

Comparison of Hip Abductor and Adductor Muscle Strength in Taekwondo and Non-taekwondo Practitioners

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Abstract

Background: Taekwondo is an empty hand combat that entails the use of the whole body. Spinning and turning kicks are the proper way of kicking in taekwondo which allow one to maximally perform the hip abductor and adductor muscles simultaneously. To measure the hip abductor and adductor muscles of Taekwondo and Non-taekwondo practitioners, Hand-Held Dynamometer (HHD) is used. This study aimed to compare the hip abductor and adductor muscles strength in Taekwondo and Non-taekwondo practitioners.

Methods: This analytical study of paired continuous variable was conducted using cross-sectional method. Thirty-two subjects were examined from September–October 2014 at the skills laboratory of Faculty of Medicine, Universitas Padjadjaran. Sixteen of them were Taekwondo practitioner and the other sixteen of them were Non-Taekwondo practitioner. Gender, weight, height, Body Mass Index (BMI) and maximum strength of hip abductor and adductor muscles were examined by using Hand-Held Dynamometer (HHD).

Results: Of all physical characteristics being examined, it showed that the p-values were above 0.5. The independent t-test showed that the average strength of hip abductors and adductors muscle in Taekwondo and Non-taekwondo practitioners were significantly different in which the both p-values were less than 0.05.

Conclusions: The maximum strength of hip abductor and adductor muscles of Taekwondo and Non-taekwondo practitioners were significantly different. The strength of hip abductors and adductors muscles is greater in Taekwondo practitioners compared to Non-taekwondo practitioners. [AMJ.2016;3(3):392–5]

Keywords: Hand held dynamometer, hip abductor, hip adductor, taekwondo

Introduction

Taekwondo is an empty hand combat that entails the use of the whole body. Tae means “to Kick” or “Smash with the feet,” Kwon implies “punching” or “destroying with the hand or fist,” and Do means “way” or “method.”¹ Taekwondo is known for its use of high spin and jumping kicks. One of kind kicks, for instance, a roundhouse kick, requires one’s hip abductor and adductor muscles to strain and relax in order to perform a strong and quick kicks. Given this, this study will focus on the hip abductor and adductor muscles, particularly in Taekwondo and Non-taekwondo practitioners.²

Kisner and Colby³ stated that strength is defined as the capability of either a single or a group of muscle, say by dynamically or can

be statically, producing tension and a resulting force in one maximal effort, based on demands placed upon them. A dynamometer is a tool used specifically to measure the muscle strength. A Hand-H Dynamometer (HDD) is used in this study because the cost-is effective, affordable, and immensely reliable and valid compared to other dynamometers.⁴ Two of the most basic kicks used in Taekwondo are turning kick and roundhouse kick. Both use more hip abductor and adductor muscles during the repeated training. In doing so, Taekwondo practitioners might have a better development in strengthening their hip abductor and adductor muscles.⁵ Therefore, this study would like to examine the strength of hip abductor and adductor muscles in Taekwondo practitioners and then compare it to Non-taekwondo practitioners.

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Methods

This study was carried out from September–October 2014 at the Skills Laboratory, Faculty of Medicine, Universitas Padjadjaran. All subjects examined in this study were approved by the Health Research Ethics Committee, Faculty of Medicine, Universitas Padjadjaran. Hand-Held Dynamometer (HDD) was obtained from the Department of Physical Medicine and Rehabilitation, Faculty of Medicine, Universitas Padjadjaran/Dr. Hasan Sadikin General Hospital Bandung.

The method used in this study was cross-sectional study with random selection of sixteen Taekwondo practitioners and sixteen Non-taekwondo practitioners as subjects of the study. The inclusion criteria were yellow-belted and beyond Taekwondo practitioners, students of Universitas Padjadjaran, BMI ranged from 18.5 to 24.9, aged 20 to 26 years old, and no current use of medication with cardiac or musculoskeletal effects; whereas, the exclusion criteria were white-belted Taekwondo practitioners, overweight or underweight, and minimum history of extreme hip and ankle injury, and knee surgery.

As for preparation, the subject was being assessed by the inclusion and exclusion criteria, the main goal and procedure of the examination were being explained. After agreeing to do the examination, the subject was asked to fill in the inform consent form. The dominant extremity was being confirmed, and then the subject was asked to lie on a flat-surface bed with their shoes taken off. The large curved transducer pad onto the HOGGAN MicroFET 2 Hand-Held Dynamometer was installed and the power button was being turned on, finally the SI unit was calibrated to 0.0 newton (N).

After running the procedure, the first muscles group being examined was the hip abductor. The subject was asked to lay on sides with the lower extremity positioned straight and above the opposite limb, which was flexed to 90° at the hip and knee for stabilization.

Subsequently, the Hand-Held Dynamometer transducer pad was placed on the distal femur close to the lateral knee.⁶ The subject was instructed to raise his/her examined limbs upward and rise as maximum as possible within 5 seconds, while the clinician directed the resistance to the subject's abduction. The entire procedure was done three times on each subject. The first reading was not taken because it was a practice trial for the subjects to undergo the feeling of pushing against the dynamometer. The examination was then conducted twice at the same side with a total timing of 2 minutes. Having finished the examination, the results were read from the LCD display, and being recorded in SI unit of newton (N).

Afterwards, the hip adductor muscles were examined. The subject was asked to lay on sides with the lower extremity positioned straight and above the opposite limb, which was flexed to 90° at the hip and knee for stabilization. Subsequently, the Hand-Held Dynamometer transducer pad was placed on the medial surface of the distal femur close to the medial side of the knee.⁶ The subject was instructed to raise his/her examined limbs upward and rise as maximum as possible within 5 seconds, while the clinician directed the resistance to the subject's abduction. The entire procedure was done three times on each subject. The first reading was not taken because it was a practice trial for the subjects to undergo the feeling of pushing against the dynamometer. The examination was then conducted twice at the same side with a total timing of 2 minutes. Having finished the examination, the results were read from the LCD display, and being recorded in SI unit of newton (N).

The obtained data were numerical and paired variable, therefore, the strength of hip abductors and adductors muscles in Taekwondo and Non-taekwondo practitioners were analyzed statistically using the independent t-test. It was considered statistically significant when $p < 0.05$. The analysis was performed by comparing the strength of the hip abductors and adductors

Table 1 The Physical Characteristics of the Subjects

Physical Characteristics	Taekwondo Practitioners	Non-taekwondo Practitioners	P-value
Weight (kg)	45-74	48-77	0.696
Height (m)	1.5-1.83	1.53-1.8	0.668
BMI	1.87-24.2	18.8-24	0.797

Note: BMI= body mass index

Table 2 The Maximum Strength of Hip Abductors and Adductors in Taekwondo and Non-taekwondo Practitioners

Muscle Strength	Range		P-value
	Taekwondo Practitioners	Non-taekwondo Practitioners	
Hip Abductors Muscle Strength (N)	298.972	225.956	0.000
Hip Adductors Muscle strength (N)	246.109	187.841	0.001

Note: BMI= body mass index

muscles in Taekwondo and Non-Taekwondo practitioners.

Results

The p-value obtained for all physical characteristics were above 0.5. It indicated that the physical characteristics of the subjects were not significantly different; therefore, comparison can be made between both groups.

The independent t-test showed that the average strength of hip abductors and adductors muscle in Taekwondo and Non-Taekwondo practitioners were significantly different in which the p-values were less than 0.05.

Discussions

The result showed that there were significant differences between the Taekwondo and Non-taekwondo practitioners. The null hypothesis which stated that there is no difference in the strength of hip abductors and adductors muscles among Taekwondo and Non-Taekwondo practitioners is being rejected. There were few factors that led to the occurrence of this phenomenon.

First, the difference occurred due to the subjects' physical characteristics, and the inclusion and exclusion criteria of this investigation. The chosen Non-Taekwondo practitioners were less active in exercising and working out in the day. Although some of them were also athletes, they did not practice Taekwondo in their daily life. In contrast, the maximum strength of abductors and adductors muscles was higher by comparing Taekwondo practitioners to Non-Taekwondo practitioners.

One of the most common and practiced kicks in Taekwondo, Dollyo Chagi, a roundhouse kick, is a kick started with the foot moved upward upon the waist level bent in the

knee and stand on the other foot, in which the practitioner turns his body around.⁷ When the knee of the attacking foot is in the same line pointing the target with the heel of the other foot, the round movement continues into a rapid stretching of the hitting foot.⁸ As the Dollyo Chagi is being performed, the kicking leg is being flexed first, and then extended. The adductors provide a useful source of flexor and extensor torque at the hip. The bidirectional torques is useful during high power kicking. The adductor longus has a flexor moment arm and generates a flexor torque similar to the rectus femoris. When the hip is near full flexion, the adductors are mechanically prepared to augment the extensors. The posterior fibers of the adductor magnus are powerful extensor of the hip, which have a similar function as the hamstrings muscles and the adductor longus has an extensor moment arm, and is capable of generating an extension torque similar to the posterior head of the adductor magnus.⁹ During kicking, a single limb in standing position is very dependent to the hip abductors. At this phase, the pelvis is comparable to a see-saw, with its fulcrum represented by the femoral head. When the see-saw is balanced, the Hip Abductor Force (HAF) is equal to the body weight (BW). Balance of opposing torques is called static rotary equilibrium. During single limb support, the hip abductor muscles must produce a force twice of body weight in order to achieve stability.⁹ Due to the repeated practice of hip abductors and adductors kinesiology, a Taekwondo practitioner will have a greater strength in abductor and adductor muscles due to the repeated usage of hip muscles during the kicking in Taekwondo.¹⁰

Hence, Taekwondo practitioners who often perform the kicks which frequently contract the hip abductors and adductors by repeatedly rotating the hip while swinging their legs, and the chances for the athletes in other fields such as tennis, badminton, table tennis, squash, bowling, basketball, and others to rotate

their hips and contract hip abductors and adductors, are so much lesser.¹¹ Throughout the study, there were some exceptions. A futsal player and a swimmer were being examined for this study, and the results showed a big contrast between their abductor and adductor muscles strength compared to the Non-taekwondo practitioners. The biases occurred due to the high strength of hip adductors muscle performance in futsal player, and high strength of both hip abductors and adductors muscles performance in swimmer, because a futsal player often kicks a ball with an external rotation of hip joint, and contractions of the hip adductors to produce a powerful kick¹²; whereas, a swimmer who always performs breaststroke, free-style stroke and butterfly style swimming, has the hip abductors and adductors that are developed well in order to produce a high hip rotational torque.¹³ Fortunately, since the exception was a minor percentage in the large group, the average strength after all does not affect much.

The limitation of the study was the difficulty in finding sufficient numbers of Taekwondo practitioners who fulfilled the inclusion criteria to participate in the study. As at Universitas Padjadjaran, the Taekwondo club has a very limited numbers of Taekwondo practitioners, especially the female practitioners. It is recommended and preferred to obtain Taekwondo practitioners from a larger Taekwondo practitioner group, for example Taekwondo Indonesia, in order to gather sufficient numbers of Taekwondo practitioner for future studies.

In conclusion, the strength of hip abductors and adductors muscles in Taekwondo practitioners is greater than in Non-Taekwondo practitioners. Therefore, Taekwondo training is also a recommended individual sport to build a better hip abductors and adductors muscle strength. Nevertheless, Universitas Padjadjaran Taekwondo Club training method should be shared and implemented in other Taekwondo communities in order to create more intense training and better development of hip abductors and adductors muscle in Taekwondo practitioners.

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