Comparative Analysis of Anthropometric Variables in Female Athletes and Non-athletes

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Abstract

Background: Anthropometry refers to the study of physical characteristics and measurements of human body. The objective of this study is to find the anthropometric differences between Indian female athletes and female non-athlete. It also portrays how sports bring changes in a female’s body composition and build up.

Methods: Primary data was collected with the help of a set of questions from 40 female athletes and 40 female non-athletes. All women taken for this study is between 18 – 30 years. Seven variables were considered for collection and comparison of data; these are height, weight, BMI, body fat percent, waist, hip and chest circumference.

Conclusion: Comparative study between female athletes and female non-athletes show how sports changed their body composition. The analysis was done by using t test for height, hip, chest and Mann Whitney U test was used for analyzing weight and waist. The study showed that female athletes are much fitter and less prone to physical and mental problems.

Keywords: Anthropometry, athletes, female, and non-athletes

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1.Introduction:

Anthropometry refers to the study of physical characteristics and measurements of human body. This study developed in the early 19th century helps to see the changes and differences in different groups of people over generations. Also, anthropometrical differences where noticed from people from different geographical regions and with different food habits both external and internal factors change the anthropometry of an individual. Differences in physical attributes between athletes and non-athletes have been noticed (1). This study has proved beneficial in many areas of scientific research, including judicial record maintenance and medical sciences. Height of an individual is associated with many other characteristics like health of heart and longevity of an individual (2). The first factor which determines the anthropometry and physical appearance of an individual is inherited traits from parents. Mendelian inheritance that characteristics and traits are carried from generation to generation following the law of Independent assortment, law of dominance and law of segregation. These laws depicted through dihybrid cross show the probabilities of an individual to develop certain characteristics from his/her parents. Studies have shown that characteristics like height can be inherited up to about 50% and muscular strength varies between ranges of 30% to 83%. But genetics factor are not the only determinants (3). External features like geographical location, climate, food habits etc. also bring about changes in the anthropometric characteristics of a person. These changes which happen in an individual from external factors are known as evolution. Players from different sport also tend to develop and acquire different anthropometric changes. Thus, differences are seen between athletes from different sport and the general population (2). Humans have followed a long change of evolution to build and discard body factors according to their needs. This study deals with the anthropometric differences between a women athlete and a non-athlete. Various factors like BMI, weight, arm span, fat mass etc. tend to differ for individuals who
engage into sports occasionally or never. Body weight of an individual also helps in different studies like approximation of the effect of drugs on renal function and determining pharmacodynamics in individuals with the tendency of obesity. Anthropometric measurement helps in collecting unique data of a large population in an easy and cost-effective way (1).

Sports have extremely beneficial effects on women and girls. Body composition of an individual is a deciding factor of an individual’s health, wellness and nutrition (1). The future mothers are much better physical and mental condition if they engage into physical activities. It has been seen that people who engage into physical activities are at lower risk of having cardiac diseases and stress. Sports specifically for women have a very positive effect during pregnancy, child birth, old age and menopause (4). The paper is of great significance to the society as it helps more women to bring the changes that sport brings. Characteristics like BMI, fat mass should be kept under surveillance to prevent obesity and other complicacies that come along. Also, ideal fitness can boost the self-esteem and confidence of women. As fitness is very essential for survival, humans have shown to engage in sports from the pre-historic era. Games like sprinting, swimming, wrestling; archery has been witnessed in cane paintings from the ancient period (1). This paper divides the sample population into athletes (who maybe professional or amateur) and non-athletes (who do not frequently take part in sports).

To assess the auxiliary qualities associated to greatness in aerobatic execution, body synthesis, anthropometric estimations, power, strength and flexibility were resolved in Junior Olympic tumbling contenders. Physical parameter estimations were performed on 65 male Class I and II all-around gymnasts (1).

With the level of participation increasing in sports we can conclude that sports has a positive impact on the society. This research paper dealing with the anthropometric differences between Indian women athletes and non-athletes significantly will show that sports brings a positive change in a women’s body which in turn improves internal health. It is still a taboo for many women to come out and participate in sports due to various intrinsic and extrinsic barriers. This paper will be an eye opener to most showing that sports and physical activities helps women to move towards a healthier society. Anthropometrical and morphological differences play a very important role in determining the athletic success of an athlete in the long run. It has highly believed that physical features and anthropometric profiles indicate whether a player will be sustainable for specific sports at the highest level. The objective of this study was to investigate the anthropometric differences between Indian female athletes and female non-athlete.

2. Material & methods:

The research details will be based on around 80 women, out of which 40 are elite athletes from different sports like basketball, football, rugby, swimming etc and 40 are healthy non-athletes aged between 18-30 years. I have used random sampling

- Height
- Weight
- Waist
- Hip
- Chest

Primary data was collected directly from the athletes and non-athletes on the above-mentioned variables. The sample for the study was taken from elite players from West Bengal, Tamil Nadu, Maharashtra, Bihar and Delhi. The non-athlete women’s measurements were also collected directly. Proper measurement was taken from 40 women athletes and 40 non-athletes.

The data was divided into two groups athletes and non-athletes according to the variables. This division was done to understand the differences in anthropometric measures between the two sets.

The samples were made to stand such that the feet is flat on the floor with their heels against the corner where the wall and floor meet. The head, shoulders, and buttocks were touching the wall.
They were made to stand straight with their eyes looking straight ahead. The line of sight and chin should be parallel to the floor. Height was measured in this method. The scale was placed on a level, uncovered surface in an area. Before each measurement, it was made sure that the scale reads zero. If the scale does not read zero before the sample gets on, it will not weigh accurately. The samples were made to remove heavy outer clothing (such as coats, jackets, and vests), purses, shoes, and any heavy accessories such as belts with heavy belt buckles. They also remove everything from their pockets including money (coins), pens and wallets. The samples were made to step on the scale and stand motionless in the middle of the scale platform with their feet slightly apart and the body weight distributed equally on both feet. Arms were made to relax and hang down loosely at the sides of the body. As digital scales are very sensitive to movement and any movement will change the weight measurement, so samples were made to stand very still. The weights were recorded on the scale and simultaneously on the sample's weight sheet. The measurement of height, waist, hip and chest circumference was done in Centimeters. Weight was measured in Kilograms and B.M.I was calculated in Kg/m².

Body mass index, fat percentage and waist hip ratio were calculated by their respective formulas. The mean was calculated and a comparative study was done using Independent Sample T test and Mann Whitney U test analysis to find the statistical differences between the two groups. SPSS version 24 was used for statistical analysis and interpretation of data. Level of significance was kept at 0.05.

3. Results and Discussion:

<table>
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<th>Sr. No.</th>
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<th>Sig. Value</th>
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<tr>
<td>2</td>
<td>Weight</td>
<td>.000</td>
</tr>
<tr>
<td>3</td>
<td>Hip</td>
<td>.377</td>
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<tr>
<td>4</td>
<td>Waist</td>
<td>.000</td>
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<tr>
<td>5</td>
<td>Chest</td>
<td>.174</td>
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</tbody>
</table>

Independent sample T-test was performed by using data for all the selected variables height, weight, hip, waist and chest circumference. Variables such as, Height, hip and chest circumference fulfilled all the assumption of Independent Sample T-test but for the variables weight and waist the assumption were not met for homogeneity of variances (Levene's Test). Hence, for the variables weight and waist circumference, Mann Whitney U test was performed for comparison between female athlete and non-athlete. It was found that except Weight and Waist Circumference (p<0.05) all the other variables were found to be insignificant (p>0.05).

The results have shown a difference in the mean score (height) between athletes and non-athletes. The athletes have shown a greater mean height than the non-athletes, thus showing that sports maybe to some extent affects our height. Height mainly is a genetic factor. 60-85% of our height is decided by our genes that we inherit from our parents. The remaining part of the growth depends on nutrition and physical activity. Nutrition plays an important role in determining the height of an individual in the early years of growth. The prime time for an individual to grow to the full length of their height is puberty. During the pubertal period Epiphyseal plates are added to the ends of our bones to increase in height. When growing is complete, which is majorly between the age of 18-25yrs, our bones ossify, the plates are sealed and no further growth in height takes place. Thus, nutrition and proper diet is extremely required for a slow increase in height. In fact, studies have shown that proper balanced diet can lead to increase in height between generations.

On the other hand, physical activity and engaging into regular sports has proved to be beneficial in case of sports. Physical activities stimulate bone epiphysis, cell proliferation thereby promoting bone development. As these growth plates get stimulated, a higher rate of calcium absorption helps to develop the bone to full length. Human growth hormone (HGH) secreted by anterior lobe of
pituitary gland is directly related to an individual’s growth in height. Participation in sports increases the secretion of HGH by increasing metabolism. Also, regular exercise is said to promote sleep. Proper sleep helps to develop bone in the spine and other parts, also increase HGH secretion and thereby potentially increase the height of an individual. Dynamic sporting activities promote growth and prevent stunted height. The slight difference in the mean score of the 2 groups is noticed as non-athletes even though have a balanced diet, yet the bones do not grow to the full length due to lack of the benefits that regular sportsmen have from physical activities.

The previous analysis had shown that 1.9 billion people around the globe are overweight, out of which 650 million adults are obese. Thus, it shows that being obese or overweight is prevalent in maximum population. Obese can lead to major cardiac problems, stroke and diabetes. The only two ways to control overweight and prevent obesity are proper maintained diet and regular exercise. Sports help to reach the required body along with maintaining internal processes fit and boosted. Intense physical activities increase the metabolic rate of our body thus burning the extra fat deposited. It is seen that a heavier person will burn more weight compared to a lighter person as more energy is required to overcome the higher resistance provided by a heavier person as compared to a lighter one.

The metabolic rate seems to pump up by 20% due to sports and physical activities. Specific trainings help in different ways. Aerobic training is beneficial for cardiac processes and paces up the blood pumping capacity of the heart. Yoga is another form of exercise which is an intense physical activity making an individual more mindful and fit. Resistance training along with weight on the other hand helps to tone and strengthen muscles.

Thus, a significant difference is seen in the mean weight between of athletes and non-athletes. The mean height of the sample population of non-athletes is 160 cm corresponding to which, the ideal weight should be between 47.2 – 59.42 Kgs. But our sample population has a weight of 67 Kgs which lies in the overweight category. On the other hand taking the same condition for athletes, the mean weight of athletes in accordance to their height lies in the normal weight category. This shows and proves that athletes vary from the non-athlete population on fitness and anthropometric grounds.

Body Mass Index (BMI):

\[ BMI = \frac{\text{Weight (in Kgs)}}{\text{Height}^2 \text{(in m)}} \]

- The normal BMI - 18.5 – 25
- Overweight – 25 – 30
- Obese – Above 30

BMI as shown is directly related to an individual height and weight. Those with higher BMI are at a risk of diabetes, arthritis, hypertension, high cholesterol and sleeping disorders.

\[ \text{Body fat} \% = (1.39 \times \text{BMI}) + (0.16 \times \text{Age}) - (10.34) \times \text{gender} \]

Where 1 is for men
Where 0 is for women

The ideal body fat percentage for women ranges between (10 - 13) %. The acceptable range lies till 31% beyond which is obese. The effect of being overweight and obese has an extremely adverse effect on a women’s body mechanism. The primary effect the obesity leads to specific disease to women is called polycystic ovary syndrome (PCOS). Also, diseases related to heart are at a higher risk. Obesity can also lead to post menopause, breast cancer and endometrial cancer.
more often in older women. The risk of gynaecological cancer also increases with increase in BMI. Maternal obesity during pregnancy can also be detrimental to both fetus and the mother (9). BMI also directly affects body dissatisfaction in both normal population and athletes (10). Women/girls who are engaged in sports have enhanced physical and mental perceptions. Also, sports reduces the chances of obesity and overweight does importing confidence and a positive mental image of their own self. (High body esteem)

Evidences (11) show girls engaged into sports have much lighter and regular periods with reduced chances of abdominal cramping and discomfort. Sports also reduce chances of osteoporosis and cardiovascular disease. Exercise is also proved to reduce mood swings in women by releasing endorphins, which is a mood regulator.

Thus, it shows that having a lower BMI and fat percentage not only has a difference in anthropometric measurements but also tends to influences and benefit women in other internal processes which could not be measured through simple experiments during this research.

The formula for this measurement is

\[ \frac{\text{waist circumference}}{\text{hip circumference}} \]

Mean:

- W: H Ratio for athletes: 0.79
- W: H Ratio for non-athletes: 0.95

Waist circumference was measured between the lower ribs and iliac crests whereas; hip circumference was measured between iliac crest and thighs. Waist hip ratio is a measure of obesity and visceral fat it is a letter indicator of the above-mentioned factors than other measures. It can depict the lack of certain muscles and pressure of visceral fat which is directly related to the increased risk of cardiovascular diseases (12).

A high waist – hip ratio signifies that the waist circumference is much higher than the hip circumference indicates high quantity of visceral fat, henceforth at a higher risk of cardiovascular disease. Having low hip circumference indicates lack of developed gluteals muscle and peripheral fat are at a lower risk or no risk of cardiovascular disease. Visceral fat induces cardiovascular disease in many ways. Proteins that are a defence mechanism against cardiovascular disease are less efficient and become repressive in the pressure of visceral fat. Visceral fat tends to multiply the level of plasma leptin which is directly related to cardiovascular disease (13). Also angiotensin, a regulator of blood pressure is more active in case of visceral fat. Visceral fat is also related to conditions like oxidative stress, hypertension, inflammation etc. on the other hand peripheral fat is protective against CVD. Studies (14) show that individual who have higher amount of fat in lower body tends to indicate lower risk of diabetes.

Women athletes also show a higher chest circumference is mainly because of strength and weight training. This increases the underlying muscles below the fatty tissue of the breasts. Exercise and training increases the diameter of muscle fibers thus increasing the whole muscle thereby increasing the chest circumference measurements.

4. Conclusion:

The objective of study was to compare Indian female athletes and female non-athletes on grounds of basic anthropometric measures. The results demonstrate that a significant difference between the two groups. The athletes show much better measurements than non-athletes showing that are at a much lower risk of having chronic disease. Whereas, the non-athletes show that their scores are more towards obesity and other chronic disease. It is concluded that female athletes are much fitter and less prone to physical and mental problems. This makes them much confident and higher their self-esteem which improves their quality of life.


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**References:**


