

Comparison of eccentric utilization ratio of elite karate (*kata*) with elite Wushu athletes

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1. Introduction

Karate and Wushu are gaining popularity as a sport globally. In Karate there are two events: Kata and Kumite. Kata is a series of preset movements consisting of offensive and defensive maneuvers, whereas kumite is a sparring form where opponents attempt to strike each other to score points. Karate Kata and Wushu Taolu have many similarities as movements in these events are preset and require the exponent to execute all steps in a controlled and deliberate manner. The countermovement jump (CMJ) and squat jump (SJ) are commonly used tools to assess eccentric utilization ratio (EUR) in sports (McGuigan, et al., 2006; Secomb, et al., 2015). To our knowledge, there are no studies conducted to compare the EUR characteristics of a martial arts athletes specializing in the aesthetic forms of combat sports.

2. Methodology

21 national elite Karate (Kata) and Wushu Taolu athletes participated in this study, 10 males and 11 females, (age 23.05 ± 3.47 years, body weight: 59.08 ± 7.83 kg). Each athlete performed three countermovement jumps (CMJ) with a downward movement followed immediately by an explosive vertical jump. Athletes were able to self-select the depth of downward movement. Each athlete also performed three squat jumps (SJ) where the exponent started the jump in a half squat position and performed only an upward movement without any countermovement. The mean data of the three jumps was taken. An independent T-test was used to analyze the differences between genders and differences between the two athlete groups. Level of significant was set at $p < .05$. All analysis was done using IBM SPSS version 21. EUR was calculated from the ratio of peak power in the CMJ and SJ.

3. Results

There were no significant differences in EUR between the genders in either sport ($p < .05$); however, EUR tended to be lower in females (Table 1).

Table 1. EUR scores of Karate (Kata) and Wushu athlete by gender

Sport	Gender	n	EUR (peak power)
Karate (Kata)	M	4	.99 ± .03
	F	3	.97 ± .06
Wushu	M	6	1.08 ± .14
	F	8	1.02 ± .03

n=number; M=Male; F=Female; EUR=Eccentric Utilization Ratio; Mean ± SD

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While there was no significant difference in the EUR values between WushuTaolu and Karate Kata ($p < .05$) it was evident that the karate athletes presented with EUR values lower than 1.00 demonstrating the capacity to produce high levels of power from a static position (Table 2). In contrast, WushuTaolu athletes generally showed EUR values in excess of 1.00.

Table 2. EUR scores of Karate (Kata) and Wushu athletes

Sport	N	EUR (peak power)
Karate (Kata)	7	.98 ± .04
Wushu	14	1.04 ± .02

n=number; EUR=Eccentric Utilization Ratio; Mean ± SD

4. Discussion and conclusion

The results of this study suggest that there was no significant difference in EUR between the genders or Karate (Kata) and Wushu Taolu athletes. In support of our findings, previous authors have not observed any specific gender differences on the EUR (McGuigan, et al., 2006). It was however apparent that the Karate athletes showed an EUR value of below the value of 1.00 which was generally lower than was observed in the Wushu athletes. This difference may be due to the nature of the Karate Kata event where exponents are required to execute techniques from a lowered stance the majority of the time. As for the Wushu event, there are more jumps in a Taolu when compared to Karate Kata and more dynamic athletic movements. Higher EUR values are indicative of a greater reliance on the stretch shortening cycle (McGuigan, et al., 2006). Different training practices may also account for the differences observed as a lesser degree of augmentation (EUR) in long distance runners has been observed when compared to strength-matched controls and this augmentation was correlated to the compliance of the muscle-tendon unit in the knee extensor muscles (Kubo, et al., 2000). Further, compliance of the vastus lateralis muscle has also been demonstrated to be negatively correlated to 100 m sprint time (Kubo, et al., 2000b).

One limitation of the present study is that comparison of EUR at different phase of training was not taken into account as an earlier study has shown that there can be a significant difference between off-season and preseason EUR values (McGuigan, et al., 2006).

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