

Determinants of Sports Performance in National Level Wushu Players: A Correlational Study between Anthropometric Variables and Wushu Performances

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Abstract:

Background: Martial Art sports performances are highly demanded and incorporated with the physical attribution of Martial Art athletes. This study aimed to identify the relationship between the anthropometry variables and sports performances of the male national-level Sanda Wushu players.

Materials and Methods: The total population sampling method was used and 41 elite male Wushu players registered for the 2022 National Wushu Championship whose weight category between 56kg and 80kg participated in this study. Participant's demographic information, 22 anthropometric measurements of body height, sitting height, body weight, BMI, girth measurements of head, neck, arm relaxed, arm flexed and tensed, forearm, wrist, chest, waist, gluteal, thigh, mid-thigh, calf, ankle circumferences, limb length of the arm, forearm, hand, thigh, tibial, foot lengths and sports performances were measured. Wushu Performances were assessed by using a scoring system developed by the authors. The relationship between anthropometric parameters and performances was tested by the Pearson Correlation test using SPSS (version 22) software.

Results: The findings revealed that the arm length ($p=0.001$, $r=0.671$), and tibial length ($p=0.001$, $r=0.667$) have a significant positive correlation with sports performances.

Conclusion: It was evident that the athletes with the highest arm length and tibial length have shown the highest performance in Wushu sports. It is suggested that to obtain higher Wushu sports achievements, consider players' anthropometrical advantages.

Key Word: Anthropometric measurements; Girth measurement; Limb length; Sanda; Sport performance; Wushu;

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I. Introduction

Wushu originated in ancient China over 1000s years ago as a mode of maintaining health and acting as a defense practice against external forces like animals and enemies by the monks. Later, Wushu has been evolved and popularized in several countries and as a result, Wushu sports emerged. In the early times, Wushu is well-known as Kung Fu and is the most prominent traditional sport with a worldwide spread (Lu, 2008; Theeboom et al., 2017) and will see the Olympics in the near future (Han et al., 2021). Wushu Sanda is a form of Chinese boxing based on the modern combat fighting technique (L. Huang et al., 2020; Ma et al., 2017). The latter discipline is also identified as a highly confrontational sport and is involved in the attacking and defensive arts (H. C. Huang et al., 2018). Sanda is evolved to higher performances because of the economic efficiency of the movements and their certain characteristics (Jin & Gao, 2017). During the Sanda competition, each player plays with barehanded movements based on the fixed rules and regulations on the competition platform. It is a dynamic, high-intensity intermittent sport that involves a wide physical and physiological profile to compete professionally (Del Vecchio et al., 2018).

Sanda is not the same as other martial arts. It combines full-contact attacking with the opponent including grappling, punches and kicks with similar wrestling, taekwondo, and boxing (Shariat et al., 2017). In a study, Zhao emphasizes that the clever use of punches directs a great threat to the opponent (Zhao et al., 2019). Lower limb striking Sanda's another main strike skill used in the most powerful means of fighting and competition. Kicking is used as an offensive start action by athletes to stop the opponent athlete's approach. Having unique sport-specified body abilities like anthropometric and physiological factors is vital in earning chances in any competition. Athletes' Anthropometric measurements have a significant effect on the particular

sport. These are assistive to achieve athletes' performance and are important to achieve higher performance in sports(Masanovic et al., 2021; Slimani et al., 2017).

Anthropometry is the branch of human sciences involved with physique measurements such as size, structure, strength, and working potential(Kuhn & Revolutions, 2017; Pion et al., 2014; Shariat et al., 2017; Till et al., 2017). In sports, talent can be described as the capacity to respond correctly to the demands of sports' required performance(Pion et al., 2014). Anthropometric measurements are one of the determining variables in the future sports performance of young athletes(Johnston et al., 2018). It is also used in the economists' prediction of talent evaluation programs in sports due to their relationship with sports performance(Sánchez-Muñoz et al., 2020). The study also significantly shows anthropometric; traits play a major role in improving sports performances(Of et al., 2015). The point system in some martial arts shows the advantages granted by longitudes of limbs(Akpina et al., 2013; Górski & Orysiak, 2019). In combat sports, the body structure of the athlete provides a variety of the sport performance executed related to many different body involvements technical, motor skills and strategies. According to that Sanda involves more expanded several perfect physical shapes for executing higher sports performances(Lenetsky et al., 2013; Saad, 2020).

Wushu Sanda is based on weight category sport. There is extensive quality evidence in the sport skill about the appropriateness of weight categories(Barbieri et al., 2017). According to the weight categories, anthropometric measurements are recruited in the competition in a different manner(Brito et al., 2012). The elite Sandaathletes and professional Sanda coaches in the world have considered the body physique parameters as one of the key factors which are affecting high performance in the sport. Several studies have been conducted to identify the physical parameters of Sanda's earlier engagement. Therefore, athletes and coaches needed to pay attention to the physical components and body compositions of Sanda athletes' bodies(Chathuranga & Perera, 2022). As a result, among numerous markers of personal characteristics, anthropometric measures become of great interest. Although there also can be found enough studies concerning the anthropometric attributes that support players in the field of many sports(da Silva & Vieira, 2020). But they were very rare in Wushu sports performance analysis. According to scientific studies, the anthropometric parameters of Boxing and Taekwondo athletes have gained additional support for their particular sports performances(Shariat et al., 2017). Therefore, this study aimed at investigating the relationship between anthropometric measurements and Wushu Sanda performance levels.

II. Material And Methods

This cross-sectional study was carried to Sri Lanka Wushu national-level athletes who participated in the 2022 National Wushu competition. A total of 41 male athletes participated in the weight category between 56kg to 80kg and the mean age was 31.46 (31.46 years \pm 3.53), with athletes selected more than 5 years of training age (8.43 years \pm 2.75).

Study Design: Observational study design was used for the study.

Study Duration: November 2021 to April 2022.

Sample size: Forty-one (41) National level Wushu athletes.

Sample size calculation: Total population sampling method was utilized for the study.

Subjects & selection method: The study population included 2022 National Wushu Championship registered male athletes between the weight category of 52kg to 70kg.

Inclusion criteria:

1. Athletes with more than 5 years of Wushu training experiences
2. Only male athletes

Exclusion criteria:

1. Isolated athletes due to COVID 19
2. Injured or sick players at the time of data collection

Procedure methodology

The Standardized Anthropometric Professionals' Assessment guidelines provided by the International Society for the Advancement of Kinanthropometry (ISAK) were used for data collection(da Silva & Vieira, 2020). Three basic measurements; body height, sitting height, and body weight, 13 body segment

circumferences; head, neck, arm relaxed, arm flexed and tensed, forearm, wrist, chest, waist, gluteal, thigh, mid-thigh, calf, and ankle, 6 body limbs lengths; arm's length, forearm length, hand length, thigh- length, tibial length, and foot length were measured. Athletes' performances were measured by scoring their performance according to sports achievements.

Statistical analysis

Collected data were analysed with a 95% of confidence level by using the IBM Statistical Package for Social Sciences version 22 software. The Kolmogorov-Smirnov test (n>30) was used to verify the data distribution. The anthropometric and sports performance parameters were analysed and interpreted by descriptive statistics. The Pearson correlation test was used to identify the relationship between WushuSanda performances and anthropometric parameters.

III. Result

The sample's mean age was 31.46 years ±3.53, and the mean training age of 8.43 years ±2.75, with a mean height of 173.98 cm±5.12 and mean weight of 69.97 kg ±8.46. The sample's mean performance level score was 8.34±4.05.

Table no 1: Descriptive statistics summary of demographic data for male national-level Wushu athletes.

Parameter	Mean	SD	Minimum	Maximum
Age (years)	31.46	3.53	21.00	38.00
Training age (years)	8.43	2.75	5.00	16.00
Body height (cm)	173.98	5.12	162.60	188.80
Body weight (kg)	69.97	8.46	57.10	88.70
BMI	23.45	2.84	19.9	33.7
Performance level	8.34	4.05	2.00	18.00

Athletes' performance was categorized according to the competition type's achievement level and Figure 1 shows the performance level of the sample in the last five years. The Performance level is measured by providing marks according to athletes' achievements. The athletes who achieved the World Championship Gold medal offered the highest sports marks and gradually decreased the marks for the silver medal, bronze medal and participation. The lowest scores were given to the provincial level participation. There were very few athletes who achieved world titles and that was the world championship bronze medals. In the study there were many athletes founds with national level achievements.

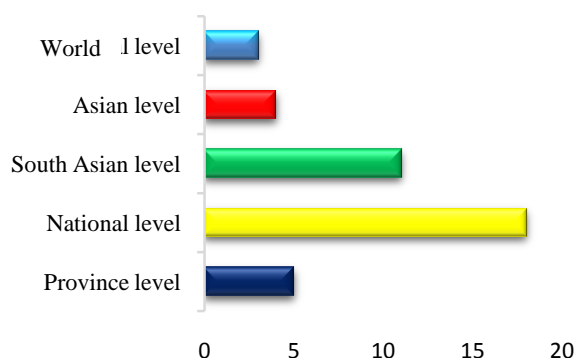


Figure 1. Sport achievement level distribution of the study group

Table 2. Relationship between performances and anthropometric parameters for the male national Wushu athletes.

Parameter (cm)	Mean±SD		Performance
Body height	173.98±5.12	r	0.016
		p	0.923
Sitting height	85.23±5.14	r	0.734
		p	0.561
Body weight (kg)	69.97±8.46	r	-0.065
		p	0.684
Head	54.65±2.11	r	0.060
		p	.0709
Neck	37.27±1.74	r	0.032
		p	0.844
Arm relaxed	32.07±12.76	r	0.162
		p	0.312
Arm flexed and tensed	34.32±9.12	r	0.201
		p	0.207
Forearm	29.36±12.38	r	0.143
		p	0.372
Wrist	18.95±7.20	r	0.216
		p	0.175
Chest	92.89±12.12	r	-0.079
		p	0.625
Waist	79.18±11.15	r	-0.125
		p	0.435
Gluteal	93.74±6.33	r	0.059
		p	0.716
Thigh	55.80±3.49	r	0.085
		p	0.599
Mid-thigh	51.53±3.52	r	0.072
		p	0.656
Calf	35.27±3.06	r	-0.035
		p	0.827
Ankle	21.36±1.41	r	0.260
		p	0.100
Arm length	34.05±3.96	r	0.671**
		p	0.001
Forearm length	29.19±1.57	r	-0.151
		p	0.347
Hand length	18.95±0.89	r	0.055
		p	0.732
Thigh-length	40.66±2.70	r	0.007
		p	0.967
Tibial length	49.06±4.62	r	0.667**
		p	0.001
Foot length	25.61±1.48	r	-0.106
		p	0.511

The summary statistics of anthropometric measurements and correlations are shown in table 02. Thirteen girth measurements were measured including the head, neck, arm relaxed, arm flexed and tensed, forearm, wrist, chest, waist, gluteal, thigh, midthigh, calf, and ankle. But any girth measurements have not significantly correlated with the sport performance of Sanda athletes ($p>0.05$). However, the body lengths of arm's length, forearm length, hand length, thigh length, thigh length, tibial length, and foot length only. The arm length ($r=0.671$, $p=0.001$), and tibial length ($r=0.667$, $p=0.001$) show a significant positive correlation with the sport performance of athletes. Moreover, other limb lengths were not significantly correlated with the performance of Sanda athletes ($p>0.05$) as shown in table 02. Further, arm length and tibial length correlation graphs are shown in Figures 2 and 3.

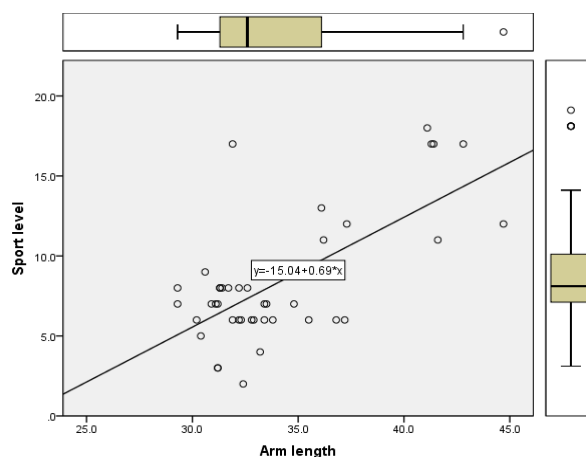


Figure 1. Correlation between performances and arm length of the male Wushu Sanda players

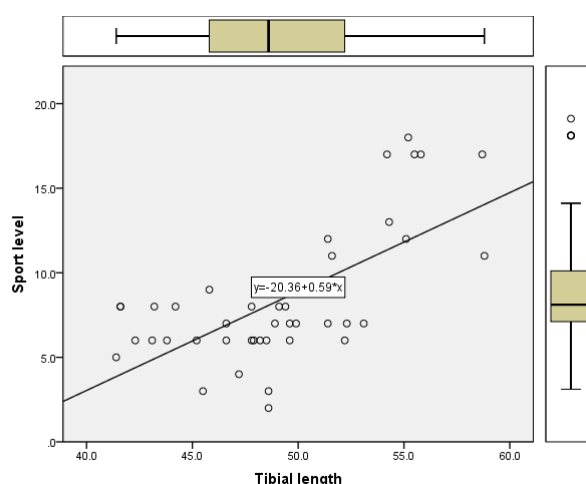


Figure 2. Correlation between performances and tibial length of the male Wushu Sanda players

IV. Discussion

The present study aimed to investigate a relationship between national-level male Sanda players' anthropometric parameters and sports performances. The studies have identified the determinant anthropometric factors that enhance the athlete's performance according to the sport. It should be able to know these advantages and identify the present level and other athletes' performances are supportive to increase winning possibilities in the Wushu sport. Further, these can be used to identify the athlete's weak areas and suggestions to overcome their performance to competitive levels (ARAZI et al., 2016). In weight-dominant sports obtain an advantage over the opponent, athletes normally attempt to improve muscle mass and decrease adiposity fat in each weight category to increase their performances (Brito et al., 2012).

Accordingly, studies have been conducted to identify the relationship between body measurements and combat sports performances. In the study, it is revealed there was no relation between girth measurements and sports performances. Studies have emphasized power as an important factor of the Wushu due to its wide-ranging use of the energy system and rapid actions (Schick et al., 2010) and it found that martial art athletes' wrist circles positively correlated to the arm circumference (Marinho et al., 2016). Further, that study has also emphasized there are no girth measurement differentiations between the medal-winning athlete and non-medalist (Yetgin, 2022). However, in the study of Iermakov et al., they have done a study with anthropometric measurements and kinematics and found boxers with a great circumference of the wrist and forearm have shown great arm power (Iermakov & Podrigalo, 2016). Studies have shown that having longer extremities helps athletes succeed in striking sports like combat sports (Formalioni et al., 2020). Longer limbs may provide a reach advantage for executing techniques from distance (Casolino et al., 2012). So, athletes with long extremities can handle the opponent by making a safe distance. In this study, it is revealed that there is a positive relationship

between arm length and tibial length with the performances. Proportionally, it has been shown that there is a significant correlation ($p=0.001$) between Wushu sports performance and arm length.

However, table 2 shows a significant level of positive correlation between Wushu sports performance and arm length ($R=0.671$). This indicates that arm-length increment support improves sports performance. A comparative study also proved that athletes with higher arms represented martial art sports (Kin- et al., n.d.). The study by Kumar et al. has been conducted with 70 Boxing athletes; results showed that the arm length of the boxing players was the most significant predicting factor to increase the punching performance (Devender Kumar, 2019). Further, the study has shown that there is a significant correlation ($p=0.001$) between tibial length and sports performances and readings emphasize there is a moderate level of positive correlation between tibial length and Wushu sports performance ($R=0.667$). In 2019, Bride's study found that selected anthropometric parameters correlated with their sports achievements. The players with Illiac height have shown a higher winning possibility through the study period competitions (Sheppard et al., 2008). Another study of anthropometrics and the physiology of the 28 athletes' combat sports revealed that the high-level power found in the legs and arms of combat athletes correlates with the limb lengths (Slimani et al., 2017). But the study of the Arazidid not reveal a correlation between tibial length and sports performances (Arazi et al., 2016). In the competition, most athletes try to kick a face and get a knockout from the opponent. In martial art sports, successful takedowns bring the athlete to the key matter of winning (Kirk, 2016). Kicks are given more scores than punches, favouring longer levers (Górski & Orysiak, 2019). But the study of Bidge et al., and Scamardella emphasize there have been considerable doubts about the stature of successful and combat sports (Bridge et al., 2014; Claessens et al., 1994).

V. Conclusion

The study shows strong identification of the anthropometric profile of elite male Wushu national players. Within the confines of the study, it can be concluded that the athletes with higher arm length and tibial length have greater winning possibilities in Wushu Sports performances. This suggests that coaches should use anthropometric advancement for talent identification with performances. These findings would be vital for the development of a specific training program for Wushu players to identify their talents and lead them to achieve higher sports achievements.

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