World Applied Sciences Journal 35 (3): 356-360, 2017
ISSN 1818-4952

DOI: 10.5829/idosi.wasj.2017.356.360

Somatotype and Body Composition Characteristics of Indian University Level Football Players

Sukanta Saha

Department of Physical Education, Memari College, Memari, Burdwan, West Bengal, India

Abstract: Somatotype and body composition characteristics of athletes determine the success in particular sports events in various ways. The knowledge of these characteristics is necessary to establish their importance for the success in competitive sport. This study evaluates somatotype and body composition variables of Indian university level football players. The measurements were performed on 204 university level (mean age 20.78 years) male football players of 16 different universities. Body composition was estimated from skinfold, muscle girth and bone diameter measurement; and somatotype was determined using the Heath-Carter method. Result indicated that the mean height and weight of the university level football player was 168.75 cm. and 60.70 kg. respectively. They possessed 9.31 % body fat, 49.64 % skeletal muscle mass and 13.34 % skeletal mass. The mean somatotype of the Indian university level football player was ectomorphic mesomorph (2.33-4.63-2.90). The Indian university level football player had inferior height, weight, lean body mass and mesomorphic value of somatotype component than the overseas football player.

Key words: Somatotype · Body Fat · Skinfold · Muscle Girth · Mesomorphy

INTRODUCTION

Football is probably the world's most popular sport, played in practically every nation at varying levels of competence. Football may be played competitively or for fun, as a career, a means of keeping fit or simply a recreational pursuit [1]. The physique and body composition variables of an athlete is considered to be an important determinant of success in many sports and in top level sport there would appear to be a tendency for individuals to gravitate towards the event to which they are anthropometrically best suited [2-9]. Football games require comprehensive ability including physical, mental and tactical abilities [10-12]. Football players cover 8-12 km. during a match, consisting of 24% walking, 36% jogging, 20% coursing, 11% sprinting, 7% moving backwards and 2% moving in possession of the ball [1]. Therefore, players must have physical abilities to make rapid and powerful movements. They must have aerobic and anaerobic capacities that make them competent in prolonged vigorous offensive and defensive maneuver to win a match.

The objective of this paper was determination of somatotype and body composition characteristics of football players who play inter university football tournament in India.

MATERIALS AND METHODS

A total of 204 university level (age range 19-25 years) male football players of 16 different universities who participated in the East Zone Inter University football tournament held at Visvs-Bharati University, Santiniketan, West Bengal, India in 2006, were selected as subject in this study. Date of birth of the subjects was collected from the original sheet which they submitted to the organizing committee. Each player was weighted in kilograms and their stature determined in centimetres. Skinfold measurements (in millimetres) were taken in eight sites (triceps, sub-scapular, supraspinale, pectoral, axilla, abdominal, thigh and calf) using standard Harpenden Skinfold Caliper (GAIAM-PRO manufactured by "Baty International, Victoria Road, Burgess Hill, West Sussex, RH159LB, U.K". The spring pressure of the skinfold

Corresponding Author: Sukanta Saha, Department of Physical Education, Memari College, Memari, Burdwan, West Bengal, India.

caliper was 10 gm./mm^2). The five muscle girths (upper arm, fore arm, chest, thigh and calf) of the subjects were measured by using Freemans Flexible Steel Tape to the cm. Four bone diameters (humerus, bistyloid, femur and bimalleolus) of the subjects were measured by Lange Caliper (Manufactured by GPM Swiss Med.) to the cm.

Somatotype: To assess the somatotype (endomorphy, mesomorphy and ectomorphy) of the subjects Heath and Carter (1990) somatotype estimation equations were used.

Equation for Endomorphy: $0.1451(X) - 0.00068(X)^2 + 0.0000014(X)^3 - 0.7182$

where 'X' is the sum of the triceps, sub-scapular and supraspinale skinfold thickness multiplied by 170.18 ÷ height in cm.

Equation for Mesomorphy: (0.858 × H.B.D) + (0.601 × F.B.D) + (0.188 × C.A.C) + (0.161 × C.C.C) – (Height × 0.131) + 4.5

where- H.B.D = Humerus Bone Diameter; F.B.D = Femur Bone Diameter; C.A.C = Corrected Arm Circumference (Arm Girth in cm. – Triceps Skinfold in cm.); C.C.C = Corrected Calf Circumference (Calf Girth in cm. – Calf Skinfold in cm.)

Equation for Ectomorphy: If H.W.R. (Height in cm ÷ ^{3}v weight 1/3 in kg) is greater than or equal to 40.75 (≤ 40.75) then

Ectomorphy = (H.W.R × 0.732) – 28.58

If H.W.R. is less than 40.75 but greater than 38.25 (> 40.75 but < 38.25) then

Ectomorphy = (H.W.R × 0.463) – 17.63

If H.W.R. is equal to or less than 38.25 (≥ 38.25) then

Ectomorphy = 0.1 or recorded as ½

Body Composition: Assessment of Body Mass Index (BMI):

BMI = [Weight in Kg. ÷ (Height in m.)^2]

Measurement of % Body Fat as per Siri Equation (1956):

% Body Fat = [(4.95 ÷ Body Density)-4.5] × 100

Where body density was calculated as per Jackson and Pollock (1978) – seven sites equation:

Body density $=1.112–0.00043499(\Sigma 7skf)+ 0.00000055(\Sigma 7skf)^2– (0.00028826(X_2)$

where, Σ7skf = sum of 7 skinfolds i.e. Pectoral, Axilla, Abdominal, Suprailiac, Subscapular, Triceps and Midthigh; and X2 = age in years.

Assessment of Lean Body Mass or Fat Free Mass (LBM):

LBM = (Body Weight – Total Body Fat Weight)

Measurement of Skeletal Muscle Mass (SMM) as per Poortman's Formula (2005):

SMM (Kg.) = Height[{0.0064 × (CAG)^2} + {0.0032 × (CTG)^2} + {0.0015 × (CCG)^2}] + (2.56 × Sex) + (0.136 × Age)

where – Height in m.; Age in Years; Sex (Male = 1 & Female = 0); CAG = Corrected Arm Girth in cm. (Arm Girth in cm. – Triceps skinfold in cm.); CTG = Corrected Thigh Girth in cm. (Mid-Thigh Girth in cm. – Mid Thigh skinfold in cm.); CCG = Corrected Calf Girth in cm. (Calf Girth in cm. – Calf skinfold in cm.)

Assessment of % Skeletal Muscle Mass (% SMM):

% SMM = [SMM (Kg.) ÷ Body Mass (Kg.)] × 100

Measurement of Skeletal Mass (SM) as per Drinkwater et al. Formula (1986):

SM (Kg.) = [(HB + WB + FB + AB) ÷ 4]^2 × ht × 0.92Kg. × 0.001

where - HB = Humerus Biepicondyler Diameter; WB = Bistyloideus Diameter; FB = Femur Biepicondylar Diameter; AB = Bimalleolar Diameter; ht = Height in cm.

Assessment of % Skeletal Mass (% SM):

% SM = [SM (Kg.) ÷ Body Mass (Kg.)] × 100

Measurement of Body Surface Area (BSA) as per Mosteller's Formula (1987):

BSA (m^2) = [{Height (cm.) × Weight (Kg.)} ÷ 3600]$^{1/2}$

Table 1: Descriptive statistical parameters of body composition variables of football players

Body Composition Variables	Mean	SD	SEM
Height (cm)	168.75	5.79	0.410
Weight (kg)	60.70	6.05	0.424
BMI	21.30	1.74	0.122
% Body Fat	9.31	2.07	0.145
Lean Body Mass (kg)	56.84	5.46	0.383
% Skeletal Muscle Mass	49.64	2.83	0.198
% Skeletal Mass	13.34	0.90	0.086
Body Surface Area (m^2)	1.68	0.10	0.007

Table 2: Descriptive statistical parameters of somatotype components of football players

Somatotype Components	Mean	SD	SEM
Endomorphy	2.33	0.58	0.040
Mesomorphy	4.63	0.95	0.066
Ectomorphy	2.90	0.95	0.066

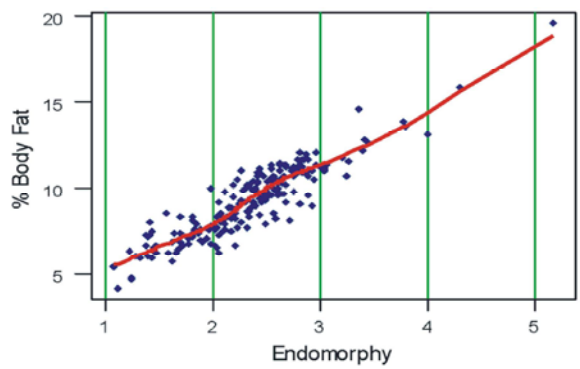

Fig. 1: Fcatter plot of % body fat of football player in respect to endomorphy component

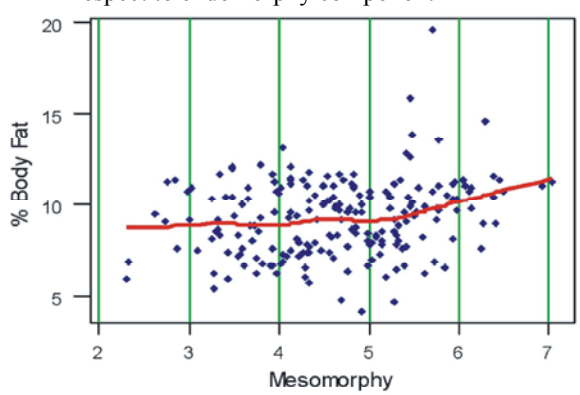

Fig. 2: Fcatter plot of % body fat of football player in respect to mesomorphy component

RESULTS

Mean, standard deviation (SD) and standard error of mean (SEM) of body composition variables were presented in Table 1. The average height and weight of the Indian university level football players were 168.75 cm and 60.70 kg respectively. Football players were possessed 9.31% body fat, 49.64% skeletal muscle mass and 13.34% skeletal mass. Table 2 shows the mean, standard deviation (SD) and standard error of mean (SEM) of physique of Indian university level football player. The mean somatotype of the football player was ectomorphic mesomorph (2.33-4.63-2.90). Figures 1-3 presented the scatter plot of % body fat of the subjects in respect to endomorphy, mesomorphy and ectomorphy component respectively.

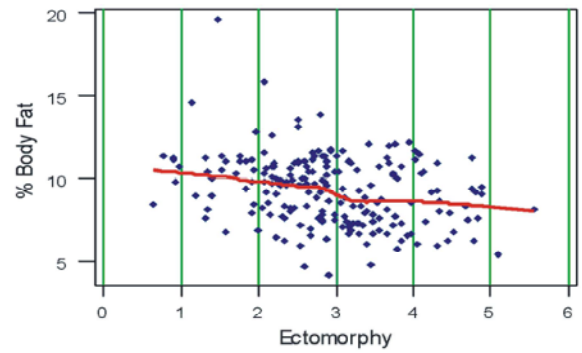

Fig. 3: Fcatter plot of % body fat of football player in respect to ectomorphy component

DISCUSSION

Physique and body composition are important factors for success in any games and sports. Kitagawa *et al.* [13] and Wilmore [14] indicated that body composition affects physical strength and skill in various sports. The mean height and weight of the Indian universty level footballers examined in this study were lower than those reported for top level soccer players and athletes of other countries [15-24]. It seems that in football game there is also a tendency of an increase in body height of the players, which was to some extent confirmed by Jankovic and associates [25]. They found that body height had a discriminative role in the selection of young soccer players, in favor of those who were taller. It is highly probable that the height itself does not guarantee the success in the game. Still, it is also likely that a particular body height at a younger age has an important role in the selection of players as for determining their position in play even before entering the senior competition level. Although Reilly [1] mentioned that the lack of height might not be in itself a bar to success in soccer and that it might determine the choice of playing position, it is obviously a disadvantage.

The mean BMI of the subjects was normal value at 21.30 kg/m^2, while the mean percentage of body fat was stumpy at 9.31%. This point to the fact that the football players accumulate a certain amount of body fat outside the playing season. The body fat then disappears during strenuous training in both the preparation and the competition period. Individual body fat (Fig. 1-3) values varied between 4.24% to 19.55%, with goalkeepers having the highest fat levels. The footballers of California and Hongkong have lower values of % body fat [9, 26] whereas higher % body fat values have been reported in their counterparts from the UK, the USA and Spain [27-29]. The average value of 14.9% of body fat found in Croatian soccer players corresponds to the value found in English college players (14.7%) and the value found in the Scottish club Aberdeen (14.9%). It is, however, significantly higher than in Brazilian first league players (10.9%), Portuguese players (10.5%) and English players (12.4%) according to Dunbar and Power [30]. Body composition variables of the Indian university level football player of the present study approximately accords with the Indian college level athletes as reported by Saha S. [31]. Rico-Sanz [9] and Saha S. et al. [32] stated that footballers should have a body fat percentage of around 10% and this is in agreement with the finding of the present study.

Neni *et al.* [33] reported that the somatotype of Indonesian soccer players was ectomorphic mesomorph (2.7-4.9-3.0) which agrees with the present finding (2.33-4.63-2.90) and previous studies of leading footballers from Russia (1.7-5.6-2.6) [34]. Rienzi *et al.* [35] reported that South American international soccer players are balanced mesomorph (2-5.5-2). The somatotype components endomorphy, mesomorphy and ectomorphy scores of the Indian football players were inferior than their counterparts from the Liverpool, Russian and South American international teams [28, 35, 36].

CONCLUSION

According to the results of this study, it was concluded that Indian university level football player had lower height, weight, lean body mass and mesomorphic value of somatotype component than the overseas football player. The results of this article provides the information to sports scientist, coaches and sport authorities that somatotype and body composition variables should consider while talent selection process and development of training programmes.

REFERANCES

1. Reilly, T., 1996. Science and Soccer, pp: 2-64.
2. De Garay, A.L., L. Levine and J.E.L. Carter, 1974. 'Genetic and anthropological studies of Olympic athletes', Academic Press, New York
3. Hirata, K., 1966. J. Sports Med. Phys. Fitness, 6: 207-222.
4. Housh, T.J., W.G. Thorland, G.O. Johnson and G.D. Tharp, 1984. J. Sports Med. Phys Fitness, 24(3): 169-174.
5. Reilly, T. and R. Hardiker, 1981. J. Sports Med., 21: 186-191.
6. Singh, S.P. and S. Sidhu, 1982. Sports Med Phys Fitness, 22: 185-190.
7. Tanner, J.M., 1964. The Physique of the Olympic Athlete, Allen and Unwin, London.
8. Wilmore, J.H. and D.L. Costill, 1999. Physiology of Sports and Exercise. 2nd ed. Human Kinetics, Champaign, pp: 490-507.
9. Rico-Sanz, 1998. J. Int. J. Sport Nutr, 8: 113-123.
10. Bangsbo, J., 1994. Acta Physiologica Scandinavica 151 Supplementum, 619: 1-155.
11. Tumility, D., 1993. J Sports Med., 16: 80-96.
12. Ekblom, B., 1986. Sport Med., 3: 50-60.
13. Kitagawa, K., K. Ikuta, Y. Hara and K. Hirota, 1974. Jpn J Phys Fitness Sports Med., 23: 96-100.
14. Wilmore, J.H., 1983. Med Sci Sports Exerc., 15: 21-31.
15. White, J., J.L. Mayhew and F.C. Piper, 1988. J Sports Med Phys Fitness, 20: 317-24.
16. Reilly, T., 1975. An ergonomic evaluation of stress in professional football. PhD thesis, Liverpool Polytechnic,
17. Reilly, T., 1979. What research tells the coach about soccer. Washington: AAHPERD.
18. Williams, G., R.M. Reid and R. Coutts, 1973. Br J. Sports Med., 7: 390-91.
19. White, J.E., T.M. Emery, J.L. Kane, R. Groves and A.B. Risman, 1988. Science and football. (E. & FN Spon) London.
20. Faina, M., C. Gallozzi, S. Lupo, R. Colli, R. Sassi and C. Marini, 1998. World Championship France.
21. Medved, R., 1966. J. Sports Med. Phys. Fit., 6: 89-92.
22. Wil- liams, G., R.M. Reid and R. Coutts, 1973. Br. J. Sports Med., 7: 390-95.
23. Raven, P., L. Gettman, M. Pollock and K. Cooper, 1976. Br. J. Sports Med., 109: 209-13.
24. Ramadan, J. and R. Byrd, 1987. J. Sports Med. Phys. Fit., 27: 424-29.

25. Burke, L.M., R.S.D. Read and R.A. Golland, 1985. Br J. Sports Med., 19: 100-3.
26. Chin, M.K., Y.S. Lo, C.T. Li and C.H. So, 1992. Br J. Sports Med., 26: 262-266.
27. Florida-James, G. and T. Reilly, 1995. Br J. Sports Med., 29: 41-45.
28. Silvestre, R., C. West, C.M. Maresh and W.J. Kraemer, 2006. J Strength Cond Res., 20: 177-183.
29. Diaz, F.J., M.J. Brien, K. Wigglesworth and J.J. Eppig, 2006. Rev Invest Clin., 55: 528-534.
30. Dunbar, G.M.J. and K. Power, 1995. J. Sports Sci., 13: 501-505.
31. Saha, S., 2014. World Applied Science Journal, 30(11): 1474-1478.
32. Saha, S., B. Kundu and S. Mondal, 2014. Journal of Trainology, 3: 35-40.
33. Neni, T.R.., B. Santosa and A. Kumi, 2006. Anthropol Sci., 22: 45-50.
34. Martirosov, E.G., E.V. Skhomorokov, I. Farmochi and S.H. Varga, 1987. Arkh Anat Gistol Embriol., 93: 29-33.
35. Rienzi, E., B. Drust, T. Reilly, J.E. Carter and A. Martin, 2000. J. Sports Med. Phys. Fitness, 40: 162-169.
36. Fidelix, Y.L., J. Berria, E.P. Ferriri, J.G. Ortiz, T. Cetolin and E.L. Petrosik, 2014. Journal of Human Kinetics, 42: 259-266.