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Short notice
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Relations of Body Dimensions and Specific Motor Abilities of Female Volleyball Players in Relation to the Playing Position

Tamara Karalić[1], Aleksandra Vujmilović[2], Nikolina Gerdijan[1]
[1]Faculty of Physical Education and Sports University of Banja Luka, Bosnia and Herzegovina
[2]Public Institution Medical School, Banja Luka, Bosnia and Herzegovina

Correspondence:
Tamara Karalić, Faculty of Physical Education and Sports, University of Banja Luka Bosnia and Herzegovina
tamara.karalic@ffvs.unibl.org

Abstract: *The subject of research is the physical dimensions and motor abilities of young volleyball players, and the problem is the relationship between these anthropological characteristics and specific playing positions in volleyball. The study included 55 female volleyball players aged 14 to 16 who had been actively training for at least 2 to 4 years. Five (5) dimensions were tested to assess volleyball players' morphological status, as well as the parameters of 5 specific motor tests to assess explosive power, dexterity, and flexibility. Correlation analysis revealed a strong, statistically significant relationship between specific body dimensions and specific motor abilities from various tests. This is especially true for volleyball players' body height (ATV) and arm span (RAR), as well as their maximum, reach a height of the arms (MD1RM) and (MD2RM), in the spike (MDSM), and in the block (MDBLZ). Only the female volleyball sample's body weight (ATT) was unaffected and had no relations to any of the observed parameters.*
Keywords: *correlation, volleyball, motor skills, body dimensions, positions.*

Introduction

Volleyball is recognized as an extremely complex phenomenon throughout the sports system. It arose from the need to solve practical human behavior problems caused by the modern way of life. (Bogojević, 2018, Karalić & Vujmilović, 2018).

An individual who chooses to play volleyball should be aware that modern volleyball requires a young person to have specific morphological and functional abilities, such as being extremely tall, having long limbs, having a high aerobic and anaerobic capacity, having motor intelligence, being able to overcome fatigue and stress, and so on. Secondly, the potential of motor skills is sought (speed, explosive power, coordination, flexibility, precision, endurance, reaction speed, dexterity, agility), whose correct disposition and interaction would ensure not only a quality player but also game success (Vujmilović, 2013).

Creating a volleyball player model has always piqued the interest of researchers and volleyball experts, especially now that science and training techniques have advanced to the point where it is possible to know exactly how fast, strong, tall, agile, and so on promising volleyball player must be. As a result, the essential components of the volleyball player model and their mutual relationship are researched and analyzed, laying the groundwork for a successful selection and training process in general. (Vrbik, Čižmek & Gruić, 2011; Milić, Nešić, Trajković & Radenković, 2012; Perko, 2021). Because this sport has several playing positions, determining the model of the volleyball player we are discussing extends to determining the model in relation to the playing position (setter, opposite, libero, receiver, middle blocker) in order to form a team, a team based on that model (Janković, Đurković & Rešetar, 2009; Mirković, 2018; Karalić, 2021).

The physical dimensions and motor abilities of young volleyball players are the subjects of study, and the problem is the relationship between these anthropological characteristics and specific volleyball playing positions. The purpose of this study is to see if there is a statistically significant relationship between volleyball players' body dimensions and specific motor abilities in relation to their playing position.

Methods

The study included 55 female volleyball players aged 14 to 16 who had been actively training for at least 2 to 4 years. The respondents were divided into five groups based on their position on the field: group 1: opposites (11), group 2: middle blockers (13), group 3: receivers (17), group 4: setters (9), and group 5: liberos (5).

The morphological status of volleyball players was evaluated using five dimensions: body height (ATV), body weight (ATT), arm span (RAR), maximum one-handed reach (MD1RM), and maximum two-handed reach (MD2RM). Maximum reach in the spike (MDSM), maximum reach in the block from a place (MDBLM), and maximum reach in the run-up block (MDBZ) were among the criteria of five particular motor tests used to measure the kind of jumping's explosive force, dexterity, and flexibility they are used in volleyball practice as a modified Sargent test and tests 9-3-6-3-9 (93639) and forward bend on the bench (PRKL). The correlation of two specific systems anthropological status of female volleyball players was tested using standard statistical procedures.

Results

Table 1 shows a strong correlation between body height (ATV) and tests for the **Opposite** group: maximum reach in the spike (MDSM =**0.73**), maximum reach in the block from a place (MDBLM =**0.84**), and maximum reach in the run-up block (MDBLZ) =**0.72**). There was also a very high correlation of arm span (RAR) with the tests: maximum reach in the spike (MDSM = **0.88**), maximum reach in the block from a place (MDBLM = 0.88), and with the test maximum reach in the run-up block (MDBLZ) =**0.84**). The one-handed maximum reach (MD1RM) test is associated with the test's maximum reach in the spike (MDSM=**0.71**), maximum reach in the block from the place (MDBLM=**0.75**), maximum reach in the run-up block (MDBLZ=**0.76**) and forward bend on the bench (PRKL=**0.64**). The tests maximum reach in the spike (MDSM=**0.73**), maximum reach in the block from the place (MDBLM=**0.76**), maximum reach in the run-up block (MDBLZ=**0.77**), and forward bend on the bench (PRKL=**0.63**) showed a high correlation of body dimensions maximum reach with two hands from the place (MD2RM). Bodyweight (ATT) did not show a correlation with specific motor ability tests.

Table 1. *Correlation of morphological and motor space variables for the OPPOSITES group*

Marked correlations are significant at the level p = .05; N=11; r= .553 OPPOSITES					
	MDSM	**MDBLM**	**MDBLZ**	**93639**	**PRKL**
ATV	0.73	0.84	0.72	0.23	0.26
RAR	0.88	0.88	0.84	-0.00	0.47
ATT	0.18	0.35	0.37	0.09	-0.05
MD1RM	0.71	0.75	0.76	-0.11	0.64
MD2RM	0.73	0.76	0.77	-0.10	0.63

A review of Table 2, for the group **Receivers**, showed a very high correlation between body height (ATV) and tests: maximum reach in the block from a place (MDBLM=**0.47**) and maximum reach in the run-up block (MDBLZ=**0.47**). Body dimension arm range (RAR) is weak but statistically significantly associated with the maximal reach test in the block from a place (MDBLM=**0.48**). The one-hand maximum reach test (MD1RM) is related to the test maximum reach in the block from a place (MDBLM=**0.67**), the maximum reach in the run-up block (MDBLZ=**0.60**). Significant correlation with the body dimension of the two-hands maximum reach from the place (MD2RM) is indicated by the values of the coefficients of the maximum of the variable reach in the block from the place (MDBLM =**0.60**) and maximum reach in the run-up block (MDBLZ=**0.53**). Bodyweight (ATT) also did not show a significant relationship with one variable of specific motor space in the group of Receivers.

Table 2. *Correlation of morphological and motor space variables for the RECEIVERS group*

Marked correlations are significant at the level p =.05; N=17; r= .456 RECEIVERS					
	MDSM	**MDBLM**	**MDBLZ**	**93639**	**PRKL**
ATV	0.22	0.47	0.47	0.25	-0.23
RAR	0.34	0.48	0.44	0.13	-0.33
ATT	0.04	0.08	0.02	0.20	0.32
MD1RM	0.45	0.67	0.60	0.28	-0.20
MD2RM	0.37	0.60	0.53	0.31	-0.19

A review of Table 3, for the group of **Middle Blockers**, showed a slightly weaker but significant correlation between body height (ATV) and the maximum reach in the spike test (MDSM= **0.63**) but high with tests maximum reach in the block from a place (MDBLM=**0.83**) maximum reach in the run-up block (MDBLZ=**0.85**) while it is significant with a forward bend on the bench test (PRKL=**-0.53**). A significant association was also observed by arm span (RAR) with tests: maximum reach in the spike (MDSM=**0.63**), maximum reach in the block from the place (MDBLM=**0.68**), and forward bend on the bench test (PRKL=**-0.66**). The one-hand maximum reach test (MD1RM) is significantly related to tests maximum reach in the spike (MDSM=**0.65**) and forward bend on the bench (PRKL=**-0.61**), and very high related to tests maximum reach in the block from the place (MDBLM=**0.80**), maximum reach in the run-up block (MDBLZ=**0.82**). A high correlation of body dimensions and the two-hand maximum reach from a place (MD2RM) was observed with maximum reach in the spike test (MDSM=**0.67**), maximum reach in the block from the place test (MDBLM=**0.80**), maximum reach in the run-up block test (MDBLZ= **0.81**) and with a forward bend on the bench test (PRKL=**-0.60**). In the Middle Blockers group, there was no correlation between body weight (ATT) and specific motor space tests.

Table 3. *Correlation of morphological and motor space variables for the MIDDLE BLOCKERS group*

Marked correlations are significant at the level p = .05; N=13; r= .514 MIDDLE BLOCKERS					
	MDSM	**MDBLM**	**MDBLZ**	**93639**	**PRKL**
ATV	0.63	0.83	0.85	0.30	-0.53
RAR	0.63	0.68	0.74	0.35	-0.66
ATT	0.38	0.34	0.44	0.39	-0.13
MD1RM	0.65	0.80	0.82	0.42	-0.61
MD2RM	0.67	0.80	0.81	0.46	-0.60

A review of Table 4, for the **Setters** group, showed a significant correlation between body height (ATV) and the tests: maximum reach in the block from a place (MDBLM=**0.66**) and maximum reach in the run-up block (MDBLZ=**0.64**). A significant relation of arm span (RAR) with the maximum reach in the spike (MDSM=**0.70**) and maximum reach in the run-up block (MDBLZ=**0.72**) was also observed.

Table 4. *Correlation of morphological and motor space variables for the SETTERS group*

Marked correlations are significant at the level p =.05; N=9; r=.602 SETTERS					
	MDSM	**MDBLM**	**MDBLZ**	**93639**	**PRKL**
ATV	0.52	0.66	0.64	0.20	0.22
RAR	0.48	0.70	0.72	0.20	0.47
ATT	0.42	0.07	0.11	0.27	0.26
MD1RM	0.66	0.76	0.79	0.15	0.46
MD2RM	0.57	0.76	0.77	0.09	0.45

The one-hand maximum reach test (MD1RM) is significantly related to the maximum reach in the spike test (MDSM=**0.66**), the maximum reach in the block from a place (MDBLM=**0.76**), and the maximum reach in the run-up block (MDBLZ=**0.79**). Significant correlation of the body dimension two-hands maximum reach from the place (MD2RM) was observed with the tests maximum reach in the block from the place (MDBLM=**0.76**), maximum reach in the run-up block (MDBLZ=**0.77**). In the Setters group, was no correlation between body weight (ATT) and motor tests.

A review of Table 5, for the **Liberos** group, showed a very high correlation of body height (ATV) with the tests: maximum reach in the spike (MDSM=**0.86**), maximum reach in the block from the place (MDBLM=**0.92**), and maximum reach in the run-up block (MDBLZ)= **0.79**). There was also a strong correlation between arm span (RAR) and the following tests: maximum reach in the spike (MDSM=**0.90**), maximum reach in the block from a place (MDBLM=**0.92**), and maximum reach in the run-up block (MDBLZ=**0.83**), while bodyweight (ATT) is only strongly correlated with test 9-3-6-3-9. (**-0.82**). The one-hand maximum reach test (MD1RM) is strongly related to the test's maximum reach in spike (MDSM=**0.85**), maximum reach in a block from a place (MDBLM=**0.94**), and maximum reach in the run-up block (MDBLZ=**0.90**).

Table 5. *Correlation of morphological and motor space variables for the LIBEROS group*

Marked correlations are significant at the level p = .05; N=5; r= .754 LIBEROS					
	MDSM	**MDBLM**	**MDBLZ**	**93639**	**PRKL**
ATV	0.86	0.92	0.79	0.10	0.50
RAR	0.90	0.92	0.83	0.13	0.53
ATT	-0.06	-0.09	-0.24	-0.82	0.55
MD1RM	0.85	0.94	0.90	0.52	0.08
MD2RM	0.87	0.95	0.90	0.48	0.14

Furthermore, the two-handed maximum reach test (MDOH2RM) is related to the maximum reach in the spike test (MDSM=**0.87**), the maximum reach in the block from a place (MDBLM=**0.95**), and the maximum reach in the run-up block (MDBLZ=**0.90**).

Discussion

To better understand the role of the player in the position of ***Opposites***, a few important details from the area of technical and tactical requirements of this specialist must be stated. In women's volleyball, an alternative, "female" type of opposite whose role is to receive service in five rotations (except rotation 6) and thus frees one attacker from zone 4 or out of the second line. In technical terms, the opposite player must have a diverse repertoire of spike techniques because, as the best striker, he frequently participates in a set or match deciding points. He usually performs a strong rotational jump service with a high degree of risk, but also a short, placed service with the aim of changing the rhythm of the service and making it harder for the opponent to receive the service. As a result, the technical and tactical demands of this role heavily influence the morphological characteristics of volleyball players who specialize in this role. This playing position "seeks" high volleyball players (jump service, reach a height in the spike, reach a height in the block), as evidenced by the high correlation obtained between body height (ATV) for the group Correctors and explosive power tests of jumping type, and demonstrates that body height and upper extremity length are important parameters that also determine retrieval height in a spike or block (González-Ravé & Clemente-Suarez, 2011; Đurković, Marelić & Rešetar, 2012).

The forward bend on the bench test (PRKL) had a significant relationship with the maximum one-handed reach (MD1RM =0.64) and maximum two-handed reach (MD2RM =0.63) tests. The data appears logical because, at some point during the measurement of body dimensions and performance of these two tasks, each volleyball player performed active stretching. Second, the obtained connection indicates that no limiting (internal and external) factors of flexibility existed. In morphological terms, this means that volleyball players in this position are well prepared (Grgantov, Katić, and Janković, 2006; Gabbett and Georgieff, 2007; Rašidagić, Manić, and Vidović, 2010; Konstan-

tinos, Panagiotis, and Ioannis, 2019; Bojanić, Ljubojević, Krivokapić, and Nokić, 2020), that their bone structure does not restrict their movement and that their bone structure did not limit their movement and that their tendons, ligaments, and muscle structure were elastic enough.

When we select the role of the ***Receiver*** in the game, it is critical to consider the status of abilities and characteristics critical to this player's success. The ability to have excellent eyesight (visibility in the game) and the ability to maximally connect the forearms in the technique of playing with a "hammer" (forearm play) are both required (Janković, Đurković & Rešetar, 2009).

If the aforementioned requirements are met, this player is predisposed to be successful and accurate in receiving a variety of services and defending the field. Bodyweight (ATV) and arm span (RAR), as well as maximum range tests, were also found to be significantly related to performing tests that simulate blocking as a typical technical-tactical element of defense in this group. According to research, this was most likely due to previously well-established movement patterns (Pérez-Turpin, Cortell-Tormo, Suárez-Llorca, Chinchilla-Mira & Cejuela-Anta (2009), Gortsila, Theos, Nešić & Maridaki (2013), Horicka, Hianik & Simonek (2014) and Sopa & Szabo (2015), and they can be directly related to the specified specific motor tests.

Given that the group of ***Middle Blockers*** found a correlation between body weight (ATV) and arm span (RAR) with tests of maximum reach in the spike and block, it is clear how important the flexibility of the whole body and longitudinal dimensionality of both upper and lower extremities volleyball. The importance of this ability in team sports has been proven and emphasized Bazett-Jones, Gibson & McBride (2008), Acero, Sánchez & Fernández-del-Olmo (2012), Aslam (2016), Gulati, Jajin, Lehri & Kumar (2021) in their research. The first three specific motor space tests simulate blocking technique, which means that agility in frontal (spike, half-high ball, I tempo) and lateral (stepping, and later cross) movement, as well as a vertical rebound in blocking, are tested (Barnes, Schilling, Falvo Weiss, Creasy, & Fry, 2007; Schaal, Ransdell, Simonson, & Gao, 2013). In addition to the lateral agility (left and right) that precedes the blocking action, they must have a developed sense of timing of the block jump for maximum reach ("timing").

Considering that there is no longer any growth of short players in modern volleyball positions, selection, this trend is maintained in this sample of female volleyball players. The average body height for the ***Setters*** sample is ATV = 175.44 cm, which means that the Setters group belongs to the category of very tall volleyball players (if Martin's catechization of body height is accepted). In this sense, it is entirely logical to significantly correlate body height (ATV) with maximum reach in the block from a place (MDBLM=**0.66**) and maximum reach in the run-up block (MDBLZ=**0.64**), arm span (RAR) with maximum reach in the block from a place (MDBLM=**0.70**) and maximum reach in the run-up block (MDBLZ=**0.72**). What these tests have in common is that they all involve moving and retrieving objects. As a result, in this section, the flexibility of the entire body, particularly the shoulder girdle, and the length of the upper and lower extremities were expressed again, resulting in a significant, i.e. high connection of the variables mentioned. The authors Cabral de ArajoTonico, B.G., Cabral de Arajo Tonico, S., de Miranda, & Dantasi Reis came to a similar conclusion (2011).

Perhaps the most attention is drawn to the results in Table 5, which can be explained by the fact that the ***Liberos*** group consisted of only 5 volleyball players, which could be one of the reasons for the high interconnectedness of individual variables. According to these data, the Liberos group achieved the best average results in the maximum reach tests not only in comparison to other groups but also in comparison to the entire sample of respondents. Only in the test of maximum reach in the run-up block (MDBLZ=**35.2**) were slightly weaker results obtained. This means that the volleyball players in the Liberos group compensated for any physical deficiencies (body height and arm span) with a strong bounce. It's also worth noting that there was a strong negative correlation between body weight (ATT) and test 9-3-6-3-9 in this group (-**0.82**). The lower body weight of the volleyball players in the Liberos group conditioned and influenced the higher task speed and greater mobility on the volleyball court, and they most likely performed better in this test compared to other groups in the sample. Other abilities include the ability to stop, start, and change the direction of the whole or parts of the body in a fast and controlled manner, as well as the ability to stop, start, and change the direction of the whole or parts of the body in a small space (Karalić, 2010).

Conclusion

The analysis of the relations between body dimensions and specific motor abilities revealed a strong relationship between specific body dimensions and the manifestation of specific motor abilities during the execution of selected tests. The correlation is statistically significant as well. This is especially true of volleyball players' body height and arm span, as well as their reach height in the spike and block. Only the body weight of the volleyball players in the sample is unaffected and has no relationship to any of the observed parameters.

The optimal morphological characteristics of athletes are heavily dependent on the sport of choice; however, those whose body structure is adapted to the requirements of a specific sport generally achieve better results. Because the athlete is competing at a higher level, the need for adjustment is more pronounced. In this context, this study confirms the conclusion (Marelić, Đurković & Rešetar, 2007) that success in volleyball is unquestionably dependent on the morphological characteristics of the formed volleyball player, the most basic of which are body height and weight, which are valued based on the volleyball player's current age.

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