Analysis of Anthropometric Factors and Physical Conditions Determining Feeder Skills in Sepaktakraw

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Abstract

This study aims to analyze the anthropometric factors of physical conditions that have a dominant influence on the feeder's ability in sepaktakraw. This study applies a quantitative approach with an associative research type. Associative research aims to identify the relationship or influence between two or more variables. In this study, two types of statistical analysis were used, namely simple correlation tests and multiple linear regression tests. The research sample was taken using a purposive random sampling technique of 15 athletes. Data were collected through anthropometric tests, physical condition tests, and feeder tests in sepaktakraw sports. Furthermore, the data obtained were analyzed using the SPSS application. The results of this study indicate that the variables that do not significantly affect feeder skills with the partial test method (t-test) are height 0.858, body mass index 0.087, leg length 0.558, aerobic endurance 0.147. Thus, in this study the anthropometric factors that have a dominant influence on sepaktakraw feeder skills are the length of the sole of the foot, while the physical condition factor that has a dominant influence on sepaktakraw feeder skills is agility. This finding is expected to enable Central Java sepak takraw coaches to pay attention to the anthropometric components and physical conditions that have a dominant influence on improving sepak takraw performance.

Keywords: Anthropometry; physical condition; sepaktakraw feeder

Introduction

Sepaktakraw is played from basic to professional level because it has extraordinary technique, physical, tactics, and motivation (Padli et al., 2019). So, there are different characters at the level to cultivate each of these aspects. Of course, various organized training procedures are needed to improve the appropriate level of play. Basic skills in sepaktakraw must include several aspects and cannot stand alone. For example, in the basic technique of sepak takraw there is something called sepak sila, this requires internal defense skills (non-locomotor). Sepaktakraw has three positions tekong serves, Smasher smashes, and feeder passes the smash. In sepaktakraw, a pass is to serve the ball to a teammate and hope the ball can be smashed into the opponent's area (Pratama et al., 2017).

There are several passing techniques in sepaktakraw, including sepak sila, sepak kura, memaha, shoulder, and head, but almost all players today use sepak sila as their best passing technique (Hanafi, 2020). According to (Sitorus & Hasibuan, 2021) this technique is done by using the inside of the foot to hit the ball. In line with According to (Sulaiman et al., 2018) "Smash in takraw has a higher difficulty level compared to other techniques. Smash is one of the most important attack techniques and is a very decisive series". These techniques include: 1) basic techniques include, sepak sila, sepak kuda, memaha, mendada, heading, and shoulder. 2) Special/advanced techniques include, serve, receive serve, pass, smash, and block (Raharjo et al., 2021).

Anthropometry is concerned with the relationship between the structure and function of the human body, especially in the context of movement (Eston, 2016:82). So that anthropometry becomes an important part in determining the success of an athlete (Bandyopadhyay, 2007). In addition, the agility of foot movement with high frequency depends on the strength of the calf muscles (Bompa & Carrera, 2015:79). As well as (Ita, 2019) "The anthropometric structure is related to the measure of the athlete's ability to make movements related to the involved sport". Body proportions or anthropometry factors play an important role in achieving success. According to (Tur & Bibiloni, 2019) anthropometry refers to body measurements such as height, weight, circumference, and creases.

Physical factors such as height, weight, sitting height, upper and lower limb length, and body type affect sports performance (Furqon, 2000:41). Thus, anthropometry plays an important role in the relationship between body characteristics and sports performance (Thirumagal, 2013). As time goes by and based on age, the anthropometric conditions of a person will change and follow the development of human movement. This requires always taking anthropometric measurements before starting an activity and even after doing the movement. Anthropometric measurements are a series of quantitative measurement activities to assess body composition (Casadei & Kiel, 2021:79).

Feeder in sepaktakraw, the task is very difficult because you have to control the field, tame the ball from the opponent's serve or smash, and give a good pass to the smasher. The series of passing movements requires ideal height and weight to get unhindered acceleration (Hanif, 2015:39). The ability of the feeder in sepaktakraw requires good physical condition. Physical factors determine sepaktakraw skills which include, endurance, speed, coordination, skill, balance, strength, agility, and flexibility, as well as the ability to serve, pass, and smash

(Hidayat et al., 2016). According to (Ardhi & Asim, 2022) that with the appropriate physical condition and the role of movement, it has an impact on the function and system of the organism.

In a sports activity, athletes are required to complete various physical tasks in order to achieve optimal results (Brewer, 2009:102). Speed is the ability to move in a short time, it can also be interpreted as a person's ability to cover a distance quickly (Banister, 2011). Feeders who have better speed capabilities will seem a little less likely to make mistakes when feeding (Mason et al., 2005). Based on the background of the problem that has been described above, the author wants to conduct a study with the title "Anthropometric Factors and Physical Conditions Determining the Ability of Sepaktakraw Feeders in Central Java in 2024".

Method

This study applies a quantitative approach with an associative research type. The purpose of this study is to identify the relationship between two or more variables. According to (Sugiyono, 2017:44), the correlation technique is suitable for use when the data is on an interval or ratio scale and has a normal distribution. The population used in this study was all male sepak takraw athletes from Central Java who play the feeder position. The total population in this study was 73 athletes. The sampling technique used purposive random sampling, which is a method of taking samples intentionally according to the sample requirements needed by considering the considerations made by the researcher.

This research was conducted at the Central Java PPLOP Center located in the Jatidiri Area, Karangrejo Village, Gajahmungkur District, Semarang City. Data collection was conducted on Central Java sepaktakraw feeder athletes, totaling 15 people. Methods for measuring dominant variables of anthropometric and biomotor factors in sepaktakraw games. The data collection technique is carried out through tests and measurements, tests are carried out to determine height, weight, body mass index, leg length, stride length, speed, agility, balance, leg muscle power, aerobic endurance and anaerobic endurance. The type of correlation used is Pearson Product Moment developed by Karl Pearson. The collected data was processed and analyzed using a Computerized Statistics Program with the SPSS (*Statistical Product and Service Solutions)* Version 23 system.

Table 1. IMT Classification

Klasifikasi		Indeks Massa Tubuh (IMT)
Kurus	Berat Ringan	<17,0
	Ringan	17,0 – 18,4
Normal		18,5 – 25,0
Gemuk	Ringan	25,1 – 27,0
	Berat	>27

Table 2. Speed (20m run)

Kriteria	Waktu
Baik Sekali	<2,89
Baik	3,18 – 2,90

Cukup	3,33 – 3,19
Kurang	3,47 – 3,34
Kurang Sekali	>3,48

Table 3. Agility (agility court)

Kriteria	Waktu
Baik Sekali	<6,54
Baik	10,75 – 6,55
Cukup	12,86 – 10,76
Kurang	14,97 – 12,87
Kurang Sekali	>14,98

Table 4. Balance (stroke stance test)

Kriteria	Waktu
Baik Sekali	> 51
Baik	37 - 50
Sedang	15 - 36
Kurang	5 - 13
Kurang Sekali	< 4

Table 5. Lower limb muscle power (vertical jump)

Kriteria	Waktu
Baik Sekali	>68
Baik	59 – 67
Cukup	54 – 58
Kurang	49 – 53
Kurang Sekali	<48

Table 6. Aerobic endurance (MFT)

Kriteria	Waktu (ml/kg/min)
Baik Sekali	>53,5
Baik	47,3 – 53,4
Cukup	44,2 – 47,2
Kurang	41,1 – 44,1
Kurang Sekali	<41,0

Table 7. Anaerobic endurance (RAST)

Nilai	Kategori
0 – 4	Bagus Sekali
4.1 – 10	Bagus
10.1 – 15	Cukup
15.1 – 20	Kurang
>21	Sangat Kurang

Table 8. Sepaktakraw feeder test

Kriteria	Nilai
Baik Sekali	>25

Baik	20-24
Cukup	15-19
Kurang	10-14
Sangat Kurang	<9

Results

The findings in this study were obtained through tests and measurements of primary data that included anthropometric factors and physical condition factors as independent variables and sepaktakraw feeder skills in male sepaktakraw athletes in Central Java as dependent variables. The data were then processed and analyzed using the KMO and Barlett's Test methods. Data calculations were carried out using correlation tests, partial tests (t-tests), Simultaneous Tests (f-tests) and Coefficient of Determination (R2) tests. The results of the analysis of male sepaktakraw feeder athletes in Central Java are described in the following table:

Table 9. Linear correlation test of anthropometric factors

Variable X	Correlation Feeder (Y) Coefficient Pearson Correlation (r)	Sig. Value
Height	0.074	0.396
Weight	0.397	0.071
Body Mass Index	0.677	0.003
Leg Length	-0.360	0.094
Foot Length	0.570	0.013

Based on the table, it shows that the anthropometric factor of the BMI variable has the strongest and most significant degree of closeness to feeder skills with a Pearson correlation value of 0.677 and a sig. value of 0.003, followed by the length of the sole of the foot with a Pearson correlation value of 0.570 and a sig. value of 0.013. Both of these variables have a statistically significant level of closeness to feeder skills. While the weight variable has a weak and approaching significant relationship, but is not yet statistically convincing with a Pearson correlation value of 0.397 and a sig. value of 0.071. As for height with a Pearson correlation value of 0.074 with a sig. value of 0.036, leg length with a Pearson correlation value of 0.-360 and a sig. value of 0.094 shows a very weak and insignificant relationship.

Table 10. Linear correlation test of physical condition factors

Variable X	Correlation Feeder (Y) Coefficient Pearson Correlation (r)	Sig. Value
Speed	0.234	0.201
Balance	0.355	0.097
Agility	0.727	0.001
Leg Muscle Power	0.209	0.228
Aerobic Endurance	0.029	0.459
Anaerobic Endurance	0.019	0.474

Based on the table above, it shows that the physical condition factor of the agility variable has the strongest and most statistically significant degree of closeness to feeder skills with a Pearson correlation value of 0.727 and a sig. value of 0.001.

Table 11. Partial test (t-test) of anthropometric factors on feeder skills

Anthropometry	Coefficients Standardized Coefficients Beta	T	Sig.
Height	0.026	0.184	0.858
Weight	0.607	3.733	0.005
Body Mass Index	0.320	1,920	0.087
Leg Length	0.099	0.608	0.558
Foot Length	0.715	3,872	0.004

In the multiple linear regression analysis test, based on the partial test coefficients table (t-test), it is known that the variables of the anthropometric factors, namely the length of the sole of the foot and body weight, provide a sig. < 0.05 so that these variables are said to have a significant effect on feeder skills. In the variables of height, BMI and leg length statistically provide sig. > 0.05 so that there is no significant effect on feeder skills.

Table 12. Partial test (t-test) of physical condition factors on feeder skills

Anthropometry	Coefficients Standardized Coefficients Beta	T	Sig.
Speed	0.479	3.006	0.017
Balance	0.427	2,788	0.024
Agility	0.703	4,518	0.002
Leg Muscle Power	0.550	2,480	0.038
Aerobic Endurance	0.320	1,608	0.147
Anaerobic Endurance	0.649	3.280	0.011

In the multiple linear regression analysis test, based on the partial test coefficients (t-test), it is known that the physical condition factor of the variables of agility, speed, balance, leg muscle power and anaerobic endurance with a sig. value < 0.05, then the variable is mentioned significantly influence feeder skills. While the anaerobic endurance variable statistically does not have a significant effect on feeder skills because the sig. value > 0.05.

Table 13. Simultaneous test (f test) of anthropometric factors on feeder skills

Anova Model	F	Sig.
Regression	8,877	0.003

Based on the table, the F value is 8.877 with a value of 0.003 < 0.05. The predictor variables simultaneously have a significant effect on the dependent variable feeder.

Table 14. Simultaneous test (f test) of physical condition factors on feeder skills

Anova		
Model	F	Sig.
Regression	10,473	0.002

Dependent Variable: Feeder
Independent Variables:
Speed, Balance, Agility, Leg
muscle power, Aerobic
endurance, Anaerobic
endurance

Based on the table, the F value is 10.473, significant at 0.002 < 0.05. The predictor variables simultaneously affect the dependent variable feeder.

Table 15. Determination coefficient of anthropometric factors

Model Summary Anthropometry	
R	R Square
.912	90.2%

The R value result of 0.912 shows a very strong relationship between the combination of the five independent variables from the anthropometric factor and the dependent variable feeder. The R Square (R^2) value = 0.902 means that 90.2% of the variation in the feeder variable can be explained by the five predictor variables simultaneously. The rest (100% - 90.2% = 9.8%) is explained by other factors outside the model.

Table 16. Determination coefficient of physical condition factors

Model Summary Physical Condition	
R	R Square
.942	91.1%

The results in the R value table of 0.942 indicate a relationship between the combination of the five independent variables of the physical condition factor and the dependent variable of the feeder. The R Square (R^2) value = 0.911 means that 91.1% of the variation in the feeder variable can be explained by the five predictor variables simultaneously. The rest (100% - 91.1% = 8.9%).

Discussion

Based on data analysis and hypothesis testing, the anthropometric factors and physical condition factors that determine the feeder skills of sepak takraw athletes can be described as follows:
1) Weight

Body weight is one of the important components in sepaktakraw. An athlete is required not to have excess body weight, this is because if the player has a fat or obese body weight, the athlete will have difficulty in doing the feeder movement in sepaktakraw and this will reduce the success in doing the feeding movement on the sepaktakraw feeder. Excess weight or overweight in sepaktakraw will greatly affect the athlete's performance on the field. This is related to the characteristics of sepaktakraw which requires instant fast movements so that it requires a body weight condition that supports the fast movement.

Research by (Azhar et al., 2023) entitled analysis of anthropometric factors and physical conditions determinants of back service ability in sepaktakraw game, which examines this research analyzes the anthropometric factors and physical conditions that predominantly influence the ability to perform a back serve in sepaktakraw games. The results of the study show that the ability to perform a back serve is predominantly influenced by anthropometric factors, namely height and leg length, as well as physical condition factors including speed, flexibility, leg muscle strength, and balance. have similarities in several aspects but there are differences in the research methods and samples used

2) Foot Length

Biomechanically, the size of the sole of the foot can affect the improvement of sepaktakraw athlete performance, especially feeders. This condition is related to the working principle of the lever which provides benefits, both in terms of the efficiency of energy use to produce greater force and in obtaining speed and wider range of motion. In sepaktakraw feeder movements, the length and width of the sole of the foot can affect the results of contact with the ball. If the sole of the foot has a long and wide size, then the chance of contact with the ball will be greater. This makes it very easy for the feeder to process the ball. In addition, the length of the sole of the foot also plays a role in the initial push movement.

Research by (Hidayat et al., 2016) entitled anthropometric and biomotor factors determining sepaktakraw skills of male athletes in the central java PON, which examines the anthropometric and biomotor factors that determine sepaktakraw skills. The results of the study indicate that several anthropometric factors that have been proven to influence skills in sepaktakraw include body weight, leg length, and leg muscle strength. have similarities in several aspects but there are differences in the research methods and samples used.

3) Speed

Speed is a person's movement skill that is done briefly. Speed is the most important component needed to always be able to display superior abilities in sports. Speed is related to strength where if an athlete has a good level of strength then he will get the desired level of speed ability. A player who has good speed will be able to make short movements compared to the abilities of other players. When making a passing movement, a feeder who has a good level of speed will be able to produce explosive movements very quickly and this will increase success in doing the feeder.

4) Balance

One thing that cannot be ignored in sports activities is balance. In addition, balance can also be a support in mastering the skills of feeder movements in sepaktakraw. Balance

is the ability of an individual to maintain the stability of his body, both when in a moving position (dynamic) and in a static position. As when doing a sepaktakraw pass, here a high balance is needed in maintaining the center of gravity so as not to fall easily when doing a pass movement using one leg. So that it can avoid sports injuries. According to research from (Jaya, 2017) balance can control and maintain body position, both when performing various types of movements and when in a stationary state. This research has similarities in one of the variables measured, but there are differences in other variables, samples, methods and analysis of results

5) Agility

Agility is a skill in changing different directions without losing balance. Agility is very much needed in the sepaktakraw feeder position. In sports games, there are often changes in direction on the objects being played. This will emphasize the need for athletes to have good agility. So that they will be able to move according to the desired direction. Agility plays an important role in sepaktakraw in performing various techniques. Unpredictable movement patterns in sepaktakraw require a feeder to have good agility. In sepaktakraw games, there are often difficult ball positions. From here, having good agility will make it easier to practice movements in difficult conditions without falling. Good agility can provide convenience when moving in all directions quickly and precisely.

6) Leg Muscle Power

Power is the main element in all sports that require high-speed movement and technical skills. The passing movement in sepaktakraw really needs the power component to be able to produce optimal passing results. Power is the key point to optimize the feeder's passing technique ability. This refers to the passing movement that requires rapid acceleration in approaching and kicking the ball. A player with good leg power will be able to do high explosives, thus the feeder can overcome balls that are not clear where they are going to produce a good short pass. According to (Gamble, 2010:112) increasing the involvement of power generators in muscle capacity will further increase acceleration and speed. This study has similarities in the measured muscle variables and data collection techniques, but has differences in several other variables, such as time, samples, and data analysis.

7) Anaerobic Endurance

Anaerobic endurance is the ability of the body's organism to minimize fatigue caused by the level of load that occurs anaerobically. In addition, it has the characteristics of high-intensity training where in its implementation it requires adenosine triphosphate (ATP) which is processed repeatedly more quickly compared to the aerobic energy system. The feeder is required to have good consistency in making passes from the beginning to the end of the match because sepaktakraw sports are increasingly experiencing improvements in terms of technical abilities such as varied defensive and attacking abilities. This type of endurance is closely related to the efficiency of the cardiovascular and respiratory systems in providing the oxygen and energy substrates needed by muscles to sustain physical activity (Liu et al., 2018). This study has similarities, namely examining leg muscle strength, but differs in the samples used and the research methodology.

Conclusion

Based on the results and discussion, it can be concluded that the anthropometric factor that has a dominant influence on determining feeder skills in sepaktakraw is the length of the sole of the foot with an effective contribution of 40.75% and a relative contribution of 45.1%. The total contribution of the five anthropometric factor variables to feeder skills reaches 90.27%, indicating that this model has very good predictive power and only 9.73% of the variation in feeder skills is influenced by other anthropometric factors. Meanwhile, the physical condition factor that has a dominant influence on determining feeder skills in sepaktakraw is agility with an effective value of 51.10% and a relative value of 56.0%. The total contribution of the five physical condition factor variables to feeder skills reaches 91.13%, indicating that this model has very good predictive power and only 8.87% of the variation in feeder skills is influenced by other physical condition factors.

Author's Statement

The author declares truthfully that this article is the result of original research, free of plagiarism, and has not been published elsewhere. All data and analysis are carried out objectively and can be accounted for according to academic principles.

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