Sports Biomechanical and Physiological Analyses of the Jump Inside Kick of Wushu Athletes

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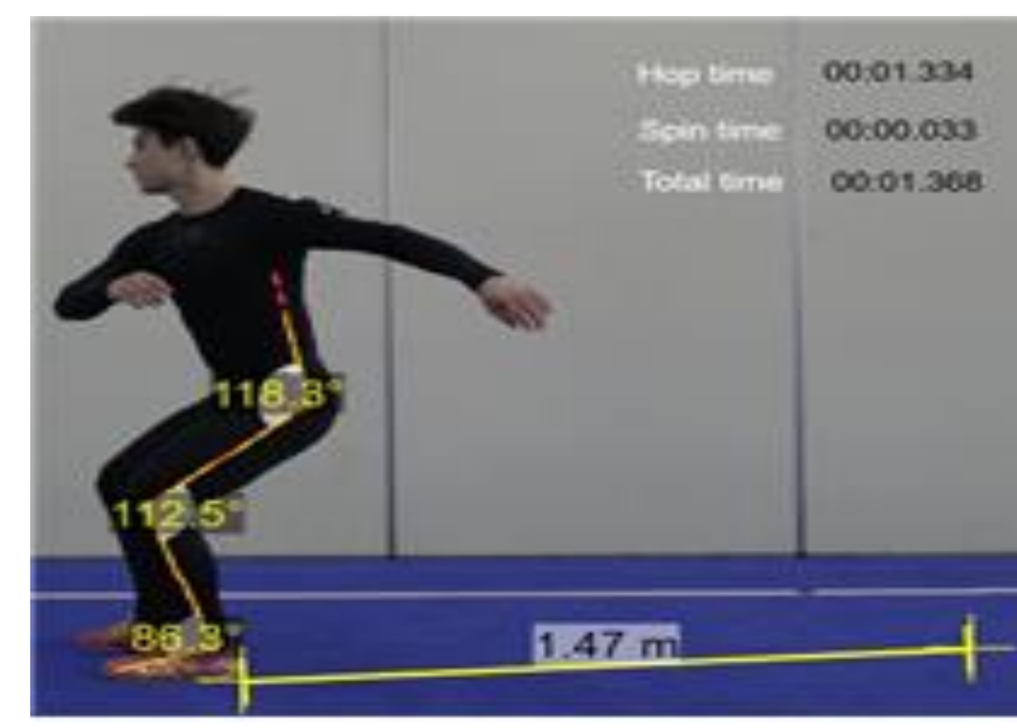
Background & Purpose

Wushu is an elite sport that is played as a martial art. Although it is important to understand the rotation angle technique in air for getting into high-rank, it has been investigated to the area of the sports biomechanics. In other words, there is a lack of physiological evidence in the literature of analysis of the jump inside kick in the self-taolu of Wushu. This study aimed to compare the athletes who represent 360˚, 540˚, and 720˚ rotations by dividing the subjects into two classes of national players, and general players, of Wushu. In addition, the comparative kinetics of the muscular function of the athletes was analyzed to help young athletes perform high-latitude aerial rotation techniques.

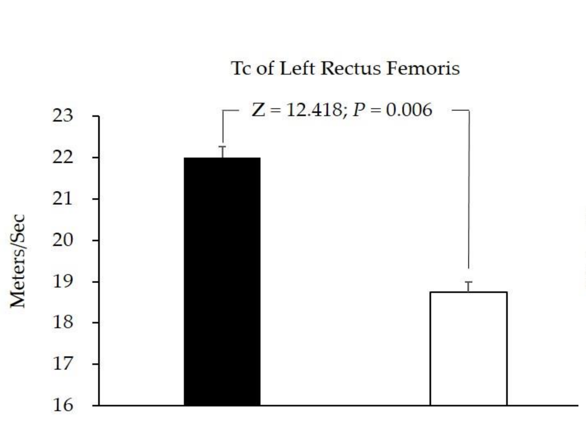
Materials & Methods

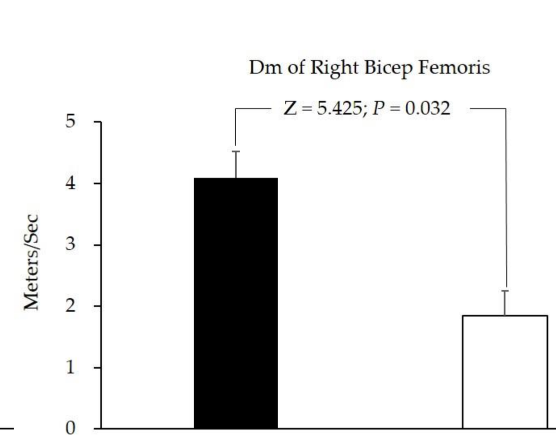
The subjects' mean (SD) age was 25.00 (3.92) years old. After taking baseline measurements, they were assigned to one of two groups, which were separated into the national class group (NCG; n = 2), and the general class group (GCG; n = 2). All participants agreed to take assessments, which consisted of jump inside kick, body composition, tensionmyography (TMG), and isokinetic moments tests. In sports biomechanical measures, the jump inside kick at 360˚, 540˚, and 720˚ were assessed by image analysis using 2 high-speed cameras, and analyzed by Dartfish program. In physiological measurement, the Tc, Dm, and Vc of TMG for static muscle contraction were assessed to use a technique based on the quantification of radial muscle belly displacement in the vastus lateralis, vastus medialis, rectus femoris, bicep femoris, gastrocnemius lateralis, gastrocnemius medialis, and tibialis anterior, in both legs. Peak torque (Pt) and work per repetition (Wr) of isokinetic moments for dynamic muscle contraction were extracted by knee extension / flexion, ankle inversion / eversion, and ankle plantarflexion / dorsiflexion tests.

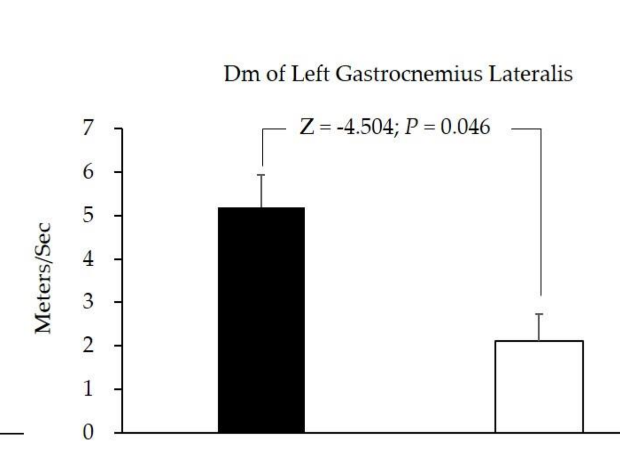


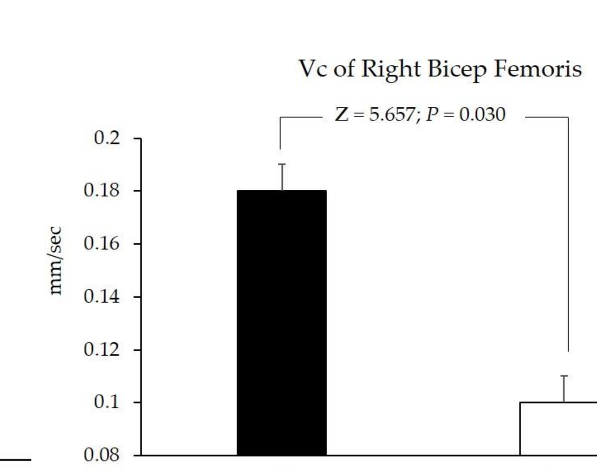
Results

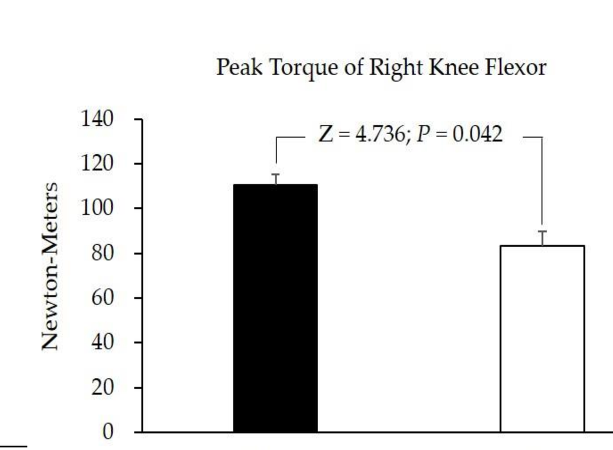
There were no significant differences in body composition between the groups, although there were higher muscle mass and basal metabolic rate in the NCG, and lower fatness in the NCG, compared with the GCG. In the sports biomechanical analysis of the jump inside kick, although the Event times, Phase time, and distance/time related to the jump inside kick of NCG were higher than those of GCG, there was no significant difference between the groups. Although the angles of hip, knee, and ankle joints relating to the jump inside kick of NCG were wider than those of GCG, there was no significant difference between the groups. In the physiological analysis of the static muscle contractions, although there was no significant difference in Tc between the NCG and GCG, the Tc of the left rectus femoris, Dm of the right bicep femoris, and Dm of the gastrocnemius lateralis of the NCG were significantly higher than those of the GCG. The Vc of the right bicep femoris in the NCG was also significantly higher than that in the GCG. In the dynamic muscle contractions, the right Pt of the knee flexor and left Pt of the ankle dorsiflexor in the NCG were significantly higher than those in the GCG.

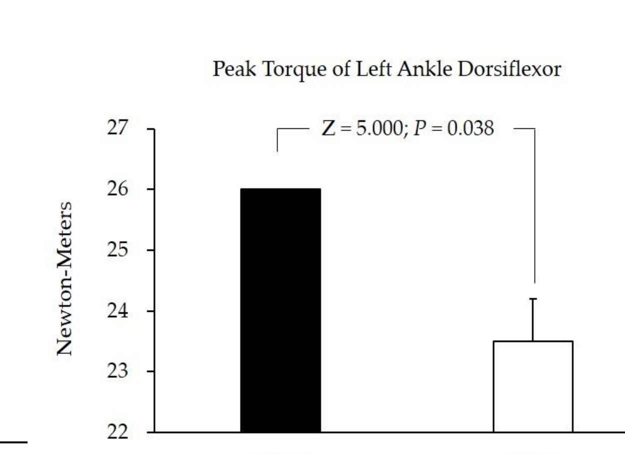












Conclusion

From some sports biomechanical aspects, there was no differences in physique and the technical part of the NCG and the GCG as a self-taolu athlete, but it can be interpreted that the static and/or dynamic muscle contractions required for the jump leap of the physiological aspects were significantly higher in the national players. It can be confirmed that in order to be a world-class self-taolu athlete, it is necessary to develop the muscle function for jumping leap during the jump inside kick.

Electromyostimulation-effect of Isometric Exercise on Body Composition and Biomarkers in Elderly Obese Patients

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Background & Purpose

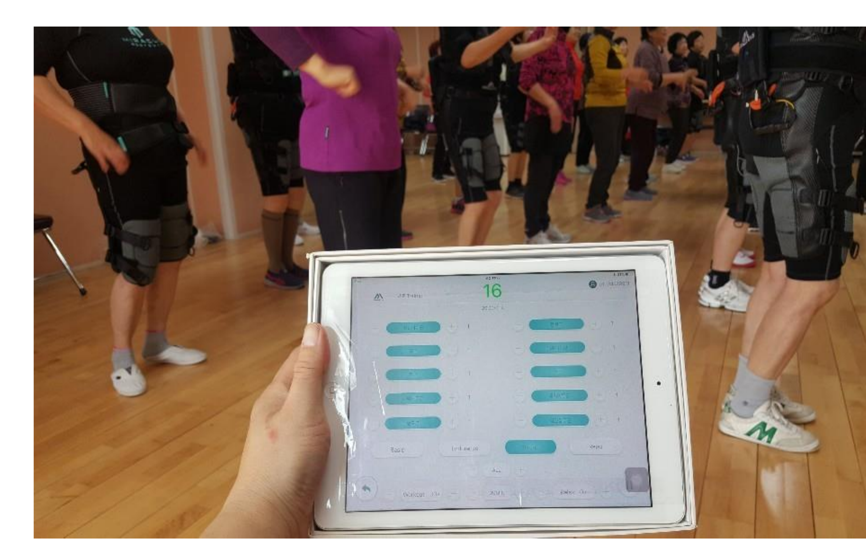
Even though there is some evidence that electromyostimulation (EMS) favorably improves body composition in young men, it is not known if EMS can be applied to elderly people with obesity to provide positive effects on body composition and biomarkers produced by adipose tissue. This study was to compare the EMS-effect of isometric exercise on body composition and biomarkers in obese elderly.

Materials & Methods

Thirty participants with obesity were randomly classified into a control group (CON, n = 10; male = 4; female = 6), isometric exercise group (ISOM n = 10; male = 4; female = 6), and ISOM + EMS group (EMSG; n = 10; male = 5; female = 5) as shown in Table 1. EMS suits used in this study enabled the simultaneous activation of 8 pairs with selectable intensities. Program sessions of EMS were combined with isometric exercises 3 times a week for 8 weeks. Although ISOM and EMSG received the same program, ISOM did not receive electrical stimuli. The bioelectrical impedance analysis was employed for body composition. After the subjects were stabilized for 10–15 min, 5 mL of blood was collected from the antecubital vein of the subjects with a disposable syringe by a medical laboratory technologist before and after the experiments. Interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-a), and C-reactive protein (CRP) from the serum were analyzed using an ELISA kit. Prior to analysis, we observed the difference between groups through Mann–Whitney U test. An analysis of variance (ANOVA) test was used to evaluate the significance of the differences between groups at baseline. Then, the effects of the interventions were assessed using an analysis of variance for repeated (2 × 2) measures (group, time, and group by time interaction). The level of statistical significance chosen was $p \le 0.05$.

Table 1. Physical characteristics of the subjects

Variables (unit)	Groups			Z	*p*
	CON	ISOM	EMSG		
Age (y)	68.7 ± 2.7	69.1 ± 3.9	67.3 ± 2.9	−0.908	0.376
Height (cm)	161.4 ± 5.5	162.6 ± 2.7	164.5 ± 4.1	−0.328	0.769
Weight (kg)	67.7 ± 3.8	68.1 ± 2.7	69.1 ± 8.7	−0.272	0.810
Percent fat (%)	38.3 ± 4.3	37.4 ± 3.2	37.2 ± 2.7	−0.082	0.936



Results

As shown in Table 2, significant effect of the EMS intervention was found in body weight when comparing three groups. Also, skeletal muscle mass and fat mass were significantly different in group by time interaction. A significant effect of the EMS + isometric exercise concerning an increased skeletal muscle mass was evident comparing with CON and ISOM. As shown in Table 3, there were significant changes in IL-6, TNF-a, and CRP in all groups. Compared with CON and ISOM, a significant effect of the ISOM + EMS intervention concerning decreased IL-6 and TNF-a, as well as reduced CRP were evident. Eventually, all biomarkers were significantly different in the group by time interaction.

Table 2. Changes and differences of fatness profiles

Items	Time	Groups			*p*		
		CON	ISOM	EMSG	G	T	G×T
Weight (kg)	Pre	67.7 ± 3.8	68.1 ± 2.7	69.1 ± 8.7	0.816	0.324	0.046
	Post	68.4 ± 6.1	67.4 ± 2.8	65.3 ± 5.8			
Muscle (kg)	Pre	21.2 ± 4.6	21.4 ± 5.5	20.3 ± 6.5	0.731	0.295	0.035
	Post	19.3 ± 5.4	21.8 ± 5.4	22.8 ± 6.5			
Fat (kg)	Pre	25.3 ± 2.1	26.6 ± 5.8	26.9 ± 3.9	0.656	0.815	0.039
	Post	26.6 ± 7.4	26.6 ± 1.1	22.6 ± 2.7			

All values are expressed as mean ± standard deviation. CON, ISOM, EMS represent control group, isometric exercise group and EMS + isometric group, respectively.

Table 3. Changes and differences of biomakers profiles

Items	Time	Groups			*p*		
		CON	ISOM	EMSG	G	T	G×T
IL-6 (pg/mL)	Pre	14.3 ± 7.3	13.6 ± 1.1	13.9 ± 3.4	0.466	0.124	0.008
	Post	15.5 ± 6.1	12.9 ± 8.8	9.4 ± 5.2			
TNF-a (pg/mL)	Pre	28.2 ± 8.6	27.4 ± 8.5	27.3 ± 6.9	0.433	0.195	0.016
	Post	29.3 ± 7.4	25.8 ± 9.4	21.8 ± 4.5			
CRP (pg/mL)	Pre	35.3 ± 11.1	36.6 ± 10.8	37.9 ± 13.4	0.256	0.705	0.043
	Post	42.6 ± 9.4	27.6 ± 11.1	24.3 ± 12.8			

All values are expressed as mean ± standard deviation. CON, ISOM, EMS represent control group, isometric exercise group and EMS + isometric group.

Conclusion

The results indicate that a significant effect due to the EMS intervention was found concerning body composition and biomarkers in the elderly participants with obesity. In other words, it was found that EMS + isometric exercise activates to reduce IL-6 and TNF-a that are released from adipose tissue, and ultimately reduces the concentration of CRP secreted by the liver. These results suggest that EMS can be an effective tool for elderly people who are bedridden or non-active.