

COMPARING THE DIFFERENCE BETWEEN FRONT-LEG AND BACK-LEG ROUND-HOUSE KICKS ATTACKING MOVEMENT ABILITIES IN TAEKWONDO

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The purpose of this study is to compare front-leg and back-leg movement abilities in Taekwondo athletes with a weight level of less than 68 kg. Six male subjects (age: 19.8 ± 1 , height: 175.6 ± 3.9 , weight: 62.5 ± 4.8) conducted back-leg attacking movements and front-leg attacking movements with their dominant leg. The back-leg attacking movements include back leg round-house kick and strike back round house kick. The front-leg attacking movements include front leg round-house kick and slide round-house kick. From statistics obtained, the kicking of relative force, compound acceleration, and tangential acceleration are better for back-leg attacking movements. However, front-leg attacking movements are better in tangential velocity. The range of waist a rotation and the flexibility of the hip joint are important to roundhouse kick techniques to the kinetic chain.

KEY WORDS: Taekwondo, Back leg round-house kick, Strike back round house kick, Front leg round-house kick, Slide round-house kick

INTRODUCTION: Taekwondo became an "Olympic sport" at the Sydney 2000 Olympic Games. Taekwondo now has an important place in Olympic Games. Many countries are training Taekwondo athletes to increase their medals. The short distance, high speed kicking and attacking force are characteristic of a Taekwondo match. "Taekwondo athlete movement frequently involves: a closed sparring stance, axe or roundhouse type kicks, and attacker's offensive kick. But now the round-house kick is still used often and mainstream offensive" (Roh & Watkinson, 2002).

Thus many kick movements are based on round-house kick. The back leg round-house kick, strike back round-house kick, front leg round-house kick, and slide round-house kick are often used in Taekwondo matches. However, the importance of velocity and force is a frequently discussed topic around the coaches of Taekwondo. The purpose of this study is to compare differences in round-house kick and between front-leg and back-leg movement abilities in Taekwondo.

METHODS: This study focused on the first and second weight classes (under 68 kg) for Olympic Games. All subjects were experienced in world class Taekwondo matches. Six male Taekwondo athletes (age: 19.8 ± 1 year old, height: 175.6 ± 3.9 cm, weight: 62.5 ± 4.8 kg.) were subjects in this study.

The equipment and devices included an accelerometer (CXL50LP3), a load cell (300 kg), and a Biovision system. Biovision system and DasyLab5.5 software were used to collect and analyze the data.

The load cell was fixed on one side to the wall; the other side was fixed to a bag. The accelerometer was fixed on the subject's dominant ankle. The subject performed back leg round-house kick (BL-RHK), strike back round-house kick (SB-RHK), front leg round-house kick (FL-RHK) and slide round-house kick (S-RHK) to kick the bag. BL-RHK and SB-RHK are back-leg attacking movements. FL-RHK and S-RHK are front-leg attacking movements. Every movement was performed three times.

The data of the fastest velocity from three trials was analyzed. The parameters for this study were force (F), compound acceleration (a_c), tangential acceleration (a_t) and tangential velocity (V_t). The force was normalized to body weight as relative force. The compound acceleration, defined as the whole attacking movement acceleration ability, was determined by three directional components (a_x, a_y, a_z) using the formula $a_c = \sqrt{a_x^2 + a_y^2 + a_z^2}$. The

tangential acceleration was defined as the kicking leg acceleration ability from bent leg to straight leg. The tangential velocity was integral tangential acceleration from bent leg to straight leg, using the formula $V_t = \int a_t dt$.

Repeated measures one-way ANOVA was used to determine the differences for all parameters between front-leg and back-leg round-house kicks attacking movement. The LSD post hoc test was used for pair-wise comparisons. Statistical significance was set at 0.05.

RESULTS: A one-way ANOVA revealed that, the back-leg attacking movement's relative force is significantly greater than front-leg's ($p < .05$). Figure 1 shows is the relative force in BL-RHK and SB-RHK are significantly greater than FL-RHK and S-RHK respectively ($p < .05$). The back-leg attacking movement's compound acceleration is better than front-leg attacking movement's. BL-RHK and SB-RHK are significantly greater than FL-RHK and S-RHK respectively ($p < .05$).

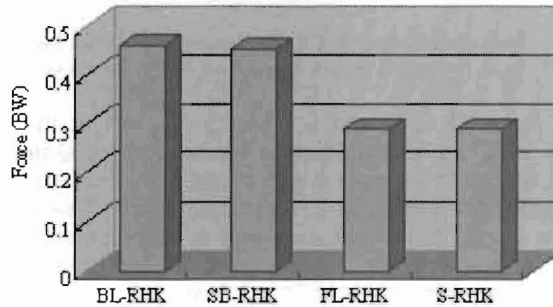


Figure 1 Relative force of BL-RHK, SB-RHK, FL-RHK and S-RHK.

The results show the tangential acceleration, and BL-RHK is significantly greater than FL-RHK and S-RHK respectively ($p < .05$); SB-RHK is significantly greater than FL-RHK ($p < .05$). The tangential velocity, in contrast, for FL-RHK and S-RHK, are significantly faster than for BL-RHK and SB-RHK respectively ($p < .05$), (see Figure 2).

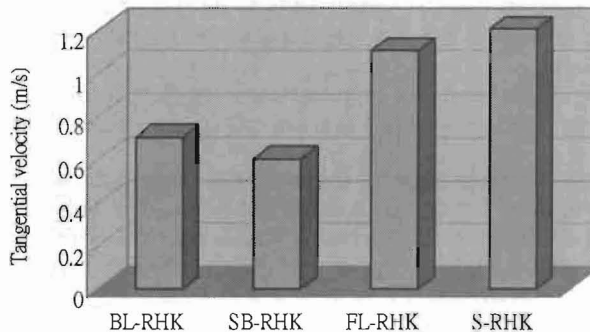


Figure 2 Tangential velocity of BL-RHK, SB-RHK, FL-RHK and S-RHK.

Table 1 One-way ANOVA, Mean and Standard division of relative force, compound acceleration, tangential acceleration and tangential velocity in BL-RHK, SB-RHK, FL-RHK and S-RHK.

Measure	BL-RHK		SB-RHK		FL-RHK		S-RHK		F
	M	SD	M	SD	M	SD	M	SD	
Relative force (BW)	.46	.06	.45	.08	.29	.04	.29	.04	77.28*
Compound acceleration (m/s ²)	21.75	2.18	22.00	1.67	14.74	1.55	14.46	1.43	29.91*
Tangential acceleration (m/s ²)	18.55	1.95	17.40	4.43	10.70	1.91	11.56	2.52	11.41*
Tangential velocity (m/s)	.64	.04	.73	.04	1.19	.03	1.27	.08	35.24*

* $p < .05$

Table 2 LSD of relative force, compound acceleration, tangential acceleration and tangential velocity in BL-RHK, SB-RHK, FL-RHK and S-RHK.

Measure	LSD
Relative force (BW)	BL-RHK > FL-RHK, S-RHK SB-RHK > FL-RHK, S-RHK
Compound acceleration (m/s ²)	BL-RHK > FL-RHK, S-RHK SB-RHK > FL-RHK, S-RHK
Tangential acceleration (m/s ²)	BL-RHK > FL-RHK, S-RHK SB-RHK > FL-RHK
Tangential velocity (m/s)	FL-RHK > BL-RHK, SB-RHK S-RHK > BL-RHK, SB-RHK

DISCUSSION: The show that back-leg attacking movements have bigger a relative force. It infers that BL-RHK and SB-RHK hit the target's rotation angle higher than for FL-RHK and S-RHK. Tsaousidis and Zatsiorsky (1996) bring up the "effective mass" concept. "Effective mass" plays an important role during body impact. "For instance in a football kick the effective mass was estimated at 2.5 kg, and in handball at 0.38 kg when the ball was hit coming off the front wall and at 0.9 kg from the back wall" (Plagenhoef, 1971).

In tangential velocity, the FL-RHK and S-RHK hit the target directly, and the rotation angle is smaller. BL-RHK and SB-RHK should spend more time in rotation. Tangential velocity in front-leg attacking movements are therefore faster than back-leg ones.

The attacking velocity and attacking force are frequently discussed issues in Taekwondo. The result of this study shows that the back-leg attacking movements, BL-RHK and SB-RHK, have a more powerful force than the front-leg attacking ones, FL-RHK and S-RHK. Meanwhile, the back-leg attacking movements have slower velocity than the front-leg attacking ones. It is because the pattern of the back-leg and front-leg attacking movements are different. The rotating arc of the back-leg attacking movement is bigger than that of the front-leg attacking movement. Therefore, the force of a back-leg attacking movement is more powerful. On the other hand, the attack distance of front-leg attacking movements is shorter. That is why the velocity of the front-leg attacking movements is faster.

The whole attacking movement acceleration ability was estimated by compound acceleration (a_c). The relative force is back-leg attacking movement's better. Compound acceleration of back-leg attacking movements is bigger than front-leg ones. It complies with Newton's acceleration law, so the compound acceleration can indicate the magnitude of force.

Tangential acceleration (a_t) was an indicator of the kicking leg acceleration ability. The results show the tangential acceleration, not only BL-RHK is better than FL-RHK and S-RHK, but also SB-RHK is better than FL-RHK. However, kicking movements, SB-RHK and S-RHK, have relative velocity between two legs. BL-RHK and FL-RHK kicking movements do not have relative velocity. The tangential acceleration cannot be used to predict these two movements because of their relative velocities. The results indicate back-leg attacking movements are better than front-leg ones.

If a coach wants to measure an athlete's acceleration ability using the compound acceleration (a_c) is good estimate.

CONCLUSION: The kinetic chain indicates that the rotation range of waist and the flexibility of the hip joint are essential for effective roundhouse kicks. Therefore, the Taekwondo coaches should reinforce the training of these two items to their athletes to enhance the skills and techniques of the front-leg attacking movements.

This study has only six subjects. The sample size is limited. It can be enlarged according to the variety of weight classes, age, genders, and performances. Therefore, the profound research will be accepted.

For future research, fixing three accelerators on the hip, knee and ankle, researchers can find the lower extremity's kicking situation which also reveals the contribution of three segments in Taekwondo movement.

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