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Comparison of Vertical Jump Test Measuring Instruments with Choronojump on the Explosive Power of Leg Muscles of Indonesian Badminton Elite Athletes

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Abstract

This research uses the Survey Research Method, a quantitative research type approach meaning research that is comparative or different. The population and sample in this study were 17 Indonesian Badminton Elite athletes consisting of male and female athletes. Data collection techniques using tests and measurements: physical condition tests; For leg muscle explosiveness by using a vertical jump measuring instrument and a chronojump. Data analysis using quantitative descriptive analysis techniques, overall data analysis using SPSS version 23. To obtain the results of this study, which is better the result of the explosive power of the leg muscles in Indonesian Badminton athletes using Vertical Jump and Chronojump. The results of this study showed that: There was a difference in the explosive power of the limbs in terms of the use of vertical jump and chronojump tools in Indonesian Badminton Elite athletes with an average value between the two groups, whereas in the vertical jump group with an average value of 40.91, the chronojump group with an average value of 45.47. This means that the chronojump group is better than the vertical jump group, this is evidenced by the results of descriptive analysis of the study with an average difference of 4.56. However, further research is recommended to pay attention to other physical factors, athlete psychology, and other factors that affect the achievements of elite Indonesian badminton athletes.

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INTRODUCTION

Physical condition is a very important element in almost all sports. Therefore, physical exercise needs serious attention, well planned, and systematically so that the level of physical freshness and functional ability of body tools is better. Strength is one of the important basic physical components because it relates to the quality of motion of an athlete. An athlete can move quickly, and can cope with certain loads, maintaining a stable body position requires good-quality muscle strength.

The element of good physical condition is one of the supports for the achievement of a sport, but not only that, basic technical skills become a supporting role for the achievement of an athlete's achievements. Mastery of good basic techniques and good physical condition for athletes must certainly be considered by a coach to deliver his athletes to the highest achievements.

Sports activities cannot be separated from human life, In sports each individual has different goals, some aim for achievement, physical freshness, and community/recreation. There are four basic human purposes for doing sports today. First, humans carry out their activities for society/recreation, namely humans who do sports only to fill leisure time, carried out full of joy, so that it is done casually and informally, both places, facilities, and regulations. Second, humans carry out sports activities for educational purposes, such as school children who are taken care of by sports teachers. Activities that are carried out formally, aim to achieve national education goals through sports activities arranged through a certain curriculum. Third, humans carry out sports activities to achieve a certain level of physical freshness. Fourth, humans who carry out certain activities to achieve optimal achievement. Sports that aim to achieve optimal achievement require a good and regular exercise program. There are so many sports that can be used as achievement sports, in principle to achieve optimal achievement goals in each sport, must be based on the principles of the sports science approach (Bompa and Buzzichelli 2019). The modern training principles of each sport require specificity. In M. Sajoto's opinion, four kinds of equipment need to be possessed, if someone will achieve an optimal performance. These completeness include: 1) Physical development (physical Build-Up), 2) Technical development (Technical Build-Up), 3) Mental development (Mental Build-Up), and 4) Champion Maturity (Sajoto (1995). Harsono (1988) said that 4 aspects of training need to be considered and trained carefully, namely physical training, technique, tactics, and mental. Conducting sports activities regularly and programmatically through sports achievements able to lift the dignity, dignity, and honor of the nation through sports achievements at the provincial, national, and international levels (Fachrezzy et al. 2020; Hermawan et al. 2021; Jariono & Subekti 2020). In this context, with the empowerment of sports, the sense of nationalism and national identity becomes clearer(Jariono, Nurhidayat, Nugroho, et al. 2021; Jariono, Nurhidayat, Sudarmanto, et al. 2021; Nugroho et al. 2021; Nugroho & Jariono 2023). Sports activities cannot be separated from human life, in exercising each individual has different goals, some aiming for achievement, physical freshness, and society (Act, 2022).

The aspect of physical exercise takes precedence because it is the foundation of a sport of achievement. Physical condition is a very important

element in almost all sports. Therefore, physical exercise needs serious attention, well planned, and systematically so that the level of physical freshness and functional ability of body tools is better. Strength is one of the important basic physical components because it relates to the quality of motion of an athlete. An athlete can move quickly, and can cope with certain loads, maintaining a stable body position requires good-quality muscle strength. Badminton achievements are not only determined by good massing and breeding, but at the elite level, athletes to be able to compete with other countries requires a technological approach and pays attention to the physical condition of athletes to achieve achievements in badminton. It is hoped that the answers related to the results of the research conducted will help contribute to the improvement of Indonesia's sports achievements. The purpose of this study was to determine the difference between vertical jump test measuring instruments and Chronojump in Indonesian Badminton Elite athletes.

METHODS

The research method used is the Survey Method using a Quantitative Comparative research type approach. The population in the study was the entire Indonesian Badminton Elite athletes who joined Cipayung.

Participants

The population and sample in this study were 17 Indonesian Badminton Elite athletes with sex characteristics of 9 sons and 7 daughters, using purposive sampling. This research will be conducted in Cipayung, East Jakarta in 2023.

Sampling Procedures

The sampling procedure in this study includes: (i) researchers selected a total sample from the Indonesian Badminton Elite Cipayung East Jakarta; (ii) after the sample is filled, the researcher and team then perform anthropometric tests and measurements and physical conditions; and (iii) samples taken as the basis for research.

Materials and Apparatus

This study used the following procedures: (i) the first stage researchers conducted tests and measurements of leg muscle explosive power (Power) with Vertical Jump and Chronojump test kits; (ii) researchers group and categorize data; and (iii) the test was conducted at the Indonesian Badminton Training Training, Cipayung, East Jakarta. Data analysis in this study used percentage descriptive analysis. After the data is obtained, then proceed to analyze the data to conclude this study using quantitative descriptive analysis techniques.

Procedures

This research was carried out at the Indonesian Badminton Training Center, Cipayung, East Jakarta. The sampling procedure in this study used total sampling. Data collection techniques using tests and measurements of leg muscle explosive power (power) perform vertical jump test measuring instruments with chronojump.

Design or Data Analysis

Data analysis in this study used comparative analysis. After the data is obtained, then proceed to analyze the data to conclude this study using comparative analysis techniques, and overall data analysis using SPSS version 23.

RESULT

1. Data validity and reliability
   Empirical data obtained through tests and measurements consisting of a comparison of vertical jump and chronojump test measuring instruments on the explosive power of the limb muscles of Indonesian Badminton Elite athletes using the validity and reliability test of research data as follows:

Table 1. Reliability of vertical jump and chronojump tools

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items
0,894	0,897

Crombach's alpha value above is 0.894 found in the interpretation of the correlation coefficient with an interval of 0.80 – 1.000 has a very high level of reliability. The value of the correlation coefficient is greater with r-table $_{N = 17}$ or the number of samples 17 with a level of 5% $\alpha = 0.05$ is 0.361, then the results of the test item data have a very strong level of reliability, or in other words, the data on the results of statement item items can be continued at the research stage.

2. Data description

Based on the results of descriptive frequency analysis of tests and measurements of height and weight physical condition consisting of average values and standard deviations can be seen in the following table:

Table 2. Results of descriptive analysis of vertical jump and chronojump tools

Statistic	Limb explosive power using tools	
	Vertical jump	Chronojump
N	17	17
Mean	40,91	45,47
Std. Deviation	8,29	9,26
Range	24,09	35,72
Minimum	28,21	27,76
Maximum	52,30	63,48
Sum	695,44	772,95

Based on the results of descriptive analysis of the data in Table 2, the comparison data of vertical jump and chronojump test measuring instruments on the explosive power of the limb muscles of Indonesian Badminton Elite athletes are: (1) Data on the results of leg explosive power in terms of the use of vertical jump tools in Indonesian Badminton Elite Athletes consisting of 17 athletes (n = 17) obtained the highest score of 52.30 and the lowest score of 28.21 obtained scores range of 24.09 with a total value of 695.44 for an average value of 40.91 and standard deviation of 8.29, and (2) Data on the results of limb explosive power in terms of the use of chronojump devices in Indonesian Badminton Athletes consisting of 17 athletes (n = 17) obtained the highest score of 63.48 and the lowest score of 27.76 obtained a range value of 35.72 with a total value of 772.95 for an average value of 45.47 and standard deviation of 9.26.

3. Data Normality Test

The research data that will be analyzed statistically must meet the requirements of analysis with an ANOVA statistical test, It is necessary to test the requirements for the relationship analysis comparison of vertical jump and chronojump test measuring instruments on the explosive power of the limb muscles of Indonesian Badminton Elite athletes in this study collected, then before statistical analysis is carried out for hypothesis testing, a requirements test is first carried out, namely normality with the Kolmogorov-Smirnov Z test.

Table 3. Recapitulation of Kolmogorov-Smirnov Z data normality test results

Statistics	Limb explosive power using tools	
	Vertical jump	Chronojump
N	17	17
Kolmogorov-Smirnov Z	0,173	0,186
Asymp. Sig. (2-tailed)	0,110	.200*

Based on Table 3 related to the value of Kolmogorov-Smirnov Z (KS-Z) in all data groups turned out to be greater than the value of $\alpha = 0.05$. Thus it can be concluded that the sample of this study came from a normally distributed population. This conclusion implies that parametric statistical analysis can be used to test the hypotheses proposed in this study.

4. Test the hypothesis

The analysis of variance used is a t-test at a significant level of 95% or α 0.05. This is intended to determine the comparison of vertical jump and chronojump test measuring instruments on the explosive power of the limb muscles of Indonesian Badminton Elite athletes. The results of hypothesis testing comparison of vertical jump and chronojump test measuring instruments.

Table 4. Recapitulation of the correlation coefficient significance test (t-test)

Variable	t-test	Sig.
Comparison of Vertical Jump and Chronojump Test Measuring Instruments	5,053	0,001

Based on the analysis of the t-test correlation coefficient in Table 4.10 above, a $t_{_count}$ value of 5.053 and $t_{_table\ (17\text{-}2(15);0.05)}$ of 1.812 was obtained. Based on these results, it can be concluded that the correlation coefficient (t-test) is a comparison of vertical jump and chronojump test measuring instruments significant or H_0 rejected and accepted H1. Thus, it can be concluded that the hypothesis of a comparison of vertical jump and chronojump test measuring instruments in Indonesian Badminton Athletes is accepted. This means that the coefficient can be generalized or applied to the population as a whole athlete in Badminton games where a sample of 17 people is taken.

DISCUSSION

Based on the analysis of the results of the analysis of the relationship between the two independent variables with one dependent variable in hypothesis testing, it needs to be studied further by providing an interpretation of the relationship between the results of the analysis achieved by the theories underlying this study. This explanation is needed to know the suitability of the theories put forward with the results of the research obtained comparing vertical jump and chronojump test measuring instruments.

The results of the hypothesis test show that there is a comparison of vertical jump and chronojump test measuring instruments on the explosive power of the leg muscles of Indonesian badminton athletes. This can happen because when maintaining power the need for good explosive power, the explosive power of the leg muscles is needed so that when jumping can hit the target with and have power so that it is easy to anticipate and not easily slammed by the opponent. Thus an athlete is expected to have good leg muscle explosiveness. From the results of testing this hypothesis, it can be stated that there is a comparison of vertical jump and chronojump test measuring instruments. The explosive power of leg muscles is a determining factor in various badminton sports and so on. Linking the theory above with the results of this study, it is very clear that

the explosive power of the leg muscles is related to the explosive power of the legs in Indonesian badminton athletes.

Limb muscle explosive power is one element of physical condition that has an important role in sports activities, both as a supporting element in a certain motion and the main element to achieve perfect motion techniques is explosive power(Forza and Edmundson 2019; Pueo et al. 2018; Pueo, Penichet-Tomas, and Jimenez-Olmedo 2020). Explosive power often referred to as muscular power is the power to use maximum force used in the shortest possible time(Cruvinel-Cabral et al. 2018; Patiño-Palma, Wheeler-Botero, and Ramos-Parrací 2022; Soler-López et al. 2022). Because the explosive power of leg muscles is one of the boi-motor components identified with explosive force (explosive strength), explosive power consists of (1) explosive power (explosive power), (2) fast explosive power (speed Power), (3) strong explosive power (strength power), and (4) long-lasting explosive power (endurance power)(Bompa and Buzzichelli 2019). Therefore, the explosive power of leg muscles is very important in determining the explosive power of the limbs in Indonesian badminton athletes.

Furthermore, the explosive power of leg muscles is a concern for every badminton athlete, so physiologically it will encourage leg explosiveness in Indonesian badminton athletes. Explosive power is a component of physical condition that can determine the results of a person's achievements in motion skills. The size of the explosive power is influenced by the muscles that attach and wrap the limbs(Ahmed, Saraswat, and Esht 2022; Gonçalves et al. 2021; Stepinski, Ceylan, and Zwierko 2020). The limbs are the lower part of the human body that functions to move the body, such as walking, running, and jumping. The occurrence of movement in the limbs is caused by the presence of muscles and bones, muscles as active means of movement, and bones as passive locomotion. Therefore, the explosive power of leg muscles is very important in determining the explosive power of the legs in Indonesian badminton athletes.

From the differences seen in the comparison of vertical jump and chronojump test measuring instruments in Indonesian badminton athletes, it is necessary to pay attention to every badminton athlete in training and competing, because physiologically it will produce leg explosive power in Indonesian badminton athletes who are better than before or more than the people around them. The explosive power of the leg muscles is a component. The physique that must be possessed by badminton game athletes, especially those related to the results of this study, is the explosive power of the limbs in Indonesian badminton athletes.

These results show that the comparison of vertical jump and chronojump test measuring instruments in Indonesian Badminton Elite athletes must have an indicator of increased leg muscle explosive power that supports maximum contraction in producing leg explosive power in Indonesian Badminton Elite athletes. What has been produced in this study, which shows the relationship between the explosive power of the legs in terms of the use of vertical jump and chronojump tools of Indonesian Badminton Elite athletes, is a reference in increasing the explosive power of the leg muscles of Indonesian Badminton Elite athletes.

CONCLUSION

The findings of this study can be concluded that one way to assess athletes' achievements is to know the physical profile of athletes, There is a comparison

of vertical jump and chronojump test measuring instruments in Indonesian Badminton Elite athletes. However, further research is needed related to the quality of physical fitness, environmental factors, psychosocial, athlete psychology, and related to improving athlete performance.

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