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Analysis of Limb Muscle Power of Male and Female Basketball Athletes KONI Madiun City Year 2024

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Abstract

The Madiun City has a myriad of athletes, in this case basketball athletes. Both male athletes and female athletes are all mentored and trained. The purpose of this study was to find scientific data on the leg muscle power of male and female basketball athletes at KONI Madiun City. This research method uses quantitative methods with an experimental approach with a one shoot model design. The target of this study involved 10 male athletes and 10 female athletes. The test instrument used is the Vertical Jump Test. The results showed that the power produced by male basketball athletes showed a minimum power of 301 Joules, and a maximum power of 429 Joules with an average power of 365.47 Joules. While the power produced by female basketball athletes shows a minimum power of 169 Joules, and a maximum power of 255 Joules with an average power of 206.51 Joules. With the conclusion, in Men's Basketball Athletes there are 1 person in the excellent category, 8 people in the good category, and 1 person in the moderate category. Meanwhile, in Female Basketball Athletes, there are 1 person with a good category, 5 people with a moderate category, and 4 people with a less category.

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INTRODUCTION

Based on the notification letter from KONI (Indonesian National Sports Committee) regarding the measurement of the physical condition of basketball athletes in 2024 to Universitas PGRI Madiun, Universitas PGRI Madiun conducted tests and measurements of the physical condition of athletes to evaluate the athletes' biomotor skills, which is also based on the opening of the Republic of Indonesia Law Number 11 of 2022, in order to improve the quality of human life and human welfare, national development in the field of sports is carried out systematically, planned, integrated, and sustainable, and oriented towards the welfare of sports players, then equal access and sports infrastructure are fulfilled by the government (Keolahragaan, 2022). Sports achievements in Indonesia must be improved in order to make the nation proud. Sports achievements at the international level will bring the good name of the nation in the international arena, while sports achievements at the regional level, will make their respective regions proud. Kemenpora or the Ministry of Youth and Sports assisted by other agencies, namely KONI (Indonesian National Sports Committee) which stands for the Indonesian National Sports Committee, is tasked with fostering sports achievements at the National and Regional levels in all sports achievements.

One of them is KONI Madiun City, the parent organisation in Madiun City is responsible for the progress of the achievements of its athletes who in fact want to have high competitiveness with KONI in other cities. So that Madiun City KONI held a Physical Condition Test and Measurement for Madiun City Basketball athletes in collaboration with the PGRI Madiun University Sports Science Study Program as the implementer. One of the biomotor components that has become urgent is Power. In (McBride, 2017) ‘Power is defined as the rate of performing work and is a product of force and displacement’ or can be interpreted as strength x speed. Meanwhile, according to (Natera et al., 2020), power can be defined ‘as the maximum rate of work produced per unit time or the greatest product of instantaneous force and velocity’.

Power training is divided into two, namely power training for upper extremities and for lower extremities. To increase the power capacity of the upper extremities, special exercises are carried out. According to (Soriano et al., 2017) in his research entitled ‘The Optimal Load for Maximal Power Production During Upper-Body Resistance Exercises: A Meta-Analysis’ mentions extraordinary results, namely “moderate loads from 30 to 70% of 1RM appear to provide the optimal load for peak power and mean power in the bench press exercise” it can be interpreted that training with moderate loads (from 30 to 70% of 1RM) can provide the optimal load to achieve peak power and average power in bench press exercises. In a study conducted by (Utomo et al., 2024) with the title ‘The Effect of Combined Method Training

Circuit Training Plyometric on Power and Strength' showed a significance result of 0.000 < α 0.05, which means that there is an increase in explosive power before and after giving exercise treatment in the form of a combination of training methods CTP (Circuit Training Plyometric).

Power is very important to measure, even so in Madiun City KONI Basketball athletes who conduct tests and measurements of biomotor power components to determine the extent of the power of the leg muscles of basketball athletes in Madiun City KONI.

METHODS

The type of research used in this research is quantitative descriptive research, which explains a phenomenon through data in the form of numbers and images in the form of charts, graphs, or the like. This population research method was used because the population of male and female basketball athletes only numbered 20 people.

Participants

The population used in this study were all Madiun City KONI Male and Female Basketball Athletes in 2024 with details of 10 male athletes and 10 female athletes.

Sampling Procedures

This research is population research, which uses all the population as the object under study (sample). That is 20 participants.

Materials and Apparatus

The test instrument used in this study is a vertical jump test which has units of centimetres, the materials needed are a vertical jump board, chalk, meter, recording device, and tester. Then then the results of the vertical jump test are converted into joules using the following formula:

$$P = \frac{U}{\Delta t}\ P = \frac{F\ (d)}{\Delta t}$$

$$P = \frac{m.g.d}{t} = \text{Joule/detik}$$

Description:

P = Power
m = body mass (Kg)
g = Gravity (9.8(m)⁄s2)
d = Distance travelled (metres)
t = Time taken to cover the distance (seconds) (Setyawan, 2017)

Procedures

The procedure for doing the vertical jump test is, first the athlete stands upright in front of the vertical jump board with one of the hands closest to the wall raised up to find mark 1 with chalk coated on his hands. Then the athlete jumps as high as possible to reach a height by attaching the hand to the vertical jump board which is considered mark 2. Then mark 2 is subtracted from mark 1, then the jump results appear in centimetres.

Design or Data Analysis

The approach used in connection with this research problem is a one shot model, which means an approach model that uses one time data collection at a time

(Arikunto, 2019) The research location is at GOR (Sports Arena) Cendekia PGRI Madiun University, Jalan Margatama, Madiun City.

The classification of athletes' upright jumps can be determined in the norms set by experts. The vertical jump norm used will be displayed in the following table:

Table 1. ***Vertical Jump Norm***

Gender	Very Good	Good	Average	Poor	Very Poor
Male	> 65	50 – 65	40 – 49	30 – 39	< 30
Female	> 58	47 – 58	36 – 46	26 – 35	< 26

(Mackenzie, 2015)

RESULT

Power Measurement Data of Men's Basketball Athletes

The following will display data on the measurement of leg muscle power of Madiun City KONI Men's Basketball athletes along with the height of the jump made with the vertical jump instrument in table 2 below:

Table 2. Raw Data on Jump Height and Limb Muscle Power of Men's Basketball Athletes

No	Name	Body Mass (Kg)	Jump Height (Cm)	Power (*Joule*)	Clasification
1	ESB	65.8	63	410.4	**Good**
2	GP	56.3	54	300.9	**Good**
3	NR	65.7	49	318.7	**Average**
4	MBAD	58.1	69	396.8	**Very Good**
5	LABD	63.4	51	320.1	**Good**
6	FAPP	65.8	57	371.3	**Good**
7	RCL	65	57	366.8	**Good**
8	BDP	63.4	62	389.1	**Good**
9	YAL	78.8	55	429.0	**Good**
10	SSP	60.2	59	351.6	**Good**

Power Measurement Data of Women's Basketball Athletes

The following will display data on the measurement of leg muscle power of Madiun City KONI Women's Basketball athletes along with the height of the jump made with the vertical jump instrument in table 2 below:

Table 3. Raw Data on Jump Height and Limb Muscle Power of Women's Basketball Athletes

No	Name	Body Mass (Kg)	Jump Height (Cm)	Power (*Joule*)	Clasification
1	SA	49.9	38	187.7	**Average**
2	CKT	53.6	42	222.8	**Average**

3	FPN	46.9	37	171.8	**Average**
4	JCS	54.8	47	255.0	**Good**
5	KWA	53.4	45	237.9	**Average**
6	CAW	65.5	30	194.5	**Poor**
7	ART	54	44	235.2	**Average**
8	KK	58.5	32	185.3	**Poor**
9	KR	80.1	26	206.2	**Poor**
10	MCC	48.7	35	351.6	**Poor**

Descriptive Data of Men's Basketball Athletes

The following table will show descriptive statistics of vertical jump data with centimetres in Madiun City KONI men's basketball athletes.

Table 4. Descriptive Data of Vertical Jump of Men's Basketball Athletes in Centimetre Units

Descriptive Statistics (Cm)					
	N	Minimum	Maximum	Mean	Std. Deviation
Male_Cm	10	49	69	57.60	5.948
Valid N (listwise)	10				

Based on table 4 above, it can be seen that the average leg muscle power of Madiun City KONI Putra Basketball athletes is 57.60 cm, with a standard deviation of 5.948, as well as a minimum jump of 49 cm, and a maximum jump of 69 cm. Furthermore, from the data that has been displayed above, the data will be converted into units of power, namely joules, and the results will be seen in table 5 below:

Table 5. Descriptive Data of Conversion in Joule Units

Descriptive Statistics (Dalam *Joule*)					
	N	Minimum	Maximum	Mean	Std. Deviation
Male_Joule	10	301	429	365.47	42.476
Valid N (listwise)	10				

Based on table 5 above, it can be seen that the average leg muscle power of Madiun City KONI Putra Basketball athletes with power is 365.47 Joules, with a standard deviation of 42.476, as well as a minimum jump with power of 301 Joules, and a maximum jump with power of 429 Joules. In order to make it easier to read the data, the data above will be displayed into a data graph that looks like the following:

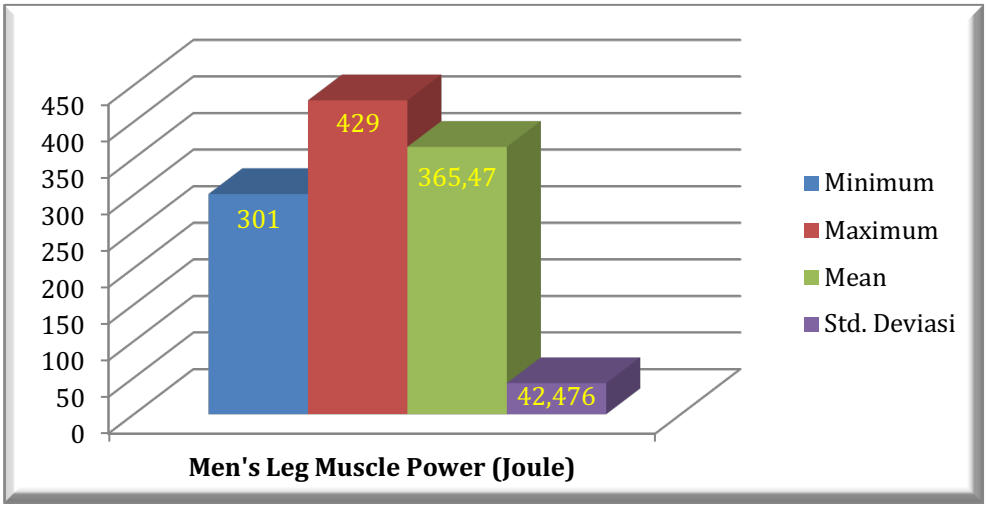

Fig 1. Graph of Conversion Data in Joule Units (Male)

Descriptive Data for Women's Basketball Athletes

The following table will show descriptive statistics of vertical jump data with centimetres in Madiun City KONI Women's Basketball athletes.

Table 6. Descriptive Data of Vertical Jump Female Basketball Athletes in Centimetres Units

Descriptive Statistics (Cm)					
	N	Minimum	Maximum	Mean	Std. Deviation
Female_Cm	10	26	47	37.60	6.947
Valid N (listwise)	10				

Based on table 6 above, it can be seen that the average leg muscle power of Madiun City KONI Women's Basketball athletes is 37.60 cm, with a standard deviation of 6.947, and a minimum jump of 26 cm, and a maximum jump of 47 cm. Furthermore, from the data that has been displayed above, the data will be converted into units of power, namely joules, and the results will be seen in table 4 below:

Table 7. Descriptive Data Conversion in Joule Units

Descriptive Statistics (Dalam Joule)					
	N	Minimum	Maximum	Mean	Std. Deviation
Female_Joule	10	169	255	206.51	29.828
Valid N (listwise)	10				

Based on table 7 above, it can be seen that the average leg muscle power of Madiun City KONI Women's Basketball athletes with power is 206.51 Joules, with a standard deviation of 29.828, as well as a minimum jump with power of 169 Joules, and a maximum jump with power of 255 Joules. In order to make it easier to read the data, the data above will be displayed into a data graph that looks like the following:

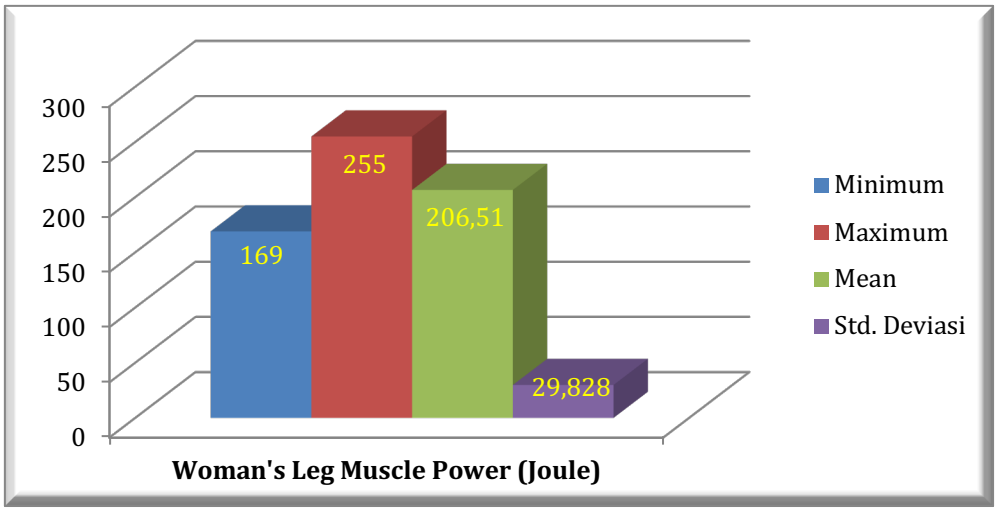

Fig 2. Graph of Conversion Data in Joule Units (Female)

DISCUSSION

From the results of the analysis conducted in depth, it can be seen that the power produced by male basketball athletes shows a minimum power of 301 Joules, and a maximum power of 429 Joules with an average power of 365.47 Joules. While the power produced by female basketball athletes shows a minimum power of 169 Joules, and a maximum power of 255 Joules with an average power of 206.51 Joules. Maximum muscle strength can be achieved at the age of 25-48 (Sapti, 2018). This is because the formation of muscle cells is perfect at around 25-48 years of age. There is a decrease in muscle power when age reaches above 48 years. But of course this varies from person to person, depending on the habits he does. Meanwhile, the average age of Madiun City KONI Basketball athletes ranges from 20-23 years, which means that the maximum muscle strength of these athletes can still be maximised in the future by practicing using training methods that are relevant to the development of their biomotor power.

Power development can also be done from an early age (Zelenovic & Singh, 2023), increasing explosive power can also be done for 4 weeks, by providing a plyometric training programme method (Kreyziu et al., 2019). Not only that, but training with the plyometric training method is also able to increase explosive power, sprints, and agility of basketball players (Aksovic et al., 2021). Power enhancement training can also be done for 12 weeks at the age of 17-18 years (Bujar Begu, Artan Kryeziu, 2017). Development of leg muscle explosive power in basketball athletes, can be realized through planned or programmed, rational and well-organised training (Aksovic, Kocic, et al., 2020). Basic principles and practical strategies to return athletes to high performance also need to be applied (Maestroni et al., 2020).

In (Shalom et al., 2023) it was also mentioned that the test results from explosive power measurements increased significantly.

Meanwhile, differences in explosive power in basketball athletes can also be expressed through age differences from various tests such as the long jump, jump, 20 metre sprint with a squat start, and 30 metre sprint with a standing start (Aksovic & Beric, 2017) Therefore, training methods to increase leg muscle power actually continue to develop, comparisons made regarding CT (Complex Training) with PLT (Plyometric Training) produce explosive power that is equally good but with a higher time by CT than PLT (Wang et al., 2023).

The development and combination of exercises continues to be carried out by experts, with a sample of 10 professional athletes, the improvement of left leg and right leg power is carried out with a mixed method, namely plyometric training and several specific exercises and carried out with a test called the Opto Jump (Gherghel et al., 2021). The type of sports activity performed, will also affect leg muscle power (Mocanu et al., 2023). Power ability can also be improved in 10 weeks with a training frequency of 2 times a week (Aksovic, Beric, et al., 2020).

This study is also in line with previous research (Shalom et al., 2024), which states unequivocally that the leg muscle power of male basketball athletes is higher than female basketball athletes, and is also distinguished by age and position in the game. The importance of warming up before training and competing also greatly affects the results of leg muscle power (Chen, 2023). For coaches who do not have special tools to train power, it is recommended to use Flywheel, because this tool is also able to increase power (Stojanović et al., 2021). Body size or anthropometric aspects also greatly affect leg muscle power (Kelly et al., 2021).

CONCLUSION

From the results of research on the analysis of leg muscle power of male and female basketball athletes KONI Madiun City, it can be concluded that the power produced by male basketball athletes shows a minimum power of 301 Joules, and a maximum power of 429 Joules with an average power of 365.47 Joules. While the power produced by female basketball athletes shows a minimum power of 169 Joules, and a maximum power of 255 Joules with an average power of 206.51 Joules. In Men's Basketball Athletes there are 1 person in the excellent category, 8 people in the good category, and 1 person in the moderate category. Meanwhile in Women's Basketball Athletes, there are 1 person in the good category, 5 people in the moderate category, and 4 people in the less category.

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