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Circuit training using elastic band: Can it improve the direction-changing agility of Kabaddi athletes?

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ABSTRACT

The ability to quickly change direction is important for kabaddi players, as it is crucial for building points and defeating opponents. The aim of this study was to determine the speed increase during change of direction after circuit training by using elastic bands with different resistance loads. We used the experimental design (pretest-posttest method). The sample consisted of 44 male Kabaddi athletes younger than 20 years old and belonging to the Junior Elite level in kabaddi, from Bali Province, Indonesia. They were divided into 4 groups based on circuit training intensity and elastic band resistance load. Each athlete received a 6-week treatment program. The data were processed through the Statistical Package for the Social Sciences (SPSS), version 24.0 (IBM, USA). The results showed that there is a statistically significant relationship between circuit training using elastic band and the athlete's speed in changing direction. Also, it is evident that the training program with a series of high-intensity exercises using an elastic band with a resistance load of 2.27 kgf increased the speed in changing direction by 13.74%.

KEYWORDS

Martial Arts; Combat Sports; Resistance Band Training; Male Athletes

1. INTRODUCTION

Kabaddi is inextricably linked to the Hindu folk tale, Mahabharata, or specifically the tale of Abhimanyu when he was surrounded by his enemy Chakraviyuh (Chandra, 2018). The sport itself is the modern iteration of ancient martial arts with modified rules in order to be accepted as a sport

(Kumar, 2014). The word “Kabaddi” comes from a Tamil word, "kai-pidi" (கைபிடி), which means “hand-shake” (Raja, 2018). Before it was commonly known as Kabaddi, the sport was known as Hu-Tu-Tu in Western India and Ha-Do-Do in Eastern India (Bovas, 2020).

Kabaddi is a sport in the culture of the Indian people (Kumar, 2014) and on the road to be known globally (Malkappagol, 2018). Kabaddi itself has been introduced in Southeast Asia (Kumar, 2014) and its introduction in Indonesia occurred at the Asian Beach Games in 2009.

Kabaddi is a team sport with 2 teams which aims at attacking the opponent team’s territory and gaining points by touching or grabbing the members of the opposing team (Sanjit & Pandey, 2016). There are a few types of points in this sport, namely touchpoint, grab point, bonus point, and super tackle. In this game, one round lasts for 20 minutes for males and 15 minutes for females. The team with the highest points will come out as the winner.

The vital motoric skill in Kabaddi is agility (Muthukumar & Kumaresan, 2019; Aggarwala et al., 2019) and most of the training regiments for Kabaddi athletes are focused on the agility aspect (Balasubrananian et al., 2014). Each player needs good speed, especially in changing direction, to catch the opponents while avoiding enemy grapple (Majlesi et al., 2012). Interestingly, a study by Yallap & Munireddy (2019) found that shuttle runs training to increase speed did not significantly affect the kabaddi athlete’s performance.

When performing speed training, its supporting factors are important to be addressed and one of these factors is changing of direction (CoD) (Chaabene et al., 2018). Speed itself is supported by 2 factors, namely perceptuality and decision making. The decision-making is supported by visual scanning ability, anticipation, situation awareness, pattern recognition, and change of direction (Sheppard & Young, 2006). The capacity to change direction when moving is one of the key factors in the field or team sports (Alhammad et al., 2019; Paul et al., 2015). In addition, CoD is supported by the relevant techniques to the practiced sport, straight sprinting agility, leg muscle, and athlete’s anthropometry. Kabaddi athletes need a good CoD as the sport is limited by the playing field. Besides, the coach is important to choose the training regimen (Shapie et al., 2019).

Based on the arguments that have been previously elaborated, the athlete’s speed should be improved by an appropriate training regimen accompanied by proper testing. Generally, the speed training for kabaddi athletes is focused on general speed but not on its derivative like changing direction quickly without losing balance. Therefore, a new form of training is needed to help kabaddi athletes to perform better in the game. Thus, the form of training in the study will focus on the circuit training by using elastic bands in order to increase the athlete’s speed in changing direction. So, the

study aims to determine the increase in speed during change of direction after circuit training using elastic bands with different resistances. The results from this article can be used as a reference for coaches to increase kabaddi athlete's performance and expand the knowledge in sport science, especially in kabaddi.

2. METHODS

2.1. Study Design and Participants

This was an experimental study which began with a pre-test before the treatment, continued with the 6-week treatment, and finished with a post-test.

The sample in the study consisted of 44 male athletes who were younger than 20 years old and belonged to the Junior Elite level in kabaddi (Table 1). The inclusion criteria were athletes who were registered as Kabaddi athletes, while the exclusion criteria were athletes who did not have any lower limbs injury or broken bones. There were 4 groups and each group contained 11 randomly assigned participants using a purposive sampling technique.

Table 1. Participant characteristics

Criteria	**N (total = 44)**
Age (years old)	
16	8
17	12
18	18
19	9
Height (cm)	
160-165	20
166-170	14
171-175	7
>175	3
Weight (kg)	
51-60	7
61-70	20
71-80	15
>80	2
Kabaddi experience (years)	
3	23
4	4
5	17

2.2. Tests and Measurements

The measurement of speed in changing direction is the Illinois agility test, as it has good effectiveness and reliability to measure athlete's capability in changing direction (Dawes, 2019; Stewart et al., 2014). Moreover, the movements in the Illinois agility test are similar of what usually done in Kabaddi. During the conduct of the study, time was measured in seconds using a stopwatch (Anytime Xl-013). The test was done in the afternoon and the participants were asked to do a warm-up and given instruction and demonstration on how to do each test before any measurement. The Illinois agility test was done twice and the best score was chosen (Dawes, 2019).

2.3. Procedures

The study was conducted using two variables with two levels, namely circuit training with high and low-intensity training and elastic band with different resistance loads (1.77 kgf and 2.27 kgf; both with 100% elongation) in order to increase the load during the test. The independent variable was the circuit training with different intensities using elastic bands with different resistance loads. Meanwhile, the dependent variable in the study was the speed to change the direction of male kabaddi athletes measured in seconds.

After the division into four groups, a pretest for the speed in changing direction was carried out. Following the pretest, the participants have given the elastic band circuit training treatment according to the grouping for 6 weeks (Table 2). The first post of circuit training was the pro-agility drill, the second post was the L drill, the third was the T drill, the fourth was the corner drill, the fifth post was the X drill, and eventually, the sixth post was the butterfly drill. For the low-intensity training, the duration of each post was 5 seconds per drill with 15-second rest. Meanwhile, for the high-intensity training the duration of each post was 10 seconds per drill with 10-second rest. The training was done in 4 repetitions and 6 sets in the first 2 weeks, 5 repetitions in 7 sets for the following 2 weeks, and finally 6 repetitions in 8 sets within the last 2 weeks. It was done 3 times a week under the supervision of coaches in each group. The training duration was 6 weeks because several studies reported a significant improvement after 6 weeks of speed training (Dawes & Roozen, 2012; Singh & Sathe, 2017; Zouhal et al., 2019). A posttest was given after the end of circuit training and the results were compared with the pretest.

Table 2. Research design framework

Variable	Circuit Training Method	
	Low Intensity (A1)	**High Intensity (A2)**
Elastic Band 1.77 kgf (B_1)	A_1B_1	A_2B_1
Elastic Band 2.27 kgf (B_2)	A_1B_2	A_2B_2

Note: A_1B_1: Low-intensity circuit training method group, Elastic band 1.77 kgf; A_1B_2: Low-intensity circuit training method group, Elastic band 2.27 kgf; A_2B_1: High-intensity circuit training method group, Elastic band 1.77 kgf; A_2B_2: High-intensity circuit training method group, Elastic band 2.27 kgf.

2.4. Statistical Analysis

The search data was processed through the Statistical Package for the Social Sciences (SPSS), version 24.0 (IBM, USA). The Kolmogorov-Smirnov normality test was performed in order to determine the data distribution. Then, the Levene's homogeneity test was performed in order to determine whether the subject is homogeneous or not. Two-way ANOVA test followed by a Tukey LSD test were done to compare the mean difference of Illinois agility test results between groups to see if there is an interaction between variables.

3. RESULTS

We start the presentation of this section by showing the results of the relationship between the circuit methods and the types of elastic band (Table 3).

Table 3. The relationship between the circuit methods and the types of elastic band

Circuit training	N	Elastic band	Statistics	Pretest	Posttest
Low Intensity	11	1.77kgf	∑X	189.78	181.16
			$\bar{x}$	17.2527	16.4691
			SD	0.54637	0.44442
	11	2.27 kgf	∑X	187.96	170.49
			$\bar{x}$	17.0873	15.4991
			SD	0.50126	0.77988
High Intensity	11	1.77kgf	∑X	185.78	164.37
			$\bar{x}$	16.8891	14.9427
			SD	0.41532	0.37202
	11	2.27 kgf	∑X	188.49	162.59
			$\bar{x}$	17.1355	14.7809
			SD	0.49891	0.44284

Note. ∑X: Total Time (in seconds); $\bar{x}$: Average speed yield; SD: Standard Deviation.

The results from Table 3 show no statistically significant relationship ($p > 0.05$) between the circuit methods and the type of elastic band in the pre-test. However, a different result was found in the post-test that showed the statistically significant relationship between the circuit training methods and the type of elastic band ($p < 0.05$).

Based on the mean percentage in speed after treatment, it is apparent that the increase in mean score of the changing direction speed within the A_1B_1 group was 4.54%, the A_2B_1 group was 11.52%, A_1B_2 group was 9.29% and A_2B_2 group was 13.74% (Figure 1).

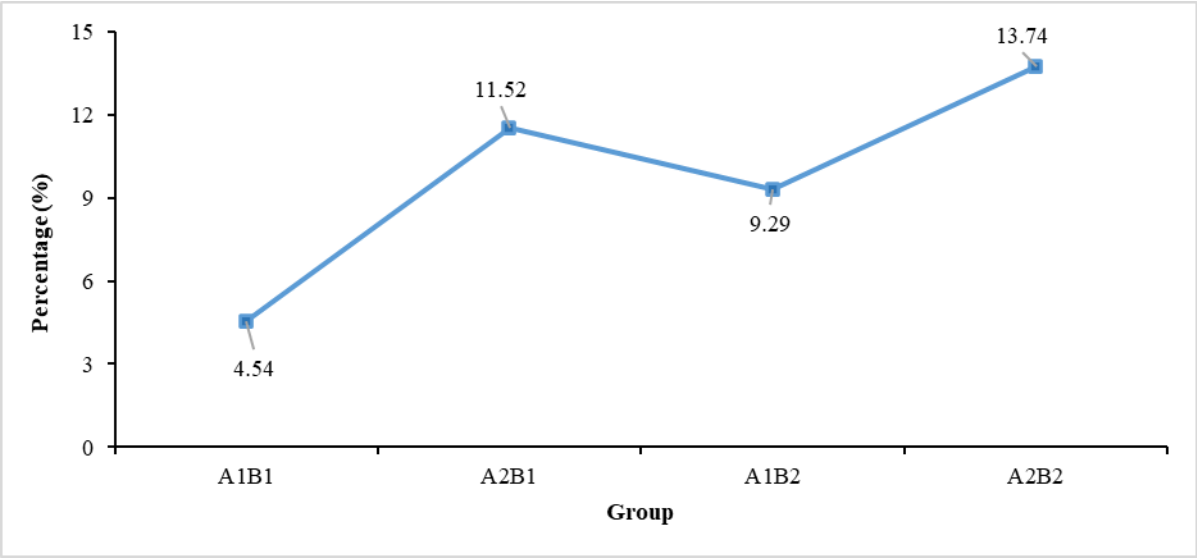

Figure 1. Percentage increase in speed in changing direction after circuit training

The highest Illinois agility test was shown by the A_1B_1 group, about 16.5% (Figure 2). Based on the two-way ANOVA result, we observed a statistically significant difference in the pretest with low-intensity training with a harder elastic band (A_1B_2) and all high-intensity training (Figure 2). Combined, it can be said that the high-intensity training and harder elastic bands produced greater changes than the other group training.

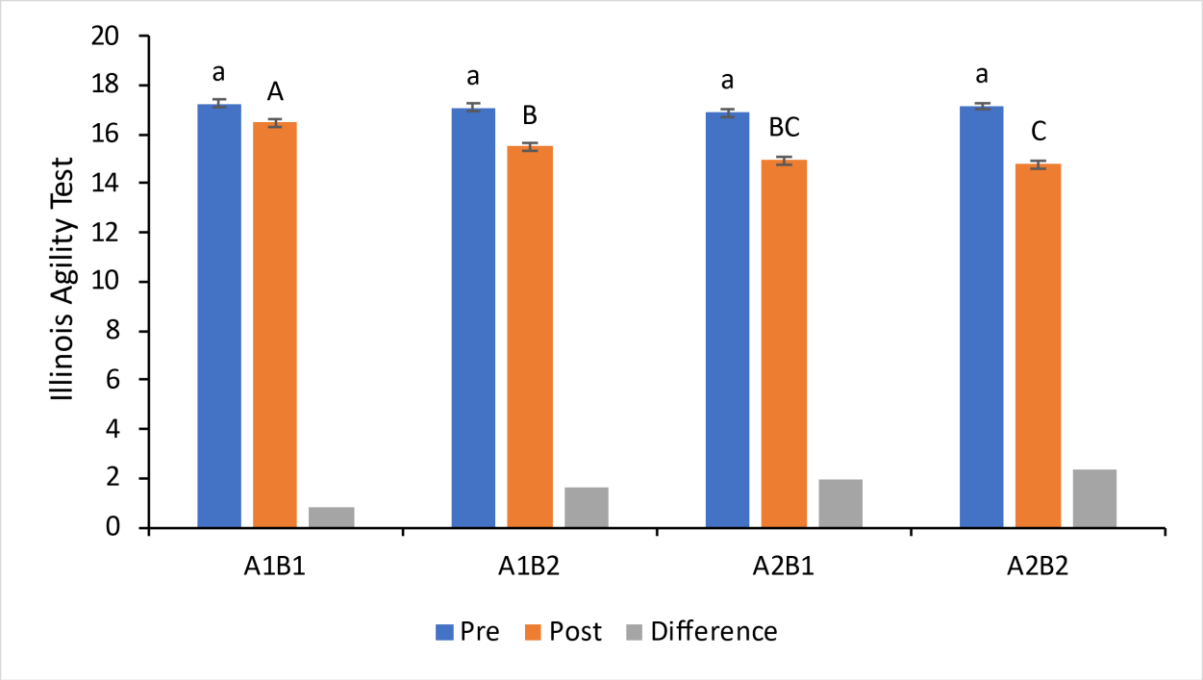

Figure 2. Average results of speed between groups

The following table (Table 4) presents the results of the effects between subjects.

Table 4. Tests results of the effects between subjects

Source	Type III Sum of Squares	Mean Square	F	p value
Corrected Model	19.173[a]	6.391	22.421	0.000
Intercept	10466.171	10466.171	36716.029	0.000
Circuit training	13.854	13.854	48.602	0.000
Elastic band	3.523	3.523	12.358	0.001
Circuit training*Elastic band	1.796	1.796	6.301	0.016

From the results of the corrected model, it is clear that the p-value was smaller than 0.05 (0.000). Thus, these results show that that the obtained model that has been attained is valid. The intercept value obtained by a p-value of 0.000 (< 0.05) also shows that the intercept has given significant contribution. The circuit training variable has significant effect on the speed posttest data because the p-value is lower than 0.05 (0.000). Meanwhile, the elastic band variable also has significant effect on the speed in the posttest data (p-value<0.05; 0.001). The interaction between the circuit training variables and elastic band also has a significant effect on the speed posttest data with the p-value of 0.016 (Table 4).

4. DISCUSSION

The ability to change direction in kabaddi has never been discussed in any training programs or studies, even though the aforementioned ability is a major factor in kabaddi if we examine the form of movement performed in the game. This ability is an important part of kabaddi because the sport is limited by the shape and size of the playing field. Unlike running track that majority requires speed, kabaddi athlete relies on speed in changing the direction of motion to get points. The study proves that the high and low-intensity circuit training method using elastic bands can be used as training to improve the ability to change direction. The circuit training method used with different drills in each post and different intensities causes different effects on the body.

The results of the current study share several similarities with those of the previous studies. Feito et al., 2018) states that the circuit training method produced a good response to body functions. Then, the results of a study by Hermassi et al. (2017) demonstrated that two sessions of circuit training per week showed an interaction effect that increased speed. In addition, Paoli et al. (2013) report that a higher intensity training has advantages in carrying out the exercise program, while a lower one has an advantage in systolic pulse. High-intensity training will increase athlete's agility, speed, and resilience during anaerobic movement (Mathisen & Pettersen, 2015), while low intensity training will decrease fatigue and has a good effect on physical activity involvement (Liu et al., 2018). High-intensity training programs are indeed designed to address the athlete's fitness and their physical and mental readiness (Haddock et al., 2016). Meanwhile, the high-intensity resistance training has an increased impact on speed as well (Kulothungan et al., 2019). Using different intensities in the training period will have different effects so it should be directed according to the objectives of the training. The combination of both high and low intensity will give a positive effect in the training, in terms of body adaptation in fatigue management. High-intensity training provides a better effect than continuous training for competitive athletes (Pavon & Lavie, 2017).

The results from one of the previous study also showed that strength training with an emphasis on eccentric muscles is a promising element in the strength programs to increase the change of direction time (Chaabene et al., 2018). Straudi et al. (2014) report that high-intensity circuit training improves the functional abilities in walking. Speed has traditionally been viewed as a quality that is primarily influenced by leg muscle strength (Tanner & Gore, 2013). Changes in direction are elements contained in agility (Chaabene et al., 2018). A study by Hayashida et al. (2014) shows that muscle strength had a significant correlation with speed. Leg muscle strength is highly correlated with running ability (Penailillo et al., 2016). Speed can be increased by strength training incorporated

with training that can improve balance (Makhlouf et al., 2018). This shows that the quality of muscle strength greatly affects when maneuvering changes during motion and eventually increases athlete's speed.

Neuromuscular adaptation takes place when there is a stimulus in the aforementioned system. The stimulus will be received by the sensory neuron in the muscle (by muscle spindle and Golgi tendon organ) and relayed to the brain, then, it will be followed by an impulse to the motor neuron in muscle so the muscle can contract in response. The training inhibits the Golgi tendon organ reflex in the motor impulse to induce the adaptation in the muscle (Kisner et al., 2018). A focused training to neuromuscular adaptation for 6 weeks could increase the speed parameters (Wojtys et al., 1996). An athlete should have the necessary lower joint movement, good intramuscular coordination, and sufficient lower limb power to do a proper change of direction. This includes posture stabilization, neuromuscular, and sensorimotor related to dynamic stabilization (Gambe, 2012). The results of the study support this theory.

Sonoda et al. (2018) state that a continuous exercise in the lower extremities can increase speed. The use of resistance training with elastic bands as a clinical modality and tool was recognized in the 1980s and the usage has begun to increase in recent years. Its benefits include the increased functional capacity, strength, muscle activation, and endurance, as well as improved body composition, potency, and quality of life (Lopes et al., 2019). Then, a study conducted by Lopes et al. (2019) shows that training with an elastic rubber provides better strength gains over resistance training using conventional devices. Resistance training is an effective tool to stimulate muscle hypertrophy and increase muscle strength (Mangine et al., 2015). Different types of resistance training have the potential to improve the different components of physical fitness related to skills (e.g. muscle strength, balance, and speed) in different ages, like young, adults, and seniors (Prieske et al., 2018). Resistance exercise is a form of an active strength exercise, both dynamic and static, which contracts the muscles by holding the force exerted manually or mechanically. The use of elastic bands has a variety of resistance loads to complement the training regimen (Uchida et al., 2016).

Resistance exercise is an important element in a rehabilitation program for someone with functional disorders. It has the potential to increase the body's functional workability and prevent or reduce the risk of disease and injury (Yu et al., 2013). Resistance training is an effective tool to stimulate muscle hypertrophy and increasing strength and becoming one of the most popular forms of exercise to increase muscle contractile capacity in adults and athletes (Martins et al., 2013). The benefits of resistance training are the increased physical performance, movement control, speed,

walking, functional independence, cognitive abilities, and self-confidence (Westcott, 2012). In addition to increasing muscle strength and body function, resistance training with elastic bands affects improving balance in making changes in direction (Kwak et al., 2016). To effectively change direction, a good body balance is needed (Rouissi et al., 2018).

Resistance training using elastic bands showed the potential as an effective method compared to conventional resistance training in the aspect of agility, speed, vertical jump, and power (Katushabe & Kramer, 2020). The study is supported by the latest study of Chaabene et al. (2020), who stated that resistance training is an effective way to increase the change of direction speed in teenager and adult athletes. Similar results from a study by Ghazaly et al. (2018) have found the significant effect of the elastic band on martial arts athletes. In addition, Kang et al. (2016) use elastic bands to increase the dynamic balance, flexibility, and speed of athletes. Elastic bands can stand all-direction loads and naturally adjust the load intensity so it is suitable for exercise (Chen et al., 2014).

Speed needs good lower limbs strength. Static exercise is not enough to train the lower limb for more dynamics movement. Lower leg muscle strength helps improve the performance in activities that require changing of direction quickly while maintaining balance and controlling the body for the next movement (Singh et al., 2016). Elastic band training can give sufficient load while doing dynamic changing of direction, which is not achievable using conventional weight training. This kind of training is effective for hip joints and body stabilization (Kang et al., 2016). The resistance load will train the involved muscles when doing the movement that needs agility.

Nevertheless, the use of an elastic band will not have a direct effect on speed. The elastic band will train the supporting factors in the dynamic in changing of direction, such as balance, explosive power, and running speed. The elastic band is suitable for a training regime that increases speed. The elasticity will give dynamic loads when training, thus induce the neuromuscular adaptation on the movement during the training. The results of a study by Janusevicius et al. (2017) show that resistance training using an elastic band increases the strength of knee flexor muscle and sprinting speed.

Training that uses the high-intensity circuit training method has been shown to improve the ability to change the direction of movement of Kabaddi athletes. In addition to muscle strength, other bio-motor components also support the change of direction, such as speed and balance. It is hoped that future research can make interaction relationships between other supporting variables. The limitation of the study is the limited observed variable to see the effect to the speed in changing direction. It is hoped that further study could increase the observed variable, such as decision making that supports speed.

5. CONCLUSIONS

The results of the current study show the positive interaction between circuit training and elastic band in increasing the athlete's speed when changing direction. High-intensity circuit training using hard elastic bands increases the speed in changing direction of Kabaddi athletes when compared to a lower intensity and lighter elastic bands. It is recommended that coaches choose a form of training relevant to the needed techniques and skills for kabaddi game.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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