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SOMATOTYPES OF EAST-ZONE INDIAN INTER-UNIVERSITY KHO-KHO PLAYERS

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Abstract

Background. Somatotyping in modern sports can be an important factor to be considered. Different studies have already taken the initial step to identify the sport-specific somatotypes for different games and sports. In contrast with the Kho-Kho game, some attempts have been made to identify somatotypes specific for these games. But there are only few studies that have been conducted, and various areas are still waiting to be explored.

Study purpose. The present study aimed to identify the specific somatotypes of the kho-kho players. Additionally, this study also made an attempt to explore the important somatic traits that influence the somatotypes of the Kho-Kho players.

Materials and methods. A total number of 74 players from six Kho-Kho teams that participated in East Zone Inter-University Tournament were purposively selected for the study. The anthropometric data collection was done according to the standard procedures given by ISAK (International Society for Advancement of Kinanthropometry). The statistical analysis was done by using MS Excel (2021) and SPSS'23.

Results. The results of the study showed that most of the Kho-Kho players (90.6%) were possessing ectomorphic and mesomorphic dominant traits. There was also a significant difference found in ectomorphic and mesomorphic traits among the players possessing mesomorphic-ectomorph ($p<0.05$), ectomorphic-mesomorph ($p<0.05$) and ectomorph-mesomorph ($p<0.05$) somatotypes. Furthermore, the discriminant analysis also highlighted that attributes of ectomorphic traits (Discriminant coefficient = 1.168) and mesomorphic traits (Discriminant coefficient = 0.812) were important somatic traits for the Kho-Kho players. Overall, 88.6% of the original cases have been correctly represented by the discriminant analysis.

Conclusions. The present study showed that Kho-Kho players for the most part possess the ectomorphic and mesomorphic dominant somatotypes. Furthermore, based on the study results, it can be also concluded that somatic attributes in the similar body types also play important role to determine players' performance level.

Keywords: anthropometric, ectomorph, mesomorph, endomorph, discriminant analysis.

Introduction

The impact of somatotypes on sport performance is a very important area to be study in the field of sport science (Eston & Reilly, 2009). Based on athlete's physical traits, including lean muscle mass and body fat distribution somatotype can be differentiated. This somatotypes are mainly endomorphic, mesomorphic, ectomorphic dominant types (Carter, 2002). Several studies (Ryan-Stewart, 2018; Cardenas-Fernandez, 2017; Kandel, 2014) showed that there is positive relation exists between the somatotyping and sport performance. It was investigated that the mesomorph and ectomorph dominant traits might be the essential factor for strength specific games (Ryan-Stewart, 2018). Similarly, some games having some specific somatotypes has very much position impact on the game performance (Cárdenas-Fernández, 2017). Having low rate of endomorphic traits and higher ectomorphic dominant somatic traits can influence the agility related movements (Kandel, 2014). These forementioned studies indicates that there is a relationship exist in between sport and somatotypes. A number of studies has already established positive impact of somatotypes in relates to different games and sports. However, there are only a few studies found regarding the impact of somatotypes on the indigenous sport Kho-Kho.

The playing style of Kho-Kho is very highly intensive and dynamic in nature. It requires speed, ability to change the direction, endurance and explosive leg power as a basic physical abilities (Joshi & Kalode, 2019; Rathore & Singh, 2014). These specific physical abilities also related to the somatic traits of the athlete. Studies showed that mesomorph characteristics have very much correlation with the explosive power (Cinar and Koca, 2018). Ectomorph dominant somatotypes were suitable for the events that requires endurance and strength for prolonged time (Cinar & Koca, 2018; Franchini et al., 2019). The endomorphic somatotypes may not dominant in sporting event. Somehow it is also possessed by the athletes but less dominant while compared to other two dominants characteristics (Cinar and Koca, 2018). It is understandable that different body shapes may have distinct benefits or drawbacks in terms of in-game performance (Kandel et al., 2014; Knechlte et al., 2010; Giannopoulus et al., 2017). These potential relationships might also be better understood by looking at somatotype of kho-kho players.

Existed literature already explained the relation among physiological parameters and kho-kho playing abilities (Perumal et al., 2019; Pal et al., 2018). However, the importance of somatic traits and somatotype were not examined thoroughly in Kho-Kho games .Though they were very much related to physiological variables (Perumal et al., 2019; Pal et al., 2018; Kandel et al., 2014; Knechlte et al., 2010; Giannopoulus et al., 2017). Some Studies tried to investigate anthropometric measures and somatotypes with playing abilities (Manohar, 2015; Jaiswal, 2014). However, very limited number of studies has aimed to identify the distinct somatotypes of the kho-kho players.

Therefore, the present study firstly aimed to identify the the somatotypes of the kho-kho players. Secondly, this study also aimed to find out the which somatic traits were more distinctive. Analyzing across different somatotype categories of Kho-Kho players, specific somatic traits could be uncovered. Understanding the somatotypes of the kho-kho players with performance level will hold significant value for optimizing training programs, talent identification, and player development strategies within this unique. When the possible relationship between somatic features within the performance level is investigated, significant insights into the physical needs and potential advantages of certain body types can be established.

Materials and methods

Participants

All the players were selected from teams participated in East Zone Inter University Kho-Kho Tournament (India) held in the year 2023. The present study was confined among six (6) teams; among which three (3) of them were finalist and three (3) of them were non-finalist team. All the teams were purposively selected and they had played minimum 4 matches. The total number of 74 (34 from finalist team 40 from non-finalist team) players were from both finalist and non-finalist teams were participated.

Data collection

A written consent from the respected teams were taken prior to the collection of the data. All anthropometric measurements were taken according to guidelines given by ISAK (The International Society for Advancement of Kinanthopometry). The anthropometric measurements were measured by ISAK (level-1) certified person only. The Standards and tools for the assessment given by ISAK were used for the calculation of the somatic traits (Norton, K., 2018)

In the following table 1 description of the anthropometric dimensions has been mentioned.

Table 1. Description of sites for measure, equipment's used and unit of measure

Sites for the measurements	Equipments used	Units of measure
Standing stature	Stadiometer (Seca 213)	Centimetre (cm)
Body mass	Weighing machine (Hoffen Digital weighing machine)	Kilogram (kg)
Four skinfolds (triceps, subscapular, supraspinale, medial calf)	Harpenden calliper (Galaxy)	Millimetre (mm)
Two bone breadths (biepicondylar humerus and femur)	Sliding calliper (Cescorph)	Centimetre (cm)
Two limb girths (arm flexed and tensed, calf)	Anthropometric tape (Cescorph)	Centimetre (cm)

Classification of the participants

All the participants teams has been categorized into qualified and non-qualified groups based on the qualification criteria of the tournament. It was assumed that players of qualified teams were better at performer. In support, a Team Performance Index (SPI) was calculated to ranked the all qualified and non-qualified teams to observe the performance level. The SPI has been calculated based on ratio of point scored by a team per matches and matches played (minimum 4 matches).

Team Performance Index (TPI):

Team performance Index (TPI) in constructed for the ranked the teams based on their overall team performance. Mathematical expression for (TPI):

$$TPI = \frac{\sum(S_n/T_n)}{N};$$

Where S_n = Total Point scored in each match played (n= 1, 2, 3, 4…. n). T_n = Time duration taken for score 'Sn'.

Statistical analysis

All the collected data has analysed using MS Excel (2021) and SPSS'23. Descriptive statistics were implied as required to present the data. To determine the significance difference between the finalist team and non-finalist team 't-test' was applied at 0.05 significance level.

The discriminant analysis has been done for identification of the most influential somatic trait on the somatotypes of the kho-kho players. All the players were divided into two groups based on a criterion which was qualification for the final round and failed to qualify for the final round. The somatic traits which are ectomorph, mesomorphic and endomorph has been considered as independent variables. Based on these somatic traits, discriminant coefficient was calculated for the forementioned somatic traits from the both players of the categorial groups. The significance of the model has been further evaluated by analysing Wilk's Lambda value and the canonical correlation coefficient.

Results

In this following section obtained result of the current study has been mentioned. The table 2 provides somatotype characteristics for non-qualified teams (N=40) and qualified teams (N=34) in a competition. The somatotypes are categorized based on endomorphic, mesomorphic and ectomorphic traits. The players from the qualified teams with mesomorphic-ectomorph players showed a mean score of 1.64±0.52, 4.37±0.14, & 5.32±0.16 for endomorphic, mesomorphic, and ectomorphic traits, respectively (table 2).

And for the ectomorphic-mesomorph types the average scores for endomorphic, mesomorphic, and ectomorphic traits are 1.67±0.31, 5.12±0.11, and 4.30±0.18, respectively (table 2). The scores for endomorphic, mesomorphic, and ectomorphic traits are 2.00±0.22, 4.00, and 4.00, respectively for the mesomorph-ectomorph types (table 1). The mean score of the balanced-ectomorph for endomorphic, mesomorphic, and ectomorphic traits are 2.5±0.11, 2.5±0.11 & 4.98±0.16 respectively and for the body types balanced-mesomorph the mean scores are 2.4±0.08, 5, 2.4±0.08. On the other hand, For the players of non-qualified teams having mesomorphic-ectomorph somatotype, showed average scores for endomorphic, mesomorphic, and ectomorphic traits are 1.87±0.12, 3.03±0.65, and 4.45±0.61, respectively (table 2). Similarly, players of non-qualified teams possessed by ectomorphic-mesomorph somatotypes, the average scores for endomorphic, mesomorphic, and ectomorphic traits are 1.99±0.22, 4.20±0.54, and 3.90±0.54 respectively and for mesomorph-ectomorph, the scores for endomorphic, mesomorphic, and ectomorphic traits are 2.00±0.11, 3.22, and 3.22, respectively (table 2). The mean score of the balanced-ectomorph for endomorphic, mesomorphic, and ectomorphic traits are 2, 2& 4.36±0.08 respectively and for

the body types balanced-mesomorph the mean scores are 2.67±0.03, 4.87±0.03, 2.67±0.21 (table 2).

Table 3. Overall description of the somatotypes among the EZIU Kho-Kho players, 2023

SL No.	Somatotypes	Distribution of the players (N=74)	
1	Mesomorphic-ectomorph	36.5 %	90.6%
2	Ectomorphic-mesomorph	23.0%	
3	Mesomorph-ectomorph	12.2%	
4	Balanced-mesomorph	10.8%	
5	Balanced-ectomorph	8.1%	
6	Endomorphic mesomorph	4.1%	
7	Endomorphic-ectomorph	2.7%	
8	Endomorph-mesomorph	1.4%	
9	Mesomorphic-endomorph	1.4%	

The description of of the body types possessed by the kho-kho players from EZIU, 2023 were presented in table 3. It showed total number of nine (9) somatotypes were found among the players. From the table 3 it presented that mesomorphic-ectomorph (36.5%), ectomorphic mesomorph (23%) and mesomorph-ectomorph (12.2%) were at the top of the table 3. Whereas endomorphic dominant somatotypes were positioned at the bottom based on their percentage distribution.

Table 4 showed that rank of the teams based on the Team performance index. It can be observed from table 4, that qualified teams DD, TMB & PRV having TPI credit more than 1. (1.53, 1.36 & 1.19 respectively). While non-qualified teams NS, SMBP &BH having comparatively low TPI credit equal or less than 1 (1, 0.94 & 0.72 respectively).

Table 5 represented the difference of somatic traits between qualified and non-qualified teams. It showed that players with mesomorphic-ectomorph types having attributes of mesomorphic (p = 0.0002) and ectomorphic traits (0.0495) significantly higher than non-qualified teams (table 5). In somatotypes of ectomorphic-mesomorph, also having mesomorphic (p=0.001) and ectomorphic traits (p = 0.044) significantly differ than non-qualified teams (table 5). Similarly in mesomorph-ectomorph somatotypes showed better mesomorphic and ectomorphic traits among the players from the qualified teams (p = 0.03 & p = 0.03 respectively).

Table 2. Description somatic traits of qualified and non-qualified teams of EZIU Kho-Kho tournament, 2023

Somatotypes	Qualified Team			Non-qualified Team		
	Endo-morphic traits (Mean±SD)	Meso-morphic traits (Mean±SD)	Ecto-morphic traits (Mean±SD)	Endo-morphic traits (Mean±SD)	Meso-morphic traits (Mean±SD)	Ecto-morphic traits (Mean±SD)
mesomorphic-ectomorph	1.64±0.52	3.29±0.46	5.35±0.16	1.87±0.12	2.86±0.38	4.45±0.61
ectomorphic-mesomorph	1.67±0.31	5.14±0.55	3.71±0.75	1.99±0.22	4.16±0.28	2.87±0.49
mesomorph-ectomorph	2.00±0.22	5.50±0.70	5.50±0.70	2.00±0.11	3.12±0.37	3.12±0.37
Balanced-ectomorph	2.50±0.11	2.50±0.11	4.98±0.16	2.00±0.23	2.00±0.23	4.36±0.16
Balanced-mesomorph	2.10±0.45	4.85±0.95	2.10±0.45	2.00±0.97	4.87±0.03	2.00±0.97

Table 4. Description of the topmost five somatotypes (which describe more that 90% of the players) among the teams with their Performance Index

	Team Initials	Team Performance Index (TPI)	Rank	Mesomorphic ectomorph (%)	Ectomorphic-Mesomorph (%)	Mesomorph-Ectomorph (%)	Balanced-ectomorph (%)	Balanced-mesomorph (%)
Qualified Team (N=32)	DD	1.53	1	63.64	9.09	9.09	9.09	9.09
	TMB	1.36	2	20	20	10	10	40
	PRV	1.19	3	36.36	45.45	00	00	18.18
Non-qualified Team (N=32)	NS	1	4	35.71	28.57	21.43	7.14	7.14
	SMBP	0.94	5	33.33	22.22	33.33	11.11	0
	BH	0.72	6	33.33	33.33	11.11	00	22.22

However, among these three somatotypes endomorphic traits were having insignificant difference between the qualified and non-qualified teams (p=0.0181, 0.195 & 0.50 respectively) (table 5).

The table 6 represents the results of a discriminant analysis performed on a set of predictor variables to classify observations into two groups - qualified teams and non-qualified teams. The table shows the standardized and unstandardized discriminant function coefficients for the

Table 5. Difference between somatic traits found between qualified and non-qualified teams

Somatotypes	Somatic Traits	Qualified Team (Mean)	Non-Qualified team (Mean)	p- value
Mesomorphic-ectomorph	Endomorph	1.64	1.87	0.181
	Mesomorph	3.29	2.86	0.010*
	Ectomorph	5.35	4.45	0.001*
Ectomorphic-mesomorph	Endomorph	1.67	1.99	0.195
	Mesomorph	5.14	4.16	0.000*
	Ectomorph	3.71	2.87	0.012*
Ectomorph-mesomorph	Endomorph	2	2	0.50
	Mesomorph	5.5	3.14	0.04*
	Ectomorph	5.5	3.14	0.04*
Balanced-ectomorph	Endomorph	2.5	2	0.42
	Mesomorph	2.5	2	0.42
	Ectomorph	4.98	4.36	0.61
Balanced-mesomorph	Endomorph	2.1	2	0.57
	Mesomorph	5	4.87	0.68
	Ectomorph	2.1	2	0.57

three predictor variables - Ectomorphic traits (1.168 & 1.284), Mesomorphic traits Endomorphic traits (0.029 & 0.057). It also shows the values of group centroids value 1.267 and -1.267 for the qualified and non-qualified teams respectively. The eigenvalue found in this study is 1.683a and Wilk's Lambda coefficient is 0.373. The canonical correlation coefficient also found 0.792. These values in the table 6 can be used to estimate the discriminant function, evaluate its significance, assess classification accuracy and interpret the results of the analysis.

Discussion

The finding of the study revealed that majority of the Kho-Kho players having ectomorphic or mesomorphic dominant traits. It was found that somatotypes such as mesomorphic-ectomorph, ectomorphic-mesomorph and mesomorph-ectomorph were possessed by more than 70% of the players. However, discriminant analysis showed that mesomorphic and ectomorphic attributes are significantly higher among the qualifying team. This might be the reason behind the performance difference in qualifying teams than non-qualifying teams.

It's interesting to note that somatic traits can have an impact on athletic performance, particularly in games like Kho-Kho that require speed and explosive power. According to Kumar and Arumugam (2018), individuals with ectomorphic and mesomorphic dominant traits tend to perform better in these areas. The present study also found that players from qualified teams exhibited comparatively higher somatic attributes than that of the non-qualified team (Table 2). Similarly, this study also indicates that more than 90% of the Kho-Kho players were having either ectomorph

Table 6. Interpretive measure for Discriminant Function Coefficients between players of qualified and non-qualified teams

Variables	Standardized Discriminant Function Coefficients	Unstandardized Discriminant Function Coefficients	Values of Group Centroids		Eigen value	Wilk's Lambda Coefficient	Canonical correlation
			Qualified teams	Non-qualified teams			
Ecto-morphic Traits	1.168	1.284					
Meso-morphic Traits	0.812	0.792	1.267[ac]	-1.261[bc]	1.683[a]	0.373	0.792
Endo-morphic Traits	0.029	0.057					

[a] For the Qualified teams 86.4% of original grouped cases has been correctly classified.
[b] For non-qualified team 90.9% of the original ceases has been correctly qualified.
[c] Overall, 88.6 % of the original cases has been correctly qualified.

or mesomorph characteristics as dominant traits (Table 3). Indeed, those 90% of the players can solely explained by five somatotypes, namely mesomorphic-ectomorph, ectomorphic-mesomorph, mesomorph-ectomorph, balanced-mesomorph and balanced ectomorph. These traits may contribute to an individual's ability to change direction quickly and generate explosive power, making them well-suited for sports like Kho-Kho (Manohar, 2015).

Achieving the optimal level of performance in any sport is contingent upon several factors, encompassing physical attributes, psychological elements, and skill-related aspects. A significant number of studies has been already enlightened that somatotyping on the basis of anthropometric factors has the possible effect on the sport performance (Malousaris et al., 2008; Sleeper et al., 2012; Singh et al., 2010). Importantly, the utilization of a targeted training program also has the potential to induce transformations in anthropometric variables, consequently leading to notable alterations in somatic traits. An investigation conducted by Sadeghkhani et al. (2022), showed that planned plyometric and resistance training program can be effective on the attributes of ectomorphic and mesomorphic traits of athletes. The study was conducted for eight weeks on the elite sport person of various fields. The findings of the study demonstrated that this particular training program resulted in significant changes in somatic traits among the participants (Sadeghkhani et al., 2022). A number of studies (Sleeper et al., 2012; Zaccagni, 2012; Ostojic, 2006) has been also indicated that specific training regimens can have a direct or indirect influenced the somatotypes and somatic traits. This might be one of the reasons for which majority (more than 90%) of the Kho-Kho players were found mesomorphic or ectomorphic dominant; because of the specific training programme for Kho-Kho game.

The present study implied a Team Performance Indicator (TPI) to rank all of the qualified and non-qualified teams (table 4). The TPI is formulated based on the overall scoring by an induvial team per match played. The greater the credit of the TPI, the higher the team's rank. As a result of the TPI, all of the qualified teams received the top three rankings (ranks 1, 2 & 3). The non-qualified received lower ranks, indicating that there might be some performance difference exist between the qualified and non-qualified teams in terms of scoring.

A statistical comparison of the morphological traits of the five out of nine identified somatotypes has been presented in table 5. The analysis revealed that these five somatotypes accounted for 90% of the Kho-Kho players in the study. The players possessing mesomorphic-ectomorph somatotypes, showed a significant difference in the mesomorphic traits (p = 0.010) of the players of the qualifier and non-qualifier teams and the ectomorphic traits (p= 0.001) (table 5). In the ectomorphic-mesomorph group (table 5), the mesomorph feature showed a significantly higher mean value in the players of qualified team (mean = 5.14) compared to the players of non-qualified team (mean = 4.16). Similarly, there was also a significant difference (p-value of 0.044*) exist in the ectomorph characteristic between the players of qualified and the players of non-qualified teams in the ectomorphic-mesomorph group. While assessing the mesomorph-ectomorph somatotypes, it was found that both mesomorphic traits (0.04) and the ectomorphic traits (0.04) were significantly higher in the players of the qualified teams (table 4).

A similar result achieved by Manohar (2015) while studying on medallists and non-medallist Kho-Kho players. Medallist players were shown to have more mesomorphic and ectomorphic features than non-medallist players, and they are predominantly mesomorphic-ectomorphs. The result found in the current study also very much accordance with the study done by Arjunan (2015) on the college level kho-kho players. It was found that mesomorphic and ectomorphic traits were significantly dominant but endomorphic traits were not a significantly dominant while compare with other two morphic traits (Arjunan, 2015). Moreover, the study indicated that when comparing the balanced mesomorph and balanced ectomorph somatotypes, there were no significant differences in any of the three somatic traits between the players of qualifying and non-qualifying teams. In the case of balanced-morphic somatotypes, all three somatic traits carry a comparable weight while defining the somatotyping. It could be inferred that in activities where endomorphic traits are more influential in determining body types; mesomorphic or ectomorphic traits may not have as significant an impact.

The data presented in table 4 and table 5 highlighted characteristics differences between players from qualified and non-qualified teams. These differences were evident from the both TPI and the attributes of somatic traits found among players from qualified and non-qualified teams. The findings from table 5 showed that significant difference exists in mesomorphic and ectomorphic traits of the players in three out of five somatotypes. These three specific somatotypes identified in the present study were mesomorphic-ectomorph, ectomorphic-mesomorph and mesomorph-ectomorph. It is noteworthy that players from all these three body types were solely accounted for the 70% of the players considered in this study. Based on the evidence uncovered in the results (table 4 & 5), the present study proceeded to investigate the specific morphic traits that exert influence while defining the somatotypes of EZIU Kho-Kho players.

The results of discriminant analysis identified the specific the somatic traits that have the most impact on the body types of the EZIU Kho-Kho players (table 6). The discriminant coefficient measures the effectiveness of the variable for the discrimination (Jhonson & Wichern, 2007). Higher value of the discriminant coefficient indicates higher discriminating power. In the present study it was found that ectomorphic trait was the most powerful discriminant variable and followed by the mesomorphic traits among the Kho-Kho players of EZIU 2023 (table 6). Having ectomorphic and mesomorphic dominant somatotypes have more advantages for the game like Kho-Kho which demands sudden acceleration, leg explosiveness and ability to change the direction (Joshi & Kalode., 2019; Rathore & Singh, 2014). The group centroid represents how the groups were clearly distant apart on the basis of discriminant functions for each group, i.e., qualified teams and non-qualified teams. The centroid value of qualified team (1.268) distinguishably indicated that players of qualified teams possessed better attributes of somatic traits which was suitable for the playing nature of the Kho-Kho game (table 6).

The coefficient of Wilk's lambda in discriminant analysis verifies the significance of the discriminant model as whole. The range of the Wilk's Lambda value lies between 0 to 1 in linear discriminant analysis. As the resulted value closer

to 0, the significance level becomes higher. The value of 0.373 for Wilk's lambda in the present study indicating a higher significant level of the discriminating model in the present study (Everitt & Horthron, 2006). Additionally, the eigenvalue of the present study clearly supporting the discriminant function of the present study with a coefficient of 1.683a. This eigenvalue coefficient clearly explained adequate amount of variance in the categorial variables exist for the support of the present model. Along with this predicted model has been accurately able to predict 88.6% of the original cases in this study (table 6).

Conclusions

The study highlighted that ectomorph and mesomorph dominants traits can be a one of the basic criteria for the selection of Kho-Kho players from the East Zone India. Moreover, the attributes of the dominant somatic traits could be also defining factor for the performance level. Though future studies are needed to establish direct impact of somatic traits and the performance. According to the objective, the study was successfully able to assess the specific somatotypes and somatic dominant traits for the Kho-Kho players. Additionally, study also signified the areas where the similar somatotypes differ in terms of somatic attributes among the players of qualified and non-qualified teams.

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Conflicts of interest

All the authors in the present study has declared no conflicts of interest with respect to authorship and publication of the study.

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СОМАТОТИПИ МІЖУНІВЕРСИТЕТСЬКИХ ГРАВЦІВ У ХО-ХО В РЕГІОНІ СХІДНА ІНДІЯ

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 7 с., 6 табл., 26 джерел.

Історія питання. Соматотипування в сучасному спорті може бути важливим фактором, який слід брати до уваги. Інші дослідження вже зробили перший крок для визначення спортивних соматотипів для інших ігор і видів спорту. На відміну від гри хо-хо, були зроблені певні спроби виявити соматотипи, характерні для цих ігор. Але було проведено лише кілька досліджень, а різні області досі чекають на дослідження.

Мета дослідження. Метою цього дослідження було визначити специфічні соматотипи гравців у хо-хо. Крім того, у цьому дослідженні також була зроблена спроба вивчити важливі соматичні риси, які впливають на соматотипи гравців у хо-хо.

Матеріали та методи. Для участі в дослідженні було цілеспрямовано відібрано загалом 74 гравці із шести команд гравців у хо-хо, які брали участь у міжуніверситетському турнірі регіону Східна Індія. Збір антропометричних даних проводили відповідно до стандартних процедур, наданих ISAK (Міжнародне товариство з розвитку кінантропометрії). Статистичний аналіз проводили з використанням MS Excel (2021) та SPSS'23.

Результати. Результати дослідження показали, що більшість гравців у хо-хо (90, 6%) мали ектоморфні та мезоморфні домінантні риси. Також була виявлена статистично значуща різниця в ектоморфних і мезоморфних рисах серед гравців із соматотипами мезоморфний-ектоморф ($p<0,05$), ектоморфний-мезоморф ($p<0,05$) і ектоморф-мезоморф ($p<0,05$). Крім того, результати дискримінантного аналізу також показали, що атрибути ектоморфних рис (коефіцієнт дискримінації = 1, 168) і мезоморфних рис (коефіцієнт дискримінації = 0, 812) є важливими соматичними рисами для гравців у хо-хо. Взагалі, 88, 6% вихідних випадків були правильно представлені дискримінантним аналізом.

Висновки. Це дослідження показало, що гравці в хо-хо здебільшого мають ектоморфний і мезоморфний домінантні соматотипи. Крім того, на підставі результатів дослідження можна також зробити висновок, що соматичні атрибути подібних типів статури також відіграють важливу роль для визначення рівня результативності гравців.

Ключові слова: антропометричний, ектоморф, мезоморф, ендоморф, дискримінантний аналіз.

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