



Somatotype, Body Composition and Anthropometric Profiles of Indian Male Greco-Roman Wrestlers

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Abstract

Background: Wrestling is known as a sport which highly requires physical preparation besides performing techniques such as clinch, fighting, throws and takedowns, joint locks, pins and other grappling holds.

Objectives: The aim of the present study was to assess body composition, anthropometric profiles and somatotype rating of young male Greco-Roman wrestlers and sedentary controls.

Methods: Nine heavyweight category wrestlers with mean age of 16.2 ± 0.89 years, 19 lightweight category male wrestlers with mean age of 16.4 ± 0.95 years, and 50 sedentary males with mean age of 16.9 ± 0.94 years, were recruited for the study.

Results: The results suggested that heavyweight category wrestlers were taller (178.3 ± 5.76), heavier (76.5 ± 8.17) than the other two categories. Body surface area was also found to be highest (1.95 ± 0.15) while sedentary controls were found to be highest in %BF (12.4 ± 2.10). Somatotype rating of the heavyweights, lightweights and sedentary controls were 4.3 - 5.0 - 2.6, 4.1 - 5.1 - 2.2 and 4.6 - 2.9 - 2.8 respectively. Wrestlers were found to be endomorphic-mesomorph while the controls were balanced endomorph. A significant ($P < 0.05$) differences were noticed almost in all the parameters except bicep and endomorphic component when compared among the groups. Body height, weight, BSA and suprailliac skin fold were found to be significantly ($P < 0.05$) differed when compared between the weight category groups. ANOM plot revealed that insignificant somatotype mean variation exist between the weight categories. Wrestler of Poland, Turkey and Iran have also reported that the %BF, BMI and somatotype rating scores which was higher in Greco-Roman wrestlers.

Conclusions: The present study compared the different anthropometric characteristics, somatotype rating and body composition profiles of Greco-Roman wrestlers and sedentary control groups. Differences in various parameters were found to be being related to training regimen and their socio-economic status.

Keywords: Wrestling, Greco-Roman Wrestlers, Body Composition, Anthropometry

1. Background

Wrestling is one of the most dynamic sports which is mainly consisted of abrupt explosive attacks as well as counterattacks that are performed repetitively at a high intensity and alternated with submaximal work up to 6 minutes (1, 2). Wrestlers are highly involved in technics that exert forearm flexors, deltoids and biceps brachii muscles (3). Wrestlers must have huge somatic build, extreme muscle girths and strongly developed epiphyses, adapted to bear heavy load (4). One of the previous study has shown that the strength durability of arm and trunk muscles differs its role is highly significant in the game condition (5). In Greco-Roman type of wrestling, participants are neither permitted to bout their counterpart under the waist, nor are they permitted to use their own legs to trip, lift or ex-

ecute (6). Anthropometric traits and body type are associated with motor abilities. Also it differs in different games and levels of activity (7). It has been found that somatotype plays key role in success of combat sports. Evidences suggest that somatotype affects the athletic performance (8).

Carter and Heath classified Somatotypes into three components: endomorph (fatty persons); mesomorph (muscular); and ectomorph (thin) (4, 7, 9-11). In a study, somatotypes and body composition of athletes in Poland were investigated (12). It was conducted on the basis of previous studies (13-17).

2. Objectives

The present study aimed to evaluate and assess the (i) body composition, anthropometric profiles and so-

matotype rating of young male Greco-Roman wrestlers and sedentary controls, and to (ii) compare and find the difference in body composition, anthropometric profile and somatotype rating between two weights categories of wrestlers.

3. Methods

3.1. Participants

The entire cross-sectional study was carried out on 28 male young Greco-Roman wrestlers from the Northern and Eastern region of India. During the scientific assessment of Sports Authority of India (SAI) trainees, all the participants were interviewed and were informed about the aims of the present study. The general characteristics of subjects were collected (age; training regimen; weight category; dietary habits). Two levels were distinguished in terms of weight category: H: heavier category, i.e. 71, 76, 77, 82, and 85 kg ($n = 19$) and L: lighter category, i.e. 46, 50, 53, 58, 60, 63, 65, and 69 kg ($n = 9$). The inclusion criteria were being medically fit; being healthy; lack of heredity disease.

3.2. Experimental Conditions and Procedures

3.2.1. Body Composition Assessment

Body fat percentage (%) and lean body mass (LBM, kg), body mass index (BMI), skinfolds (bicep, triceps, subscapular, suprailiac, calf), sum of skinfolds, muscle circumference from arm and calf were assessed. Bone diameters of biepicondylar humerus and biepicondylar femur were also measured. Somatotype (H-C) was calculated from the skinfolds, arm and calf circumferences and bone diameters. Body surface area (BSA) and height weight ratio (HWR) were respectively measured by using Du Bois and Du Bois and Heath Carter methods (9, 18). Informed consents were signed prior to the study. The study protocol was consistent with the ethical guidelines of the 1975 Declaration of Helsinki. The arm and calf circumference were measured by steel measuring tape. Skinfold thickness was measured by means of digital skinfold calliper (Skyndex, LLC, USA) at four anatomical sites of the body - the biceps, triceps, sub-scapular and suprailiac. Body fat percentage was measured by standard equation (19). The technical error of measurement (TEM) was used to evaluate the validity and reliability of variable measurement. Body fat percentage was measured by ISAK equation and Somatotype was measured using Heath and Carter procedure (19).

3.2.2. Training Regimen

The training protocol consisted of 4 - 5 hours for 6 days. There were two training sessions in a day i.e. morning

and evening session and both of which comprised of physical training for two hours and skill training for about two hours. The training protocol included different strength and endurance training programs along with exercises like speed exercises, speed drills, speed techniques, standing techniques, ground techniques, hold bout, 7 partners \times 6 minutes, 30 second attacks, stepping, partner exercises etc. were practiced. Strength and endurance training was also applied according to their sports specific requirement. Warm up and cool down session after and before starting of the main practice were also included in the programme. Besides the technical and tactical training the players were also provided psychological or mental training session.

3.3. Statistics

Data were analysed using Independent *t*-test and analysis of mean (ANOM) by SPSS software (SPSS Inc., Chicago, version 16.0; IL, USA).

4. Results

Table 1 depicts the descriptive traits of the anthropometric, body compositions and somatotype rating of elite Indian male Greco-Roman wrestlers and sedentary controls. Highly significant ($P < 0.01$) differences were observed almost in all the parameters when compared among these three groups. On the other hand no such significant difference was seen in bicep skinfold and endomorphic rating of somatotype when compared among these groups. Heavyweight category wrestlers were dominated over their other counterparts in almost all the anthropometric and body composition profiles. On the other hand mesomorphic component was found to be more in lightweight category wrestler as compared to heavyweight category wrestler and control group.

Figure 1 showed the proportionality profiles (Phantom Z_p score) of anthropometric parameters such as body weight, bicep, tricep, subscapular, suprailiac, calf skinfolds, mid upper arm circumference, calf circumference, biepicondylar humerus and biepicondylar femur. Results of both heavier and lighter weight category wrestler and sedentary controls as proportional scores through the Phantom are presented. Heavyweight wrestlers showed higher Z_p scores of body weight (0.50) than the lightweight wrestlers (0.30). Bicep skinfold demonstrated a high and positive Z_p score (2.0) in the heavyweight categories. Z_p values of triceps skinfold ranged between (1.0 to 4.0). Both subscapular and suprailiac skinfolds thickness was found to be considerably

Table 1. Descriptive Traits of the Anthropometric, Body Compositions and Somatotype Rating of Subjects^a

Parameters	Heavyweight (N = 9)	Lightweight (N = 19)	Controls (N = 50)	F Value and Level of Significance
Age (y)	16.2 ± 0.89	16.4 ± 0.95	16.9 ± 0.94	3.936 ^c
Height (cm)	178.3 ± 5.76	168.8 ± 6.28	158.8 ± 6.90	40.916 ^c
Weight (kg)	76.5 ± 8.17	65.6 ± 6.98	49.0 ± 5.53	102.850 ^c
BMI	24.1 ± 1.91	23.0 ± 1.65	19.6 ± 1.95	38.899 ^c
FFM (%)	88.0 ± 2.28	88.5 ± 2.78	87.5 ± 2.10	2.380 ^c
FM (%)	11.9 ± 2.28	11.5 ± 2.78	12.4 ± 2.10	2.941 ^c
HWR	42.1 ± 1.25	41.9 ± 1.17	43.5 ± 1.46	11.276 ^c
BSA (m ²)	1.95 ± 0.15	1.75 ± 0.10	1.48 ± 0.10	99.264 ^c
Bicep (mm)	6.5 ± 2.71	7.2 ± 3.11	7.6 ± 2.06	5.833 [NS]
Tricep (mm)	7.1 ± 3.51	8.7 ± 2.82	7.3 ± 2.78	3.227 ^c
Subscapular (mm)	8.6 ± 2.57	9.4 ± 2.86	6.2 ± 2.42	3.227 ^b
Suprailiac (mm)	9.1 ± 1.92	11.1 ± 2.19	7.4 ± 2.98	11.067 ^c
Calf (mm)	10.4 ± 1.68	11.6 ± 2.80	7.7 ± 2.97	216.991 ^c
MUAC (cm)	25.2 ± 5.54	24.4 ± 4.82	24.4 ± 2.77	33.132 ^c
Calf C. (cm)	35.1 ± 4.49	35.2 ± 4.12	32.6 ± 3.56	1.139 ^c
Bi.Humerus (cm)	6.8 ± 0.69	6.8 ± 0.86	6.2 ± 0.73	56.274 ^c
Bi.Femur (cm)	8.3 ± 1.08	8.7 ± 0.96	8.6 ± 0.73	214.203 ^c
Endomorphy	4.3 ± 0.32	4.1 ± 0.70	4.6 ± 0.79	3.144 [NS]
Mesomorphy	5.0 ± 0.06	5.2 ± 0.81	2.9 ± 1.29	35.063 ^c
Ectomorphy	2.6 ± 0.50	2.2 ± 0.87	2.8 ± 0.94	3.734 ^b

Abbreviation: NS, not significant.

^aValues are expressed as mean ± SD.

^bP < 0.01.

^cP < 0.05.

higher positive Z_p values in the sedentary controls. MUAC showed highest positive Z_p score in case of heavy sedentary categories (3.0). Calf circumference showed positive Z_p score in the wrestling categories only. Biepicondylar humerus and Biepicondylar femur showed positive Z_p values in all the three categories which ranged between (0.70 to 2.6) and (0.9 to 3.1) respectively.

Table 2 represents the anthropometric characteristics and somatotype rating of subjects based on their weight category. Contestants from heavier (H) categories obviously differed from lighter category athletes in height ($t = 3.83$, $P < 0.01$), weight ($t = 3.65$, $P < 0.01$), BSA ($t = 4.20$, $P < 0.01$) and suprailiac skinfold ($t = 2.34$, $P < 0.05$). No such significant differences were observed in rest of the anthropometric and somatotype parameters when compared between these two weights categories.

Figure 2 represents the mean somatotype ratings of wrestlers, both heavy and light category and sedentary controls on a Somatochart. Players of heavy and lightweight category were typically endomorphic-

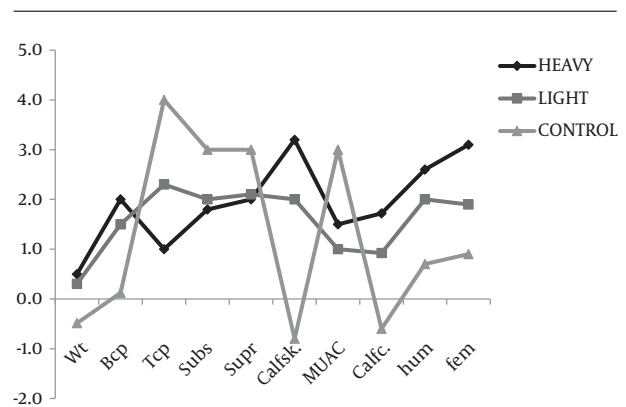


Figure 1. Proportionality profiles of elite Indian male Greco-Roman wrestlers (heavy and light weight categories) and controls through Phantom Z score

mesomorph in nature while the controls portrayed balanced endomorphic characteristics.

Figure 3 represented the ANOM plot of the mean so-

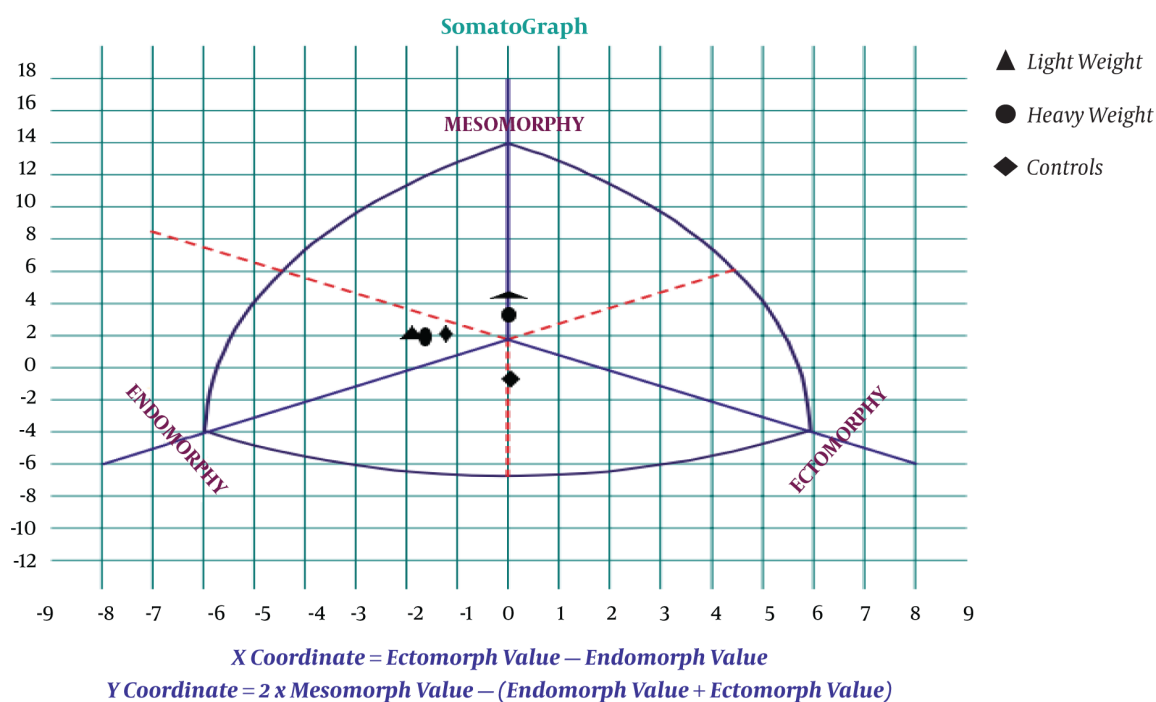


Figure 2. Somatochart showing mean somatotype distribution of Indian Greco-Roman wrestlers of heavyweight (n = 9), lightweight (n = 19) and sedentary controls (n = 50)

matotype rating and their significant difference from the overall population mean (if any) with regard to different weight categories of wrestlers. All the three somatotype rating of the wrestler, i.e. endomorph, mesomorph and ectomorph showed no significant differences with the means of individual weight categories from the average population mean.

Table 3 represented the comparisons of %BF, BMI, endomorphy, mesomorphy and ectomorphy of male Greco-Roman wrestlers of heavy and lightweight categories of previous studies as reported by the authors with the present study. Percent body fat, BMI and somatotype ratings were found to be higher in wrestlers of previous studies of Poland, Turkey and Iran. It was evident from the table that the comparatively higher body fat percent, BMI and mesomorphic component of somatotype rating was observed in male wrestlers Turkey (20).

5. Discussion

The aim of the present study was to assess body composition, anthropometric profiles and somatotype rating of young male Greco-Roman wrestlers and sedentary controls. The study revealed that there are significant differences in various anthropometric profiles body composi-

tion parameters, body built type among the three categories of subjects. Wrestlers of heavyweight category revealed that greater height (178.3 ± 5.76) and weight (76.5 ± 8.17) was compared to the lightweight category wrestlers. Almost similar observations were made by Basar et.al. (23). Physical fitness tests would provide wrestlers and coaches with information of physiologic status and also can allow them to compare that capacity with reference standard from appropriate peer groups. Wrestlers of heavyweight class represent strong type of body build, defined as overweight. The notion of overweight might seem disputable. Wrestling is a dynamic sports which requires constant action during the bouts. They should improve motor and physical capacities. The controls of our study showed remarkably lower body height and weight than their wrestler counterpart. This is in partly agreement with the study done by Hiremath et al. (24). The wrestlers had been adapted to sports specific physiological characteristics on account of training and exercise and nutritional status as compared to the sedentary controls as they showed less developed physical characteristics despite being at the same age group. This in turn resulted in higher BMI in wrestlers as compared to the sedentary controls. Though the statistically significant differences were observed in case of height and weight between heavy

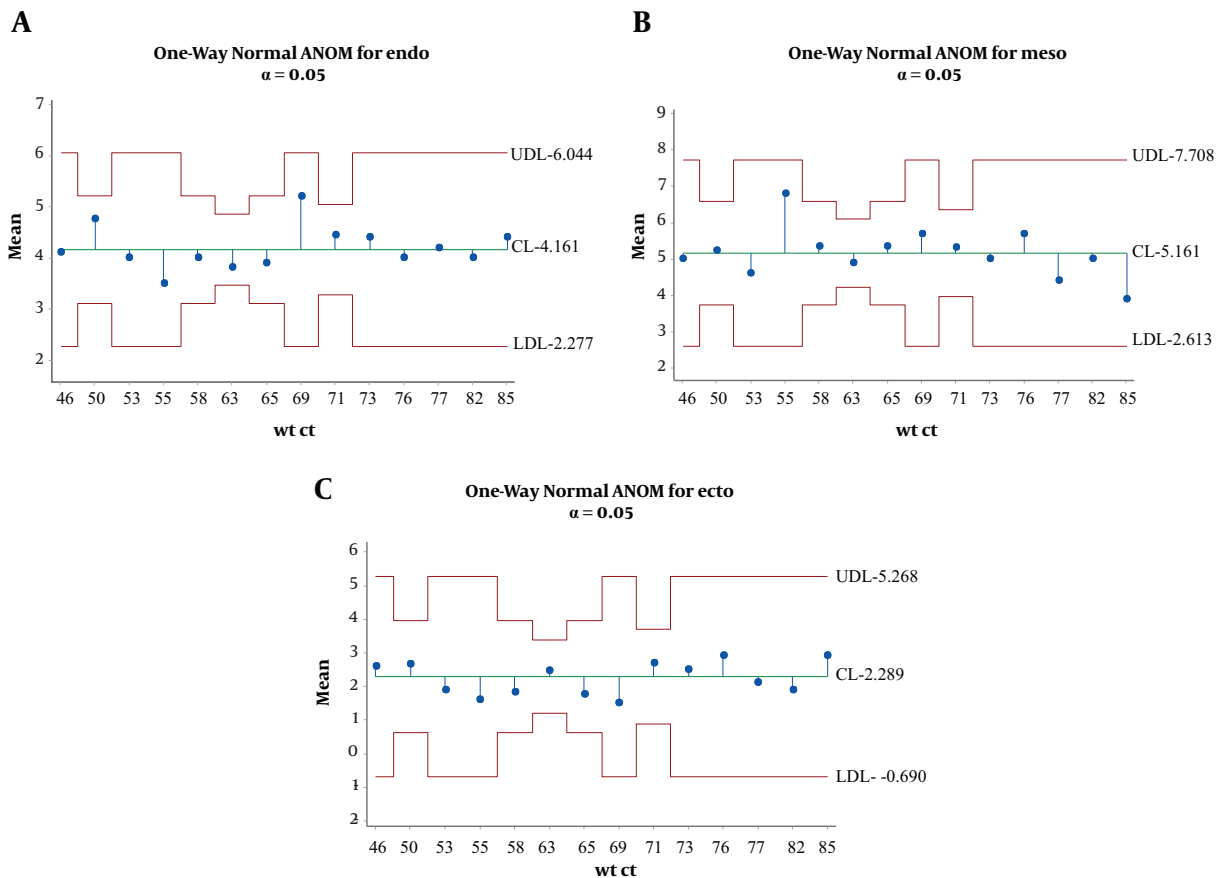


Figure 3. A, ANOM Plot of endomorphy related to weight categories of the Indian male Greco-Roman wrestlers of heavyweight (n = 9) and lightweight category (n = 19); analysis of means plot of endomorphy with 95% decision limits. B, ANOM Plot of mesomorphy related to weight categories of the Indian male Greco-Roman wrestlers of heavyweight (n = 9) and lightweight category (n = 19); Analysis of means plot of mesomorphy with 95% decision limits. C, ANOM Plot of ectomorphy related to weight categories of the Indian male Greco-Roman wrestlers belonging to heavyweight (n = 9) and lightweight category (n = 19); analysis of means plot of ectomorphy with 95% decision limits. UDL, upper decision limit; CL, central line, LDL, lower decision limits.

and light weight category wrestlers when compared these two groups. However, BMI did not showed any remarkable difference when compared between these two groups. But there were remarkable differences among the three groups which are not found to be corroborated with the study reported by Hiremath et al. (24). The result of the present study revealed that %BF and %FFM of the wrestling categories did not differed significantly but the sedentary controls had comparatively higher %BF than the wrestlers which is in agreement with the study done by Hiremath et al. (24) and Stercovicz and Starosta (5) where they had compared to the untrained sedentary controls and was found huge difference indicating that wrestlers were lean. This fact supports the assumption that wrestlers try to maximize lean body mass and minimize fat mass. It could be the reflection of adaptations in physiological functions of the body to long-term wrestling training. In the present

study, highest HWR was noticed in the controls, which is in agreement with the study conducted by Stercovicz and Starosta (5). The heavyweight category wrestlers were found to have the highest body surface area (1.95 ± 0.15) as compared to the lightweight wrestlers and sedentary controls (1.48 ± 0.10). For many clinical purposes, BSA is a better indicator of metabolic mass than body weight because it is less affected by abnormal adipose mass. It is well established that wrestling is a sport that requires high physical activity and mechanical power. A high size athlete (in terms of weight) may have the advantage in some physical performances compared to a lighter and smaller one. In general, the heaviest weightlifters lifts most weight and this is simply because they have so much body mass, and consequently strength, that they can effectively overcome the inertia (the tendency of a body to stay at rest) of the load (25). The heavyweight and lightweight

Table 2. Independent *t*-Test of the Anthropometric and Body Composition Profiles of the Heavy (N = 9) and Light (N = 19) Weight Category Elite Indian Male Greco-Roman Wrestlers

Parameters	t Value	P Value
Age (y)	0.53	0.60 [NS]
Height (cm)	3.83	0.0007 ^b
Weight (kg)	3.65	0.001 ^b
BMI	1.56	0.12 [NS]
FFM (%)	0.46	0.64 [NS]
FM (%)	0.37	0.71 [NS]
HWR	0.41	0.68 [NS]
BSA (m ²)	4.20	0.0003 ^b
Bicep (mm)	0.57	0.56 [NS]
Tricep (mm)	1.29	0.20 [NS]
Subscapular (mm)	0.71	0.48 [NS]
Suprailliac (mm)	2.34	0.02 ^a
Calf circumference (cm)	1.18	0.24 [NS]
MUAC (cm)	0.39	0.69 [NS]
Calf Circumference (cm)	0.05	0.95 [NS]
BiepicondylarHumerus (cm)	0.0	1.00 [NS]
Biepicondylar Femur (cm)	0.99	0.33 [NS]
Endomorphy	0.81	0.42 [NS]
Mesomorphy	0.73	0.47 [NS]
Ectomorphy	1.27	0.21 [NS]

Abbreviation: NS, not significant.

^aP < 0.01.^bP < 0.05.

category wrestlers showed significant differences in BSA. Skinfold measurement was found to be differed significantly among these groups. But between the wrestling categories, difference was noticed only in case of suprailliac skinfold. Considering anthropometric measurements with respect to style and weight category is of utmost importance in talent selections (26-28). However, to the best of our knowledge, no study was found in this field. The same was found in Turkey (29, 30). Difference in training

programs of Greco-Roman and Freestyle wrestlers would be possible reason for the changes in anthropometric characteristics. In the present study the lightweight category wrestlers were found to have higher values of skinfolds. But girth measurements were higher in heavyweight category wrestlers.

Somatotype is important in determining talent identification of athletes. A combination of factors including power, strength and body composition are considered for this purpose. Bloomfield et al. proposed that endomorphy and mesomorphy increases and ectomorphy decreases in the higher weight classes in wrestling and the lighter wrestlers tend to be balanced mesomorphs and the heavier ones endo-mesomorph (31). Carter, in his study on Olympic athletes, reported a mean somatotype rating of 2.5 - 6.5 - 1.5, but they range from 1.5 - 5.5 - 2.5 in the under 60-kg weight class to 4.0 - 7.5 - 1.0 in the heavyweight class (32). Akyuz et al. found that somatotype of Turkish wrestlers as 2.9 - 4.5 - 1.5 (29). While, in our study, somatotypes of Greco-Roman wrestlers were 4.3 - 5.0 - 2.6 for the heavy categories and 4.1 - 5.2 - 2.2 for lightweight categories. Wrestlers were found to be endomorphic mesomorph in nature while the controls were balanced endomorph (4.6 - 2.9 - 2.8). Such difference was observed in Turkish wrestlers also and this is not taken in to consideration the styles of wrestlers by Akyuz et al. However, Cicioglu et al. reported that somatotype values could differ depending on seasonal changes also (33). This difference between present study and the study conducted by Akyuz et al. may be correlated with seasonal variation (29). Further, a study was conducted by Duzgun et al. (21), on somatotype of the Greco-Roman wrestlers and was found as balanced mesomorphy. From ANOM analysis it was evident that between the weight categories, endomorphy, mesomorphy and ectomorphy mean values were varied but the difference was not statistically significant. Previous studies from Poland, Turkey and Iran showed %BF, BMI and somatotype rating were higher in the Greco-Roman wrestlers. Bayraktar and Koc (20) have also showed a comparatively higher %BF, BMI and mesomorphy rating in male wrestlers. The above studies are corroborated with findings of the present study particularly in somatotype and percent body fat.

5.1. Conclusions

The present study compared the anthropometric characteristics, somatotype and body composition profiles of Greco-Roman wrestlers and sedentary controls and the differences that observed were considered as being related to training programs and socio-economic status. However, the comparison of the training programs of these athletes was not monitor and also details about their socio-

Table 3. Comparison of Selected Anthropometric Parameters and Somatotype Ratings of Male Greco-Roman Wrestlers of Different Authors with Present Study^a

Author(s)	Country	No.	%Fat	BMI	Endomorphy	Mesomorphy	Ectomorphy
Katarzyna et.al. (2011)	Poland	H = 12; L = 11	H = 13.2 ± 1.30; L = 10.9 ± 1.89	H = 27.8 ± 1.95; L = 24.8 ± 1.18	H = 2.2 ± 0.30; L = 1.7 ± 0.43	H = 6.8 ± 1.00; L = 6.3 ± 0.76	H = 1.1 ± 0.50; L = 1.3 ± 0.42
Irem Duzgun et.al. (21) (2016)	Turkey	46	9.1 ± 2.35	26.0 ± 3.68	2.1 ± 0.48	5.5 ± 1.29	1.3 ± 0.95
Ali Jafari et.al. (22) (2016)	Iran	16	10.9 ± 1.64	22.1 ± 1.68	2.1 ± 0.46	5.2 ± 0.70	2.8 ± 0.63
Bayraktar and Koc (20) (2017)	Turkey	19	17.3 ± 4.20	27.9 ± 3.90	4.1 ± 1.44	7.7 ± 1.20	1.0 ± 0.55
Present Study	India	H=9; L=19	H = 11.9 ± 2.28; L = 11.5 ± 2.78	H = 21.4 ± 1.91; L = 22.9 ± 1.65	H = 4.3 ± 0.32; L = 4.1 ± 0.70	H = 5.0 ± 0.06; L = 5.2 ± 0.81	H = 2.6 ± 0.50; L = 2.2 ± 0.87

^aValues are expressed as mean ± SD.

economic profiles were not taken in to the consideration. Thus in future, studies on the above mentioned factors may shed more light on such differences particularly in Greco Roman wrestler.

Footnotes

Authors' Contribution: Data collection: Atriya Neogi, Apoorva Tiwari, and Tambi Medabala; manuscript writing, statistical analysis: Atriya Neogi; study design, Manuscript checking: Snehunsu Adhikari and Swapan Kumar Dey.

Conflict of Interests: It is not declared by the authors.

Ethical Approval: Ethical clearance was taken from the Institutional Ethical Committee.

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