



AMERICAN JOURNAL OF  
**PHYSICAL EDUCATION AND  
HEALTH SCIENCE (AJPEHS)**

ISSN: 2992-9679 (Online)

VOLUME 2 ISSUE 1 (2024)



PUBLISHED BY  
**E-PALLI PUBLISHERS, DELAWARE, USA**

## Assessing the Somatotype Profile of Gorkha Soccer Players

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### Article Information

**Received:** March 13, 2024

**Accepted:** April 06, 2024

**Published:** April 10, 2024

### Keywords

*Anthropometric, Endomorph,  
Mesomorph, Ectomorph,  
Gorkha*

### ABSTRACT

Many factors influence the Somatotype of the human body. In addition to genetics, there are also environmental factors and cultural differences. This study aimed to find out the somatotype Profile of Gorkha soccer players based on their playing position and also to determine which anthropometric type is the most distinctive. The study sample consisted of 30 National-level Soccer players from different academies or clubs who participated in the National Level Championships Tournament will be selected purposively as subjects and aged 18-25 years, including Striker (N=10), Midfielder (N=10) and Defender (N=10). Heath and Carter's (1990) equations for decimal anthropometry (ISAK) measurements were used. Body density percentage was calculated according to the equation of Durnin and Womersley (1974). Then, the amount of body fat was determined using the Siri (1956) equation. The results indicated that most of the players showed a body type that was ectomorphic mesomorph, which is the most important component in all positions. Therefore, the study concluded that a body type with a strong ectomorph and slight mesomorph advantage would benefit soccer players at the elite level.

### INTRODUCTION

Soccer is the most popular sports discipline in the world. There are many physical indicators of soccer performance. Anthropometric characteristics are important indicators and can influence the progress of soccer players (Shahram Faradjzadeh Mevaloo, A. F. 2021). The literature review showed that height, body mass, body fat percentage, and somatotype are some of the important anthropometric characteristics associated with performance (Norton and Olds 1996).

Somatotype is an essential characteristic that can indicate elite athletic suitability. This parameter, combined with body composition and proportionality indices, could be used in talent identification programs. There is a large amount of data in the literature about the suitability of different somatotype patterns not only for sports disciplines but also for intra-sport positions, events and weight categories. However, some of these data need to be refreshed and updated due to secular trends, modification of the rules of the sport, greater availability of elite athletes as subjects, and emerging new training methods.

Body composition makes an important contribution to an individual's level of physical fitness performance, particularly in activities that require one to carry one's body weight, which is associated with multiple jumps because the effectiveness of any physical performance has been related to numerous basic traits found in boys and girls which includes their maturation, body size and types of body (Daksh Sharma, 2017).

Body composition and shape in different groups of humans, including athletes, determines Somatotype which can be classified into three categories Endomorphy (related to fatness), Mesomorphy (related to muscle mass)

and Ectomorphy (related to linearity and slenderness), (Shahram Faradjzadeh Mevaloo, A. F. 2021).

This study aimed to find out the somatotype Profile of Gorkha soccer players based on their position and also find out which somatotype category were more distinguishing. It was hypothesized that the somatotype of Gorkha players would vary in different playing positions.

### LITERATURE REVIEW

Many factors are important in determining the success of a football player or a team. Football players have to adapt to the physical demands of the game, which are multifactorial. Players may not need to have an extraordinary capacity within any one of the areas of physical performance but must possess a reasonably high level within all areas. Morphological characteristics, body composition and somatic dimensions play a vital role in determining the success of an athlete (J. E. Lindsay Carter, B. H. 1990) & (William Duquet and J. E. Lindsay Carter, R. E. 2009). During a football match, the player's movements are characterized by high intensity, short-term actions and pauses of varying length. To be successful in such a team sport, football players need an optimal combination of technical, tactical, physical characteristics (e.g. somatotype and body composition), and mental motivation (Sukanta Saha, B. K. 2014), among other sports characteristics. Moreover, (Shahram Faradjzadeh Mevaloo 2021) research on Iranian soccer players provides relevant context regarding somatotype variations among players in different sports and positions. The study's methodological approach, including the use of ISAK measurements and Heath-Carter equations, ensures rigorous assessment and comparison of

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somatotypes. Additionally, the discussion on body fat percentage variations among playing positions reflects findings from a (Kumar, V. 2020) investigation on women soccer players, emphasising the multifactorial nature of body composition in sports performance. Furthermore, insights from studies on volleyball players by (Omprakash Gangey 2016) and football players by (Sukanta Saha *et al.* 2014) underscore the importance of position-specific physique characteristics in athletic success, supporting the relevance of the current study's findings for player development and training strategies. The present study extends this understanding by focusing on specific somatotype profiles in soccer players. Numerous studies have shown how crucial it is to take anthropometric traits into account when developing training plans, identifying potential, and optimizing performance across a range of sports.

**MATERIALS AND METHOD**

A total number of 30 national-level soccer players from different academies or clubs who participated in the National Level Championships Tournament will be purposively selected from Gorkhas of West Bengal and Sikkim, who were selected as subjects for the study. The age range of the subjects was between 18 years to 25 years. The players had experience in competitive Soccer for 10-12 years and also, they were active in playing Soccer. After observing each subject's playing position and taking the subject's view, and coach's concern, they were divided into three groups Striker (n=10), Midfielder (n=10) and Defender (10). Participants provided written informed consent from the players before the collection of the data.

**Anthropometric Measurements**

All the measurements had been done by following the standard methods described by the International Society for Advancement of Kinanthropometry. The

anthropometric measurements were measured by an ISAK (level-1) certified person only. The Somatotype was considered as Height, Weight, Biceps, Triceps, Subscapular, Supraspinal, Medial Calf, Upper Arm Flex, Calif, Bi-epicondylar Humerus and Bi-epicondylar Femur were used. (Adhikari and McNeely 2015). To assess the somatotype (Endormorphy, Mesomorphy and Ectomorphy) of the subjects Heath and Carter (1990) equations for a decimal anthropometric somatotype were used.

**Equation for Endomorphy**

$0.1451(X) - 0.00068(X^2) + 0.0000014(X^3) - 0.7182$   
Where 'X' = (Sum of triceps, subscapular and supraspinale skinfolds) multiplied by (170.18/ height in cm).

**Equation for Mesomorphy**

$(0.858 \times H.B) + (0.601 \times F.B) + (0.188 \times C.A.G) + (0.161 \times C.C.G) - (Height \times 0.131) + 4.5$   
Where H. B= Humerus Breadth, F. B= Femur Breadth, C.A.C= Corrected Arm Girth (Flexed Arm Girth – Triceps Skinfold/10), C.C.C= Corrected Calf Girth (Maximal Calf Girth – Calf Skinfold/10).

**Equation for Ectomorphy**

If  $HWR \geq 40.75$ , then Ectomorphy =  $0.732 \times HWR - 28.58$   
If  $HWR < 40.75$  and  $> 38.25$ , then Ectomorphy =  $0.463 \times HWR - 17.63$   
If  $HWR \leq 38.25$ , then Ectomorphy = 0.1 or (recorded as 1/2)

Body density was calculated by the equations of Durnin and Womersley (1974). Then, body fat was determined by the Siri equation (1956) for each of the densities previously calculated.

In the following table mentions the name of Anthropometric variables, equipment used and unit of measurement.

**Table 1:** Description of anthropometric variables, equipment used and unit of measurement

Anthropometric Variables	Equipment Used	Unit of Measurements
Height	Stadiometer	Centimeter (cm)
Weight	Weighing Machine	Kilogram (kg)
Skinfold thickness of body parts (Biceps, Triceps, Subscapular, Supraspinale & Medial Calf)	Harpenden Caliper	Millimeter (mm)
Circumference of body parts (Upper Arm flexed & Calif)	Anthropometric Tape	Centimeter (cm)
Diameter of body parts (Biepicondylar Humerus and Femur)	Sliding Caliper	Centimeter (cm)

**Analytical Procedure**

For analysis of data standard statistical procedure was used. Mean was calculated as a measure of central tendency by using the formula-

$$\bar{x} = \frac{\sum x}{n}$$

The standard deviation (SD) was calculated as the

measure of variability by using the formula-

$$\sigma = \sqrt{\frac{1}{n} \sum (x - \bar{x})^2}$$

The range was calculated as the simplest measure of variability or dispersion by using the formula-  
Range (R) = Max Value – Min Value

**RESULTS AND DISCUSSIONS**

Somatotypes of Gorkha soccer players were displayed in the following Table. The mean average and standard deviation of somatotype categories were shown in Table 2.

According to the International Society for Advancement of Kinanthropometry (ISAK) measurements were found the somatotypes i.e., Endomorphy, Mesomorphy and Ectomorphy.

**Table 2:** Descriptive basic data and Somatotype of Male Gorkha Soccer Players based on positions (Mean±SD)

Playing Level	Playing Position	Body Types		
		Endomorphy	Mesomorphy	Ectomorphy
National Level	Striker	2.65 ± 0.92	3.89 ± 1.45	2.50 ± 1.28
	Midfielder	2.62 ± 0.88	4.24 ± 0.52	2.44 ± 0.37
	Defender	2.05 ± 0.74	4.41 ± 0.78	2.60 ± 0.87

**Table 3:** Body fat percentage (%) by player’s position

Position	Body Fat %	
	Mean ± Sd	Range
Striker	7.5 ± 1.103066	9.74 – 6.44
Midfielder	7.28 ± 0.378871	7.94 – 6.66
-Defender	7.18 ± 0.418783	7.8 – 6.37

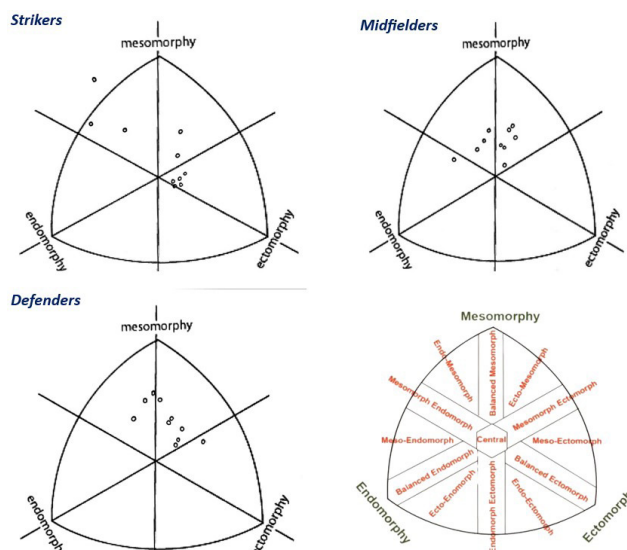
Different equations have determined body fat (%). Descriptive values of each equation for all players. There are significant differences in body fat determined by 11 Anthropometric measurements using Heath and Carter (1990) equations, for body fat (%) was calculated using Durnin and Womersley (1974) and body density and fat % by Siri (1956). From these values, the mean body fat for each player was calculated and differences between

playing positions were analyzed (Table 3). Strikers had a higher body fat than other positions, although no significant differences with midfielders and defenders were observed.

The percentage of Gorkha soccer players which fall under each somatotype component and the classification of somatotype according to their position is shown in Table 4. Most of the players showed a somatotype that

**Table 4:** The percentage of profiles that fall under each major somatotype category for National Level Gorkha Soccer Players regarding playing position

Playing Level	Somatotype Categories	Striker	Midfielder	Defender
National Players	Ectomorphic Mesomorph	2	6	6
	Endomorphic Mesomorph	3	3	3
	Mesomorphic Ectomorph	4	-	1
	Balanced Ectomorph	1	-	-
	Mesomorphic Endomorph	-	1	-



**Figure 1:** Somatotype distribution of somatotype categories of Gorkha soccer players by positions

was Ectomorphic Mesomorph is the most important component in all positions. It showed a total number of five (5) somatotypes were found among the players. Table 4 it presented that Ectomorphic Mesomorph (S=2, M=6, D=6), Endomorphic Mesomorph (S=3, M=3, D=3), and Mesomorphic Ectomorph (S=4, M=0, D=0) were at the top of the table 4. Whereas Balanced Ectomorph and Mesomorphic Endomorph the less representative in their percentage distribution.

To ease the interpretation of the somatotype results, a somatochart were performed for each position (Figure 1). Strikers (n=2), Midfielders (n=6) and Defenders (n=6) are all located in the ectomorphic-mesomorph quadrant, while the other positions showed a higher dispersion.

## DISCUSSION

The presented findings provide the somatotypes, body fat percentage, and anthropometric characteristics of male Gorkha soccer players at the national level based on their playing positions considering the somatotype distribution, body fat percentage, and differences among playing positions. Ectomorphic Mesomorph emerges as the dominant somatotype category across all playing positions, indicating a blend of lean muscle mass and slender body types. This finding aligns with the dynamic and endurance-focused nature of soccer, where players require a combination of agility and strength. Moreover, the prevalence of Endomorphic Mesomorph and Mesomorphic Ectomorph somatotypes suggests a diversity in body compositions among players. This variety may be attributed to individual player characteristics and playing styles associated with different positions.

The dominance of Ectomorphic Mesomorph as the primary somatotype component across all playing positions aligns with previous research in soccer. A supportive study conducted by Reilly *et al.* (2000) found that elite soccer players often exhibit characteristics associated with the mesomorphic and ectomorphic somatotypes, emphasizing the importance of a balance between muscle mass and agility in the sport. Additionally, the higher values of endomorphy and mesomorphy observed in strikers compared to midfielders and defenders are consistent with the notion that strikers may benefit from a more robust and muscular physique, providing an advantage in goal-scoring situations (Ostojic *et al.*, 2014). The analysis of body fat percentage indicates variations across playing positions. Strikers exhibit a slightly higher body fat percentage compared to midfielders and defenders, although the differences are not statistically significant. This finding may be associated with the specific physiological demands and playing styles of strikers, who may prioritize explosive movements and strength, potentially contributing to a slightly higher body fat percentage.

The discussion of body fat percentage incorporates the use of various anthropometric measurements and equations, including those by Heath and Carter (1990), Durnin and Womersley (1974), and Siri (1956). The

utilization of multiple methods adds robustness to the analysis, providing a comprehensive understanding of body composition among Gorkha soccer players. While the study provides valuable insights, it is essential to acknowledge certain limitations. The sample size, specific training regimens, and dietary habits of players were not discussed in detail, which could influence somatotype and body fat percentage outcomes.

The lack of statistically significant differences in body fat percentages among playing positions, as shown in Table 3, underscores the complexity of assessing body composition in soccer players. A study by Silva *et al.* (2013) supports this idea, indicating that factors beyond playing positions, such as playing style, dietary habits, and individual training protocol may influence body fat variations among soccer players.

The findings of this study offer practical implications for training programs tailored to position-specific physique characteristics. The support from existing literature, such as the work of Ostojic *et al.* (2014) and Reilly *et al.* (2000), underscores the importance of individualized training approaches based on the unique demands of playing positions in soccer.

These findings have implications for player development, training, and position-specific strategies. Coaches and sports scientists may use this information to tailor training programs based on the physiological characteristics associated with different playing positions. Furthermore, ongoing research and longitudinal studies are encouraged to enhance the understanding of somatotype variations and their impact on soccer performance among diverse populations.

## CONCLUSION

Based on the results, in light of the conclusion drawn and within the limitations of the study, it can be revealed that our body system has been gifted by nature to accommodate and change appropriately within the physiological limits. Gorkha soccer players' body type with high dominance in Ectomorphic Mesomorph with a slight Endomorphic Mesomorph leads to higher and more effective performance. Furthermore, the Body Fat % of Gorkha soccer players is 75%, Midfielders 73%, and Defenders at 71% respectively. So, the study concluded that the Ectomorphic and Mesomorphic body types benefit elite-level soccer players. This study can be used by coaches, strength and conditioning coaches, sports scientists, and nutritionists as normative data on the body profile of male Gorkha soccer players, sets national and international standards, playing positions, and tournament levels.

## Acknowledgment

We sincerely appreciate all those who have contributed to the completion of this manuscript. This work would not have been possible without the support, guidance, and collaboration of numerous individuals and organizations.

## REFERENCES

- Ackland, T. R., Lohman, T. G., & Sundgot-Borgen, J. (2012). Current status of body composition assessment in sport: review and position statement on behalf of the ad hoc research working group on body composition health and performance, under the auspices of the I.O.C. Medical Commission. *Sports Medicine*, 42(3), 227-249.
- Anup Adhikari, D. C. (2022). Somatotype and Anthropometric Characteristics of Indian Female Rowers. *International Journal of Kinanthropometry*, 65-69.
- Anup Adhikari, E. M. (2015). Anthropometric Characteristic, Somatotype and Body Composition of Canadian Female Rowers. *American Journal of Sports Science*, 61-66.
- Carter, J. L., & Heath, B. H. (1990). *Somatotyping: development and applications* (Vol. 5). Cambridge university press.
- Carter, J. E. L. (2002). The Heath-Carter Anthropometric Somatotype—Instruction Manual. San Diego State University.
- Cavia, M. M., M. A. T. T. (2019). Anthropometric characteristics and somatotype of professional soccer players by position. *Journal of Sports Medicine and Therapy*, 073-080. <https://doi.org/10.29328/journal.jsmt.1001047>
- Durnin, J. V., & Womersley, J. (1974). Body fat assessed from total body density and its estimation from skinfold thickness: measurements on 481 men and women aged from 16 to 72 years. *British Journal of Nutrition*, 32(1), 77-97.
- Eston, R. G., & Reilly, T. (Eds.). (2001). *Kinanthropometry and exercise physiology laboratory manual* (Vol. 1). London, UK: Routledge.
- Gangey, O., & Kerketta, I. (2006). Relationship between selected motor fitness and playing ability of volleyball players. *Sciences*, 29(1), 6-11.
- Jaiswal, A. (2014). Anthropometric and Somatotyping Study among the Female Kho-Kho Players of Pondicherry: A Comparative Analysis. *Journal of Global Economics*. <https://doi.org/10.4172/2375-4389.1000122>
- Kumar, V. A. S. (2020). Relationship between anthropometric characteristics and playing ability among women soccer players. *Journal of Xidian University*, 1048-1052.
- Mone, A., F. A. (2023). Anthropometric Profile of Age Level & National Level Female Gymnasts In Bangladesh. *International Journal of kinanthropometry*, 34-46. <https://doi.org/10.34256/ijk2315>
- Norton, K., Olds, T. (1996). *Anthropometric: a textbook of body measurement for sports and health course*. 1 a. ed. Sydney, Australia. Editorial UNSW Press.
- Ostojic, S. M., Castagna, C., Calleja-Gonzalez, J., & Jukic, I. (2014). The biological and performance effects of thermal stress on elite female soccer players. *Journal of Sports Medicine and Physical Fitness*, 54(5), 521-527.
- Rajasingh, F. J. (2015). Analysis of volleyball playing ability from Anthropometric and motor fitness variables Among volleyball players. Shodhganga@INFLIBNET. Retrieved from <http://hdl.handle.net/10603/72912>
- Rai, S. (2018). Dynamics of Gorkha identity in the selected fictions of Indra Bahadur Rai and Manohar Thapa.
- Reilly, T., Bangsbo, J., & Franks, A. (2000). Anthropometric and physiological predispositions for elite soccer. *Journal of Sports Sciences*, 18(9), 669-683.
- Roy, M. C., & Sarkar, S. (2022). Comparison of Body Composition Among the Selected Groups of Female Kabaddi Players. *International Journal of Kinanthropometry*, 2(2), 58-64
- Shahram Faradjzadeh Mevaloo, A. F. (2021). Somatotype of Iranian Soccer Premier League Players. *nt. J. Kinanthrop.*, 72-77.
- Sharma, D. (2017). Relationship of somatotype classification with the playing ability of softball male players. *International Journal of Physical Education, Sports and Health*, 89-90.
- Singh, A. (2022). Study of selected anthropometric variables and somatotype components of male football players of Punjab. Shodhganga@INFLIBNET. Retrieved from <http://hdl.handle.net/10603/495777>.
- Silva, A. M., Santos, D. A., Matias, C. N., Minderico, C. S., Schoeller, D. A., Sardinha, L. B., & Teixeira, P. J. (2013). Total energy expenditure assessment in elite junior basketball players: A validation study using doubly labeled water. *Journal of Strength and Conditioning Research*, 27(7), 1920-1926.
- Sukanta Saha, B. K. (2014). Positional differences in morphology, somatotype and body composition characteristics in university-level Indian footballers. *Journal of Trainology*, 35-40.