POSITION SPECIFIC MORPHOLOGICAL CHARACTERISTICS OF ELITE CADET FEMALE HANDBALL PLAYERS

UDC:796.322.071.2-055.2:796.052
(Original scientific paper)

Marijana Čavala

Faculty of Kinesiology, University of Split, Split, Croatia

Abstract:

With the aim of determining the common morphological features of cadet female handball players and of analyzing their specificities i.e. the probable variation between the four playing positions (back court players, wings, pivots, goalkeepers), 17 anthropometric measures were applied to the sample of 70 players. The basic descriptive parameters were calculated and then an analysis of variance and a discrimination analysis were performed. When observing the differences in morphological characteristics based on playing positions, it is obvious that pivots, outer players and goalkeepers, unlike wing players, are dominantly and markedly dimensioned in skeleton measurements. The obtained position-related differences in morphological characteristics of players suggest that the experienced players from the sample were earlier successfully subjected to the selection process and oriented to a particular playing position. Therefore, in top-quality team-handball it would be recommendable to select players whose morphological profiles are as compatible as possible with positional specificities in the demand for the game.

Key word: *differences, handball, morphological, player position.*

INTRODUCTION

In sport games, including handball, some playing positions that require appropriate anthropologic types of players consistent with specific functions and needs of the position have been distinguished. According to playing positions, players mainly differ in their morphological features (Srhoj et al, 2002; Rogulj et al, 2005; Čavala and Katić, 2010).

Researches in handball on female population are to some extent less frequent than on male population, and were mostly conducted on senior female players, which makes this research even more valuable since it provides information on top quality female handball players of cadet age.

Villa et al. (2011) have come to a conclusion that middle, right and left back players and wing players mostly belong to the mesomorph constitution group, while pivots and goal keepers belong to the endomorph group. In addition to this, they have noted a significant difference in the anthropometrical characteristics between the wing players and the players in all other playing positions, particularly with regard to the pivots and backs. Chiara et al. (2011) also studied the differences between playing positions where they established a statistically significant difference between growth, mass, body mass index (BMI), several skin fold girths and lengths, as well as the total body mass, muscle mass and adipose tissue of female players in different positions. Post-hoc analysis showed that wing players and goal keepers have the greatest mutual differences. These results have confirmed and expanded previous researches on the presence of anthropometrical differences within playing positions in handball.

In male players, in addition to all the previously mentioned characteristics, voluminosity and a greater quantity of adipose tissue is even more pronounced (Srhoj et al., 2002; Šibila and Pori, 2009).

We may draw a conclusion from the previous researches that anthropometry in the diagnostic procedure has its role in the selection of female handball players within playing positions in handball. Therefore, we established a significant difference between playing positions manifested through a more stressed longitudinality of the outer positions and the goal keeper in addition to a pivot who also has a more marked voluminosity, while in wing positions, we established lower values of longitudinal dimensionality, i.e. they are the shortest players with a lower body centroid centre.

The aim of the present study was to identify differences in morphological characteristics of cadet elite female handball players according to playing positions.

MATERIALS AND METHODS

Subjects sample

The sample of subjects was defined as a set of female handball players in the Republic of Croatia, aged 15,31 on average, belonging to the age group of cadets. The research was conducted in 2010 on the sample of 70 (seventy) subjects, the members of the following handball clubs: *Sinj* (Sinj), *Podravka Vegeta* (Koprivnica), *Karlovac* (Karlovac), *EMC Split* (Split), *Sesvete Agro-proteinka* (Sesvete), *Cerna* (Cerna), *Bjelovar* (Bjelovar), *Opatija-Liburnija* (Opatija), *PAN Đakovo* (Đakovo), *Vranjic* (Vranjic), *Orijent Presoflex* (Rijeka), *Koka* (Varaždin), *Lokomotiva* (Zagreb), *Dalmatinka* (Ploče), *Knin* (Knin) and *Željezara* (K. Sućurac). The subjects were measured in the second part of the competition period.

According to their position in the game, the subjects involve 9 goalkeepers, 30 outside players, 20 wing players and 11 pivots.

Variables sample

The choice of 17 morphological variables was based on the presumed existence of four dimensions, i.e. longitudinal skeleton dimensionality, transverse skeleton dimensionality, body volume and body mass, and subcutaneous fatty tissue (Momirović i sur. 1969; Kurelić i sur., 1975; Mišigoj-Duraković, 1989; Katić i sur. 1994). The following variables were chosen:

- measures for assessment of longitudinal skeleton dimensionality: body height, leg length, arm length and hand length;
- measures for assessment of transverse skeleton dimensionality: knee diameter, elbow diameter, wrist diameter, and hand diameter;
- measures for assessment of body mass and volume: body weight, upper arm circumference in relaxation, upper arm circumference in flexion, thorax circumference, and lower leg circumference; and
- measures for assessment of subcutaneous adipose tissue: upper arm skinfold, back skinfold, abdominal skinfold and lower leg skinfold.

Data analyses

Arithmetic mean (X), standard deviation (SD), minimal (MIN) and maximal (MAX) results, coefficient of asymmetry (a_3), coefficient of distortion (a_4) were calculated by standard descriptive statistics methods. Normality of distribution was tested by Kolmogorov-Smirnov procedure; and maximal differences between real and theoretical cumulative frequencies (MAXD) were calculated.

Differences in morphological characteristics to playing position were also determined by the analysis of variance (MANOVA/ANOVA) and canonic discriminative analysis.

Data processing was done by Statistica ver. 7.1. programme.

RESULTS AND DISCUSSION

The basic descriptive parameters showed all the variables to exhibit normal distribution, without any extreme dispersion of data, which was of upmost importance for subsequent statistical analysis (Table 1).

By observing table 2, we may conclude that there are differences in the morphological characteristics between playing positions (p=0,00) which was expected considering the specific quality of the task with relation to positions and other roles in the game.

Statistically significant differences have been established in all the variables to assess body volume and mass, as well as in longitudinality and transversal dimensionality of the skeleton except for the fist and knee dimensions. The differences have not been established in sub-skin adipose tissue variables except for the lower leg skin fold variable.

By a detailed perception of the arithmetic means results, we may observe that pivots, outer players and goal keepers are dominantly and markedly dimensioned in skeleton measures. It is well known that the outer players should generally be the tallest players since their tasks in the game are in connection with explosive jumps over the defending players. Their body height is required not only for the shooting purpose, but in the overview of the game (breadth and height of the field of vision) and in the perceptive speed manifested in how quick they can recognize the position and reaction of the opponents and co-players. The goal keeper should also be morpho-

Table 1. Descriptive statistics (N=70)

VARIABLE	AM	SD	MIN	MAX	a_3	a_4	MAXD
Body heigh	173,22	6,24	159,10	183,00	-0,42	-0,44	0,07
Body weight	65,40	7,68	49,00	88,60	0,23	0,16	0,05
Arm length	76,09	3,23	68,00	84,00	-0,11	-0,11	0,05
Leg length	98,10	3,98	86,70	107,00	-0,73	0,94	0,09
Hand length	18,44	0,95	16,00	20,70	0,00	0,44	0,10
Knee diameter	9,04	0,49	8,10	10,00	-0,05	-0,85	0,08
Elbow diameter	6,36	0,36	5,70	7,20	0,36	-0,61	0,13
Wrist diameter	5,26	0,21	4,70	5,70	-0,20	-0,12	0,11
Hand diameter	7,54	0,36	6,30	8,40	-0,34	1,78	0,12
Upper arm circumference in flexion	27,77	1,94	24,10	35,50	0,79	2,47	0,08
Upper arm circumference in relaxation	26,24	1,93	21,80	32,50	0,30	0,74	0,07
Thorax circumference	84,63	4,46	75,50	97,00	0,18	-0,30	0,05
Lower leg circumference	36,02	2,49	24,80	40,60	-1,30	4,76	0,06
Upper arm skinfold	12,34	3,31	5,85	21,50	0,11	-0,45	0,09
Back skinfold	9,85	2,13	6,50	17,40	0,91	1,53	0,09
Abdominal skinfold	17,11	5,75	9,00	33,00	0,61	-0,53	0,15
Lower leg skinfold	11,71	2,92	7,10	21,50	1,41	2,53	0,13

Test= 0,19

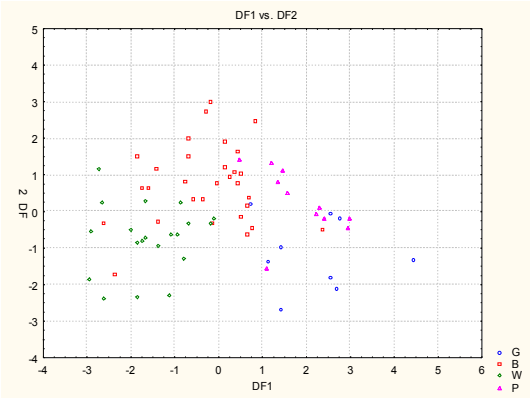
Table 2. Results of analysis of variance and canonic discrimination analysis

Wilks'λ	df1	df2	F	p
0,14	51	149	2,68	0,00

VARIABLE	AM				F	p	DF1	DF2
	G	B	W	P				
Body heigh	176,38	174,36	167,03	178,81	18,85	0,00	0,59	0,53
Body weight	71,78	66,22	58,80	69,94	12,68	0,00	0,51	0,25
Arm length	78,38	76,37	73,36	78,40	12,22	0,00	0,50	0,27
Leg length	98,88	98,75	94,80	101,71	11,70	0,00	0,43	0,49
Hand length	18,63	18,65	18,02	18,45	2,01	0,12	0,13	0,24
Knee diameter	9,03	9,12	8,88	9,10	1,12	0,35	0,09	0,23
Elbow diameter	6,56	6,37	6,10	6,65	9,32	0,00	0,44	0,22
Wrist diameter	5,35	5,25	5,16	5,40	4,22	0,01	0,30	0,11
Hand diameter	7,73	7,54	7,41	7,63	1,96	0,13	0,20	0,00
Upper arm circumference in flexion	28,71	28,11	26,56	28,33	4,50	0,00	0,27	0,24
Upper arm circumference in relaxation	27,07	26,34	25,13	27,32	4,57	0,00	0,31	0,18
Thorax circumference	87,28	85,64	81,58	85,25	5,72	0,00	0,29	0,25
Lower leg circumference	37,26	35,67	35,21	37,43	3,07	0,03	0,26	-0,05
Upper arm skinfold	13,71	11,96	12,27	12,40	0,64	0,59	0,08	-0,16
Back skinfold	10,91	9,98	9,13	9,97	1,58	0,20	0,16	0,03
Abdominal skinfold	18,80	18,19	14,59	17,35	1,97	0,13	0,15	0,20
Lower leg skinfold	14,89	11,39	10,89	11,48	4,96	0,00	0,24	-0,26
CanR							0,82	0,62
						G	2,19	-1,16
					C	**B**	-0,26	0,75
						W	-1,59	-0,74
						P	1,82	0,26

Key: Wilks'λ – the value of Wilks' lambda, df1 and df2 – freedom degrees, F – the value of F-test, p – significance level coefficient, AM- arithmetic mean, DF – correlations of the variables with a discriminant function, CanR – canonical discrimination coefficient, C – group centroids for every playing position, G – goal keeper, B – back, P – pivot, W – wing

logically dimensioned, which has been confirmed in this study as well, since a greater body surface enables him to 'passively' cover and defend a larger part of the goal frame. Pivots also have a strong and robust constitution which can be explained by the fact that they are practically constantly in the contact game with one or two opponent players. The pivots are less longitudinally dimensioned, i.e. they belong to players with shorter body constitution. The reason for this lies in the tasks of the game requiring from wing players to be the fastest, to maximally overplay the opponent in a very small space. Therefore, fast sprints, counter attacks, pivots running into the defence area, high take-offs in dive shooting determine lower height of the general body centroid centre, and thus even lower values of the longitudinal skeleton dimensionality.



Graph 1. The positions of centroids for four groups of playing positions in the co-ordinate system of two discriminant functions (morphological space)

Coaches frequently expect an athletic constitution in their female handball players in addition to a maximum reduction of sub-skin adipose tissue since sub-skin adipose tissue is perceived as a ballast mass or a restrictor which, regardless of the playing position has a negative influence on the performance in the game. Adipose mass works as a limiting factor in achieving the dimensions which determine the intensity of the motor activity. It is important to stress that handball is dominated by explosive movements and fast reactions whether it is about the defensive movements of the goal keeper, fast and explosive jumps of the outer shooters or the nimbleness and the agility of the wing and back players. Further on, it is evident that there are no statistically significant differences within certain playing positions in the variables to assess sub-skin adipose tissue in addition to the knee diameter variable. The exception is NABPOT variable which makes a statistical difference among the players, and it is more stressed in goal keepers. By observing arithmetic means we can see that, though these are not statistically significant results, we may still observe the stressed adipose component in goalkeepers, which is most logical, since the training process itself is individualised and different compared to other players. While other players perform their tasks through various forms of running and moving, the goal keeper does not have particularly demanding trainings focused on the developing of endurance. The total endurance is smaller than in field players, so we may assume this is one of the main reasons this particular position has the most pronounced dimension of the sub-skin adipose tissue compared to other positions. With regard to other variables, the position of pivots comes as the second which is not surprising since in this position the players maintain static positions, blockings etc. due to their greater body mass. Namely, the position of the pivot in the game asks for strength and robustness, 'allowing' at the same time a larger quantity of fat and non-fat mass. The pivots are followed by outer players, while wing players have least problems with adipose tissue, probably due to the specific quality of the technical-tactics activities of their 'working post'. Namely, wing players perform tasks in the game which require fast and frequent sprints from a certain player, explosive jumps, and regarding their position in the field, they run the longest distance, thus their aerobic and speed endurance is most developed, which has a positive influence on the decrease of the ballast mass.

Therefore, we may claim that present differences in the morphological constitution reveal the differentiation and the selectivity of players regarding specific kinesiological requirements in certain playing position.

CONCLUSION

This paper is partially trying to study just one anthropological characteristic – morphological area as a predictor to the difference in the playing positions. We established a pronounced differentiation between the wing players and other positions, manifested primarily in the longitudinal dimensionality of the skeleton. The reasons for

this are the tasks in the game which demand from the wing players to be the fastest, to overplay the opponent with maximum speed in a very small space. Therefore, fast sprints, counter attacks, pivots running into the defence area, high take-offs in dive shooting determine a lower height of the general body centroid centre and, at the same time, lower values of the skeleton longitudinal dimensionality.

The results of this research may be used as model values in female handball for cadet categories of players. Further on, during selection it is essential to give advantage to the players whose morphological characteristics satisfy the demands in situation conditions in the game (regarding playing positions). Additionally, it is crucial to include other anthropological features in the following researches in order to obtain relevant information on the anthropological complexes of female handball players in different playing positions. Thus, the explanations should be searched for in an athlete's integral potential, and not in the isolated anthropological characteristics which are undoubtedly the future researching directions.

REFERENCES

Cavala, M. & Katić, R. (2010). Morphological, motor and situation-motor characteristics of elite female handball players according to playing performance and position. *Collegium Antropologicum*, *34* (4):1355-61.

Chiara, M., Piscitelli, F., Lampis, C. & Zancanaro, C. (2011). Anthropometry and body composition of female handball players according to competitive level or the playing position. *Journal of Sports Sciences, 29* (12): 1301-09.

Katić, R., Zagorac, N., Živičnjak, M. & Hraski, Ž. (1994). Taksonomic Analysis of Morphological/ Motor Characteristics in Seven- Year Old Girls. *Collegium. Antropologicum, 18* (1):141-154.

Kurelić, N., Momirović, K., Stojanović, M., Šturm, J., Radojević, Đ. & Viskić-Štalec, N. (1975). Struktura i razvoj morfoloških i motoričkih dimenzija omladine [The structure and development of the morphological and motor dimensions of the young]. Institut za naučna istraživanja Fakulteta za fizičko vaspitanje, Beograd.

Mišigoj- Duraković, M. (1989). Taksonomska analiza morfoloških karakteristika mladih sportaša R. Hrvatske. Kineziologija, 21:69-75.

Momirović, K. (1969). Faktorska struktura antropometrijskih varijabli [Factorial structure of certain anthropometric variables]. Visoka škola za fizičku kulturu, Institut za kineziologiju. Zagreb.

Rogulj, N., Srhoj, V., Nazor, M., Srhoj, Lj. & Čavala, M. (2005). Some Antropologic Characteristics of Ekite Female Handball Players at Different Playing Positions. *Collegium Antropologicum*, *29* (2):705-709.

Srhoj, V., Marinović, M. & Rogulj, N. (2002). Position specific morphological characteristics of top-level male handball players. *Collegium Antropologicum, 26* (1):219-227.

Šibila, M. & Pori, P. (2009). Morphological Characteristics of Handball Players. *Collegium Antropologicum, 33* (4):1079-1086.

Vila, H., Manchado, C., Abraldes, A., Alcaraz, P., Rodriguez, N. & Ferragut, C. (2011). Anthropometric profile in female elite handball players by playing positions. EHF Scientific Conference 2011. Science and Analytical Expertise in Handball. Vienna. 219-222.

Correspondence:
Marijana Čavala
Faculty of Kinesiology,
Teslina 6,
21000 Split, Croatia
e-mail: marijana@kifst.hr
00385 91 4557902

СПЕЦИФИЧНОСТИТЕ НА МАРФОЛОШКИТЕ КАРАКТЕРИСТИКИ КАЈ ВРВНИТЕ РАКОМЕТРАКИ ВО ЗАВИСНОТ ОД ПОЗИЦИЈАТА НА КОЈА ИГРААТ

УДК:796.322.071.2-055.2:796.052
(Оригинален научен труд

Марија Чавала

Универзитет во Сплит, Факултет за кинезиологија, Сплит, Хрватска

Абстракт

На примерок од 70 врвни ракометраки, до кадетска возраст применети се 17 антропометриски мерки со цел да се утврат нивните заеднички морфолошки карактеристики и да се анализираат специфичностите, т.е. веројатните разлики во зависност на 4 играчки позиции (надворешмна позиција, крилни, и кружен напаѓач и голман). Во рамките на статистичката обработка пресметани се основи дескриптивни параметри, како и принета е анализа на варијансата и дескриминативна каноничка анализа. Врз основа на добиените резулати може да се констатира дека кај пивотмените, надворешните играчи и голманите доминира и е нагласена димензионалноста во мерките на скелетот за разлика од крилните играчи. Добините разлики во морфолошката градба укажуваат на диференцирање и селекција на ракометарки во зависнос од специфичните кинезиолошки барања на поединечното место на кое играчот игра. Во врвниот ракомет е препорачливо да за одредена позиција се бираат ракометарки кои се со своите морфолошки белези се компатибилни на барањата на тоа игрчко место.

Клучни зборови: *разлики, ракомет, морфологија, играчки позиции*