

# Analysis Factor Related to the Quality of Physical Conditions Martial Art in Match Category (Empirical Studies of the Martial Arts adolescent Athlete)

Haris Nugroho

FKIP, Universitas Negeri Sebelas Maret Surakarta, Indonesia

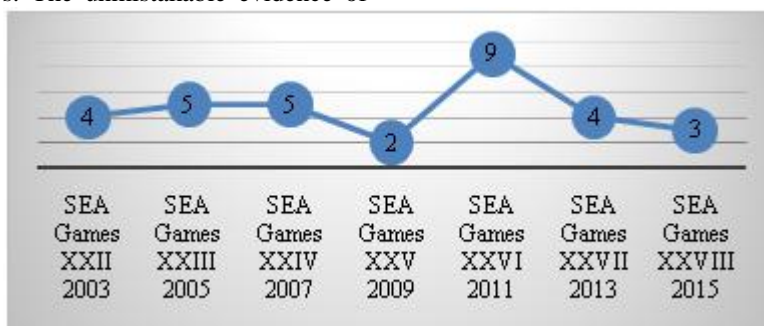
**Abstract:** This study aimed to know: (1) Anthropometric factors that determine the physical quality of the martial arts athletes Competition category of martial arts Adolescent Athletes, (2) Physical condition factors that determine the physical quality of martial arts athletes of the match category. This study used correlational design, using confirmatory factor analysis techniques. Confirmatory factor analysis technique through SPSS program 23.00 with the provision if the measure of sampling adequacy ( $MSA > 0.5$ ) then the instrument is feasible to use and ( $MSA < 0.5$ ) then the instrument is not feasible to use with significant level  $\alpha = 0.05$ , for Confirm the latent variables that determine the physical quality of the martial arts athlete of the match category. The collected data is then verified and tabulated to then be quantitatively processed with : (a) Multivariate confirmatory factor analysis to reduce to several factors only and (b) Calculating the contribution value of each factor on the dominant latent variable is transformed in anti-image correlation and communalities.

**Keywords:** Analysis Factor, Physical condition, martial arts, match category

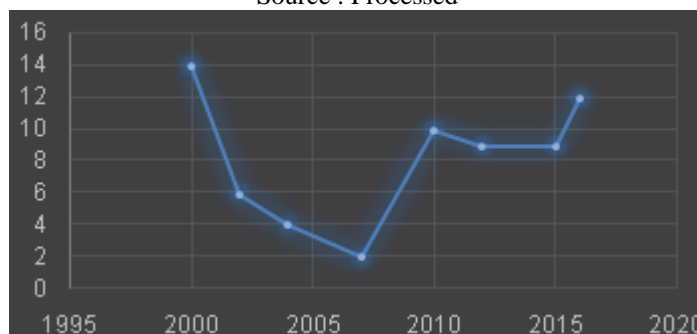
## 1. Introduction

The development of Indonesia's martial arts sport has ups and downs of achievement. It can be seen from several multi-event and world championship followed by Indonesia. Even for several times, Indonesia has failed to achieve maximum achievement, such as the 2002 world championships in Penang Malaysia, 2004 world championships in Singapore, 2007 world championship in Pahang Malaysia, and multi-event SEA Games in 2003 in Vietnam, SEA Games in 2005 in the Philippines and the 2009 SEA Games in Laos. The unmistakable evidence of

Indonesia's martial arts failure at some of the world championships and multi-event SEA Games will be a stark contrast when it comes to cultural, It is given that martial arts is a traditional sport native to the Indonesian nation so it is very reasonable if "should" Indonesia martial arts achievement can speak a lot and dominate at various international events. Furthermore, the researcher tries to analyze gold medal achievement that is processed from various sources in multi-event SEA Games and world championship as a clear picture of the ups and downs of Indonesia martial arts achievement as follows



**Chart 1.1:** Obtaining Gold Medal Branch of Martial arts Sports on Multi Event SEA Games  
 Source : Processed



**Charts 1.2:** Obtaining Gold Medal Branch of Martial arts Sports At the World Championships

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If examined more deeply to the results of Indonesian material art achievement in international championships both in the world championships and multi-event SEA Games, the achievement of the maximum shown single category, double and team, while for match category decreased achievement and failed to compete with Vietnam And Malaysia who became the heavy rivals of the state of Indonesia in every championship.

In order to develop the achievement of material art, a profile study of martial arts athletes is required. The folks' profile is needed as a foundation in reflecting the needs of athlete achievers, such as: physical, technical, tactical and mental. To find out the physical capability of a martial art it is necessary to study the study of the needs of the components of supporting physical conditions and statistical tests that can describe the profile of the sport of martial arts. However, until now there have been no empirical testing related components of physical conditions and anthropometry that best suits the physical needs of the sport of martial arts

## 2. Theoretical Review

### A. Martial arts in Competition Category

In accordance with the Indonesian martial arts Game Rules munas IPSI 2012 results in Chapter I about Match Rules, especially on Article 1 The Definition of Each Category is mentioned that "Competition Category is: Category featuring 2 (two) fighter from different angles. Both face each other using the elements of defense and attack ie: Fending / dodging / attacking on target and dropping opponent; Using competing techniques and tactics, endurance of stamina and morale, using the rules by utilizing the wealth of techniques and stance (PB IPSI, 2012).

### B. Physical Conditions

Physical condition is an important element and the basis for developing techniques, tactics, and strategies in various sports. According to Sajoto (1988), physical condition is one of the most indispensable requirements in improving the achievement of an athlete, even as the point of departure of a sporting prefix of achievement. Further explained that the physical condition is a unified whole of the components that can't be separated just like that, either upgrading or maintenance (Sajoto, 1988).

According Harsono components of physical conditions is cardiovascular endurance, strength resistance, muscle strength (strength), flexibility, speed, stamina, agility, power (Harsono, 1988). Another classification developed by Bouchard, presented by Sugiyanto shows a tendency, providing a more detailed description of the physical domain. The classification Bouchard makes, uses the term "physical qualities". The classifications made are as follows: (1) organic quality, consisting of aerobic capacity and anaerobic capacity; (2) Muscle quality, namely: muscle strength, aerobic capacity of local muscle, anaerobic capacity of local muscle, power, and flexibility; (3) Quality of kinetic perception, consisting of reaction speed, speed of movement, coordination of nerves, and kinetic sensitivity (Sugiyanto, 1993).

### C. Anthropometry

The term of anthropometry comes from the word "anthropos (man)" which means man and "metron (measure)" which means size (Bridger, 2003). Wickens et al. (2004) explains that anthropometry is the study and measurement of the dimensions of the human body. According to Sanders and McCormick; Pheasant and Pulat that anthropometry is the measurement of body dimensions or other physical body characteristics that are relevant to the design of something that people wear. (Sanders and McCormick, 1987; Pheasant, 1988; Pulat, 1992). In general anthropometric measurements can be divided into two types: static anthropometric and dynamic anthropometric measurements (Tarwaka, 2004). In this paper only presented the type of static anthropometric measurement.

### D. Analysis of Movement Type and Physical Elements of Martial Art Athlete

The basic techniques of attack in the sport of pencak silat can be briefly reviewed based on the characteristics of movement, the physical elements involved, and the major muscles involved, as listed in the following table.

**Table 1:** Characteristics of Movement, Physical Elements and Major Muscles Involved

<i>Movement</i>	<i>Characteristics of Movement</i>	<i>Physical Element</i>	<i>Major Muscles Involved</i>
Kick	<ul style="list-style-type: none"> <li>• Hard kick, strong and fast</li> <li>• Coordinate movement</li> </ul>	<ul style="list-style-type: none"> <li>-speed</li> <li>-strength</li> <li>-shape</li> </ul>	<ul style="list-style-type: none"> <li>- Shoulders</li> <li>- upper arm</li> </ul>
Blows	<ul style="list-style-type: none"> <li>• hard blows, strong and fast movement</li> <li>• Coordination - Speed</li> </ul>	<ul style="list-style-type: none"> <li>-Speed</li> <li>-Accuracy</li> <li>- Agility</li> <li>- accuracy</li> </ul>	<ul style="list-style-type: none"> <li>- forearm</li> <li>- back</li> <li>- chest</li> <li>- stomach</li> </ul>
Avoid	<ul style="list-style-type: none"> <li>• fast evasion</li> <li>• Fast evasion</li> <li>• Meticulous</li> <li>• Movement</li> <li>• Movemen Coordination</li> </ul>	<ul style="list-style-type: none"> <li>-Speed</li> <li>-Accuracy</li> <li>- Agility</li> <li>- accuracy</li> </ul>	<ul style="list-style-type: none"> <li>- waist</li> <li>- limbs</li> <li>- ankle</li> </ul>
Denial	<ul style="list-style-type: none"> <li>- quick denial</li> <li>- fast reaction</li> <li>-motion coordination</li> <li>- Rapid reaction</li> <li>- carefulness of motion</li> <li>- motion coordination</li> </ul>	<ul style="list-style-type: none"> <li>-Speed</li> <li>-Accuracy</li> <li>- Agility</li> <li>- accuracy</li> </ul>	

Prediction The need of physical quality in the sport of martial art, among others:

- a. Power and anaerobic capacity are visible on kicks, punches, denials shadows, drops, dings.
- b. Endurance of strength on the number of kicks, punches, evasion tanks.
- c. Cardiorespiratory endurance at the length of time each round and overall
- d. Agility and accuracy on the avoid kick, avoid the beating, denials, catch the fall.
- e. The formation of high-defense attack movement.
- f. Coordinate on the whole attack movement.

### 3. Research Methodology

#### A. The Objectives of research

Based on the background, problem identification, and problem formulation that has been previously disclosed, the purpose of this research is as follows:

- 1) Knowing which anthropometry factors are dominant determines the quality of the physical condition of martial arts martial arts categories for juvenile athletes.
- 2) Knowing which anthropometry factors predominantly determine the quality of physical condition of martial arts martial category for female teenage athletes.
- 3) To know which factors of physical condition predominantly determine the quality of physical condition of martial arts martial category for male teen athletes.
- 4) Knowing which physical condition factors predominantly determine the quality of physical condition of martial arts martial category for female teenage athletes.
- 5) To know the relationship between dominant anthropometry factor and the achievement of martial arts athlete category of teenage boys.
- 6) To know the correlation between dominant anthropometry factor and the achievement of martial arts athlete category of female teenagers.
- 7) Knowing the relationship between dominant physical condition factors with the achievement of martial arts athlete category of teenage boys.
- 8) To know the correlation between dominant physical condition factor and the achievement of martial arts athlete category of female teenagers.
- 9) Knowing the relationship between dominant anthropometry factor and dominant physical condition factor simultaneously with the achievement of martial arts athlete category of young men.
- 10) Knowing the relationship between dominant anthropometry factor and dominant physical condition factor simultaneously with the achievement of martial arts athlete category of female teenagers.

#### B. Research Approach and Data Analysis Technique

This research was a quantitative research using survey method. Based on the level of explanation, this study is categorized correlational research in which research conducted to determine the relationship between variables hypothesized in the study.

After taking the data in the form of anthropometry measurement which consist of weight, height, length of arm range, sitting height, leg length and foot length, and test result and measurement of physical condition component consisting of several physical components with data analysis used in this research was factor analysis.

Factor analysis is a technique to analyze the interdependence of several variables simultaneously with the aim to simplify the form of the relationship between several variables studied to a number of factors less than the variables studied. The steps in the factor analysis are as follows: (a) Formulating the problem; (B) Creating a correlation matrix; (C) Determination of the number of factors; (D) factor

Rotation; (E) Interpretation of factors; (F) Selection of surrogate variables; And (g) Fit Model (model accuracy).

### 4. Result and Discussion

#### A. Description of Research Data

Statistic	N	Mean		Std. Deviation)	
		Men	Women	Men	Women
Weight (X1)	100	56.87	50.38	90.15	7.02
Height (X2)		166.72	155.54	53.40	6.33
Arm Range Length (X3)		167.99	155.65	82.61	6.92
Sitting Height (X4)		87.36	83.66	20.81	6.21
Length (X5)		90.75	87.80	145.81	9.22
Footprint Length (X6)		24.49	23.24	12.54	1.07
Sit And Reac (X7)		18.84	18.07	29.34	5.49
Shoulder Flexibility Test (X8)		37.14	36.95	93.62	10.97
Ruller Drop Test (X9)		19.14	20.82	26.02	6.22
Eye, Hand and Foot Coordination (X10)		23.96	15.58	52.97	4.91
Balance (X11)		34.82	24.91	606.85	10.86
Triple Hop Jump (X12)		12.22	9.28	1.17	1.63
Basketball Throw (X13)		6.49	5.27	1.24	2.18
Hexogon Obstacle Test (X14)		13.52	15.33	8.32	3.73
Jump Drop (X15)		18.67	13.41	20.35	4.80
Hand Speed (X16)		50.69	42.86	122.03	10.01
Run 3 Meters (X17)		7.52	7.88	2.11	0.94
Run 30 Meters (X18)		4.78	5.55	0.14	0.39
Handgrip Strength (X19)		35.55	23.36	63.79	5.49
Push Up (X20)		45.56	39.63	176.84	10.76
Sit Up (X21)		50.92	41.11	116.42	11.83
Back Up (X22)		84.37	68.23	413.77	18.65
Leg squat (x23)		31.47	13.93	62.88	7.57
Multi Phase Run (X24)		48.44	36.25	62.76	6.99

#### B. Normality Test Data

Statistic	N	Men		Women		Note
		L_count	Sig.	L_count	Sig.	
Weight (X1)	100	.062	.200*	.061	.200*	If sig. > α = 0,05 data was normally distributed if sig. < α = 0,05 Data was not normally distributed
Height (X2)		.079	.125	.091	.041	
arm range length (X3)		.069	.200*	.106	.008	
Sitting height (X4)		.074	.196	.253	.000	
Length (X5)		.232	.000	.222	.000	
Footprint length (X6)		.325	.000	.190	.000	
Sit And Reach (X7)		.085	.070	.085	.070	
Shoulder Flexibility Test (X8)		.082	.092	.130	.000	
Ruller Drop Test (X9)		.108	.006	.072	.200*	
Eye, Hand and Foot Coordination (X10)		.138	.000	.110	.004	
Balance (X11)		.108	.006	.177	.000	
Triple Hop Jump (X12)		.065	.200*	.076	.168	
Basketball Throw (X13)		.129	.000	.188	.000	
Hexogon Obstacle Test (X14)		.093	.032	.108	.006	
Jump Drop (X15)		.079	.125	.156	.000	
Hand Speed (X16)		.055	.200*	.100	.015	
Lari Bolak Balik 3 Meter		.107	.007	.088	.053	

(X17)				
Run to 3 Meters (X18)	.081	.108	.044	.200*
Handgrip Strength (X19)	.057	.200*	.093	.031
Push Up (X20)	.077	.153	.077	.148
Sit Up (X21)	.067	.200*	.050	.200*
Back Up (X22)	.065	.200*	.069	.200*
Leg Squat (X23)	.078	.137	.199	.000
Multi-Phase Run (X24)	.058	.200*	.116	.002

**C. Result of Analysis Confirmatory Factor Step I**

Statistik	N	Analisis Tahap I		Ket.
		Putra	Putri	
Weight (X1)	100	0.799	0.640	Ketentuan jika nilai <i>measure of sampling adequacy</i> (MSA) > 0,5 maka instrument layak dipakai dengan taraf signifikansi $\alpha = 0,05$ maka instrument tidak layak dipakai dengan taraf signifikansi $\alpha = 0,05$
Height (X2)		0.773	0.682	
Long arm range (X3)		0.648	0.671	
Sitting high (X4)		0.723	0.639	
Long legs (X5)		0.579	0.639	
Foot length (X6)		0.451	0.331	
Sit And Reac (X7)		0.402	0.452	
Shoulder Flexibility Test (X8)		0.539	0.657	
Ruller Drop Test (X9)		0.367	0.459	
Eyes, hand, and foot coordination (X10)		0.613	0.632	
Balance (X11)		0.223	0.419	
Triple Hop Jump (X12)		0.801	0.838	
Throwing basketball (X13)		0.736	0.640	
Hexagon Obstacle Test (X14)		0.831	0.741	
Jump Drop (X15)		0.712	0.665	
Hand speed (X16)		0.544	0.598	
run back and forth 3 meters (X17)		0.729	0.782	
Run to 30 Meters (X18)		0.587	0.734	
Handgrip Strength (X19)		0.753	0.593	
Push Up (X20)		0.810	0.738	
Sit Up (X21)		0.747	0.800	
Back Up (X22)		0.715	0.778	
Leg Squat (X23)		0.650	0.779	
Multi-Phase Run (X24)		0.769	0.812	

In the Anti Image Matrices correlation tab, there are four variables that have MSA value under 0,50 was the foot length (x6), sit and reach (X7) ruller drop test (X9) and balance (X11) athletes men and women respectively (0.451, 0.492, 0.367 and 0.223) and (0.331, 0.452, 0.459 and 0.419), which had to be redisplayed and must be removed or eliminated as they were not significant for further tests.

The next step was to reduce the variable with factor analysis II by not including the anthropometric variable for the foot length indicator because in the first analysis step both had MSA value below 0.5 which means that factor is not eligible to be included in factor analysis II.

**D. Result of Analysis Confirmatory Factor Step II**

Statistics	N	Analysis step I		Ket.
		Putra	Putri	
Weight (X1)	100	0,661	0,661	Conditions: if the score of measure of sampling adequacy (MSA,0.5) so instruments was worthy to used and (MSA,0.5), so instrument was not worthy to used with significance $\alpha = 0,05$
Height (X2)		0,682	0,682	
Long arm range (X3)		0,668	0,668	
Sitting high (X4)		0,674	0,674	
Long legs (X5)		0,679	0,679	
Foot length (X6)		0,709	0,709	
Sit And Reac (X7)		0,663	0,663	
Shoulder Flexibility Test (X8)		0,664	0,664	
Ruller Drop Test (X9)		0,843	0,843	
Eyes, hand, and foot coordination (X10)		0,677	0,667	
Balance (X11)		0,775	0,775	
Triple Hop Jump (X12)		0,693	0,693	
Basketball throw (X13)		0,674	0,674	
Hexagon Obstacle Test (X14)		0,783	0,783	
Jump Drop (X15)		0,788	0,788	
Hand speed (X16)		0,584	0,584	
Run 3 Meters (X17)		0,735	0,735	
Run 30 Meters (X18)		0,800	0,800	
Handgrip Strength (X19)		0,793	0,793	
Push Up (X20)		0,828	0,828	
Sit Up (X21)		0,661	0,661	
Back Up (X22)		0,682	0,682	
Leg Squat (X23)		0,668	0,668	
Multi phase run (X24)		0,674	0,674	

In Anti Image Matrices tabulation there was no variable that had MSA value under 0,50 which means that all variables can be tested further using extraction process with Principal Component Analysis method that yield value of Communalities.

**E. Result of Extraction Steps**

Statistic	N	Analysis Steps Ii extraction step		Note
		Men	Women	
Weight (X1)	100	0.674	0.559	Result of each extraction crossed by 100 %
Height (X2)		0.730	0.809	
Arm Range Length (X3)		0.756	0.803	
Sitting Height (X4)		0.589	0.712	
Length (X5)		0.514	0.609	
shoulder flexibility test (X8)		0.628	0.509	
koordinasi mata, tangan dan kaki (X10)		0.586	0.602	
triple hop jump (X12)		0.544	0.604	
lempar bola basket (X13)		0.558	0.523	
hexagon obstacle test (X14)		0.613	0.582	
Jump Drop (X15)		0.686	0.634	
Hand speed (X16)		0.680	0.554	
Run 3 meter (X17)		0.483	0.711	
Run 30 meter (X18)		0.592	0.494	
handgrip strength (X19)		0.656	0.731	
push up (X20)		0.605	0.637	
sit up (X21)		0.630	0.739	
back up (X22)		0.501	0.618	
Leg squat (X23)		0.509	0.677	
Multi Phase Run (X24)		0.737	0.653	



## 5. Conclusion

Based on the results of research and data analysis that has been done, and refer to the discussion in the previous chapter, it turns out the proposed hypothesis can be accepted, so it can be concluded that the anthropometry factor and physical condition condition (latent variables  $\xi_1$  and latent variables  $\xi_2$ ) that determine the physical quality of the athlete Pencak silat category of matches of young men and women can be measured from each research indicator as follows:

- 1) The dominant factor of anthropometry determines the physical quality of the athlete of the male teenage counter category comprising X1 weight (0.674 or 67.4%), height of X2 (0.730 or 73%), length of X3 arm bands (0.756 or 75, 6%), X4 seated height (0.589 or 58.9%) and limb length X5 (0.514 or 51.4%).
- 2) The dominant factor of anthropometry determines the physical quality of martial arts athletes in the category of female teenagers consisting of X1 weight (0,559 or 55,9%), height X2 (0,809 or 80,9%), 0.803 or 80.3%), X4 seated height (0,712 or 71,12%) and length of limb X5 (0,609 or 60,9%)
- 3) The dominant factor of the quality of physical condition determines the physical quality of the athlete of the male teenage match category consisting of: shoulder flexibility test X8 (0,628 or 62,8%), eye coordination, hand and foot X10 equal to 0,586 or 58,6% Triple hop jump X12 (0,544 or 54,4%), X13 basketball throw (0,558 or 55,8%), hexagon obstacle test X14 (0,613 or 61,3%), X15 jump height (0,686 or 68 , 6%), hand velocity X16 (0.680 or 68.0%), sprint 3 meters X17 (0.483 or 48.3%), run 30 meters X18 (0,592 or 59,2%), handgrip strength X19 (0,656 or 65,6%), push up X20 (0,605 or 60,5%), sit up X21 (0,630 or 63,0%), back up X22 (0,501 or 50,1%), X23 multiracial races (0.509 or 50.9%), and one leg squat X24 (0.737 or 73.7%).
- 4) The dominant factor of the quality of physical condition determines the physical quality of the athlete of the category of female teenagers consisting of: shoulder flexibility test X8 (0,509 or 62,5%), eye coordination, hands and feet X10 (0,602 or 60,2%), Triple hop jump X12 for (0,604 or 60,4%), X13 basketball throwing (0,523 or 52,3%), hexagon obstacle test X14 equal (0,582 or 58,2%), X15 agility jump (0,634 or 63 , 4%), hand velocity X16 (0,554 or 55,4%), sprint 3 meter X17 (0,711 or 71,1%), 30 meter X18 (0,494 or 49,4%), handgrip strength X19 (0,731 or 73,1%), push up X20 (0,637 or 63,7%), sit up X21 (0,739 or 73,9%), back up X22 (0,618 or 61,8%), The X23 multiracial run (0.677 or 67.7%), and one leg squat X24 (0.653 or 65.3%).
- 5) There was a correlation between anthropometry factor with achievement of male teenagers in martial art of equal to 0.61
- 6) There was a correlation between anthropometry factor with the achievement of juvenile athlete martial art category equal to 0,695
- 7) There was relationship between physical condition factor with achievement of athlete of martial art category of teen men equal to 0,816
- 8) There was correlation between physical condition factor with achievement of juvenile athlete martial art at men equal to 0,762

- 9) There was a relationship between anthropometry factor and physical condition factor simultaneously with the achievement of teenagers athletes martial art men's category equal to 0.844
- 10) There was an association between anthropometry factor and physical condition factor simultaneously with the achievement of juvenile athlete martial art category equal to 0.829.

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