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Biomotor Status and Kinesiological Education of Girls Aged 10 to 12 Years – Example: Volleyball

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A B S T R A C T

The aim of this study was to define processes of orientation and/or selection towards sports game of volleyball in schoolgirls of Kaštela, aged 10–12, by examining the relations between regular classes of physical education (PE) and extracurricular sport activities. For this purpose, two morphological measures were used (body height and body mass) and a set of 11 motor tests (6 basic motor abilities tests and 5 motor achievement tests) on a sample of 242 girls aged 10–12 was used, divided into a subsample of 42 girls participating in volleyball training (Volleyball players) and a subsample of 200 girls who do not participate in volleyball training (volleyball non-players). Based on the comparison of test results of schoolgirls from Kaštela and Croatian norms, factor analysis of applied variables and discriminant analysis of these variables between volleyball players and non-players, processes and/or phases of selection in forming quality volleyball players were defined. Selection processes are preceded by orientation processes in physical education classes, i.e. choosing those sport activities which are in accordance with the biomotor status of students. Results have shown that orientation and initial selection in female volleyball needs to be executed based on the motor set of psychomotor speed, repetitive strength of the trunk and flexibility (muscle tone regulation), and body height. Volleyball training has affected the muscle mass development and the development of strength factors, so that explosive strength of jumping and/or takeoff, along with body height, has predominantly differentiated female volleyball players from non-players, aged 10 to 12, and serve and spike quality will have dominant influence on the match outcome.

***Key words**: schoolgirls aged 10–12, biomotor status, kinesiological education, volleyball, selection*

Introduction

Physical education programme in higher grades of elementary school is based on the propositions of area of physical education which is determined by educational and anthropological components (HNOS, 2006)[1]. Educational work in the area of physical education consists of educational guideline, kinantrophological and upbringing guideline, and according to the type of educational work in the area of physical education, it is divided into classroom work and extracurricular activities (Neljak, 2012)[2]. The educational guideline defines acquisition of theoretic kinesiological and biotic motor knowledge. Kinanthropological guideline involves systematic and continuous transformation primarily of morphological, motor and functional characteristics, while the upbringing guideline of physical education has a purpose of creating such a system of values towards physical exercise in students that will stimulate self-initiated and lifelong practice of physical exercise.

Such practice is the source of including children in sport clubs, and the teacher is undoubtedly the key subject in implementing basic and specific objectives of physical education.

Only knowledgeable, planned, programmed and implemented teaching can satisfy numerous general and specific goals of physical education (Neljak B. et al., 2006)[3].

At the beginning of every school year teachers identify the initial status of each student, thus creating an important set of information to be used in designing the curriculum of the immediate classroom teaching.

General objectives of physical education are also permanently oriented towards the effective use of free time and including students into sport clubs and developing an interest for personal improvement in different sport activities. Extracurricular activities that are acceptable

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and available to each student maintain optimum development of all dimensions of kinanthropological characteristics. Quantitative defining of motor abilities and achievements of each student provides a sufficient set of information to be used by a kinesiologist to properly guide the students in choosing extracurricular activities which will eventually make a selection of students with outstanding results towards a certain sport activity in school or outside-of-school clubs.

A vast number of studies around the world, with the classified criteria of use, depending on the sport it represents, have dealt with the phenomena of motor and anthropometric area, and this study is an example of direction, selection and orientation of female students aged 10–12 towards volleyball through all three forms of educational work in the area of physical education.

The age of 9–10 is the most suitable period for kinesiological motor learning of sport games, therefore for volleyball as well. The organization of classroom teaching of physical education itself is the reason why girls begin more serious orientation towards extracurricular activities mostly when they reach the fifth grade.

All girls who want to and are free from respective health restrictions should preferably be offered an opportunity to practice volleyball. Selection is a process rather than an instantaneous action. It implies continuous follow up of girls at sports schools and in starter volleyball groups alike.

Modern volleyball is characterized by a very high outreach of male and female volleyball players above the net and high ball velocity on jump service and spiking. A very high speed level of reaction and agility is required to be able to control such balls on serve reception, especially in field defense. Many authors consider motor abilities, agility and explosive strength, along with pronounced longitudinal skeleton dimensionality, to be essential characteristics for successful volleyball performance[4–14].

When training female volleyball players, it should always be kept in mind that training patterns differ substantially between male and female volleyball players. Weimin (1990)[13] points to the specificities in female training because of psychological characteristics (emotionality, lower tendency to companionship as opposed to men) and physiological properties (higher articular mobility, lower muscle strength, higher fat percentage, etc.).

In the area of coordination, good results can be achieved as early as at the age of 7–9 (not later than age 11). In the area of functional abilities, attention should in particular be paid to the development of aerobic capacity at age 14–16. As opposed to boys, whose endurance increases without much training, in girls it will decline unless submitted to systematic training.

Balyi (1999)[14] depicts four main periods in the volleyball player's career. During the first period training is done for fun (age 5–10). Second period (age 10–14) implies learning the fundamentals of volleyball technique and tactics. The third period (age 14–18) is characterized by distribution of particular roles within the team (specialization). In the fourth period (age 18 to the end of career), the main goal of training is to win at a contest. All efforts are invested toward upgrading all individual and team capacities to the highest possible level.

Feris et al. (1995)[4] used a battery of motor tests for physical and physiological variables (including hand extension in shoulder joint), also measuring maximum ball throwing velocity by using a radar, in 13 female volleyball players. Results showed the strength of shoulder joint extension performed at a high speed to be the predominant physical variable correlating with ball throwing velocity. The throwing strength in female volleyball players can be improved by including exercises increasing the strength of shoulder joint extension, especially high speed exercises, in the training process. The game performance in volleyball can be upgraded by speed training focused on shoulder joint extensors.

Morales (2002)[7] has collected data on the Puerto Rico female volleyball team and USA college female volleyball players for years, and compared the results obtained on some anthropometric characteristics and motor abilities with game performance. Study results showed that height and agility correlate most closely with game performance, whereas the effect of jumping was less pronounced.

Among other findings, Stamm et al. (2003)[11] found the explosive strength of throwing type (as assessed by throwing a medicine ball) to significantly correlate with spiking performance.

Grgantov et al. (2007)[21,22] identified morphological structures on a sample consisting of 246 young female volleyball players according to age and confirmed the effects of these morphological structures on technical and situation efficacy. Regression correlation analysis established that the developed skeleton, which is based on predominated longitude, was a significant and positive predictor of situation success across all age categories and that the set of variables of the 6 techniques assessed was a relatively good predictor of situation efficacy across all age categories in that the best predictor of player quality in the youngest cadets was the serving technique, in younger cadets block and spike techniques, in cadets spike and block technique, and in juniors the field defense technique.

Katić et al. (2006)[23], using a sample of 147 female volleyball players aged 14–15 and a sample of 50 female volleyball players aged 16–17, applied a battery of 12 motor tests as variable predictors and a set of 6 elements of technique and assessment of player quality as criterion variables. By regression correlation analysis it was found that the mechanisms for regulating force and speed were good predictors of player quality in female volleyball players aged 14–15 and in female volleyball players aged 16–17, with mechanism for force regulation having a considerably greater impact on player quality than mechanism for speed regulation. Based on the results, a potential selection model for achieving top results in female volleyball was depicted.

By using a selective sample which was defined by a group of 80 young female volleyball players aged 12–14 on one hand, who participated in an active training process during the period of equal duration, and on the other hand, by a group of 80 students of the same age who were kinesiologically inactive, Milić et al. (2011)[24], by using discriminant analysis, found a statistically significant difference between the subjects, defined by varying intensity of kinesiological activity and, importantly, a separation in the area of some anthropometric and motor dimensions. In anthropometric area, the experimental group of female volleyball players is characterized by a higher value of hypothetical factor of longitudinal dimensionality of the body, and these differences are linked to the hereditary influence, properly executed selection and varying intensity of motor dynamics in everyday life.

The space of the motor dimensions is also defined by the domination of the young athletes. All results, which quantitatively define the set made of 8 motor variables, speak in favour of young female athletes, which is explained by genetic predetermination, successful selection, a well organized and planned programme of younger cadets and cadets volleyball school, and finally by different treatment of kinesiological activity.

It is important to mention that the study was conducted on a sample of subjects from primary school »Bijaći«, recognizable for their outstanding results and quality selection of young female volleyball players.

The aim of this study was to determine the biomotor status of students in »Bijaći« primary school and to compare it to Croatian norms. A specific objective was to determine differences in anthropometric characteristics, motor abilities and achievements between students who chose volleyball as extracurricular activity and those who didn't.

Materials and Methods

Study subjects

The subject sample was defined with 242 girls aged 10–12 years, fifth and sixth grade students in »Bijaći« primary school from Kaštel Novi. The sample was divided into two subsamples: subsample of 42 girls who train volleyball (volleyball players, training 6 hours a week) and a subsample of 200 girls who do not participate in volleyball training (volleyball non-players).

Instruments

A total of 13 variables were used to assess the biomotor status. Measures of anthropometric characteristics were represented by body height and body weight variables. The space of basic motor abilities and achievements was defined by a set of 11 tests (6 basic motor abilities tests and 5 motor achievement tests) which consisted of the following variables: hand tapping to assess frequency of movement, standing long jump to assess explosive strength of horizontal jumping type, obstacle course backwards to assess coordination, crossed-arm sit-ups to assess repetitive strength, seated straddle stretch to assess flexibility, bent-arm hang to assess static strength, 6-min run test to assess aerobic endurance, 30-m run to assess anaerobic abilities and speed, long jump to assess explosive strength of the legs of horizontal jumping coordination and speed of approach type, high jump-scissors technique to assess explosive strength of lower extremities of vertical jumping, coordination and speed of approach type, and side medicine ball throw to assess explosive strength of upper extremities. All measuring instruments used to record the kinanthropological status of subjects are integral parts of methodology, monitoring and evaluating in the area of physical and health education.

It needs to be mentioned that motor achievement variables, due to their complexity, depend on a number of basic motor abilities.

Data analysis

Data analysis methods involved calculating descriptive statistical parameters: arithmetic mean ($\overline{X}$), standard deviation (SD), minimum (Min) and maximum (Max) result, coefficient of asymmetry (Skew), coefficient of kurtosis (Kurt) and determining MaxD value to assess normality of variable distribution using KS-test.

Factor analysis was used to analyze the structure of morphological characteristics, motor abilities and achievement and within the analysis a varimax rotation of principal components of the inter-correlation matrix was conducted, and to determine the differences between female volleyball players and non-players, canonic discriminant analysis was used, calculating the structure of discriminant function (DF), group centroids and canonic discrimination coefficient (CanR).

Results

Results of descriptive variable statistics of biometric status area in 242 girls aged 10–12 years are shown in Table 1. The analysis of distribution parameters shows that no significant deviation from a normal distribution was detected, which means that all variables are suitable for further multivariate statistical analysis. Testing the normality of distribution was conducted by using a Kolmogorov-Smirnov test with the critical value of 0.11. Somewhat lower distribution features, although within the boundaries of statistical tolerance, were detected only in the high jump variable, used to assess motor achievement of explosive strength of lower extremities saturated with body coordination and speed of approach, which is to be expected due to the small range of results.

Basic parameters of biomotor variables in Table 2 indicate that students from »Bijaći« primary school in Kaštel Novi had greater body height (3.4 cm) and greater body mass (3.00 kg) in comparison to female student population of the same age group in Croatia. Regarding motor abilities, students from Kaštela had significantly better results in a test assessing frequency of movement,

TABLE 1
DESCRIPTIVE STATISTICS OF VARIABLES (MORPHOLOGICAL, MOTOR ABILITIES AND ACHIEVEMENT) IN GIRLS AGED 10–12 YEARS (N=242)

Variable	$\overline{X}$	SD	Min	Max	KS	Skew	Kurt
Body height (cm)	155.09	8.67	132.00	178.00	0.06	0.00	–0.38
Body weight (kg)	45.24	9.60	26.60	82.00	0.08	0.89	1.21
Arm plate tapping (freq.)	33.99	4.18	21.00	47.00	0.08	–0.05	0.47
Standing broad jump (cm)	159.24	19.55	109.00	222.00	0.06	0.17	–0.22
Obstacle course backwards#	16.10	3.57	9.42	26.61	0.04	0.34	–0.30
Crossed–arm sit-ups (freq.)	34.27	7.12	12.00	59.00	0.07	0.31	1.33
Seated straddle stretch (cm)	71.62	10.34	44.00	98.00	0.05	–0.01	–0.22
Bent-arm hang (s)	22.41	15.07	1.10	83.51	0.10	1.21	1.89
6-min run (m)	934.51	113.14	670.00	1250.00	0.03	0.17	–0.18
30-m run# (s)	5.82	0.41	4.63	7.11	0.07	0.33	0.13
High jump (cm)	94.45	8.16	80.00	115.00	0.12	0.35	–0.18
Long jump (cm)	208.64	27.37	154.00	295.00	0.11	0.51	–0.21
Medicine ball throw (cm)	518.06	127.91	280.00	900.00	0.11	0.71	0.20
						Test = 0.11	

#variable with opposite metric orientation
$\overline{X}$ – arithmetic mean, SD – standard deviation, Min – minimum result, Max – maximum result, KS – Kolmogorov-Smirnov test, Skew – coefficient of asymmetry, Kurt – coefficient of kurtosis

TABLE 2
DESCRIPTIVE STATISTICS OF BIOMOTOR VARIABLES IN GIRLS AGED 10–12 YEARS (KAŠTELA AND CROATIAN STANDARDS)

Variable	Kaštela (N=242)		Croatian normss	
	$\overline{X}$	SD	$\overline{X}$	SD
Body height (cm)	155.09	8.67	151.7	8.8
Body weight (kg)	45.24	9.60	42.2	10.5
Arm plate tapping (freq.)	33.99	4.18	25.5	7.2
Standing broad jump (cm)	159.24	19.55	160.0	17.2
Obstacle course backwards# (s)	16.10	3.57	16.0	2.0
Crossed-arm sit-ups (freq.)	34.27	7.12	28.5	2.2
Seated straddle stretch (cm)	71.62	10.34	54.0	9.8
Bent-arm hang (s)	22.41	15.07	27.5	15.3
6-min run (m)	934.51	113.14	1012.0	145.5

#variable with opposite metric orientation

repetitive strength of the trunk and flexibility test than students in Croatian population, who had better results in tests assessing muscle endurance (static strength of arms) and aerobic endurance test. It is evident that greater body mass poses an additional exertion on muscle and aerobic endurance manifestation. However, at this age, the development of ectomorphy and mesomorphy is the basis for psychomotor speed manifestation in terms of movement frequency (arm tapping, as well as sit-ups) and regulation of muscle tone.

Previous studies have shown[21–23] that body height and psychomotor speed, along with explosive strength whose major development is yet to come, are the basis for success in volleyball. Therefore, students from Kaštela have essential predispositions for volleyball training and it is necessary to make a selection among them and to form top players through training procedures, especially because of the earlier results supporting this (Milić et al., 2011)[24]. A number of female volleyball players precisely from Kaštela are members of the national volleyball team and play in different European clubs.

Factor analysis was used to analyze the structures of morphological characteristics, motor abilities and achievement. Significant isolated varimax factors of the defined set of variables are shown in Table 3. The first varimax factor accounted for most of the variability, almost 38% and it acts as a factor of general motor efficacy. That motor efficacy is responsible for energetic regula-

tion of movement dominated by explosive strength of lower extremities, saturated with muscle and aerobic endurance and whole body coordination. Precisely this explosive strength of lower extremities which defines »jumping« is the predominant ability across all age categories in volleyball. Here, it is already noticeable that muscle endurance of arms follows the energy component with the purpose of maintaining the proper volleyball posture when performing an overhand pass, spike and block. With all technical elements, movement should be fixated in individual performance phases, which is also related to synergetic regulation of movement.

The second varimax factor is predominantly defined by body height and body mass which enables the manifestation of explosive strength of the arms and shoulders when throwing a medicine ball, realisation of which requires flexibility in terms of greater movement amplitude and better regulation of the muscle tone. The factor described can be recognized in the realisation of volleyball serve and spike.

The third varimax factor is defined by two variables, repetitive strength of the trunk and/or basic strength of the trunk variable and movement frequency of the arms variable (arm tapping). These variables are underlain with the regulation of movement frequency which, in this case, begins in the frequency of the trunk and it is transferred to the frequency of upper extremities as it is dictated by the final realisation in performance of technical elements over the net (spike), where regulation of the force, speed, direction and amplitude of hitting the ball is necessary.

A significant difference was found between female volleyball players and non-players in the area of biomotor variables by using canonic discriminant analysis with the canonic discrimination coefficient of 0.72 (Table 4). Discriminant function and group centroids clearly show that volleyball players, compared to non-players, have better results in all applied variables. As it was expected, explosive strength of jumping, sprint and throwing, along with body height are responsible for group sep-

TABLE 3
VARIMAX FACTORS OF THE BIOMOTOR AREA (V) IN GIRLS AGED 10–12 YEARS

Variable	V1	V2	V3
Body height (cm)	0.174	0.869	-0.073
Body weight (kg)	–0.082	0.869	0.065
Arm plate tapping (freq.)	0.188	0.158	0.725
Standing broad jump (cm)	0.781	0.253	0.201
Obstacle course backwards#	–0.525	0.101	–0.568
Crossed-arm sit-ups (freq.)	0.143	0.043	0.749
Seated straddle stretch (cm)	0.225	0.514	0.303
Bent-arm hang (s)	0.617	–0.322	0.253
6-min run (m)	0.519	0.011	0.442
30-m run# (s)	–0.720	–0.019	–0.303
High jump (cm)	0.788	0.080	–0.075
Long jump (cm)	0.827	0.206	0.233
Medicine ball throw (cm)	0.389	0.598	0.340
Eigenvalues	4.918	2.139	1.065
% of Variance	37.827	16.453	8.192
Cumulative %	37.827	54.281	62.473

#variable with opposite metric orientation

TABLE 4
CANONIC DISCRIMINATION ANALYSIS BETWEEN PERSPECTIVE YOUNG FEMALE VOLLEYBALL PLAYERS AND OTHER GIRLS

Variable	Volleyball players	Volleyball non–players	DF
	$\overline{X}$±SD	$\overline{X}$±SD	
Body height	160.70±7.26	151.95±7.78	–0.54
Body weight	48.73±8.82	43.28±9.49	–0.27
Arm plate tapping (freq.)	35.40±3.81	33.20±4.18	–0.25
Standing broad jump (cm)	173.61±16.48	151.17±16.25	–0.64
Obstacle course backwards#	14.56±2.92	16.96±3.62	0.33
Crossed-arm sit-ups (freq.)	34.85±6.49	33.95±7.45	–0.06
Seated straddle stretch (cm)	74.94±9.88	69.75±10.15	–0.24
Bent-arm hang (s)	25.91±15.55	20.45±14.47	–0.17
6-min run (m)	991.78±102.52	902.37±106.15	–0.40
30-m run# (s)	5.55±0.35	5.96±0.38	0.52
High jump (cm)	98.86±7.91	91.97±7.22	–0.43
Long jump (cm)	228.60±24.99	197.43±21.72	–0.63
Medicine ball throw (cm)	595.06±128.25	474.83±105.78	–0.49
Centroids	–1.666	1.666	
CanR			0.719*

#variable with opposite metric orientation, *p<0.01; DF – discriminant function, CanR – canonic discrimination coefficient

Fig. 1. Left: field defense – forearm set technique, right: spike. Cecilija Dujić, aged 25, professional player in »Evreux Voley-Ball«, France, member of The Croatian national volleyball team (2012). Right: Cecilija Dujić, a young volleyball player in Kaštela at the age of 11 (1998): body height 170.50 cm, body weight 48.0 kg, arm plate tapping 34, standing broad jump 190 cm, obstacle course backwards 11.7 s, crossed-arm sit-ups 54, seated straddle stretch 86 cm, bent-arm hang 35.2 s, 6-min run 1250 m, 30-m run 5.34 s, high jump 105 cm, long jump 246 cm, medicine ball throw 600 cm.

aration, and therefore for success in volleyball in girls of this age group. Success in volleyball is contributed by aerobic endurance, movement frequency and flexibility, although to a lesser extent.

Discussion

This paper deals with the relationship between primary kinesiological education (PE) and extracurricular volleyball activity within school and outside-of-school clubs. The function of the PE teacher in primary school is to conduct the primary orientation and/or initial selection for volleyball. To obtain the necessary relevant information for the orientation and selection process:

– first, biomotor characteristics of female students in primary school in Kaštela were determined by comparison with the general population in Croatia,
– next, the factor structure of biomotor abilities and motor achievements was determined, i.e. qualitative characteristics of biomotor functioning of fifth grade and sixth grade students of primary school, and
– lastly, differences between female volleyball players and non-players were determined, obtaining morphological and motor characteristics which, in the end, determine success in volleyball in female volleyball players aged 10 to 12 years.

These analyses were based on:

– determining initial biomotor status of female students,
– identifying factors of biomotor status which determine success in volleyball in girls aged 10 to 12 years, and
– conducting initial selection and establishing the training processes which lead to forming quality female volleyball players.

Students from Kaštela, compared to the population of female students of the same age in Croatia, have greater body height and greater body mass, i.e. the ectomorph and mesomorph component development is much more prominent, and these are important determinants of volleyball efficacy across all age categories. This is mirrored in the manifestation of technical elements above the net where skeleton longitude and muscle mass facilitate spike and block realisation[21–23].

Students from Kaštela are also superior to their peers in Croatia in the ability of muscle tone regulation (flexibility), psychomotor speed (movement frequency) and basic strength of the trunk (repetitive strength of the trunk). These motor abilities are underlain with the integration of muscle tone regulators and movement frequency regulators, which happens under the influence of cognitive processors, as it is noted in Katić and Bala's study (2012)[25]. This is especially noticeable in fine move-

Fig. 2. Left: block jump, right: spike. Danica Uljević, aged 22, professional player, captain of HAOK »Mladost«, Zagreb; member of The Croatian national volleyball team (2012). Right: Danica Uljević, a young volleyball player in Kaštela at the age of 11 (2001): body height 174.5 cm, body weight 50 kg, arm plate tapping 39, standing broad jump 188 cm, obstacle course backwards 12.42 s, crossed-arm sit-ups 44, seated straddle stretch 92 cm, bent-arm hang 33.84 s, 6-min run 1017 m, 30-m run 5.28 s, high jump 110 cm, long jump 267 cm, medicine ball throw 640 cm.

ment regulation in ball manipulation and optimum regulation of force and speed in all elements of volleyball game.

Factor analysis of biomotor area has identified three factors and/or three phases of functioning in female students:

– the first factor is predominantly connected to the manifestation of explosiveness of lower extremities which enables timely positioning for performance of specific technical elements as well as realisation of forceful and high takeoff during serving, spiking and blocking;
– the second factor is responsible for ecto-mesomorphic development of female students which enables the manifestation of explosive strength of upper extremities with muscle tone regulation when performing serve and spike; and
– the third factor is responsible for integration of basic strength of the trunk and movement frequency of upper extremities which enables efficient realisation of all techniques on the net and defense zone in terms of regulation of force and speed with coordination, muscle tone regulation (flexibility) and synergetic regulation during serve, spike and set precision.
– Each of the isolated factors or mechanisms is influenced by cognitive functioning[25]. Factors also represent development phases of volleyball efficacy.

Canonic discriminant analysis has confirmed that body height and explosive strength of jumping and/or takeoff dominantly differentiate female volleyball players from non-players aged 10 to 12 years. According to the results obtained in this age group, serve quality, followed by spike quality, will have the dominant impact on the outcome of the match.

To illustrate the selection processes described and training procedures in forming elite female volleyball players, two volleyball players of world quality are mentioned, both originating from Kaštela volleyball club, presenting results of their biomotor variables when they were 11 years old (Figure 1 and Figure 2).

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BIOMOTORIČKI STATUS I KINEZIOLOŠKA EDUKACIJA DJEVOJČICA OD 10 DO 12 GODINA – PRIMJER ODBOJKA

SAŽETAK

Cilj istraživanja je definirati procese orijentacije i/ili selekcije za sportsku igru odbojke kod djevojčica grada Kaštela, starosne dobi od 10–12 godina i to kroz odnos redovne nastave tjelesne i zdravstvene kulture (TZK) i izvannastavne sportske aktivnosti. U tu svrhu na uzorku od 242 djevojčice u dobi od 10–12 godina koji je podijeljen na subuzorak od 42 djevojčice koje treniraju odbojku (Odbojkašice) i subuzorak od 200 djevojčica koje nisu uključene u trening odbojke (Neodbojkašice) primijenjene su 2 morfološke mjere (tjelesna visina i tjelesna masa) i skup od 11 motoričkih testova (6 bazičnih testova motoričkih sposobnosti i 5 testova motoričkih postignuća). Temeljem usporedbe testovnih rezultata djevojčica grada Kaštela i normativa Republike Hrvatske (HR), faktorske analize primijenjenih varijabli i diskriminativne analize tih varijabli između odbojkašica i neodbojkašica, definirani su procesi i/ili faze selekcije u formiranju kvalitetnih odbojkašica. Procesima selekcije prethode procesi orijentacije u nastavi TZK to jest odabir one sportske aktivnosti koja je u skladu sa biomotoričkim statusom učenica. Rezultati su pokazali kako usmjerenje i inicijalnu selekciju u ženskoj odbojci prvo treba raditi na temelju motoričkog sklopa psihomotorne brzine, repetitivne snage trupa i fleksibilnosti (regulacija mišićnog tonusa), te tjelesne visine. Trening odbojke utjecao je na razvoj mišićne mase i razvoj faktora snage, tako da je eksplozivna snaga skočnosti i/ili odraza uz tjelesnu visinu dominantno diferencirala odbojkašice od neodbojkašica uzrasne dobi od 10 do 12 godina, a dominantni utjecaj na ishod meča imat će kvaliteta servisa te smeča.