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SOMATOTYPES OF NATIONAL ELITE COMBATIVE SPORT ATHLETES

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ABSTRACT
PIETER, W.; BERCADES, L. T. Somatotypes of National Elite Combative Sport Athletes. Brazilian Journal of Biomotricity, v. 3, n. 1, p. 21-30, 2009. The purpose of this study was to assess and compare the somatotypes of elite adult combative sport athletes. Subjects were members of the Philippine national senior teams in karate and pencak silat (30 men, 24.27 ± 4.66 years, 168.85 ± 5.09 cm, 64.88 ± 10.63 kg and 10 women, 20.33 ± 2.58 years, 158.65 ± 5.18 cm, 54.55 ± 7.06 kg) as well as fencing (6 women, 24.33 ± 3.72 years, 153.25 ± 6.04 cm, 54.25 ± 8.37 kg). The Heath-Carter somatotype method was used to assess the physiques of the athletes. To determine differences between combative sports groups, 1-way Anovas were used. The global somatotype analysis almost revealed a trivial difference in somatotype attitudinal mean (SAM) between karate and silat men ($p = 0.056$, $eta^2 = 0.211$). There was no difference in SAM between elite and developmental silat athletes ($p = 0.883$, $eta^2 = 0.001$). However, there was a trivial difference ($eta^2 = 0.226$) in age between the two levels of competition (26.88 ± 2.03 years and 22.50 ± 5.40 years for the elite and developmental men, respectively) ($p = 0.046$).

Key words: Filipino, physique, body build, karate, pencak silat, fencing.

INTRODUCTION

The physique of athletes is suggested to contribute to their performance (e.g., BLOOMFIELD et al., 1994; CARTER and HEATH, 1990). Most studies on somatotypes of athletes have been conducted in the West. Large scale anthropometric investigations, including those on somatotype, have been done at Olympic Games (e.g., CARTER, 1982) or on specific sports, such as swimming (CARTER and ACKLAND, 1994), soccer (RIENZI et al., 2000), gymnastics (CLAESSENS et al., 1991), or rowing (CLAESSENS et al., 2001).

Anthropometric studies on combative sport athletes are scarce. For instance, Zabukovec

and Tiidus (1995) reported Canadian elite professional male kickboxers to have a Heath-Carter somatotype of 2.6 – 4.3 – 2.5. In a study on Italian physical education students, Gualdi-Russo and Graziani (1993) reported a combined sample of karate, wushu and judo athletes to have somatotypes of 3.19 – 5.02 – 2.14 and 3.26 – 4.03 – 2.47 for males and females, respectively. Chan et al. (2003) found that British female taekwondo club athletes were more endomorphic than their male counterparts but they were not different in mesomorphy.

Taaffe and Pieter (1990) profiled the physical and physiological characteristics of American elite male and female taekwondo athletes (*taekwondo-in*). Franchini et al. (2007) likewise described Brazilian elite male judo athletes (*judoka*) from an anthropometric and judo-specific fitness perspective. Katic et al. (2005) found Croation adult elite karate athletes (*karateka*) to be predominantly characterized by a mesomorphic physique and transverse skeletal dimensionality. Fritzsche and Raschka (2007) reported German adult male elite *karateka* to have a Heath-Carter somatotype of 2.0-3.7-2.7 and their female counterparts, of 3.4-2.4-2.4.

However, research on the anthropometry of fencers is scarce. Tsolakis et al. (2006) found no differences in somatotype between Greek female fencers 18 – 20 years and those who were older than 20 years. The somatotype of young (12.5 years) female Cuban fencers was reported to be 3.0 – 3.2 – 3.5 (CARTER and HEATH, 1990).

Information on non-Caucasian combative sport athletes is limited, regardless of the scientific discipline. For instance, Wong et al. (2006) explored pre-competition mood states as a function of performance in Malaysian male and female adolescent *karateka*, while Han et al. (2006) studied the relationship between anxiety and performance in Korean male *taekwondo-in*, among others. Imamura et al. (2002) investigated the physiological response during and following training in Japanese female *karateka*. The anthropometric profiles of male Korean *taekwondo-in* competing at different levels were described by Olds and Kang (2000).

There is also a lack of published research on Filipino athletes in general and combative sport athletes in particular. For instance, Bercades et al. (1999) provided an anthropometric profile of young Filipino female artistic gymnasts competitive at the club level. Ampongan and Pieter (2005) investigated competition state anxiety in male and female *elite taekwondo-in*, while pre-competition mood states in young male and female *taekwondo-in* were studied by Pieter et al. (2006).

Our team investigated the somatotypes of Filipino female elite *judoka* (PIETER et al., 1998b) as well as their fat distribution (PIETER et al., 1998a). More recently, total body fat and skinfold patterning were studied in male and female *karateka* and pencak silat athletes (PIETER et al., 2006). As far as the authors know, there is no information on the anthropometric profile of Filipino fencers. The purpose of this study, then, was to describe the somatotypes of male and female Filipino combative sport athletes and to compare them between sports within gender.

METHODS

– Subjects

Participants were members of the Philippine national senior teams in karate (12 men, 24.00 ± 4.79 years, 169.67 ± 4.85 cm, 64.25 ± 7.09 kg) and pencak silat (8 men, 26.88 ± 2.03 years, 169.94 ± 5.63 cm, 70.88 ± 16.17 kg). In addition, members of the silat men's developmental team were tested (n = 10, 22.50 ± 5.40 years, 167.00 ± 4.94 cm, 60.85 ±

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7.01 kg). The female athletes were members of the national senior teams in karate (n = 5, 20.25 ± 1.29 years, 161.00 ± 3.62 cm, 55.80 ± 6.94 kg), pencak silat (n = 5, 20.40 ± 3.65 years, 156.30 ± 5.78 cm, 53.30 ± 7.75 kg) and fencing (n = 6, 24.33 ± 3.72 years, 153.25 ± 6.04 cm, 54.25 ± 8.37 kg). After securing institutional ethical approval, informed consent was signed by the subjects.

– Procedures

Height was measured with a wall-mounted wooden stadiometer to the nearest 0.5 cm and an electronic weighing scale was used to assess body mass to the nearest 0.01 kg. Skinfold thicknesses were taken with a Lange caliper at the following sites: triceps, subscapular, supraspinale, and medial calf. In addition, biepicondylar widths of the humerus and femur were measured as well as the girths of the flexed and tensed upper arm, and calf. The median was used for statistical analysis if the measurements had to be taken three times, while the mean was utilized if the first two measurements were within the acceptable range (ROSS and MARFELL-JONES, 1991). The Heath-Carter method was used to estimate somatotype (CARTER and HEATH, 1990].

– Statistical Analysis

To determine the differences in somatotype between sports within gender, a 1-way Anova was used. The level of significance was set to 0.05. It was decided not to adjust the type 1 error for multiple comparisons, because the interest was in the comparisonwise error rate as the data were generated through actual observations. The objective was to unearth any possible leads regarding the relationship between the independent and dependent variables (BENDER and LANGE, 2001; ROTHMAN, 1990). The estimated power for the sample size used was 80%.

RESULTS

Karate compared to silat – males

There were no differences between elite *karateka* and silat athletes in age ($p = 0.128$, $eta^2 = 0.124$), height ($p = 0.911$, $eta^2 = 0.001$) and weight ($p = 0.223$, $eta^2 = 0.081$). Table 1 displays the descriptive statistics of global somatotypes and somatotype components. The analysis of the global somatotype in 3-dimensional space (somatotype attitudinal mean, SAM) between *karateka* and silat athletes almost showed a statistically significant, albeit trivial, difference ($p = 0.056$, $eta^2 = 0.211$). However, there was no difference in global somatotype in 2-dimensional space (somatotype dispersion mean, SDM) ($p = 0.139$, $eta^2 = 0.132$).

Table 1 Descriptive statistics of somatotypes in male combative sport athletes

	Karate	Silat Elite	Silat Developmental
Endomorphy	2.42 ± 0.72	3.20 ± 1.71	2.40 ± 1.27
Mesomorphy	4.70 ± 0.95	5.58 ± 1.63	4.77 ± 1.55
Ectomorphy	2.55 ± 1.10	2.02 ± 1.08	2.67 ± 1.36
SAM	1.13 ± 0.62	1.99 ± 1.14	2.08 ± 1.03
SDM	3.38 ± 1.57	4.78 ± 2.52	2.93 ± 2.05

Analysis of the somatotype components showed no difference in endomorphy between *karateka* and silat athletes ($p = 0.184$, $eta^2 = 0.096$). There also was no difference in

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mesomorphy (p = 0.144, eta^2 = 0.115) and ectomorphy (p = 0.308, eta^2 = 0.058).

Figure 1 depicts the somatoplots of elite karateka and silat athletes. There was a 63% overlap of silat with karate.

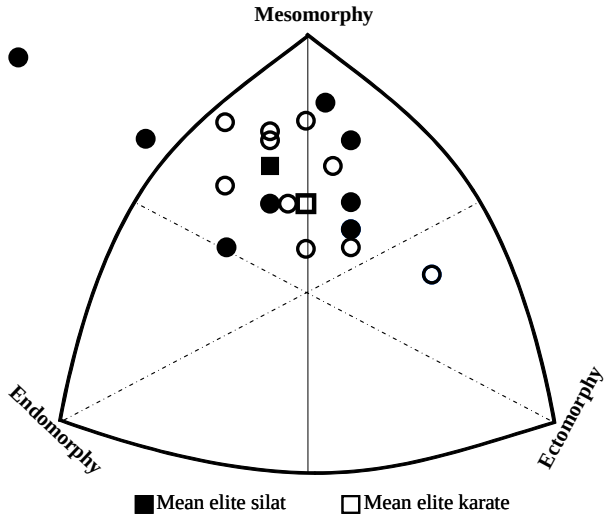

Figure 1 - Somatoplots of elite male karate and silat athletes

Comparison between elite and developmental silat athletes – males

The elite silat athletes were older (p = 0.046), but the difference was trivial (eta^2 = 0.226). However, there were no differences between groups in height (p = 0.256, eta^2 = 0.080) and weight (p = 0.095, eta^2 = 0.164).

There also was no difference between elite and developmental silat athletes in SAM (p = 0.883, eta^2 = 0.001) or in SDM (p = 0.105, eta^2 = 0.156). There were no differences between groups in endomorphy (p = 0.279, eta^2 = 0.073), mesomorphy (p = 0.302, eta^2 = 0.066) and ectomorphy (p = 0.292, eta^2 = 0.069).

Figure 2 shows the somatoplots of elite and developmental silat athletes. There was a 50% overlap of developmental with elite silat athletes.

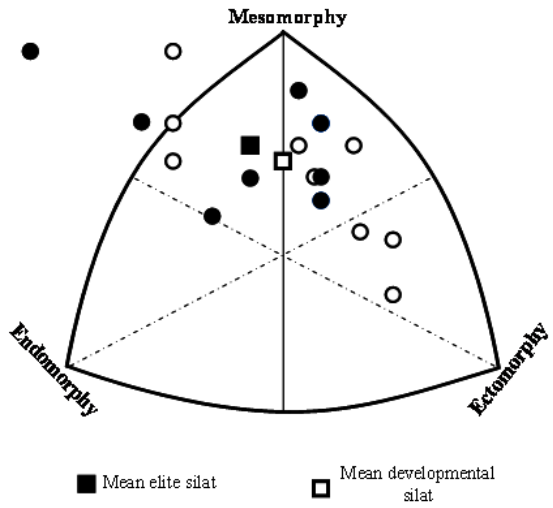

Figure 2 - Somatoplots of male elite and developmental silat athletes

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Comparisons between female combative sport athletes

Table 2 displays the means and standard deviations of the somatotypes of the athletes. There was no statistical difference in age between the groups ($p = 0.083$, $eta^2 = 0.318$) and neither were there differences in height ($p = 0.091$, $eta^2 = 0.309$) and weight ($p = 0.658$, $eta^2 = 0.062$). Table 2 depicts the means and standard deviations of the somatotypes of the female combative sport athletes. There was no difference in global somatotype in 3 dimensional space (SAM) ($p = 0.194$, $eta^2 = 0.223$) nor was there in SDM ($p = 0.437$, $eta^2 = 0.120$).

Table 2 Descriptive statistics of somatotypes in female combative sport athletes

	Karate	**Silat**	**Fencing**
Endomorphy	3.05 ± 0.91	3.98 ± 0.88	3.69 ± 0.74
Mesomorphy	3.68 ± 0.89	4.09 ± 0.54	4.84 ± 0.63
Ectomorphy	2.38 ± 1.03	1.94 ± 0.41	1.32 ± 0.80
SAM	1.41 ± 0.45	0.90 ± 0.47	1.10 ± 0.36
SDM	3.28 ± 1.03	3.11 ± 1.29	4.35 ± 2.29

There was no difference in endomorphy among groups ($p = 0.237$, $eta^2 = 0.199$) and neither was there in ectomorphy ($p = 0.122$, $eta^2 = 0.277$). However, there was a small difference in mesomorphy ($p = 0.045$, $eta^2 = 0.379$). Bonferroni post-hoc analysis showed that the fencers were more mesomorphic than the *karateka* ($p = 0.049$). Figure 3 shows the somatoplots for the female athletes. There was a 80% overlap of silat with *karateka*, while the overlap with fencers was 40%.

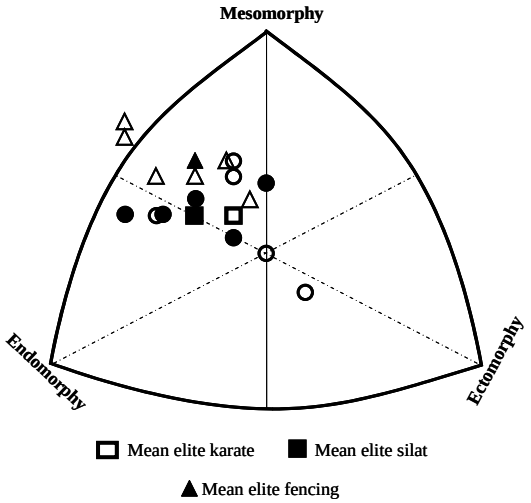

Figure 3 - Somatoplots of female elite combative sports athletes

DISCUSSION

Tables 3 and 4 display comparative data on somatotypes in male and female combative

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sport athletes. Although there was no statistically significant difference in mesomorphy between the male developmental and elite silat athletes, in practical terms the latter recorded a higher rating and they also were more endomorphic. In the females, on the other hand, the *karateka* were significantly less mesomorphic than the fencers. The female silat athletes were more endomorphic than the *karateka*, although statistically not significant. Compared to international fencers, the Filipino counterparts were less endomorphic than their Greek colleagues 18-20 years old (TSOLAKIS et al., 2006). In sports where the body has to be propelled through space as fast as possible, being more endomorphic is suggested to be detrimental to performance (e.g., GIAMPIETRO et al., 2003; KATIC et al., 2005; SINNING, 1985). Differences in sport-specific requirements, however, may determine the extent to which endomorphy may be detrimental.

Table 3 Comparative somatotypes of male combative sport athletes

Sport/Study	Somatotypes
This study – silat developmental	2.40 – 4.77 – 2.67
This study – silat elite	3.20 – 5.58 – 2.02
Karate	
This study	2.42 – 4.70 – 2.55
FRITZSCHE and RASCHKA (2007) (elite)	2.0 – 3.7 – 2.7
FRITZSCHE (2006)	2.3 – 4.9 – 2.9
GIAMPIETRO et al. (2003) (elite)	2.1 – 3.5 – 3.1
GIAMPIETRO et al. (2003) (club)	2.6 – 4.2 – 2.7
AMUSA and ONYEWADUME (2001) (elite)	2.5 – 3.9 – 3.0
KRAWCZYK et al. (1997)	3.07 – 5.07 – 1.79
CLAESSENS et al. (1986) (elite)	2.6 – 5.2 – 2.6
Taekwondo	
OLDS and KANG (2000) (club)	2.5 – 4.9 – 2.7
OLDS and KANG (2000) (state)	2.2 – 4.5 – 2.2
OLDS and KANG (2000) (elite)	1.4 – 4.1 – 2.0
CHAN et al. (2003) (club)	4.2 – 4.7 – 2.9
PIETER (1991) (elite)	1.74 – 4.68 – 3.02
TAAFFE and PIETER (1990) (elite)	1.65 – 4.53 – 3.59

Table 4 Comparative somatotypes of female combative sport athletes

Sport/Study	Somatotypes
This study – silat	3.98 – 4.09 – 1.94
Fencing	
This study	3.69 – 4.84 – 1.32
TSOLAKIS et al. (2006) – 18-20 years	4.3 – 2.3 – 2.9
TSOLAKIS et al. (2006) – > 20 years	3.1 – 1.9 – 3.7
CARTER and HEATH (1990) – Bolivar Games 1981	3.6 – 3.6 – 2.4

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Karate	
This study	3.05 – 3.68 – 2.38
FRITZSCHE and RASCHKA (2007) (elite)	3.4 – 2.4 – 2.4
FRITZSCHE (2006)	3.6 – 4.5 – 2.7
AMUSA and ONYEWADUME (2001) (elite)	4.4 – 4.7 – 1.3
Taekwondo	
CHAN et al. (2003) (club)	6.3 – 4.2 – 2.0
SONG et al. (1997) (varsity)	5.0 – 4.1 – 2.5
PIETER (1991) (elite)	2.47 – 3.08 – 3.47
TAAFFE and PIETER (1990) (elite)	2.08 – 3.23 – 3.98

Giampietro et al. (2003) revealed that there was no statistical difference between Italian male elite professional and amateur *karateka* in somatotype, which was corroborated by the current study as far as the male silat athletes are concerned. Similar to the Italian *karateka*, the elite male silat athletes were also more mesomorphic from a practical point of view. However, contrary to the Italians, they were also more endomorphic. The elite Italian *karateka* were more ectomorphic, which together with the significant difference in Scelic height between elite and amateurs, led the authors to suggest that lower limb development was important in karate. Katic et al. (2005) reported longitudinal skeletal development to be one of the predictors of karate performance.

When comparing the Filipino male elite *karateka* and silat athletes in the current study, there was no statistical difference in somatotype. However, the latter scored higher in endomorphy and mesomorphy, while the *karateka* were more ectomorphic. The ectomorphy result confirms the findings of Giampietro et al. (2003). Fritzsche and Raschka (2007) also reported German elite male *karateka* to be more ectomorphic than lower ranked colleagues. Contrary to the Italian *karateka* (Giampietro et al., 2003), height was not a distinguishing factor in practical terms for the Filipino counterparts, which may negatively affect performance due to lack of reach (KATIC et al., 2005). Katic et al. (2005) revealed that Croation elite karateka were mesmorphic with well developed transverse skeletal dimensionality.

Although there are sports-specific differences between karate and silat as far as their energy requirements are concerned (AZIZ et al., 2002; BENEKE et al., 2004), the physiques of the male Filipino and international *karateka* are remarkably similar compared to those of their silat counterparts. More research is indicated, especially in terms of the exact contribution of physique characteristics to performance in both sports. The female silat athletes, on the other hand, seem to be closer to their counterparts from Botswana (AMUSA and ONYEWADDUME, 2001), especially relative to their endomorphic component. As in the men, differences in weight division may account for some of the variation, i.e., the groups comprised all weight categories. Future research should assess somatotype by weight classification.

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