

The Relationship between Selected Physical Fitness Attributes and Technical Skill Levels of Junior Male Volleyball Players

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Abstract - Volleyball games require comprehensive ability including physical, technical, mental and tactical abilities. Physical attributes of players have a noticeable impact on both individual player talent and team strategy. Players must therefore be physically capable of meeting the demands of the volleyball sport. The goal of the study was to determine how certain physical fitness characteristics and the technical ability levels of junior male volleyball project players related to one another. Volleyball technical skill level is the ability of junior volleyball players to react readily and effectively to unexpected mobile tasks with coordinated complex mobility during the game.

By using the compressive sampling technique, 42 junior male volleyball project players from Debretabor and Tikl Dingay towns were chosen. They ranged in age from 19.19 ± 0.862 and had an average playing experience of 2.02 ± 0.780 years. The researcher was used cross sectional research design in order to identify the relationship between physical fitness traits and technical skill levels of junior volleyball players. Among technical skills of volleyball serving and spiking were selected variables and from the vast category of physical fitness variables strength endurance explosive power, agility, and speed were selected. Those junior volleyball project players were measured the technical skill level and physical fitness trait by using standard testing procedure. Data were collected from both variables. The collected data was analyzed by using Pearson product moment correlation coefficient and used statistical package for social science (SPSS), version 23 to find out the relationship between selected physical fitness traits and technical skill levels of junior volleyball players. The level of significant was set a ≤ 0.05 .

Four physical fitness trait of junior volleyball players were tested by using the standard procedure set by the Mackenzie, (1997). Each exam was administered to participants according to test protocol. In order to know the contribution of the physical fitness trait to the technical skill levels of junior volleyball players it must be known the significance relationship between those two variables. Junior volleyball players' serving and spiking (attacking) technical skill factors, along with four physical fitness variables, make up the study (explosive power, strength endurance, agility and speed.) These junior volleyball players' physical performance and technical ability levels were summarized using descriptive statistics (minimum, maximum mean, and standard deviation). The collected data was analyzed by using Pearson product moment correlation and performed with in computer system using statistical package for social science (SPSS), version 23 to determine the association between physical fitness characteristics and the technical skill levels of junior volleyball players, and to utilize linear regression to determine which physical fitness characteristic is most crucial in predicting these players' technical skill levels. The level of significant was set at p-value of ≤ 0.05 .

The result shows that there were statistically positive and negative significant as well as insignificance relationship between upper body strength endurance explosive power, agility, and speed with technical skill performance (serve and spike) of volleyball players. The most important predictor physical fitness trait for technical skill performance of junior volleyball players was strength endurance among other physical fitness traits. So the researcher recommended that it is better to focus on strength endurance of players during training to improve their serving and spiking performance.

Key Words— Physical Fitness attributes, Technical skill level, Junior, Volleyball, Players

I. INTRODUCTION

Physical fitness trait is the capacity to perform an activity effectively and efficiently, and more specifically the ability of junior volleyball players to perform certain physical activity without being too tired to implement different volleyball technical skills during the game to overwhelm the opponent. Physical fitness is conceptualized as either performance- or health-related and has many different components. Athletic performance is the best way to link to the specificity of performance-related fitness with relation to one's athletic competence. The more physically fit a person is, the longer they can go without resting, how effectively they function, and how quickly they can recover from exhaustion. Hassmen, Koivula and Utela (2000), states that for a good performance in volleyball game the high standard of fitness is the basic requirement. There for fitness must be gained through conditioning programed physical training. Explosive power is the capacity to efficiently combine strength and speed to produce the greatest amount of muscle force at the fastest possible rate, as in actions like jumping and throwing. It is also the capacity to convert energy into force quickly. (2002) Grey, Kumar, and Manjaripanda.

Upper body strength endurance is the specific form of strength displayed in activities which require relatively long duration of muscle tension with minimal decrease in efficiency. It has been said that volleyball is an interval sport with both anaerobic and aerobic components.

Volleyball matches are usually played to the best of 21 points, and that can take some time if the teams are closely matched. To play continuously for an extended period of time requires good muscular, aerobic and mental endurance (Gabbett & Georgieff 2007). Agility movements can be defined as rapid whole body movements that require single or multiple changes in direction (i.e. vertical, lateral, or horizontal) it includes acceleration, deceleration and velocity in response to an external stimulus. For example opponent movements, location of the ball and other situations (Gabbett 2008). Speed is the ability to perform a movement quickly. It is the time it takes us to respond to a stimulus. States that speed is basically how fast the participants can move partial their body or the whole of their body, and is measured in meters per second. Speed is hence the rate of movement, which frequently refers to the capacity to move quickly. It is a crucial component in all explosive sports and occupations that call for quick changes in space (Chauhan, 2003). Physical fitness is one of the fundamental criteria to control the game in any circumstance and is the cornerstone of building technical skill ability for volleyball players. This is so because upper body strength endurance, explosive power, agility, and speed are the essential requirements for technical skills (serving and spiking). Because of the intense competition and high degree of physical requirements, volleyball is a very physical sport. There are different fitness requirements for different playing positions, all players on a volleyball team need to be able to play in all positions at some time and to perform it they must have an optimal performance level. Fitness factors predict the performance levels of any athlete. There are a number of prerequisites for optimum performance. Some of the factors are physiological, environmental, psychological and sociological etc. In order to become proficient in the game of volleyball, a specific set of abilities and methods must be mastered. Such skills include serving, passing, receiving, setting, spiking a ball, and blocking (Gopinathan, Helina & Grace 2009).

According to Grey et al. (2002), the world's top sporting nations are very conscious of fitness factors that are supposed to play a dominant role in their future performance in sports and games. While physical fitness components of a specific game are the primary factor among those entire factors, no doubt that player performance is influenced by many other factors. Also, because volleyball is a sporadic sport, a vertical jump is essential to the spike, the block, the topspin and floating serves. The height of the vertical jump and the body position used prior to ball contact are likely factors in the volleyball spike that is most effective.

Volleyball technical skill level is the ability of junior volleyball players to react readily and effectively to unexpected mobile tasks with coordinated complex mobility during the game. (López & Palao, 2009). A volleyball serve is when the right-back player places the ball in play when it is in the service zone. To someone who is not very familiar with our sport, this performance could look easy. In fact, William G. Morgan introduced one of the original volleyball techniques—serving—in the 1897 edition of the game's first published regulations. Mohan and Sharma (2009), it is a skill commonly described as the first element of the defense, essential in preventing a team from siding out. Since the introduction of the rally point system by the FIVB in 1998. The service has become an even more important skill in the game. Basically, a good service in combination with an efficient defensive strategy neutralizes the opponent's opportunity of creating a point. On the other hand, a mistake while serving leads to an error and consequently to a point, not just to a side-out as it used to be with the traditional scoring system. In high-level volleyball, the chance of obtaining a direct point using the service is low. Nevertheless, the benefits from serving are not only based on the possibility of scoring, but also on influencing the next attack play of the opponent. (Barnes, 2007).

The technique used to send the ball over the net to the adversary such that it cannot be returned is known as a volleyball spike (attack). The spike is executed by moving the arm in such a way that the ball is angled to land on the court's opposite side on the other team. Typically, a spike strikes the ball at a downward angle and with high force (Lenberg & Kinda. 2006). It is crucial to have a firm grasp of volleyball's technical skills in order to effortlessly dominate the game and overwhelm the opposition throughout a match. Also, players need to refine their tactical abilities. Tactical skills are defined as “the decisions and actions of players in the contest to gain an advantage over the opposing team or players”.

Basic volleyball resources might focus on the technical skills of the game and may overlook the tactical aspects. Coaches even omit tactical considerations from practice because they focus so intently on teaching technical skills. For volleyball players to develop better as overall players, they need to learn techniques and tactics together (Barnes, 2007).

The relationship between physical fitness traits and technical skill levels of volleyball players were studied by different researcher but There are inconsistent results existed by those researchers regarding with the relationship between physical fitness trait and technical skills of volleyball players among those researchers, (Gangey, & Kerketta, 2006) revealed that “there is strong correlation between agility of an individual y with volleyball playing performance”. Tiwari, (2012). States that “the most valid combination in predicting spiking ability consisted of agility and explosive power”. Those researchers conclude that there is significant relationship between agility and explosive power with volleyball playing performance.

Even though there are numerous studier's for volleyball players at national and international level regarding with the relationship between physical fitness trait and technical skill level, some researches output shows that insufficient evidence has been reported in Ethiopian context related with the relationship between physical fitness traits and technical skill of junior volleyball player's performance. Therefore, the goal of this study was to investigate the relationships between technical skill levels, specifically serving and spiking ability, and physical fitness traits, such as explosive power, upper body strength endurance, agility, and speed, in the context of Debretabor and Tikl Dingay town in the Amhara Regional State of Ethiopia.

II. Material And Methods

This cross sectional study was carried out on junior volleyball projects players aged U-19, found in Debretabor and Tekl dengay town, Amhara Regional state, Ethiopia from November 2019 to June 2020 to test their Physical fitness trait and technical skill.

Study Design: The cross-sectional research design was employed by the researcher. This kind of design is useful for determining how one variable relates to another and for determining how frequently two natural groups co-occur (Creswell & John, 2014). This study examined the relationship between junior volleyball players' technical skill levels and physical fitness attributes.

Study Location: Debretabor and Tekl dengay town, Amhara Regional State, Ethiopia.

Study Duration: November 2019 to June 2020.

Sample size: 42 junior male volleyball players.

Subjects & selection method: The study focus mainly on junior male volleyball projects players there are 24 junior volleyball players in Debretabor town and 18 junior volleyball players in Tekldengay town volleyball project. So this study included all 42 players by using comprehensive sampling technique since they are easily manageable and few in numbers.

Procedure methodology

The researcher followed standard procedures for testing the selected variables and registering the score in fitness record sheet under the direct supervision of the participants. To determine how certain physical fitness characteristics and volleyball technical skill levels interact (serving and spiking). The participants had ample stretching and warming-up exercises completed before the examinations began. The testing session included warm-up, test, and relaxation periods. Every test was described and demonstrated. Practice trials were given to participants prior to the exam to help them become accustomed to the testing process. Each exam was administered to participants according to test protocol.

Data gathering procedure for physical fitness traits test

Four physical fitness trait of junior volleyball players were tested by using the standard procedure set by the Mackenzie, (1997).

Table 3.1: Selected physical fitness components, there testing methods and purpose.

Fitness Components	Name of the test	Purpose of the test
Speed (cm)	30 m sprint test	To test the players' capacity for travelling the specified distance in a short amount of time.
Strength endurance(rep)	One minute Push up test	To test the strength of upper body muscle group.
Explosive Power(cm)	Vertical jump Without approach test	To test the explosive power performance of lower extremities
Agility(sec)	T-Shuttle run test	To test the ability of the player in a single or multiple changes in direction.

Source: Mackenzie, (1997) 101 evaluation test

Statistical analysis

In order to know the contribution of the physical fitness trait to the technical skill levels of, junior volleyball players it must be known the significance relationship between those two variables. Junior volleyball players' serving and spiking (attacking) technical skill factors, along with four physical fitness variables, make up the study (explosive power, strength endurance, agility and speed.) These junior volleyball players' physical performance and technical ability levels were summarized using descriptive statistics (minimum, maximum mean, and standard deviation). The collected data was analyzed by using Pearson product moment correlation and performed with in computer system using statistical package for social science (SPSS), version 23 to determine the association between physical fitness characteristics and the technical skill levels of junior volleyball players, and to utilize linear regression to determine which physical fitness characteristic is most crucial in predicting these players' technical skill levels. The level of significant was set at p-value of ≤ 0.05 .

This study was dealt with the ethical issues and code of conduct related to the investigation. According to ethical guidelines, researchers must avoid placing participants in circumstances that could put them at risk of injury as a result of their participation. The harm could be psychological or bodily. To ensure that there is no risk or injury to the study's participants, the Sport Academy, Bahir Dar University postgraduate studies' ethics review committee accepted this research. Before starting the research, the researcher secured approval from the coach, the district sport office, and all of the players. All of the players were given written consent after being fully informed of the study's purpose, the procedures to be followed, the potential benefits of participating in the study, as well as any potential risks. The data collection methods were fully disclosed to participants, and all research data were kept confidential.

III. Result

Demographic characteristics of junior male volleyball project players in Debretabor and Tikil Dingay town

Table 4.1: Demographic characteristics (n=42)

Variables	Minimum	Maximum	Mean(Sat.D)
Height	1.65	1.78	1.705± 0.035
Weight	53	63	57.52 ±3.038
Age	18	21	19.19 ±0.862
Playing experience	1	3	2.02 ±0.780

As shown from the above table, descriptive characteristics of 42 junior volleyball players from Debretabor and Tekel Dengay town age (19.19 ± 0.862) height (1.705 ± 0.035) weight (57.52 ± 3.032) and playing experience (2.02 ± 0.780). Participants were relatively had the same age, height weight and playing experience.

Physical fitness traits of junior male volleyball project player in Debretabor and Tikil Dingay town

Table 4.2: Descriptive statistics on physical fitness trait of junior volleyball players (n= 42)

PFT	Minimum	Maximum	Mean(Sta.D)
Strength endurance(rep)	20	35	29.43 \pm 3.630
Explosive power(cm)	38	48	42.79 \pm 2.504
Agility(sec)	17.00	12.50	14.67 \pm 1.136
Speed(sec)	5.60	4.40	4.94 \pm 0.280

The table above displays the minimum, maximum, mean, and standard deviation of the chosen physical fitness parameters (strength endurance, explosive power, agility, and speed of junior volleyball players in Debretabor and Tekl Dengay town in Amhara regional state of Ethiopia). The minimum and maximum value of strength endurance (20 and 35), the minimum and maximum value of explosive power (38 and 48), the minimum and maximum value of agility (12.50 and 17.00) and the minimum and maximum value of speed (4.40 and 5.60). The mean of strength endurance of the participant is 29.43.

With standard deviation of 3.630, the mean value of explosive power of the participant is 42.79 cm with standard deviation 2.54, the mean value of Agility of the participant was 14.67 sec, with standard deviation of 1.136, the mean value of the speed was 4.94 cm with standard deviation of 0.280.

Technical skill levels of junior male volleyball players in Debretabor and Tikil Dingay town

Table 4.3: Descriptive statistics on technical skill levels of junior volleyball players (n= 42)

Technical skills	Minimum	Maximum	Mean(Sta.D)
Serve	34	52	41.62 \pm 4.701
Spike	23	51	35.19 \pm 6.142

The lowest, maximum, mean, and standard deviation of the technical skill levels of serving and spiking for male junior volleyball players are provided in table 4.3. The player's mean serving ability is 41.62 with a standard deviation of 4.701 and their participant's mean spiking ability is 35.19 with a standard deviation of 6.142.

The junior volleyball players' serving and spiking abilities in Debretabor and Tikil Dingay town are correlated with their upper body strength and endurance

Table 4.4: Shows the relationship between strength endurance with serving and spiking skill levels of junior volleyball players (N=42)

Variable	Correlation Coefficient	P Value
Strength endurance and serve	.422	.005
Strength endurance and spike	-.386	.012

Correlation is significant at the ≤ 0.05 level (2-tailed)

The findings of physical fitness features were significantly connected with the outcomes of volleyball skill performance, as can be seen from the table above. The table demonstrates how junior male volleyball players' strength endurance correlates with their serving skill ($r = 0.422$; $p = 0.005$) and their spiking ability ($r = -0.386$; $p = 0.012$).

The relationship between explosive power with serving and spiking skill levels of junior male volleyball players

Table 4.5: Shows the relationship between explosive power with serving and spiking skill levels of junior volleyball players (N=42)

Variables	Correlation Coefficient	P value
Explosive power and serve	-.299	.055
Explosive power and spike	.404	.008

Correlation is significant at the ≤ 0.05 level (2-tailed)

The aforementioned table shows that there is no correlation between the explosive power test and level of serving competence ($r = -0.299$, $p = 0.55$). The findings indicated a weak and negligible correlation between junior volleyball players' explosive power and serving efficiency. Nonetheless, a substantial and favorable association between junior volleyball players' explosive powers and spiking ability has been discovered ($r = 0.404$ with $p = 0.020$).

The relationship between Agility with serving and spiking skill levels of junior volleyball players

Table 4.6: Shows the relationship between Agility with serving and spiking skill levels of junior volleyball players (N=42)

Variables	Correlation Coefficient	P Value
Agility and serve	.052	.746
Agility and spike	.357	.020

Correlation is significant at the ≤ 0.05 level (2-tailed)

As seen in the aforementioned table, there is no correlation between the outcomes of physical fitness variables (agility) and the outcomes of volleyball skill performance (serve). The table displays the relationship between speed and serving skill ($r=0.053$, $p=0.746$). Nonetheless, a favorable and substantial link between agility and spiking skill in male junior volleyball players has been discovered ($r = 0.357$ with $p = 0.20$).

The relationship between speed with serving and spiking skill levels of junior volleyball players

Table 4.7: Shows the relationship between speed with serving and spiking skill levels of junior volleyball players (N=42)

Variables	Correlation Coefficient	P value
Speed and serve	- .113	.477
Speed and spiking	- .218	.166

Correlation is significant at the ≤ 0.05 level (2-tailed)

The aforementioned table shows that there has been a negligible and inverse correlation between speed and volleyball skill performance (serves and spike). The table displays the correlation between speed and serving and spiking skills in male junior volleyball players ($r = -0.113$, $p = 0.477$) and ($r = -0.218$, $p = 0.166$).

Result of regression analysis and prediction of technical skill levels based on physical fitness traits of junior volleyball players. Determining the degree to which physical fitness features significantly predict the technical ability levels of junior volleyball players was one of the study's goals. In order to reduce the non-significant physical fitness features for volleyball players, linear regression analysis was used for this aim. After correlation, linear regression is the next level up. When predicting the value of a variable based on the value of another variable, it is employed. The dependent variable is the one we're trying to forecast (outcome variable). The variable we are utilizing to forecast the value of the other variable is referred to as the independent variable, or occasionally as (the predictor variable).

Table 4.8: Summary of regression prediction of spiking performance with physical fitness traits

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.621	.386	.320	4.930

predictors: (Constant), speed, explosive power, agility, strength endurance

This table provides the R and R-square values. The R value represents the simple correlation and is 0.621 (R Column), which indicates moderate degree of correlation. The R2 value (R Square column) indicates how much of the total variation in the dependent variable (spiking performance level) can be explained by the independent variable (physical fitness traits). In this case, 38.6% can be explained, which is an optimal predictor.

Table 4.9: Coefficient of regression prediction of spiking performance with physical fitness traits

Model		Unstandardized Coefficients		Standardized Coefficients	T	P
		B	Std. Error	Beta		
1	(Constant)	16.655	20.315		.820	.418
	explosive power	.861	.311	.360	2.765	.009
	Agility	.748	.392	.251	1.907	.064
	strength endurance	-.576	.249	-.306	-2.315	.026
	Speed	-3.208	2.827	-.150	-1.135	.264

. Dependent Variable: spiking

The Coefficients table provides us with the necessary information to predict spiking performance level from physical fitness traits as well as determine whether those physical fitness traits contributes statistically and significantly to the model or not by looking at the Significance column (p value) Furthermore, Linear regression equation was calculated to predict AAHPERD Wall spike test of the players based on one minute push up test and vertical jump test without approach. We can use the values in the "B" column under the "Unstandardized Coefficients as shown in the above table. To represent the regression equation as players spiking performance is equal to 16.655 + 0.861 (explosive power) -.576 (strength endurance). Which means that One centimeter increase in explosive power will increase

spiking performance by 0.861 repetitions. And if strength endurance increases by one repetition there is decrease in spiking performance by 0.576 repetition's. As a result explosive power of volleyball players was found to be the most predictor physical fitness trait for spiking performance.

Table 4.10: Summary of regression prediction of serving performance with physical fitness traits of volleyball players

Model				
	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.555 ^a	.308	.233	4.196
Predictors: (Constant), speed, explosive power, agility, strength endurance				

This table provides the R and R- square values. The R value represents the simple correlation and is 0.555 (R Column), which indicates moderate degree of correlation. The R-square value (R Square column) indicates how much of the total variation in the dependent variable, spiking performance level, can be explained by the independent variable (physical fitness traits). In this case, 30.8% can be explained, which is an optimal predictor for serving performance of volleyball players.

Table 4.11. Coefficient of regression prediction of serving performance with physical fitness traits of volleyball players

Model	Unstandardized Coefficients		Standardized Coefficients	t	P
	B	Std. Error	Beta		
1 (Constant)	51.733	17.288		2.992	.005
explosive power	-.553	.265	-.289	-2.088	.044
Agility	.328	.334	.138	.984	.331
strength endurance	.695	.212	.461	3.281	.002
Speed	-3.030	2.406	-.176	-1.259	.216

Dependent variable: serving

The Coefficients table provides us the necessary information to predict serving performance level from physical fitness traits as well as determine whether those physical fitness traits contributes statistically and significantly determinant factor to the model or not by looking at the Significance column (p value) Furthermore, Linear regression equation was calculated to predict brumbach serving test for physical fitness traits which have significance value (explosive power and strength endurance) of the players based on one minute push up test and vertical jump without approach test. We can use the values in the "B" column under the "Unstandardized Coefficients" column, as shown in the above table. To represent the regression question as players serving performance is equal to 51.733 - 0.553 (explosive power) + 0.695 (strength endurance). This indicates that One centimeter increase in explosive power will be decrease in serving performance by 0.553. And serving performance will improve by 0.695 repetitions if strength endurance increases by one repetition. From this, we can infer that strength endurance is the most reliable physical fitness characteristic for volleyball players' serving performance.

Strength endurance of junior male volleyball players

The average number of pushups performed by junior volleyball players in our study was 29.43, and its relationship to serve and spike was statistically significant (p 0.5). It nearly matched the results given by Taware, et al (2013).) with the title "A Profile of Fitness Parameters and Volleyball Players' Performance" Its participants completed an average of 28.90 push-ups at their utmost capacity. from a population of 40. But it is not consistence with the study reported by (Inder et al 2016), with the title "Relationship between selected motor fitness and playing ability of volleyball players". They found mean value of 34.70 from their 30 junior volleyball players. The performance difference in push up results is related to the difference in strength of the shoulder, chest muscle and upper arms.

Explosive power of junior male volleyball players

In our study mean score of junior volleyball players in relation to vertical jump without approach test has been 42.79 centimeters and it is significantly correlated with spiking ability of junior volleyball players have found vertical jumping distance of national norms for junior volleyball the excellent score is above 65cm and the average score is between 40 – 49(Daviss,2000). So our finding is consistent with his findings.

Agility of junior male volleyball players

In our study the mean score of junior volleyball players in relation to T-shuttle run agility test score was 14.67 seconds. (Paule et al 2000). Have found that the mean value of agility for junior volleyball player is 19.32. And as we observed there is no consistence result between our study and their findings.

Speed of junior male volleyball players

In our study the mean score of junior volleyball players to 30m sprint run test was 4.94 second. It was inconsistency with the findings reported by (Davis 2000). He develops a national norm for 16 to 19-years of old and he stated that > 4.6 score is categorized in poor performance.

Volleyball serves and smashes cause the ball to move at a very high speed, therefore players must be swift to position themselves to return or pass the ball. By engaging in sports-specific drills like multidirectional sprinting and utilizing an uneven ball called a response ball that bounces erratically, one can increase speed—both in terms of movement and reaction time.

IV. Conclusion

The following statements were made as a conclusion based on the study's findings.

- ❖ Junior volleyball players' technical skills and some physical fitness characteristics are significantly connected with one another. Other physical fitness characteristics are also significantly correlated with those technical characteristics.
- ❖ There is significance relationship between strength endurance with serve and strength endurance with spike.
- ❖ Explosive power and spike have a significant association, while serve and explosive power don't have much of a connection.
- ❖ Junior volleyball players' agility and spike have a significant association, but their agility and serve have no significant relationship.
- ❖ The junior volleyball players' spike and serve times and their speed are not significantly correlated.
- ❖ The most important physical fitness trait predictor for volleyball technical skill performance was strength endurance.

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