RESEARCH ARTICLE

INTERNATIONAL JOURNAL OF KINANTHROPOMETRY

DOI: 10.34256/ijk2616

The Correlation of Anthropometric Measurements and Motor Parameters of Elite Karate Athlete

H.A.K.I. Sathsarani [1,*], W.K.D.S.A. Wickramarachchi [1]

[1] Department of Sport Sciences and Physical Education, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka, P.O. Box 02, Belihuloya, Sri Lanka.

* Corresponding author email: insathsarani@gmail.com

DOI: https://doi.org/10.34256/ijk2516

Received: 22-01-2026; Revised: 17-03-2026; Accepted: 05-04-2026; Published: 12-04-2026

Abstract

Introduction: This review aims to examine the relationship between anthropometric measurements and motor parameters of elite karate athletes, and to identify how body composition influences athletic performance. **Methods:** Relevant literature was collected from databases such as PubMed, Scopus, Web of Science, and Google Scholar. A total of 20 research articles focusing on elite karate athletes were selected based on their relevance to anthropometric variables and motor performance indicators such as agility, strength, speed, flexibility, and endurance. Motor skills examined include vertical jump test, agility test, speed test, T- test, 20m shuttle run test and aerobic test. **Results:** The findings indicate that anthropometric characteristics such as body height, body weight, limb length, and muscle mass, and body fat percentage are significantly associated with motor performance. Lower body fat percentage and higher muscle mass were generally linked to better performance in speed, agility, and explosive power. Additionally, limb length and height showed positive relationships with jumping ability and overall movement efficiency. **Conclusion:** Anthropometric measurements play a crucial role and closely related determining motor performance in elite karate athletes. These findings highlight the importance of optimizing body composition and physical characteristics to enhance performance. Coaches and trainers can use this information to design more effective, individualized training programs.

Keywords: Anthropometric Parameters, Correlation Analysis, Motor Skills, Karate Performances.

Resumen

Introducción: Esta revisión tiene como objetivo examinar la relación entre las mediciones antropométricas y los parámetros motores de atletas de élite de karate, e identificar cómo la composición corporal influye en el rendimiento deportivo. **Métodos:** Se recopiló literatura pertinente de bases de datos tales como PubMed, Scopus, Web of Science y Google Scholar. Se seleccionó un total de 20 artículos de investigación centrados en atletas de élite de karate, basándose en su relevancia respecto a variables antropométricas e indicadores de rendimiento motor, tales como agilidad, fuerza, velocidad, flexibilidad y resistencia. Las habilidades motoras examinadas incluyeron la prueba de salto vertical, la prueba de agilidad, la prueba de velocidad, la prueba T, la prueba de carrera de lanzadera de 20 metros y la prueba aeróbica. **Resultados:** Los hallazgos indican que las características antropométricas —tales como la estatura, el peso corporal, la longitud de las extremidades, la masa muscular y el porcentaje de grasa corporal— están significativamente asociadas con el rendimiento motor. Un menor porcentaje de grasa corporal y una mayor masa muscular se vincularon, por lo general, con un mejor rendimiento en velocidad, agilidad y potencia explosiva. Además, la longitud de las extremidades y la estatura mostraron relaciones positivas con la capacidad de salto y la eficiencia general del movimiento. **Conclusión:** Las mediciones antropométricas desempeñan un papel crucial y están estrechamente relacionadas con la determinación del rendimiento motor en los atletas de élite de karate. Estos hallazgos subrayan la importancia de optimizar la composición corporal y las características físicas para potenciar el rendimiento. Los entrenadores y preparadores físicos pueden utilizar esta información para diseñar programas de entrenamiento más eficaces e individualizados.

Palabras Clave: Parámetros Antropométricos, Análisis De Correlación, Habilidades Motoras, Rendimiento En Karate.

Introduction

Karate is a combat sports which will have its Olympic debut at the 23rd Olympic Games in Tokyo 2020. According to the World Karate Federation (WKF), Karate is divided into two classes that consist of the Kata (demonstration) and Kumite (fighting). Kata consisting of predetermined series of defensive and offensive Karate techniques, which simulate an actual fight against an imaginary opponent (Chaabène et al., 2012). Kata as a formal, methodical, slow and smooth as well as performed in low stances. Kata involves essential elements of martial art that give it merit over an opponent's performance (Chaabène et al., 2012). Kumite is a Karate battle which takes place under real match circumstances. Kumite includes liberally selected defensive and offensive Karate techniques executed against a real opponent (Tabben et al., 2013). Both groups are classified into individual categories by gender, age, and weight. Division of the cadet category (fourteen and fifteen years) is -47kg, -54kg, and +54kg for the female gender, and -52kg, -57kg, -63kg, -70kg and +70kg for the male gender. In the junior category (sixteen and seventeen years) -48kg, -53kg, -59kg, and +59kg for the female, and -55kg, -61kg, -68kg, -76kg, and +76kg for the male. In the under 21 years and senior are -60kg, -67kg, -75kg, -84kg and +84kg for the male, and -50kg, -55kg, -61kg, -68kg, +68kg for the female.

For karate to advance, one must be knowledgeable about both the attributes of the modality and the elements linked to improved performance. Due to the rigorous and large number of training and contests, kumite is regarded as a modality with a high physiological requirement of the athlete. Rapid accelerations and decelerations are another characteristic of the sporting gestures' movement in this sport (Tabben et al., 2013). During the athletes' conflict, these particular modality characteristics which include a short recuperation period and low execution time call for a stronger application of force, speed, strength and resistance. A strong aerobic capacity helps athletes avoid exhaustion and recover more quickly between bouts, which is related to their energy demands throughout a competitive event. Anaerobic capacity, on the other hand is also significant because it is essential to the athletes' performance (Chaabène et al., 2012). Indeed, it has a strong correlation with the athlete's, top speed and explosive strength, two essential skills for karate mastery. Previous studies have explored various aspects of physical performance in athletes from karate Some research has shown that weight and body fat percentage have been found to negatively impact speed and endurance. Height and leg power are positively correlated with vertical jump ability.

An important aspect in directing Karate students to kata or kumite specialization are anthropometric indicators. During sports selection, coaches direct short karatekas with comparable limb lengths to the kata specialization. In contrast, tall karatekas with long limbs are directed by coaches to kumite specialization. In order to efficiently execute specific techniques and tactical skills, a desirable physical fitness is needed. The following parameters have been reported as the important factors in Karatekas performance power, flexibility and agility.

Karate is a martial art that requires a high degree of technical competence and physical condition because of its striking methods and rapid motions. Karate athletes may maximise their performance by having a better understanding of the elements that affect motor skills. It has been demonstrated that anthropometric factors, such as height, weight, body composition, limb length, arm length are important for athletic performance in a variety of sports. In addition, it is imperative to close this gap for a number of reasons. First of all, it can offer insightful information to trainers and sports scientists who want to customise training plans to improve karate athletes' physical prowess. Secondly, it may help find and develop potential, making sure that athletes with the best anthropometric profiles are developed in the right way. Finally, by identifying possible biomechanical risk factors linked with various body types, it can aid in injury prevention measures.

Material and Methods

Subject

In this study examining the correlation between anthropometric variables and motor parameter in elite karate athletes. The guidelines for human experimentation were adhered to in this investigation. Elite karate athletes, aged 22 +- 5 years, representing both genders, were chosen to participate in the research. There were well-trained athletes who actively competed in national events. The requirements for admission included participating at the national level, being a professional athlete for at least three years, participating in at least four weekly training sessions for the sport and finishing in the top three in the state rankings in their particular category. Athletes unable to complete the experimental protocol due to osteomioartucular injuries were not included in the study.

Procedure

In here data were sourced from databases such as PubMed, Scopus and web of science and google scholar. Every subject was put through two assessments. In the first, the athletes' anthropometric measurements were assessed in order to determine their body composition. Tests measuring the competitors' ability to jump vertically, running speed, endurance training test, shuttle run made up the second evaluation.

Evaluation of Anthropometric Variables

For the evaluation of the anthropometric variables measurements body height was measured with a stadiometer to the nearest 0.1 cm. Body weight was measured with a digital scale with a capacity of 0.1 to 200kg while wearing the minimum clothing. Body mass index expressed in kgm^{-2} was obtained by the ratio between body mass and squared from the stature. A qualified nutritionist employed a professional adipometer (Lange skinfold caliper) to quantify cutaneous skin folds. Every measurement was taken with the body's right side in mind.

Evaluation of Motor Parameters

The motor parameters were assessed using standard tests of physical abilities used by researchers in sports science studies. The tests were chosen because of their ability to evaluate such important motor abilities necessary for practicing karate as explosive power, agility, speed, flexibility and endurance. The test procedures and criteria are outlined in Table 1.

Table 1. Evaluation of Motor Parameters

Test	Method	Procedure	Evaluation
Jump vertically The capacity to jump vertically is a major measure of lower body explosive strength, which is essential for karate practitioners to execute strong kicks and quick manoeuvres.	The lower limbs' explosive strength was evaluated using the Vertical Jump Test. A Vertex device (or similar device) was used by athletes to measure their vertical leap height while they were standing.	To record their standing reach height, athletes had to stand flat-footed and reach upward. They reached the highest point on the Vertex by making a maximum vertical leap from a standing position. The vertical leap ability was calculated as the difference between the standing reach height and the jump height	The best of three attempts was noted. Higher jump heights were correlated with increased explosive power when the results were compared to normative data for elite athletes.
Speed test (30m sprint test) Karate practitioners need to be able to run fast in order to close gaps quickly, dodge blows, and move at a high speed throughout bouts	A 30-Meter Sprint Test, which gauges acceleration and the maximal running speed over a brief distance, was used to assess running speed.	On a level, straight track, athletes ran 30 meters from a standing start. Electronic timing gates or a digital stopwatch were used to record the time. Every competitor ran two trials, with the quickest time being noted.	The time was measured against predetermined standards for world-class karate competitors. Superior speed and acceleration were indicated by faster timings.
Endurance test The ability to continue high-intensity efforts throughout a karate competition is essential for competitors to preserve their performance levels. Method: The Yo-Yo Intermittent Recovery Test (Level 1), a valid indicator of an athlete's aerobic	The Yo-Yo Intermittent Recovery Test (Level 1), a valid indicator of an athlete's aerobic capacity and capability to recuperate between high-intensity workouts, was used	Beeps from an audio recording were used to signal the athletes to run back and forth between two markers spaced 20 meters apart repeatedly. The total distance travelled was recorded after the athlete was unable to for keep up the pace the duration of the	The endurance was measured by the total distance run before fatigue. Higher aerobic ability and endurance were indicated by longer distances travelled

capacity and capability to recuperate between high-intensity workouts, was used to test endurance.	to test endurance.	test	
Agility test (Shuttle run) In karate, agility is a crucial motor talent that allows practitioners to quickly change directions and keep their balance while performing intricate manoeuvres and evasions.	Agility, or the athlete's capacity for rapid direction changes, was assessed using the 5-10-5 Shuttle Run Test.	After standing at the starting line, athletes ran five meters to one side, ten meters to the other, and then five meters back to the starting line. Timing gates or stopwatches were used to record time. Recorded was the best of two trials	Agility was measured as the overall time needed to finish the shuttle run. Better quickness and agility were indicated by shorter times.
Sit and reach test Measures the flexibility of the lower back and hamstring muscle.	The athlete uses a sit-and-reach box with their feet up against it while their legs extended. The athlete slowly extends their hands, one on top of the other, while maintaining a straight knee.	Three tries are usually permitted to determine the distance the fingertips can reach. The best effort is noted and its flexibility evaluated by comparing it with normative data.	The distance recorded in cm or inches. The best three attempts are typically recorded. To compared against normative data for different age groups and genders. A higher reach distance is better flexibility.
Standing long jump test Assesses explosive leg power	The athlete places their feet shoulder-width apart and stands behind a defined line. They leap as far forward as they can after bending their knees and swinging their arms.	Measure the distance between the starting line and the closest landing point, which is typically the heels. Usually, three tries are permitted, with the best jump being recorded. This test evaluates the power and strength of the lower body.	The distance from the starting line to the closer point of contact on landing is measured in cm or inches. Give to three attempt and get the best jump recorded. Compare the jump distance with the normative data to evaluate leg power. A longer jump distance is better lower body explosive strength.
Squat jump test Assesses lower body power, particularly the quadriceps and glutes.	The athlete begins in a deep squat position with their hands on their hips. They then jump as high as they can without using their arms.	The jump height measured using a force platform, contact met or vertical jump measuring device.	Give to three attempts and get the highest jump is the best. Vertical hump height can be compared to normative data. Higher jump height indicates better lower body power.

Result

Relationships between anthropometric factors and the performance capabilities of athletes engaged in competitive karate have been established based on the findings from the studies reviewed. Variables such as body composition, height, weight, muscle mass, and limb length were associated with performance indicators including speed, agility, endurance, flexibility, and explosive power. A summary of the reviewed studies and their major findings is presented in Table 2.

Table 2. Overall results through 20 articles.

Population	Sample	Test	Results	Reference
15 male Elite level karate athlete, aged between 20and 24 years and the karate athletes under examination had actively engaged in numerous national and international tournaments	Committed 21 hours per week to training and boasted 8 years of experience in the domain of sports Karate	Speed test Agility test	A significant correlation was observed between body fat percentage, muscle mass, bone mass, and punch speed among karate athletes. Athletes with lower muscle mass and higher body fat percentage tended to demonstrate slower punching speed. Assessment of body composition variables such as body fat percentage and muscle mass may be useful for improving technical training and punch performance in karate athletes	Lita Mulia, Tomoliyus and 5 others (Singapore)
6 male karate athletes, medalists from European and world championship in senior categories.	Practice karate for 8 to 10 years depending on their age and trained 7-8 times a week.	Aerobic test	The findings of the present study indicate that Body composition variables such as body fat percentage and muscle mass showed significant relationships with aerobic performance indicators in karate athletes. Better body composition was associated with improved aerobic capacity	Kristina Nema Pavel Ruzbarsky
46 karate athletes	Male 34, 19.0± 9.84 years, 67.6 ±21,8kg and female athletes 12, 16.0± 4.47 years, 59.1±11.8kg,	Sit and reach test Standing long jump test	Karate tournament in which athletes are involved in one to three fights does not seem to impair their performance in terms of muscular strength, power and flexibility, regardless of age, sex and number of fights performed during the competition. This may be related to the high level of fitness of the athletes preceding the matches	Mathews Amarante , Agatha Graca and 5 others (Brazil)
83 male athlete who took part in the national teams participates.	karate players 28, wrestling players 33, Taekwondo players 22	Squat jump test Standing long jump test Speed test	Individual capacities such as such as height and body mass were associated with physiological and neuromuscular performance differences among combat sport athletes. Differences were also observed in VO_2 max and motor performance variables such as sprint speed and jumping ability across karate, wrestling, and taekwondo athletes	Satılmış, Soyler & Kilincarslan
79 kata and kumite players aged 11 to 13.	37 were competitors in kumite, 23 in kata and 19 participants who competed in both.	Vertical jump test	Body height, arms and legs length represent constitutional benefits for success in sports fighting. Multivariate analysis showed of variance indicated that the only significant effect was age.	Arkadiusz Janiak and 3 others
30 of senior karatekas with dan master degrees, dan a professional	Kumite senior female karatekas 15, and senior male karatekas 15.	Aerobic test	Senior female karatekas are characterized by a leptosomic build type and symmetrical range of limbs. Senior male karatekas are	Pawel Piepiora, Magdalena superson and 3

experience of 4 years or more.			characterized by a pyknic type of build with a positive Ape index. In senior female karatekas, a correlation was observed between the Ape index and the number of ranking points. Among the senior male karatekas, no correlation was observed between the Ape index and the number of ranking points.	others
122 men athletes	69 MMA athletes, 45 professional athletes ,8 amateur athletes	T- test	MMA sports performance is a complex and multi-faceted phenomenon which might require a variety of demands, including technical, physical. Biological and sensorimotor skills.	Nathalia Ferreira Camero and 4 others
9 kata and kumite players aged 11 to 13	37 were competitors in kumite ,23 in kata and 19 participants who competed in both disciplines.	Vertical jump test	Body height, arms and legs length represent constitutional benefits for success in sports fighting. Multivariate analysis showed of variance indicated that the only significant effect was age	Kahrovic Izet, Aksovic Nikola and 6 others
32 karate competitors within the aged 18-25.	12 women and 20 men karate athletes.	Beep test Hand movement speed test Flexibility test 20m shuttle run test Standing broad jump test	Identify and assess the morphological and motor fitness determinants of successful performance in Karate. Most combat sports require a combination of technique, strength, aerobic fitness, power, and speed.	Pawel Przybylski, Arkadiusz Janiak and 3 others (Poland)
70 Male and female athletes within the age range of 12-17 who licend in taekwondo, judo, karate and wrestling and participated in the study voluntarily.	21 elite athlete and 49 non elite athletes.	Athletic skill tests Motor coordination tests	Comparing the elite and non-elite athletes, statistically significant differences were found in favor of the Elie group ($p<0.05$) in terms of heigh, sitting height, body weight, speed, core endurance, grip strength, upper extremity strength, anaerobic power, KTK jumping sideways and hopping. There was no statistical difference between the groups in terms of fat percentage, MI, agility, vertical jump, flexibility, KTK moving sideways and walking backwards values ($p> 0.05$). There seem to be important distinctions between athletes who reach the national peak and those who do not in terms height, sitting height, body weight, sped, anaerobic power, grip strength, peer extremity and core strength as well as motor competency related to anaerobic power.	Hilal Gursoy, Umut Canil
37 male karate athletes age of 18-30, they are participants in many competitions of international rank and medal winners.	They have longer sports career, active athletes and competitors in the senior and U-	Speed test Standing long jump test	Motor abilities in particular speed, explosive force as well as coordination of movement play an important role in Karate sport, especially for the competitors who participate in the discipline kumite.	Shkelzen Shala, Zorica Stankowski and 2 others

	21 category.			
773 Karate athletes.	97 athletes U14 category (12-13 years old), 238 in cadet (14-15 years old) 261 in junior (16-17 years old) and 177 in U21 (18-20years old)	Sit and reach test 20m shuttle run test Standing long jump test	Agility, coordination and speed of upper limb movements, and flexibility test showed that the karatekas obtained much higher scores than those observed in age- matched populations. Young karatekas show a high fitness level in comparison with the general population, especially with regards to aerobic performance, lower-body muscular power and upper-limb movement speed.	Oskar Martinez and 3 others (Spain)
18 Karate athlete	8 females and 10 males' athletes	Squat jump test Countermovement jump test	Significant correlations were observed between squat jump (SJ), countermovement jump (CMJ), and change of direction speed (CODS) in male and female karate athletes. Regression analysis indicated that SJ was the strongest independent predictor of CODS performance regardless of gender.	Alex Ojeda and 5 others (Chile)
13 karate athletes age 20.7± 4.2 years	Junior, under 21 and senior athletes with 6 females.	Aerobic test	There is a negative association between total fat mass, body fat percentage and Karate specific Aerobic test performance. KSAT performance was higher in athletes with lower total fat mass and lower fat percentage.	Jose Fransisco da Silva and 9 others.
101 male karate athletes age 18-65 from the South African Japanese Karate Association.	26-45 years, 46-65 years age, 18-65 years age	Aerobic test	The kinanthropometric attributes of South African male national and international karate athletes between the ages of 18-65 participating in kata and kumite, are influences by the high levels of training which they are exposed to, kinanthropometry does influence their karate performance, do have a healthy level of anthropometry and are positively affected by karate training as no kinanthropometry health risks are evident.	Alexandar Nichas, Brandon Stuwart Shaw and 5 others (South Africa)
International level 24 karatekas. At least 15 years of practice and belonging the International Karate team.	Karatekas 11 men and 13 women.	Jump tests (squat jumps, countermovement jumps, repeated countermovement jump) Mobility tests	Kata athletes are characterized by a greater mobility of the ankle joint. By focusing on jumping skills, kata technique leads to an increase of the concentric phase when performing squat jump. Finally, kata athletes showed better stability in closed eyes condition. This can be useful for optimizing coaching programs for both beginners and karatekas based on the specific selected technique.	Luca Molinaro , Juri Taborri and 2 others.
51 elite karate athletes from both genders.	22+_5 years old	Vertical jump test Countermovement jump Squat jump	Body composition presents an influence on the athlete's capacity of power jump, and it can be used as a tool to guide the technical aspects of the training process to	Diego Spigoion, Charlini and 7 others

			help improve Karate performance.	
16 male karate kumite competitors of the national karate team and all participants are at least black belt holder.	Senior 8 and junior 8 participated.	Vertical jump test T-test 20m Shuttle run test	Senior athletes revealed a significant on lower body fat percentage, greater strength and leg power, lesser time in agility and higher in oxygen consumption ($p<0.05$) but no significant difference in flexibility compared to junior team ($p>0.05$). It can be concluded that senior karate athlete's physical performance is superior compared to the junior athletes.	Nasree Najmi (Malaysia)
206 male university level athletes	Practitioners of Judo, Jiu-jitsu, Karate, Kickboxing, Taekwondo and wrestling.	Vertical jump test 20m Shuttle run test	The development of a sport specific anthropometric profile via heigh and mass based and morphometric and somatotopic variables can aid in the design of training protocols and the identification of athlete markers as well as serve as a diagnostic criterion in predicting combat athlete performance.	Martino Andrade and 4 others
25 Male karate athlete of junior age and all participants were member of CC Shotokan from Lonznica and they were engaged in Karate for at least 8 years kata and kumite.	Participants were trained at least 4 times a week, with a weekly scope of training of about 6 hours.	Specific motor test	The major findings of this study were that morphological characteristics effect on specific motor skills in Karate athletes from Loznica, of junior age.	Dusica Rakita and 4 others

Discussion

The study aimed to explore the relationship between anthropometric measurements and motor parameters among elite karate athletes. According to this finding offer important insights into how specific physical characteristics may influence performance in this highly demanding of karate. These results are consistent with previous research, such as the work by (Němá & Ružbarský 2023) who also reported, that body composition is correlated with aerobic and anaerobic variables of Karate athletes. The finding from this study is consistent with those of (Cavedon et al.,2023), who observed a positive correlation between body fat percentage, muscle mass, and bone mass with punch speed among Karate athletes. Athlete exhibiting lower muscle mass and higher body fat tend to demonstrate slower punching speed. The assessment of body fat percentage, muscle mass emerges as a valuable tool for informing the technical aspect of training, particularly in enhancing punch speed for Karate practitoners. As highlighted in this study by (Amarante Do Nascimento et al., 2023) Karate tournament in which athletes are involved in one to three fights does not seem to impair their performance in terms of muscular strength, power and flexibility, regardless of age, sex and number of fights performed during the competition. This may be related to the high level of fitness of the athletes preceding the matches.

Senior female karatekas are characterized by a leptosomic build type and symmetrical range of limbs. Senior male karatekas are characterized by a pyknic type of build with a positive Ape index. In senior female karatekas, a correlation was observed between the Ape index and the number of ranking points. Among the senior male karatekas, no correlation was observed between the Ape index and the number of ranking points. (Piepiora et al., 2022).

Which found there is a negative association between total fat mass, body fat percentage and Karate specific Aerobic test performance. KSAT performance was higher in athletes with lower total fat mass and lower fat percentage. (Silva et al., 2020). On the other hand, other researchers found that Agility, coordination and speed of

upper limb movements, and flexibility test showed that the karatekas obtained much higher scores than those observed in age- matched populations. Young karatekas show a high fitness level in comparison with the general population, especially with regards to aerobic performance, lower-body muscular power and upper-limb movement speed (Martinez-de-Quel, 2021). The findings of the present study confirm that body height, arms and legs length represent constitutional benefits for success in sports fighting. Multivariate analysis showed of variance indicated that the only significant effect was age (Izet et al., 2023).

Another relevant finding of the present study was comparing the elite and non-elite athletes, statistically significant differences were found in favor of the Elie group ($p<0.05$) in terms of heigh, sitting height, body weight, speed, core endurance, grip strength, upper extremity strength, anaerobic power, KTK jumping sideways and hopping. There was no statistical difference between the groups in terms of fat percentage, MI, agility, vertical jump, flexibility, KTK moving sideways and walking backwards values ($p> 0.05$). There seem to be important distinctions between athletes who reach the national peak and those who do not in terms height, sitting height, body weight, speed, anaerobic power, grip strength, peer extremity and core strength as well as motor competency related to anaerobic power (Gürsoy, & Canli, 2021)

The physical and physiological requirements of karate can account for the relationship that have been noticed. The benefits longer limbs provide in creating stronger propulsions during explosive movements, for example is, probably reflected in the strong association found between leg length and vertical jump height. This propulsion is crucial in karate for kicks and evasive manoeuvres. The association between BMI and running speed may also suggest that retaining speed without sacrificing endurance a prerequisite for maintaining high- intensity performance throughout a match requires an ideal balance between muscle mass and fat.

The results of this study have applications in the development and instruction of professional karate fighters. These finding can be used by coaches and trainers to create more customized training plans that emphasize improving particular physical characteristics. For instance, in order to make up for the loss of a mechanical advantage in jumping, athletes with shorter leg length may need to engage in specific strength and plyometric training. Furthermore, tracking BMI and modifying training to maximize body composition may assist enhance speed and endurance, two qualities that are essential for success in competitive karate.

Conclusion

The present review highlights that there is a relationship between anthropometric characteristics and motor performance among elite karate athletes. Variables such as body composition, limb length, height, weight and muscle mass were found to significantly influence by key motor parameters including speed, agility, strength, endurance, and explosive power. In particular, lower body fat percentage and higher muscle mass were consistently associated with better performance outcomes. These findings highlight the importance of optimizing body composition and physical characteristics to enhance competitive performance in karate. Furthermore, the results provide valuable guidance for coaches and trainers in designing individualized training programs based on athletes' anthropometric profiles and developing training programs. Future research should focus on longitudinal studies and sport-specific assessments to further clarify these relationships and improve talent identification and performance development in karate.

References

Amarante Do Nascimento, M.A.T.H.E.U.S., Graça, Á., Pereira Do Nascimento, J.R., Santos Fonseca, H.I.G.O.R., Belem, I.C., Ricardo Guilherme, F.L.Á.V.I.O. (2023). Changes of Physical Capabilities of Muscular Strength, Power and Flexibility in a Karate Competition. *Journal of Human Sport & Exercise*, 18(4). https://doi.org/10.14198/jhse.2023.184.08

Andrade, M. S., Mesquita, R. N., & Coelho-e-Silva, M. J. (2018). Anthropometric and physiological profile of combat sports athletes: associations with performance indicators. *Journal of Human Kinetics, 63*, 101–112. https://doi.org/10.2478/hukin-2018-0010

Camarco, N. F., Neto, I. V. de S., Ribeiro, E., Jr., & Andrade, A. J. M. (2022). Anthropometrics, performance, and psychological outcomes in mixed martial arts athletes. Sports, 10(8), 118. https://doi.org/10.3390/sports10080118

Cavedon, V., Sacristani, F., Sandri, M., Zancanaro, C., Milanese, C. (2022). Anthropometric Prediction of DXA-Measured Percentage of Fat Mass in Male Karate Athletes. *The Journal of Sports Medicine and Physical Fitness*, 63(4): 558-565. https://doi.org/10.23736/s0022-4707.22.14355-0

Chaabene, H., Hachana, Y., Franchini, E., Mkaouer, B., Chamari, K. (2012). Physical and Physiological Profile of Elite Karate Athletes. *Sports Medicine*, 42(10): 829-843. https://doi.org/10.1007/BF03262297

Gürsoy, H., & Canli, U. (2020). Elite performance characteristics of combat athletes. Baltic Journal of Health and Physical Activity, 12(4), 1-11.https://doi.org/10.29359/BJHPA.12.4.01

Gürsoy, H., Canli, U. (2021). Identification of Elite Performance Characteristics Specific to Anthropometric Characteristics, Athletic Skills and Motor Competencies of Combat Athletes. *Journal of Physical Activity and Health,* 13(4): 47-57. https://doi.org/10.29359/BJHPA.13.4.06

Izet, K., Aksović Nikola, A., Oliver, R., Bojan, B., Milan, Z., Saša, B., Raid, M., Benin, M., Dobrescu Tatiana, D. (2023). Morphological Characteristics as Predictors of Competitor's Selection in Karate. *Journal of Scientific of Education, Sports, and Health,* 24*(*1): 28-38. https://doi.org/10.29081/gsjesh.2023.24.1.03

Martinez-de-Quel, O., Alegre, L., Castillo-García, A., Ayán, C. (2021). Anthropometric and Fitness Normative Values for Young Karatekas. *Biology of Sport*, 38(3): 351-357. https://doi.org/10.5114/biolsport.2021.99324

Molinaro, L., Taborri, J., Tessitore, A., & others. (2020). Effects of kata and kumite practice on balance, mobility, and jump performance in elite karate athletes. *Journal of Sports Sciences, 38*(12), 1398–1408. https://doi.org/10.1080/02640414.2020.1737265

Najmi, N. (2012). Comparison of body fat percentage and physical performance of male national senior and junior karate athletes. *Master's thesis, Universiti Teknologi MARA, Malaysia.* https://ir.uitm.edu.my/id/eprint/16352/

Němá, K., Ružbarský, P. (2023). Relationships between Selected Performance Parameters and Body Composition in Karate. *Journal of Kinesiology and Exercise Sciences*, 33(104): 18-24. https://doi.org/10.5604/01.3001.0053.9658

Nichas, A., Shaw, B. S., Millard, L., Breukelman, G. J., & Shaw, I. (2020). Kinanthropometric attributes of elite South African male kata and kumite karateka. *Archives of Budo, 16*, 181–194. https://doi.org/10.12659/AOB.926451

Ojeda-Aravena, A., Herrera-Valenzuela, T., Valdés-Badilla, P., Azócar-Gallardo, J., Campos-Uribe, V., & García-García, J. M. (2022). Relationship between explosive strength characteristics and change of direction speed in junior and cadet karate athletes. *Isokinetics and Exercise Science, 30*(1), 29–38. https://doi.org/10.3233/IES-210114

Piepiora, P., Superson M., Bagińska J., Stackeová, M., Witkowski, D. (2022). Anthropometric Predispositions for Kumite Specialization in Traditional Karate. *Arch Budo*, 18: 203-209. https://doi.org/10.5604/01.3001.0015.9267

Przybylski, P., Janiak, A., Zarów, R., Dadeło, E., & Andzel, W. (2019). Morphological and motor fitness determinants of Shotokan karate performance. International Journal of Environmental Research and Public Health, 16(19), 3621.https://doi.org/10.3390/ijerph16193621

Rakita, D., Rakonjac, D., Vukadinović-Jurišić, M., & Obradović, J. (2018**).** The influence of morphological characteristics on the specific motor skills of junior-age karate athletes. *Exercise and Quality of Life, 10*(1), 43–49. https://doi.org/10.31382/eqol.180605

Satılmış, N., Söyler, M., & Kılınçarslan, G. (2023). Comparison of anthropometric characteristics and biomotor ability variables of athletes in different combat sports. *The Online Journal of Recreation and Sports, 12*(4), 829–837. https://doi.org/10.22282/tojras.1352653

Shala, S., Stankovska, Z., Kostovski, Z., & colleagues. (2021). The influence of motor abilities on karate performance in senior male international karate athletes. *Sport Science International Journal*, 18(1), 25–31. https://doi.org/10.5550/ssi.2021.18.1.25

Silva, J.F.D., Aguilar, J.A., Moya, C.A.M., Correia Junior, M.G.A., Gomes, W.D.S., Oliveira, V.M.A.D., Santos, M.A.M.D. and Queiroz, D.D.R., 2020. Association between Body Composition and Aerobic Capacity in karate Athletes. *Revista Brasileira de Cineantropometria & Desempenho Humano*, 22: e71789. https://doi.org/10.1590/1980-0037.2020v22e71989

Spigolon, D., Hartz, C. S., Junqueira, C. M., Longo, A. R., Tavares, V., Faycal, H., de Paula, M., Jacinto, L. C., & Moreno, M. A. (2018). The correlation of anthropometric variables and jump power performance in elite karate athletes. *Journal of Exercise Physiology Online, 21*(1), 140–148. https://doi.org/10.14500/jeph.21.1.140

Tabben, M., Sioud, R., Haddad, M., Franchini, E., Chaouachi, A., Coquart, J., Chaabane, H., Chamari, K. Tourny-Chollet, C., 2013. Physiological and Perceived Exertion Responses during International Karate Kumite Competition. *Asian Journal of Sports Medicine*, 4(4): 263. https://doi.org/10.5812/asjsm.34246

Acknowledgement

I would like to express my sincere gratitude to everyone who contributed to the successful completion of this manuscript. I extend my deepest appreciation to those who provided me with the opportunity and resources to conduct this research. In particular, I am immensely grateful for the invaluable advice, continuous guidance, and scholarly support provided by Ms. W.K.D.S.A. Wickramarachchi, Senior Lecturer in the Department of Sport Sciences and Physical Education, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka. Her insights were instrumental in drafting and refining this manuscript. Finally, I would like to acknowledge my co-authors for their excellent ideas, constructive recommendations, and collaborative effort throughout the writing process.

Funding

There is no external funding to declare.

Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Informed Consent Statement

All the athletes included in the study provided written informed consent.