Research in Kinesiology
2023, Vol. 51, No. 1 pp. 34 - 39

RELATIONSHIPS BETWEEN ANTHROPOMETRIC, MOTOR, AND TECHNICAL-TACTICAL INDICATORS OF FEMALE STUDENTS ATTENDING VOLLEYBALL CLASSES AT SOFIA UNIVERSITY "ST. KLIMENT OHRIDSKI"

Original paper

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Abstract

Physical activity among students is largely influenced by the interest in the sports offered and the way the learning process is conducted. Volleyball is a dynamic and high-intensity game. The specifics of the actions performed in the game situations place demands on the optimal state of motor qualities and technical-tactical skills of the practitioners. Correlation analysis will be used to determine the relationships between anthropometric indicators, indicators of motor fitness, and technical-tactical skills in female students of Sofia University "St. Kliment Ohridski", in groups with non-professional orientation. We will determine the relationships and measure the strength of dependence between the variables in the groups of indicators that are directly related to the volleyball game, using Pearson's simple linear correlation coefficient (r).

The number of obtained relationships between the three indicators will support the determination of the right goals in volleyball training of female students from groups with a non-professional orientation at Sofia University, through proper selection of means, methods, degree, and volume of workload.

Keywords: *volleyball, correlations, female students, training, Sofia University*

INTRODUCTION

The problem of increasing the efficiency of the educational process at school and the university is extremely relevant, given the conditions in which it took place (Ignatov & Petkova, 2022). Despite the insufficient number of hours regulated by the Physical Education and Sports Act of the Republic of Bulgaria, the efforts of sports teachers are aimed not only at improving the methodology and organization of training but also at motivating students for regular sports activities and a healthy lifestyle. The number of administrative teaching hours in higher education institutions is decreasing, and this makes it necessary to increase the efficiency and intensity of classes, as well as to apply new forms, means, and methods (Yaneva, 2017). The role of the pedagogue (coach/teacher) is to use a variety of means and methods in an interesting way, putting everyone on equal footing to learn the basic skills of technique, develop muscularity, quick reactions, general functionality, motor behaviour, and overall sports movement (Antonova, M. & Antonova, V (Антонова, М & Антонова, В), 2021).

Any movement produced by the contraction of skeletal muscles that causes an increase in energy expenditure beyond the basal level is referred to as physical activity (Muntaner-Mas et al., 2022; Piggin, 2020). World Health Organization (2020) recommends adults aged between 18 and 64 to participate in 75–150 min of moderate to vigorous intensity of physical activity throughout the week. Physical activity among students is largely influenced by the interest in the sports offered and the way the learning process is conducted (Tsoneva & Stoyanova (Цонева & Стоянова), 2010). According to Kostadinov (2015), students' lasting interest in sports depends on their habits, the need to acquire new knowledge and skills, and ways to improve motor and functional abilities. All this determines the need for the harmonious development of the personality. Students should achieve comprehensive progress in the sport they have chosen, related with the mastery and improvement of technical-tactical elements, as well as the improvement of their general physical and mental condition, in order to make sporting activities a permanent part of their everyday life" (Kostadinov (Костадинов), 2019). Establishing the current state of physical preparedness of students facilitates teachers to determine the goals and objectives most accurately and correctly, choose the means and methods, and determine the workload in order to facilitate the learning and training process (Antonova (Антонова), 2015; 2016; 2017). "Identifying the current state of physical preparedness of students enables teachers to correctly determine the goals of their future activity, to choose the appropriate methodology that leads to the optimization of the training process" (Mitreva (Митрева), 2014), "as well as the means, methods, volume and degree of workload" (Chakarov & Mitev (Чакъров & Митев, 1987).

The game of volleyball "is characterized by high dynamics and variability of movements, which places great demands on the physical, as well as the technical-tactical and psychological preparedness of the players" (Zhelyazkov (Желязков), 1998; Zhelyazkov & Dasheva (Желязков & Дашева), 2011). "Regular volleyball activities of students contribute to significant changes in the basic parameters of the processes of self-regulation and psychological well-being by strengthening mental health" (Popovych, et al., 2022). Sports activity in the profiled volleyball groups is aimed at strengthening health, quick recovery after accumulated mental fatigue, and improving mood, self-esteem, and confidence (Antonova (Антонова), 2017). "The development of motor qualities and the improvement of the technique of the volleyball game are carried out in unity and interrelation" (Kolev

(Колев), 2019). The same believes that "the effectiveness of the work, as well as the optimization of the training process largely depends on establishing the importance of the links and the strength of the dependencies between the different parties in the preparation (Kolev (Колев), 2019).

METHODS

The aim of the present study was to determine the strength of the dependencies between three groups of indicators – anthropometric, motor qualities related to the volleyball game, and basic elements of volleyball technique.

To realize the goal, we set the following **tasks**:

1. A literature survey.
2. Establishment of dependencies between indicators.

The object of the study was female students from Sofia University "St. Kliment Ohridski", attending the volleyball elective-compulsory sports groups.

The subject of the study were anthropometric indicators, some motor qualities related to the volleyball game and elements of its technique.

The contingent of the study were 32 female students from the 1st to the 4th year, from different faculties of “St. Kliment Ohridski”, aged from 19 to 22 years.

The study was carried out in October, of the academic year 2022/2023.

To achieve the aims and objectives of the present study, the statistical method *Correlation Analysis* was used to reveal the existing relationships and dependencies between anthropological, physical fitness, and sport-technical skills indicators. The following indicators were acquired (Table 1).

Table 1. Indicators

№	INDICATORS	UNITS	ACCURACY	DIRECTION OF INCREASE
1.	Height	cm	1	+
2.	Weight	kg	1	+/–
3.	BMI	indexes	0,01	+/–
4.	Standing reach	cm	1	+
5.	Shuttle /9-3-3-9 m/	s	0,01	–
6.	Special speed /3 m/	count	1	+
7.	Speed endurance	s	0,01	–
8.	Standing long jump	cm	1	+
9.	Standing vertical jump	cm	1	+
10.	Thick ball 1	cm	1	+
11.	Thick ball 2	cm	1	+
12.	Thick ball 3	cm	1	+
13.	Flexibility	cm	1	+
14.	Abdominal crunches for 30 s crunches	count/s	1	+
15.	Overhead passing with 2 hands after moving	count	1	+
16.	Forearm passing with 2 hands after moving	count	1	+
17.	Overhead passing with 2 hands towards a target near the net	count	1	+
18.	Forearm passing with 2 hands towards a target near the net	count	1	+
19.	Serving	count	1	+

The number of the relationships and the degree of dependencies are established by *Pearson's coefficient (r)*, for simple in type, linear in form, and quantifiable traits.

Correlation dependencies have the following degrees, which values range from −1 to +1 (Table 2.).

Table 2. Correlation dependencie

Value (r)	Strength (degree) of the dependence
r = 0	No dependence
< 0,3	Weak
0,3 – 0,5	Moderate
0,5 – 0,7	Significant
> 0,9	Very high
r = 1	Functional dependence

RESULTS AND DISCUSSION

Significant values will be assumed to be relationships above r=0.361, with the number of subjects n=32, α=0.05 and Pt>95% (Gigova (Гигова), 2009). In Table 3. the obtained correlation dependencies are presented.

	№1	№2	№3	№4	№5	№6	№7	№8	№9	№10	№11	№12	№13	№14	№15	№16	№17	№18	№19
№1	1																		
№2	**0,521**	1																	
№3	-0,056	**0,821**	1																
№4	**0,915**	**0,586**	0,078	1															
№5	0,122	0,089	0,026	0,061	1														
№6	-0,303	0,160	0,386	-0,154	-0,377	1													
№7	0,479	0,211	-0,062	0,413	0,499	-0,468	1												
№8	-0,164	-0,159	-0,088	-0,047	**-0,719**	0,092	-0,441	1											
№9	**0,767**	**0,528**	0,096	**0,845**	-0,257	-0,121	0,256	0,299	1										
№10	0,341	**0,513**	0,379	0,315	-0,303	0,217	-0,042	0,046	0,427	1									
№11	0,028	0,300	0,334	0,041	-0,388	0,238	-0,302	0,336	0,265	**0,529**	1								
№12	0,421	0,478	0,281	0,382	-0,485	0,009	-0,150	0,313	**0,588**	**0,551**	**0,615**	1							
№13	-0,128	0,056	0,150	-0,104	-0,225	0,236	-0,269	0,172	-0,067	-0,021	0,160	0,155	1						
№14	-0,129	0,157	0,268	0,036	-0,428	0,450	-0,213	0,332	0,209	0,498	0,358	0,370	0,018	1					
№15	0,110	0,274	0,245	0,210	**-0,501**	0,421	-0,492	0,341	0,273	0,271	0,327	0,452	0,319	0,403	1				
№16	-0,070	0,304	0,404	0,116	-0,438	0,484	-0,473	0,371	0,151	0,201	0,296	0,311	0,427	0,370	**0,621**	1			
№17	-0,042	0,053	0,098	0,045	-0,042	0,10	0,070	0,153	-0,022	0,234	0,355	0,129	-0,081	0,358	0,241	0,064	1		
№18	-0,116	0,158	0,234	0,010	-0,265	0,204	-0,350	0,419	0,178	-0,018	0,283	0,185	0,277	0,099	0,362	0,397	0,102	1	
№19	-0,079	0,031	0,089	-0,046	-0,533	0,193	-0,242	**0,514**	0,178	0,069	0,044	0,299	0,450	0,280	0,397	0,272	0,028	0,224	1

Table 3. Correlation matrix

There are a total of 54 relationships between the 19 indicators, including:

- 1 relationship with a very high dependence (above 0.9);
- 4 relationships with high (0.7 to 0.9) dependence – 1 with a negative sign (inverse proportionality);
- 12 relationships with significant dependence (from 0,5 to 0,7), 2 of which have a negative sign ('–');
- 37 relationships with moderate dependence (0.3 to 0.5), 9 of which have a negative sign ('–).

The correlation matrix shows that the indicator with the most correlations is №5 "Shuttle" – 9. Six of them are with moderate dependence, 2 are decreasing with significant strength and one is high and decreasing. The highest dependence is the relationship between №1 "Height" and №4 " Standing reach" (r=0.915).

"Height" has correlations of varying degrees of strength with 2 of the anthropometric indicators – №2 "Weight" – moderate (r=0.521) and №4 "Standing reach" which has a very high strength of dependence (r=0.915) and 3 relationships with the physical fitness group determinants. The correlation with indicator №9 "Vertical rebound from place" (r=0,767) is defined as very strong. The other two relationships are of moderate strength. Height and weight have a direct relationship to jumping ability. That is why the links are of such strength.

No correlations are seen with indicators from the sport-technical skills group. At this stage, physical development does not influence the mastery of the elements of the volleyball technique.

Indicator №2 "Weight" has 5 correlations with different degrees of dependence. Two are with the indicators of the anthropometric group. One with a high strength r=0.821 with №3 "BMI" and r=0.586 (significant) with №4 "Standing reach". Indicators №2 and №3 are interrelated and one determines the other. The other 3 relationships are related to the expression of motor qualities. One relationship is of moderate strength and the other two are with significant degree with indicators №9 "Standing vertical jump" and №10 "Thick ball 1" (r=0.513). Sometimes, the higher weight contributes to the greater strength that is exhibited when performing these actions requiring explosiveness.

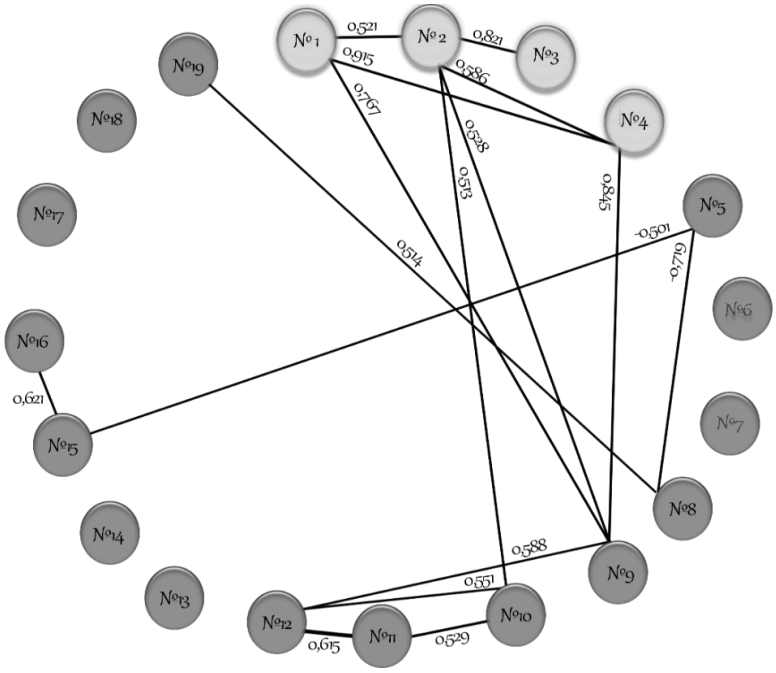

Figure 1. Correlation-structure model of links

"BMI" has correlations with three indicators whose level of dependence is moderate. Two of the correlations are with indicators from the physical fitness group and one from the sport-technical skills group.

There are three correlations of different strengths with indicator №4 "Standing reach". There is a large correlation with №9 "Standing vertical jump" (r=0.845), and two of moderate strength with indicators from the group characterizing the condition of motor skills. Standing reach and Standing vertical jump are interrelated indicators.

It is noteworthy from the correlation-structure model (Figure 1.) that the anthropometric indicators have no pronounced correlation dependencies with the elements of the game technique.

№5 "Shuttle" has relationships with 9 indicators. Five are moderate. With №8 "Standing long jump" (r=-0.719), the correlation has a high inverse dependence. There are two significant relationships with indicators from the sport-technical skills group. These correlations are with №15 "Overhead passing with 2 hands after moving" (r=-0.501) and №19 "Serving" (r=-0.533).

For indicators №6 "Special speed" and №7 "Speed endurance", correlations are seen with indicators from both the physical fitness and sport-technical skills groups. Some of the correlations are of inverse proportionality.

The reason is that by increasing the speed endurance (characteristic of the volleyball game) and decreasing the movement time, the examined players will improve their positioning to perform the relevant technical skill. A timely and on-the-spot starting position implies better control of the ball and more accurate aiming in the desired direction (goal).

Indicator №8 "Standing long jump" has the most correlations with the indicators determining the quality of volleyball skills in students – three. Two of the correlations are of moderate strength, related to the forearm passing with 2 hands, and the third is significant - with indicator №19 "Serving" (r=0.514). The horizontal jump is not typical for the specifics of the volleyball game, but it has partial application in the execution of some elements (jump serving and spiking from the second line).

From the correlation matrix, it can be seen that the "Standing vertical jump" (№9) has a relationship with two indicators of the same group (№2 "Weight" and №4 "Standing reach"). Significant in strength (r=0.588) is the relationship with indicator №12 "Thick ball 3".

Indicator №10 "Throwing a tight ball from a sitting position with two hands on top" has 3 relationships of different strengths. Significant in strength relationship is with №11 (r=0.529) and with №12 (r=0.695). Again, there is a significant relationship of №11 "Thick ball 2" with №12 "Thick ball 3" (r=0.615). This indicator has two more correlations of moderate strength.

All three indicators (№10 "Thick ball 1", №11 "Thick ball 2", and №12 "Thick ball 3") have approximately the same dynamic structure and characterize the explosive power of the upper limbs and the trunk. Their high-level performance is essential for the execution of almost all elements of the volleyball technique and their variations during the game.

In indicators №12 "Thick ball 3", №13 "Flexibility" and №14 "Abdominal crunches" there are moderate correlations with the studied technical attributes.

Of the sport-technical group indicators, №15 "Overhead passing with 2 hands after moving" has a significant degree correlation (r=0.621) with indicator №16 "Forearm passing with 2 hands after moving". Two moderate correlations exist with indicators №18 "Forearm passing with 2 hands towards a target" and №19 "Serving". There is a moderate correlation with indicator №16 "Forearm passing with 2 hands after moving".

The correlations between the passes are completely logical. They are also related to the game's actions. Quality control in directing the ball in the desired direction is a prerequisite for a more effective attack.

CONCLUSIONS

The following **conclusions** can be drawn from the analysis:

1. The anthropometric indicators have significant relationships only with the indicators of the physical fitness group and have no pronounced correlation dependencies with the elements of the game technique.

2. Faster movement enables the correct starting position to be taken on time, for better control and more efficient execution of the relevant technical move.

3. The strength of the upper limbs and the trunk are characteristic of the specifics of the game. Their performance at a high level is essential for executing almost all elements of volleyball technique and their variations during the game.

4. The relationships between the passings are completely normal. They are also linked during the game activities.

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