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Extracting Values Coefficients of Determination for the Estimate variance between some Physical and Skill Abilities of Volleyball Players

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Abstract :
This study aimed to estimate the variance between some physical and skill abilities (serving; setting) in order to determine the value of the coefficient of determination between the variables. The researcher applied a set of physical and skill tests to a sample of (24) players from the Raid Al-Msila Volleyball Club (RCM). Through the data obtained and statistically processed, the study reached the following results: There is a statistically significant correlation between physical and skill abilities at a significance level of (0.05) among volleyball players (n = 24). The values of the coefficient of determination and the common variance between physical and skill abilities (serving; setting) were determined to be less than (40%) among volleyball players (n = 24).

Keywords: Coefficient of Determination - Statistical Estimation - Physical Abilities - Skill Abilities

Article info

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1. Introduction

Determining the physical performance requirements of a volleyball player is an important element in training programs, as it connotes the importance of these abilities and how to develop them to achieve optimal performance based on the volleyball player's abilities and special capabilities. Determining these requirements enables us to identify appropriate and applicable training methods and approaches, as well as their impact and influence on the player's skill requirements, to achieve efficient performance in all aspects. Reaching the highest levels also requires harmonizing all training components, especially the physical aspect, the result of physical performance combined with all other processes and aspects. As is well known, training programs have points of intersection with skill aspects, which are determined in the annual physical preparation program according to the specialized requirements of the volleyball player. Therefore, it is necessary to determine the most important physical abilities and their importance according to a practical and applied sequence, with the aim of developing all aspects of volleyball players, enabling them to highlight their full physical and skill capabilities to achieve the best possible performance.

Physical requirements are the basic pillar for performing skills, including volleyball skills, and their accurate performance. These requirements include physical abilities, which are physical and physiological characteristics. These physical characteristics can be developed through continuous training and practice. Specific physical requirements are also one of the most important aspects necessary for mastering skills to achieve the required skill performance. Preparation for the physical aspect helps develop the player's physical and functional abilities (Adel Majeed Khazal et al., 2014, p. 21). The researcher points out the importance of the planning process, which is one of the important foundations for ensuring work to raise the athletic level. Reaching high athletic levels does not come randomly, but rather through organized training over a long period. This gives great importance to the role of planning in the athletic training process, it is a necessary and effective to ensure continuous progress in the athletic level. In addition to the goal that it seeks to achieve, it contains all the factors upon which achieving this goal (Khaled Tamim Al-Hajj, 2017, p. 139)

Referring to the skill requirements of volleyball, it is a problem of a set of basic skills that require a large amount of skill elements, speed, muscle strength, endurance, flexibility, and neuromuscular coordination. These are special requirements of physical qualities that the coach must take into account and work to develop them in the players, especially if we know the difficulty of learning some skills, as is the case with the crush, in which speed is involved (Latrash Zoubir, Qahluz Murad, 2022, p. 239).

By studying the significance of the scientific and practical estimation of the common variance between physical and skill requirements and determining the interpretation ratios, we can build training programs according to a clear picture of the available physical and skill capabilities and the ability to build a statistical database to know the rates of improvement and development for the volleyball player. By knowing these ratios and studying the predictions between them, the researcher can determine the strength and nature of the relationship and the extent of acceptance of the proposed statistical model between the physical requirements and the performance of the skill requirements of the volleyball player.

Physical abilities are among the foundations upon which the success of the skill level depends. If the player lacks physical abilities, he will not be able to master the basic skills of the game. Therefore, improving physical abilities is considered a factor contributing to the development of skill performance.

The elements, qualities, and physical abilities in volleyball are limited to muscle strength, endurance, speed, and strength characterized by speed (ability), explosive power, agility, flexibility, speed, and accuracy, as general and specific physical abilities in volleyball. On the other hand, the researcher emphasizes the impact of many variables on the aforementioned physical and skill abilities, as there are

many factors that influence the evaluation, improvement, and development. Motor performance to reach its best level in the desired activity (Habir Al-Saeed, Shadi Abdel Razzaq, 2023, p. 24).

Physical abilities with their various elements are the basis for practicing all sports activities, and performing basic skills in volleyball requires the availability of special physical abilities (Ahmed Faris Mohammed Saleh, 2011, p. 17). Achieving the best performance inevitably passes through a set of physical abilities that qualify the volleyball player to reach these levels through the necessary physical efficiency, which are nothing but physical abilities linked to the skill aspects and all other requirements, with the aim of exploiting them to the maximum extent to achieve the desired goals. The volleyball player must also have the ability to integrate the requirements that characterize the conditions of competition, which is the main entrance to his arrival and achievement of what is required of him and thus the outputs in the form of performance as a whole.

The stages of preparation and their relationship to physical and skill capabilities constitute an important point of intersection between the stages of the physical preparation program and the desired level. Therefore, sports training must include or incorporate the axes of measurement, testing, and evaluation processes with the aim of development, advancement, and reaching the highest levels. This is due to their importance and effective role in the selection processes, determining the outcome, and determining the current level of players (Amoura Yazid, 2023, p. 167). Through this, the performance requirements for the higher levels require great efforts during the season to meet the performance requirements during the competition period. Therefore, this period came at the forefront in terms of importance, and upon it depends the success of the player and the team and the continuation of good performance during the season. Since the preparation period is the basic period during which the player is prepared, this period is the beginning of the training process, during which the player is prepared and prepared physically, skillfully, and psychologically to move to the main stage (the competition stage). (Mowaffaq Asaad Mahmoud, 2011, pp. 146-147).

This is one of the most important basic pillars upon which the study was built in demonstrating the ability to determine the nature of the relationships between variables and the significance of predicting the impact of physical variables on the skill requirements of the volleyball player, based on the common variance between them, which requires that it be of a practical and estimative nature for the features of the data obtained and through it the ability to make decisions according to the parameter requirements of the most important variables studied in all stages of the physical preparation program. This is the main purpose of the preparation and formation stage, which is to raise the player's physical fitness and prepare him fully physically, as well as to contribute relatively, starting from the second half of the stage, to preparing the player technically in terms of basic skills and implementing game plans (Amin Hilal, 2017, p. 62). The researcher points to the significance of the determination coefficients in the presence of a statistically significant correlation between the physical and skill requirements, regardless of their nature. What is important is the significance and strength of the relationship between the correlation matrix between them, which is determined starting from what the prediction models contain in terms of contribution between all variables. Physical preparation programs and the elements they contain to improve the physical and skill capabilities of the volleyball player through the methods and approaches used in them, which represent the basis for determining all goals, especially Physical abilities are the first foundation upon which athletic performance is built. Therefore, developing them gives the player the ability to perform with high efficiency according to specific ratios fundamentally related to volleyball and its most important skill capabilities through which he can achieve the best levels.

Therefore, the researcher comes to the attention of the importance of interpreting the values of the determination coefficients statistically and their importance in clarifying the points of overlap between

some physical and skill abilities of the volleyball player in terms of the common variance between the variables, as it gives us an initial picture of the statistical model that the researcher can extract according to the data and results obtained. From here lies the problem of the study that investigates the contents of the values extracted from the determination coefficients and their significance between some skill requirements of the study sample and the extent of the high percentages of determination coefficients to explain the relationship based on the variables studied above, and this is through posing the following question:

- What are the values of the coefficient of determination to extract the common variance between some physical and skill abilities of volleyball players?

2. Study Hypotheses:

- The coefficient of determination values are highly correlated with the explanation of the shared variance between some physical and skill abilities among volleyball players.
- There is a statistically significant correlation between the physical and skill abilities of volleyball players at a significance level of (*0.05*).
- The shared variance values between the two variables are determined within limits greater than (50%) for volleyball players.

3. Study objectives:

- the study aims to analyze the relationship between physical abilities and skill abilities, and to explain the common variance between them using the coefficients of determination *(R^2)*.
- To determine the type and strength of the relationship between the study variables (physical abilities and skill abilities) among volleyball players, and the extent of their practical and scientific significance, using a statistical model.

4.Defining Concepts and Terms:

1.4. Coefficient of Determination:

It is a measure that expresses the extent to which the independent variable explains changes in the dependent variable. It is usually designated R^2 (Taha Hussein Al-Zubaidi, 2012, p. 200). It is the square of the correlation coefficient, indicating the proportion of the independent variable or variables that explain changes in the dependent variable (Abdullah Al-Najjar, Osama Hanafi, 2010, p. 180).

Hence, we can say that the coefficient of determination is used to determine the significance of the degree of fit of the least squares line to the sample data that the researcher seeks to test. Therefore, it is the ratio of the sum of the squares of the weighted deviation to the sum of the squares of the total deviations (Abdullah Amer Al-Hamali, 2014, p. 258).

4.2 Estimation:

Indicators calculated from sample data are called statistics and are used as an estimate of population indicators, called parameters. In this case, statistical measures calculated from sample data are called point estimates. Statistical measures calculated from sample data can also be used to estimate the range within which a population parameter can fall with a certain probability. This estimate is called an interval estimate. (Sharaf Al-Din Khalil, pp. 8-9)

4.3. Physical Abilities:

Physical requirements, with their various components, are the foundation for practicing and mastering all sports activities. They are the foundation upon which the rest of the building is built. Therefore, attention must be paid to developing the physical abilities specific to the type of sport being practiced. (Abu Odeh Muhammad, 2009, p. 3). Basic physical abilities enable a player to correctly perform the various motor skills required by the game they are playing. The importance of one or more physical abilities over others is determined by the nature and requirements of the game being practiced,

while taking into account the close interrelationship between the various basic physical abilities. (Imad al-Din Abbas Abu Zaid, 2005, p. 82).

4.4. Skill Abilities:

The skill requirements for volleyball players include all the basic skills of the game, whether with or without the ball, and mean all the necessary and purposeful movements that the player performs and performs within the framework of the game law and aims to achieve the best results during training or competing.

These requirements can be developed through good planning of skill preparation curricula that aim to enable the player to achieve accuracy, mastery and integration in performing all basic skills in a way that enables him to perform them in a perfect and automatic manner under any circumstances of the match. (Adel Majeed and others, 2015, p. 51)

5.Methodological Procedures of the Study:

5.1. Study method:

Based on the study's objectives and their compatibility with the analysis of the relationship between variables, the researcher used the descriptive method to study the common variance between variables, utilizing the methods offered by this approach through correlational studies.

5.2. Study Population:

The population is determined through a set of methodological and statistical procedures. The nature of the population determines the type of sampling chosen. Therefore, the current population is known and limited, comprising (28) senior and junior players from the Raed Al-M'sila Volleyball Club (RCM).

5.3. Study Sample:

Based on the data related to the type of current study population and the sampling framework used, a sample of 24 volleyball players from the RCM Club was selected using a comprehensive survey method, considering that the population size can be studied in its entirety.

5.4. Study Tools:

In order to arrive at and infer results, the researcher used a set of physical and skill tests on the study sample, as shown in the following table:

Table No. (01) represents the total physical and skill tests applied to the study sample (n = 24)

Physical tests	***Skill tests***
The (Saut Puissance) test for a volleyball player using a device (Myotest). The aim of this test is to measure the explosive power of the legs without reverse movement	The smash test aims to evaluate the level and degree of the volleyball player's serve
Medicine ball throw test (1 kg) The purpose of this test is to measure the explosive strength of the distinctive arm of a volleyball player.	The preparation test aims to evaluate the level and degree of preparation of a volleyball player.
Nelson Selective Motor Response Test The purpose of the test is to measure the reaction speed of a volleyball player	
The (9 3 6 3 9 meter) test aims to measure the agility of a volleyball player	
The numbered circles test aims to measure neuromuscular coordination in volleyball players	

5.5. Statistical methods used: These methods aim to analyze the obtained data, extract indicators, and make decisions. The researcher used a set of descriptive and inferential statistical methods using the SPSS program.

6. Presentation, analysis and discussion of the results.

6.1. Results of the test of normal distribution of physical abilities and skill abilities of volleyball players: One of the most important conditions for using parametric tests is that the data obtained must follow a normal distribution, in addition to the data being quantitative. Therefore, the researcher applied the Shapiro-Wilk test to verify the normality of the data distribution.

Table No. (02) represents the results of the normal distribution of data on physical and skill abilities among volleyball players (n = 24)

Statistical Variables	Test value	P-value	Significance level	Statistical decision
Explosive Leg Power	0.921	0.062	0.05	Data follow a normal distribution.
Explosive Arm Power	0.931	0.105		
Agility	0.942	0.179		
Reaction Speed	0.954	0.322		
Neuromuscular Coordination	0.930	0.098		
Serving	0.935	0.129		
Setting	0.945	0.209		

The obtained results, which are related to the value of the Shapiro-Wilk test, show that the study data are normal and follow the normal distribution for the purpose of employing parametric tests and inferring the variance ratios between the physical and skill abilities in the study sample. By referring to the results of the normality test, we note that the probability values ***(P-value)*** are within the range (0.062-0.209) for all physical and skill abilities, and they are not statistically significant, considering that (P) is greater than the approved significance level (α) ***(P= (0.807-0.167) > 0.05***), and thus the researcher confirms that the data follow the normal distribution

6.2. Presenting the results of descriptive indicators of physical abilities and skill abilities of volleyball players:

Descriptive statistics represent the primary approach used to apply test statistics from an inferential perspective. The researcher also relied on all descriptive statistical measures to extract all values and place them within their statistical range, consistent with the applied inferential tests.

Table No. (3) represents the results of the descriptive indicators of physical and skill abilities among volleyball players (n = 24)

Statistical Variables	Mean	Std.Error	Std.Deivation	Variance	Skewness
explosive strength of the legs	32.95	0.873	4.279	18.313	0.320
explosive strength of the arms	18.69	0.981	4.809	23.130	-0.101
agility	8.39	0.112	0.552	0.305	-0.550
reaction speed	1.47	0.032	0.158	0.025	-0.346
neuromuscular coordination	9.42	0.343	1.681	2.828	-0.188
serving technique	12.37	0.784	3.842	14.766	0.660
setting technique	98.50	2.453	12.021	144.522	0.124

The results of Table (3) illustrate the descriptive indicators of the study sample's data on physical and skill abilities, which provide an accurate statistical picture through which the researcher can draw all possible inferences, which are a key indicator in the application of all statistical tests.

- The arithmetic mean values for the physical abilities ranged from (1.47-32.95) with a standard error of the mean (0.032-0.981), while retaining all units of measurement for each test from a statistical perspective.

- The arithmetic mean values for the skill abilities (sending and preparation) ranged from (12.37-98.50) with a standard error of the mean (0.784-2.453), while retaining all units of measurement for each test from a statistical perspective.
- The values of the dispersion coefficients and the shape show all the data on the descriptive statistics related to the characteristics of the study sample (n = 24).

6.3. Extracting the results of the coefficient of determination values between some physical abilities and skill abilities (serving) among volleyball players:

Table No. (04) represents the extraction of the results of the coefficient of determination values between some physical abilities and skill abilities (serving) among volleyball players (n = 24)

The Mode	(R_p)	(R^2)	Adjusted (R^2)	Std. Error of the Estimate	F	df 1	df 2	P-value
01	0.558	0.311	0.245	3.337	4.742	2	21	0.020
	Significance level (0.05)			Statistical decision: There is statistical significance				
Variables: : Explosive power of legs and arms; serving.								

The data in the table above illustrates the significance of the correlation between some physical abilities and skill abilities among volleyball players (n = 24). The researcher confirms the existence of a statistically significant correlation ***(R_p=0.558)***, given that the P-value is less than the significance level ***(2/α=0.025)***, thus accepting the alternative hypothesis ***(P= 0.020 < α/2)***

- The coefficient of determination value ***(R^2=0.311)*** indicates that the proportion of shared variance between physical abilities (explosive power of the legs and arms) and the skill of smashing reached ***(31.1%)***. This means that the proportions of explanation between the variables from a statistical perspective are directly related to the values of the corrected coefficient of determination. The corrected coefficient of determination ***(adj.R^2=0.245)*** is a weak value, primarily related to the number of independent variables added to the model, which determines the model's improvement, including the percentage of shared variance between some physical abilities and the smash serve skill among volleyball players.
- The standard error of estimation ***(3.337)*** for all variables intersecting with the dependent variable (serving), according to the explanatory values obtained through the correlation matrix

6.4. Extracting the results of the coefficient of determination values between some physical abilities and skill abilities (preparation) among volleyball players:

Table No. (05) represents the extraction of the results of the coefficient of determination values between some physical abilities and skill abilities (preparation) among volleyball players (n = 24)

The Mode	(R_p)	(R^2)	Adjusted (R^2)	Std. Error of the Estimate	F	df 1	df 2	P-value
01	0.611	0.374	0.280	10.200	3.981	3	20	0.022
	Significance level (0.05)			Statistical decision: There is statistical significance				
Variables: agility; reaction speed; neuromuscular coordination; setting technique.								

The data in the table above illustrates the significance of the correlation between some physical abilities and skill abilities among volleyball players (n = 24). The researcher confirms the existence of a statistically significant correlation ***(R_p = 0.611)***, given that the P-value is less than the significance level ***(2/α = 0.025)***, thus accepting the alternative hypothesis ***(P= 0.022 < α/2)***

- The coefficient of determination ***(R^2 = 0.374)*** indicates that the proportions of shared variance between physical abilities (agility, reaction speed, neuromuscular coordination) and preparation skills reached ***(37.4%)***. This means that the proportions of explanation between the variables from a statistical perspective are directly related to the values of the corrected coefficient of determination.

- The corrected coefficient of determination ***(adj.R^2 = 0.280)*** is a weak value, primarily related to the number of independent variables added to the model, which determines the improvement of the model and, consequently, the proportion of shared variance between some physical abilities and preparation skills among volleyball players.
- The standard error in the estimate ***(10.2)*** for all variables intersecting with the dependent variable (setting) according to the explanatory values obtained through the correlation matrix.

6.5. Extracting the results of the values of the common variance between some abilities and determining between some physical abilities and the preparation skill of volleyball players:

Table No. (06) represents the extraction of the results of the values of the common variance between some of the specific abilities between some of the physical abilities and the skill of serving among volleyball players (n = 24)

The Model	Dimension	Eigenvalue	Condition Index	Constant	Variance Proportions		
					Agility	Reaction Speed	Neuromuscular Coordination
01	1	3.975	1.000	0.00	0.00	0.00	0.00
	2	0.018	14.845	0.04	0.02	0.00	0.72
	3	0.005	28.771	0.13	0.03	0.96	0.27
	4	0.002	45.207	0.83	0.95	0.04	0.00

The table represents one of the outputs of the collinearity diagnostics, which is linked to the variance inflation factor (VIF), to determine the extent of multicollinearity.

The value of the variance inflation factor for the independent variables, physical abilities, was ***(VIF=1.013)***, which is within the range of recognized statistical criteria. It can be argued that there is moderate multicollinearity. The eigenvalues of the variables also indicate a linear overlap between physical abilities and passing skill, given that all values (0.041-0.008) are close to zero.

Regarding the condition index, we note a problem with the third dimension (19.452), especially since its value is greater than 10. Consequently, there is a problem with multicollinearity between the two variables.

6.6. Extracting the results of the values of the common variance between some abilities and the ability to determine between some physical abilities and the skill of serving among volleyball players:

Table No. (07) represents the extraction of the results of the values of the common variance between some of the specific abilities between some of the physical abilities and the preparation skill among volleyball players (n = 24)

The Model	Dimension	Eigenvalue	Condition Index	Constant	Variance Proportions	
					explosive strength of the legs	explosive strength of the arms
01	1	2.952	1.000	0.00	0.00	0.01
	2	0.041	8.520	0.04	0.08	0.97
	3	0.008	19.452	0.96	0.92	0.03

The table represents one of the outputs of the collinearity diagnostics, which is linked to the variance inflation factor (VIF), to determine the extent of multicollinearity.

The variance inflation value for the independent variables agility ***(VIF = 1.308)***; reaction speed ***(VIF = 1.765)*** and neuromuscular coordination (VIF = 1.551). This is within the range of recognized statistical criteria, and it can be argued that there is moderate multicollinearity. The eigenvalues of the variables also indicate a linear overlap between physical abilities and preparation skills, given that all values (0.002-0.0018) are close to zero.

Regarding the condition index, we note a problem with all dimensions, especially when the values are greater than 10, and thus there is a problem of multicollinearity between the variables.

7.Discussion of the Results:

Deriving the values of the coefficient of determination *(R^2)* is of utmost importance, especially when the relationship between the variables is statistically significant. This can be explained by the presence of correlational variation in all variables, based on the nature and strength of the relationship. Since inference from the coefficient of determination and its values are linked to the condition of statistical significance of the correlation coefficient, it is affected by the indicators of the variance inflation factor *(VIF)* and its statistical conditions.

R^2 represents the explanatory value of the shared variance between physical abilities and the skills of serving and setting, through the correlation matrix between them and determining the extent of the significance of these values. This is based on variables that have a linear relationship, through which we can address the contribution ratios between physical abilities and skill abilities in order to achieve high levels of performance. A browser of regression analysis literature will find numerous types of regression analysis that suit different conditions related to the type and number of independent and dependent variables, the form and distribution of the variables, their correlation with each other, and the sample size (Saad bin Saeed Al-Qahtani, 2015, p. 249). Regression analysis measures the degree of influence of independent variables on the dependent variable (Mustafa Hussein Bahi, Abdel Fattah Mahmoud Annan, 2001, p. 101). By referring to the study's hypotheses (the values of the coefficient of determination are determined by high percentages in explaining the common variance between some physical and skill abilities among volleyball players), we note that the values of the coefficient of determination are within the weak range. This explains why this percentage is not high due to several variables, including sample size and the problem of collinearity.

There is a statistically significant correlation between the physical and skill abilities of volleyball players at a significance level of *(0.05)*: Based on the values obtained, which confirm the existence of a statistically significant correlation between physical abilities and the skills of serving and setting among volleyball players (n = 24), the obtained results are consistent with the findings of the study of researchers (Mizgish Youssef and Salami Abdel Rahim 2022), (Bossag Badr El-Din 2020), and (Haj Ahmed Murad et al. 2018), which demonstrated the existence of a correlation between some physical abilities and skill abilities among volleyball players. The researcher also confirms that the statistical significance of the correlation coefficient is the first condition for determining the common variance between variables, and that the interpretation is not causal, but rather a correlational change in one of the independent variables (physical abilities) affects the change in the dependent variable (sending and setting skills), and the strength and direction of the relationship between the studied variables.

The values of the common variance between the two variables are determined within limits greater than (50%) for volleyball players:

Covariance is considered one of the most important statistical measures, especially in the study of the multiple correlation coefficient. Referring to the previous hypothesis, we note that the values of the common variance are directly affected by the value of the coefficient of determination. Therefore, the researcher assumed that the percentage of influence is large compared to the logical relationship between physical abilities and their impact on the performance of skill abilities in volleyball players, and that the significant contribution is due to physical abilities, rather than other variables. However, the researcher attributed this to the distance between the points of the two variables in the distribution pattern and the problem of diagnosing linear parallelism, which in turn was reflected in the following results:

The percentage of common variance between some physical abilities and the skill of serving in the study sample was determined to be (31.1%), with the remaining percentage (68.9%) attributed to other variables and factors.

The percentage of common variance between some physical abilities and the skill of serving in the study sample was determined to be (37.4%), with the remaining percentage (62.6%) attributed to other variables and factors.

8.Study Results:

- The coefficient of determination values were determined at moderate percentages in explaining the shared variance between some physical and skill abilities among volleyball players (n = 24).
- There was a statistically significant correlation between physical and skill abilities at a significance level of *(0.05)* among volleyball players (n = 24).
- The shared variance values between physical and skill abilities (serving; setting) were determined to be less than (40%) among volleyball players (n = 24).

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