Does Pre-season Training Improve Body Composition, Physical Fitness, and Isokinetic Muscle Strength in Female Taekwondo Athletes?

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Abstract

The aim of this study was to examine the effects of a 6-week pre-season Taekwondo training program on body composition, physical fitness, and isokinetic muscular strength in female athletes. Twenty-two collegiate female athletes with mean ages ranging from 18.8 to 19.4 years participated. They were divided into four groups according to their weight categories: G1 (≤49 kg), G2 (>49 kg-57 kg), G3 (>57-67 kg), and G4 (>67 kg). The training program included 3 sessions a day, 3 days a week for 6 weeks. Body composition parameters were measured by Dual X-Ray Absorptiometry (DXA). Physical fitness tests including sit and reach, grip strength, sit-ups, standing long jump, 50 m shuttle run, and 20 m multi-stage endurance shuttle run were applied. Isokinetic strength was measured by an isokinetic dynamometer. The extensors and flexors of the knee and trunk were tested at three fixed angular velocities (60°·s⁻¹, 120°·s⁻¹, and 240°·s⁻¹). Significant time x group interaction effects were found for fat tissue (p < 0.05). G4 demonstrated significant decreases in fat tissue (p < 0.01) and percent body fat (p < 0.05) after the training program. However, no significant changes were found for body mass, lean tissue, and bone mineral density in all groups. G1 demonstrated significant improvements on the 50 m shuttle run (p < 0.001) and the multistage endurance run (p < 0.001), while G2 showed significant changes for grip strength (p < 0.01), the 50 m shuttle run (p < 0.01), and the multistage endurance run (p < 0.05). G1 demonstrated significant improvement in left extension (p < 0.0001) and left flexion (p < 0.05) at 60°·s⁻¹, left flexion (p < 0.001) at 120°·s⁻¹, and all variables at 240°·s⁻¹. Significant changes were also found in G2 (left and right extension at 60°·s⁻¹ and 120°·s⁻¹; right and left flexion at 240°·s⁻¹), and in G3 (left extension at 60°·s⁻¹, 120°·s⁻¹, and 240°·s⁻¹). However, the training had no effect on trunk isokinetic strength in all groups. In conclusion, this study suggests that a pre-season training program may decrease body fat, while improving agility, endurance, and knee muscular strength in specific weight categories of female Taekwondo athletes. However, this specific type of training should not be considered as an alternative training method for trunk strength in female athletes.

Keywords: weight category, flexibility, extension, flexion

Introduction

Taekwondo is one of the world's most popular combat sports. Due to this fact, the number of athletes participating in national and international Taekwondo events has increased rapidly. Taekwondo matches are typically structured across three 2-min rounds with 1-min intervals separating each round (30). Similar to those in most combat sports, matches are structured according to specific weight divisions. A previous study suggested that there are marked difference in technical, tactical, psychological, physical and physiological characteristics for athletes of combat sports with weight division (27). The weight division system directly influences some key aspects of an athletes’ preparation, including the management of body weight and body composition. In Taekwondo, as in any other combat sport, optimal body composition is a major concern. Thus, athletes attempt to maximize the amount of lean tissue, minimize the amount of body fat, and minimize their total body weight (19, 22). The percentage of body fat for elite international Taekwondo competitors ranges between 10% and 15% for males and females, respectively (4). The available data also provides insight into the body fat of Taekwondo practitioners, which appears to be mediated by numerous factors, including competition level, experience, sex, and age.

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Researchers have long focused on the physiological profiles of Taekwondo athletes (10, 11, 12, 18, 21). Taekwondo athletes require high levels of physical fitness, including aerobic and anaerobic power, muscular strength and power, flexibility, speed, and agility (3, 5, 6, 9, 13, 15). Hence, the capacity of elite athletes to acquire and maintain good physical fitness during both pre- and in-season training has become paramount. A study found that elite athletes achieved significant improvements in running speed, ventilator anaerobic threshold, explosive power, anaerobic alactic power, and lateral agility following participation in a Taekwondo match compared to their pre-match levels (8). However, information on a more extensive range of fitness components in female athletes, in relation to weight categories, is particularly deficient. These shortcomings may limit the development of specialized conditioning programs for different populations within the sport. More extensive research is warranted in these areas to permit population specific training recommendations.

More recently, increasing evidence suggests that the conditioning program an athlete follows plays an important role in performance enhancement and injury prevention, and Taekwondo athletes are no different (1, 16). In general, pre-season training programs consist of higher volume and intensity training regimes that incorporate multi-faceted aspects of physical conditioning (14, 25). High-level Taekwondo athletes perform a variety of different training modes concurrently within one training phase. They incorporate strength and power, speed, anaerobic and aerobic conditioning, along with a variety of Taekwondo specific training (skill, technical, and tactical sessions).

However, much of the current strength and conditioning literature does not address the issue of how this concurrent training may influence strength and power adaptations. Significant improvements in strength and power have been reported over short-term periods of pre-season training (17, 29). Argus et al. (1) reported moderate increases in bench press and box squat, and small decreases in bench throw, jump squat, and fat mass after 4 weeks of pre-season intensive training. Jones et al. (18) found that female soccer, field hockey, and softball athletes improved in 1RM bench press and squat after a 12-week strength and conditioning program. They reported that physical strength was correlated with 1RM upper-body and lower-body strength.

Nevertheless, few studies have examined the magnitude of improvement achievable over the pre-season period in elite female Taekwondo athletes. Due to the lack of related studies, knowledge about conditioning for female Taekwondo athletes should be extended rather than merely implementing extensions of current male training programs. Therefore, the aim of this study was to examine body composition, physical fitness, and isokinetic muscular strength in elite female Taekwondo athletes after 6 weeks of pre-season training, according to weight categories. We hypothesized that body composition, physical fitness, and isokinetic muscular strength would significantly improve after 6 weeks of the pre-season training program and that improvements would differ between the athletes’ weight categories.

Methods

Subjects

Twenty-nine collegiate female Taekwondo athletes volunteered to participate in this study. Seven subjects were excluded from the training group due to failure to complete the training program. The data reported correspond to twenty-two subjects with mean ages ranging from 18.8 to 19.4 years. Subjects were divided into 4 groups according to the Olympic Games’ weight categories for Taekwondo players: G1 (N = 8, ≤49 kg, age 18.9 ± 1.36 yr, height 162.6 ± 4.75 cm), G2 (N = 6, >49-57 kg, age 19.3 ± 1.37 yr, height 169.1 ± 5.07 cm), G3 (N = 4, >57-67 kg, age 19.3 ± 1.26 yr, height 172.3 ± 5.30 cm), and G4 (N = 4, >67 kg, age 19.3 ± 1.26 yr, height 172.3 ± 5.30 cm). They were informed of any risks associated with participation in the experiment. A written consent form was obtained from all subjects before participating, and all procedures described in this study were approved by the Institutional Review Board at Kyung Hee University.

Pre-season training program

All participants followed a conditioning training program for six weeks. As shown in Table 1, the training program included three sessions a day. The sessions consisted of three different exercises: distance running and stepping in the morning, interval training in