Chapter – III

PROCEDURE

The method, which was adopted for the selection of subjects, selection of test items, administration of test and the statistical procedure used for analyzing the data are described in this chapter.

Selection of Subjects

The purpose of the present study was to assess Body Composition, Body Surface Area and Waist-Hip Ratio among varying levels of Blood Pressure Group. In order to draw an adequate representative sample, 670 Male subjects of age group between 45 to 55 years were selected by incidental sampling from the hospitals of Baroda, Ahmedabad, Rajkot and Surat.

This type of sampling design is usually applied to those samples which are taken because they are the most available (Guilford and Fruchter, 1973)\(^1\). The investigator simply took the nearest individual as

subjects of the study until the sample reached the desired size. It is a Non-random (or "non-probability") method to select samples by any kind of procedure that does not give all cases in the population equal chances to fall into the sample. Sometimes the context of the study allows or facilitates using a certain method of sampling, sometimes the researcher has the possibility of selecting the method.

Regarding the verification of the age of the respondents, researcher had asked the respondents about their age and date of birth. Further they were bifurcated into three groups of 331, 312 and 27 according to their level of Blood Pressure i.e. High Blood Pressure, Normal Blood Pressure and Low Blood Pressure. To ascertain the level of Blood Pressure of the respondent help was taken from the medical doctors. Blood Pressure of each subjects selected for the study was measured by doctors itself.

**COLLECTION OF DATA**

After gathering authentic research tools to collect the data pertaining to Body Composition, Body Surface Area and Waist-Hip Ratio of High Blood Pressure, Normal Blood Pressure and Low Blood Pressure subjects, the researcher had approached various hospitals for necessary permission & approval to collect the data from the subjects. Researcher
nad gone to OPD (Out Patient Department) of various hospitals on different days between 10 am to 2 pm during the day.

<table>
<thead>
<tr>
<th>City</th>
<th>Name of Hospital</th>
<th>High BP</th>
<th>Normal BP</th>
<th>Low BP</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baroda</td>
<td>Nurhari Hospital</td>
<td>24</td>
<td>21</td>
<td>4</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>Lady Pillar Hospital</td>
<td>16</td>
<td>11</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Bhailal Amin Hospital</td>
<td>9</td>
<td>15</td>
<td>3</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Baroda Heart Institute</td>
<td>11</td>
<td>27</td>
<td>1</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>SSG Hospital</td>
<td>32</td>
<td>15</td>
<td>6</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>92</strong></td>
<td><strong>89</strong></td>
<td><strong>14</strong></td>
<td><strong>195</strong></td>
</tr>
<tr>
<td>Ahmedabad</td>
<td>Civil Hospital</td>
<td>21</td>
<td>16</td>
<td>2</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>Vadilal Sarabhai Hospital</td>
<td>19</td>
<td>24</td>
<td>3</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>Panchshil Hospital</td>
<td>21</td>
<td>11</td>
<td>1</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Siddhi Vinayak Hospital</td>
<td>22</td>
<td>27</td>
<td>2</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>83</strong></td>
<td><strong>78</strong></td>
<td><strong>8</strong></td>
<td><strong>169</strong></td>
</tr>
<tr>
<td>Rajkot</td>
<td>H.J. Doshi Hospital</td>
<td>20</td>
<td>29</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Jainath Hospital</td>
<td>26</td>
<td>16</td>
<td>1</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>Sadhu Vasvani Hospital</td>
<td>21</td>
<td>21</td>
<td>0</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>P.D. Updyay Hospital</td>
<td>20</td>
<td>9</td>
<td>2</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>87</strong></td>
<td><strong>75</strong></td>
<td><strong>4</strong></td>
<td><strong>166</strong></td>
</tr>
<tr>
<td>Surat</td>
<td>Janeta Hospital</td>
<td>16</td>
<td>24</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>New Civil Hospital</td>
<td>23</td>
<td>20</td>
<td>1</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Old Civil Hospital</td>
<td>30</td>
<td>26</td>
<td>0</td>
<td>56</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>331</strong></td>
<td><strong>312</strong></td>
<td><strong>27</strong></td>
<td><strong>670</strong></td>
</tr>
</tbody>
</table>

The researcher had personally visited all the hospitals to collect the data along with a group consisting of five Physical Education Teachers working in various higher secondary schools in Vadodara. These teachers
were given initially orientation and hand on training regarding the measurement of Body Composition, Body Surface Area and Waist-Hip-Ratio. The entire process of orientation was supervised by the specialists from the field of medicine and Physical Education. The training was basically imparted on the process of measuring various measurements required for Body Composition, Body Surface Area and Waist-Hip-Ratio with respective calibrated instruments. Thus, the orientation and hand on training was conducted for three times and at each time it was about three hours. Conducting such clinic for the Physical Education Teachers had made the team proficient in measuring Body Composition, Body Surface Area and Waist-Hip-Ratio as well as confident in reporting. This actually helped the researcher in collecting the accurate data from the respondents.

Thus, from the four major cities of Gujarat state i.e. Baroda (195), Ahemdabad (169), Rajkot (166) and Surat (140) research scholar had in total examined 670 subjects. The samples were further divided into three groups based on their Blood Pressure levels namely High Blood Pressure Group, Normal Blood Pressure Group and Low Blood Pressure Group. Thus, 331 in High Blood Pressure Group, 312 in Normal Blood Pressure Group and 27 in Low Blood Pressure Group were identified and included as the subjects for the present study.
Administration of Test

For administration of test the researcher along with the helping team met the subjects and the objectives of the test were explained to them and also a demonstration of the test items was given to make the subjects well-versed with the procedure of the test. To collect the data researcher and the team had spent minimum of seven days in each hospital in each city. In some cases researcher and the team had spent about fifteen days in the same hospital.

Selection of Test Items

For the purpose of this study, tests were conducted for the following items:

1. Body Composition (Skinfold Thickness)
   a) Objective: To measure the Fat Percentage.
   b) Equipment: Harpenden Skinfold Caliper, paper and pen.
   c) Procedure: There are many ways used to measure the fat percentage by Skinfold caliper. One is the 4-site system\(^2\), which

is most commonly used, and the second system is 3-sites\textsuperscript{3}, third is 7-site system\textsuperscript{4}. For the present study 4-site system was adopted as a study (Demura and Sato, 2007)\textsuperscript{5} stated that measurement of suprailiac and abdominal skinfold thickness is useful to accurately estimate body density or body composition among Japanese adults.

ACSM Guidelines\textsuperscript{6} for Skinfold Measurement were considered and followed while measuring the skinfold at 4-sites. All the Skinfold Measurements were taken with help of Harpenden Skinfold Caliper which was calibrated with a specified required jaw pressure. All measurements were taken on the right side of the body with subject standing upright.

In order to facilitate obtaining the measurements, the necessary landmarks were put at 4-sites with black eye brow marker pen. For every measurement a fold of skin and subcutaneous tissue was picked up firmly between thumb and fore-finger of the left hand and pulled away from the underlying muscles by the investigator. Caliper were placed directly on the skin surface, one cm away from the thumb and finger, perpendicular

\textsuperscript{3} Ibid.
\textsuperscript{4} Ibid.
to the skinfold, and halfway between the crest and the base of the fold and allowed to exert their full pressure before reading the thickness of the fold. Pinch was maintained while reading the caliper. All the skinfolds were taken in millimeter on the right side of the subject.

The Measurements were taken at the 4 sites by following Norton & Olds Guidelines\(^7\):

1. Abdomen

   The skinfold measurement of the Abdomen was taken by raising the vertical fold of skin at 5 cm (approximately in the middle of the belly of the Rectus Abdominis) from the right side of the omphalion (midpoint of the navel). The care was taken that the measure at the initial grasp was firm and broad so that the underlying muscle was not grasped. Also care was taken that caliper was not placed inside the naval. The reading to the nearest half millimeter was recorded.

2. Suprailiac

   To measure the Suprailiac skinfold a fold of skin was raised at the point 5 to 7 centimeter above the iliac crest (top of hip bone)

depending on the size of the subject. The fold was grasped medially downward at about a 45° angle. Measurement was recorded to the nearest half millimeter.

3. Triceps

To obtain the Triceps skinfold, point was marked halfway between the elbow and the acromial process of the scapular with the subjects arm hanging loosely downward with palm of hand facing forward. The fold of the skin was lifted parallel to the longitudinal axis of the upper arm and the reading to the nearest half millimeter was recorded.

4. Thigh

The measurement was taken on the right side of the subject on the lateral side of the thigh with the subject standing straight. A vertical pinch of the skinfold was made parallel to long axis of femur at the midpoint of the distance between the inguinal fold and the superior border of the patella. The measurement was recorded in nearest half millimeter.
d) **Scoring**: For scoring YMCA Equation for estimation of Percentage Body Fat was used

\[ \% \text{ Fat} = 0.29288 (\text{Sum of 4 Sites}) - 0.0005 (\text{Sum of 4 Sites})^2 + 0.15845 (\text{age}) - 5.76377 \]

e) **Norms**: as Stated by D. Golding, C. Myers and W. Sinning

<table>
<thead>
<tr>
<th>Rating</th>
<th>% Fat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under Weight</td>
<td>&lt; 18.5</td>
</tr>
<tr>
<td>Normal Weight</td>
<td>18.5 – 24.9</td>
</tr>
<tr>
<td>Over Weight</td>
<td>25.0 – 29.9</td>
</tr>
<tr>
<td>Obesity Class I</td>
<td>30.0 – 34.9</td>
</tr>
<tr>
<td>Obesity Class II</td>
<td>35.0 – 39.9</td>
</tr>
<tr>
<td>Obesity Class III</td>
<td>Above 40.0</td>
</tr>
</tbody>
</table>

2. **Body Surface Area (BSA)**:

a) **Objective**: To measure the Body Surface Area.

b) **Equipments**: A Stadiometer and Portable Weighing Machine.

c) **Procedure**: For obtaining Body Surface Area, Height was measured in centimeters and Weight was measured in Kilograms as follows:

**Height**

Height was measured to the nearest centimeters, with the help of Stadiometer each subject was made to stand upright with hands by his sides and head level with eyes looking straight ahead

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on the stadiometer without any footwear. A scale was placed on the head of the subject and the reading was recorded.\textsuperscript{10}

Weight

Weight was measured in nearest of the half Kilogram on a calibrated Weighing Machine in minimum clothing without any footwear. Care was taken that the subject's weight was evenly distributed on both the feet. The reading accordingly was recorded.\textsuperscript{11}

d) **Scoring:**\textsuperscript{12} For scoring following formula was used

\[
BSA = \sqrt{\frac{\text{Height (cm) \times Weight (kg)}}{3600}}
\]

e) **Norms:**\textsuperscript{13} An Adult should have an Average BSA 1.9m\(^2\).


\textsuperscript{11} Ibid.


3. Waist Hip Ratio

a) **Objective**: To measure the intra-abdominal fatness.

b) **Equipment**: A Steel Measuring Tape.

c) **Procedure**: To find out the Waist-Hip Ratio, Waist and Hip were measured to its nearest centimeters.

**Waist Circumference**

Waist was measured at its narrowest point, Waist circumference was measured midway between the lower rib margin and the iliac crest in the horizontal plane. The subject stood erect with their weight evenly distributed on both feet without any clothing on the upper part of the body i.e. over the abdomen area. While recording, it was made sure that the tape was not too tight or too loose, was lying flat and horizontal.\(^{14}\)

**Hip Circumference**

The hips were measured at the widest point in centimeters with the help of a measuring tape. Hip circumference was measured at the point yielding the maximum circumference over the buttocks using a steel measure tape at the nearest 1cm while the subject was standing.

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\(^{14}\) Surinder Nath, *Anthropometry the Measurement of Body Size, Shape and Form*, p.85.
The hip girth measurement was taken over minimal clothing, at the level of the greatest protrusion of the gluteal (buttock) muscles. The subject stood erect with their weight evenly distributed on both legs slightly parted, it was made sure that the gluteal muscles were not tensed. While recording, it was made sure that the tape was not too tight or too loose, was lying flat and horizontal.\textsuperscript{15}

d) **Scoring:**\textsuperscript{16} For scoring the following formula was used

\[
\text{Waist Hip Ratio} = \frac{\text{Waist (cm)}}{\text{Hip (cm)}}
\]

e) **Norms:** as Stated by Bray and Gray\textsuperscript{17}

**Risk**

<table>
<thead>
<tr>
<th>Level</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>&lt; 0.83</td>
</tr>
<tr>
<td>Moderate</td>
<td>0.83 – 0.88</td>
</tr>
<tr>
<td>High</td>
<td>0.89 – 0.94</td>
</tr>
<tr>
<td>Very High</td>
<td>&gt; 0.94</td>
</tr>
</tbody>
</table>

4. **Blood Pressure:**

a. **Objective:** To measure the Blood Pressure Level.

b. **Equipment:** Sphygmomanometer.
c. **Procedure:** To measure the blood pressure, help of the doctors was taken. Dr. Reddy\(^{18}\) guidelines were followed for precautions taken before measuring the blood pressure. The measurements were taken on different days between 10 am to 12 pm during the day. For measuring Blood Pressure the subject was requested to seat comfortably with the forearm rested on a table. It was ensured that left arm was stretched out at the mid-chest level which is extremely important because if the arm is at a lower level, the reading of Blood Pressure will be higher than it's actual and if the arm is held at a higher level, the reading will be lower than its actual. It was ensured that the subject was rested for a few minutes after the application of the cuff, before the Blood Pressure was taken. It was ensured that subject had not consumed tea, coffee or alcohol, before at least half an hour before measuring blood pressure.

An inflatable cuff was placed around the arm in such a position that its inflation compressed the brachial artery. A stethoscope was placed over the artery distal to the cuff, and the cuff was then inflated. A tube connects to the cuff to a pressure gauge that reports the cuff pressure in millimeters of mercury (mmHg). Inflation was continued until cuff

pressure was roughly 30 mmHg above the pressure sufficient to collapse the brachial artery completely which stopped the flow of blood and eliminated the sound of the pulse. The investigator then slowly let the air out of the cuff. When the pressure in the cuff fell below systolic pressure, blood could again enter the artery. At the first, blood entered only at peak systolic pressure and the stethoscope picked up the sound of blood pulsing through artery. As the pressure fell further, the sound changed, because the artery was remaining open for longer time. When the cuff pressure fell below diastolic pressure, blood flow became continuous and the sound of the pulse becomes muffled or disappeared. Thus the pressure at which the pulse appeared corresponds to the peak systolic pressure; when the pulse faded; the pressure reached its diastolic level. The distinctive sounds heard during this test are called sounds of Korotkoff. These sounds are produced by turbulence as blood flow passes the constricted portion of the artery. The reading of all subjects were accordingly measured by doctors and recorded by investigator.\textsuperscript{19}

d. **Scoring**: Classification of Blood Pressure for Adults according to JNC 7 Report\(^\text{20}\).

<table>
<thead>
<tr>
<th>Blood Pressure</th>
<th>Systolic mm Hg</th>
<th>Diastolic mm Hg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 120</td>
<td>&lt; 80</td>
</tr>
<tr>
<td>Pre-Hypertension</td>
<td>120-139</td>
<td>80-89</td>
</tr>
<tr>
<td>Stage 1 Hypertension</td>
<td>140-159</td>
<td>90-99</td>
</tr>
<tr>
<td>Stage 2 Hypertension</td>
<td>≥ 160</td>
<td>≥ 100</td>
</tr>
</tbody>
</table>

**Instrument's Reliability**

The skinfold caliper, weighing machine, stadiometer, steel measure tape, sphygmomanometer etc. used in this study were calibrated and supplied by the leading firms and their reliability was ensured by manufactures. All the instruments used were availed from the Research Laboratory of Sports and Physical Education of M.D. Desai College of Physical Education, Gujarat Vidyapith. Thus, the instruments were considered reliable for the purpose of this study.

Tester’s Competency

For the collection of data research scholar had taken help from Physical Education Teacher who were experts in the field. To ensure the competency in the technique of measuring skinfold, waist circumference and hip circumference and recording height and weight for the purpose of the study, the scholar with the team had number of practice sessions in testing procedure under the guidance of experts of medicine and Physical Education field. All the measurements were taken by the investigator with the assistance of a trained Physical Education Teachers and doctors.

Statistical Procedure

Since the purpose of the study was to assess and compare the Body Composition, Body Surface Area, Waist Hip Ratio in varying levels of Blood Pressure, One Way Analysis of Variance test was used to identify the mean difference between the varying Levels of Blood Pressure groups.