

# Anthropometric Factors Determinants Of Pencak Silat Tanding Category

Muhad Fatoni

Department of Sports Education  
Universitas Muhammadiyah Surakarta  
Surakarta, Indonesia  
[mf378@ums.ac.id](mailto:mf378@ums.ac.id)

Haris Nugroho

Department of Physical Education  
Universitas Sebelas Maret  
Surakarta, Indonesia  
[haris\\_silat@yahoo.com](mailto:haris_silat@yahoo.com)

Nur Subekti

Department of Sports Education  
Universitas Muhammadiyah Surakarta  
Surakarta, Indonesia  
[ns584@ums.ac.id](mailto:ns584@ums.ac.id)

**Abstract—** The purpose of this study was to determine the anthropometric factors that determine the skills of the tanding category of pencak silat. This study uses a correlational method, with a confirmatory factor analysis design that confirms the relationship of indicator variables with latent variables that determine the skills of pencak silat. The collected data is then verified and tabulated to be processed quantitatively by: (a) Analysis of multivariate statistical factors using Statistical Product and Service Solutions (SPSS) computerized software so that it can be reduced to a number of factors. (b) Calculate the value of the average contribution of each factor in the latent variable and the dependent variable. (c) Describe the value and position of the average score of the dominant variable in importance-performance matrix transformation. The results of this study are as follows: (1) The anthropometric factor that determines the skills of pencak silat in the match category is height with a percentage of roles to a factor of 79%, and the length of legs with a percentage of roles to a factor of 76%. The conclusions in this study are as follows: (1) Anthropometric factors (latent variables  $\xi_1$ ) that determine the skills of pencak silat match categories can be measured by variable height indicators (X1) with a value of 0.86, and leg length (X2) with a value of 0, 83.

**Keywords—** Physical Condition, Football, Sport Training  
**Introduction**

## I. INTRODUCTION

Along with the progress of the age, pencak silat has now become one of the martial arts sports that has evolved into the realm of achievement sports that have been contested in sharing events, ranging from early age, pre-adolescence, adolescence and adulthood. At the early age level, many single event competitions were held, at pre-adolescence and adolescent levels there was a comparison between schools, between regions, provinces, and also nationally. At the adult level there are championships between students, inter-regional championships, and the most prestigious ones such

as National Sports Week (PON), (SEA GAMES), Asia-Pacific Championship, and World Championship. There are two categories of pencak silat sport, the category is the TGR category (Single, Double, Team), and the Match Category

Pencak Silat match category is a match that is full body contact, so the components and physical quality of a fighter will be very decisive in every match that is undertaken. Appearance activities in one breakthrough consist of (1) tide attitude, (2) step pattern, (3) martial arts attack, and (4) back tide attitude. The match consists of three rounds and each round takes place in 2 minutes clean, the break between rounds of one minute, shows that the physical condition of the fighter will be very influential in the match.

In PB match rules. IPSI (2012: 17) that attackers must be organized and strung together in various ways or techniques in the direction of "as many as 6 (six) attack techniques. The permitted attack technique is to be organized in various ways in a non-similar manner. Attacks are an integral part of defense or defense, so attacks can be referred to as active defenses or defenses, as the main component of an attack is "punches" (attacks using hands), and "kicks" (attacks using legs). In pencak silat matches, the value to be calculated is if the attack and the defense of the target is precise and powerful. Therefore, good physical condition is absolutely necessary. This is in line with Subekti's opinion (2013: 7-8): "In the rules of competition it is stated that every attack / breakthrough is limited to" as many as 6 types of attacks ". With the number of movements each attack when viewed from the element of physical ability, then how much the ability of fighters to attack and defend is a very important component.

As a competitive sport, pencak silat is now used as a venue for competition in obtaining the highest achievements, but as a native Indonesian martial arts sport, pencak silat has recently experienced a significant decline in performance, from several single event and multi event events to the red pencak silat team white has decreased in the

acquisition of medals, especially in the match class, so the target charged is not fulfilled. This then has an impact on the quality of this nation's achievements as experienced by the achievements of other martial arts sports in the multi-game Sea Games which are illustrated in the following table.

**Table 1.** Achievement of other martial arts sports in the multi-game Sea Games

Cabor	SG 2005 Philipina			SG 2007 Thailand			SG 2009 Laos			Catatan
Cabor Beladiri	Emas (T)/(Ra)	Perak	Prg.	Emas (T)/(Ra)	Perak	Prg.	Emas (T)/(Ra)	Perak	Prg.	Catatan
Judo	3(16)/(4)	4	4	1(16)/(5)	3	5	1(18)/(6)	1	6	Menurun signifika
Karate	5(18)/(1)	6	4	2(18)/(3)	4	8	3(17)/(3)	3	6	Meningk at tdk.
Pencak Silat	5(16)/(2)	4	2	5(13)/(1)	3	4	2(17)/(4)	3	3	Menurun signifika
Teakwondo	1(15)/(5)	4	6	1(16)/(6)	1	1	1(21)/(5)	3	6	Menurun signifika
Gulat	0(12)/(4)	2	3	1(9)/(2)	2	2	2(18)/(4)	4	6	Meningk at tdk.
Wushu	1(13)/(4)	2	1	1(15)/(7)	0	5	2(21)/(4)	6	3	Meningk at tdk.
Tinju	0(13)/(5)	1	10	0(17)/(6)	0	6	0(15)/(6)	3	6	Meningk at tdk. signifika

From the table above, it can be seen that Indonesian martial arts achievements, especially pencak silat, have decreased. Of course many factors that are the reasons for the achievement of the homeland pencak silat is currently declining. The achievements of athletes in a sport cannot be formed instantly. The formation of athletes who can achieve high and be able to compete internationally requires systematic planning and carried out in stages and continuously starting from problems, nurseries and coaching so as to achieve high achievements. Anwar Pasau (in Sajoto, 1995: 2-5) states that increasing sports performance is inseparable from the determinants of achievement improvement, namely: (1) Biological aspects such as potential (basic abilities of the body), function of body organs, structure and posture body and nutrition, (2) psychological aspects such as intellectual, motivation, personality, coordination of muscle and nerve work; (3) environmental aspects such as social environment, facilities and infrastructure, weather and family; (4) supporting aspects such as trainers, systematic training programs, funds and awards.

This illustrates that good guidance and training in martial arts should be in accordance with the characteristics

of the martial arts branch. In physical development, the trainer must be able to develop a training approach with its own characteristics, Subekti (2013). Thus it is necessary for the forms or models of training that are appropriate, effective and efficient. Subekti (2013) further stated that there are many training models, especially in the branches of pencak silat colleges, which still use traditional models and override modern scientific developments.

The formation of physical elements, to create fighter in accordance with the demands of the criteria for pencak silat competition, of course can not be separated from the nursery process which is expected to produce superior athletes, because anthropometry and physical factors will determine the training process towards achievement. The selection of athletes to pursue the sport of martial arts is inseparable from body shape (anthropometry). The ideal body shape in accordance with the sport being studied is one of the conditions that can affect sports achievement. Mochamad Sajoto (1988: 11) states "One aspect of achieving achievement in sport is the aspect of biology which includes the structure and posture of the body, namely the size of the height and the length of the legs, large size, width and weight, and somatotype (body shape)". Based on the background of the problem stated above, the author would like to conduct a study, entitled "Anthropometric Factors Determinants of Pencak Silat Tanding Category".

## II. METHODS

### a. Participants

Participants in this study were drawn from pencak silat members at Sebelas Maret University (UNS) with inclusion criteria needed in the study. The inclusion criteria are:

- Male sex
- Physically and mentally healthy
- Aged adult
- Compete in the match class

Totaling 80 college male athletes who participated in this study.

### b. Research Variables

In this study there is one latent variable with three indicator variables and one dependent variable with the following details: Anthropometry factor ( $\xi_1$ ) with indicator variables as follows: 1) Height (X1) 2) Weight (X2) 3) Leg length (X3) while the dependent variable is the skill of pencak silat (Y)

### c. Procedure

The study design is confirmatory factor analysis technique, which is a factor analysis technique that is a priori based on theories and concepts that are already known or predetermined (Gudono, 2012). Data will be processed using

computerized statistical programs using the SPSS system (Statistical Product and Service Solutions).

According Siswandari (2009: 156) confirmatory factor analysis technique exactly the same as the exploratory factor analysis technique by calculating the loading factor or factor coefficient or the value of  $\lambda_i$  which is similar to the regression coefficient  $\beta_i$  which is the lodging factor between  $X_i$  indicators and the  $F_i$  factor formed. If the value of the loading factor or the value of  $\lambda_i$  obtained is greater or equal to half ( $\lambda_i \geq 0.5$ ) or can be tested by the t test, and if the variable indicates a significant value means the variable  $X_i$  or instrument or item is valid to be used as member of the factor concerned. The steps in conducting confirmatory factor analysis in this study are as follows:

a. Prerequisite Test for Analysis

Before the data analysis process is carried out using factor analysis methods, several statistical prerequisite tests are carried out first, namely:

- a. Normality test
- b. Linearity Test

b. Factor Analysis

In this study the independent variables analyzed to determine the dominant determinants of pencak silat skills were the height, weight, and length of the legs. Testing the hypothesis in this study is done by looking for the correlation coefficients of each predictor, the Y regression equation for each predictor variable, the Y regression equation for all predictor variables together with multiple correlation coefficients. The calculations in hypothesis testing are as follows:

- a. Kaiser-Meyer-Olkin and Bartlett's test of sphericity
- b. Anti-image correlation test
- c. Total variance explained test
- d. Communalities or role factors
- e. Component matrix (*dimensi penyusun faktor*)
- f. Component score coefficient matrix

d. .Statistical Method

Multivariate statistics was used to analyze the data. According to Joseph et al (1995) factor analysis is used to analyzed interrelationship structure among variables. Assumptions existed in factor analysis is for any given variables there is as association with other variables. Factor analysis analyzed correlation among variables. Statistical work is done using SPSS Ver 22 Software (IBM, Co).

### III. RESULTS

In this chapter the results of the study will be presented based on the confirmatory factor analysis design. in this study the indicator variables were analyzed to find out the dominant factors in determining the skills of pencak silat in the match categories were height, weight, and leg length.

**Table 2.** Results of KMO and Bartlett's Test  
Anthropometric Factor Analysis for Determining Pencak  
Silat Skills in the Comparative Category

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.683
Bartlett's Test of Sphericity	Approx. Chi-Square	843.081
	Df	36
	Sig.	.000

a. Factor Analysis I

The results obtained by the Kaiser-Meyer-Olkin measure Measure of Sampling Adequacy abbreviated as KMO-MSA and Bartlett's Test of Sphericity. The results of the KMO-MSA test on the 9 tested variables obtained a value of  $0.683 > 0.5$  while the Bartlett's Test of Sphericity number showed an Approximate Chi-square number of 843,081 with a Degree of Freedom (df) 36 and a significance of 0,000. The magnitude of the correlation between the independent measured variables has a value between 0 and 1, to state that the STRONG relationship of KMO-MSA numbers must be above 0.5 and the opportunity value (Sig.) Must be  $< 0.05$ . This shows that the collection of variables in this study is significant and can be further processed.

b. Factor Analysis II

**Table 3.** Results of KMO and Bartlett's Test  
Anthropometric Factor Analysis for Determining Pencak  
Silat Skills in the Comparative Category

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.753
Bartlett's Test of Sphericity	Approx. Chi-Square	780.602
	Df	21
	Sig.	.000

From the table above, the results of the analysis of the second factor obtained from Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO-MSA) and Bartlett's Test of Sphericity toward 7 variables tested obtained a value of  $0.753 > 0.5$  while Bartlett's Test of Sphericity figures showed an Approximate number The Chi-square is 780,602 with a Degree of Freedom (df) 21 and a significance level of 0,000. The magnitude of the correlation between the independent variables measured has a value between 0 and 1, to express the strong relationship between KMO-MSA numbers must be above 0.5 and the opportunity value (Sig.)

Must be  $<0.05$ . This shows that the collection of variables in this study is significant and can be further processed.

**Table 4.** Results of Communalities of Anthropometric Factor Determinants of Pencak Silat Skills in the Comparative Category

Variable	Initial	Extraction
Tinggi Badan	1.000	.789
Panjang Tungkai	1.000	.764

*Extraction Method: Principal Component Analysis.*

From the table above, it can be seen the initial value and extraction value. The initial value reflects the role or contribution if the factor influencing variables individually form these factors, while the results of communalities for each variable are in the extraction column. The extraction value describes the percentage of roles or contributions of each dimension or sub-variables that form factors individually to the factors. This also means the number in the extraction column shows the percentage of rotated component matrix. From the table above it is known that the biggest dimension role is anaerobic endurance variable, with a value of 0.980 or 98% and the smallest is ankle coordination with a value of 0.308 or 30.8%. Then to find out the contribution of each variable in each component, it is necessary to do a rotation process that produces the component Matrix as above.

**Table 5.** Results of Rotated Component Matrix Anthropometric Factor Analysis Determinants of Pencak Silat Skills Tanding Category

Variabel	Component	
	1	2
Tinggi Badan	<b>.861</b>	-.218
Panjang Tungkai	<b>.834</b>	-.262

*Extraction Method: Principal Component Analysis.*

*Rotation Method: Varimax with Kaiser Normalization.*

Based on the results of Rotated Component Matrix Analysis of anthropometric factors determining the skills of pencak silat in the match category, it turns out that all the component factors have a value of  $\geq 0.5$ . This means that the dimensions of the anthropometric factor which consists of variable height, and limb length, are members of the anthropometric variable factors in determining the skills of martial arts.

Result of hypothesis that has been proposed and the calculation of statistical analysis of the factors that have been done, the results of the hypothesis testing of this study are:

a. Height determines the skill of pencak silat in the match category

Based on the value of the anti-image correlation found in table 4.5 the height factor has a value of 0.668 or  $> 0.5$  with the value of communalities in table 4.6 of 0.789, which means that the height has a percentage role of 79% and the value of rotated component matrix is 0.86, which means that height is a member of anthropometric factors, determinants of pencak silat skills (H1 accepted)

b. Body weight determines the skills of pencak silat in the match category

Based on the value of the anti-image matrix correlation found in table 4.3 the weight factor has a value of 0.41 or  $> 0.5$ , thus the weight is not feasible to be used as a member of the factor and must be eliminated from further analysis, which means the hypothesis is rejected (H2 rejected)

c. The length of the leg determines the skills of the pencak silat match category

Based on the value of anti-image matrix correlation contained in table 4.5 the leg length factor has a value of 0.677 or  $> 0.5$  with the value of communalities in table 4.6 of 0.764 which means the leg length has a percentage role of 76% and rotated component matrix value of 0.86, which means that the leg length is a member of the anthropometric factor that determines the skills of pencak silat (H3 is accepted)

#### IV. DISCUSSION

Based on the results of hypothesis testing on anthropometric factor analysis ( $\xi_1$ ) the determinant of pencak silat skills in the above categories, there is one anthropometric variable that must be eliminated or excluded from the dominant analysis factor or (H0 rejected) because it has an MSA value below 0.5 ie weight (0.41) while the anthropometric factor that determines the skills of the pencak silat match category (H0 is accepted) or which has a component value of factor  $\geq 0.5$  is:

a. Height with a component value of 0.86

b. Leg length with a component value of 0.83

The results of this study illustrate that the anthropometric factors that determine the skills of pencak silat in the match category are height and leg length.

From the results of data analysis and the explanation above, it is known that there is one variable that has a small or less dominant value contribution so it must be eliminated, that is weight. Body weight is eliminated because biomechanical weight does not have a close relationship with skills, or in this case specifically pencak silat an explanation



that is acceptable is that weight is the capital of fighter in determining the match class, so that in the long-term training process the body weight is relatively constant or still, not like the length of the legs or height, which over time will increase in quality and function.

The results of factor analysis in this study were calculated using the KMO and Bartlett's Test method with SPSS computerized statistical software supported by the theoretical basis stated in CHAPTER II, from the explanation and analysis of the data obtained, the anthropometric factor variable determines the skills of pencak silat match categories. which consists of 3 indicator variables. The results of the statistical analysis of factor analysis of all variables are as follows:

- a. The dominant anthropometric factor in determining the skills of pencak silat is height and leg length. After data collection and further analysis of the data on the sample, it can be stated that the skills of pencak silat pesilat putra in Surakarta are formed or influenced by height (0.86), leg length (0.83), because of the two independent variables having a correlation value positive and is above  $\geq 0.5$  based on the value of rotated component matrix. Then it can be concluded that the greater the value of rotated component matrix from the independent variables will increasingly bring the fighter in performing the skills of the pencak silat match category.
- b. The anthropometric factor which has a low correlation value or is less dominant in determining the skills of pencak silat is weight. This can be seen in the Anti Image matrices correlation table 4.3, in the table there is 1 variable with an MSA value below 0.50 which is body weight (0.41). Thus these factors must be eliminated or excluded from further analysis tests because they do not have sufficient values for the provisions for further testing

## V. CONCLUSION

Based on the results of research and data analysis that has been done, and referring to the discussion in the previous chapter, it turns out that the proposed hypothesis is acceptable, thus conclusions can be obtained as follows The anthropometric factor (latent variable  $\xi_1$ ) that determines the skill of pencak silat match category can be measured by the variable height indicator (X1) with a value of 0.86, and leg length (X2) with a value of 0.83.

## VI. ACKNOWLEDGMENT

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## REFERENCES

- [1] Bompa, Tudor O. 1990. *Theory and Methodology of Training: The Key To Athletic Performance*. Second

Edition Debuque Iowa: Kendall/Huns Publishing Company. 1994. *Theory and Methodology of training*, Dubuque, Iowa: Hunt Publishing Company.

- [2] Fox, E.L., Bowers, R.W., Foss, M.L. 1993. *The Physiological Basis of Physical Education and Athletics*. New York: Saunders College Publishing Co.
- [3] Gallahue, David, L., & Ozmun, John, C. 1998. *Understanding Motor Development: Infants, Children, Adolescents, Adults*.
- [4] Ghazali, Imam. 2006. *Aplikasi Analisis Multivariate dengan Program SPSS*. Semarang :Badan Penerbit Universitas Diponegoro.
- [5] Gudono. 2012. *Analisis Data Multivariat*. Yogyakarta : BPFE
- [6] Hairy, Jusnul. 1989. *Fisiologi Olahraga*. Jakarta: Departemen Pendidikan dan Kebudayaan. Dirjendikti.
- [7] ISAK. 2001. *International Standarts for Anthropometric Assessment*. Australia : The International Society for The Advancement of Kinanthropometry
- [8] Ismaryati. (2009). *Tes & Pengukuran Dalam Olahraga*. Surakarta: UNS Press
- [9] Lubis, J.( 2004). *Panduan Praktis Pencak Silat*. Jakarta: Rajawali
- [10] Nugroho, Haris. (2011). *Jurnal : Analisis Kebutuhan Fisik, Teknik, dan Mental Cabor Pencak Silat*.
- [11] PB. IPSI (Ikatan Pencak Silat Indonesia). 2012. *Peraturan pertandingan olahraga pencak silat dan perwasitan*. Jakarta: KONI Pusat.