CHAPTER-3
MATERIALS AND METHODS

Research methodology is a way to systematically solve the research problem. Redmen and Mory defined research as a “systematized effort to gain new knowledge”. It is a careful and systematic study in the field of knowledge, undertaken to establish facts of principles (Grinnel, 1997). It may be understood as a science of studying how research is done scientifically. It is tried to explain the various steps that are generally adopted in studying this research problem along with the logic behind them. It is necessary for researcher to know not only the research methods or techniques but also the methodology. Researchers not only need to know how to develop certain indices or tests or how to apply particular research techniques but they also need to know which of these methods or techniques, are relevant and which are not, and what would they mean and indicate. Tools and techniques are indispensable in research work. Most of the advancement in knowledge has taken place because of experiments conducted with the help of statistical methods. In fact, there is hardly any research work today that can said to be complete without statistical data and statistical methods.

3.1 Scope of the Study

The present study was confined to Punjab and the survey was conducted on 200 subjects. 100 women from teaching profession and an equal number of working women from non-teaching profession, who were occupied with any paid job outside their houses, were selected. The subjects for the study were working women in the age group of 35-40 years. These subjects were further divided into two age groups. The age group of ‘35 to 37 years & 6 months’ represented by Group I i.e. $G-I_{(T)}$ and $G-I_{(NT)}$ and the age group of ‘above 37 years & 6 months up to 40 years’ was represented by Group II i.e. $G-II_{(T)}$ and $G-II_{(NT)}$. To assess the various parameters i.e. anthropometric measurements, nutrient intake, lifestyle activities, energy expenditure (Annexure), health and disease, general anxiety level and socio-economic status of the subjects, a scale of R L Bhardwaj, a Dutt’s Personality Inventory scale were employed for the study.
3.2 Sampling Technique

For the said study, multi layered sampling techniques have been used. As the scope of the study narrowed down on the nature of respondents being one hundred teaching working women, it was decided to focus on only Higher Educational Institutions in Punjab. Convenience sampling technique was used to identify Higher Educational Institutions located in Punjab as these institutions comprises the population of teaching working women and non-teaching working women which also lead to formation of homogeneous group. It is a statistical (non-probability) method of drawing representative data by selecting people because of the ease of their volunteering or selecting units because of their availability or easy access from a homogeneous group.

From these Institutions, the subjects as respondents were identified based on their nature of work and age wise distribution. Therefore, Quota sampling was used to select the respondents for the said age groups in scope of the study and also for the nature of work they carry in the institutions like teaching or non-teaching. Once the group of specific age bracket was identified with specific work assignment, the sample number of one hundred respondents was selected from the homogeneous group of subjects on the basis of convenience. A quota sample is a type of non-probability sample in which the researcher selects people according to some fixed quota. That is, units are selected into a sample on the basis of pre-specified characteristics so that the total sample has the same distribution of characteristics assumed to exist in the population being studied. This means that subjects are chosen in a non-random manner, and some members of the population have no chance of being included.

3.3 Collection of Data

The Primary data were collected from working women. An equal number of teaching and non-teaching women were undertaken. Structured questionnaires to assess the various parameters i.e. anthropometric measurements, nutrient intake, lifestyle activities, energy expenditure, health and disease, general anxiety level and socio-economic status of the subjects, were employed for the study.

The questionnaire consisted of the following main parts:
A. General Information
The general information constituted questions regarding name, age, educational qualification, occupation, marital status and family type (nuclear and joint family).

B. Anthropometric Measurements
Body measurements such as height, weight, waist circumference (in cm), hip circumference (in cm), biceps, triceps, sub-scapular and supra-iliac skin fold in (mm) were taken to calculate body mass index, waist- hip ratio, the body density & body fat percentage.

Weight: The subjects were weighed on a portable weighing machine. Heavy articles such as shoes, sweaters were removed. The weight was recorded in minimum of 0.1 kilograms.

Height: A portable meter rod was used to measure the height of the subject.
1. The respondent instructed to stand with their feet flat on the centre of the base plate, feet together and heels against the rod. The respondent's back was kept as straight as possible, preferably against the rod but not leaning on it. Subjects’ arms were hanging loosely by their sides facing forwards.
2. Respondent's head was in Frankfort Plane in a horizontal position (i.e. parallel to the floor). The Frankfort Plane is an imaginary line passing through the external ear canal and across the top of the lower bone of the eye socket, immediately under the eye. This position is important if an accurate reading is to be obtained. An additional check is to ensure that the measuring arm rests on the crown of the head, i.e. the top back half.
3. Height was recorded in centimetres and millimetres, Height was recorded in 0.1 centimetres.

Waist Circumference: Waist circumference at the midpoint between the lower border of the rib cage and the iliac crust. Waist circumference is a convenient and simple measurement that is unrelated to height (Han TS et al, 1997) correlates closely with BMI and WHR (Lean et al., 1995) and is an approximate index of intra-abdominal fat mass (Ross Ret al., 1992) and total body fat (Lean et al., 1996).

Hip Circumference: The site for hip measurement was taken at the maximum extension of the buttocks and the reading was recorded in 0.1 cm thrice and an average was recorded for that.
**Skin fold:** For taking the various skin folds pinching of skin fold grasped the skin over the marked site between thumb and fore finger and the fold was pulled along with its fat tissue parallel to longitudinal axis of the arm away from the underlying muscle. Lever of the calliper was released slowly and dial on the calliper was observed. When the needle stabilized, value was recorded in mm. and the process was repeated three times.

**Triceps skinfold:** It was taken on the mid-point over the triceps muscle region taken on the posterior side of the arm between the olecranon (elbow) and the acromion (shoulder) with arm held vertically.

**Biceps:** It was taken on the midpoint of the bicep muscle anteriorly half way between the shoulder and the elbow joint.

**Suprailiac:** Suprailiac skinfold was taken obliquely just above the hip bone (iliac crest) at the midaxillary line.

**Subscapular:** The site for the subscapular skinfold lies just below the inferior angle of the right side of the scapula.

For calculating body fat percentages skin fold measurement of biceps, triceps, suprailiac, sub scapula measurement was taken by using the skin fold calliper.

**C. Assessment of Health related Fitness**

For assessing the physical fitness of the subject, the following tests taken from top end sports battery 2000 are performed.

(a) **Muscular strength** - Sit-ups/30 second

(b) **Muscular endurance** - Total Sit-ups/1 minutes

(c) **Cardio vascular endurance** - 9 minute run and walk test

(d) **Flexibility** - Forward reach test in cm

**(a) Muscular strength -Sit-ups/ 30 seconds (Davis et al. 2000)**

Subjects were given 10 minute times for warming up. Subjects were instructed to lie on the mat with knees bent, feet flat on the floor and they were asked to keep their hands on their ears throughout the task. Subjects were helped to hold the feet on the ground by the assistant. Assistant kept the entire foot continuously touching the floor by applying pressure on his foot and knee. After giving the command 'Go', stopwatch was started. Subjects sit up touching the knees with their elbows, then returned back to the floor and continued to perform as many sit ups as possible in 30 seconds. Every time helper counted
and recorded the number of correct sit-ups completed in 30 seconds and recorded value to assess the subjects (women) performance.

(b) Muscular endurance - Sit-Ups/minutes (Davis et al. 2000)

Subjects were guided to lie on the floor in a supine position with the knees bent at a 45 degree ankle. The feet were placed hip distanced apart. Subjects were held from their ankles to maintain heel contact with the floor. Every subject was instructed to breathe out on the way up every time. As many sit ups they could do in one minute were recorded with the stop watch on mobile (time specified 1 minute).

(c) Cardio-vascular endurance - 9 minute run and walk test (Cooper 1968)

To conduct this test, a specific course was measured in distance so that the number of laps completed can be counted and multiplied by the course distance. Markers were placed to divide the course into quarters before starting the test. Spotters were assigned to count the laps and kept an eye on the time of stop signal. A whistle, stop watch and help were also rendered.

Test: Subject remained alert behind the starting line and on the signal 'Go', the performers ran and walked as many laps as possible around the course of 400 meters within nine minutes when the signal to 'Stop' was given.

Scoring: Number of completed laps was multiplied with the course distance and the distance of incomplete lap (segment) was added and the final score was recorded for each subject.

(d) Flexibility- Modified sit & reach test (Wells & Dillon 1952)

Time to warming up was given before the test to be performed. To measure the flexibility, subjects were asked to sit on the floor with their hip back and head against a wall. Legs were fully extended and the bottom of their feet put against the flexo-meter. The subjects were asked to place their hands one on top of the other and asked to forward the wooden block as far as possible, without lifting the hip, back or head and hold the final position for few seconds. Finally the number of centimetres (cm.) reached to the nearest one half inch was recorded thrice and the average score was recorded.

D. Twenty four hour dietary recall

For consecutive three days to record the type and amount of food items consumed for the purpose of calculating dietary intake, 24 hr. dietary method was used. While using this
method information regarding type and amount of food eaten or nutrient taken on the previous three days was recorded.

**E. Lifestyle activity and Health & Disease questions**

This method was used to enquire regarding the subjects overall health if they were suffering from any kind of disease or ailment and which kind of medicine or treatment is adopted.

**F. Measurement of Anxiety level**

Dutt’s personality inventory (Annexure) was used to measure the general anxiety level in the subject. The scale consisted of 90 statements and trichotomised response pattern was obtained.

**G Assessment of Socio-Economic status**

The socio-economic status scale developed by R.L. Bhardwaj, (Annexure) was used to assess the socio-economic status of the subjects.

### 3.4 Research Design

Exploratory cum diagnostic research design was considered appropriate. The main purpose of using this research design was that of formulating a problem for more precise investigation or of developing the working hypothesis from an operational point of view. The major emphasis in exploratory research design was on the discovery of ideas and insight. Exploratory research design is flexible enough to provide opportunity for considering different aspects of a problem under study because initially a problem was defined broadly; then transformed into more precise meaning when facts may necessitate changes in research procedure for gathering relevant data concerning survey literature. A diagnostic research design was adopted because it determined the frequency with which something occurs or its association with something else (Kothari, 2003 and Sonatakti, 2010). As the present study tried to explore and investigate about the dietary pattern of obese and non-obese women. It also focuses on the identifying relationship between dietary pattern and physical fitness and other attributes of obesity.

### 3.5 Measurement Tools for Analysis

1. **Body Mass Index (BMI):** Anthropometric measurements such as height, weight, waist circumference, hip circumference were taken to calculate body mass index (BMI)
and waist hip ratio (WHR) in order to assess the type and extent of obesity. BMI is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in metres (kg/m$^2$).

The classification of overweight and obesity, according to BMI, is shown in the following Table. This is a measure of relative body fatness to evaluate risk factors associated with obesity. The proposed critical limits of BMI by WHO 2004 (http://apps.who.int/bmi/index.jsp?intro_age=intro_3.html accessed on Jan. 2, 2014) were utilised for the assessment of obesity as given in table.

<table>
<thead>
<tr>
<th>Body Mass Index (BMI) Kg/m2</th>
<th>Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;18.5</td>
<td>Underweight</td>
</tr>
<tr>
<td>18.5-24.99</td>
<td>Normal</td>
</tr>
<tr>
<td>25-29.99</td>
<td>Pre obesity</td>
</tr>
<tr>
<td>30-34.99</td>
<td>Obesity Class I</td>
</tr>
<tr>
<td>35-39.99</td>
<td>Obesity Class II</td>
</tr>
<tr>
<td>&gt; 40</td>
<td>Obesity Class III</td>
</tr>
</tbody>
</table>

BMI can be considered to provide the most useful albeit crude, population-level measure of obesity. BMI can be used to estimate the prevalence of obesity within a population and the risks associated with it, but does not, however, account for the wide variation in the nature of obesity between different individuals and populations.

(2) Waist circumference (WC): Cut-off values for WC were 85 and 80 cm for men and women respectively were considered as per the cut off value of normal anthropometric variables in Asian Indian adults (Snehlata, 2003).

(3) Waist hip ratio (WHR): To calculate abdominal obesity, waist and hip circumference were measured and waist-hip ratio was calculated. The acceptable upper limit of WHR for men ‘0.85’ and ‘0.81’ for women were taken (Snehlata, 2003).

$$\text{WHR} = \frac{\text{Waist Circumference in cm}}{\text{Hip Circumference in cm}}$$
Over the past 10 years or so, it was accepted that a high WHR (WHR >1.0 in men and >0.85 in women) indicates abdominal fat accumulation (Han, TS et al., 1997). However, recent evidence suggests that the WHR may therefore remain a useful research tool, but individuals can be identified as being at increased risk of obesity-related illness by using waist circumference alone as an initial screening tool.

(4) **Assessment of fat in adult women:** Durnin and Womersley (1974) method is used for assessment of body fat in case of adult males and females. This method involves the measurement of various skinfolds i.e. biceps, triceps, subscapular and suprailiac. Calculation for percent body fat was calculated with the help of body density. For calculating the body density average of each of the four skinfolds i.e. biceps, triceps, subscapular and suprailiac was obtained involving the following steps:

(a) Averages of the four skinfold values were added to get the total skinfold value.
(b) Body density was calculated by using the formula appropriate to the age and sex category of the subject i.e. given below:

\[
\text{Body density} = 1.1423 - 0.0326 \log (\text{biceps} + \text{triceps} + \text{subscapular} + \text{suprailiac})
\]

Calculated body density with the help of above formula was converted to percent body fat with the following formulae devised by Siri (1965):

\[
\% \text{ body fat} = \frac{4.95}{\text{body density} - 4.50} \times 100
\]

(5) **Energy intake:** The nutritive value of these diets in terms of energy and macronutrients i.e. carbohydrates, proteins, fats, calcium, iron and vitamin-c were calculated with the help of “Nutritive Value of Indian Foods” by Gopalan et al. (2004). The average nutrient intake per day per subject was calculated and compared with recommended allowances as given by ICMR, 2010.

(6) **Energy expenditure:** To calculate their energy expenditure, there daily life style activities were recorded and total energy expenditure is calculated by multiplying rate of energy expenditure of the activity with duration of activity in minutes and total body weight in kilograms (Werner et al., 2007).

(7) **Anxiety level:** 90 statements of anxiety level further bifurcated into various psychic components as per the Dutt’s Inventory Personality Inventory. The following components were studied for each respondent: Loneliness, Depression, Inferiority complex, Guilt-
proneness, Ergic tension, Paranoid suspiciousness, Emotional instability, Hypochondriacal tendencies and Somatic reactions.

(8) Socio Economic Status: For assessing the socio economic status, subjects were asked to give responses for father, mother and herself (case) separately in seven areas i.e. social, family, education, profession, caste, total assets and monthly income. Scoring key was used for weightage score for each item. Same process of scoring was followed in respect of each page of the scale. Separate scoring keys for each page of the test were used and then area-wise total of weighted score of father, mother and case was converted into Z-scores as per the manual instructions. Social status, economic status and socio-economic status as a whole was calculated by consulting the manual tables. Interpretation of status was ascertained with help of T-scores.

**Nature of socio Economic Status**

<table>
<thead>
<tr>
<th>Nature of socio Economic Status</th>
<th>Abbr. Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Upper class</td>
<td>UC</td>
</tr>
<tr>
<td>2. Upper middle class</td>
<td>UMC</td>
</tr>
<tr>
<td>3. Middle class</td>
<td>MC</td>
</tr>
<tr>
<td>4. Upper lower class</td>
<td>ULC</td>
</tr>
<tr>
<td>5. Lower class</td>
<td>LC</td>
</tr>
</tbody>
</table>

3.6 Statistical Framework

(1) Mean of Individual Series

Mean values have been used to find the average of various items. The following formula has been used to calculate the arithmetic mean:

\[ \bar{X} = \frac{\sum X}{N} \]

Where,  

- \( \bar{X} \) = Arithmetic mean  
- \( \sum X \) = Sum of all the values of the variable X, and  
- \( N \) = Number of observations.

(2) Standard Deviation

It is a measure of how widely values are dispersed from the average value (the mean). The standard deviation values have been calculated by using the following formula:
S.D. \( (\sigma) = \sqrt{\frac{\sum d^2}{N}} \)

\[ d = (X - \bar{X}) \]

Where,
- S.D. \( (\sigma) \) = Standard Deviation
- \( \bar{X} \) = Actual Mean of Series
- \( (X - \bar{X}) \) = Deviations of the Items from the Mean, and
- \( N \) = Number of observations.

(3) **Coefficient of Variation**

It is a relative measure of dispersion based on standard deviation. The series having greater CV are said to be more variable than the other and the series having less CV are said to be less variable than the other.

\[ CV = \frac{\sigma}{\bar{X}} \times 100 \]

Where,
- CV = Coefficient of Variation
- \( \sigma \) = Value of Standard Deviation, and
- \( \bar{X} \) = Value of Mean

(4) **Simple Percentage Analysis**

Simple percentage analysis is most important and widely used statistical tool in analysis and interpretation of data. The simple percentages are calculated through the following formula:

\[ \text{Single Unit in a whole of } N \text{ Units} \times 100 \]

\[ \frac{N}{N} \]

(5) **One sample t-test**

In order to measure the distinctiveness between two constructs, t-test has been carried out. The test statistics, ‘t’, is calculated from the sample data and then compared with its probable value based on t-distribution at a specified level of significance for concerning degrees of freedom for accepting or rejecting the null hypothesis:

\[ t = \frac{\bar{X} - \mu}{S \sqrt{n}} \]

With d.f. = \( (n - 1) \)
(6) **Independent sample t-test**

In order to measure the distinctiveness between two constructs, t-test has been carried out. To assess the socio-economic status in non-teaching respondents, two classes i.e. UMC and MC are compared and find out the significance among them. The test statistics, ‘t’, is calculated from the sample data and then compared with its probable value based on t-distribution at a specified level of significance for concerning degrees of freedom for accepting or rejecting the null hypothesis:

\[
t = \frac{x_1 - x_2}{\sqrt{\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1 + n_2 - 2}}} \times \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}
\]

With d.f. = (n1+n2-2)

(7) **Paired sample t-test**

Paired sample t-test is a way to test for comparing two related samples, involving small values of n that does not require variances of the two populations to be equal, but the assumption that the two populations are normal must continue to apply. For a paired sample t-test, it is necessary that the observations in the two samples be collected in form of what is called matched pairs i.e., “each observation in the one sample must be paired with an observation in the other sample in such a manner that these observation are somehow “matched” or related, in an attempt to eliminate extraneous factors which are not of interest in test”. Such a test is generally considered appropriate in a before and after treatment study. To apply this test, we first work out the difference score for each matched pair, and then find out the average of such differences, D, along with the sample variance of the difference score. If the values from the two matched samples are denoted as Xi and Yi and the differences by Di (Di = Xi - Yi), then the mean of differences i.e.

\[
D = \frac{\sum Di}{n}
\]

where D = Mean of differences
n = number of matched pairs

This calculated value of t is compared with its table value at a given level of significance.
Correlation

Correlation is a technique that is used to measure and describe a relationship between two variables. The correlation between two variables can be measured by using Pearson’s Coefficient of Correlation or Spearman’s Rank Correlation Coefficient. In this study, only Pearson’s Coefficient of Correlation has been used to study the relationship. Pearson’s Correlation measures the degree and direction of linear relationship between two variables. Correlation coefficient (r) ranges in value from −1 (a perfect negative relationship) and +1 (a perfect positive relationship). The value of 0 indicates no linear relationship. Correlation Analysis has been divided into two steps:

1. Firstly, whether relationship between two variables exists or not, has been determined.
2. Secondly, testing whether it is significant.

Pearson Correlations have been calculated and their significance tested using SPSS 21.0 software.

Pearson’s Coefficient of Correlation: This method is used when deviations are taken from assumed Mean.

\[ r = \frac{\sum dx dy - \left( \frac{\sum dx}{N} \right) \left( \frac{\sum dy}{N} \right)}{\sqrt{\left( \sum dx^2 - \frac{(\sum dx)^2}{N} \right) \times \left( \sum dy^2 - \frac{(\sum dy)^2}{N} \right)}} \]

dx = Deviations obtained from the Assumed Mean of the X Series
dy = Deviations obtained from the Assumed Mean of the Y Series
\( \Sigma dx = \) The Sum of the Deviations of X Series from the Assumed Mean
\( \Sigma dy = \) The Sum of the Deviations of Y Series from the Assumed Mean

Analysis of Variance (ANOVA)

ANOVA or analysis of variance is used to compare the means of more than two populations. ANOVA analysis uses the F-statistics, which tests if the means of the groups, formed by one independent variable or a combination of independent variables are significantly different. It is based on the comparison of two estimates of variances—one representing the variance within groups, often referred to as error variance; and the other representing the variance due to differences in group means. If the two variances do not differ significantly, one can believe that all group means come from the same sampling
distribution of means and there is no reason to claim that the group means differ. If, however, the group means differ more than can be accounted for due to random error, there is reason to believe that they were drawn from different sampling distributions of means. The F-statistics calculates the ratio between the variance due to difference between groups and the error variance:

\[ F = \frac{\text{Variance due to difference between groups}}{\text{Error variance}} \]

The larger the F ratio, the greater is the difference between groups as compared to within group differences. An f-ratio equal to or less than one indicates that there is no significant difference between groups and the null hypothesis is correct. If the null hypothesis (that the group means do not differ significantly) is correct, then we can conclude that the independent variables did not have an effect on the dependent variable. However, if F-test proves that the null hypotheses to be wrong, multiple comparison tests are used to further explore the specific relationships among different groups.

Analysis of variance (ANOVA) has been carried out to compare more than two means at a time. The process of the analysis is given hereunder:

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>d.f.</th>
<th>T.S.S.</th>
<th>M.S.S.</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Categories</td>
<td>n-1=a</td>
<td>S1</td>
<td>S1/a=x</td>
<td>x/y</td>
</tr>
<tr>
<td>Error</td>
<td>b-a=c</td>
<td>S2</td>
<td>S2/c=y</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>N-1=b</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Where, \( n = \) No. of categories to be compared
\( N = n \times Y \)
\( Y = \) No. of data points
T.S.S. = Total Sum of Squares
M.S.S. = Mean Sum of Squares (TSS/d.f.), and
d.f. = Degree of Freedom.