3 MATERIALS & METHODS
The methodology of the present study comprises of selection of subjects, selection of variables for quantification of physique, body composition, physiological characteristics and assessment of gynecological aspects and psychological variables, administration of test and statistical analysis.

Selection of subjects:-

A sample design is a defined plan determined before data collection for obtaining a sample from a given population. In the present study purposive sample design was the method
Comparison of Psychophysiological Correlates of Sports Women and Non Sports Women of Chhattisgarh

obtained for selection of the subjects, as the population was scattered & randomization was not possible.

In order to study psycho-physiological correlates of sports women and non sports women total 264 women were selected from different cities viz Raipur, Durg, Bhilai, Bagbahara, Mahasmand, Rajnadgaon, and Bilaspur of Chhattisgarh. Out of 264 women subjects, 139 were Sports Women (SW) who participated in different competition, at state, national and university level, & 125 Non Sports Women (NSW) who never participated in any competition or physical education program. The subjects were categorized in four different age groups, the age groups were 25-30 years, 30-35 years, 35-40 years and 40-45 years. Each age group consisted of at least 30 subjects.

Variables selected: The variables selected for the present study were divided into four categories which are as follows-

1. Physical
2. Physiological
3. Gynecological
4. Psychological

1. PHYSICAL:

Under physical category various anthropometric variables were measured. Anthropometry is the study of the measurement of the human body in terms of the dimensions of bone, muscle, and adipose (fat) tissue. Measures of subcutaneous adipose tissue are important. Actual stature, weight, and body measurements including skin folds, girths, and breadths were collected for the purposes of assessing body composition parameters for comparison between SW and NSW and for provision of reference data.
Anthropometric measurements such stature, weight, skin folds and circumferences will allow cross-sectional analysis of the relationship between body composition and physiological and psychological variables.

Following anthropometric variables were selected:

1. Body weight (kg.)
2. Height (vertical measurement (cm))
3. Transverse measurement (cm)
4. Biocromial (diameter)
5. Bi-iliocristal (diameter)
6. Elbow (diameter)
7. Knee (diameter)
8. Girth measurements (cm)
9. Chest
10. Upper Arm
11. Calf
12. Thigh
13. Abdominal
14. Skin fold thickness (mm)
15. Biceps skinfold
16. Triceps skinfold
17. Subscapular skinfold
18. Subraspinale skinfold
19. Abdominal skinfold
20. Thigh skinfold
21. Calf skinfold

PHYSIOLOGICAL:

1. Heart Rate
2. Peak Flow Rate
3. Blood Pressure—systolic and diastolic
Comparison of Psychophysiological Correlates of Sports Women and Non Sports Women of Chhattisgarh

4. Hemoglobin

GYNECOLOGICAL:
1. Age at menarche (check list)
2. PMS (check list)
3. Gynaecological Problems (questionnaire)

PSYCHOLOGY
1. Personality Type A- Type B scale (Ray & Bozek)
2. Adjustment Inventory (Asthana, 1968)
3. Self-concept Inventory (Sherry et al 1988)

TECHNIQUE OF TAKING ANTHROPOMETRIC MEASUREMENTS:
The techniques used for taking various measurements are as following:-

1. PHYSICAL VARIABLES (Anthropometric Measurements)

1.1 Age: Each subject was asked to fill her date of birth on the proforma, the chronological age was measured from the date of birth of the subject given by her during data collection.

1.2. Body Weight-(Kg.)
The subject wearing minimum clothing, stood erect in the center of the platform of a portable weighing machine and the weight was recorded. The meddle at zero was checked before taking weight of each subjects. The measurement was recorded in kilograms.
Instruments used:-

**Weighing machine:** The Krupp’ weighing was used, the *unit of measurement* was kilogram (kg) and it measured minimum one tenth of a kilogram (1/10).

1.3. Height (stature): Anthropometer was used to measure the height. The anthropometer was held vertically in front of the subject in midsagital plane & the horizontal movable bar was brought down to touch the point vertex. The stature was measured in centimeters.

Instruments used:-

**Anthropometre:** Siber - Henger GPM anthropometer was used, unit of measurements of the instrument is centimeter (cm) with millimeter (mm) gradations. The accuracy of the instrument is millimeter (mm)

1.4. Circumference: (cm)

**a. CHEST:** The girth is taken at the level of the mesosternale. The subject stands with the elbow relaxed so that the right arm hangs freely to the side. The examiner stands facing the subject. The subject should breathe normally and the measurement was taken at the end of a normal expiration. The recorder walks around the subject to make sure that the tape is parallel to the floor and that the tape is snug, but does not compress the skin. The measurement is made at minimal respiration to the nearest 0.1 cm.
b. Upper Arm Circumference: The subject stands with the elbow relaxed so that the right arm hangs freely to the side. The examiner stands facing the subject’s right side. The measuring tape is placed around the upper arm at the marked point perpendicular to the long axis of the upper arm. The tape is again held so that the zero ends are held below the measurement value. The tape rests on the skin surface, but is not pulled tight enough to compress the skin. The arm circumference is recorded to the nearest 0.1 cm.

c. Abdominal Circumference: The subject is in a standing position. The examiner stands behind the subject and palpates the hip area for the right iliac crest. The examiner marks a horizontal line at the high point of the iliac crest and then crosses the line to indicate the midaxillary line of the body. The examiner then stands on the subject’s right side and places the measuring tape around the trunk in a horizontal plane at this level marked on the right side of the trunk. The recorder walks around the subject to make sure that the tape is parallel to the floor and that the tape is snug, but does not compress the skin. The measurement is made at minimal respiration to the nearest 0.1 cm.

d. Calf: The subject stands with the right leg just in front of the left leg and the weight shifted back to the left leg. The edge of the examining table may be used for the subjects to hold onto to maintain her balance. The examiner stands on the subject’s right side and the measuring tape is placed around the calf at the point that
is already marked by a (+). The tape is positioned perpendicular to the long axis of the calf with the zero end of the tape held below the measurement value. The tape rests firmly on the skin without compressing the skin. The recorder checks to make sure the tape is positioned correctly. The calf circumference is measured to the nearest 0.1 cm.

e. **Thigh Circumference**: The subject stood with the right leg just in front of the left leg and the weight shifted back to the left leg. The edge of the examining table was used for the subject to maintain balance. The examiner stood on the subject's right side and the measuring tape was placed around the midthigh. The tape is positioned perpendicular to the long axis of the thigh with the zero end of the tape held below the measurement value. The tape rests firmly on the skin without compressing the skin. The recorder checked to make sure the tape is positioned correctly. The thigh circumference was measured to the nearest 0.1 cm.

**Instruments used:-**
Fiber glass flexible, non-stretchable Anthropometric tape: Siber- Henger GPM Anthropometer (cm) tape with unit of measurements centimeter (cm) with millimeter (mm).

1.5. **DIAMETER:**

**a. Biacromial diameter**: The subject sat on the body measurement table, which was approximately chair height. The subject was asked to sit erect with the arms hanging
freely at the sides. The examiner stood behind sliding calipers. The examiner checked the posture of the subject making sure that the shoulders are neither too far back nor forward, and that there was a noticeable curvature in the lower back. The objective was to have the subject relaxed with the shoulders downward and slightly forward so that the reading is maximal. The examiner then located the acromial process. The caliper rests gently between the thumb and forefinger of the examiner. This allows the examiner to palpate the bony ridges with other fingers. The examiner located the lateral border of the acromial process on each shoulder. The arms of the sliding caliper were placed directly on the skin next to the lateral border of each acromial process and pressure was applied to compress the soft tissue over the acromial processes without hurting the subject. The maximum breadth across the lateral borders of the acromial processes was measured to the nearest 0.1 cm.

b. Biiliocristal diameters:-The subject stood erect with feet together. The waist and top of hips were exposed. The examiner stood behind the subject holding the large sliding calipers. At the same time, the examiner located the right side of the iliac crest at its highest point. At this point, the arms of the sliding caliper were placed on the lateral borders of each iliac crest. The soft tissue was compressed to obtain the bone measurement without hurting the subjects. The maximum breadth at the highest point of the iliac crests was measured to the nearest 0.1 cm.

c. Femur Biepicondylar:-The subject stood erect with feet together facing the examiner. The right arm was
extended forward until it was perpendicular to the body. The examiner then flexed the right arm of the subjects so that the elbow forms a $90^\circ$ angle with the fingers pointing up and the posterior part of the wrist toward the examiner. With the small sliding caliper held at a $45^\circ$ angle to the plane of the long axis of the upper arm, the greatest breadth across the epicondyles of the elbow were measured to the nearest 0.1 cm. This measurement is taken with the calipers at a slight angle because the medial condyle was more distal than the lateral condyle.

d. Humerus: The distance was measured between the medial and lateral epicondyle of the humerus when the arm was raised anteriorly to the horizontal and the forearm was flexed at right angle to the upper arm. The bony points first felt were the epicondyle; the calipers were placed directly on the epicondyles so that the arms of the caliper point upward at about $45^\circ$ angles to the horizontal plane.

Instruments used:-

Anthropometer and Sliding caliper: Siber - Henger GPM anthropometer was used, unit of measurements of the instrument is centimeter (cm) with millimeter (mm) gradations. The accuracy of the instrument is millimeter (mm)

1.6. Skinfold Measurement:

a. Biceps: The subject stood erect with feet together, shoulders relaxed and the arms hanging freely at the sides. The examiner stood behind the subject’s right side. The
examiner stands in front of the subject’s right side. The point on the mid-acromiale-radiale line of the right upper arm was located in the same area as the marked midpoint for the upper arm circumference. A fold of skin and subcutaneous adipose tissue is grasped gently with thumb and fingers approximately 2.0 cm above the marked level with the skinfold parallel to the long axis of the arm. The jaws of the calipers are placed at the marked level, perpendicular to the length of the fold, and the skinfold thickness is measured to the nearest 0.1 mm while the fingers continue to hold the skin.

b. Triceps: The subject stood erect with feet together, shoulders relaxed and the arms hanging freely at the sides. The examiner stood behind the subject’s right side. The point on the posterior surface of the right upper arm was located in the same area as the marked midpoint for the upper arm circumference. A fold of skin and subcutaneous adipose tissue was grasped gently with thumb and fingers approximately 2.0 cm above the marked level with the skinfold parallel to the long axis of the arm. The jaws of the calipers were placed at the marked level, perpendicular to the length of the fold, and the skinfold thickness was measured to the nearest 0.1 mm while the fingers continue to hold the skinfold.

c. Subscapular Skinfold: The subject stood erect with shoulders and arms relaxed at the side. The examiner palpates for the inferior angle (or triangle portion) of the right scapula. The examiner makes a (+) on the inferior angle of the scapula with the cosmetic pencil marker. The examiner grasps a fold of skin and subcutaneous adipose
tissue directly below (1.0 cm) and medial to the inferior angle. The skin fold forms a line about 45° below the horizontal extending diagonally toward the right elbow. The jaws of the caliper were placed perpendicular to the length of the fold about 2.0 cm lateral to the fingers with the top jaw of the caliper on the mark over the inferior angle of the scapula. The skin fold thickness was measured to the nearest 0.1 mm while the fingers continue to hold the skin fold.

**d. Suprailliac:** The subject stood and the right hip area was exposed. The examiner places his/her thumb (left) on the intersecting marks and picks up the skin fold with the thumb and fingers. The skin fold should slope downward and forward at a 45° angle extending toward the pubic symphysis. The caliper was placed perpendicular to the skin fold about 2.0 cm medial to the fingers and the skin fold was measured to the nearest 0.1 mm.

**e. Abdominal** The subject was in standing position, and the abdominal area was exposed. The examiner places his/her thumb (left) on approximately in the midline of the belly of the rectus abdominis the intersecting marks and picks up the skin fold with the thumb and fingers. The jaws of the skinfold caliper were placed perpendicular to the length of the fold and the shaft of the thigh over the marked point. Skinfold was corded to the nearest 0.1 mm.

**f. Calf Skinfold:** The calf skinfold is measured in the midline of the anterior aspect of the right calf. This level has already been marked from the calf circumference measurement. The subject sits on a chair with her knee
flexed, at 90° foot flat on the floor. A fold of skin and subcutaneous tissue is grasped in the midline about 2.0 cm above the marked point. The jaws of the skinfold calipers are placed perpendicular to the length of the fold and the shaft of the thigh over the marked point. Skinfold was recorded to the nearest 0.1 mm.

g. Thigh Skinfold: The thigh skinfold was measured in the midline of the anterior aspect of the right thigh. This level has already been marked from the thigh circumference measurement. The subject stood with her weight shifted back on the left leg with the right leg forward, knee slightly flexed, and foot flat on the floor. A fold of skin and subcutaneous tissue was grasped in the midline about 2.0 cm above the marked point. The jaws of the skinfold caliper were placed perpendicular to the length of the fold and the shaft of the thigh over the marked point. Skinfold was recorded to the nearest 0.1 mm.

Instruments used:

**Skifold caliper** – Siber - Henger GPM skinfold caliper was used, unit of measurements of the instrument is millimeter (mm). The accuracy of the instrument is millimeter (mm).

**Cosmetic pencil (Wax base):** For making the correct anatomical site for taking the skin fold measurement.

**Measuring and Recording Guidelines**

Body measurements are always taken on the right side of the body. All measurements, except skinfolds, were taken to the nearest tenth of a centimeter or 1.0 millimeter. Skinfold measurement was taken to the nearest 0.1
millimeter. Measures that exceed specific limits were repeated by examiner. All skinfold measurements was done in duplicate (i.e., twice by the same examiner) since these measures have the most variability.

1.7 Somatotype components: - The technique of somatotype is used to appraise body shape and composition. The resulting somatotype gives a quantitative summary of the physique as a unified whole.

The Heath-Carter method of somatotyping described below is “The Heath Carter Anthropometric Somatotype Method” requires the following anthropometric measurements for obtaining the somatotype: Height, Weight, Triceps skinfold, Subscapular skinfold, Supraspinale skinfold, Calf skinfold, Humerus biepicondylar diameter, Femur biepicondylar diameter, Biceps girth, Calf girth.

Exact decimal rating of endomorphy can be assigned from the measurements directly using the following equation of Carter (1980):

\[
\text{Endomorphy} = -0.7182 + 0.1451X - 0.00068X^2 + 0.0000014X^3
\]

Where X is the sum of triceps, subscapular and supraspinale skinfolds, which should be corrected for the height of the subject Corrected sum of skinfolds = (sum of skinfold/Height) x 170.18 endomorphy = -0.7182+0.1451x esf-0.0068 x Esf-(sum of triceps, subscapular and supraspinale skinfold multiplied by (170.18/height in cm)
this is called height corrected endomorphy and is the preferred method for calculating endomorphy.

Mesomorphy= (0.858 humerus width + 0.188 corrected arm girth + 0.161 corrected calf girth) – (height x 0.131) + 4.50

Ectomorphy rating can be directly calculated from Height Weight Ratios (HWR = Height/Weight 0.33) employing the following equation of Carter (1980):
Ectomorphy = HWR x 0.732 – 28.58
If HWR <40.75 but >38.25, then
Ectomorphy = HWR x 0.463- 17.63
If HWR <38.25, a rating of 0.1 is to be assigned.

Somatotype categories –

Somatotypes with similar relationships between the dominance of the components are grouped into categories name to reflect these relationships.

1. Ectomorphic endomorph – endomorphy is dominant and ectomorphy is greater than mesomorphy.

2. Balanced endomorph – endomorphy is dominant and mesomorphy and ectomorphy are equal (do not differ by more than one half unit)

3. Mesomorphic endomorphy is dominant and mesomorphy is greater than ectomorphy.

4. Mesomorph endomorph- endomorphy and mesomorphy are equal (do not differ by more than one half unit) and ectomorphy is smaller.

5. Endomorphic mesomorphy- Mesomorphy is dominant and endomorphy is greater than ectomorphy.

6. Balanced mesomorph- mesomorphy is dominant and mesomorphy and ectomorphy are equal (do not differ by more than one half unit)
7. Ectomorphic mesomorph – mesomorphy is dominant and ectomorphy is greater than endomorphy.

8. Mesomorph ectomorph – mesomorphy and actomorphy are equal (do not differ by more than one half unit) and endomorphy is lower.

9. Mesomorphic ectomorph – ectomorphy is dominant and mesomorphy is greater than endomorphy

10. Balanced ectomorph – ectomorphy is dominant; endomorphy and mesomorphy are equal and lower (or do not differ by more than one half unit)

11. Ectomorphy is dominant, and endomorphy is greater than mesomorph.

12. Endomorph ectomorph – endomorphy and ectomorphy are equal (or do not differ by more than one half unit] and mesomorphy is lower.

1.8 Body Composition: Body composition is the term used to describe the different components that, when taken together, make up a person's body weight. The human body is composed of a variety of different tissue types including lean tissues (muscle, bone, and organs) that are metabolically active, and fat (adipose) tissue that is not.

a. Body fat percentage:

A person's total body fat percentage is the total weight of the person's fat. The resulting number reflects both essential fat and storage fat. Arguably, body fat percentage is the superior gauge of an individual's fitness level, as it is the only body measurement which directly calculates the particular individual's body composition without regard to the individual's height or weight.
Comparison of Psychophysiological Correlates of Sports Women and Non Sports Women of Chhattisgarh

It is body fat mass in terms of percentage and was estimated from the equation of Katch and McArdle (1973)

\[ \text{Body fat} (\%) = 0.43(A) + 0.58(B) + 1.47 \]

A = Triceps fat fold (mm)

B = Subscapular fat fold (mm)

b. Absolute (total) body fat mass (kg)

It includes 3% essential fat plus storage (non-essential) fat

\[ \text{Absolute Body Fat Mass (Kg)} = \frac{\text{Percent Fat}}{100} \times \text{Body Mass} \]

c. Essential fat mass (kg)

It is a lipid rich store (as much as 3% of body mass in males) in bone marrow, brain, spinal cord and internal organs.

\[ \text{Essential Fat Mass (Kg)} = \frac{3}{100} \times \text{Body Mass} \]

d. Storage (Non-Essential) Fat Mass:

It is the storage fat that accumulates in adipose tissues, subcutaneous regions and serves as nutritional reserve to protect the various internal organs from trauma.

\[ \text{Storage Fat Mass (Kg)} = \text{Total Body Fat Mass (Kg)} - \text{Essential Fat Mass (Kg)} \]

e. Lean body mass (kg) [LBM]

It is composed of essential fat (+ sex specific reserve fat in females); muscles and bones. It is considered as in vivo entity of fat free mass.

\[ \text{Lean Body Mass (Kg)} = \text{Body Mass (Kg)} - \text{Storage Fat Mass (Kg)} \]
Comparison of Psychophysiological Correlates of Sports Women and Non Sports Women of Chhattisgarh

**f. Body Surface Area:**

Body Surface Area (A) (in Sq.m.) = \( w^{0.425} \times h^{0.725} \times 71.84 \)

**g. Body Mass Index (BMI):** \( \text{(WHO, 1995; Ferro-Luzzi et al 1992)} \)

BMI or Body Mass Index is another method of estimating a person’s body fat percentage based upon simple weight and height measurements. While the BMI calculation is an indirect measurement, it has been found to be a fairly reliable indicator of body fat measures in most people. Although some studies still question the accuracy of the BMI method of body fat measurement, especially for athletes.

It is the ratio of weight (kg) to stature \((m)^2\)

It is an age independent nutritional index. Following categories of nutritional status can be derived as per Ferro-Luzzi et al (1992):

\[
\text{BMI} = \frac{\text{Weight (kg)}}{\text{Stature (m)}^2}
\]

<table>
<thead>
<tr>
<th>Range Variation</th>
<th>Nutritional status</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Normal nutritional status</td>
</tr>
<tr>
<td>II</td>
<td>Mild or Grade I malnutrition</td>
</tr>
<tr>
<td>III</td>
<td>Moderate or Grade II malnutrition</td>
</tr>
<tr>
<td>IV</td>
<td>Severe or Grade III malnutrition</td>
</tr>
</tbody>
</table>

**h. Ponderal Index** (Comas, 1960; Livl’s, 1998)

\[
\frac{\text{Height(cm)}}{\sqrt[3]{\text{Weight(kg)}}}
\]

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Range</th>
<th>Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>01.</td>
<td>Below 38.3</td>
<td>Stockier 1</td>
</tr>
</tbody>
</table>

50
<table>
<thead>
<tr>
<th></th>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>02.</td>
<td>Above and equal to 38.3 but less than 40</td>
<td>Stockier 2</td>
</tr>
<tr>
<td>03.</td>
<td>Above and equal 40 but less than 41.8</td>
<td>Stockier 3</td>
</tr>
<tr>
<td>04.</td>
<td>Above and equal 41.8 but less than 43.5</td>
<td>Leaner 4</td>
</tr>
<tr>
<td>05.</td>
<td>Above and equal 43.5 but less than 45.2</td>
<td>Leaner 5</td>
</tr>
<tr>
<td>06.</td>
<td>Above and equal 45.2 but less than 46.8</td>
<td>Leaner 6</td>
</tr>
<tr>
<td>07.</td>
<td>Above and equal 46.8</td>
<td>Leaner 7</td>
</tr>
</tbody>
</table>

**i. Index of Androgyne:** It is used to determine the degree of masculinity in physique.

\[ IA = (3 \times \text{biacromial breadth}) - \text{bicristal breadth} \]

**j. Muscle Mass (kg):**

Theoretically, it is 44.8% of the body weight.

\[ \text{Muscle Mass (Kg)} = [\text{Body Mass (Kg)} \times 44.8] \div 100 \]

**k. Bone mass (kg):**

It is 14.9% of the body weight.

\[ \text{Bone Mass (Kg)} = [\text{Body Mass (Kg)} \times 14.9] \div 100 \]

**l. Body Density (g/cc):**

It is the body mass per unit volume (density = mass \div volume). It is calculated by Siri equation.

\[ \%\text{Body Fat} = \frac{495}{\text{Body Density}} - 450 \]

Or

\[ \text{Body Density} = \frac{495}{(\%\text{Body Fat} + 450)} \]

2. **PHYSIOLOGICAL VARIABLES**

Following Physiological Variables were measured (Goyal and Patel 2005)

**a. Heart rate (beats/minute):** Heart rate is the number of heartbeats per unit of time, typically expressed as beats per minute (BPM), it can vary as the body's need for oxygen...
changes, such as during exercise or sleep. It is used by athletes, in monitoring their heart rate to gain maximum efficiency from their training. Heart rate is measured by finding the pulse of the body.

b. **Blood pressure (mmHg):** The term *blood pressure* usually refers to the pressure measured at a person's upper arm. It is measured on the inside of an elbow at the brachial artery, which is the upper arm's major blood vessel that carries blood away from the heart. A person's BP is usually expressed in terms of the systolic pressure and diastolic pressure, for example 115/75. Blood pressure & Pulse Rate is also important indicators of sound health status.

The classification of bloods pressure (mmHg) was done according to the WHO (1978) as follows:

<table>
<thead>
<tr>
<th>Classification</th>
<th>Systolic BP (mmHg)</th>
<th>Diastolic BP (mmHg)</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>Hypertension(stage1)</td>
<td>140-159</td>
<td>90-90</td>
</tr>
<tr>
<td>Hypertension(stage2)</td>
<td>&gt;160</td>
<td>&gt;100</td>
</tr>
</tbody>
</table>

**Method of measurement:**
Subject was asked to sit in comfortable portion on the chair, after five minutes rest HR, SBP and DBP were measured and recorded.

**Instrument Used:**
Hicks Automatic Blood pressure Monitor Modal BP -102

**c. Peak Flow rate:** Peak flow rate was measured with the help of peak flow meter. The subject stands in erect position, insert the mouthpiece in to mouth, he then takes a deep
breath seals lips around the mouth piece and than blows out as hard as possible the reading of the printer is recorded. 

*Instrument Used: Peak Flow Meter. (Vitalograph)*

d. **Hemoglobin:** Hemoglobin test was done to assess the prevalence of anemia. Oxyhemoglobin was estimated using Sahil’s Haemometer following standard technique (WHO 1968).

Hemoglobin level: The subject was classified on the basis of different level of hemoglobin as per WHO [1975] as follows:

<table>
<thead>
<tr>
<th>Range</th>
<th>Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than or equal to 7</td>
<td>severe anemic</td>
</tr>
<tr>
<td>above 7 but less than or equal to 10</td>
<td>Moderate anemic</td>
</tr>
<tr>
<td>Above 10 but less than 12</td>
<td>Mild anemic</td>
</tr>
<tr>
<td>Above or equal to 12</td>
<td>Normal</td>
</tr>
</tbody>
</table>

3. **GYNAECOLOGICAL VARIABLES**

a. **Age of menarche:** Data on the age at menarche was collected by recall method since all subjects were educated; therefore, the accuracy of the method is almost undoubted. According to Bajema [1974], recalled age at menarche is accurate enough for anthropological and epidemiological purposes involving group comparisons.

2. **PMS (Pre-menstrual syndrome):** It is a term used to describe any symptoms which occur any time after ovulation and disappear almost as soon as the period arrives so the crucial point is not what symptoms one experiences but when, what are the symptoms of PMS & this is where a lot of confusion has arisen because over 150 symptoms can be classified as PMS. For collecting information on PMS check list was prepared and was used.
3. Gynaecological Problem: Gynaecological problems faced by women during trimesters of pregnancy, during child birth, after pregnancy and during pre menopause period were recorded through gynaecological problem questionnaire. The questionnaire was constructed for the purpose of the present study.

Construction of questionnaire

Gynaecological Problem Questionnaire (GPQ)

To enquire about various problems faced by the subjects under study during various phases of pregnancy and during pre menopause phase a questionnaire was prepared. The questionnaire was prepared in consultation with guide, co-guide, and medical expert in gynecology and professional colleague.

By keeping the problem under study the questionnaire was prepared in a way so that accurate and valid responses are assured which provides meaningful data.

The purpose and scope of the study was clearly identified. The scholar outlined the field of the study and the questionnaire was developed in an orderly fashion which covered all the aspects of the problem. All the questions were arranged in a logical order. Care was taken to make each question clear to avoid ambiguity or grammatical errors. The following steps were taken to prepare questionnaire:-

(1) Initial writing: – Rough draft of the questionnaire was prepared giving due thought to appropriate sequence of question. The researcher invariably re-examined and revised the rough draft after consultation with guide co-guide and other expert.

(2) Trial run: – The questionnaire was given to sports women and medical expert (gynecologist) and physical education professional for critical evaluation, answer and to give
suggestions so that the questionnaire could be reformed according to the suggestion.

(3) **Rewriting:** On the basis of suggestions received necessary changes were made and questionnaire was finally constructed.

### 4. PSYCHOLOGICAL VARIABLES

**a. A-B Personality Type (Ray and Bozek).** Personality type was assessed with the help of questionnaire.

**b. Adjustment Inventory (Asthana 1968):** To assess Adjustment of SW and NSW Adjustment Inventory prepared by Asthana was used the Inventory consists of 42 statements. The scoring of the questionnaire was based on two point scale where the responses are yes or no the minimum score that can be obtained on the administration of test.

The scholar personally met all the responded and explained the importance and gist of her work and sought cooperation from them. The subjects agreed to be the part of the study and to extend full cooperation. The questionnaires were handed over to them and were asked to return it within 15 days of time. After 15 days subjects who did not respond were again contacted & persuaded to cooperate, all the subjects returned the questionnaire duly filled.

**c. Self-concept (Sherry et. al.):** Self-concept is generally defined as one’s knowledge about his/her characteristics and personal limitations and a way in which one looks at such characteristics as different from or similar to others. It is one of the important aspects of social development.
that is formed through social experiences and interpersonal relationships.

Criterion Measure

The purpose of the present investigation Self-concept Inventory (Sherry et. al.) was used to examine the effect of participation in physical activity on self concept in SW, and to compare self concept of SW and NSW. The questionnaire consists of 48 statements which are categorized: under eight variables namely – (HP) Health and Physique (6 statements), Temperamental Qualities (5 statements), Academic Status (8 statements), Intellectual abilities (7 statements), Habits and Behaviour (5 statements) Emotional Tendencies (5 statements), Mental Health (7 statements) and Socio-economic Status (5 statements).

Scoring

The scoring of the questionnaire was based on two point scale where the responses are yes or no the minimum score that can be obtained on the sub variable Health and Physique, temperamental Qualities, Academic Status, Intellectual abilities, Habits and Behaviour, Emotional Tendencies, Mental Health and Socio-economic Status are 0 and maximum marks that can be obtained are 6, 5, 8, 7, 5, 5, 7 and 5 respectively.

To assess the Self-concept of a sports person it is essential to total the score of all the eight sub-scale. Thus, a minimum score of 0 and maximum score of 48 can be obtained by a respondent.
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Statistical Analysis: Descriptive analysis was done to observe the status of the subjects, comparative analysis done to locate difference between SW and NSW, correlation analysis was done to see relationship among various variables under study, similarly predicting factors for depended variables were calculated through regression analysis.