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Impact of Biomotor Dimensions on Player Quality in Young Female Volleybal Players

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A B S T R A C T

A set of 18 test for assessing anthropometric characteristics and 12 tests for assessing motor abilities was used on a sample of 183 young female volleyball players (average age of 13.11 ± 1.07 years). The main goal of this research was to determine the latent structure of biomotor status, as well as relations of that status to situational efficiency in female volleyball players. Situational efficiency of young volleyball players was assessed on a five-point Likert scale, in relation to each individual player's contribution to the performance of her team, and with regard to the result of that team achieved in the competition. By factor analysis, 3 anthropometric (»endo-mesomorphy«, »longitudinal dimensionality of the skeleton« and »transverse dimensionality of the skeleton«) and 4 motor factors (»explosive power of legs and agility«, »precision«, »explosive power of arms and flexibility« and »balance«) were obtained. Significant impact of morphological-motor factors on situational efficiency of young female volleyball players was obtained by regression analysis. Set of predictor variables accounts for 40% of the total variance of the system. On a univariate level, all extracted factors, except precision and balance, had a significant impact on situational efficiency. Factors named »longitudinal dimensionality of the skeleton« and »explosive power of legs and agility« had the greatest partial contribution in explaining the criteria. Obtained results confirmed previous findings about the importance of individual dimensions of biomotor status for efficiency in volleyball.

***Key words**: volleyball, anthropometric characteristics, motor abilities, situational efficiency*

Introduction

Volleyball is a complex poly-structural sports ball game in which the success of the game depends on the cooperation of team members. Given the number and complexity of situational structures and movement structures, volleyball game is divided into complex 1 and complex 2[1], which are further divided into phases. Complex 1 includes all phases performed by a team receiving a serve (serve receiving, setting in attack phase, spiking in attack phase and spike coverage in attack phase), and complex 2 includes all phases performed by a team serving (serve, block, court defense, setting in counterattack, spiking in counterattack and spike coverage in counterattack). Each phase consists of associated technical-tactical elements. For example, setting is performed by overhand pass technique (jumping, standing and landing) and forearm pass technique. By further analysis it can be established that during performance of technical-tactical elements in volleyball, different movement structures are performed such as jumps, hits, short sprints, direction changes, stopping, landing, etc.

Period between the ages of 13 and 15 is at a transition from the phase emphasizing the development of basic motor abilities and elementary tactical-technical volleyball skills into a phase emphasizing the development of position-specific abilities and skills[2]. For that transition to be as successful as possible, it is important for young female volleyball players to adopt all of the abovementioned structures. Performance quality of those movement structures depends, among other things, upon biomotor dimensions of female and male volleyball players.

Based on the results obtained by a research investigating relations between particular dimensions of biomotor status and volleyball efficiency (3–15), it can be concluded that higher values of longitudinal dimensionality of the skeleton and low percentage of subcutaneous fat

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tissue are important for success in volleyball. Regarding motor abilities, explosive power and agility have the greatest positive impact on situational efficiency.

Impact of biomotor status on situational efficiency has been analyzed in other sports games. Research results in handball[3–5] indicate that more successful female players have a more distinctive mesomorphic component of somatotype, as well as better coordination, explosive and repetitive power in comparison to less successful handball players. On a sample of young female basketball players[6] established that young players of the lowest quality class achieve significantly poorer results in tests assessing running speed, agility and throwing explosive power in comparison to basketball players of the two remaining classes of higher quality.

In volleyball, most researchers have analyzed the impact of biomotor status on efficiency of female and male volleyball players in junior and senior female and male players[7–9].

A somewhat smaller number of studies investigating the abovementioned issues was conducted on young female volleyball players aged 13 to 15[10–13].

Most of those studies were characterized by a relatively small sample of female entities and (or) variables, which makes attaining quality information about the structure of biomotor status in young female volleyball players and its relation to situational efficiency more difficult.

Therefore, the primary goal of this research is to determine the latent structure of biomotor status and its relation to situational efficiency using a larger sample of young female volleyball players and applying a larger number of anthropometric and motor variables.

Materials and Methods

Study subjects

Subject sample included 183 young female volleyball players aged 13 to 15, who have been participating in the training process averagely for 3.1 years in 12 volleyball clubs of the Dalmatia region: OK »Marina-Kaštela«, OK »Kaštela Cemex«, OK »Split«, OK »Brda«, OK »Makarska«, OK »Sinj«, OK »Klis«, OK »Trogir«, OK »Dubrovnik«, OK »Nova Mokošica«, OK »Ćilipi« and OK »Donat«. All subjects of average age 13.11 ± 1.07 years, apart from their weekly 4.5–6 hour engagement, participate in games of a weekend league for young players (minimum of 16 games during a season).

Instruments

Sample of predictor variables included the results of anthropometric measuring of 18 measures for assessing morphological characteristics and a set of 12 tests of basic motor abilities. Selection of 18 morphological variables for this research was made under assumption about the existence of four latent dimensions: longitudinal dimensionality of the skeleton, transverse dimensionality of the skeleton, body mass and volume and subcutaneous fat tissue[14], which were measured according to the procedures suggested by Mišigoj-Duraković[15]. Four measures were selected for assessing longitudinal dimensionality of the skeleton; Body height, Arm length, Leg length, Hand length.

Four measures were selected for assessing transverse dimensionality of the skeleton: Knee diameter, Elbow diameter, Wrist diameter and Hand diameter.

Six measures were selected for assessing body mass and volume: Body weight, Upper arm circumference flexed, Upper arm circumference relaxed, Thorax circumference, Forearm circumference and Calf circumference.

Four measures were selected for assessing subcutaneous fat tissue: Triceps skinfold, Abdominal skinfold, Back skinfold and Calf skinfold.

As suggested by International biological program (IBP), measures of symmetrical parts of the body werw conducted on the left side of the body[15].

Twelve tests of motor abilities were used for assessing motor status: Standing long jump for assessing explosive power of horizontal jumping, 20 meter sprint for assessing sprinting explosive power, Throwing a 2 kg medicine ball from supine position for assessing throwing explosive power, Arm plate tapping and foot tapping for assessing movement frequency, Side steps for assessing movement agility, Bent arm hang for assessing static strength, Sit-ups for assessing repetitive strength, Obstacle course backwards for assessing coordination, Seated straddle stretch for assessing flexibility, Standing on one leg lengthwise on a bench for assessing balance and Shooting a target (Darts) for assessing precision.

Situational efficiency of female volleyball players was the criterion variable in this research. It was assessed on a 5-point Likert scale based on 2 criteria[12]:

Team quality: Teams were ranked according to quality into 3 groups. The 1st group included 4 top-placed teams from the regional competition, the 2nd group included teams placed 5th to 8th, and the 3rd group included teams placed 9th to 12th in the regional championship.

Individual player's quality within the team: Coaches will classify players within their teams into 3 groups according to this criterion: the 1st group includes players (1–3) who are the best players of their teams, the 2nd group (3–6) includes remaining players of the starting line-up and players who enter the game contributing to the result, and the 3rd group includes players who enter the game very rarely or not at all.

Data analysis

Data analysis methods involved calculating descriptive statistical parameters: arithmetic mean (M), standard deviation (SD), minimum (Min) and maximum (Max) result, skewness (Skew), kurtosis (Kurt) and determining the MaxD value for examining the normality distribution of variables using a KS-test. Factor analysis was applied to analyze the structure of morphological characteristics and basic motor abilities. Guttman-Kai-

ser criterion was used to extract significant principal components and then varimax rotation of principal components of the intercorrelation matrix was conducted. Player quality prediction was performed by linear regression analysis on reduced and identified factors in the obtained latent space.

Results and Discussion

Results of descriptive statistics of morphological variables, as well as of tests assessing basic motor abilities of 183 young female volleyball players, are presented in Table 1. Analysis of distribution parameters indicates that variable representing the test assessing balance deviates significantly from normal distribution, and its positive asymmetry and leptokurtosis of distribution point to the fact that this test is too difficult for population of this age. Therefore, the authors suggest simpler test for assessing balance, e.g. »Standing stork test«, to be used in future research. All other variables had distribution that does not deviate significantly from the normal distribution, and were suitable for further multivariate statistical analysis. Normality distribution testing was performed by Kolmogorov-Smirnov test with a critical value of 0.10.

By comparing mean values of young female volleyball players presented in Table 1 with results of female handball players of the same age or athletes of the same age in other sports, a more detailed comprehension is achieved of the level of individual anthropometric characteristics and motor abilities.

Young female volleyball players tested in this research were averagely 4 cm taller and had a 3 kg heavier body mass in comparison to 152 female students attending »Bijaći« primary school in Kaštela and 25 Croatian female karateka of approximately the same age tested in a research conducted by Katić et al. (2012)[16]. In comparison to female handball players of approximately the same age[17], tested female volleyball players were averagely 5 cm taller and with the same body mass. This points out the importance of body height for success in volleyball, and of body mass for success in handball. These results could have been expected because the net separates the teams in volleyball disabling the contact between the players so distinctive body mass is not necessary, and due to the height of the net, taller players are in advantage during blocking and spiking.

Subjects of this research were of equal height as somewhat younger female volleyball players in a research conducted by Grgantov et al. (2006)[12], but they have averagely 1.5 kg more body mass and somewhat higher values of subcutaneous fat tissue.

In comparison to 14 female American volleyball players aged 12 to 14[10], volleyball players from this research were approximately 2 cm taller and had approximately 2 kg lower body mass, but somewhat more distinctive voluminosity. This indirectly suggests more desirable anthropometric characteristics of Croatian volleyball players with a more distinctive height growth, larger muscle mass and smaller percentage of subcutaneous fat tissue in relation to young American volleyball players.

In this research, Grgantov et al. included only the most talented 12 and 13-year-old female volleyball players who have already joined the U-15 selection in their clubs. This was not a precondition for participating in the research, so it can be assumed that their average player quality was somewhat lower. The abovementioned indirectly confirms research results[12,18,19] which suggest that more distinctive subcutaneous fat tissue has a negative impact on situational efficiency in volleyball, while more distinctive height growth has a positive impact.

In tests assessing motor abilities, young female volleyball players achieved better results in comparison to Kaštela students of approximately the same age[20] particularly in explosive and repetitive power. Obstacle course backwards is the only test in which they have achieved somewhat lower results. It can be assumed that their greater average height made the performance of that test more difficult, especially during threading through the frame of a vaulting box.

In accordance with the aim of the research, by using factor analysis, morphological and motor status of young female volleyball players were identified in a qualitative, i.e. structural sense. Varimax factors of the morphological set of variables are therefore presented in Table 2 and varimax factors of the motor set of variables in Table 3.

Morphological status of female volleyball players was defined by three factors explaining over 73% of the total variance.

The first morphological factor is responsible for soft tissue development, equally of muscle and of fat tissue, the second morphological factor is responsible for skeletal longitudinal dimensionality development, and the third morphological factor is responsible for skeletal transverse dimensionality development with a more distinct development of upper extremities.

Endo-mesomorphy is the dominant morphological characteristic of young female volleyball players explaining over 48% of their total variability. Players in volleyball have to manifest a high level of agility and jumping, while excess subcutaneous fat tissue has a negative impact on motor abilities. Furthermore, female volleyball players with a body mass greater than that required, run a higher risk of injury to the locomotor system, but also, their functional abilities decrease due to greater energy consumption. Therefore, female volleyball players with distinct endo-mesomorphy have difficulty in performing volleyball elements in which agility and jumping are emphasized (primarily spike, block, but also moving towards the ball during serve reception, field defense and setting). Taking into consideration that during a volleyball game of 5 sets, certain technical-tactical elements are repeated up to 100 times[21] and the earlier mentioned negative impact of endo-mesomorphy on efficiency in volleyball gains added importance. Therefore, it can be expected in youth and especially in junior female volleyball players, for development functions continuity and

TABLE 1
DESCRIPTIVE STATISTICS OF VARIABLES (OF MORPHOLOGICAL CHARACTERISTICS AND MOTOR ABILITIES) IN YOUNG FEMALE VOLLEYBALL PLAYERS AGED 13–15 (N=183)

Variables	$\overline{X}$	SD	Min	Max	KS	Skew	Kurt
Body height (cm)	169.31	7.71	145.90	193.10	0.05	0.08	0.50
Arm length (cm)	70.47	3.99	58.80	85.80	0.06	0.20	0.87
Leg length (cm)	101.18	5.12	87.80	115.00	0.05	0.09	0.02
Hand length (cm)	19.14	1.14	16.50	21.70	0.08	–0.19	–0.37
Knee diameter (cm)	9.16	0.45	8.10	10.40	0.06	0.06	–0.21
Elbow diameter (cm)	6.10	0.34	5.40	7.30	0.09	0.22	0.33
Wrist diameter (cm)	5.18	0.29	4.40	6.10	0.10	0.26	0.78
Hand diameter (cm)	7.43	0.38	6.50	8.90	0.10	0.28	0.54
Body mass (kg)	57.34	8.96	35.70	81.60	0.05	0.18	–0.06
Upper arm circumference flexed (cm)	26.02	2.31	19.00	34.00	0.06	0.17	0.56
Upper arm circumference relaxed (cm)	24.81	2.40	18.00	33.00	0.08	0.35	0.37
Thorax circumference (cm)	82.59	6.63	51.00	101.20	0.08	–0.59	2.33
Calf circumference (cm)	34.02	2.67	23.50	41.00	0.06	–0.39	0.91
Forearm circumference (cm)	23.24	1.48	19.50	29.90	0.08	0.57	1.62
Triceps skinfold (cm)	17.25	4.87	6.40	31.53	0.07	0.54	0.54
Back skinfold (cm)	10.26	2.96	4.20	21.33	0.10	1.15	1.80
Abdominal skinfold (cm)	15.86	5.47	4.83	39.00	0.07	0.96	2.07
Calf skinfold (cm)	14.39	4.37	3.73	25.73	0.07	0.33	–0.19
Standing long jump (cm)	176.27	20.00	110.00	225.00	0.05	–0.26	0.18
Arm plate tapping (freq)	39.43	4.27	31.00	52.00	0.06	0.19	–0.24
20 m sprint (s) #	3.74	0.26	2.98	4.53	0.04	0.24	0.17
Side steps (s) #	9.84	0.78	7.75	13.37	0.08	0.90	2.67
Bent arm hang (s)	25.87	15.55	1.00	89.27	0.10	1.02	1.22
60 seconds sit-ups (freq)	44.50	7.51	20.00	65.00	0.06	–0.03	0.44
Obstacle course backwards (s) #	15.01	3.33	8.31	27.11	0.08	0.89	1.58
Seated straddle stretch (cm)	79.34	10.23	55.00	110.00	0.06	0.27	–0.04
Foot tapping (freq)	22.05	1.83	17.00	26.00	0.10	–0.01	–0.54
One leg standing (s)	11.89	10.90	2.03	91.00	0.23	3.26	16.45
Throwing a 2 kg medicine ball (m)	5.89	0.87	3.60	8.10	0.06	–0.06	0.01
Darts (score)	73.25	30.31	15.00	174.00	0.05	0.50	0.61
							Test = 0.10

#variable with opposite metric orientation

training processes in volleyball to cause restructuring of soft tissues, i.e. differentiation of muscles from the fat tissue, and domination of muscle tissue in relation to fat tissue.

Longitudinal dimensionality of the skeleton, or height growth, is the second most important characteristic in young female volleyball players, and it was dominant in 19% of the subjects. These players have better predispositions (under condition of other dimensions of anthropological status to be equally developed) for playing the middle and outside hitter positions which are characterized by high number of spike jumps and block jumps during a game. It is evident that selection processes as well as training processes (ossification of bone tissue) have led to differentiation of transverse dimensionality of the skeleton into a separate morphological dimension as previously described by the structure of the first isolated factor. Because of the larger contact surface, this feature can be an advantage during performance of all volleyball elements, especially of serve, spike and block.

Motor status of young female volleyball players is defined by four factors explaining 61% of the total variability of subjects. Clearly the specific training processes have affected the differentiation of motor abilities, so the isolated factors are in line with technical-tactical requirements in volleyball.

The first factor integrates explosive power of lower extremities and agility/coordination, saturated by whole body coordination, muscle endurance (static strength of

TABLE 2
VARIMAX FACTORS OF MORPHOLOGICAL SPACE (V) IN YOUNG FEMALE VOLLEYBALL PLAYERS AGED 13–15 (N=183)

Variables	V1	V2	V3
Body height	0.07	0.91	0.27
Arm length	0.11	0.90	0.17
Leg length	0.03	0.89	0.19
Hand length	–0.03	0.79	0.34
Knee diameter	0.41	0.33	0.61
Elbow diameter	0.33	0.18	0.74
Wrist diameter	0.08	0.27	0.76
Hand diameter	0.07	0.39	0.67
Body mass	0.70	0.51	0.42
Upper arm circumference flexed	0.77	0.12	0.44
Upper arm circumference relaxed	0.81	0.12	0.45
Thorax circumference	0.64	0.37	0.14
Calf circumference	0.70	0.24	0.41
Forearm circumference	0.61	0.18	0.57
Triceps skinfold	0.82	–0.10	0.17
Back skinfold	0.81	0.05	0.02
Abdominal skinfold	0.84	0.01	0.04
Calf skinfold	0.71	–0.11	0.05

TABLE 3
VARIMAX FACTORS OF MOTOR SPACE (V) IN YOUNG FEMALE VOLLEYBALL PLAYERS AGED 13–15 (N=183)

Variables	V1	V2	V3	V4
Standing long jump	0.71	0.06	0.37	–0.03
Arm plate tapping	0.14	0.28	0.53	–0.47
20 m sprint from a standing start#	–0.78	–0.26	0.04	0.02
Side steps #	–0.71	0.07	–0.35	0.07
Bent arm hang	0.64	–0.04	–0.03	–0.10
60 seconds sit-ups	0.57	0.04	0.35	0.28
Obstacle course backwards #	–0.64	0.25	–0.09	0.29
Seated straddle stretch	0.07	–0.22	0.70	–0.16
Foot tapping	0.42	0.47	0.22	–0.34
One leg standing	0.07	–0.02	0.03	–0.82
Throwing a 2 kg medicine ball	0.18	0.16	0.77	0.09
Darts	–0.09	0.88	–0.03	0.02

#variable with opposite metric orientation

the arms) and basic core strength and as such represents the basis of motor efficiency in young female volleyball players in all elements of the game, and it can be recognized in almost 23% of them.

The second factor is defined by motor precision which is the basis of specific precision development which affects the efficient realization of all elements of the game, especially of spike, serve, serve reception and setting.

The third factor is responsible for the manifestation of explosive power of upper extremities, which is greatly contributed by muscle tone regulation of the trunk and arm movement frequency. Factor defined in such a way is crucial in spike, block and serve realization.

The fourth factor is defined by a variable assessing motor balance, i.e. the ability of synergetic regulation of movement which is important for taking and maintaining an optimum position of body parts during realization of all volleyball elements.

Significant impact of morphological-motor factors on situational efficiency of young female volleyball players was obtained by regression analysis. Multiple correlation was 0.63, which means that the system of predictor variables accounted for 40% of the total variance of the system (Table 4).

On a univariate level, all 3 anthropometric factors and 2 out of 4 motor factors had significant impact on situational efficiency. Factors named »longitudinal dimensionality of the skeleton« and »lower body explosiveness and agility« had the greatest partial contribution to explaininig the criterion.

Explosiveness of the legs and agility enable young female volleyball players to assume a position for playing a ball, while distinctive longitudinal dimensionality of the skeleton combined with explosive power of the legs enables the contact with the ball during jump spiking, blocking, setting and serving as high as possible in relation to the net. In younger age groups in volleyball, special emphasis should be put on accurate and timely positioning for playing a ball. In other sports, imprecise and untimely reaching the ball can be compensated to some extent by receiving or catching the ball farther from the body. Because of the specificity of rules which control the setting technique in volleyball very strictly, this is not possible in volleyball. This is the reason why technical errors in young female volleyball players are usually the consequence of inadequate anticipation of opponents' intents and insufficiently agile movement towards the ball.

Factors named »explosiveness of upper body and flexibility«, »transverse dimensionality« and »endo-mesomorphy« contribute significantly to situational efficiency of female volleyball players as well. Out of these factors, only endo-mesomorphy is negatively related to game efficiency.

»Explosiveness of the arms and flexibility« is particularly expressed during forceful spiking and serving in volleyball. Even though these elements are not the main feature of young female volleyball players, they are still important. Namely, according to Blazevich (2007)[22], »Throw-like movements differ from push-like movements in that the joints of the kinetic chain extend sequentially, one after another«. By accelerating the proximal segments of arm and then stopping them, one gets a transfer of momentum along the arm that results in a high velocity of the end point.

Due to the aforementioned, besides explosive power of the arms, high amplitude of movements starting with hip movements and hitting arm shoulder movements (spine

TABLE 4
REGRESSION ANALYSIS RESULTS FOR PLAYER QUALITY CRITERION IN THE FACTOR SPACE OF MORPHOLOGY AND MOTORICS OF YOUNG FEMALE VOLLEYBALL PLAYERS (N=183)

Factor	r	β	p
1. Endo-mesomorphy and/or voluminosity	–0.19	–014	0.04
2. Skeleton longitudinality	0.37	0.28	0.00
3. Skeleton transversality of the arms	0.22	0.19	0.00
4. Lower body muscular power and agility	0.37	0.34	0.00
5. Precision	0.11	0.11	0.06
6. Upper body muscular power and flexibility	0.37	0.22	0.01
7. Balance	–0.06	–0.09	0.12
ρ	0.63		0.00
δ	0.40		0.00

r – coefficient of correlation, β – regression coefficient, ρ – multiple correlation, δ – coefficient of determination

rotation around the longitudinal axis) is also important during spiking and serving. During the second part of the arm swing during spiking, acceleration of individual body segments is continued by elbow joint extension and plantar flexion of the wrist joint. If this sequential extension is performed correctly, it will result in high velocity in the wrist joint which will then be carried on to the spiked (served) ball.

The results obtained are very similar to results obtained by other authors[8–10,12,13,23–25], suggesting that explosive power and agility, along with longitudinal dimensionality of the skeleton have the greatest positive impact on efficiency in volleyball. At the same time, excess subcutaneous fat tissue has a negative impact on performance, slowing down player's movement on the court and decreasing vertical jumping.

Conclusion

Impact of individual dimensions of the biomotor status on situational efficiency of young female volleyball players was analyzed in this research by using 18 anthropometric variables and 12 basic motor tests. As expected, longitudinal dimensionality of the skeleton, explosive power of legs and agility make the greatest contribution to situational efficiency. Out of 7 obtained factors, only precision and balance do not have a statistically significant partial contribution in explaining the criterion. Due to the fact that both precision and balance were tested only by a single test each, this entails the necessity of further analysis of these motor abilities by using a larger number of tests which will be suited for young female volleyball players. This way, all motor abilities would be represented in factor analysis by equal number of tests.

In the area of anthropometric characteristics, with the purpose of a more quality comparison of results, the authors suggest for future research to calculate the somatotype because that method has been used in many researches in various sports[26–31].

In the area of motor abilities, it is also difficult to compare results with other researches because the same tests have not been used. Particularly, there is a lack of studies using basic motor tests. It is the authors' opinion that research of basic motor abilities of young athletes is essential, with a purpose of an improved assessment of their ultimate potentials within the chosen sport, but also with the aim of revealing possible weaknesses which could be limiting in their future player development. However, tests for assessing specific motor abilities of female volleyball players, and importance of which will become more and more prominent in further phases of their careers, cannot be neglected.

From the aforementioned, it can be concluded that a consensus is necessary between science and practice in volleyball in order to create a unique battery of tests for assessing individual dimensions of the anthropological status of female and male volleyball players in particular age groups. Results of previous scientific research should be taken into consideration[32–35], as well as opinion of quality volleyball coaches. It is very difficult in practice to measure athletes using a large number of tests. In order to economize, using tests with highest projections on primary factors is suggested in determining the player efficiency prediction in the manifest space.

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UTJECAJ BIOMOTORIČKIH DIMENZIJA NA IGRAČKU KVALITETU MLADIH ODBOJKAŠICA

S A Ž E T A K

Na uzorku od 183 mladi odbojkašica prosječne dobi 13,11±1.067 godina, primijenjeno je 18 testova za procjenu antropometrijskih karakteristika i 12 testova za procjenu motoričkih sposobnosti. Glavni cilj istraživanja bio je utvrditi latentnu strukturu biomotoričkog statusa, kao i relacije tog statusa sa situacijskom uspješnošću odbojkašica. Situacijska uspješnost mladih odbojkašica procijenjena je na likertovoj skali od 1 do 5 obzirom na igrački doprinos pojedine igračice za igru svoje ekipe, te obzirom na postignuti rezultat te ekipe na natjecanju. Faktorskom analizom dobivena su 3 antropometrijska (»endomezomorfija«, »longitudinalna dimenzionalnost skeleta« i »transverzalna dimenzionalnost skeleta«) i 4 motorička faktora (»eksplozivna snaga nogu i agilnost«, »preciznost«, »eksplozivna snaga ruku i fleksibilnost« i »ravnoteža«). Regresijskom analizom dobiven je značajan utjecaj morfološko-motoričkih faktora na situacijsku uspješnost mladih odbojkašica. Sustav prediktorskih varijabli objašnjava 40% ukupne varijance sustava. Na univarijatnom nivou značajan utjecaj na situacijsku uspješnost imaju svi ehstrahirani faktori osim preciznosti i ravnoteže. Pri tome najveći parcijalni doprinos objašnjavanju kriterija imaju faktori »longitudinalna dimenzionalnost skeleta« i »eksplozivna snaga nogu i agilnost«. Dobiveni rezultati potvrđuju dosadašnje spoznaje o važnosti pojedinih dimenzija biomotoričkog statusa za uspjeh u odbojci.