Predominance of Pencak Silat athletes in the fighting category

Predominio de los atletas de Pencak Silat en la categoría de lucha

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Abstract

Background: Talent identification in pencak silat is needed as prediction of the future performance of young players to achieve success at national or international level in pencak silat.
Purposes: The research purpose was determined predominance model of pencak silat athletes in the fighting category in adolescents aged 14-17 years.
Method: The study was used survey design. The 100 male adolescents aged 14-17 years (50 pencak silat athletes in the fighting category and 50 non-pencak silat athletes in the fighting category) participated in this study. The data collected consisted of 8 anthropometric tests and 21 physical condition tests. Data analysis used stepwise discriminant analysis.
Result: Based on stepwise discriminant analysis, 19 predictor variables were generated that maximally discriminated between athletes and non-athletes in the fighting category. By classifying Fisher's linear discriminant functions based on the 19 predictor variables, 100% of all subjects were correctly classified. The distinguishing characteristics of athletes and non-athletes of fighting category of pencak silat are height, weight, BMI, sitting height, ratio of sitting height/height, spine flexibility, reaction speed, eye-hand coordination, eye-foot coordination, static balance, dynamic balance of the right and left legs, lower limb muscle power, hand speed, agility of the 3x3m shuttle run, speed 30m, abdominal muscle strength, arm muscle strength, and VO2max.
Conclusion: There were 5 anthropometric variables and 14 physical condition variables allow for differentiating between athletes and non-athletes of the fighting category of pencak silat.

Keywords

Fighting category; Pencak silat; predominance

Resumen

Antecedentes: La identificación de talentos en pencak silat es necesaria como predicción del desempeño futuro de los jugadores jóvenes para lograr el éxito.
Propósitos: El propósito de la investigación fue determinar el modelo de predominio de los atletas de pencak silat en la categoría de lucha en adolescentes de 14 a 17 años. Método: El estudio se diseñó con una encuesta. Participaron en este estudio 100 adolescentes varones de 14 a 17 años (50 atletas de pencak silat en la categoría de lucha y 50 atletas que no eran de pencak silat en la categoría de lucha). Los datos recopilados consistieron en 8 pruebas antropométricas y 21 pruebas de condición física. El análisis de datos utilizó el análisis discriminante por pasos.
Resultado: Con base en el análisis discriminante por pasos, se generaron 19 variables predictoras que discriminaron al máximo entre atletas y no atletas en la categoría de lucha. Al clasificar las funciones discriminantes lineales de Fisher con base en las 19 variables predictoras, el 100% de todos los sujetos fueron clasificados correctamente. Las características distintivas de los atletas y no atletas de la categoría de lucha de pencak silat son la altura, el peso, el IMC, la altura sentada, la relación entre la altura sentada y la altura, la flexibilidad de la columna, la velocidad de reacción, la coordinación ojo-mano, la coordinación ojo-pie, el equilibrio estático, el equilibrio dinámico de las piernas derecha e izquierda, la potencia muscular de las extremidades inferiores, la velocidad de la mano, la agilidad de la carrera de ida y vuelta de 3x3 m, la velocidad de 30 m, la fuerza de los músculos abdominales, la fuerza de los músculos del brazo y el VO2máx.
Conclusión: Hubo 5 variables antropométricas y 14 variables de condición física que permiten diferenciar entre atletas y no atletas de la categoría de lucha de pencak silat.

Palabras clave

Categoría de lucha; pencak silat; predominio

Introduction

Pencak silat is a martial art in Indonesia (Wilson, 2009). Etymologically, pencak silat comes from two words, namely pencak and silat. The word "pencak" means basic martial arts movements that are bound by a rule, while the word "silat" means perfect martial arts movements that come from spirituality. So in general, pencak silat is defined as one of the martial arts whose every movement follows or is bound by special rules. Pencak silat means a game with the skills of parrying, attacking, and defending oneself with certain techniques, so it can be said that in pencak silat there are attacking and defensive techniques. As a competitive sport, the development of the Indonesian pencak silat has experienced ups and downs in achievement. This can be seen from several multi-events and world championships participated in by Indonesia. Even in several of its participations, Indonesia has failed to achieve maximum achievements, such as in the 2002 world championship in Penang, Malaysia. The 2004 world championship in Singapore, the 2007 world championship in Pahang, Malaysia, and the 2003 SEA Games in Vietnam, the 2005 SEA Games in the Philippines and the 2009 SEA Games in Laos (Trisnowiyanto, 2016). Real evidence that cannot be denied regarding the failure of Indonesian pencak silat in several world championships and SEA Games, one of these indications is Indonesia's failure to become the overall champion in the 2015 SEA Games with 3 gold, 2 silver and 5 bronze medals (Kuswanto, 2016).

Achievement development in pencak silat can be achieved through programmed, regular, measurable and systematic training involving various disciplines of science and technology from biological, psychological, environmental factors, and training programs. Physical characteristics such as anthropometry and physical condition contribute to determining the performance or appearance of a silat athlete. Anthropometry is stated as a measure of the dimensions of the human body regarding physical geometry, mass, characteristics of the human body, and each athlete basically has different shapes, heights, and weights (Pelana, 2018). The components of physical condition as performance indicators in sports are a choice or combination of physical condition variables that play an important role in achieving success in a sport. Which indicators can be an ideal profile that can be used to predict future physical condition needs for a sport (Hughes & Bartlett, 2002), this is in accordance with the results of a review conducted by O'Donoghue (2005). The components of physical condition include strength, endurance, speed, power, flexibility, balance, accuracy, coordination, agility, and reaction. The physical condition is a complete unity of components that cannot be separated, either in terms of improvement or maintenance.

A study reported that body height plays a role of 79% and leg length plays a role of 76% in fighting category pencak silat skills (Fatoni, 2016), the ratio of leg length and body height has a significant relationship both singly and multiplely with pencak silat crescent kick ability with a relative contribution of 12.02% and an effective contribution of 8.09% (Subekti, Kristiyanto, & Purnama, 2014). Physical factors also determine pencak silat skills in the fighting category. A study reports that flexibility has a role of 29%, speed has a role of 97%, anaerobic endurance has a role of 98%, leg muscle power has a role of 97%, and eye-foot coordination has a role of 30% (Fatoni, 2016). It has been explained that several anthropometric variables and physical conditions play a role in the fighting category of pencak silat. Therefore, in achieving achievements in the sport of pencak silat, not only one anthropometric profile or physical condition as a prerequisite to participate in the highest level of play, therefore the anthropometric variables and physical conditions must be involved. Through discriminant analysis, it can explore the dominant anthropometric variables and physical conditions in pencak silat athletes which can then be used for the selection of pencak silat athletes in the future. This research purpose was determined the predominance model of pencak silat athletes in the fighting category for adolescents aged 14-17 years. Which model is based on the measurement of anthropometric variables and physical conditions.

Method

Research Design

Researchers used survey designs to obtain direct measurement information from subjects.

Participants

The 100 male adolescents aged 14-17 years participated in this research, consisting of two groups, namely control and target. The control group was male adolescents who played in the pencak silat as a recreational sport (non-athlete group, n = 50). The target group was male adolescents who played in the pencak silat as a competitive sport and participated in championships ranging from district/city, provincial, regional, national, and international levels (athlete group, n = 50).

Procedure dan measurements

Participants completed 29 tests consisting of anthropometry and physical conditioning. Before the tests, standard instructions and demonstrations were given to participants according to the test guidelines. All tests were conducted at the same location. Tests were conducted in the morning and athletes were instructed not to engage in vigorous exercise the day before the test session.

Anthropometry

All subjects were measured for anthropometry: height, weight, BMI, arm span, sitting height, sitting height/body height ratio, leg length, and foot length. Height was measured without shoes using a stadiometer with an accuracy of 0.1 in meters (m). Weight was measured using a scale while wearing at least kilograms (kg). BMI was calculated using the formula $\frac{\text{Weight}}{\text{Height x Height}}$. Arm span, sitting height, leg length, and foot length were measured using a measuring tape in centimeters (cm) to the nearest 0.1 cm and recorded. The sitting height/body height ratio was calculated using the formula $\frac{\text{Sitting height}}{\text{Height}}$ x 100% (Ashok, 2008; Can et al., 2022).

Physical condition

All subjects were measured for their physical condition: strength/resistance of abdominal muscle used sit-up test, arm strength used push-up test and back strength used back-up test, forearm muscle strength used handgrip strength test, leg strength used one leg squat, spine flexibility used sit and reach test, shoulder flexibility used shoulder flexibility test, reaction speed used ruler drop test, eye-hand coordination used hand wall toss test, eye-foot coordination used mitcel soccer test, static balance used standing stroke test, dynamic balance used Y-balance test, upper limb muscle power used medicine ball throw, lower limb muscle power used 3 hop test and 30-second square agility jump, agility used 3x3m shuttle run and hexagon agility test, foot speed used 30m acceleration test, hand speed test, aerobic power (VO2max) used multi-stage fitness test (Ashok, 2008; Idris, Rudi, & Indrayogi, 2023; Açikgöz & Cengizel, 2023; Mackenzie, 2005).

Statistical Analysis

Discriminant analysis was used to assign individuals into athlete and non-athlete groups. Descriptive statistics were used to determine the mean and standard deviation of both groups. The data showed normality through multivariate normality testing based on Mahalanobis distance and homogeneous based on Box'M sig value > 0.05 (p-value = 0.074). Multivariate analysis was used to distinguish the two groups. Stepwise discriminant analysis was used to analyze the data with minimal significance set at <0.05. Using stepwise discriminant analysis, the researcher extracted a subset of variables that maximally differentiated between the two groups using forward and backward methods. Sig of F was used to stop the discriminant analysis extraction procedure with a significance of <0.05 for entered and >0.05 for removed. Fisher's coefficient linear discriminant functions were used as discriminant functions to analyze the classification as "athletes" or "non-athletes" of the pencak silat fighting category based on anthropometric variables and physical condition. Data analysis was performed using SPSS 17.

Results

Data description

In the multivariate test, differences between athletes and non-athletes were found in all anthropometric variables and physical conditions, this can be seen in table 1.

Table 1. Multivariate test results of anthropometric variables and physical conditions

Wilks' Lambda	F	p-value
.038	61.706	.000*

Significance p<0.05

Differences between athletes and non-athletes were also found in anthropometric variables, i.e. height, weight, BMI, arm span length, sitting height and leg length. The athlete group has a higher body height, heavier body weight, longer arm span, higher sitting height and longer leg length. The ratio of sitting height/body height and foot length did not show any differences, this is because the results were not much different or looked the same, as seen in table 2.

Table 2. Description of data and results of anthropometric test differences

Test Antropometri	Group				Wilks' Lambda	F	p-value
	Athletes (n = 50)		Non-athletes (n = 50)				
	Mean	SD	Mean	SD			
Height (m)	1.565	.023	1.515	.027	.500	98.176	.000*
Weight (kg)	56.282	1.945	49.528	2.361	.287	243.777	.000*
BMI (kg/m2)	23.008	.854	21.598	.959	.619	60.323	.000*
Arm span (m)	1.587	.028	1.567	.026	.882	13.051	.000*
Sitting Height (m)	.378	.012	.364	.010	.686	44.828	.000*
Sitting Height/Height Ratio (%)	.242	.007	.240	.005	.979	2.137	.147
Leg Length (m)	.832	.016	.824	.014	.932	7.108	.009
Foot Length (m)	.227	.011	.227	.006	1.000	.013	.910

* Significance p<0.05

In the physical condition variables, differences were found between athletes and non-athletes in spine flexibility, eye-hand coordination, eye-foot coordination, dynamic balance of right and left legs, muscle power (upper limb and lower limb), hand speed, shuttle run agility, hexagon agility test, speed, muscle strength (forearm, abdominal, arm and back), square jump agility, and VO2max. Several variables were not found to be different in the two groups, such as should flexibility, reaction speed, static balance and leg strength. Although no differences were found between the two groups, the athlete group had better flexibility in the spine and shoulders. In terms of reaction speed, athletes have faster reactions than non-athletes as seen from the shorter cm distance in catching the ruler when it is dropped, the athlete's reaction moves quickly. In static balance, the athlete group was able to maintain a static balance position longer than the non-athlete group. The same was true for leg strength, although no differences were found between the two groups, the athlete group was superior in leg strength (table 3).

Table 3. Description of data and results of different tests of physical condition

Tes Kondisi Fisik	Group				Wilks' Lambda	F	p-value
	Athletes (n = 50)		Non-athletes (n = 50)				
	Mean	SD	Mean	SD			
Spine Flexibility (cm)	21.040	5.299	16.140	5.237	.819	21.627	.000*
Shoulder Flexibility (cm)	38.660	12.153	36.580	12.562	.993	.708	.402
Reaction Speed (cm)	20.820	5.906	21.780	7.046	.994	.545	.462
Eye-Hand Coordination (repetition)	18.000	2.213	14.960	2.204	.674	47.376	.000*
Eye-Foot Coordination (repetition)	18.660	2.105	16.280	1.917	.737	34.930	.000*
Static Balance (seconds)	25.996	7.919	25.084	8.768	.997	.298	.587
Right Leg Dynamic Balance (cm)	91.633	.547	91.026	.314	.679	46.348	.000*
Left Leg Dynamic Balance (cm)	92.307	.352	91.994	.346	.830	20.053	.000*
Upper Limb Muscle Power (m)	4.839	2.097	3.984	1.416	.945	5.711	.019*
Lower Limb Muscle Power (m)	10.272	1.911	8.778	1.598	.845	17.968	.000*
Hand Speed (repetition)	50.280	7.519	36.260	7.706	.536	84.788	.000*
Shuttle Run 3x3m Agility (seconds)	7.534	.800	8.242	.885	.848	17.619	.000*
Hexagon Agility Test Agility (seconds)	14.419	2.390	15.943	4.235	.952	4.911	.029*
Speed 30m (seconds)	5.403	.339	5.845	.312	.680	46.063	.000*
Forearm Muscle Strength (kg)	24.704	4.878	22.432	5.170	.950	5.109	.026*
Leg Strength (repetition)	7.700	1.787	7.480	1.843	.996	.367	.546
Abdominal Muscle Strength (repetition)	48.780	9.485	35.280	10.400	.681	45.991	.000*
Arm Muscle Strength (repetition)	43.380	11.966	37.700	10.051	.937	6.605	.012*
Back Muscle Strength (repetition)	71.820	18.912	64.640	16.024	.959	4.195	.043*
Square Agility Jump (repetition)	14.040	2.899	12.620	3.362	.950	5.116	.026*
VO2max (mL/kg/min)	36.294	6.036	29.842	4.183	.717	38.596	.000*

* Significance p<0.05

Discriminant analysis

Stepwise stages for entered and removed variables

Through the stepwise stages, researchers entered predictor variables in stages based on significant F values (sig F below 0.05) (forward), then combined by eliminating insignificant predictor variables (sig F above 0.05) (backward). In this research, there are 19 stages for entering predictor variables (forward

stage) where 1 predictor variable is entered one by one at each stage. Then each time a predictor variable is entered, it is combined with the elimination of the predictor variable (removed) that has been entered, the variable is removed if sig> 0.05. Table 4 displays one by one the predictor variables that are entered and removed.

Based on stepwise, 19 variables were produced that discriminated between athletes and non-athletes of pencak silat, namely body weight (Wilks' Lambda = .287; F = 243.777; p<0.05), hand speed (Wilks' Lambda = .205; F = 187.553; p<0.05), abdominal muscle strength (Wilks' Lambda = .168; F = 158.533; p<0.05), eye-foot coordination (Wilks' Lambda = .149; F = 135.639; p<0.05), spine flexibility (Wilks' Lambda = .134; F = 122.013; p<0.05), 30m speed (Wilks' Lambda = .122; F = 111.938; p<0.05), reaction speed (Wilks' Lambda = .108; F = 108.749; p<0.05), 3x3m shuttle run agility (Wilks' Lambda = .099; F = 103.820; p<0.05), arm muscle strength (Wilks' Lambda = .090; F = 101.088; p<0.05), static balance (Wilks' Lambda = .084; F = 97.460; p<0.05), VO2max (Wilks' Lambda = .079; F = 93.521; p<0.05), BMI (Wilks' Lambda = .075; F = 90.036; p<0.05), height (Wilks' Lambda = .070; F = 88.568; p<0.05), right leg dynamic balance (Wilks' Lambda = .063; F = 90.953; p<0.05), eye-hand coordination (Wilks' Lambda = .057; F = 92.383; p<0.05), sitting height (Wilks' Lambda = .053; F = 92.221; p<0.05), sitting height/body height ratio (Wilks' Lambda = .051; F = 90.552; p<0.05), left leg dynamic balance (Wilks' Lambda = .047; F = 90.829; p<0.05), and lower limb muscle power (Wilks' Lambda = .045; F = 89.986; p<0.05) (table 5).

The 19 predictor variables are statistically significant with Wilks' Lambda value = .045; Chi-square = 275.040 with significance p <0.05, which means that the average value of the discriminant score of the two groups is significantly different. Furthermore, the canonical correlation squared value (.977) shows the degree of relationship between the discriminant results or the amount of variability that can be explained by the 19 predictor variables on the predominance of pencak silat athletes in the fighting category. The 97.7% of the predominance of pencak silat athletes in the fighting category can be explained by the discriminant model formed.

The predominance model of fighting category of pencak silat athletes based on discriminant functions

The predominance model of pencak silat athletes of fighting category was explained by the discriminant function obtained based on the stepwise discriminant analysis on the coefficient fisher's linear discriminant functions. The function of 19 predictor variables is determined, allowing coaches to classify each male teenager aged 14-17 years into one of the categories, namely athletes of pencak silat fighting category and non-athletes of pencak silat fighting category. The following explains 2 functions (function for athletes and non-athletes). Each teenager will be tested with tests and measurements of 19 predictor variables. Then the test results are entered into the function. Then the highest value of the two functions will indicate the teenager is included as a athlete of pencak silat or non-athlete of pencak silat.

1. Athletes of pencak silat: 679494.489 (height) – 8614.492 (weight) + 19421.577 (BMI) – 444512.525 (sitting height) + 717239.634 (sitting height/height ratio) – 100.317 (spine flexibility) – 72.933 (reaction speed) – 174.461 (eye-hand coordination) – 110.695 (eye-foot coordination) + 50.471 (static balance) + 1730.966 (dynamic balance of the right leg) + 1930.615 (dynamic balance of the left leg) – 38.955 (lower limb muscle power) – 12.276 (hand speed) + 188.780 (3x3m shuttle run agility) + 2218.146 (30m speed) – 34.456 (abdominal muscle strength) + 15.497 (arm muscle strength) – 86.983 (VO2max) – 684006.006.
2. Non-athlete of pencak silat: 681116.561 (height) – 8664.810 (weight) + 19527.753 (BMI) – 438730.110 (sitting height) + 709032.874 (sitting height/height ratio) – 101.876 (spine flexibility) – 73.859 (reaction speed) – 176.043 (eye-hand coordination) – 112.268 (eye-foot coordination) + 51.092 (static balance) + 1740.544 (dynamic balance of the right leg) + 1938.589 (dynamic balance of the left leg) – 37.411 (lower limb muscle power) – 12.936 (hand speed) + 195,084 (3x3m shuttle run agility) + 2246,646 (30m speed) – 35,163 (abdominal muscle strength) + 15,889 (arm muscle strength) – 88,032 (VO2max) – 688047,469.

Table 4. Stepwise stages for entered and removed of predictor variables

Variable	Stepwise																					
	0		1		2		3		4		5		6		7		8		9		10	
	For-ward	Back-ward	For-ward	Back-ward	For-ward	Back-ward	For-ward	Back-ward	For-ward	Back-ward	For-ward	Back-ward	For-ward	Back-ward	For-ward	Back-ward	For-ward	Back-ward	For-ward	Back-ward	For-ward	Back-ward
Height13	.000		.055		.056		.016		.024		.007		.002		.024		.038		.025		.038	
Weight1	.000*	.000		.000		.000		.000		.000		.000		.000		.000		.000		.000		.000
BMI12	.000		.044		.047		.013		.019		.004		.001		.014		.022		.015		.023	
Arm Span Length	.000		.503		.688		.604		.589		.229		.090		.183		.194		.161		.151	
Sitting Height16	.000		.416		.378		.580		.812		.801		.776		.799		.748		.862		.650	
Sitting Height/Height Ratio17	.147		.808		.912		.424		.274		.178		.131		.104		.115		.136		.086	
Leg Length	.009		.533		.625		.595		.670		.233		.163		.313		.309		.326		.323	
Foot Length	.910		.258		.374		.408		.223		.535		.542		.365		.553		.680		.509	
Spine Flexibility5	.000		.004		.008		.001		.001*	.001		.000		.000		.000		.000		.000		.000
Shoulder Flexibility Test	.402		.235		.313		.645		.742		.920		.884		.852		.734		.922		.651	
Reaction Speed7	.462		.506		.135		.036		.016		.009		.001*	.001		.000		.000		.000		.000
Eye-Hand Coordination15	.000		.000		.001		.001		.007		.028		.014		.009		.019		.017		.023	
Eye-Foot Coordination4	.000		.000		.000		.001*	.001		.001		.004		.002		.014		.017		.005		.011
Static Balance10	.587		.836		.917		.473		.167		.029		.006		.020		.017		.011*	.011		.004
Dynamic Balance Right Leg14	.000		.011		.072		.161		.432		.817		.565		.419		.393		.162		.131	
Dynamic Balance Left Leg18	.000		.222		.252		.905		.806		.789		.778		.829		.929		.841		.802	
Upper Limb Muscle Power	.019		.153		.067		.143		.305		.473		.937		.432		.588		.250		.133	
Lower Limb Muscle Power19	.000		.203		.172		.824		.586		.366		.076		.044		.029		.066		.071	
Hand Speed2	.000		.000*	.000		.000		.000		.000		.000		.000		.000		.000		.000		.000
Agility Shuttle Run 3x3m 8	.000		.001		.001		.032		.156		.095		.093		.005*	.005		.000		.000		.000
Agility Hexagon Agility Test	.029		.016		.113		.854		.925		.775		.896		.936		.635		.836		.701	
Speed 30m 6	.000		.000		.000		.003		.012		.003*	.003		.000		.000		.000		.000		.000
Forearm Muscle Strength	.026		.107		.017		.083		.098		.178		.094		.050		.126		.107		.169	
Leg Strength_One Leg Squat	.546		.780		.748		.838		.918		.360		.795		.691		.675		.366		.348	
Abdominal Muscle Strength 3	.000		.000		.000*	.000		.000		.000		.000		.000		.002		.000		.000		.000
Arm Muscle Strength 9	.012		.193		.426		.244		.168		.075		.036		.061		.004*	.004		.003		.002
Back Muscle Strength	.043		.066		.014		.357		.252		.632		.878		.870		.281		.761		.383	
Square Agility Jump	.026		.827		.506		.911		.368		.680		.921		.953		.337		.303		.199	
VO2max 11	.000		.002		.011		.038		.095		.251		.350		.169		.097		.070		.022*	.022

*Entered predictor variable
**Removed predictor variable
Note: the number above the variable indicates the order in which the variable was entered

Table 4. (Continued)

Variable	Stepwise																			
	11		12		13		14		15		16		17		18		19	
	Forward	Back-ward	For-ward	Back-ward	For-ward	Back-ward	For-ward	Back-ward	For-ward	Back-ward	For-ward	Back-ward	For-ward	Back-ward	For-ward	Back-ward	For-ward	Back-ward	Forward
Height 13	.052		.015*	.015		.001		.000		.000		.021		.008		.011			
Weight 1		.000		.002		.000		.000		.000		.000		.000		.000			
BMI 12	.028*	.028		.008		.000		.000		.000		.000		.000		.000			
Arm Span Length	.175		.076		.227		.301		.327		.182		.370		.218			.170**	
Sitting Height 16	.388		.024		.010		.011		.016*	.016		.028		.009		.004			
Sitting Height/Height Ratio 17	.035		.042		.014		.016		.023		.040*	.040		.015		.006			
Leg Length	.404		.076		.290		.744		.732		.572		.410		.507			.419**	
Foot Length	.304		.025		.099		.033		.023		.047		.065		.147			.153**	
Spine Flexibility 5		.000		.000		.000		.000		.000		.000		.000		.000			
Shoulder Flexibility Test	.330		.170		.293		.832		.707		.854		.790		.565			.343**	
Reaction Speed 7		.001		.000		.000		.000		.000		.000		.000		.000			
Eye-Hand Coordination 15	.046		.032		.030		.006*	.006		.008		.007		.001		.003			
Eye-Foot Coordination 4		.016		.012		.003		.008		.004		.008		.011		.008			
Static Balance 10		.006		.003		.001		.001		.000		.000		.000		.000			
Dynamic Balance Right Leg14	.067		.065		.003*	.003		.001		.001		.000		.000		.001			
Dynamic Balance Left Leg 18	.709		.837		.375		.464		.089		.051		.018*	.018		.030			
Upper Limb Muscle Power	.073		.101		.139		.288		.118		.150		.092		.059			.063**	
Lower Limb Muscle Power 19	.028		.038		.019		.059		.136		.059		.023		.037*	.037			
Hand Speed 2		.000		.000		.000		.000		.000		.000		.000		.000			
Agility Shuttle Run 3x3m 8		.000		.000		.000		.000		.000		.000		.000		.000			
Agility Hexagon Agility Test	.633		.570		.309		.326		.451		.461		.623		.377			.255**	

Speed 30m 6		.000	.000	.000	.000	.000	.000	.000	.000	
Forearm Muscle Strength	.208	.157	.244	.302	.223	.103	.159	.132	.125**	
Leg Strength_One Leg Squat	.391	.480	.398	.855	.092	.141	.064	.108	.140**	
Abdominal Muscle Strength 3		.000	.000	.000	.000	.000	.000	.000	.000	
Arm Muscle Strength 9		.001	.002	.000	.000	.000	.000	.000	.001	
Back Muscle Strength	.436	.470	.411	.454	.169	.289	.245	.309	.690**	
Square Agility Jump	.138	.209	.401	.292	.191	.126	.247	.403	.482**	
VO2max 11		.027	.007	.001	.002	.000	.000	.000	.000	

*Entered predictor variable
**Removed predictor variable
Note: the number above the variable indicates the order in which the variable was entered

Table 5. Entered variables

Step	Entered	Wilks' Lambda	F	p-value
1	Body Weight	.287	243.777	.000
2	Hand Speed	.205	187.553	.000
3	Abdominal Muscle Strength	.168	158.533	.000
4	Eye-Foot Coordination	.149	135.639	.000
5	Spine Flexibility	.134	122.013	.000
6	Speed 30m	.122	111.938	.000
7	Reaction Speed	.108	108.749	.000
8	Agility Shuttle Run 3x3m	.099	103.820	.000
9	Arm Muscle Strength	.090	101.088	.000
10	Static Balance	.084	97.460	.000
11	VO2max	.079	93.521	.000
12	BMI	.075	90.036	.000
13	Height	.070	88.568	.000
14	Right Leg Dynamic Balance	.063	90.953	.000
15	Hand-Eye Coordination	.057	92.383	.000
16	Sitting Height	.053	92.221	.000
17	Sitting Height/Height Ratio	.051	90.552	.000
18	Left Leg Dynamic Balance	.047	90.829	.000
19	Lower Limb Muscle Power	.045	89.986	.000

Identification of the predominance of fighting category of pencak silat athletes

Based on the discriminant function explained above, table 6 shows the number of samples correctly classified using this function. The results show 100%, the subjects are correctly classified. Furthermore, cross-validation between the initial model and the discriminant model classification shows that 100% of cases grouped with cross-validation are correctly classified.

Table 6. Identification of the predominance of fighting category of pencak silat athletes in the samples used

Classification		Group	Predicted Group Membership		Total
			Athlete	Non Athlete	
Original	Count	Athlete	50	0	50
		Non Athlete	0	50	50
	%	Athlete	100.0	.0	100.0
		Non Athlete	.0	100.0	100.0
Cross-validated	Count	Athlete	50	0	50
		Non Athlete	0	50	50
	%	Athlete	100.0	.0	100.0
		Non Athlete	.0	100.0	100.0

Discussion

The research results indicated that the anthropometric and physical condition variables can be used to distinguish between athletes and non-athletes of the fighting category of pencak silat. Moreover, this research also shows a relevant model, as shown by 100% of subjects being correctly classified based on the discriminant function formed. In this research, the predominance model of fighting category of pencak silat athletes for male adolescents aged 14-17 years based on discriminant analysis produces 5 anthropometric variables (height, weight, BMI, sitting height, ratio of sitting height/height) and 14 physical condition variables (spine flexibility, reaction speed, eye-hand coordination, eye-foot coordination, static balance, dynamic balance of the right and left legs, lower limb muscle power, hand speed, 3x3m shuttle run agility, 30m speed, abdominal muscle strength, arm muscle strength, and VO2max) to distinguish between fighting category of pencak silat athletes and non-athletes.

Anthropometry

Anthropometrics is the first measurement that needs to be considered because anthropometric factors are very useful for knowing a person's body structure and can place them in a suits sport. This aims to create superior pencak silat athletes based on adequate body structure and based on their movement functions and the main needs in the silat sport. In sports, anthropometry is needed to maximize achievement by playing a role starting from determining the sport so that it can maximize the athlete's condition. Biometric aspects are an important part of sports activities and can be said to influence the sports

achievements. High-performance sports require a special biological profile with good biometric ability characteristics and psychological characteristics. The biometric aspects include height, weight, sitting height, length of upper and lower limbs, body type and others. In this research, the results of the discriminant analysis showed that the variables of weight, BMI, height, sitting height, and the ratio of sitting height/height are some of the variables that differentiate between athletes and non-athletes in the pencak silat fighting category. A research with taekwondo athletes reported lower BMI in male winners compared to male non-winners. Winners tend to be taller with a BMI slightly lower than the average for their weight category (Kazemi et al., 2006).

In this research, pencak silat athletes were also 0.05±0.04 taller than non-athletes, but with slightly higher body weight and BMI of 6.75±3.29 kg and 1.41±1.26 kg/m2 than non-athletes. Despite their higher body weight and BMI, all athletes were in the normal weight category while 2 non-athletes were in the thin category. In relation to height, taller athletes have the advantage of longer lower and upper extremities, meaning longer levers give them a greater ability to cover a larger area with less energy, which may be beneficial in combat sports when executing kicking techniques (Khayyat et al., 2020). In addition, Arazi, Noori & Izadi (2017) in their research reported that height and sitting height can help further mastery in performing techniques and balance. A research showed a significant difference between elite and non-elite combat sport athletes in terms of sitting height (Gürsoy & Canli, 2021). Regarding sitting height, using the ratio between sitting height and height was able to differentiate the level of success of athletes. The height/sitting height ratio has been identified as a promising alternative measure that is able to differentiate differences in the stature of the head and trunk, as well as legs between standard competitors in taekwondo. In this research, fighting category of pencak silat athletes had a sitting height/height ratio that was 0.002±0.007% higher than non-athletes (Can et al., 2022).

Physical condition

Spine flexibility is relevant to pencak silat because it allows for higher and more complex kicks, which then give more points. In this research, the results of the discriminant analysis showed that the spine flexibility variable is one of the variables that differentiates between athletes and non-athletes in the fighting category of pencak silat. In a previous research with a sample of southern Brazilian taekwondo, senior beginner male athletes reached 22.0±7.0 cm while senior experienced male athletes reached 25.1±9.4 in the sit and reach test (Formalioni et al., 2020). In this research, fighting category of pencak silat athletes reached 21,040±5,229 cm in the sit and reach test, better than non-athletes, namely 16,140±5,237 cm. Although they performed better, compared to taekwondo athletes, pencak silat athletes showed lower spine flexibility.

Sports success in the form of achievement levels in competitions is observed to correlate with reaction time (Lech et al., 2011). In this research, the results of the discriminant analysis showed that the reaction speed variable is one of the variables that distinguishes between athletes and non-athletes of the fighting category of pencak silat. A study reported that a shorter complex reaction time duration correlates with higher effectiveness both in phase I and throughout the bout (Lech et al., 2014). Through the ruler drop test in which both athletes and non-athletes quickly catch the dropped ruler, fighting category of pencak silat athletes were able to catch the ruler at the closest distance of 20,820 ± 5,906 cm while non-athletes were able to catch the ruler at a distance of 21,780 ± 7,046 cm. This shows that the performance of fighting category of pencak silat athletes has a faster response.

In this research, the results of the discriminant analysis showed that the variables of eye-hand coordination and eye-foot coordination were some of the variables that differentiated between athletes and non-athletes of the fighting category of pencak silat. Successful implementation of visuomotor tasks requires good eye-hand coordination. Regarding eye-hand coordination, good integration of visual and proprioceptive information is required during the competition to score points by delivering clean hits to certain target zones on the opponent's body (Chen et al., 2017). A research showed that eye-hand coordination has a significant correlation with the front punch of pencak silat (Hasyyati & Winarno, 2021). Boxing athletes were able to do 10.83 ± 3.21 repetitions in the hand wall toss test (Nabillah et al., 2022). In this investigation, fighting category of pencak silat athletes were able to do 18,000 ± 2,213 repetitions. This shown that fighting category of pencak silat athletes have higher eye-hand coordination. High level of visual-motor coordination correlates with high effectiveness and its improvement

during phase II bout (Sertić et al., 2014). In addition to eye-hand coordination, good eye-foot coordination is also needed, through eye movements then the feet respond to move. A significant correlation was found in eye-foot coordination with pencak silat crescent kick skills (Idris, Rudi, & Indrayogi, 2023).

Balance and postural control abilities are determining factors in the performance of pencak silat athletes. In this research, the results of the discriminant analysis showed that static and dynamic balance variables are some of the variables that differentiate between athletes and non-athletes in the pencak silat fighting category. Taekwondo athletes need balance to change body position and distance from opponents by stepping in different directions during the match, both when attacking and defending against opponents containing balanced movement patterns, athletes must not fall so as not to lose points (Açikgöz & Cengizel, 2023). A significant negative relationship between non-dominant leg static balance and plantar pressure on the athlete's forefoot and a significant positive relationship with plantar pressure on the rearfoot. A positive correlation was found in dynamic balance and dynamic plantar force during walking in the anterior and posteromedial directions on the dominant foot and in the posteromedial and posterolateral directions on the non-dominant foot. In line with previous resarch, the sighting category of pencak silat athletes were able to maintain static balance longer than non-athletes. In dynamic balance, they also had higher composite scores on both the right and left legs (Açikgöz & Cengizel, 2023).

Competitive performance in pencak silat is related to lower limb power. In this research, the results of the discriminant analysis showed that the lower limb muscle power variable is one of the variables that differentiates between athletes and non-athletes of the fighting category of pencak silat. Through 3 hop tests, fighting category of pencak silat athletes displayed a jump that was 1,493 meters further than non-athletes (10,272 ± 1,911 meters for fighting category athletes and 8,778 ± 1,598 meters for non-athletes). Meanwhile, in a previous research with a sample of pencak silat athletes at the district level, the 3 hop test jump was lower, namely 6.29 ± 1.43 meters (Khotimah, Syaifullah, & Hendarto, 2022). This shown that to achieve maximum performance and achievement in fighting category of pencak silat, it is necessary to monitor and improve lower limb muscle power.

In pencak silat, speed of both hands and feet is very important. In this research, the results of the discriminant analysis showed that the hand and foot speed variables are some of the variables that differentiate between athletes and non-athletes of the fighting category of pencak silat. The performance time of the 30m acceleration test of fighting category of pencak silat athletes showed a faster time of 5.403 ± 0.339 seconds, while non-athletes showed a longer time of 5.845 ± 0.312 seconds. The results of a research on pencak silat athletes aged 16-19 years showed a faster 30m acceleration performance time compared to the findings of the current research (Khasanah, Hariadi, & Taufik, 2022). In addition, the characteristics of hand speed in this finding reported higher performance in changing the position of the left hand to the right and vice versa for 15 seconds. So far, there have been no literature reports regarding hand speed performance in fighting category of pencak silat athletes.

Agility is one of the important components of biomotor skill related fitness in pencak silat (Lubis, 2004). Agility in pencak silat is the ability of a pencak silat athlete to move quickly with the correct position and provide a solid foundation when attacking or defending. This is because the opponent's technical movements are difficult to predict when attacking with punches, kicks, or even underhand sweeps. In this researh, the results of the discriminant analysis showed that the agility variable is one of the variables that distinguishes between athletes and non-athletes of the fighting category of pencak silat. In this research, fighting category of pencak silat athletes aged 14-17 years showed a performance time of 7,534 ± 0,800 seconds in the 3x3m shuttle run test, while non-athletes showed a longer performance time of 8,242 ± 0,885 seconds. Previous studies on pencak silat athletes aged 16-19 years showed faster performance times in the shuttle run, namely 7.05±5.57 seconds (Khasanah, Hariadi, & Taufik, 2022). This shown that with increasing age, the possibility of increasing agility performance.

In pencak silat, muscle strength is important when fighting because by having good strength, a pencak silat athlete will be easy to display his moves and reduce injuries (Khotimah, Syaifullah, & Hendarto, 2022). In this research, the results of the discriminant analysis showed that the variables abdominal muscle strength and arm muscle strength are one of the variables that differentiate between athletes and non-athletes in the fighting category of pencak silat. Abdominal muscle strength must be well developed because it helps in rotational movements and in withstanding the impact of kicks from opponents. Regarding abdominal resistance/strength, athletes at the Porprov championship level did 33.85

repetitions (Hardovi, 2022) while athletes at the district level were only able to do 24±3.57 repetitions (Khasanah, Hariadi, & Taufik, 2022). When compared to previous research, athletes in this research had a better level of abdominal resistance/strength for fighting category athletes, namely 48,780±9,485 repetitions in 30 seconds. However, in the 30-second push-up performance, the fighting category athletes in this research were only able to perform 43,380±11,966 repetitions of arm muscle, while athletes at the district level were able to perform 48.83±13.07 repetitions.

The importance of aerobic fitness in pencak silat performance is related to the athlete's faster recovery capacity between effort and combat. In this research, the results of the discriminant analysis showed that the VO2max variable is one of the variables that distinguishes between athletes and non-athletes of the fighting category of pencak silat. In this investigation, the VO2max value of fighting category pencak silat athletes was 36,394 ± 6,036 mL/kg/minute while the VO2max value of non-athletes was 29,842 ± 4,183 mL/kg/minute. Meanwhile, Khayyat et al (2020) reported higher VO2max values in taekwondo athletes aged 22.7 ± 2.8 years, namely 54.1 ± 4.4 mL/kg/minute. Although both are combat sports, their aerobic fitness is different. However, the influence of factors such as age also affects aerobic fitness. Increasing age increases VO2max, while starting at the age of 25 it decreases by about 1%. This investigation was carried out on adolescents aged 14-17 years.

Conclusions

In accordance with the objectives of this research, a predominance model for pencak silat athletes in the fighting category has been produced for adolescents aged 14-17 years based on anthropometry consisting of height, weight, BMI, sitting height, sitting height/body height ratio, while based on physical condition it consists of spine flexibility, reaction speed, eye-hand coordination, eye-foot coordination, static balance, dynamic balance of right and left legs, lower limb muscle power, hand speed, 3x3m shuttle run agility, 30m speed, abdominal muscle strength, arm muscle strength, and VO2max. Based on the resulting model, trainers can identify pencak silat athletes in the fighting category among male adolescents aged 14-17 years. The results of the anthropometric test and physical condition are entered into a formula or function, the highest value of both formulas or functions indicates whether you are dominant as an athlete or non-athlete. The following is the formula or function of the predominance model for pencak silat athletes in the fighting category for adolescents aged 14-17 years:

1. Athletes of pencak silat: 679494.489 (height) – 8614.492 (weight) + 19421.577 (BMI) – 444512.525 (sitting height) + 717239.634 (sitting height/height ratio) – 100.317 (spine flexibility) – 72.933 (reaction speed) – 174.461 (eye-hand coordination) – 110.695 (eye-foot coordination) + 50.471 (static balance) + 1730.966 (dynamic balance of the right leg) + 1930.615 (dynamic balance of the left leg) – 38.955 (lower limb muscle power) – 12.276 (hand speed) + 188.780 (3x3m shuttle run agility) + 2218.146 (30m speed) – 34.456 (abdominal muscle strength) + 15.497 (arm muscle strength) – 86.983 (VO2max) – 684006.006.
2. Non-athlete of pencak silat: 681116.561 (height) – 8664.810 (weight) + 19527.753 (BMI) – 438730.110 (sitting height) + 709032.874 (sitting height/height ratio) – 101.876 (spine flexibility) – 73.859 (reaction speed) – 176.043 (eye-hand coordination) – 112.268 (eye-foot coordination) + 51.092 (static balance) + 1740.544 (dynamic balance of the right leg) + 1938.589 (dynamic balance of the left leg) – 37.411 (lower limb muscle power) – 12.936 (hand speed) + 195,084 (3x3m shuttle run agility) + 2246,646 (30m speed) – 35,163 (abdominal muscle strength) + 15,889 (arm muscle strength) – 88,032 (VO2max) – 688047,469.

References

Açıkgöz, Y., & Cengizel, E. (2023). The Relationship between Plantar Pressure Distribution and Balance in Adolescent Taekwondo Athletes. Gazi Beden Eğitimi ve Spor Bilimleri Dergisi, 28(2), 160-166. https://doi.org/10.53434/gbesbd.1217210

Arazi, H., Noori, M., & Izadi, M. (2017). Correlation of anthropometric and bio-motor attributes with Special Judo Fitness Test in senior male judokas. Ido Movement for Culture. Journal of Martial Arts Anthropology, 17(4), 19-24. http://dx.doi.org/10.14589/ido.17.4.4

Ashok, C. (2008). Test your physical fitness. Delhi: Gyan Publishing House. https://books.google.co.id/books/about/Test_Your_Physical_Fitness.html?id=C8QlZC7pUNQC&redir_esc=y

Can, E., Kutlay, E., Quintana, M. S., & Bridge, C. A. (2023). Anthropometric characteristics of elite male taekwondo athletes according to weight category and performance level. Scientific Journal of Sport and Performance, 2(1), 16-27. https://doi.org/10.55860/GOVH2464

Chen, W. Y., Wu, S. K., Song, T. F., Chou, K. M., Wang, K. Y., Chang, Y. C., & Goodbourn, P. T. (2017). Perceptual and motor performance of combat-sport athletes differs according to specific demands of the discipline. Perceptual and motor skills, 124(1), 293-313. https://doi.org/10.1177/0031512516681342

Fatoni, M. (2016). Faktor anthropometri dan fisik penentu keterampilan pencak silat kategori tanding (Analisis Faktor Konfirmatori pada Pesilat Putra Usia Dewasa Kota Surakarta) (Doctoral dissertation, UNS (Sebelas Maret University)). https://digilib.uns.ac.id/dokumen/detail/51631/Faktor-anthropometri-dan-fisik-penentu-keterampilan-pencak-silat-kategori-tanding-Analisis-Faktor-Konfirmatori-pada-Pesilat-Putra-Usia-Dewasa-Kota-Surakarta

Formalioni, A., Antunez, B. F., Vecchio, F. B. D., Cabistany, L. D., Coswig, V. S., Letieri, R. V., & Fukuda, D. H. (2020). Anthropometric characteristics and physical performance of taekwondo athletes. Revista Brasileira de Cineantropometria & Desempenho Humano, 22, e55697. https://doi.org/10.1590/1980-0037.2020v22e55697

Gürsoy, H., & Canli, U. (2021). Identification of elite performance characteristics specific to anthropometric characteristics, athletic skills and motor competencies of combat athletes. Baltic Journal of Health and Physical Activity, 13(4), 6. https://doi.org/10.29359/BJHPA.13.4.06

Hardovi, B. H. (2022). Profil Kondisi Fisik Atlet Pencak Silat Kabupaten Jember dalam Kejuaraan PORPROV Jatim Ke VII 2022. SPRINTER: Jurnal Ilmu Olahraga, 3(2), 128-132. https://doi.org/10.46838/spr.v3i2.214

Hasyyati, R. W., & Winarno, M. E. (2021). Korelasi kekuatan otot lengan, power, dan koordinasi terhadap pukulan atlet pencak silat. Jurnal Olahraga Pendidikan Indonesia (JOPI), 1(1), 96-107. https://doi.org/10.54284/jopi.v1i1.9

Hughes, M. D., & Bartlett, R. M. (2002). The use of performance indicators in performance analysis. Journal of sports sciences, 20(10), 739-754. https://doi.org/10.1080/026404102320675602

Idris, I. M., Rudi, R., & Indrayogi, I. (2023). The Relationship between Abilities and Album Coordination to the Abilities of Pencak Silat Sabit Kick. JOURNAL RESPECS (Research Physical Education and Sports), 5(1), 212-225. https://doi.org/10.31949/respecs.v5i1.4360

Kazemi, M., Waalen, J., Morgan, C., & White, A. R. (2006). A profile of Olympic taekwondo competitors. Journal of sports science & medicine, 5(CSSI), 114. PMID: 24357983; PMCID: PMC3863920. https://pubmed.ncbi.nlm.nih.gov/24357983/

Khasanah, N. I., Hariadi, I., & Taufik, T. (2022). Profil Kondisi Fisik Atlet Pencak Silat Usia 16-19 Tahun. In Prosiding Seminar Nasional" Sport Health Seminar With Real Action" Ilmu Kesehatan Masyarakat Universitas Negeri Malang. http://conference.um.ac.id/index.php/starwars/article/view/3455#

Khayyat, H. N., Sağır, S. G., Hataş, Ö., Smolarczyk, M., & Akalan, C. (2020). Physical, physiological and psychological profiles of elite Turkish taekwondo athletes. Biomedical Human Kinetics, 12(1), 187-196. https://doi.org/10.2478/bhk-2020-0024

Khotimah, M. N., Syaifullah, R., & Hendarto, S. (2022). The Physical Condition of The Sukoharjo Pencak Silat Athlete in Team Category. Sports Medicine Curiosity Journal, 1(2), 68-76. https://doi.org/10.15294/smcj.v1i2.61662

Kuswanto, C. W. (2016). Penyusunan tes fisik atlet pencak silat dewasa kategori tanding. Jurnal Keolahragaan, 4(2), 145-154. https://doi.org/10.21831/jk.v4i2.6423

Lech, G., Jaworski, J., Lyakh, V., & Krawczyk, R. (2011). Effect of the level of coordinated motor abilities on performance in junior judokas. Journal of human kinetics, 30(2011), 153-160. https://doi.org/10.2478/v10078-011-0083-0

Lech, G., Sertić, H., Sterkowicz, S., Sterkowicz-Przybycień, K., Jaworski, J., & Krawczyk, R. (2014). Effects of different aspects of coordination on the fighting methods and sport skill level in cadet judo contestants. Kinesiology, 46(1.), 69-78. https://hrcak.srce.hr/123726

Lubis, J. (2004). Panduan Praktis Pencak Silat. Jakarta: PT. Raja Grafindo Persada. https://books.google.co.id/books/about/Pencak_silat.html?id=xgNmAAAACAAJ&redir_esc=y

Mackenzie, B. (2005). 101 Performance Evaluation Tests. London: Electric World plc. https://poruniskamab.github.io/download/101.pdf

Nabillah, A. A., Tarigan, B. S., Ramadhani, A., Lestari, E. A., Safei, I., & Iwandana, D. T. (2022). Analisis Kemampuan Koordinasi Mata-Tangan Atlet Tinju. Jurnal Olahraga dan Kesehatan Indonesia (JOKI), 3(1), 8-15. https://doi.org/10.55081/joki.v3i1.673

O'Donoghue, P. (2005). Normative profiles of sports performance. International Journal of Performance Analysis in Sport, 5(1), 104-119. https://doi.org/10.1080/24748668.2005.11868319

Pelana, R. Weight Loss in Pencak Silat Fighting Category. In Proceedings of the 2nd International Conference on Sports Science, Health and Physical Education (ICSSHPE 2017), 1, 107-110. https://doi.org/10.5220/0007055901070110

Subekti, N., Kristiyanto, A., & Purnama, S. P. (2014). Kemampuan Tendangan Sabit Mahasiswa Pembinaan Prestasi Pencak Silat UNS Surakarta Ditinjau dari Koordinasi Mata-kaki Kecepatan Rasio Panjang Tungkai dan Tinggi Badan. Indonesian Journal of Sports Science, 1(1). https://www.neliti.com/id/publications/218345/kemampuan-tendangan-sabit-mahasiswa-pembinaan-prestasi-pencak-silat-uns-surakart#cite

Trisnowiyanto, B. (2016). Latihan Peningkatan Kemampuan Biomotor (Kelincahan, Kecepatan, Keseimbangan Dan Fleksibilitas) Dengan Teknik Lari (Shuttle Run, Zig-Zag, Formasi 8) Pada Pesilat. Jurnal Keterapian Fisik, 1(2), 75-152. https://doi.org/10.37341/jkf.v1i2.85

Wilson, L. (2009). Jurus, jazz riffs and the constitution of a national martial art in Indonesia. Body & Society, 15(3), 93-119. https://doi.org/10.1177/1357034X09339103

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