

# Morphology of Indian Female Athletes of Different Track and Field Events

Anju Luthra, Rajender Lal, Dhananjay Shaw

**Abstract**—Participation in games and sports in the contemporary times has become more competing with the developed scientific knowledge, skills and methods, along with the equipment and applied research in the field. In spite of India being a large country having vast resources and potential, its performance in the world of sports on the whole needs sincere attention for better achievements. Beside numerous factors responsible for the dismal performance of a sports person, the physique and body composition, including the size, shape and form are known to play a significant role. The present investigation was undertaken to study the specific morphological characteristics of Indian female Track and Field athletes. A total of 300 athletes were randomly selected as sample for the purpose of the study from the six events having 50 athletes in each event including 100m., 400m., Shot Put, Discus Throw, Long Jump and High Jump. The study included body weight, body fat percentage, lean body weight, endomorphy, mesomorphy and ectomorphy as variables. The data were computed statistically by using Mean, Standard Deviation and Analysis of Variance. The post-hoc analysis was conducted where the F-ratio was found to be significant at .05 level. The study concluded that there is a significant difference with regard to the selected variables among the Indian female athletes of different track and field events.

**Keywords**—Indian female athletes, body composition, morphology, somatotypes, track and field.

## I. INTRODUCTION

THE journey of sports in India has observed a rich tradition from the Vedic period to the Olympics. Despite being one among the most populous countries in the world, the performance of India in sports at international level has been a point of debate and discussion in the country. After every Olympics, the disappointing performance has been put under scanner [1]. When it comes to track and field events, we are still not able to make a mark at the largest platform of sport, particularly in regard to women participation and achievements. [2]

Sports performance is usually affected by numerous physiological, psychological, and biomechanical factors along with the skill traits of that particular sport [3]. For example, taller athletes may be more successful in events like basketball, while shorter athletes may excel at gymnastics or weightlifting.

Anthropometric dimensions and morphology of an athlete is

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quite decisive in determining his or her success in a particular sport [4], [5]. The body shape which is visible today in different sports is a result of generations adapting to the emerging demands to achieve success in that particular sport [6]. The anthropometric characteristics of the elite athletes of a particular sport may be helpful in talent identification despite numerous factors affecting sports performance.

Body composition is the proportion of lean body mass and fat percentage in the body. The assessment of body composition provides sensitive indices of body fatness and therefore becomes a mean of describing relatively subtle changes in the energy balance, which may have potential influence on the sports performance. The analysis of body composition is also important in many areas like human biology, human genetics, physical anthropology, sports medicine, physiotherapy, occupational health, preventive medicine and physical education etc. [7].

Somatotyping is a procedure of classifying human body in three essential elements of physique. They are endomorphy, mesomorphy and ectomorphy. While endomorphy is related to the fatness or adiposity, mesomorphy is concerned with the musculoskeletal development and ectomorphy leads to the leanness in an individual. The morphological characteristics of athletes have been studied by various researchers from time to time, however, not much literature is found in the Indian context [8]-[12]. Hence, the researcher was motivated to undertake the study on morphology of Indian female athletes of different track and field event.

## II. PROCEDURE

### A. Sample

300 subjects were randomly selected from various national level competitions to serve as the sample of the study. This included 50 athletes in each of the selected event namely 100 m, 400 m, discus throw, shot put, long jump and high jump.

### B. Variables

The study was conducted on the following morphological variables: weight, body fat percentage, lean body weight, endomorphy, mesomorphy and ectomorphy.

### C. Collection of Data

The data were collected by using standard measurement procedures.

### D. Statistical Procedure

The data were statistically analyzed by using analysis of variance (ANOVA), followed by its post-hoc analysis for

mean difference comparison where the F-ratio was found to be significant at .05 level. Mean and standard deviation were computed to describe the data.

### III. RESULTS AND DISCUSSION

The results have been presented in Tables I-VIII and Fig. 1.

TABLE I  
 DESCRIPTION OF MORPHOLOGICAL CHARACTERISTICS OF INDIAN FEMALE ATHLETES

Variable	100m. (Mean ± SD)	400m. (Mean ± SD)	Shot Put (Mean ± SD)	Discus Throw (Mean ± SD)	Long Jump (Mean ± SD)	High Jump (Mean ± SD)
Body Weight (kg.)	49.20 ± 4.81	49.20 ± 3.50	62.30 ± 3.82	58.80 ± 6.80	50.80 ± 3.91	49.70 ± 3.74
Percentage Body Fat (%)	10.60 ± 2.17	10.50 ± 1.74	17.20 ± 1.90	16.10 ± 1.90	12.00 ± 4.93	10.20 ± 1.51
Lean Body Mass (kg.)	44.20 ± 4.36	43.60 ± 3.54	51.50 ± 3.80	49.20 ± 4.97	45.10 ± 3.26	44.60 ± 3.55
Endomorphy	2.20 ± 0.56	2.20 ± 0.37	3.50 ± 0.66	3.30 ± 0.41	2.10 ± 0.23	2.00 ± 0.29
Mesomorphy	2.50 ± 0.96	1.60 ± 1.13	3.80 ± 1.61	3.00 ± 1.27	2.20 ± 0.74	2.10 ± 0.65
Ectomorphy	3.00 ± 0.96	3.20 ± 1.06	2.20 ± 0.56	2.80 ± 1.00	3.70 ± 3.22	4.00 ± 0.93

N = 300 (50 in each event)

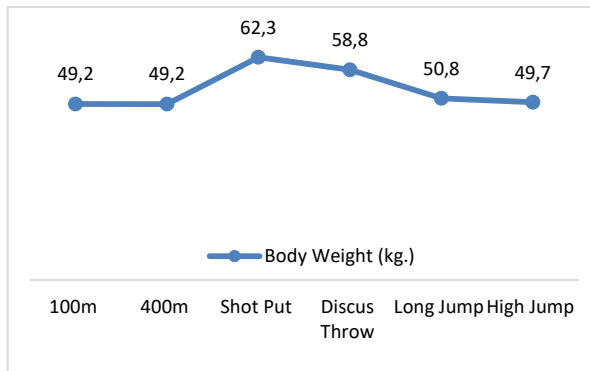


Fig. 1 (a) Body Weight of Indian Female Athletes

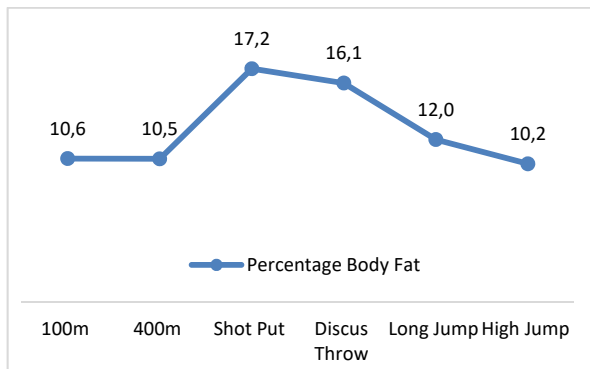


Fig. 1 (b) Percentage Body Fat of Indian Female Athletes

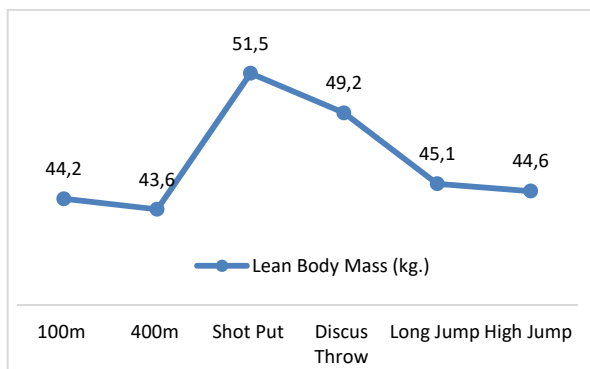


Fig. 1 (c) Lean Body Mass of Indian Female Athletes

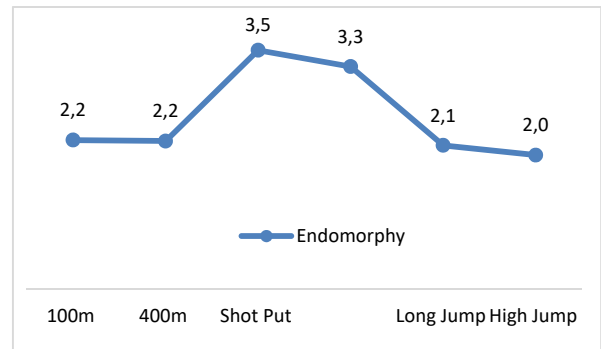


Fig. 1 (d) Morphological Characteristics of Endomorphy Component of Indian Female Athletes

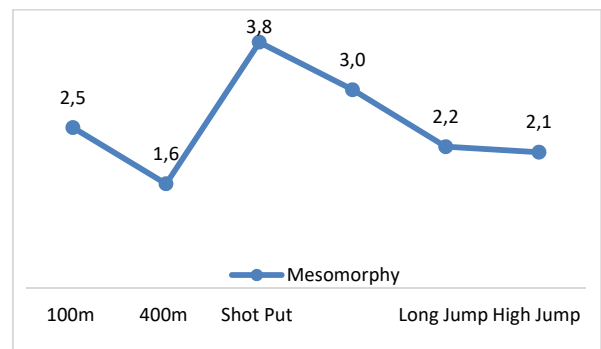


Fig. 1 (e) Morphological Characteristics of Mesomorphy Component of Indian Female Athletes

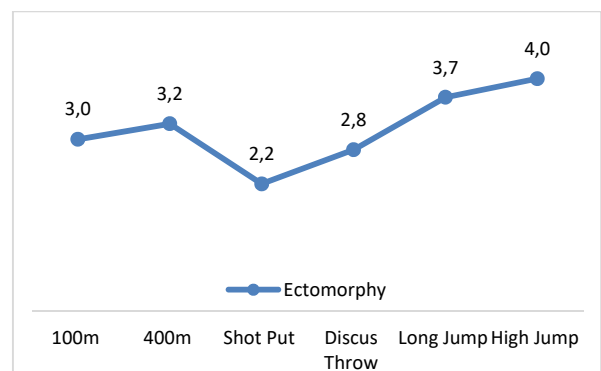


Fig. 1 (f) Morphological Characteristics of Ectomorphy Component of Indian Female Athletes

The analysis of data in Table I demonstrates the mean values of body weight, percentage body fat, lean body mass, endomorphy, mesomorphy and ectomorphy of different track and field athletes of India, which have been presented in Figs. 1 (a)-(f) for each variable separately.

TABLE II  
COEFFICIENT OF VARIANCE OF MORPHOLOGY OF INDIAN FEMALE ATHLETES

Variable	100 m	400 m	Shot Put	Discus Throw	Long Jump	High Jump	F-Ratio
Weight	9.78	7.11	10.55	6.14	7.70	7.53	83.352**
Percentage Body Fat	20.54	16.51	8.00	11.05	41.23	14.81	72.509**
Lean Body Weight	9.86	8.12	10.09	7.37	7.24	7.51	33.537**
Endomorphy	25.26	16.64	12.33	18.52	10.85	14.46	116.519**
Mesomorphy	9.78	7.11	10.55	6.14	7.70	7.53	19.634**
Ectomorphy	20.54	16.51	8.00	11.05	41.23	14.81	22.649**

F.05 (5, 294) = 3.87, F.01 (5, 294) = 6.72

It is evident from the analysis of data in Table II that the F-ratios were statistically significant at .05 level for all the selected variables namely body weight, percentage body fat, lean body weight, endomorphy, mesomorphy and ectomorphy among the Indian female track and field athletes of different events. To find out which of them has significant mean difference, the post hoc analysis was conducted for each of the variable separately, which have been presented in Tables I-VIII.

TABLE III  
COMPARISON OF MEAN DIFFERENCE OF BODY WEIGHT AMONG FEMALE ATHLETES OF DIFFERENT EVENTS

Event	400 m	Discus Throw	Shot Put	Long Jump	High Jump
100 m	0.036	9.564**	13.064**	1.584	0.486
400 m	-	9.600**	13.100**	1.620	0.522
Discus Throw		-	3.500	7.980**	9.078**
Shot Put			-	11.480**	12.578**
Long Jump				-	1.098
High Jump					-

It is evident from the analysis of data in Table III that the body weight of Indian female athletes participating in different events observed statistically significant mean difference for 100 m with discus throw and shot put; 400 m with shot put; discus throw with long jump and high jump; and shot put with long jump and high jump. However, the mean difference was statistically insignificant for all other variables.

TABLE IV  
COMPARISON OF MEAN DIFFERENCE OF PERCENTAGE BODY FAT AMONG FEMALE ATHLETES OF DIFFERENT EVENTS

Event	400 m	Discus Throw	Shot Put	Long Jump	High Jump
100 m	0.017	5.559**	6.618**	1.400	0.386
400 m	-	5.576**	6.635**	1.417	0.369
Discus Throw		-	1.059	4.159**	5.945**
Shot Put			-	5.218**	7.004**
Long Jump				-	1.786

It is exhibited from the analysis of data in Table IV that the percentage body fat of Indian female athletes belonging to different track and field events was statistically significant for

100 m as well as 400 m with discus throw and shot put; for discus throw as well as shot put with long jump and high jump. All other combinations were not statistically significant at 0.05 level.

TABLE V  
COMPARISON OF MEAN DIFFERENCE OF LEAN BODY WEIGHT AMONG FEMALE ATHLETES OF DIFFERENT EVENTS

Event	400 m	Discus Throw	Shot Put	Long Jump	High Jump
100 m	0.615	5.010*	7.321**	0.877	0.451
400 m	-	5.625**	7.936**	1.492	1.066
Discus Throw		-	2.311	4.133	4.559*
Shot Put			-	6.444**	6.870**
Long Jump				-	6.426**

It is pertinent from the analysis of data in Table V that there were significant mean differences among the lean body mass of female athletes for both 100 m and 400 m with discus throw and shot put; discus throw with high jump; shot put with long jump and high jump; and long jump with high jump. All other mean differences were not statistically significant.

TABLE VI  
COMPARISON OF MEAN DIFFERENCE OF ENDOMORPHY AMONG FEMALE ATHLETES OF DIFFERENT EVENTS

Event	400m	Discus Throw	Shot Put	Long Jump	High Jump
100 m	0.015	1.091**	1.331**	0.079	0.224
400 m	-	1.106**	1.346**	0.064	0.209
Discus Throw		-	0.240	1.170**	1.315**
Shot Put			-	1.410**	1.555**
Long Jump				-	0.145

The analysis of data in Table VI indicates that the endomorphy of Indian female athletes participating in different events observed statistically significant mean difference for 100 m as well as 400 m with discus throw and shot put; discus throw as well as shot put with long jump and high jump.

TABLE VII  
COMPARISON OF MEAN DIFFERENCE OF MESOMORPHY AMONG FEMALE ATHLETES OF DIFFERENT EVENTS

Event	400 m	Discus Throw	Shot Put	Long Jump	High Jump
100 m	0.862	0.580	1.309*	0.293	0.378
400 m	-	1.442*	2.171**	0.569	0.484
Discus Throw		-	0.729	0.873	0.958
Shot Put			-	1.602**	1.687**
Long Jump				-	0.085

The analysis of data in Table VII demonstrates that the mesomorphy of Indian female athletes participating in different events observed statistically significant mean difference for 100 m with shot put; 400 m with discus throw and shot put; shot put with long jump and high jump.

The analysis of data in Table VIII reveals that the ectomorphy of Indian female athletes participating in different events observed statistically significant mean difference for 100 m with high jump; 400 m with shot put; discus throw with

high jump; shot put with long jump and high jump.

TABLE VIII  
COMPARISON OF MEAN DIFFERENCE OF ECTOMORPHY AMONG FEMALE  
ATHLETES OF DIFFERENT EVENTS

Event	400m	Discus Throw	Shot Put	Long Jump	High Jump
100m	0.268	0.178	0.768	0.724	1.045*
400m	-	0.446	1.036*	0.456	0.777
Discus Throw		-	0.590	0.902	1.223*
Shot Put			-	1.492**	1.813**
Long Jump				-	0.321

#### IV. CONCLUSION

The finding revealed that out of the 84 comparisons of mean differences, 41 were found to be statistically significant. Hence, it may be concluded that the Indian female track and field athletes differed according to their specific event with regard to the studied variables namely body weight, percentage body fat, lean body weight, endomorphy, mesomorphy and ectomorphy.

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