यदि हाँ तो एक दिन में कितनी बार ?

20. शीतल पेय जल (Cold drink) पीती हैं ?

  (i) हाँ   (ii) नहीं

21. यदि हाँ तो कौन–कौन से

  ....

.22. शीतल पेय पदार्थ (Cold drink) दिन में कितनी बार लेती हैं ?

  (i) एक बार   (ii) दो बार   (iii) तीन बार

23. क्या आपको दो भोजन के बीच में भी कुछ–कुछ खाने की आदत है ?

24. यदि हाँ तो क्या–क्या खाती हैं ?

25. घर से बाहर भोजन करना पसन्द करती हैं ?

  (i) हाँ   (ii) नहीं

26. यदि हाँ तो कब–कब ?

27. व्यवसाय अथवा नौकरी से सम्बन्धित लंच पार्टी में जाती हैं।

   (i) हाँ   (ii) नहीं

28. क्या आप किसी किटी पार्टी की सदस्या हैं ?

   (i) हाँ   (ii) नहीं

29. यदि हाँ तो किटी पार्टी में कब–कब भाग लेती हैं ?

30. खाने की मेज पर बचे खाने का क्या करती हैं ?

   (i) खा लेती हैं   (ii) फेंक देती हैं   (iii) किसी को दे देती हैं

31. क्या आप खाना बहुत जल्दी खा लेती हैं या फिर धीमे–धीमे खाती हैं।

32. आप भोजन किसके साथ करती हैं ?

   (i) अकेले   (ii) परिवार के सदस्यों के साथ (iii) टी.वी. देखते हुए   (iv) दोस्तों के साथ

33. आपको आहार में उपस्थित पोषक तत्वों के बारे में जानकारी हैं ?

   (i) हाँ   (ii) नहीं

34. आप किन–किन पोषक तत्वों के बारे में जानती हैं ?

   (i) प्रोटीन   (ii) कार्बो हाइड्रेट   (iii) वसा   (iv) विटामिन   (v) खनिज लवण

35. क्या आप अपने भोजन में सलाद का प्रयोग करती हैं ?

   (i) हाँ   (ii) नहीं

36. आप फल लेना पसन्द करती हैं ?

   (i) प्रतिदिन   (ii) सप्ताह में एक दिन   (iii) सप्ताह में दो या तीन दिन

37. आप सुबह का नाश्ता लेना पसन्द करती हैं ?

   (i) प्रतिदिन   (ii) कभी–कभी

38. आप एक दिन में भोजन (proper meal) कितनी बार लेती हैं ?

   (i) दो बार   (ii) तीन बार

39. आप नाश्तें में क्या–क्या खाती हैं ?

Diet History	Types of the food Consumed
Meal	भोज्य पदार्थों के नाम
1. नाश्ता (सुबह)	....
2. दोपहर का खाना	....
3. शाम का नाश्ता	....
4. रात का खाना	....
5. कोई अन्य चीज (जो बीच में खाती हों)	....

40. क्या आप अधिक भारिता व मोटापा को कम करने के लिये भोजन में कोई परहेज करती हैं ?

   (i) हाँ   (ii) नहीं

41. यदि हाँ तो किस प्रकार का परहेज करती हैं ?

42. क्या आप अधिक भारिता व मोटापा को कम करने के लिये दवाईयों का प्रयोग करती हैं ?

   (i) हाँ   (ii) नहीं

43. यदि हाँ तो वह दवाईयाँ किस प्रकार की होती हैं ?

44. क्या आपकों थाइराइड की समस्या हैं ?

   (i) हाँ   (ii) नहीं

45. यदि हाँ तो क्या आपने थायरॉयड टेस्ट करवाया है ?

   (i) हाँ   (ii) नहीं

46. क्या आप पान तम्बाकू खाती हैं ?

   (i) हाँ   (ii) नहीं

47. यदि हाँ तो क्या–क्या खाती हैं ?

   (i) पान   (ii) तम्बाकू   (iii) बीड़ी–सिगरेट   (iv) रजनी गंधा

48. कितने समय के अन्तराल पर खाती हैं ?

   (i) दिन भर में एक बार   (ii) 2 बार   (iii) 5–6 बार

49. क्या आपके परिवार में कोई और भी पान–तम्बाकू खाता हैं ?

   (i) हाँ   (ii) नहीं

C.   **"शारीरिक माप – (Anthropometric measurements)**

   लम्बाई (मी.)–

   otu (किग्रा.)–

   Skinfold thickness

   (a) Biceps -

   (b) Triceps -

   (c) Suprailliac -

   (d) Subscapulla –

D.   24 घण्टे की आहार संस्मरण तालिका–

   1. नाश्ता–

   2. दोपहर का भोजन–

3. शाम का नाश्ता—

4. रात का खाना—

APPENDIX – B

Nutrition education Packages for overweight and obese

(i) Low calorie diet chart according to BMI

a) 1000 किलो कैलोरी का डायट चार्ट

प्रातः काल—	**चाय**	—	1 कप
6.00 बजे	स्कीम दूध	—	30 मिली
	चीनी	—	1/4 चम्मच (1.25 ग्राम)
सुबह का नाश्ता —	**काले चने**	—	1 कटोरी
	चना	—	30 ग्राम
10.00 बजे	पपीता	—	1 प्लेट (60 ग्राम)
दोपहर का खाना—	**रोटी**	—	3 (60 ग्राम)
	लौकी चने की दाल	—	1 कटोरी
	चने की दाल	—	30 ग्राम
	लौकी	—	50 ग्राम
	रिफाइन्ड तेल	—	2.5 ग्राम
	खीरे का रायता	—	1 कटोरी
	दही	—	75 ग्राम
	खीरा	—	100 ग्राम
	सलाद	—	1/2 प्लेट
	गाजर	—	25 ग्राम
	टमाटर	—	25 ग्राम
	नीबू	—	25 ग्राम
शाम की चाय —	**चाय**	—	1 कप
	स्कीम दूध	—	30 मिली
	चीनी	—	1/2 ग्राम
रात का खाना —	**रोटी**	—	2 (40 ग्राम)
	सूखी सब्जी	—	1 कटोरी
	काशी फल	—	(100 ग्राम)
	रिफाइन्ड तेल	—	2.5 ग्राम

	सूप	—	1 कटोरी
	पालक	—	100 ग्राम
	टमाटर	—	50 ग्राम
रात को सोते समय–	**दूध**	—	1 गिलास
	चीनी	—	1/2 चम्मच (2.5 ग्राम)

b) 1200 किलो कैलोरी का डायट चार्ट

सुबह की चाय–	**चाय**	—	1 कप
	स्कीम दूध	—	30 मिली
	चीनी	—	2.5 ग्राम
सुबह का नाश्ता –	**लोबिया**	—	1 कटोरी (30 ग्राम)
	टमाटर	—	25 ग्राम
	प्याज	—	25 ग्राम
10.00 बजे प्रातः –	**सन्तरे का जूस**	—	1 गिलास
दोपहर का भोजन–	**रोटी** (पतली)	—	2 (40 ग्राम)
	मूंग की दाल	—	1 कटोरी (30 ग्राम)
	घी	—	2.5 ग्राम
	रायता	—	1 कटोरी
	पालक	—	100 ग्राम
	दही	—	75 ग्राम
	सलाद	—	1/2 प्लेट
	टमाटर	—	25 ग्राम
	प्याज	—	25 ग्राम
	गाजर	—	25 ग्राम
	खीरा	—	50 ग्राम
शाम की चाय –	**चाय**	—	1 कप
	स्कीम दूध	—	30 मि.ली.
	चीनी	—	2.5 ग्राम
6.00 शाम –	**स्कीम दूध**	—	1/2 गिलास (125 मि.ली.)
	चीनी	—	1/2 चम्मच
रात का खाना –	**रोटी** (पतली)	—	3
	सब्जी		
	लौकी	—	1 कटोरी
	रिफाइन्ड तेल	—	1/2 ग्राम
	रायता	—	1 कटोरी
	दही	—	75 ग्राम

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	खीरा	–	50 ग्राम
	सूप	–	1 कटोरी
	पालक	–	100 ग्राम
	टमाटर	–	100 ग्राम
	गाजर	–	75 ग्राम
रात को सोते समय–	**दुध**	–	3/4 गिलास
	चीनी	–	1/2 चम्मच

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c) 1400 किलो कैलोरी का डायट चार्ट

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सुबह की चाय–	**चाय**	–	1 कप
	स्कीम दूध	–	35 मि.ली.
	चीनी	–	1/2 चम्मच
सुबह का नाश्ता–	**दूध**	–	1/2 गिलास
	चीनी	–	5 ग्राम
	लोबिया	–	1 कटोरी
	टमाटर	–	50 ग्राम
	प्याज	–	50 ग्राम
10.00 बजे	**मौसमी जूस**	–	1 गिलास
दोपहर का खाना–	**रोटी** (पतली)	–	3 (60 ग्राम)
	दाल	–	1 कटोरी
	धुली मूँग	–	30 ग्राम
	सूखी सब्जी	–	1 कटोरी
	काशीफल	–	100 ग्राम
	रिफाइन्ड तेल	–	2.5 ग्राम
	रायता	–	1 कटोरी
	दही	–	75 ग्राम
	खीरा	–	50 ग्राम
	पपीता	–	1 प्लेट (100 ग्राम)
	सलाद	–	1 प्लेट
	टमाटर	–	50 ग्राम
	प्याज	–	50 ग्राम
	खीरा	–	50 ग्राम
शाम की चाय –	**चाय**	–	1 कप
	स्कीम दूध	–	30 मि.ली.
	चीनी	–	2.5 ग्राम
रात का खाना –	**रोटी** (पतली)	–	3 (60 ग्राम)
	रसेदार सब्जी	–	1 कटोरी (100 ग्राम)
	लौकी	–	100 ग्राम
	रिफाइन्ड तेल	–	2.5 ग्राम
	रायता	–	1 कटोरी

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	पालक	–	100 ग्राम
	दही	–	75 ग्राम
	सूप	–	1 गिलास
	पालक	–	300 ग्राम
	टमाटर	–	100 ग्राम
	गाजर	–	100 ग्राम
रात सोते समय –	**स्कीम दूध**	–	3/4 गिलास (187.5 ग्राम) ;k पौन गिलास
	चीनी	–	पौन चम्मच (3.75 ग्राम)

d) 1600 किलो कैलोरी का डायट चार्ट

सुबह की चाय–	**चाय**	–	1 कप
	स्कीम दूध	–	30 मि.ली.
	चीनी	–	2.5 ग्राम
सुबह का नाश्ता–	**काले चने**	–	1 कटोरी (30 ग्राम)
	टमाटर	–	50 ग्राम
	प्याज	–	50 ग्राम
10.00 बजे –	**मौसमी जूस**	–	1 गिलास
दोपहर का खाना–	**रोटी**	–	2 रोटी (40 ग्राम)
	दाल	–	1 कटोरी
	अरहर	–	30 ग्राम
	घी	–	2.5 ग्राम
	रायता	–	1 कटोरी
	पालक	–	100 ग्राम
	दही	–	75 ग्राम
	सलाद	–	1 प्लेट
	टमाटर	–	50 ग्राम
	प्याज	–	50 ग्राम
	खीरा	–	50 ग्राम
	गाजर	–	50 ग्राम
शाम का नाश्ता –	**दूध**	–	1/2 गिलास
	चीनी	–	5 ग्राम
	ब्रेड	–	4 स्लाइस
रात का खाना –	**रोटी**	–	3 (60 ग्राम)
	सूप	–	1 कटोरी
	टमाटर	–	100 ग्राम

	पालक	—	100 ग्राम
	गाजर	—	100 ग्राम
	सब्जी	—	1 कटोरी
	लौकी	—	100 ग्राम
	रिफाइन्ड	—	2.5 ग्राम
	दही	—	40 ग्राम
रात को सोते समय—	**दूध**	—	1 गिलास
	चीनी	—	5 ग्राम

(ii) Health and fitness tips

1. कम मूल्य (सस्ता) और बिना तेल की भोजन लेना है।

2. 45 मिनट तक तेजी से टहलना।

3. सप्ताह में पाँच दिना व्यायाम।

4. भोजन में कच्ची सब्जी व सलाद का ज्यादा प्रयोग तथा छिलके सहित भूने चने का प्रयोग करे।

5. अधिक रेशे वाला भोज्य पदार्थ जैसे— चोकर सहित आटे का प्रयोग, हरे पत्ते वाली सब्जी का प्रयोग।

6. 1/2 चम्मच मेथी दाना 1 कप पानी में रात भर भिगाने के बाद सुबह खाली पेट खाकर उस पानी को पीना।

7. जहाँ तक हो रात को सोते समय दूध का प्रयोग न करें।

8. तेल और धी का प्रयोग न करें और यदि करें भी तो रिफाइन्ड और सरसों के तेल का।

9. आलू चावल, चीनी का प्रयोग कम से कम करें।

10. खाना खाने से पहले 1 गिलास पानी पी ले तथा दिन भर में 7–8 गिलास पानी अवश्य पीये।
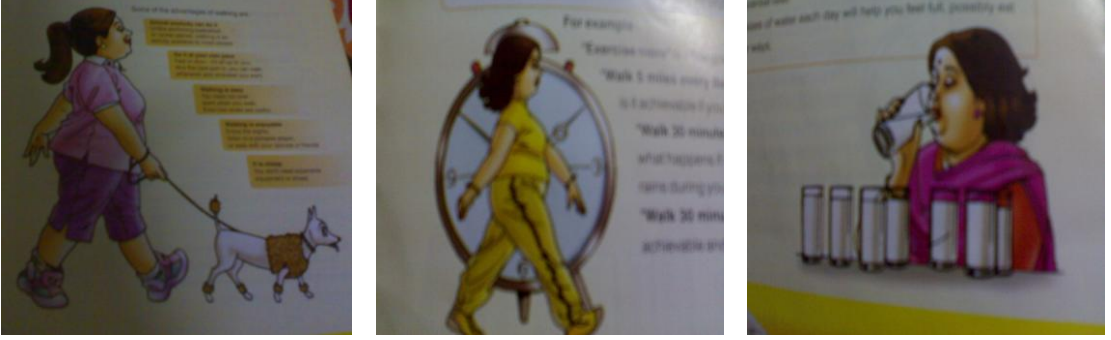
(iii) Cooking demonstration on low calorie and zero oil recipes

<div align="center">

सूजी का उपमा

</div>

सामग्री :–

सूजी	–	1 कप (100 ग्राम)
प्याज	–	20 ग्राम (बारीक कटी हुई)
टमाटर	–	25 ग्राम
हरी मिर्च	–	1
नमक	–	स्वादनुसार
नींबू	–	1 / 4 टुकड़ा
हरा धनिया	–	कटा हुआ
पानी	–	1–1 / 2 कप
राई	–	1 / 4 छोटा चम्मच
उड़द की दाल	–	10 ग्राम
करी पत्ता	–	5 – 6

विधि :–

- कड़ाही में रवा (सूजी) डाल कर भूनें।

- भूरा होने पर कड़ाही से उतार लें।

- हरी मिर्च, प्याज तथा करी पत्ता मिलाए। फिर इसको अच्छी तरह भूनें, जब तक ये गुलाबी न हो जाए।

- जब आपको लगे कि अच्छी तरह पक गई है तो इसमें कटे हुए टमाटर भूने फिर भुना हुआ रवा इसमें अच्छी तरह मिलाएँ।

- गर्म पानी डालें तथा हल्की आँच पर उसे 5 मिनट तक पकाएँ।

- नमक, तथा नींबू इकट्ठे मिलायें।

- पकाने के बाद कटा हुआ धनिया मिलाऐ।
- गरमा–गरम परोसे।

सूजी का उपमा

पोषक मूल्य –

सामग्री	मात्रा (ग्राम)	ऊर्जा (कैलोरी)	प्रोटीन (ग्राम)	वसा (ग्राम)	काबोहाइड्रेट (ग्राम)	कैल्सियम (मिग्रा)	आयरन (मिग्रा)
सूजी	100	348	10.4	0.8	74.8	16	1.6
प्याज	20	29.45	0.05	0.03	6.3	20	0.6
टमाटर	25	5	0.225	0.05	0.9	5	.45
उड़द दाल	10	34.7	2.4	.14	5.9	12	0.1
नीबू	1/4	14.2	0.22	0.075	2.77	17.5	0.57
कुल योग–		431.35	13.295	1.365	90.73	70.5	3.32

सूजी का चीला

सामग्री :–

मोटी सूजी	–	50 ग्राम (1/2 कप)
बेकिंग पाउडर	–	1/4 चम्मच
नमक	–	स्वादनुसार
सपरेटा दूध का दही	–	50 ग्राम (1/2 कप)

ऊपरी सजावट के लिए सामग्री :–

प्याज	–	20 ग्राम (1 छोटी बारीक कटी हुई)
शिमला मिर्च	–	25 ग्राम
टमाटर	–	25 ग्राम (1/2 कप, छिलका उतार, कर बारीक कटी हुई)
नमक	–	स्वादनुसार

विधि :–

- सूजी में दही मिला कर गाढ़ी पिट्ठी बनाएँ।
- इसमें बेकिंग पाउडर व नमक डाल कर अच्छी तरह मिलाए तथा नमक मिला कर 10 मिनट के लिए अलग रख दें।
- अगर पिट्ठी गाढ़ी हो तो 2 चम्मच पानी मिलाऐ।
- कम आँच पर तवा रख कर गर्म करें तथा नेपकीन से पोछें।
- एक चम्मच पिट्ठी तवे पर डालें तथा चीले की तरह फेला लें। यह ज्यादा पतला नहीं होना चाहिए।
- इस तरह और चीले को भी बनाए।
- जब चीला बन जाए तो ऊपर से टॉपिंग मिश्रण डालें।
- ध्यान से चीले को पलट लें ताकि दूसरी तरफ से भी पक जाए।

- तीन से चार मिनट बाद उतार लें तथा गरमागरम परोसें।

सूजी का चीला

पोषक मूल्य –

सामग्री	मात्रा (ग्राम)	ऊर्जा (कैलोरी)	प्रोटीन (ग्राम)	वसा (ग्राम)	काबोहाइड्रेट (ग्राम)	कैल्सियम (मिग्रा)	आयरन (मिग्रा)
सूजी	50	174	5.2	0.4	37.4	8	0.8
प्याज	20	29.45	0.05	0.3	6.3	20	0.6
शिमला मिर्च	25	7.25	.725	0.15	.75	7.5	0.3
टमाटर	25	5	0.225	0.05	0.9	5	.45
सपरेटा दूध	50	14.5	1.25	0.05	2.3	60	0.1
कुल योग–		230.2	7.45	0.95	47.65	100.5	2.25

चना दाल का पिट्ठा

सामग्री :–

चना दाल	–	50 ग्राम
जीरा पाउडर	–	1/2 छोटा चम्मच
अदरक, लहसुन पेस्ट	–	1 चम्मच
हरी मिर्च	–	1 कटी हुई
गर्म मसाला	–	1/2 छोटा चम्मच
नमक	–	स्वादानुसार
गेहूँ का आटा	–	100 ग्राम

विधि :–

- पहले आटा गूथ लें तथा अलग रख दें।

- चने की दाल को मिक्सी में पीस लें। इसमें जीरा पाउडर, अदरक–लहसुन पेस्ट, हरी–मिर्च, गर्म मसाला तथा नमक मिला लें।

- फिर 3 से 5 मिनट तक मिक्सी चलाएँ तथा पिट्ठी बना लें।

- बड़े बर्त्तन में ज्यादा पानी उबालें तथा इसमें नमक व तेल मिलाएँ।

- आटे की लोइयाँ बना लें। फिर इसे बेल लें। फिर इनमें एक चम्मच मिश्रण रखें। तथा गुजियों की तरह किनारों से मोड़ लें। अब इन गुजियों को उबलते पानी में 10 से 15 मिनट तक पकाएँ।

- पुदिने तथा धनिये की चटनी के साथ गरमागरम परोसें।

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चना दाल का पिट्ठा

पोषक मूल्य –

सामग्री	मात्रा (ग्राम)	ऊर्जा (कैलोरी)	प्रोटीन (ग्राम)	वसा (ग्राम)	काबोहाइड्रेट (ग्राम)	कैल्सियम (मिग्रा)	आयरन (मिग्रा)
चना दाल	50	186	10.4	2.8	29.9	28	4.55
गेहूँ का आटा	100	341	12.1	1.7	69.4	48	11.5
कुल योग–		527	22.5	4.5	99.3	76	16.05

खीरे की कचौड़ी

सामग्री :–

खीरा	—	100 ग्राम, मीडियम साइज
दही	—	200 ग्राम
अजवायन पाउडर	—	1/4 छोटा चम्मच
जीरा पाउडर	—	1/2 छोटा चम्मच
नमक	—	स्वादनुसार
लाल मिर्च	—	1/4 छोटा चम्मच
सूजी	—	100 ग्राम
मैदा	—	200 ग्राम

विधि :–

- मलमल के कपड़े में दही बाँध दें।

- दो घंटे तक पानी निकलने दें।

- खीरे को कुचल लें तथा कपड़े में रखकर निचोड़ दें ताकि सारा पानी निकल जाए।

- फिर इसमें दही, अजवायन, नमक, जीरा, मिर्च मिलाकर पेस्ट बना दें।

- सूजी तथा मैदा में नमक डालकर गूंथ लें।

- छोटी–छोटी लोइयाँ बना लें। दो लोई की एक लोई बनाकर बेल लें। इस पर तीन चम्मच पेस्ट रखकर दूसरी लोई रखकर बेल लें। फिर इसे किनारे से बंद कर लें।

- अब कचौड़ी से काटे से छेद कर लें।

- इडली स्टैंड में कचौड़ी रखकर भाप दें। जब कचौड़ी भूरी हो जाए तो समझें तैयार है। पुदीने की चटनी के साथ परोसें।

<div align="center">खीरे की कचौड़ी</div>

पोषक मूल्य –

सामग्री	मात्रा (ग्राम)	ऊर्जा (कैलोरी)	प्रोटीन (ग्राम)	वसा (ग्राम)	काबोहाइड्रेट (ग्राम)	कैल्सियम (मिग्रा)	आयरन (मिग्रा)
खीरा	100	13	0.4	0.1	2.5	10	1.5
दही	200	30	5.0	0.2	1.0	60	1.6
सूजी	100	348	10.4	0.8	74.8	16	1.6
मैदा	200	696	22.0	1.8	147.8	46	5.0
कुल योग–		1087	37.8	2.9	226.1	132	9.7

<div align="center">स्टीम्ड पालक व आलू</div>

सामग्री :–

पालक (ब्लांच व कटी)	–	200 ग्राम
आलू (अधउबले व टुकड़े)	–	1 कप (100 ग्राम)
प्याज (कतरे)	–	1/2 कप (40 ग्राम)
टमाटर (टुकड़े)	–	1/2 कप (50 ग्राम)
लहसुन (कद्दूकस)	–	1/2 छोटा चम्मच
अदरक (कद्दूकस)	–	1/2 छोटा चम्मच
काली मिर्च (दरदरी)	–	1/2 छोटा चम्मच

मसाले :–

पिसी लाल मिर्च	–	1/4 छोटा चम्मच
पिसा जीरा	–	1/4 छोटा चम्मच
चाट मसाला	–	1/4 छोटा चम्मच
नींबू का रस	–	1/4 टुकड़ा
कसूरी मेथी	–	1/4 छोटा चम्मच
नमक	–	स्वादनुसार

विधि :–

- एक नॉन स्टिक कड़ाही गर्म करें। जीरा, लहसुन व अदरक डालें। रंग बदलने तक सूखा ही भूनें, फिर प्याज व काली मिर्च मिला दें।
- जब वे गुलाबी हो जाएँ तो टमाटर डालकर गलने तक पकाएँ। मसाले डाल कर मिलाएँ। फिर आलू व पालक डालकर ढक दें। धीमी आँच पर इसे पकाएँ।
- फिर ढक्कन हटाकर धीमी आँच पर पकाएँ।

- प्लेट में डालकर पनीर से सजा सकते है, चपाती या चावल के साथ परोसें।

स्टीम्ड पालक व आलू

पोषक मूल्य –

सामग्री	मात्रा (ग्राम)	ऊर्जा (कैलोरी)	प्रोटीन (ग्राम)	वसा (ग्राम)	काबोहाइड्रेट (ग्राम)	कैल्सियम (मिग्रा)	आयरन (मिग्रा)
पालक	200	52	4.0	1.4	5.8	146	21.8
आलू	100	97	1.6	0.1	22.6	10	0.7
प्याज	40	59	0.1	0.6	12.6	40	1.2
टमाटर	50	10	0.45	0.1	1.8	24	0.2
नीबू कारज	1/4	14.2	0.22	0.075	2.77	17.5	0.57
कुल योग–		232.2	6.37	2.275	45.57	238.5	24.47

मिक्स वैज बिरयानी (जीरो ऑयल)

सामग्री :–

बासमती चावल	–	1 कप (100 ग्राम)
पानी	–	2 कप
प्याज (1 छोटा कटे हुए)	–	40 ग्राम
आलू (टुकड़े)	–	50 ग्राम
फूल गोभी (टुकड़े)	–	50 ग्राम
फ्रेंचबीन (टुकड़े)	–	कप 50 ग्राम
मटर	–	कप 50 ग्राम
जीरा	–	1/2 छोटा चम्मच
तेज पत्ते (कुचले हुए)	–	2

मसाले :–

बिरयानी मसाला	–	1/2 छोटा चम्मच
पिसा जीरा	–	1/4 छोटा चम्मच
पिसी लाल मिर्च	–	1/4 छोटा चम्मच
पिसा धनिया	–	1/4 छोटा चम्मच
नमक	–	स्वादानुसार

विधि :–

- चावल पकाने से पहले, 15 मिनट पानी में भिगोएँ।
- राइस कुकर गर्म करें, तेजपत्ता व जीरा डालें। इन्हें भूनने के बाद प्याज डालकर गुलाबी होने तक भूनें।
- सारी सब्जियाँ कुकर में डालें, अच्छी तरह हिलाते हुए मसाले भी डाल दें।
- अच्छी तरह भूनते हुए 2–3 मिनट पकाएँ। फिर पानी डालकर एक उबाल आने दें। इसे उबले पानी में छने चावल मिला दें।
- ढक्कन लगाकर एक सीटी आने दें।
- फिर धीमी आँच पर पकाएँ।

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- आँच से उतारकर राइस ट्रे में डालें। रायते के साथ परोसें।

मिक्स वैज बिरयानी

पोषक मूल्य –

सामग्री	मात्रा (ग्राम)	ऊर्जा (कैलोरी)	प्रोटीन (ग्राम)	वसा (ग्राम)	काबोहाइड्रेट (ग्राम)	कैल्सियम (मिग्रा)	आयरन (मिग्रा)
चावल	100	345	0.5	0.6	782	10	3.1
प्याज (1 छोटा)	40	59	0.1	0.6	12.6	40	1.2
आलू	50	48.5	0.05	0.3	11.3	5	0.35
फूलगोभी	50	15	1.3	0.2	2.0	16.5	0.75
फ्रेंचबीन	50	13	0.85	0.05	2.25	25	0.85
मटर	50	93	3.6	0.05	7.95	10	0.75
कुल योग–		573.5	6.4	1.8	818.1	106.5	7.08

हैल्दी टमाटर – पनीर

सामग्री :–

पनीर	–	100 ग्राम
टमाटर (कद्दूकस)	–	100 ग्राम
स्किम्ड मिल्क	–	1/4 कप (20 मि.ली.)
चीनी	–	2 ग्राम
सूखी कसूरी मेथी	–	2 ग्राम
जीरा	–	2 ग्राम

मसाले :–

पिसी लाल मिर्च	–	1/4 छोटा चम्मच थोड़ा सा
चाट मसाला	–	1/4 छोटा चम्मच थोड़ा सा
पिसा जीरा	–	2 ग्राम
नमक	–	स्वादानुसार
काली मिर्च	–	स्वादानुसार

सजावट :–

हरी मिर्च

विधि :–

- एक नॉन स्टिक कड़ाही गर्म करें। जीरा, बिरयानी मसाला व टमाटर डाल दें।

- अच्छी तरह हिलाते हुए, पानी सूखने तक पकाएँ। फिर टमाटर की प्यूरी, कसूरी मेथी, चीनी व बाकी मसाले मिला दें।

- धीमी आँच पर 2–3 मिनट तक मसाले रचने तक पकाएँ। फिर पनीर के टुकड़े डाल दें।

- मध्यम आँच पर 2–3 मिनट पकाने के बाद आँच से उतार लें।
- एक परोसने वाले डोंगे में सब्जी पलटें, हरी मिर्चों से सजाकर रोटी, नान या कुलचे के साथ परोसें।

हैल्दी टमाटर – पनीर

पोषक मूल्य –

सामग्री	मात्रा (ग्राम)	ऊर्जा (कैलोरी)	प्रोटीन (ग्राम)	वसा (ग्राम)	काबोहाइड्रेट (ग्राम)	कैल्सियम (मिग्रा)	आयरन (मिग्रा)
पनीर	100 ग्राम	348	24.1	25.1	6.3	790	2.1
स्किम्ड मिल्क	20 मि.ली.	5.8	0.5	0.02	0.92	24	0.04
टमाटर	100 ग्राम	20	0.9	0.2	3.6	48	0.4
कुल योग–		373.8	25.5	25.32	10.82	862	254

जीरो ऑयल लाल लोबिया करी

सामग्री :–

लाल लोबिया	–	50 ग्राम (1 कप)
मसूर दाल (धुली)	–	25 ग्राम
पानी	–	2 कप
अदरक (कद्दूकस)	–	1 छोटा चम्मच
लहसुन (कद्दूकस)	–	1 छोटा चम्मच
हरी मिर्चें (लम्बाई में कटी)	–	2
नमक	–	स्वादनुसार

तड़के के लिए :–

पिसा प्याज	–	1/2 कप (40 ग्राम)
टमाटर (कद्दूकस)	–	1 कप (100 ग्राम)
पिसी लाल मिर्च	–	1/2 छोटा चम्मच
गरम मसाला	–	1/2 छोटा चम्मच
पिसा जीरा	–	1/2 छोटा चम्मच
पिसा धनिया	–	1/2 छोटा चम्मच
राजमा मसाला	–	1/2 छोटा चम्मच
कसूरी मैथी	–	1/2 छोटा चम्मच
चाट मसाला	–	1/2 छोटा चम्मच

सजावट :–

कटा हरा धनियाँ

विधि :–

- लाल लोबिया या मसूर दाल धोकर 10 मिनट के लिए 2 कप पानी में भिगोएँ।

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- लहसुन, अदरक, नमक व हरी मिर्च डालकर कुकर का ढ़क्कन लगा दें। एक सीटी आ जाए तो 10 मिनट तक धीमी आँच पर पकाएँ। फिर आँच से उतार लें।
- एक नॉन–स्टिक पैन गर्म करें, प्याज यूँ ही भून लें। बीच–बीच में पानी का छींटा देते रहें। फिर टमाटर डाल दें।
- सूखने तक पकाएँ। मसाले मिला दें। यह मिश्रण अच्छी तरह पकाकर लोबिया में डाल दें।
- अच्छी तरह हिला कर तरी गाढ़ी होने तकं पकाएँ। एक डोंगे में पलटें, कटे हरे धनिए से सजा कर स्टीम्ड चावल के साथ परोसें।

जीरो ऑयल लाल लोबिया करी

पोषक मूल्य –

सामग्री	मात्रा (ग्राम)	ऊर्जा (कैलोरी)	प्रोटीन (ग्राम)	वसा (ग्राम)	काबोहाइड्रेट (ग्राम)	कैल्सियम (मिग्रा)	आयरन (मिग्रा)
लोबिया	50	161.5	12.05	0.5	27.25	38.5	2.95
मसूर दाल	25	171.5	12.55	0.35	29.5	34.5	2.4
प्याज	40	59	0.1	0.6	12.6	40	1.2
टमाटर	100	20	0.9	0.2	3.6	48	0.4
कुल योग–		412	25.6	16.5	72.95	161.0	6.95

पत्तागोभी, टमाटर व पालक मैडले

सामग्री :–

पालक के पत्ते (ब्लांच व कटे)	–	1 कप (100 ग्राम)
पत्तागोभी (कतरी हुई)	–	1 कप (100 ग्राम)
टमाटर (स्लाइस)	–	1/2 कप (50 ग्राम)
प्याज (स्लाइस)	–	40 ग्राम
अदरक (कद्दूकस)	–	1/2 चम्मच
तिल का तेल	–	1/2 चम्मच

मसाले :–

पिसी लाल मिर्च	–	1/4 छोटा चम्मच
पिसा जीरा	–	1/4 छोटा चम्मच
पिसी काली मिर्च	–	1/4 छोटा चम्मच
कसूरी मेथी	–	1/4 छोटा चम्मच
चाट मसाला	–	1/4 छोटा चम्मच
नींबू का रस	–	1/4 टुकड़ा
नमक	–	स्वादानुसार

सजावट :–

गाजर (कद्दूकस)

विधि :–

- एक कड़ाही में तेल गर्म करके अदरक व प्याज डालें, इन्हें रंग बदलने तक भूनें।
- फिर पत्तागोभी मिलाएँ, 2–3 मिनट तक लगातार भूनने के बाद पालक के पत्ते व टमाटर मिला दें।

- अच्छी तरह मिलाकर मसाले डाल दें। अच्छी तरह हिलाने के बाद बिल्कुल धीमी आँच पर फालतू नमी सूखने तक पकाएँ।
- एक कटोरे में पलटें, गाजर से सजाकर बेसन की रोटी के साथ गर्म परोसें।

नोट

⇒ यह बजन घटाने व मोटापे के लिए अच्छी मानी जाती हैं।

⇒ पत्तागोभी कब्ज से बचाती हैं।

⇒ पालक का आयरन, फोलिक एसिड, रक्ताल्पता, एसीडोसिस व रात्रिअंधता के लिए अच्छा हैं।

⇒ टमाटर एक लो कार्बोहाइड्रेट तत्व होने के कारण आँखों के रोग, मोटापे, लिवर के रोग के लिए उपचारक हैं।

पत्तागोभी, टमाटर व पालक मैडले

पोषक मूल्य –

सामग्री	मात्रा (ग्राम)	ऊर्जा (कैलोरी)	प्रोटीन (ग्राम)	वसा (ग्राम)	काबोहाइड्रेट (ग्राम)	कैल्सियम (मिग्रा)	आयरन (मिग्रा)
पालक	100	26	2.0	0.7	2.9	73	10.9
पत्तागोभी	100	27	1.8	0.1	4.6	39	0.8
टमाटर	50	10	0.45	0.1	1.8	24	0.2
प्याज	40	59	0.1	0.6	12.6	40	1.2
नींबू	1/4	14.2	0.22	0.075	2.77	17.5	0.57
तेल	2.5	22.5	–	2.5	–	–	–
कुल योग–		158.7	4.57	4.075	24.67	193.5	13.67

लैमनी फ्रूट चाट

सामग्री :–

सेब छिलके सहित (टुकड़े)	–	1/2 कप (50 ग्राम)
पपीता (टुकड़े)	–	1/2 कप (50 ग्राम)
केला (टुकड़े)	–	1/2 कप (50 ग्राम)
अमरूद (टुकड़े)	–	1/2 कप (50 ग्राम)
अनार	–	1/2 कप (50 ग्राम)
अंगूर	–	1/2 कप (50 ग्राम)

ड्रैसिंग :–

नींबू का रस	–	1/4 टुकड़ा
चाट मसाला	–	1/4 बड़ा चम्मच
जलजीरा पाउडर	–	1/4 छोटा चम्मच
नमक	–	स्वादानुसार

सजावट :–

ताजा पुदीना पत्ते

विधि :–

- सारे कटे फल एक डोंगे में डाल कर मिलाएँ।

- उस पर ड्रैसिंग का मिश्रण डाल कर टॉस करें।
- अलग–अलग प्लेटों में या एक ही डोंगे में डालें।
- ताजे पुदीना पत्तों से सजा कर उसी समय परोसें।

लैमनी फ्रूट चाट

पोषक मूल्य –

सामग्री	मात्रा (ग्राम)	ऊर्जा (कैलोरी)	प्रोटीन (ग्राम)	वसा (ग्राम)	काबोहाइड्रेट (ग्राम)	कैल्सियम (मिग्रा)	आयरन (मिग्रा)
सेब	50	29.5	0.1	0.25	6.7	5	0.5
पपीता	40	16	0.05	0.25	3.6	8.5	0.25
केला	40	58	0.6	0.15	13.6	8.5	0.45
अमरूद	50	25.5	0.45	0.15	5.6	5	0.7
अनार	35	32.5	0.8	0.05	7.25	5	0.15
अंगूर	50	35.5	0.15	0.3	8.25	10	0.25
नींबू	1/4	14.2	0.22	0.075	2.77	17.5	0.57
कुल योग–		211.2	2.37	12.25	47.77	59.5	2.87

स्लिमर्स च्वाइस सूप

सामग्री :–

पत्तागोभी (बारीक कटी)	–	2 कप (100 ग्राम)
हरी शिमला मिर्च (कटी हुई)	–	50 ग्राम
टमाटर बिना बीज के (कटे हुए)	–	50 ग्राम
गाजर (कद्दूकस)	–	50 ग्राम
प्याज (बारीक कटे)	–	40 ग्राम
वेज सूप मिक्स पाउडर	–	1/2 पैकेट
पानी	–	4 कप
तेल स्प्रे	–	2.5 ग्राम (पकाने के लिए)

मसाले :–

पिसा लहसुन	–	1/4 छोटा चम्मच
चाट मसाला	–	1/4 छोटा चम्मच
कढ़ी पत्ता	–	1/4 छोटा चम्मच
नींबू का रस	–	1/4 बड़ा चम्मच
नमक	–	स्वादानुसार

सजावट :–

कटा धनियाँ

विधि :–

- एक बड़े बर्तन में तेल छिड़के। प्याज डालकर कुछ देर भूनें। फिर टमाटर मिला दें।
- अच्छी तरह हिलाकर पानी व सूप पाउडर डालें। फिर हिलाने के बाद उबाल आने दें।
- गाजर, पत्तागोभी, शिमला मिर्च डालकर हिलाएँ व धीमी आँच पर पकने दें।
- सारी सब्जियाँ नर्म होने तक पकने दें। जब पानी सूख कर करीब 3 कप रह जाए तो बाकी मसाले भी मिला दें।
- लगातार चलाते हुए आँच से उतारें, सूप के कटोरों में डालें। हरे धनिए से सजाकर ब्राउन ब्रेड के छोटे टुकड़े के साथ गरम परोसें।

स्लिमर्स च्वाइस सूप

पोषक मूल्य –

सामग्री	मात्रा (ग्राम)	ऊर्जा (कैलोरी)	प्रोटीन (ग्राम)	वसा (ग्राम)	काबोहाइड्रेट (ग्राम)	कैल्सियम (मिग्रा)	आयरन (मिग्रा)
पत्तागोभी	100	27	1.8	0.1	46	39	0.8
शिमला मिर्च	50	29	1.45	0.3	1.5	30	1.2
टमाटर	50	10	0.45	0.1	1.8	24	0.2
गाजर	50	24	0.45	0.1	5.3	40	1.1
प्याज	40	59	0.1	0.6	12.6	40	1.2
नींबू	1/4 टुकड़ा	14.2	0.22	0.075	2.77	17.5	0.57
तेल	2.5	22.5	—	2.5	—	—	—
कुल योग–		185.7	4.47	3.775	69.97	190.5	5.07

टमाटर – लहसुन के साथ मैष षलगम

सामग्री :–

शलगम (छिले हुए, टुकड़े)	–	200 ग्राम
टमाटर (कद्दूकस)	–	100 ग्राम
लहसुन (कद्दूकस)	–	5 ग्राम
हरी मिर्च (लम्बाई के कटी)	–	1
चीनी (थोड़ा सा)	–	2 ग्राम
नमक	–	स्वादानुसार
पिसी हल्दी	–	1/4 चम्मच
सूरजमुखी का तेल	–	2.5 ग्राम

मसाले :–

काली मिर्च (दरदरी)	–	2 ग्राम
सूखी कसूरी मेथी	–	2 ग्राम
पिसी लाल मिर्च	–	थोड़ा सा (1/4 छोटा चम्मच)
पिसा जीरा	–	2 ग्राम

सजावट :–

कटी धनियाँ पत्ती

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विधि :–

- शलगम के टुकड़े धोकर कुकर में डालें। चीनी, हल्दी व नमक डालकर ढ़क्कन बन्द कर दें।

- शलगम नर्म होने तक पकाएँ। फिर ढ़क्कन खोलकर शलगम मैश करें।

- एक नॉन स्टिक पैन में तेल गर्म करें। लहसुन, अदरक व हरी मिर्च को रंग बदलने तक भूनें। फिर टमाटर व मसाले मिला दें।

- मसालें को घी छोड़ने तक भूनें व मैश शलगम में मिला दें।

- कुकर को दोबारा गर्म करें व धीमी आँच पर नमी सूखने तक शलगम पकाएँ। फिर आँच से उतारकर एक डोंगे में पलटें।

- कटे हरे धनिए से सजाकर गेहूँ के चोकर की रोटी के साथ परोसें।

टमाटर – लहसुन के साथ मैष षलगम

पोषक मूल्य –

सामग्री	मात्रा (ग्राम)	ऊर्जा (कैलोरी)	प्रोटीन (ग्राम)	वसा (ग्राम)	काबोहाइड्रेट (ग्राम)	कैल्सियम (मिग्रा)	आयरन (मिग्रा)
शलगम	200	58	1	0.4	12.4	60	0.8
टमाटर	100	20	0.9	0.2	3.6	48	0.4
लहसुन	5	7.25	0.315	0.005	1.49	1.5	0.065
तेल	2.5	22.5	—	2.5	—	—	—
कुल योग–		107.75	2.215	3.105	17.49	109.5	1.265

स्प्राउटेड मूँग चाट

सामग्री :–

आलू	–	100 ग्राम
स्प्राउट मूँग	–	100
प्याज	–	40 ग्राम
टमाटर	–	50 ग्राम
खीरा	–	40 ग्राम
हरी मिर्च	–	2
ताजा धनिया	–	कुछ पत्ते
चाट मसाला	–	1 छोटा चम्मच
नींबू	–	1/4 टुकड़ा
काला नमक पाउडर	–	स्वादानुसार

विधि :–

- आलू को उबालकर ठंडा कीजिए। ठंडा होने पर छीलकर एक सेन्टीमीटर के चौकोर टुकड़े कीजिए।

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- प्रेशर कुकर में आधा कप पानी के साथ अंकुरित मूँग को भाप दीजिए। फालतू पानी निकालकर ठंडा कर लें।

- एक प्याज को छीलकर गोलाई में लच्छे काटिए और उन गोल लच्छों को अलग–अलग करके ठंडे पानी में भिगो दीजिए। दूसरी प्याज को छीलकर बारीक काट लीजिए।

- टमाटरों को धोकर बारीक काटिए। खीरे को धोकर, बीज निकालकर एक–चौथाई इंच के चौकोर टुकड़े काटिए।

- हरी मिर्चों को धोकर डंढल निकालकर बारीक–बारीक काट लीजिए। ताजा धनिए के पत्तों को धोकर काट लीजिए। एक बर्तन में आलू, टमाटर व खीरे के टुकड़े, भाप लगे स्प्राउट मूँग, कटी प्याज और हरी मिर्च सबको एक साथ अच्छी तरह मिला लीजिए।

- परोसने से पहले चाट मसाला, नींबू का रस व काला नमक पाउडर डालकर अच्छी तरह मिला दीजिए।

- धनिए के कटी हुई पत्तियों और प्याज के गोल लच्छों से सजाकर ठंडा परोसिए।

स्प्राउटेड मूँग चाट

पोषक मूल्य –

सामग्री	मात्रा (ग्राम)	ऊर्जा (कैलोरी)	प्रोटीन (ग्राम)	वसा (ग्राम)	काबोहाइड्रेट (ग्राम)	कैल्सियम (मिग्रा)	आयरन (मिग्रा)
आलू	100	97	1.6	0.1	22.6	10	0.7
मूँग साबूत	100	334	24	1.3	56.7	124	7.3
प्याज	40	59	0.1	0.6	12.6	40	1.2
टमाटर	50	10	0.45	0.1	1.8	24	0.2
खीरा	40	6.5	0.2	0.05	1.25	5	0.75
नींबू	1/4 टुकड़ा	14.2	0.22	0.075	2.77	17.5	0.57
कुल योग–		520.7	26.57	2.225	97.72	220.5	10.72

दही – भिंडी

सामग्री :–

भिंडी	–	200 ग्राम
हरी मिर्च	–	1
अदरक	–	1/2 इंच की गाँठ
जीरा	–	1/2 छोटा चम्मच
काली मिर्च	–	1/4 छोटा चम्मच
सपरेटा दही	–	75 ग्राम
तेल	–	2.5 ग्राम
सूखी साबुत लाल मिर्च	–	1
धनियाँ पाउडर	–	1 चम्मच
हल्दी पाउडर	–	1/4 छोटा चम्मच
बेसन	–	5 ग्राम (छोटा चम्मच)
नमक	–	स्वादानुसार

विधि :–

- नरम और छोटी–छोटी भिंडी लीजिए। उन्हें धोकर एक साफ और सोखने वाले कपड़े से पोछकर सुखा लीजिए।

- भिंडी के डंठल और नीचे का सिरा काटिए। हरी मिर्चों को धोकर, डंठल निकालकर बीच से लम्बाई में काट लीजिए।

- अदरक को धोकर, छीलकर काली मिर्च के साथ पीस लीजिए।

- दही को फेंट लीजिए।

- नॉनस्टिक पैन में धीमी आँच पर बेसन को सूखा भून लीजिए। लगातार चलाते रहिए। जब बेसन के भुनने की खुशबू आने लगे, तब ठंडा करने के लिए रख दो।

- नॉनस्टिक पैन में तेल गर्म करें, सूखी साबुत लाल मिर्च और जीरा डालकर लगातार चलाते हुए भूनिए।

- अब हरी मिर्च, धनियाँ पाउडर, हल्दी पाउडर, बेसन मिलाकर अच्छी तरह चलाइए।

- भिंडी और नमक मिलाकर मध्यम आँच पर पाँच मिनट के लिए पकाइए। बीच–बीच में चलाते रहिए।

- अदरक और काली मिर्च का पेस्ट मिलाइए, आँच कम कीजिए और फेंटा हुआ दही अच्छी तरह मिलाकर बर्तन को ढककर आठ से दस मिनट तक पकाइए या भिंडी के पूरी तरह गलने तक पकाइए। बीच–बीच में चलाते रहिए।

दही – भिंडी

पोषक मूल्य –

सामग्री	मात्रा (ग्राम)	ऊर्जा (कैलोरी)	प्रोटीन (ग्राम)	वसा (ग्राम)	काबोहाइड्रेट (ग्राम)	कैल्सियम (मिग्रा)	आयरन (मिग्रा)
भिंडी	200	70	3.8	0.4	12.8	132	3.0
तेल	2.5	22.5	–	2.5	–	–	–
बेसन	5	18.6	1.04	0.28	2.99	2.8	0.455
सपरेटा दूध	75	21.75	1.875	0.075	3.45	90	0.15
कुल योग–		132.85	6.715	3.255	19.24	224.8	3.605

हॉट एंड सार इडली

सामग्री :–

अरहर की दाल	–	50 ग्राम
चावल	–	50 ग्राम
साबुत लाल मिर्च	–	2
इमली का गूदा	–	25 ग्राम
कसा हुआ गुड़	–	10 ग्राम
हींग	–	एक चटुकी
हल्दी पाउडर	–	1/4 छोटा चम्मच
नमक	–	स्वादानुसार
प्याज	–	20 ग्राम

विधि :–

- दाल और चावल का साफ करके, धोकर 1½ कप पानी में चार से छह घंटे के लिए अलग—अलग भिगों दीजिए। पानी निकालकर एक तरफ रख दीजिए। आपस में मिलाइए नहीं। लाल मिर्च को पीसकर इमली के गूदे के साथ मिलाकर पेस्ट बनाएँ।

- दाल को बारीक और चावलों को दरदरा अलग—अलग पीसिए। अब उन्हें अच्छी प्रकार मिला लीजिए।

- दाल और चावल के मिश्रण में लाल मिर्च, इमली का पेस्ट, कसा गुड़, हींग, हल्दी पाउडर व नमक अच्छी तरह मिल लीजिए।

- खमीर उठाने के लिए इस मिश्रण को चार—पाँच घंटों के लिए रख दीजिए।

- प्याज को छीलकर धोइए और काट लीजिए।

- इडली के साँचे में हल्का सा तेल लगाइए।

- भाप के बर्तन में थोड़ा सा पानी गर्म करिए। तैयार घोल को सांचे में डालिए। उनके ऊपर कटी प्याज फेलाइए और पन्द्रह से बीस मिनट के लिए भाप दीजिए।

- पसन्दीदा चटनी के साथ गर्म—गर्म परोसिए।

हॉट एंड सार इडली

पोषक मूल्य —

सामग्री	मात्रा (ग्राम)	ऊर्जा (कैलोरी)	प्रोटीन (ग्राम)	वसा (ग्राम)	काबोहाइड्रेट (ग्राम)	कैल्सियम (मिग्रा)	आयरन (मिग्रा)
अरहर की दाल	50	167.5	11.15	0.85	28.8	36.5	2.9
चावल	50	172.5	3.4	0.25	39.1	5	1.55
इमली का गूदा	25	70.75	0.025	0.725	16.85	42.5	2.725
गुड़	10	—	—	—	—	—	—
प्याज	20	29.45	0.05	0.3	6.3	20	0.6
कुल योग—		440.2	14.625	2.125	91.05	104	7.775

APPENDIX – C

Height and weight chart for the sucessment of Normal, over weight and obese famales on the Basis of Quefalet Index

$$BMI = \frac{Weight}{(Height\ in\ meter)^2}$$

Height (in cm)	Weight (in kg)	Height (in cm)	Weight (in kg)
135	45.56	153	58.52
136	46.24	154	59.25
137	46.92	155	60.06
138	47.61	156	60.84
139	48.30	157	61.62
140	49.00	158	62.41
141	49.70	159	63.20
142	50.41	160	64.00
143	51.12	161	64.80
144	51.84	162	65.61
145	52.56	163	66.42
146	53.25	164	67.24
147	54.02	165	68.06
148	54.76	166	68.89
149	55.50	167	69.72
150	56.25	168	70.56
151	57.00	169	71.40
152	57.76	170	72.25

LIST OF ABBREVIATIONS

Symbol literature

BMI	:	Body Mass Index
Lb	:	Pounds
WHO	:	World Health Organization
SFT	:	Skin Fold Thickness
MLAR	:	Multiple Linear and Logistic regression models
WC	:	Waist Circumference
WHR	:	Waist Hip Ratio
OR	:	Odds Ratio
SES	:	Socio Economic Status
PTH	:	Para Thyroid Hormone
CHD	:	Chronic Heart Disease
μ_u	:	Micro unit
HDL	:	High Density Lipoprotein
CL	:	Confidence Interval
MRFIT	:	Multiple Risk Factor Intervention Trial
PAL	:	Physical Activity Level
LOC	:	Loss of Control
CBI	:	Cognitive Behavioural Therapy
NFI	:	Nutrition Foundation of India
AIIMS	:	All India Institute of Medical Sciences
PI	:	Price Index
VLCC	:	Vandana Luthara Curve and Curl
ISO	:	International Standards Organization
IADL	:	Instrumental Activities of Daily Living
ADL	:	Activity of Daily Living
LPA	:	Leisure time Physical Activity

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nutrition education package

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