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A study of somatotype differences in basketball players playing at different positions

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Abstract
Purpose of the study was to test whether under-14, under-16, under-18 and above-18 age group guards, forwards and centers significantly differ in their somatotype. Basketball guards (N=50) forwards (N=50) and centers (N=50) a total of 150 players served as subjects of the study. Height, weight, two width measurements, three girth measurements, four skin folds were measured. Heath-Carter somatotype method (1980) was used to convert the data to somatotype ratings. To measure the difference between the groups Special Analysis of Variance (SANOVA) statistical technique was used. Results revealed that guards, forwards and centers in the age group of under-14, under-16 and under-18 significantly differed in their somatotype. Players playing in different positions in the bove-18 age group didn't significantly differ in their somatotype. The implications of results are discussed.

Keywords: Basketball, guards, forwards, centers, somatotype

Introduction

Anthropometric characteristics always hold significant role in competitive sports. The knowledge of these characteristics is essential to succeed in any game. It is a difficult process to identify which character influence most on performance. Team sport performance is dependent upon a diverse range of qualities including size, fitness, sport-specific skills, team tactics, and psychological attributes. The game of Basketball requires the application of variety of different abilities (Angyan, *et al*., 2003; Jelicic, *et al*., 2002) [1, 5]. Basketball is a sport that consists of activities of short duration but high intensity during the course of the game. Great physiological demands necessarily influence the anthropological characteristics (Duncan, *et al*., 2008) [2]. Specifically, the role played by a player in relation to the position in which he plays, is different from others. Further, Basketball is a game, where size, shape and body composition play an important role in providing distinct advantage for specific playing positions.

In the game of basketball, especially at the high school and college level, players specialize playing in different positions such as guards, forwards and centers in terms of the roles they play and their position in offensive set-up. Due to the specifics of each position, differences can be found among players in terms of their physique, physiology and psychology. The above is also true for the morphological characteristics ofbasketball players playing at different positions (Dežman, Trninić, &Dizdar, 2001; Erčulj, 1998; Jeličić, Sekulić, &Marinović, 2002; Trninić, Dizdar, &Fressl, 1999).

Somatotype, defined in terms of description of such morphological components as endomorph, mesomorph and ectomorph, is another valuable tool for the accurate assessment of somatic parameters needed for a given sport. Popovic *et al* (2018) [6] observed that male basketball players are likely to display a mesomorph somatotype, but there are also professional players from top teams with mixed and balanced somatotypes. Moreover, the somatotype and other anthropometric variables might be specific to geographical region, especially during growth and maturation (Malina, R. M. and Koziel S M-2013) [4]. Gryko Karol *et al.* (2018) [3] studied difference between young (under 16 years) and adult (above 16 but below 18) elite basketball players of Poland. They observed that among young centers were endomorphic, mesomorphy was dominant among young guards and ectomorphic component was dominant among young forwards.

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Among adults guards and centers are dominant in endomorphic component, guards are dominant in meso morphic component and forwards are dominant in ectomorphic component.

Objective of the study

Purpose of the study was to find out somatotype of under-14, under-16, under-18 and above-18 age group's different playing positions (guards, forwards and centers) of basketball game players significantly differ from each other.

Method

150 basketball male players in each age group (i.e., under-14, under-16, under-18 and above-18) served as subjects of the study. In that guards (n=50), forwards (n=50) and centers (n=50) in each age group. A total of600 male basketball players participated in study. The age of the sample ranged from 12 to 32 years. Data was collected from Karnataka state basketball association's different age group tournaments, School Game federation of India's different age group's district, division and state level tournaments and different invitational tournaments which was organized by basketball clubs of Karnataka state during the 2018-19 season. Height, weight, bi-acromial shoulder width, bi-illeocristal width, bi-epicondyle humerus width, bi-epicondyler femur width, triceps skin fold, sub scapular skin fold, supra-spinale skin fold and medial calf skin fold were measured. Heath-Carter somatotype method (1980) was used to convert the data in to somatotype rating. To calculate the difference among different playing position's players Special Analysis of Variance (SANOVA) was used. Equations for calculating and analysing somatotype data Somatotype Attitudinal Distance (SAD) were developed by Carter, *et al* (1983). The somatotype attitudinal distance is the difference between two Somatopoints (point in a three dimensional space, which representsa somatotype), and is calculated in component units: SAD.

Findings

Under-14 age group

In order to test the mean difference of somatotype data of under-14 age group's Guards (N=50), Forwards (N=50) and Centers (N=50) were subjected to Special Analyses of Variance. Somatotype mean and standard deviations of Guards (N=50), Forwards (N=50) and Centers (N=50) position basketball players are furnished in table1.

Table 1: Somatotype mean and standard deviation of Guards, Forwards and Centers of under 14 Age group Basketball players

Positions	Endomorphy Mean & SD	Mesomorphy Mean & SD	Ectomorphy Mean & SD
Guards	3.08±1.37	3.42±1.09	3.65±1.45
Forwards	3.21±1.42	3.40±1.37	3.95±1.59
Centers	3.62±0.69	2.84±1.30	4.43±1.62

It may be observed in the table above (Table-1) that guards and forwards are meso morphic; ectomorphs and centers are endomorphic-ectomorphs. Therefore among all players of three positions ectomorphy is dominant component. To test the mean difference between guards, forwards and centers data was subjected to SANOVA.
The summery of the SANOVA is presented in the table no.2. The obtained F-value 3.14 is higher than the critical F-value 3.01 for 2- between and 147 within degrees of freedom at 0.05 level of confidence. Hence the significant F-ratio

obtained indicated that three groups of under-14 age group's guards, forwards and centers significantly differ in their mean somatotype.

Table 2: Summary of the Special ANOVA of Somatotype of Guards, Forwards and Centers of under 14 age group Basketball players

Source	Sum of Squares	df	Mean Square	F-ratio
Between	34.215	2	17.107	3.14*
Within	801.999	147	5.455	
Total	836.214	149		

*p<0.05

Upon post-hoc analyses (table no.3) it was found that forwards and centers significantly differ in their mean somatotype. The mean difference between guards and forwards and guards and centers did not reach significant level.

Table 3: Obtained F-ratios upon Post-hoc Analysis of Somatotype of Guards, Forwards and Centers of under 14 age group Basketball players

Positions	Guards	Forwards	Centers
Guards	--	0.44	2.79
Forwards	--	--	3.40*
Centers	--	--	--

*p<0.05

Since somatotype of only one group was found significantly different, it can be concluded that somatotype among under-14 year age group players the centers weresomato typically more ectomorphic than guards and forwards, while guards were not different from either forwards or centers.
The somatochart plotted between three groups are presented in figure no 1.
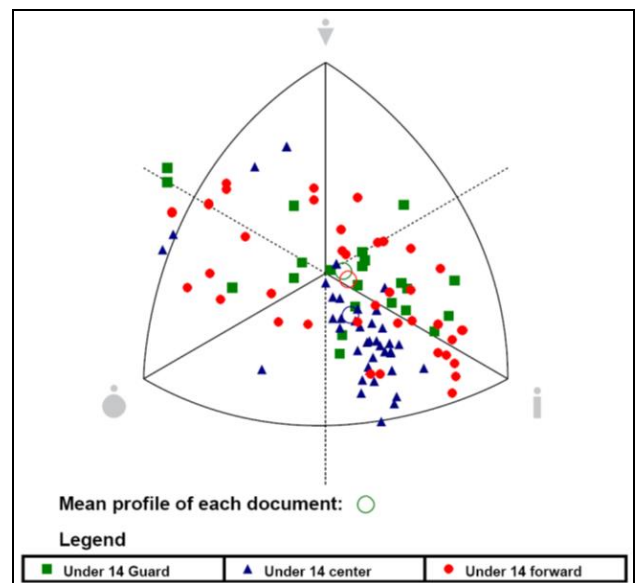

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Legend

■ Under 14 Guard   ▲ Under 14 center   ● Under 14 forward

Fig 1: Somatoplot of under-14 age group guards, forwards and centers

Under-16 age group

In order to test the mean difference of somatotype data of under-16 age group's Guards (N=50), Forwards (N=50) and Centers (N=50) were subjected to Special Analyses of Variance. Somatotype mean and standard deviations of Guards Forwards and Centers position basketball players are furnished in table -4.

Table 4: Somatotype mean and standard deviation of Guards, Forwards and Centers of under 16 age group Basketball players

Positions	Endomorphy Mean & SD	Mesomorphy Mean & SD	Ectomorphy Mean & SD
Guards	3.31±1.12	2.82±1.16	4.43±1.15
Forwards	3.95±1.25	2.75±1.10	3.96±1.72
Centers	4.03±0.90	2.52±1.13	3.84±1.21

The values presented in table 4suggest that guards and forwards are endomorphic ectomorphs and centers are ectomorphic endomorphs. To test the mean difference between guards, forwards and centers data is subjected to SANOVA.

Table 5: Summary of the Special ANOVA of Somatotype of Guards, Forwards and Centers of under 16 age group Basketball players

Source	Sum of Squares	df	Mean Square	F-ratio
Between	27.648	2	13.823	3.16*
Within	645.752	147	4.392	
Total	673.400	149		

*$p<0.05$

The summery of the SANOVA is presented in the table no.5. The obtained F-value (3.16) is higher than the tabulated value (3.01) at 0.05 level of confidence. Hence the significant F-ratio obtained indicated that three groups of under-16 age group's guards, forwards and centers significantly differ in their mean somatotype.

Table 6: Obtained F-ratios upon Post-hoc Analysis of Somatotype of Guards, Forwards and Centers of under-16 age group Basketball players

Positions	Guards	Forwards	Centers
Guards	-	3.26*	6.39*
Forwards		-	3.80*
Centers			-

*$p<0.05$

Upon post-hoc analyses (table-6) it was found that guards & forwards; guards & centers and forwards & centers significantly differ in their mean somatotype. Since all groups difference were found significantly different, we can say that somatotype of under-16 age group players different playing positions significantly different from each other.

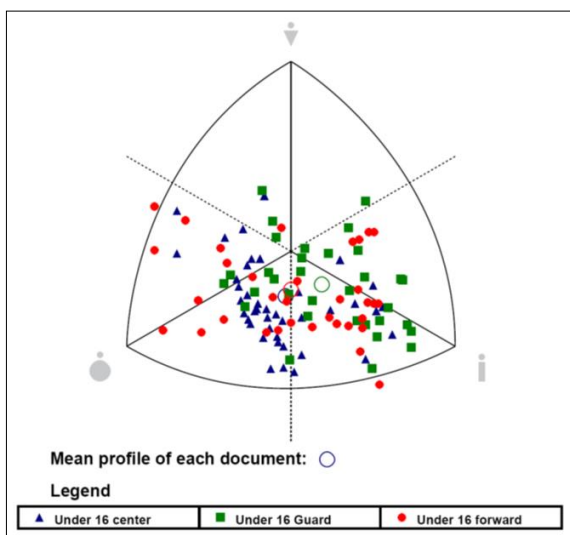The somatochart plotted between three groups are presented in figure no 2.

Fig 2: Somato plot chart of under-16 age group guards, forwards and centers

Under-18

In order to test mean difference of somatotype data of under-18 age group's Guards (N=50), Forwards (N=50) and Centers (N=50) were subjected to Special Analyses of Variance. Somatotype mean and standard deviations of Guards, Forwards and Centers position basketball players are furnished in table no.7.

Table 7: Somatotype mean and standard deviation of Guards, Forwards and Centers of under 18 age group Basketball players

Positions	Endomorphy Mean & SD	Mesomorphy Mean & SD	Ectomorphy Mean & SD
Guards	4.51±0.76	3.38±1.04	2.80±1.15
Forwards	4.48±0.41	3.18±0.76	2.37±0.87
Centers	4.17±0.35	3.57±1.46	3.23±0.83

The values presented in table no.7 reveal that endomorphy is seems to be dominant component amongunder-18 age group basketball players.

All three groups of players Guards, forwards and centersseem to be meso morphic endomorphs. The summery of the SANOVA is presented in the table no.8. The obtained F-value (5.23) is higher than the tabulated value (3.01) at 0.05 level of confidence.

Hence the significant F-ratio obtained indicated that three groups of under-18 age group's guards, forwards and centers significantly differ in their mean somatotype.

Table 8: Summary of the Special ANOVA of Somatotype of Guards, Forwards and Centers of under 18 age group Basketball players

Source	Sum of Squares	df	Mean Square	F-ratio
Between	25.850	2	12.925	5.23*
Within	362.907	147	2.468	
Total	388.758	149		

*$p<0.05$

Upon post-hoc analyses (table-9) it was found that only forwards and centers significantly differ in their mean somatotype. The mean difference between guards and forwards and guards and centers are not at the significant level.

Table 9: Obtained F-ratios upon Post-hoc Analysis of Somatotype of Guards, Forwards and Centers of under 18 age group Basketball players

Positions	Guards	Forwards	Centers
Guards	-	2.50	2.86
Forwards	-	-	11.17*
Centers	-	-	-

*$p<0.05$

Since somatotype of only one group i.e., between forwards and centers found significantly different, we can say that somatotype of under-18 age group players different playing positions significantly different from each other.

The somato chart plotted between three groups are presented in figure no 3.
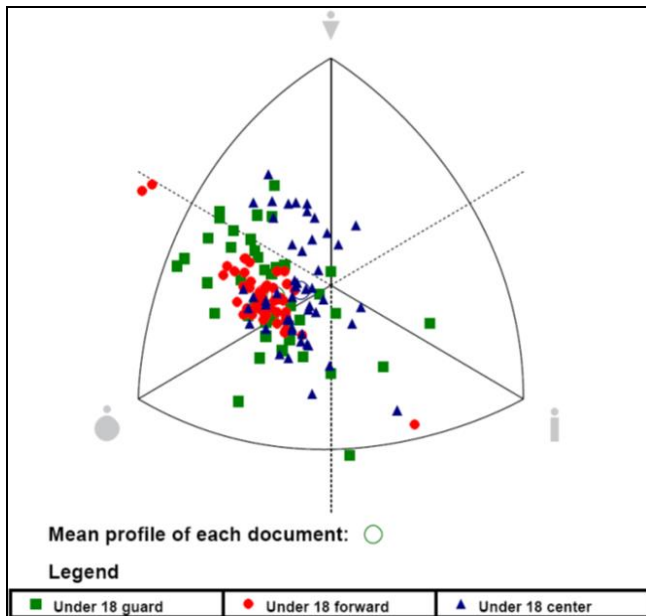
Fig 3: Somato plot chart of under-18 age group guards, forwards and centers

Above-18 age group

In order to test mean difference of somatotype data of above-18 age group's Guards (N=50), Forwards (N=50) and Centers (N=50) were subjected to Special Analyses of Variance. Somatotype mean and standard deviations of Guards, Forwards and Centers position basketball players are furnished in table no.10.

Table 10: Somatotype mean and standard deviation of Guards, Forwards and Centers of above 18 age group Basketball players

Positions	Endomorphy Mean & SD	Mesomorphy Mean & SD	Ectomorphy Mean & SD
Guards	4.65±1.09	2.72±0.86	3.33±1.17
Forwards	4.81±0.93	2.65±1.20	3.40±1.48
Centers	5.25±0.87	2.16±0.85	3.29±1.39

The values presented in table no.10 reveal that endomorphy component is dominant in all three playing position players followed by ectomorphy and mesomorphy in above-18 age group basketball players. Guards, forwards and centers all three position players seem to be more ectomorphic endomorphs.

Table 11: Summary of the Special ANOVA of Somatotype of Guards, Forwards and Centers of above 18 age group Basketball players

Source	Sum of Squares	df	Mean Square	F-ratio
Between	19.214	2	9.606	2.58
Within	548.401	147	3.730	
Total	567.615	149		

The summery of the SANOVA is presented in the table no.11. The obtained F-value (2.58) is lower than the tabulated value (3.01) at 0.05 level of confidence. Hence the F-ratio obtained indicated that three groups of under-18 age group's guards, forwards and centers didn't significantly differ in their mean somatotype.

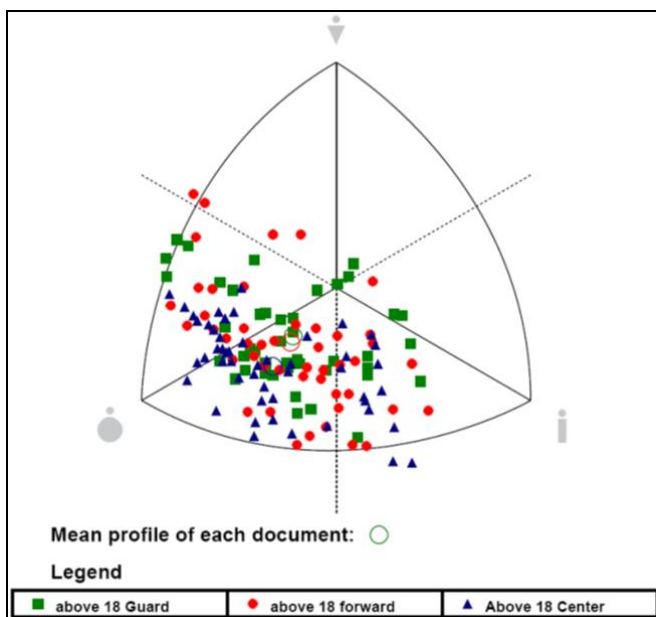The somatochart plotted between three groups are presented in figure-3.

Fig 4: Somato plot chart of above-18 age group guards, forwards and centers

Discussion and conclusion

Under-14, under-16 and under-18 age group guards, forwards and centres significantly differ in their somatotype is accepted. Only in case of above-18 age group difference was not found significant between players playing at different positions. In under-14 age group, ectomorphy is a dominant component in all three groups. Guards and forwards are having mesomorhy as their second dominant component while centres are dominant in endomorphy. As we know, basketball players needle near stature for advantage in basketball game. This was reflected in the result of under-14 age group as all position players are dominant in ectomorphy which is related to linearity. Centre players are having higher endomorphy component because position requires mass at both ends of the court to score the basket as well as to protect the rim. In recent years basketball has become more contact game. To score the basket near rim and while collecting rebound to obstruct the opponent by using body, mass is required. Usually centres are tallest amongst others in position it is reflected in results.

When under-16 age group was compared centres were ectomorphic endomorphs which are very essential physical character required for a centre player. Apart from that all three group's ectomorphy component is dominating so once again it is proved that linearity matters most in basketball. When under-18 age group players were compared change in their somatotype was found in this phace. All three groups were dominating in endomorphy followed by ectomorphy. As explained earlier, now a day's mass has become more significant character in basketball game, so it might have influenced on result. In Above-18 age group no group was found significantly different in their somatotype but still they are dominated by ectomorphic and endomorphic components. As expected centres were high somatotyping score in endomorphy component.

Based on the results of the study it was concluded that under-14, under-16 and under-18 age group guards, forwards and centres significantly differ in their somatotype while above-18 age group player's difference of somatotype was not found significant. In under-14 and under-16 age group players,

ectomorphy was dominating component. In under-18 and above-18 age group players endomorphy was dominating component. As the age progresses players has become more of ectomorphic endomorphs.

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