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The Physical Dominant Component of Kabaddi: Is It a True Predictor?

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Abstract

Kabaddi is a sport that uses good physical abilities; so far, the dominant physical components that affect achievement in Kabaddi sports are very few in a comprehensive discussion. This study aimed to determine the dominant physical factors that influence the accomplishment of kabaddi sports. The research method used is descriptive-quantitative; the research sample is Badung district Kabaddi athletes, totalling 31 athletes. Data collection techniques are carried out in the form of tests and measurements, with several test items carried out, such as hearing reaction speed, seeing reaction speed, anticipatory reaction speed, agility, flexibility, leg muscle power, back muscle strength, leg muscle strength, hand squeeze strength (right), hand squeeze strength (left), shoulder muscle strength (pull), shoulder muscle strength (push), abdominal muscle strength, arm muscle strength, balance, cardiovascular endurance, and achievement. The results of the research show that of the several test items carried out, the most vital dominant factor was the strength of the back muscle was 89.0%, and the lowest namely agility was 33,9%. The conclusion is that the dominant factor I consists of age, body weight, agility, back muscle strength, right-hand squeeze strength, left-hand squeeze strength, and shoulder muscle strength (pull); the dominant factor II consists of height, leg muscle strength, shoulder muscle strength (push), abdominal muscle strength, and arm muscle strength.

Keywords: *physics, performance, kabaddi.*

INTRODUCTION

Kabaddi is a traditional sport originating from the Asian region, specifically India. Its growing popularity is evidenced by its inclusion in international events such as the Asian Games (Yallappa, 2020)(Bovas, 2020).The game is played between two teams that alternately raid the opponent's territory, aiming to score

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points by tagging and tackling opponents (Sanjit & Pandey, 2016). Kabaddi is characterized by its high physical demands and the absence of any equipment or assistive tools during play (Chandra, 2018). Physical fitness is widely recognized as a strong predictor of athletic performance across sports disciplines and serves as a key indicator for evaluating athletic potential (Jeon & Eom, 2021). Physical components represent essential capabilities required for effective participation in any sport, depending on its nature and demands. Understanding the specific physical components relevant to a given sport is crucial, especially in disciplines like kabaddi, which are played without equipment and involve aggressive contact to secure points (Shobha, 2019). In youth sports, physical abilities are particularly vital for achieving competitive performance.

Previous research conducted by (Ryagi, 2017) emphasized that the physical demands of young athletes include speed, momentum, cardiovascular endurance, coordination, overall fitness, as well as game-specific skills such as tagging, kicking, stepping, catching, moving, defending, and applying tactics. In another study, Ryagi also highlighted that the primary motor components required by youth athletes are strength, speed, and coordination. To support athlete regeneration and talent development, a structured and intensive training program is essential to define the physical requirements aligned with the characteristics of each sport. Athletes who have developed sport-specific skills require certain motor components at a higher level of intensity.

Each sport has unique physical demands; therefore, training programs must be tailored to the specific requirements of the discipline (Root dkk., 2019). However, existing literature has not explicitly identified the dominant factors contributing to youth athletic performance. Previous findings (Deepak dkk., 2022) tend to be correlational in nature and do not thoroughly investigate which physical components significantly affect performance outcomes in youth sports. Moreover, prior studies have not specifically examined the dominant physical attributes required in kabaddi. Hence, a more in-depth investigation is needed to determine the essential physical components for kabaddi athletes. This study is crucial as a reference for athlete selection and long-term development programs in kabaddi.

METHODS

Design

This research correlates with a quantitative approach and a design for confirmative factor analysis. This study's population and subjects were young athletes in Badung District 31 with an average age of 17. Data gathering for this screening uses testing and measurement. As for the physical factors measured, anthropometry and motor components. Anthropometric factors include height and weight. Biomotor component factors that are measured include hearing reaction speed, sight reaction rate, anti-patient reaction velocity, agility, flexibility, limb muscle power, back muscle strength, threshold muscle force, hand arm strength (right), hand arm force (left), shoulder muscular strength (attracting), shoulder muscular force (pushing), abdominal muscle resistance, arm muscle energy, balance, cardiovascular endurance, and performance. The data analysis technique used in confirmatory analysis with the pre-conditional test included normality and linearity tests. Factor analysis explains the relationship between several independent changes between one and the other to identify the dominant factor (Hanief & Purnomo, 2019). Indicate methods and the purpose of their use; research procedures and an algorithm for conducting a pedagogical experiment.

Participants

The subjects in this study consisted of 15 men and 16 women. All subjects are athletes who admitted to having participated in the 2019 Bali Provincial Sports Week (Porprov). Tests and measurements were carried out on the subjects including age, height (stadiometer), weight (digital body scale), auditory reaction speed (reaction light board), reaction speed (reaction light board), anticipatory speed (reaction light board), agility (illinois agility test), flexibility (sit and reach test box), leg muscle explosiveness (vertical jump test), back muscle strength (back Dynamometer), leg muscle strength, right hand grip strength, left hand grip strength, pull dynamometer, push dynamometer, push dynamometer, abdominal muscle strength (sit up), arm muscle strength (push up), balance (stork standing test), and performance.

Data Analysis

Hypothesis testing in this study was carried out by determining the correlation coefficient of each predictor and the regression equation Y of each variable simultaneously through multi-correlation factors. Obstacles in hypothesis testing were analyzed using the Kaiser-Meyer-Olkin (KMO) test and Bartlett's Test of Sphericity, anti-image correlation test, total variance explained test, commonalities, component matrix, and component score coefficient matrix. All data was analyzed and processed using the help of SPSS software version 24.

RESULTS

Table 1. Normality Test Result and Linearity Test Results

Variabel	*Normality Test*		*Linearity Test*		
	Sig.	*Conclusion*	*Variable*	*Sig.*	*Conclusion*
Age	0.002	Abnormal	X_1Y	0.076	Linear Pattern
Height	0.200	Normal	X_2Y	0.363	Linear Pattern
Weight	0.066	Normal	X_3Y	0.779	Linear Pattern
Reaction speed (listening)	0.019	Abnormal	X_4Y	0.297	Linear Pattern
Reaction Speed (Viewing)	0.200	Normal	X_5Y	0.720	Linear Pattern
Anticipative Speed	0.200	Normal	X_6Y	0.365	Linear Pattern
Agility	0.160	Normal	X_7Y	0.210	Linear Pattern
Flexibility	0.200	Normal	X_8Y	0.310	Linear Pattern
Leg muscle power	0.200	Normal	X_9Y	0.369	Linear Pattern
Back muscle strength	0.071	Normal	$X_{10}Y$	0.062	Linear Pattern
Leg muscle strength	0.056	Normal	$X_{11}Y$	0.868	Linear Pattern
Right-hand Squeeze Strength	0.095	Normal	$X_{12}Y$	0.802	Linear Pattern
Left-hand Squeeze Strength	0.063	Normal	$X_{13}Y$	0.154	Linear Pattern
Shoulder muscle strength (Pull)	0.200	Normal	$X_{14}Y$	0.768	Linear Pattern
Shoulder muscle strength (Push)	0.000	Abnormal	$X_{15}Y$	0.994	Linear Pattern
Abdominal muscle strength	0.200	Normal	$X_{16}Y$	0.828	Linear Pattern
Arm muscle strength	0.200	Normal	$X_{17}Y$	0.183	Linear Pattern
Balance	0.008	Abnormal	$X_{18}Y$	0.174	Linear Pattern
Result	0.200	Normal			

Probability = 0.05

Table 1 presents the data from the linearity test, where the deviation from the linearity score < 0.05 is the minimum limit to achieve linearity between X and Y. Based on the above values, it is shown that between x and y, there is a linear relationship.

Table 2. KMO and Bartlett's Test Result Analysis I and Analysis II

		Analysis Factor I	Analysis Factor II
Kaiser-Mayer-Olkin Measure of Sampling Adequacy.		.465	.845
Bartlett's Test of Sphericity	*Approx. Chi-Square*	465.138	356.867
	df	190	78
	Sig.	.000	.000

The results of the KMO and Bartlett tests on factor I analysis (table 2) showed a value of 0.465 and Sig. = 0.000 < 0.05, which shows that the variables in this study are significant and can be further processed. The data is continued in the test to see the magnitude of the partial correlation between variables X and Y by following the entire variable X. The data will be viewed with an anti-image correlation, which results in *a Measure of Sampling Adequacy* (MSA) value between 0 and 1. If MSA = 1, the variable can be predicted without error by other variables; if the MSA > 0.5, the variable is still predictable and can be further analyzed; and if the MSE < 0.5, the variable is omitted and cannot be further analyzed, or removed from the rest of the variable set. The results of *the KMO* and *Bartlett* tests in factor II analysis (table 3) showed a value of 0.845 and Sig. = 0.000 < 0.05. This shows that all of the X variables in this study are significant and can be further processed.

Table 3. Analysis of Correlation Test Results of Anti-Image Matrix I and II

Variable	*Anti-image Matrices Correlation*			
	Analysis Factor I	Probability	Analysis Factor II	Probability
Age	0.559	0.50	0.816	0.50
Height	0.792	0.50	0.911	0.50
Weight	0.690	0.50	0.807	0.50

Reaction speed (listening)	0.192	0.50	Eliminated	
Reaction Speed (Viewing)	0.291	0.50	Eliminated	
Anticipative Speed	0.369	0.50	Eliminated	
Agility	0.776	0.50	0.845	0.50
Flexibility	0.280	0.50	Eliminated	
Leg muscle power	0.277	0.50	Eliminated	
Back muscle strength	0.698	0.50	0.884	0.50
Leg muscle strength	0.779	0.50	0.830	0.50
Right-hand Squeeze Strength	0.760	0.50	0.904	0.50
Left-hand Squeeze Strength	0.787	0.50	0.921	0.50
Shoulder muscle strength (Pull)	0.898	0.50	0.876	0.50
Shoulder muscle strength (Push)	0.623	0.50	0.853	0.50
Abdominal muscle strength	0.783	0.50	0.652	0.50
Arm muscle strength	0.624	0.50	0.573	0.50
Balance	0.493	0.50	Eliminated	

Based on the results of the analysis of the anti-image matrix factor in Table 3, several X variables have MSA values below 0.50, namely auditory reaction speed, visual reaction speed, anticipatory speed, flexibility, muscle strength, and balance. Variables that have an MSA value below 0.50 will be reduced and removed by elimination because they have no significant value for further testing. The next stage is to reduce again to factor II analysis on the condition that it does not include variables that have been omitted because, in factor I analysis, the MSA value is less than 0.50, which means that the variable is not eligible to be included in factor II analysis. In the results of the tabulation of the anti-image matrix (Table 3), factor II analysis showed an MSA value above 0.50, which indicates that the overall factors tested in analysis II can be continued with testing using the main component analysis method, which results in a community value.

Table 4. Communality Results

Communality Results			Results of the Rotating Component Matrix	
Variable	initial	extraction	*Component* 1	*Component* 2
Age	1.000	.760	.869	-.077
Height	1.000	.754	.557	.666
Weight	1.000	.815	.843	.322
Agility	1.000	.339	.494	.309
Back muscle strength	1.000	.890	.692	.642
Leg muscle strength	1.000	.838	.516	.756
Right-hand Squeeze Strength	1.000	.894	.796	.511
Left-hand Squeeze Strength	1.000	.879	.703	.620
Shoulder muscle strength (Pull)	1.000	.796	.757	.473
Shoulder muscle strength (Push)	1.000	.635	.387	.696
Abdominal muscle strength	1.000	.451	.061	.669
Arm muscle strength	1.000	.655	-.119	.801

Extraction Method: Principal Component Analysis.

Based on the Main Component Analysis Test to see the community value (Table 4), it was found that the largest dimensional role was the sub-variable of back muscle strength, 0.890 (89.0%), and the lowest, 0.339 (33.9%), was the agility sub-variable. Further tests to determine the contribution of variables to each component are carried out during the rotation process, which results in a Component Matrix. Based on the results of the Rotated Component Matrix data in Table 4, it can be concluded that the dominant factors between anthropometry and the physical component are divided into dominant factors I consisting of age, weight, agility, back muscle strength, right-hand grip strength, left-hand grip strength, and shoulder muscle strength (pull). The dominant factor II consists of height, leg muscle strength, shoulder muscle strength (thrust), abdominal muscle strength, and arm muscle strength.

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DISCUSSION

Physical components are the fundamental abilities required by every sport, according to the form and type of sport, respectively. The sport of Kabaddi requires physical components such as flexibility, agility, and endurance (Shobha, 2019). The sport of kabaddi requires good physical abilities because the movements in kabaddi are very complex (Shobha, 2019). Kabaddi sport involves various technical skills that can be supported in addition to the anthropometric factors of athletes (Ram, 2019). Determining the characteristics of athletes will be an evaluation and assessment that will influence the coach in determining the biomechanical implications of athletes in training (Zaccagni et al., 2019). The age range also affects general strength and sport-specific skills (Fernandez-Gamboa et al., 2020). Body shape will greatly help clinical sports professionals assess the training program to be carried out. Furthermore, it is explained that body shape is one of the athlete's initial capitals towards success. All sports performed at a professional level require a body type to perform at its best in biomechanics and physiology. Elite sports teams have various characteristics that must be tailored to the sport practiced (Zaccagni et al., 2019). At this time, body composition will determine the relationship between sports performance and body composition (Palanisamy, 2014). Coaches who know the body composition of their sports athletes will easily be able to compile the right training program to improve their ability to maximize when in competition (Bernal-Orozco et al., 2020).

Motor abilities, especially skills, also predict an essential part of performance. In addition to physical ability, body composition also has a supporting role. Body composition differs for each sport that aims to support performance (Fields et al.,

2018). Body mass and height also influence athlete endurance, which can help their ability to show their performance. The effect of relative age has a relationship with various sports to determine the specialization of the sport form (Sæther et al., 2017). Age, height, weight, and body mass index influence game strategy, especially for sports that require physical characteristics as a form of game strategy (Palao et al., 2008). Physiological factors can assist in talent identification and development for team sports (Sheppard et al., 2009). Elite dual and team sports athletes rarely reach their thirties.

Age is also one of the factors that fosters sports athletes who excel in the future. Age is an athlete's factor that can affect individual and team sports appearance (Fien et al., 2017). According to research findings, physical ability will decline as people age if they do not receive adequate training. Each athlete's ability will decrease with age due to the aging factor. The decline in performance in training will have an impact on the match. According to a narrative review by (Borges et al., 2016), age may affect performance and kinetics after the game. It is also said that there is a need for further research related to the age of elite or master athletes in the match. Age influences an indicator of the function of the cognitive-physical body (Esmaeilzadeh et al., 2018). Agility is one of the dominant factors of physical ability for kabaddi athletes because kabaddi requires the ability to change direction in the match; change of direction is an element of agility (Chaabene et al., 2018). Strength training, which can improve agility, includes training elements to improve balance. It found that continuous training on the lower extremities can increase agility. Muscle strength, a physical component, has a better influence, according to research by (Sana & Barman, 2017). Emphasizing eccentric muscles is a promising element in strengthening and strength programs to increase the significant change of direction (Chaabene et al., 2018). Research by (Hayashida et al., 2014) showed that muscle strength significantly correlates with speed.

The main novelty in this study is the dominant factor of physical needs required in kabaddi sports in supporting achievements such as age, height, agility, back muscle strength, leg muscle strength, hand muscle strength, shoulder muscle strength, abdominal muscle strength, and arm muscle strength. Suppose it can be classified that the dominant factors in Kabaddi sports are anthropometric, agility,

and strength. In that case, previous research cannot fully explain the chief characteristic of Kabaddi sports: being able to excel. Kabaddi, also a martial sport, is an intermittent sport requiring high physical abilities because martial sports are complex in performing movements (Kostikiadis et al., 2018). In sports with a significant biological component, the principles of training and the shape and composition of the body play an important role. This is very important to consider to balance or adjust to the sport to maximize achievement (Kandela et al., 2014). Each country that develops the sport of kabaddi has different criteria as a reference for determining athletes. The limitations of this study are that it only looks for correlations between several variables; it is hoped that further research can be carried out to find the cause and effect of each existing variable.

CONCLUSSION

The results showed that of several test items conducted, the highest dominant factor was back muscle strength with a value of 0.890 (89.0%), while the lowest factor was agility with a value of 0.339 (33.9%). In this study, it was found that Dominant Factor I consisted of age, weight, agility, back muscle strength, right hand grip strength, left hand grip strength, and shoulder muscle strength (pull). Meanwhile, Dominant Factor II includes height, leg muscle strength, shoulder muscle strength (push), abdominal muscle strength, and arm muscle strength. Thus, the main factors in kabaddi sports can be categorized into three groups, namely anthropometry, agility, and muscle strength.

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