Situational Efficacy of Anthropomotor Types of Young Female Handball Players

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A B S T R A C T

A battery of 26 anthropomotor and 15 situational handball tests were used in a sample of 155 girls aged 13 years, attending Split handball school for 4 years, for taxonomization and determination of relations among the areas analyzed. Figures were analyzed by taxonomic analysis using the model of polar types and canonic correlation analysis. Five types that basically corresponded to the positions in the team were identified in the anthropomotor area: universal player, wing player, outside player, middle outside player and circular player. Situation-related types showed three ways of presenting specific handball activity defined by the level of complexity of realization of specific tasks: specific handball efficacy, specific hand coordination, and movement with changes of direction. Two types of integrating attitudes, i.e. two ways of solving complex tasks, were established by canonic relations between the anthropomotor and situational types. According to the first, the energy articulated as dynamic mass is used for the purpose of achieving general handball goals, and it is typical for all-round players and outside shooters. According to the other one, different kinds of movements are used to achieve the goals in handball, typical for wing players and middle outside attack players, characterized by regulation of direction changes and handling the ball.

Introduction

The evaluation of success and the prediction of efficiency in any human activity is one of the most important tasks of the systematic work[1,2]. In sports activities, everything is actualized due to large number of factors that influence the final results, and it is mostly seen in little girls[3,4]. Starting point in planning and programming of the training process is the knowledge of biological factors, especially constitutive and motor factors[5,6], and transformation of anthropologic factors influenced by the aimed transformational process[7,8]. Creating top female

handball players is a long and serious process in which, in consistence with the time needed in transformations in later phases, it is difficult to make corrections mostly because of the stabilization of the psychosomatic functions. Therefore, the tests of achievement should be performed in earlier phases in order to avoid any omission and to obtain a final result that corresponds to the game model which the players should acquire as seniors. One of the most important phases of evaluation is at the age of 13, when the selection of candidates for official competitions as seniors is performed. This is also the period when it is possible to evaluate the achievement, since the girls have for years been in the transformational process[9,10]. Therefore, there is the intention to establish the way constitutive and motor characteristics are reflected on the aimed situation-related activities of the game as the basis of final results[11,12]. The goal of this work was set according to these characteristics. This goal includes defining the relations between the anthropomotor and situational types in 13-year-old girls, attendants of the handball school in Split. It is assumed that handball activity during years results in specific structures of morphologic characteristics, motor abilities, and situational status.

Material and Methods

Study sample included 155 girls aged 13 years (+/-3 months), attendants of the handball school in Split. The sample can be considered as representative for the population with the above-average level of motor abilities and for the sports population in general. All study girls were healthy and without and physical deficiency. The girls were divided into groups of 25 that had been training for four years, nine months *per* academic year. Training sessions were organized five times a week and lasting 80–90 minutes.

Entity testing was done after four years of training.

Variable sample for status evaluation consisted of parameters for evaluation of constitution, motor variables, and specific handball tests. Morphological status was evaluated with 13 measures according to the international biological program: height (AVIS), length of legs (ADUN), length of arms (ADUR), elbow diameter (ADIL), arm wrist diameter (ADRZ), knee diameter (ADIK), volume of upper arm (AONL), forearm (AOPL), lower leg (AOPK), body mass (ATEZ), and skinfold of the upper arm (ANNL), back (ANLE) and stomach (ATRB). Motor status was evaluated with 13 motor variables that were supposed to cover the dimensions of movement frequency, explosive strength, coordination and repeated strength: taping with hands (MTAP) and legs (MTAN), hand (MKRR), and leg circles (MKRN), long jump (MSDM), throwing medicine ball (MBML), slalom around the racks with two balls (MSNL), striking the ball with the racket (MORE), juggling with match-box (MZON), agility on the ground (MONT), polygon backwards (MPOL), trunk elevation (MCDT), and push ups (MSKM).

Specific handball status was evaluated with 15 situation-related tests that included precision, handling the ball, movement speed with and without the ball, strength of the ball throw: throwing and catching against the wall using one arm (SKR1), playing with the ball with eyes closed (SKRP), passing the ball in jump with two hands (SRK2), initial run while leading the ball (20 m) (SRB2), leading the ball in slalom (SRBL), leading the ball in square (SRBV), lateral and profound mobility without the ball (SRBB), speed of running in slalom without the ball (SRBT), realizing defense without the ball (SRXO), precise shooting in fall from 7 meters (SRP7), precise jump shooting from 9 meters (SRP9), precise

shooting from 8 meters from the ground (SRP8), throwing the ball out of fall at distance (SRSP), throwing the ball out of jump (SRSS) and from the ground (SRST). All measurements were done by qualified measurers (physical education teachers).

Taxonomic analysis under the model of polar types and canonic correlation analysis were used for the analysis consistent to the aim of the task.

Results and Discussion

Results of taxonomic analysis are shown in Table 1. Five types have been isolated, and since it is the methodology of explication of polar types that shows the supremacy in relation to other taxonomic techniques, it is easy to identify and describe the isolated types. Therefore, the first type is mostly defined by all motor variables. At the same time, measures for the evaluation of morphological status are less but also contribute positively to the definition of this type. It is the anthropomotor type of the superior motor efficacy and stronger constitution but it also owns big mass in general, especially active mass of the musculature. In descriptions of morphological types, the positive pole of this type could be called mesomorph. Motor status completes this picture in the sense of the concentration of ability. There is no doubt that it is the most universal type (all round) women handball players that can cover few specialized positions in the team, especially in defense.

The second type describes the types of young women handball players that are characterized by less height, mass, and weaker but still positive motor efficacy. In sports, it is obviously the case of more agile types that realize all the motor and sport tasks with less support of mass persistence and constitution characteristics, and are more based on agility. It is very

difficult to include this type among clear types in the usual morphological classification. On the negative side of the type it is easy to recognize Sheldon's leptosome type. In motor sense it is the type that differentiates entities according to the ability of solving complex tasks. In handball, the positional location of this type is definitely wing.

The third type in positive pole separates the girls with emphasized longitudinal characteristics, and it is the case of the entities that belong to the »tall«. It is evident that there are no other characteristics regarding the entity at the positive pole of this type, except for the absence of fatty tissue. Therefore, this type can be called ectomorph. It seems that motor structure is directly connected with this fact based on long bars of body segments[13], for the support of which the musculature has been inadequately developed, which indirectly entails some problems in movement control. In this type, outside shooters and defense blocks are easily recognized from distance.

The fourth type is not only simple but also structurally one-sided. In fact, no morphological measurement contributes seriously to its definition, and it can be defined as exclusively motor determined. Anyway, in motor set, only few variables can be separated, primarily all four variables for movement frequency evaluation, which is part of the mechanism of movement structuring. However, they have negative projections. This means that it is the case of entities with less flow of communicational canals and therefore they are included in »slow« in movements of lower and upper extremities. On the other hand, it seems that this type has developed kinesthetic feelings of arms based on a high projection of the variable that describes hand coordination. This information in terms of handball can be used in handling the ball on the level that aspires to automatic performance of the

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TABLE 1
STRUCTURE AND CORRELATIONS OF TAXONOMIC DIMENSIONS

Variable	Anthropomotor					Variable	Situational		
	TX1	TX2	TX3	TX4	TX5		TSI3	TSI2	TSI3
AVIS	0.37	−0.41	(0.62)	0.07	0.11	SKR1	0.26	(0.58)	0.48
ADUN	0.30	−0.34	(0.64)	0.06	0.08	SKRP	0.14	(0.55)	0.42
ADUR	0.37	−0.39	(0.62)	0.03	0.12	SRB2	(−0.79)	0.25	−0.03
ADIL	0.42	(−0.66)	0.00	−0.07	0.11	SRBB	(−0.60)	0.26	0.03
ADRZ	0.34	(−0.62)	0.26	−0.07	0.06	SRBL	(−0.76)	0.15	−0.32
ADIK	0.41	(−0.66)	−0.05	0.01	0.15	SRBT	(−0.57)	0.46	−0.32
AONL	0.49	(−0.63)	−0.33	−0.07	0.03	SRBV	(−0.75)	0.31	−0.03
AOPL	0.51	(−0.52)	−0.05	−0.07	0.06	SRK2	−0.19	(0.70)	0.40
AOPK	0.54	(−0.55)	−0.15	0.11	0.10	SRP7	(0.68)	0.32	−0.48
ATEZ	0.52	(−0.64)	0.06	−0.04	0.08	SRP9	(0.75)	0.37	−0.31
ANNL	0.22	(−0.54)	−0.42	−0.30	−0.13	SRP8	(0.69)	0.31	−0.43
ANLE	0.27	(−0.65)	−0.39	−0.19	−0.03	SRSP	(0.81)	−0.03	−0.02
ANTR	0.21	(−0.70)	−0.27	−0.15	−0.09	SRSS	(0.82)	0.07	−0.04
MTAP	0.46	(0.47)	0.10	−0.37	0.00	SRST	(0.87)	0.08	0.04
MTAN	0.38	(0.68)	0.04	−0.42	0.19	SRXO	−0.45	0.50	−0.36
MKRR	(0.52)	0.49	−0.02	−0.39	−0.03		Correlations		
MKRN	0.45	0.41	−0.07	(−0.50)	0.11		TSI1	TSI2	TSI3
MDSM	(0.54)	0.47	0.29	0.06	0.11	TSI1	10.00	0.19	0.30
MBML	(0.79)	0.05	0.13	0.15	−0.22	TSI2		10.00	0.01
MSNL*	(−0.76)	−0.30	0.18	−0.20	0.25	TSI3			10.00
MORE	(0.84)	0.27	−0.36	0.59	−0.11				
MZON*	(0.64)	0.34	−0.01	−0.10	−0.40				
MONT	(−0.73)	−0.42	−0.07	−0.10	0.23				
MPOL*	−0.54	(−0.60)	0.03	−0.02	−0.32				
MCDT	(0.39)	0.30	0.22	0.04	−0.14				
MSKM	0.38	0.47	−0.43	0.26	(0.69)				
Correlations									
	TX1	TX2	TX3	TX4	TX5				
TX1	10.00	−0.21	0.40	−0.24	0.22				
TX2		10.00	0.16	0.15	−0.13				
TX3			10.00	−0.02	0.13				
TX4				10.00	−0.05				
TX5					10.00				

() = Maximal row projection; * = Opposite metric orientation

tasks that include fine regulation of the hands[7]. This type of the player would describe a middle attack player engaged in adequate ball transmission, and maybe some specific defense positions.

The fifth and the last type seems to be rather unclear, because it is, likewise the fourth one, dominantly saturated by only one variable. However, it is easy to notice small but positive projections of the body

constitution, and small but negative projections of fatty folds, which means that it tends to mesomorph in the morphological sense on the positive pole. This type separates the variables that describe the managing of lower extremities, agility on the ground, but most of all articulation of the specific coordinated work of hands. This type is closest to wing attack player, as shown by the variables described.

Correlations of taxonomic dimensions are mostly less than medium, confirming the thesis on the divergent types that aspire to individual existence, with some rare common characteristics. This also means that girls at the age of 13 are typologically differentiated under the influence of growth as well as training, and we can probably expect continuous differentiation regarding their somatic and motor characteristics.

Three types are isolated in the area of situation-related tests. The first one evidently describes the general efficacy in situational conditions, dominantly marked by the power of throw, and speed of movement partly, with or without the ball. There are also three more variables that can be included in this picture, which have maximal projections on the second type. The first type therefore declares general handball efficacy introduced by the dominant type of female handball players.

The second type is specific hand coordination, important for many tasks that are realized in dynamic conditions of entity cooperation. In this example it is shown that tasks with the ball are very important because the aim of the game is achieved by bringing the ball in a specific area[14]. However, even in the specific situational sense group of elements realized in complex ways is more important in energetically defined conditions, with or without the ball. Therefore, coordination of the hands can be pointed out only after

completing the demands of general efficacy.

Finally, the third type describes the entities as capable to handle the ball but not precise and especially capable for movement with the change of direction. In the conditions of the constant change of direction, it is impossible to keep precise shooting, but skilful handling of the ball is possible, even necessary[13]. It is also possible that the players who pass through the defense of the opposed team waste their energy unnecessarily. It is also probable that, according to the game model, they are crucial by drawing attention to themselves by passing and providing the possibility of attack.

Relations of the situation-related types are medium and small, meaning that the simple integration of these types in one model is not possible without long and intensive training through different variables of the training situation and game.

Table 2 presents tests that show the importance of canonic correlations of anthropomotor and situational types. Two canonic correlations are important and they describe two ways that can relate them. Their structure is shown in Table 3.

The first anthropomotor type describes all-round players and shooters from

TABLE 2
IMPORTANCE OF CANONIC CORRELATIONS OF ANTHROPOMOTOR AND SITUATIONAL TYPES

	1	2	3
R	(0.74)	(0.28)	0.15
χ^2	1330.99	150.74	30.49
DF	15	8	3
W	0.41	0.90	0.98
P	0.00	0.04	0.32

R = canonic correlations; χ^2 = test of canonic roots; DF = deegres of freedom; W = Wilks lambda; P = significance of canonic correlations

TABLE 3
FACTOR STRUCTURE OF ANTHROPOMOTOR
AND SITUATIONAL TYPES

	1	2
Anthropomotor		
TAM1	(0.86)	0.13
TAM2	0.16	(–0.86)
TAM3	(0.61)	0.01
TAM4	0.14	(0.34)
TAM5	0.13	0.11
OBJσ	0.24	0.13
TOTσ	580.01	
REDσ	0.13	0.02
TRσ	140.62	
Situational		
TSI1	(0.99)	0.09
TSI2	0.17	0.22
TSI3	0.39	(–0.91)
OBJσ	0.39	0.29
TOTσ	1000.00	
REDσ	0.21	0.02
TRσ	240.33	

OBJσ = explained variance; TOTσ = total variance; REDσ = redundancy variance; TRσ = total redundancy variance

the outside positions, and general situational efficacy in the situational area. This means that strong constitution that includes mass and above average motor efficacy is needed to fulfill the specific characteristics of handball. However, tall players without any specific motor abilities can also be included in successful handball models, the same as those that can get the lead for their team with the change of direction with the ball[15]. The reasons for this lie in aggressive defenses that are present in handball today and complete physical activity as well as height, especially for the shoot from distance. Other types of entities cannot meet the demands.

Another canonic thesis describes the players of shorter constitution, mostly wing players, more modest players, motor wise but with a good feeling for the ball. In relation to situational efficacy, there is a predominance of movement through the space with the change of direction. Evidently, wing players and middle outside attack players, depending on the situations during the game, have to solve the problems in a specific way. This way is manifested in faking and avoiding traps of the defense that push them towards solving complex problems for the interest of the whole team.

It is also obvious that the fifth anthropomotor type (circular attack player) does not fit into any clear canonic factor.

Conclusion

With the goal to provide a structural analysis of anthropomotor area and specific situation-related status in younger handball players and to achieve relations between the two areas, testing was performed in a sample of 155 girls aged 13, attendants of handball school in Split, with a 4-year handball experience. Morphological status was evaluated by 13 measures according to the international biological program. Motor status was defined by 13 variables for evaluation of motor abilities of frequency of movements, explosive strength, coordination and repeated strength, and specific handball status by 15 situation-related tests for evaluation of precision, ball handling, speed of movement with and without the ball, and force of throwing the ball. The data were analyzed by taxonomic analysis according to the model of polar types and canonic correlation analysis.

Five types that basically correspond to the positions in handball team were obtained by the taxonomic analysis. These types are all-round player, wing player, outside player (shooter), middle outside player (organizer), and circular player. Three types, mostly marked by the de-

gree of complexity of realization of specific tasks are isolated in the area of situation-based tests. These are specific handball efficacy, hand coordination, and movement through the area with the change of direction. It is evident that systematic handball training produces stable types of players, capable to deal with the dynamic demands of modern handball.

It has been established that there are two types of integrated behaviors in solving complex tasks. In the first case, there is the use of energy articulated as a dynamic mass, i.e. the whole body, with the purpose to achieve the general handball goals, and it is typical for all-round players and shooters. According to the other one, to achieve the goals in handball it is important to use special kinds of movement, characteristic to wing and middle outside attack players, characterized by regulation of the change of direction and handling the ball. Based on the results of the survey, it is possible to give directions of transformational tasks in handball and to integrate the results obtained in the programs of creating young handball players in handball schools.

REFERENCES

1. BURTON, W. A.: Movement skill assessment. (Human Kinetics Book, Champaign, 1998). — 2. ROSS, W. D., M. J. MARFELL-JONES: Physiological testing of the high-performance athlete. (Human Kinetics Book, Champaign, 1991). — 3. BIŠOF, V., Z. JURČIĆ, N. SMOLEJ-NARANČIĆ, M. ŽIVIČNJAK, Coll. Antropol., 22 (1998) 497. — 4. ŽIVIČNJAK, M., L. PAVIČIĆ, Coll. Antropol., 19 (1995) 475. — 5. DALTON, J. E., R. A. MAIER, E. J. POSAVAC, J. Res. Pers., 11 (1977) 487. — 6. HAWES, M. R., J. Sports Sci., 12 (1994) 235. — 7. KATIĆ, R., D. BONACIN, S. BLAŽEVIĆ, Coll. Antropol., 25 (2001) 573. — 8. TRNINIĆ, S., G. MARKOVIĆ, S. HEIMER, Coll. Antropol., 25 (2001) 591. — 9. CALDER, A. W., P. D. CHILIBECK, C. E. WEBBER, D. G. SALE, Canadian Journal of Applied Physiology, 19 (1994) 185. — 10. BALE, P., J. L. MAYHEW, F. C. PIPER, T. E. BALL, M. K. WILLMAN, J. Sports Med. Phys. Fit., 32 (1992) 142. — 11. DUFOUR, A. B., A. ROUARD, J. PONTIER, L. MAURIN, Science et Motricite, 2 (1987) 3. — 12. DELIJA, K., Z. ŠIMENC, D. VULETA, Kinesiology, 27 (1995) 57. — 13. SRHOJ. V.: Morphological-motorical efficiency and contribution to a more efficient process of orientation and selection of a sport handball school. In Croat. Ph.D. Thesis. (University of Skopje, 1996). — 14. SRHOJ, V., N. ROGULJ, M. PADOVAN, R. KATIĆ, Coll. Antropol., 25 (2001) 611. — 15. KEER, R., B. BOOTH, Perceptual & Motor Skills, 46 (1978) 395.

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SITUACIJSKA UČINKOVITOST ANTROPOMOTORNIH TIPOVA MLADIH RUKOMETAŠICA

SAŽETAK

Na uzorku od 155 djevojčica polaznica rukometne škole u Splitu, uzrasta 13 godina, sa četverogodišnjim rukometnim stažom, primijenjen je skup od 26 antropomotoričkih i 15 situacijskih rukometnih testova radi taksonomizacije i utvrđivanja relacija među analiziranim prostorima. Podaci su analizirani taksonomskom analizom prema modelu polarnih taksona te kanoničkom korelacijskom analizom. U antropomotoričkom pro-

storu dobiveno je pet taksona koji načelno odgovaraju položajima u rukometnoj ekipi: univerzalna igračica, krilna igračica, vanjska igračica tipa šutera, srednja vanjska igračica tipa organizatora igre i kružna igračica. Situacijski taksoni su pokazali tri načina iskazivanja specifične rukometne aktivnosti određena stupnjem složenosti realizacije specifičnih zadataka: specifična rukometna učinkovitost, specifična koordinacija ruku i kretanje s promjenama pravca. Kanoničkim relacijama između antropomotoričkih i situacijskih taksona utvrđeno je da postoje dva tipa integrirajućeg ponašanja, odnosno dva načina rješavanja složenih zadataka. Prema prvome, rabi se energija artikulirana kao dinamička masa, tj. cijeli organizam u svrhu postizanja općih rukometnih ciljeva, a svojstvena je »all-round« igračicama i vanjskim pucačicama. Prema drugome, za postizanje ciljeva u rukometu rabe se posebni oblici gibanja svojstveni krilnim igračicama i središnjim vanjskim napadačicama, koje obilježavaju regulacija promjene pravca gibanja i baratanje loptom.