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Assessment of basic volleyball skills among sports education students: Gender differences

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ABSTRACT

This study aimed to evaluate the fundamental technical abilities in volleyball among Sports Education students. The study employed a survey design, using test instruments developed by the researchers to assess basic volleyball technique skills. A total of 114 students from the University of Muhammadiyah Surakarta, Indonesia, enrolled in the first and third semesters of the Sports Education program, participated in the study, including 64 males (mean age 20.58 ± 1.10 years) and 50 females (mean age 20.80 ± 1.23 years). Both male and female participants were in a productive age range (~20.7 years), had normal BMI (~22.48 kg/m²), and showed good resting heart rates (~65.75 bpm), indicating good physical health and fitness suitable for volleyball. The descriptive statistics for basic volleyball skills among the students indicated that the overall performance levels were moderate to high across all measured skills (top passing, bottom passing, service, smash, block). Differences in all basic volleyball skills between male and female students were statistically significant ($p < 0.05$). In conclusion, the students demonstrated moderate to high proficiency in basic volleyball skills, with males performing better than females across all skills.

KEYWORDS

Volleyball Skills; Gender; Sports Education; Students

1. INTRODUCTION

Volleyball is a netting sport characterized by collective behavior performed for short and high-intensity periods, followed by lengthy and low-intensity rest periods (García-de-Alcaraz et al., 2020). In the game of volleyball, there are some basic techniques that every player must master, including serve, passing, smash, and block, mostly done while jumping, and the number of jumps varies in terms of player roles due to different technical-tactical and motor requirements of the match. Typical actions are sprints, jumps, punches, and multidirectional movements (Sheppard et al., 2007). However, the actions that allow scoring points (spikes, blocks, and serves) are primarily performed while jumping, and the number of jumps varies in terms of player roles due to different technical-tactical and motor requirements of matches (Czaplicki et al., 2017).

Millions of people play volleyball around the world. In many countries, it has been ranked as one of the top-level competitive sports. FIVB (Federation Internationale de Volley Ball) is the largest sports organization in the world, with 220 affiliated member countries (Gaurav et al., 2011). Volleyball belongs to sports activities in which the morphological conditions of its participants affect the level of sports performance (Slovák et al., 2023). Volleyball is a fast-paced game. It is a sport that involves short and intensive physical efforts during training and competitions (Tsoukos et al., 2019). A volleyball player's fitness depends on the athlete's strength, power output, and jumping ability (Kaszuba et al., 2023). To evaluate these physical characteristics, anthropometric measurements of body composition parameters such as percent body fat (% fat), lean body mass index (B.M.I.), and somatotype components are often used (Ćopić, 2014).

Sports performance is based on a complex and intricate diversity of physical, physiological, psychological, and morphological factors and body type (somatic nature and body composition). Volleyball players must have excellent physical condition, especially about somatic properties and body composition. Studies of the physical characteristics of the human body to date suggest that the morphological characteristics of athletes play an important role in success in a particular sport. Height, the most characteristic trait of volleyball players, is significantly genetically conditioned (Challoumas & Artemiou 2018). External factors, including training and initial load, do not affect this variable. However, higher body mass is an obstacle for volleyball players in reaching a good jumping height (Bandyopadhyay, 2007). The somatic conditions required to reach the top level of sport had to be carried out in a long and time-consuming selection process.

In contrast, the harmony of somatic properties and other elements specific to volleyball was developed over many years of training (Gaurav et al., 2011). In volleyball, there is a net between the courts. The net height is 2.43 m in males and 2.24 m in females. So, it requires height and has high jumping ability (Singh et al., 2015). Examination showed that body fat affects jumping ability. Various researchers suggest that different body sizes, shapes, and proportions are beneficial in different physical activities (Matłosz et al., 2023). Achieving high achievements in volleyball requires several conditions (abilities) that must be met (Givi et al., 2021).

In obtaining high achievements, an athlete does not only rely on his talents but must have suitable physical, technical, tactical, and mental abilities (Drikos et al. 2022). The role of professionals, coaches, nutritionists, other experts, and the athletes themselves dramatically affects volleyball sports' maximum/optimal achievement (Alishah et al., 2017). In the process of training that seeks to achieve maximum or ideal performance, the function of the volleyball coach can be considered (Ćopić et al., 2014). In carrying out the training process, volleyball coaches improve athletes' affective, psychomotor, and cognitive domains and elements (Nishanbayevich, 2022). Cognitive traits are knowledge-based skills, such as the ability to devise approaches and strategies and recognize different parts of a volleyball court (Nassiri et al., 2022).

In volleyball games, the realm of skills or facets is a technical skill that must be mastered. The ability to regulate behavior as a sportsman, such as honest character, fair play in the game, acceptance of referee decisions, and so on, is included in the affective aspect. For volleyball matches, improving these three areas/domains is essential to achieve the best level of performance.

Each team is entitled to play the ball three times before making a transfer across the net, but they are also allowed to play the ball once or twice, according to volleyball rules. The game of indoor volleyball begins with a serve made with a one-handed shot and the ball over the net. The ball can be played again before it hits the ground, touches an object out of bounds, or a player makes a mistake. According to volleyball rules, the game begins with a serve received with a bottom-pass technique or an upper pass, fed with an upper-passing or a bottom-passing technique. Techniques used in volleyball games include serve, bottom passing, top passing, spike, and block.

The School Wide Optimum Mode (S.W.O.M.) technique greatly helps students improve their agility and blocking skills (Dahash et al., 2022). S.W.O.M. is one of the essential strategies for ensuring the success of the learning process, as it facilitates interaction between teachers and students.

The smash skill training model using rubber tire aids for volleyball extracurricular athletes went through several stages, including preliminary tests, expert validation tests, small- and large-group tests, and model effectiveness tests. The model was found to be acceptable to users, particularly in schools that actively participate in volleyball coaching (Subagio et al., 2021).

Study findings and data analysis revealed that the treatment group, which received e-learning, showed superior service skills—including upper serve, jump serve, and floating serve—compared to the control group, which did not receive e-learning (Samsuddin et al., 2022).

In volleyball, the midfielder has a different role than the outfielder. Consequently, the performance of Coinciding Anticipation Timing (C.A.T.) and the reaction time of midfielders are particularly important, as their offensive and blocking responsibilities are more varied. To achieve top-level performance, various specialized exercises should be performed in addition to standard volleyball drills. It is recommended to conduct further studies across different age groups, categories, and positions (Günay et al., 2019).

Finally, the development of TENDA IOT174 volleyball learning was found to improve students' cognitive function, fighting ability, and athleticism according to research findings (Muharram et al., 2023). Based on the phenomenon in the form of this fact, this study aims to investigate differences in basic volleyball skills to provide insights for improving the effectiveness and efficiency of volleyball performance.

2. METHODS

2.1. Participants

The current study was conducted between March 2022 and July 2022 on volleyball players who were enrolled in the University of Muhammadiyah Surakarta Indonesia's Sports Education study program in the first and third semesters. The study employed a survey design. A total of 114 students participated, including 64 males and 50 females, selected through a lottery-style random sampling method.

2.2. Procedures

The exercises for the participants were an upper serve, an upper passing, a bottom passing, and a smash. The development of a volleyball sports test battery was tested using a modified volleyball skill exam (Aulia et al., 2022; Furkan & Shandi, 2019). The validity of each basic volleyball skill item for male and female students for bottom passing was 0.639 and 0.638, for upper

passing was 0.603 and 0.632, for serve was 0.673 and 0.586, for smash was 0.666 and 0.556, and for blocks was 0.683 and 0.644. This indicates that the instruments used for tests and measurements of basic volleyball skills are reliable. The following describes how testing and measurements are carried out:

- For one minute, pupils pass to the wall while performing bottom passing. The target height is 2.5 meters, the target distance is 30 cm, and the score is determined by the touch of the ball on the predetermined target. The position to execute a bottom pass is behind the line, at a distance of 3 meters from the target wall;
- For one minute, pupils are required to perform top passes to the wall. The score is determined by the touch of the ball on the predetermined target with the position to execute a bottom pass behind the line (a distance of 3 meters from the target wall) and a target height of 3.5 meters, as well as the touch of the ball in the target area, which results in a score of 1.2 and 3 and a target distance of 30 cm, respectively;
- Students serve top and bottom, with 10 upper serves, scoring when the ball lands on a specified goal. The rating for the touch of the ball in the target area is 1, 2, 3, 4, and 5, with a size of 2.5 meters with a value of 2, the size of the line with a distance of 5 meters is given a value of 1, and 3 and line sizes with a value of 2. The score is given according to the fall of the ball in the target area that has been set with the position to serve behind the line (a distance of 9 meters from the target) with a net height of 2.43 meters for males, and a female of 2.24 meters;
- Smash, in which pupils deliver 10 top serves and are graded according to how far the ball falls on a predetermined target. The rating according to the touch of the ball in the target area of 1, 2, 3, and 4 with a size of 3 meters can be a value of 2, The size of the line with a distance of 4.5 meters is given a value of 1, and 3 and the size of 2. The score is given according to the fall of the ball in the target area that has been set with a position to smash behind the attack line (a distance of 3 meters from the target) with a net height of 2.43 meters for males, and a female of 2.24 meters of; and
- Block does blocks by tossing balls in the manner of blocks. The chance was presented ten times. The ball's descent to a predetermined target determines the score. The rating for the touch of the ball in the target area is 1, 2, 3, and 4, with the caveat that it can be a value of 4 if the ball falls on the target gari2 0.75 meters, and can be 3 if the ball falls on the target is. The target area has been set with a position to block behind the attack line (a distance

of 3 meters from the target), with a net height of 2.43 meters for males, and a female of 2.24 meters.

- Body mass index (BMI) is determined by dividing a person's weight in kilograms by their height in meters squared, or B.M.I. = Kg/M^2. Less than 18.5 implies underweight; between 18.5 and 24.9 means normal weight, between 25 and 29.9 means overweight; and beyond 30 means obesity; according to WHO's standard weight categories for adult males and females.
- The test determines the maximal heart rate, which is 220 less than age. For instance, 50 years old equals 220-50 or 170 times every minute.

2.3. Statistical Analysis

Data normality was tested using the Kolmogorov-Smirnov test, with a significance level of $p < 0.05$. Since the data were not normally distributed, differences in basic volleyball skills between male and female students were analyzed using a non-parametric t-test. A significance level of $p < 0.05$ was applied. All data analyses were performed using SPSS version 25.

3. RESULTS

Table 1 presents the mean scores and standard deviations for the outcomes of this study on the comparative analysis of basic volleyball technique skills in terms of gender and BMI.

Table 1. Age, BMI, and resting heart rate results

Variable	Male N = 64	Female N = 50
	Mean ± SD	Mean ± SD
Age (years)	20.58±1.10	20.80±1.23
BMI (kg/m2)	22.66±3.68	22.30±3.72
Resting Heart Rate (pulse/minute)	63.4±8.2	68.1±6.4

According to the findings of Table 1, respondents had good physical health and fitness as evidenced by their productive age group (20.69±1.16 years), normal body mass index level (22.48±3.70 kg/m2), lack of fatigue (pulse rate 65.75± 7.35bpm), and basic volleyball playing technique skills in students. The table below shows a descriptive analysis of the predicted variables.

Table 2. Descriptive statistics of basic volleyball technique skills

Variable	Male N = 64	Female N = 50	Male and Female Mean ± SD
	Mean ± SD	Mean ± SD	
Top passing	23.20±2.39	21.54±1.66	1.10 ± 1.17
Bottom passing	22.64±2.83	21.72±2.16	0.92 ± 0.67
Service	34.41±2,92	32.98±6.11	1.43 ± 3.19
Smash	28.83±4.51	26.86±5.42	1.97 ± 0.91
Block	29.11±2.15	25.40±1.44	3.71 ± 0.71

The findings of Table 2 indicate differences in the mean values of basic volleyball skills between male and female Sports Education students at the University of Muhammadiyah Surakarta. For top passing, males had a higher mean (23.20 ± 2.39) than females (21.54 ± 1.66), with a mean difference of 1.10 ± 1.17. Similarly, in bottom passing, males scored higher (22.64 ± 2.83) than females (21.72 ± 2.16), with a mean difference of 0.92 ± 0.67.

In the service skill, the male group had a mean of 34.41 ± 2.92, compared to 32.98 ± 6.11 for females, showing a mean difference of 1.43 ± 3.19. For the smash skill, males scored 28.83 ± 4.51, while females scored 26.86 ± 5.42, with a mean difference of 1.97 ± 0.91. Finally, in blocking, the male mean was 29.11 ± 2.15, and the female mean was 25.40 ± 1.44, showing the largest mean difference of 3.71 ± 0.71.

This study also used prerequisite computations to determine whether the data were regularly distributed. The results of the Kolmogorov-Smirnov Z (KS-Z) test with a significance level of =0.05 are shown in Table 3 below. The test was employed to test the normality of the data.

Table 3. Test of normality for variations in the fundamental technical abilities needed to play volleyball

Variable	Male N = 64	Female N = 50
	KS-Z ± p value	KS-Z ± p value
Top passing	0.157 ± 0.004	0.171± 0.001
Bottom passing	0.165 ± 0.002	0.151± 0.006
Service	0.151 ± 0.006	0.201± 0.000
Smash	0.116 ± 0.008	0.293± 0.000
Block	0.190 ± 0.001	0.181± 0.000

Based on the findings of the Kolmogorov-Smirnov Z (KS-Z) test, which is used to test for normality, it can be said that variables such as the fundamental technical abilities needed to play volleyball are exhibited in the normal distribution with a value of more than 0.05 ($p > 0.05$). As a result, the samples and variables in this study are described as populations with normal distribution. To determine the value of the difference in variables in the group before and after modification as well as to evaluate the difference in values between the two research groups, the paired sample test (t-test) was used. The outcomes are displayed in the following table (Table 4).

Table 4. Gender differences in basic volleyball technique skills

Variable	Paired Samples Test Male and Female	p value
	t_{count}	
Top passing	6.45	0.000
Bottom passing	4.11	0.000
Service	4.73	0.000
Smash	4.70	0.000
Block	13.71	0.000

As shown in Table 4, all p-values are less than the significance level of 0.05 ($p < 0.05$), indicating that the differences in basic volleyball skills between male and female students are statistically significant.

4. DISCUSSION

The findings of additional studies demonstrating gender and body mass index differences in basic volleyball technique skills, including service accuracy tests, upper and bottom passing, smashes, and blocks, are supported by the findings of descriptive and inferential analyses performed on students in sports education at the faculty of teacher training and education, Universitas Muhammadiyah Surakarta. The findings of this study are supported by earlier research. The development of sensor-based bottom passing exams suggests additional research, taking into account the number of samples and volleyball infrastructure for volleyball technology advancements that can be refined (Indrakasih et al., 2022). According to other research findings, there are statistically significant differences between male and female volleyball players as well as players from various team categories in the variables "solution and goal orientation," "healthy lifestyle," and "self-efficacy." Future research should investigate the effects of coaching strategies on athletes competing in various categories of endurance (Patsiaouras, 2020).

A large social and economic advantage from volleyball data analysis has the potential to be realized, according to research findings by Dai & Li. Future sports data analysis will involve kinematics analysis, which is a highly difficult academic subject. Academic importance and broad practical impact are significant elements (Dai & Li, 2021). The blended learning model's final product, which consists of e-books and volleyball instruction videos, is connected with the State University of Malang learning management system (Roesdiyanto et al., 2019). According to Nasuka's research, Semarang State University volleyball players have better motor skills than their Indonesian student volleyball club counterparts, but they have a lower anthropometric profile than players from other countries (Nasuka, 2020). Elite athletes, both senior and junior, differ greatly from local athletes in terms of power, strength, and endurance (Nasuka et al., 2020)

According to research, using underpass development strategies can enhance volleyball students' learning outcomes. Learning techniques that can improve learning efficacy below the level of volleyball are developed in response to research findings (Destriana et al., 2020). Given the paucity of study in this field, Paraskevaidis & Fokides research provides an early indicator of the potential of 360-degree video in volleyball learning. The results, however, also emphasize the necessity for more inventive methods to include 360-degree footage in typical volleyball instruction (Paraskevaidis & Fokides, 2020). It has also been established through research conducted by Kovalchuk that training loads for female volleyball players with various levels of technical readiness should be organized and intense. Specific physical fitness indicators and the capacity to employ them in contests are improved by available information (Kovalchuk et al., 2019).

The role of professionals, including coaches, nutritionists, and other experts, as well as the athletes themselves, has a significant impact on volleyball sports' maximum / ideal performance. The roles of the volleyball coach can be taken into account during the process of training that aims to reach maximum or optimal performance. Volleyball coaches strive to enhance their athletes' affective, psychomotor, and cognitive domains and components during the training process. Cognitive qualities are knowledge-based abilities, such as the capacity to formulate plans of action and identify various volleyball court areas. The domain of talent or aspect in volleyball games is a technical skill that must be mastered. The sphere of affective aspect encompasses the capacity to control conduct as a sportsman, such as honest character, fair play in the game, accepting referee judgments, and so forth. For peak/ideal performance in volleyball games, these three areas/domains must be improved.

5. CONCLUSIONS

The findings of this study allow us to conclude that basic volleyball technique skills vary depending on a student's gender. Based on these findings, it is inferred and advised to regularly practice volleyball drills that aim to enhance playing abilities. However, students need to practice fundamental volleyball techniques through the coach's function as an educator, companion, workout creator, artist, mediator, and motivator for the practice process. Given that the sample size for this study was rather small, caution should be exercised when applying basic volleyball technical abilities to gender and body mass index. Further research on some aspects, including social environment, psychosocial, physical condition factors following student characteristics, and those related to developing volleyball playing skills, is required for this study. However, more research is required to ascertain how complete physical traits, technical considerations, and psychological considerations affect volleyball playing abilities in terms of body mass index, including gender characteristics.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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