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Factors Determining the Ability of Jump Volleyball Providing

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Abstract

Purpose: This study aims to: 1) Determine the anthropometric factors (height, arm length, foot length) that most determine the ability of men's volleyball jump service. 2) Knowing the biomotor factors (leg muscle power, abdominal muscle strength, arm and shoulder muscle power, eye-hand coordination, togok flexibility and kinesthetic perception) that most determine the ability of men's volleyball jump service.
Material and methods. The population of this study were all male athletes of the Volleyball Student Activity with a total of 36 people. The approach taken in this study is a quantitative approach, using a confirmatory factor analysis design. Data were processed and analyzed using the Computerized Statistical Program with the SPSS (Statistical Product and Service Solutions) Version 22 system and using the Kaiser-Meyer-Olkin and Bartlett's Test.
Results. Based on the results of the research and the results of the data analysis that has been carried out, the following conclusions are obtained: First, the anthropometric factor that is the most dominant in determining the ability of volleyball jump service for male athletes in the UNS student activity unit is the length of the feet with a value of 0.879. Second, the biomotor factor that most dominantly determines the ability of volleyball jump service for male athletes in the UNS student activity unit is leg muscle power with a value of 0.864.
Conclusions. Anthropometric factors and biomotor factors that determine the ability of volleyball jump service to male athletes in the UNS student activity unit consist of seven factors, namely height, arm length, leg length, leg muscle power, abdominal muscle strength, arm muscle power and flexibility, togok.
Keywords: Ability, Jump Service, Volleyball

Анотація

Сетіван А.С., Крістіянто А., Пурнама С.К. Фактори, що забезпечують стрибучість в волейболі

Мета: це дослідження має на меті: 1) Визначити антропометричні фактори (зріст, довжина руки, довжина стопи), які найбільше визначають здібності чоловіків у стрибках з волейболу. 2) Визначити біомоторні фактори (сила м’язів ніг, сила м’язів живота, сила м’язів рук і плечей, координація очей та рук, гнучкість хребта та кінестетичне сприйняття), які найбільше визначають здатність чоловіків у забезпеченні стрибків у волейболі.

Матеріал і методи. У цьому дослідженні взяли участь спортсмени чоловічої статі з студентського відділу волейболу із загальною кількістю 36 осіб. Дизайн, використаний у цьому дослідженні, - це кількісний підхід, що використовує підтверджуючий факторний аналіз. Дані обробляли та аналізували за допомогою комп’ютеризованої статистичної програми із системою SPSS (Statistics Product and Service Solutions) версії 22 за допомогою тесту Кайзера-Мейєра-Олкіна та Бартлетта.

Результати. На підставі результатів дослідження та результатів проведеного аналізу даних було отримано наступні висновки: антропометричний фактор, який є найбільш домінуючим у визначенні здатності служби волейбольних стрибків для спортсменів-чоловіків, - це довжина стоп зі значенням 0,879. Біомоторним фактором, який найбільше визначає здатність служби стрибків з волейболу для спортсменів-чоловіків, є сила м’язів ніг зі значенням 0,864.

Висновки. Антропометричні фактори та біомоторні фактори, що визначають здатність волейбольного стрибка для спортсменів-чоловіків, складаються з семи факторів, а саме: довжини тіла, довжини руки, довжини ноги, сили м'язів ніг, сили м'язів живота, сили м'язів рук, гнучкості.

Ключові слова: вміння, забезпечення стрибків, волейбол

Аннотация

Сетияван А.А., Кристианто А., Пурнама С.К. Факторы, обеспечивающие прыгучесть в волейболе

Цель: это исследование направлено на: 1) Определение антропометрических факторов (рост, длина рук, длина стопы), которые в наибольшей степени определяют способность мужчин выполнять прыжки в волейболе. 2) Знание биомоторных факторов (сила мышц ног, сила мышц живота, сила мышц рук и плеч, координация глаз и рук, гибкость позвоночника и кинестетическое восприятие), которые в наибольшей степени определяют способность мужчин выполнять прыжки в волейбол.

Материал и методы. Все участники этого исследования состояли из спортсменов-мужчин, всего 36 человек. Дизайн, принятый в этом исследовании, представляет собой количественный подход с использованием подтверждающего факторного анализа. Данные обрабатывались и анализировались с использованием компьютеризированной статистической программы с системой SPSS (статистический продукт и сервисные решения) версии 22 и с использованием теста Кайзера-Мейера-Олкина и Бартлетта.

Результаты. На основании результатов исследования и результатов проведенного анализа данных сделаны следующие выводы: антропометрический фактор является наиболее доминирующим при определении способности выполнять волейбольный прыжок у спортсменов-мужчин. Единица активности - длина стопы со значением 0,879. Биомоторный фактор, который в наибольшей степени определяет способность выполнять волейбольный прыжок для спортсменов-мужчин, - это сила мышц ног со значением 0,864.

Выводы. Антропометрические и биомоторные факторы, которые определяют способность волейбольного прыжка к спортсменам-мужчинам, участвующим, состоят из семи факторов, а именно: рост, длина руки, длина ног, сила мышц ног, сила мышц живота, сила мышц рук и гибкость.

Ключевые слова: способности, обеспечение прыжков, волейбол

Introduction

In the volleyball game there are three types of service based on the position of the ball against the body including bottom service and top service [1], of the three types of service there are also several types of service variation techniques [2]. In line with the progress and developments experienced by the game of volleyball, one of the top service variation techniques that is enough to gain a lot of points up to 24% in one set in the table above namely the jump service [3], because this type of service will produce hard service hits and sharp dives so that it can makes it difficult for the opposing team to receive service [4].

Jump service is a service technique that is carried out by starting a jump like a smash but done outside the back line of the field [5]. In doing a jump service, the position of the prefix can vary depending on the player, you can use the prefix or without the prefix, if you are going to do a jump service without the prefix the factors that play a role are vertical jumps and proper coordination [6]. Meanwhile if you use the jump service prefix it takes about three to two steps behind the back line of service [7], this prefix is very useful for getting a good starting position for making jumps so as to get high jumps [8], with the right timing or timing, which is useful for hitting the ball hard and with the right time [9]. This blow will produce a top spin and also an inside spin, a server (the person who does the service) which has good anthropometric components and good biomotor abilities, which plays an important role in mastering the volleyball jump service technique [10]. With a rally point assessment, the volleyball game will be faster in completing one game but it will be longer if the game is balanced [11]. This means, training in basic jump service techniques in volleyball games that are carried out systematically, continuously and programmatically, if not supported by the supporting factors, there will be no maximum jump service basic technical skills [12].

Anthropometry is an inseparable factor in sports achievements [13]. Anthropometry is a study that is related to measuring the dimensions of the human body [14]. The field of anthropometry includes various measurements of the human body such as body weight, position when standing, when stretching the arms, body circumference, leg length and so on [15]. Having ideal body proportions plays an important role in supporting the appearance of a volleyball player, including mastering the jump service technique [16]. Because to carry out the jump service there are dominant anthropometric parts in it. By having ideal body proportions, you will be able to carry out these techniques better, more effectively and efficiently [17].

On the other hand, mastery of basic jump service techniques in volleyball games cannot be separated from the support of good biomotor abilities. Basically, biomotor ability is an ability that every human being is born with. Biomotor capability, which consists of several kinds of physical conditions, is very important to support basic jump service technical skills [18]. Biomotor is the ability of human movement which is influenced by the condition of the internal organ systems [19]. The internal organ systems in question include the neoromuscular system, respiration, digestion, blood circulation, energy, bones and joints. The basic components of biomotor include strength, endurance, speed, coordination, and flexibility [20] . As for the other components, it is a combination of various components so as to form one of its own terms, such as power is a combination of strength and speed, combined agility between speed and coordination. By knowing the biomotor ability level of a volleyball player, it will affect the mastery of techniques and it can be predicted that the player's ability to perform will be better in the future [21].

Each person's biomotor abilities play an important role in sports activities, including mastering basic jump service technical skills. The ability of biomotor plays a role in mastering basic jump service technical skills, because biomotor consists of several components of physical conditions that are very important for mastering basic jump service techniques in volleyball games [22]. Because when doing a jump service in a volleyball game, a server (the person doing the service) certainly involves or requires good physical condition. Based on this, it illustrates that, to carry out the basic technique of volleyball jump service requires several biomotor components. Based on all the components of the physical condition that have been mentioned, their maintenance and improvement cannot be separated from one another, so that the performance of an athlete in various sports can increase [23].

Anthropometric and bimotor factors can support the ability of volleyball jump service, because when doing jump service movements there are anthropometric and bimotor sections which include; height, arm length, foot length, leg muscle power, abdominal muscle strength, arm and shoulder muscle power, eye-hand coordination, togok flexibility and kinesthetic perception. This factor is a prerequisite for achieving achievement in volleyball [24]. However, it is not yet known which part of the dominant anthropometric and bimotor factors with the ability to jump service volleyball. To find out this, it is necessary to study and research in more depth, both theoretically and practically through anthropometric and bimotor tests and measurements of the ability of volleyball jump service [25].

At Sebelas Maret University (UNS) itself the game of football has developed so that it often participates in various competitions and hampionships between universities which are held at regional and national levels. From the results of field observations about the ability of men's volleyball jump service, the UNS Volleyball Student Activity Unit is quite good because from the matches that have been held, jump service is the most points gained in each match. The majority of jump service carried out by male volleyball players in the UNS Volleyball Student Activity Unit is directed to the opponent's area with weak passing abilities or to an empty area where the opponent's position is far apart so that the opponent is mistaken for receiving service and makes the opponent's attack not happen

Results

Based on the results of the research and the results of the data analysis that has been carried out, the following conclusions are obtained: First, the anthropometric factor that is the most dominant in determining the ability of volleyball jump service for male athletes in the UNS student activity unit is the length of the feet with a value of 0.879. Second, the biomotor factor that most dominantly determines the ability of volleyball jump service for male athletes in the UNS student activity unit is leg muscle power with a value of 0.864.

Table 1

Statistical description of an tropometric and biomotor factors that determine the ability of jump service volleyball student activity unit

Descriptive Statistics						
	N	Mini	Max	Sum	Mean	Std. Deviation
Height, cm	36	167	181	6251	173.64	3.331
Sleeve length, cu	36	69	82	2674	74.28	3.230
Foot Length, cu	36	24.0	28.0	926.5	25,736	1.0723
Limb Muscle Power, cu	36	58	83	2539	70.53	6,327
Abdominal Muscle Strength, cu	36	36	57	1781	49.47	5.374
Arm Muscle Power, cu	36	3.00	4.92	146.47	4.0686	0.47381
Eye-Hand Coordination, cu	36	9	19	473	13.14	2.307
Togok flexibility, cu	36	52	68	2212	61.44	4.039
Kinesthetic Perception, cu	36	1.0	6.0	119.0	3,306	1.1667
Volleyball Jump Service Ability, cu	36	21	43	1025	28.47	4.539

Source: Primary data processed (2020)

a. Height

Based on the research statistical descriptive table above, information is obtained about the anthropometric components, namely the height of the male athletes in the UNS volleyball student activity unit. The number of samples involved in the study was 36 people, the minimum value was 167, the maximum value was 181, the average value was 173.64 and the standard deviation value was 3.331.

b. Sleeve length

Based on the research statistical descriptive table above, information is obtained about the anthropometric component, namely the arm length of male athletes in the UNS volleyball student activity unit. The number of samples involved in the study was 36 people, the minimum value was 69, the maximum value was 82, the average value was 74.28 and the standard deviation value was 3,230.

c. Foot Length

Based on the descriptive table of research statistics above, information is obtained about the anthropometric component, namely the length of the feet of male athletes in the UNS volleyball student activity unit. The number of samples involved in the study was 36 people, the minimum value was 24, the maximum value was 28, the average value was 25.73 and the standard deviation value was 1.072.

d. Limb Muscle Power

Based on the descriptive statistical research table above, information is obtained about the biomotor components, namely the leg muscle power of male athletes in the UNS volleyball student activity unit. The number of samples involved in the study was 36 people, the minimum value was 58, the maximum value was 83, the average value was 70.53 and the standard deviation value was 6,327.

e. Abdominal Muscle Strength

Based on the descriptive statistical research table above, information is obtained about the biomotor component, namely the abdominal muscle strength of male athletes in the UNS volleyball student activity unit. The number of samples involved in the study was 36 people, the minimum value was 36, the maximum value was 57, the average value was 49.47 and the standard deviation value was 5,374.

f. Arm Muscle Power

Based on the descriptive statistical research table above, information is obtained about the biomotor component, namely the arm muscle power of male athletes in the UNS volleyball student activity unit. The number of samples involved in the study was 36 people, the minimum value was 3, the maximum value was 4.92, the average value was 4.06 and the standard deviation value was 0.473.

g. Eye-Hand Coordination

Based on the research statistical descriptive table above, information is obtained about the biomotor component, namely the eye-hand coordination of male athletes in the UNS volleyball student activity unit. The number of samples involved in the study was 36 people, the minimum value was 9, the maximum value was 19, the average value was 13.14 and the standard deviation value was 2.307.

h. Togok flexibility

Based on the research statistical descriptive table above, information is obtained about the biomotor components, namely the flexibility of male athletes in the UNS volleyball student activity unit. The number of samples involved in the study was 36 people, the minimum value was 52, the maximum value was 68, the average value was 61.44 and the standard deviation value was 4.039.

i. Kinesthetic Perception

Based on the research statistical descriptive table above, information is obtained about the biomotor component, namely the kinesthetic perception of male athletes in the UNS volleyball student activity unit. The number of samples involved in the study was 36 people, the minimum value was 1, the maximum value was 6, the average value was 3.30 and the standard deviation value was 1.166.

j. Volleyball Jump service ability

Based on the research statistical descriptive table above, information is obtained about the ability of men's volleyball athletes to jump service at the UNS volleyball student activity unit. The number of samples involved in the study was 36 people, the minimum value was 21, the maximum value was 43, the average value was 28.47 and the standard deviation value was 4.539.

The following will describe the results of the normality test for each variable:

1) Height (X1)

The results of the analysis on the height component obtained a value (Asymp. Sig (2-tailed)) of 0.156. It means that the probability value> 0.05 then Ho is accepted. So it is known that the data is normally distributed.

2) Arm length (X2)

The results of the analysis on the component of the arm length obtained a value (Asymp. Sig (2-tailed)) of 0.189. It means that the probability value> 0.05 then Ho is accepted. So it is known that the data is normally distributed.

3) Foot length (X3)

The results of the analysis on the long component of the foot obtained a value (Asymp. Sig (2-tailed)) of 0.062. It means that the probability value> 0.05 then Ho is accepted. So it is known that the data is normally distributed.

4) Power the leg muscles (X4)

The results of the analysis on the leg muscle power component obtained a value (Asymp. Sig (2-tailed)) of 0.200. It means that the probability value> 0.05 then Ho is accepted. So it is known that the data is normally distributed.

5) Strength of the abdominal muscles (X5)

The results of the analysis on the component of abdominal muscle strength obtained a value (Asymp. Sig (2-tailed)) of 0.200. It means that the probability value> 0.05 then Ho is accepted. So it is known that the data is normally distributed.

6) Power arm muscles (X6)

The results of the analysis on the power component of the arm muscles obtained a value (Asymp. Sig (2-tailed)) of 0.193. It means that the probability value> 0.05 then Ho is accepted. So it is known that the data is normally distributed.

7) Eye-hand coordination (X7)

The results of the analysis on the eye-hand coordination component obtained a value (Asymp. Sig (2-tailed)) of 0.103. It means that the probability value> 0.05 then Ho is accepted. So it is known that the data is normally distributed.

8) Flexibility togok (X8)

The results of the analysis on the togok flexibility component obtained a value (Asymp. Sig (2-tailed)) of 0.193. It means that the probability value> 0.05 then Ho is accepted. So it is known that the data is normally distributed.

9) Kinesthetic perception (X9)

The results of the analysis on the kinesthetic perception component obtained a value (Asymp. Sig (2-tailed)) of 0.142. It means that the probability value> 0.05 then Ho is accepted. So it is known that the data is normally distributed.

10) Volleyball jump service ability (Y)

The results of the analysis on the component of the volleyball jump service capability obtained a value (Asymp. Sig (2-tailed)) of 0.171. It means that the probability value> 0.05 then Ho is accepted. So it is known that the data is normally distributed.

Table 2

Summary of normality test results

Variable	N	Asymp. Sig (2-tailed)	Probability	Conclusion
Height (X1)	36	0.156	0.05	Data is normally distributed
Sleeve Length (X2)	36	0.189	0.05	Data is normally distributed
Foot length (X3)	36	0.062	0.05	Data is normally distributed
Power of limb muscles (X4)	36	0.200	0.05	Data is normally distributed
Abdominal muscle strength (X5)	36	0.200	0.05	Data is normally distributed
Power arm muscles (X6)	36	0.193	0.05	Data is normally distributed
Eye-hand coordination (X7)	36	0.103	0.05	Data is normally distributed
Togok flexibility (X8)	36	0.193	0.05	Data is normally distributed
Kinesthetic Perception (X9)	36	0.142	0.05	Data is normally distributed
Volleyball jump service ability (Y)	36	0.171	0.05	Data is normally distributed

Source: Primary data processed (2020)

a. The next step is to Linearity Test

test the linearity using the ANOVA method to find out whether each component of the variable has a linear relationship or not with a significance level of 0.05 as follows:

1) The results of the linearity test on the variable component of height obtained a significance value of 0.686. It is known that the value of 0.686> 0.05 so it can be concluded that there is a linear relationship between the height variable (X1) and the volleyball jump service ability variable (Y).

2) The results of the linearity test on the variable component of the arm length obtained a significance value of 0.420. It is known that the value is 0.420> 0.05, so it can be concluded that there is a linear relationship between the arm length variable (X2) and the volleyball jump service ability variable (Y).

3) The results of the linearity test on the variable component of foot length obtained a significance value of 0.398. It is known that the value of 0.398> 0.05 so it can be concluded that there is a linear relationship between the variable foot length (X3) and the variable volleyball jump service ability (Y).

4) The results of the linearity test on the variable component of leg muscle power obtained a significance value of 0.779. It is known that the value is 0.779> 0.05, so it can be concluded that there is a linear relationship between the leg muscle power variable (X4) and the volleyball jump service ability variable (Y).

5) The results of the linearity test on the variable component of abdominal muscle strength obtained a significance value of 0.349. It is known that the value of 0.349> 0.05 so it can be concluded that there is a linear relationship between the abdominal muscle strength variable (X5) and the volleyball jump service ability variable (Y).

6) The results of the linearity test on the variable component of arm muscle power obtained a significance value of 0.991. It is known that the value of 0.991> 0.05 so it can be concluded that there is a linear relationship between the arm muscle power variable (X6) and the volleyball jump service ability variable (Y).
7) The results of the linearity test on the component of the eye-hand coordination variable obtained a significance value of 0.409. It is known that the value is 0.409> 0.05, so it can be concluded that there is a linear relationship between the eye-hand coordination variable (X7) and the volleyball jump service ability variable (Y).
8) The results of the linearity test on the variable component of togok flexibility obtained a significance value of 0.686. It is known that the value is 0.864> 0.05, so it can be concluded that there is a linear relationship between the variable togok flexibility (X8) and the variable volleyball jump service ability (Y).
9) The results of the linearity test on the component of the kinesthetic perception variable obtained a significance value of 0.752. It is known that the value of 0752> 0.05 so that it can be concluded that there is a linear relationship between the kinesthetic perception variable (X9) and the volleyball jump service ability variable (Y).

Table 3

Summary of linearity test results

Variable	Linearity	Significance	Conclusion
X1Y	0.686	0.05	There is a linear relationship
X2Y	0.420	0.05	There is a linear relationship
X3Y	0.398	0.05	There is a linear relationship
X4Y	0.779	0.05	There is a linear relationship
X5Y	0.349	0.05	There is a linear relationship
X6Y	0.991	0.05	There is a linear relationship
X7Y	0.409	0.05	There is a linear relationship
X8Y	0.686	0.05	There is a linear relationship
X9Y	0.752	0.05	There is a linear relationship

Source: Primary data processed (2020)

Factor Analysis
X to Y Factor Analysis
Factor analysis 1

Table 4

Results of KMO and Bartlett's Test analysis of anthropometric and biomotor factors that determine the ability of jump service in UNS volleyball student activity units

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.748
Bartlett's Test of Sphericity	Approx. Chi-Square	217.408
	df	36
	Sig.	0.000

Source: Primary data processed (2020)

The table above shows the magnitude of the correlation between the independent variables measured to have a KMO value of 0.748 and a significance value of 0.000. If the KMO value> 0.5 and the significance value <0.05, there is a strong relationship

Based on the results of the above analysis, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy value is 0.747> 0.5 and a significance value is 0.000 <0.05, so it can be concluded that the variable components in the study are significant and can be processed to the next stage.

The table above shows the magnitude of the correlation between the independent variables measured to have a KMO value of 0.748 and a significance value of 0.000. If the KMO value> 0.5 and the significance value <0.05, there is a strong relationship

Based on the results of the above analysis, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy value is 0.747> 0.5 and a significance value is 0.000 <0.05, so it can be concluded that the variable components in the study are significant and can be processed to the next stage.

Factor analysis 2

Table 5

Results of KMO and Bartlett's Test analysis of anthropometric and biomotor factors that determine the ability of jump service in the UNS volleyball student activity unit

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.806
Bartlett's Test of Sphericity	Approx. Chi-Square	191,359
	Df	21
	Sig.	0.000

Source: Primary data processed (2020)

Based on the results of the analysis in the table above for 7 variables, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy value is 0.806 and a significance value of 0.000. If the Kaiser-Meyer-Olkin Measure of Sampling Adequacy value > 0.5 and the significance value <0.05, there is a strong relationship. The table above shows that the Kaiser-Meyer-Olkin Measure of Sampling Adequacy value is 0.747> 0.5 and the significance value is 0.000 <0.05, so it can be concluded that the 7 variable components in the study are declared significant and can be processed to the next stage.

The results of the analysis in the anti-image matrices correlation to II table showed that the seven variables, namely height had a value of 0.761, arm length had a value of 0.735, foot length had a value of 0.923, leg muscle power had a value of 0.931, abdominal muscle strength had a value of 0.632, Arm muscle power has a value of 0.945 and togok flexibility has a value of 0.711. The value of the seven variables has a Measure of Sampling Adequacy value > 0.5 so that it can be concluded that it meets the feasibility for further analysis.

The data from the anti-image matrices correlation analysis to the seven variables were declared feasible and then the testing stage was carried out using the extraction process using the principal component analysis method to produce the value of communalities which is presented in the following table 6.

The results of the communalities in the table above reflect the values provided that the greater the value of the communalities of a variable, the closer the relationship is to the formed variables. From these results the role of the largest dimension is the variable length of the arm with a value of 0.914 and the role of the smallest dimension is the power of the arm muscles with a value of 0.522. The seven variables have a value of communalities > 0.5, so it can be concluded that they can be tested using further factor analysis.

Table 6

Results of communalities analysis of anthropometric and biomotor factors that determine the ability of jump service in UNS volleyball student activity units

Factor	Initial	Extraction
Height	1.000	0.900
Sleeve length	1.000	0.914
Foot Length	1.000	0.866
Limb Muscle Power	1.000	0.590
Abdominal Muscle Strength	1.000	0.768
Arm Muscle Power	1.000	0.522
Togok flexibility	1.000	0.616

Discussion

Hypothesis testing is carried out to find the truth of the previous assumption whether the null hypothesis (H_0) proposed at a certain level of significance is rejected and the alternative hypothesis (H_a) is accepted, or vice versa, the null hypothesis (H_0) is accepted and the alternative hypothesis ($H_{a)}$) rejected. In order to obtain the results in making the hypothesis decision, this research was conducted by looking at the results of the calculation of the anti-image matrices correlation and the rotated component matrix [a]. Based on the submission of the hypothesis and the calculation of statistical factor analysis, the results of the hoptesis in this study are as follows:

a. Anthropometric factors, namely height, arm length and foot length determine the ability of the jump service at the UNS volleyball student activity unit.

1) Height determines the ability of volleyball jump service

The results of the analysis using the anti-image matrices correlation I method in table 4.6, namely the height factor obtained a value of 0.730 or> 0.5. The value of communalities in table 4.9, namely the height factor obtained a value of 0.900, which means that the height has a percentage of 90% of the role of the factor. The value of rotated component matrix [a] in table 4.10, namely the height factor obtained by a value of 0.910, which means that height is an anthropometric and biomotor factor that determines the ability of volleyball jump service (H1 accepted).

2) The arm length determines the volleyball jump service ability

The results of the analysis using the anti-image matrices correlation I method in table 4.6, namely the arm length factor obtained a value of 0.747 or> 0.5. The value of communalities in table 4.9, namely the arm length factor, obtained a value of 0.914, which means that the arm length has a percentage of 91% of the role of the factor. The value of the rotated component matrix [a] in table 4.10, namely the arm length factor, the value is 0.923, which means that the length of the arm is an anthropometric and biomotor factor that determines the ability of volleyball jump service (H2 is accepted).

3) The length of the foot determines the ability of the volleyball jump service.

The results of the analysis using the anti-image matrices correlation I method in table 4.6, namely the foot length factor obtained a value of 0.864 or> 0.5. The value of communalities in table 4.9, namely the foot length factor, obtained a value of 0.866, which means that the length of the feet has a percentage of 86% of the role of the factor. The value of rotated component matrix [a] in table 4.10, namely the foot length factor, obtained a value of 0.876, which means that the length of the foot is an anthropometric and biomotor factor that determines the ability of volleyball jump service (H3 accepted)

b. Biomotor factors, namely leg muscle power, abdominal muscle strength, arm muscle power, eye-hand coordination, togok flexibility and kinesthetic perception determine the ability to jump service at the UNS volleyball student activity unit.

1) Power the leg muscles

The results of the analysis using the anti-image matrices correlation I method in table 4.6, namely the leg muscle power factor obtained a value of 0.864 or> 0.5. The value of communalities in table 4.9, namely the leg muscle power factor, obtained a value of 0.590, which means that leg muscle power has a percentage of 59% of the role of the factor. The value of rotated component matrix [a] in table 4.10, namely the leg muscle power factor, has a value of 0.768, which means that leg muscle power is an anthropometric and biomotor factor that determines the ability to jump service for volleyball (H4 accepted).

2) Strength of the abdominal muscles

The results of the analysis using the anti-image matrices correlation I method in table 4.6, namely the abdominal muscle strength factor obtained a value of 0.682 or> 0.5. The value of communalities in table 4.9, namely the abdominal muscle strength factor, obtained a value of 0.768, which means that the abdominal muscle strength has a percentage of 76% of the role of the factor. But the value of the rotated component matrix [a] in table 4.10, namely the abdominal muscle strength factor, the value is -0.107. which means that abdominal muscle strength is an anthropometric and biomotor factor that determines the ability of volleyball jump service (H5 accepted).

3) Power the arm muscles

The results of the analysis using the anti-image matrices correlation I method in table 4.6, namely the arm muscle power factor obtained a value of 0.848 or> 0.5. The value of communalities in table 4.9, namely the arm muscle power factor, obtained a value of 0.522, which means that the arm muscle power has a percentage of 52% of the role of the factor. The value of rotated component matrix [a] in table 4.10, namely the arm muscle power factor, obtained a value of 0.630, which means that arm muscle power is an anthropometric and biomotor factor that determines the ability of volleyball jump service (H6 accepted).

4) Eye-hand coordination

The results of the analysis using the anti-image matrices correlation I method in table 4.6, namely the eye-hand coordination factor obtained a value of 0.473 or <0.5. Based on these results, the eye-hand coordination factor did not meet the feasibility for further analysis and an elimination process was carried out so that the hypothesis was rejected (H7 rejected).

5) Flexibility togok

The results of the analysis using the anti-image matrices correlation I method in table 4.6, namely the togok flexibility factor obtained a value of 0.710 or> 0.5. The value of communalities in table 4.9, namely the togok flexibility factor, obtained a value of 0.616 which means that the togok flexibility has a percentage of 61% of the role of the factor. The value of rotated component matrix [a] in table 4.10, namely the togok flexibility factor, obtained a value of 0.740, which means that togok flexibility is an anthropometric and biomotor factor that determines the ability of volleyball jump service (H8 accepted).

6) Kinesthetic perception

The results of the analysis using the anti-image matrices correlation I method in table 4.6, namely the kinesthetic perception factor obtained a value of 0.399 or> 0.5. Based on these results, the kinesthetic perception factor does not meet the feasibility for further analysis and an elimination process is carried out so that the hypothesis is rejected (H9 is rejected)

Conclusions

Based on the results of the research and the results of data analysis that have been carried out, the following conclusions are obtained: First, the anthropometric factor that most dominantly determines the ability of volleyball jump service for male athletes in the UNS student activity unit is the length of the feet with a value of 0.879. Second, the biomotor factor that most dominantly determines the ability of volleyball jump service for male athletes in the UNS student activity unit is leg muscle power with a value of 0.864. Third, anthropometric factors and biomotor factors that determine the ability to jump service volleyball in male athletes in the UNS student activity unit consist of seven factors, namely height, arm length, leg length, leg muscle power, abdominal muscle strength, arm muscle power and togok flexibility.

Conflict of interest

The authors declare that there is no conflict of interest.

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