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Original article

THE IMPACT OF USING RESISTANCE BANDS ON THE DEVELOPMENT OF MUSCULAR STRENGTH IN TAEKWONDO FEMALE ATHLETES AGED 14 TO 18

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Abstract

Aim. This study was designed to compare the effects of 8 weeks of elastic band training and the physical responses that occur in muscular strength, especially explosive strength and strength endurance in female taekwondo players aged 14 to 18 years.

Methods. A total of 05 participants were measured before and after an 8-week training programme with three weekly sessions (24 sessions) throughout the training programme, which included training sessions using elastic bands with full control of training intensity throughout the duration of the programme:

Four physical tests were selected to measure the results:

-Static vertical jump test to measure the explosive power of the legs.

-3kg medicine ball throw test to measure the explosive strength of the arms.

-60-second sit-to-stand test to measure abdominal muscle strength endurance.

-60-second squat test to measure the endurance of the leg muscles.

Results. The results indicated that the use of elastic bands develops the muscular strength of the players so that we observed statistically significant differences between the pre-test and post-test in all physical tests attributed to the training programme.

Conclusions. These results indicate that elastics are very important in the development of muscular strength in female Taekwondo athletes, and coaches should recognise their importance and use them throughout physical preparation in Taekwon

Keywords: Elastic band, Taekwondo,Muscular strength.

Introduction

Taekwondo is a martial art that incorporates various techniques, with kicks being a crucial element. To excel in scoring points, practitioners often perform a series of kicks. For these kicks to be effective and score points, they must be executed with sufficient power. The effectiveness of kicking techniques in Taekwondo is significantly influenced by the strength of the athlete's leg muscles. Leg muscle power refers to an individual's ability to maximize strength and speed to overcome resistance or load. (Aloui et al., 2019) ; (Rodriguez-Lopez et al., 2022).

In addition to being properly selected by the coach, the training regimen needs to assess the athlete's weaknesses. Resistance bands will be one technique used in this study. The addition of resistance bands to free weight training has gained widespread acceptance in training programs worldwide in recent times Shavelson (2018); (Ghram et al., 2021). It is recommended to check that the elastic rubber on this resistance band is in good condition before using it, as it can jeopardize user safety if it becomes cut. For the exercise to be performed comfortably and securely, it is also necessary to make sure that the pivot point where the resistance band is tied is sturdy.

An alternative to weight training with rubber or elastic cables as resistance is this resistance band workout (Bergquist et al., 2018); (Souto et al., 2021). Rubber resistance bands come in a range of elasticities; for strength training, this study suggests using medium-sized resistance bands. There are still a lot of coaches in the field who are ignorant about rubber resistance band power training. Resistance band workouts work incredibly well together to improve leg strength and jump height as well as speed and agility (Katushabe & Kramer, 2020); (Aloui et al., 2020); (Agopyan et al., 2018); (Hammami et al., 2022).

When correctly delivered strikes are controlled above a particular level of strength, they might result in points for the opponent during Taekwondo tournaments (Koh & Watkinson, 2002; Shirley, 1992).

Elastic bands have become an essential and necessary part of Taekwondo trainings. Because of their flexibility, they create better resistance and are therefore useful for variable loading trainings, volume and intensity determination

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trainings, and other trainings (Shoepe et al., 2010). Although elastic resistance training (ERT) is frequently employed to enhance kicking proficiency, its effectiveness has never been scientifically studied (Jakubiak, & Saunders, 2008).

This study examines the effect of using resistance bands with different levels of resistance during taekwondo training sessions on (muscular strength, explosive strength, and strength endurance) in taekwondo athletes aged 14 to 18 years.

To address this issue, we propose the following question:

Do elastic bands affect the increase in muscular strength in female Taekwondo players aged 14-18?

Hypothesis

There are statistically significant differences in strength endurance tests between the pre-test and post-test measurements of the experimental sample.

There are statistically significant differences in explosive strength tests between the pre-test and post-test measurements of the experimental sample**.**

Methods

This study was conducted over a period of 8 weeks and included pre- and post-measurements. The training program consisted of twenty-four training units using elastic bands, with an average of three sessions per week, balancing physical and tactical aspects, interspersed with preparatory matches. The training time was always at 10 AM at the same time of day to minimize the impact of daily variations on performance.

During the entire study period, the players had the same type and volume of training, and resistance band training was added in three forms:

1. One end of the elastic band was fixed to a point on the ground.

2. On the other end of the elastic band, which was designed to be connected to the athletes' ankles, it was secured in a way that allowed the athlete to exert pressure on their tendons.

3. The elastic band was stretched up to 1.5 meters towards the training glove held by the partner, along with all instructions from the partner.

To ensure that the observed differences are attributed solely to the training program, we attempted to control all the variables of the study, taking into account the training loads after each week and the type of recovery. This type of research is an experiment. Experimental research is a study conducted to discover the consequences of a treatment intentionally administered by the researchers. (Rogers & Reeves, 2019).

The sample used consisted of 5 female taekwondo athletes aged between 14and 18 from the Stars of Tebessa club. The vertical jump test and the squat test for 60 seconds were selected to measure leg strength, the 3 kg medicine ball throw test to assess the explosive strength of the arm muscles, and the sit-up from lying down test for 60 seconds to evaluate the endurance of the abdominal muscles.

Results

The data analysis techniques included experimental analysis, requirement tests (normality tests and correlation coefficients between pre-test and post-test measurements, as well as the validity and reliability of the tests used), and hypothesis testing using paired sample tests and independent sample tests. Analysis using SPSS23.

All tests were treated at the 0.05 level of significance.

Table 1. The self-validity coefficients for the tests applied to the sample

Physical tests	Coefficient of stability	Self-Validity Index
Sargent test	0.87	0.93
Medicine ball throw test	1.00	1.00
Leg muscle test (squat for 60 seconds)	0.99	0.99
Abdominal muscle test (Sit-up for 60 seconds)	0.99	0.99

Through Table (1), it is clear that the self-validity coefficients for the tests (Sargent, medicine ball throw, leg muscles, and abdominal muscles) ranged from 0.93 as the lowest value to 1.00 as the highest value, which are high coefficients. This indicates that the tests possess good self-validity.

Stability coefficients for the tests (Sargent, Medicine Ball Throwing, Leg Muscles and Abdominal Muscles) ranged from 0.87 as the smallest value to 1.00 as the largest value, which are high coefficients.

This indicates a good stability of the tests.

Presentation of the analysis of the results of the first partial hypothesis:

The first partial hypothesis came as follows: There are statistically significant differences in strength endurance tests between the pre-test and post-test measurements of the experimental sample. To answer this hypothesis, the incoming data was processed using the t-test for paired samples. The results are shown in the following tables:

Table 2. The significance value "t" for the differences between the average results of the one-minute leg muscle test for the pre-test and post-test of the experimental sample

The test.	The arithmeticmean.	Standard deviation	The value of T. The calculated.	The value of T.	The statistical decision.
pre-test.	50.80	4.91	5.98	2.77	Statistically significant
post-test.	56.60	6.22			

Through the results shown in Table (2), we observe that the mean value reached 50.80 with a standard deviation of 4.91 in the pre-test, while the mean value reached 56.60 with a standard deviation of 6.22 in the post-test. After calculating the "t" test for significance of differences, we found that the calculated "t" value was 5.98, which is greater than the tabulated "t" value of 2.77 at a significance level of 0.05 and with 04 degrees of freedom. Therefore, there are significant differences between the mean values, indicating a statistically significant difference between the pre-test and post-test in the leg muscle test in favor of the post-test.

Table 3. The significance value "t" for the differences between the average results of the abdominal muscle test for 60 seconds in the pre-test and post-test of the sample

The test.	The arithmetic mean.	Standard deviation	The value of T. The calculated.	The value of T.	The statistical decision.
pre-test.	34.40	1.94	8.48	2.77	Statistically significant
post-test.	40.40	1.94			

Through the results shown in Table (3), we observe that the mean value reached 34.40 with a standard deviation of 1.94 in the pre-test, while the mean value reached 40.40 with a standard deviation of 1.94 in the post-test. After calculating the t-test for significance of differences, we found that the calculated "t" value was 8.48, which is greater than the tabulated "t" value of 2.77 at a significance level of 0.05 and with 4 degrees of freedom. Therefore, there are significant differences between the means, indicating a statistically significant difference between the pre-test and post-test in abdominal muscle testing in favor of the post-test.

Presentation and analysis of the results of the second partial hypothesis:

The second partial hypothesis is as follows: There are statistically significant differences in explosive strength tests between the pre-test and post-test measurements of the experimental sample.

To answer this hypothesis, the incoming data was processed using the t-test for paired samples. The results are shown in the following tables:

Table 4. The significance value "t" for the differences between the average results of the Sargent test for the pre-test and post-test of the experimental sample

The test.	The arithmetic mean.	Standard deviation	The value of T. The calculated.	The value of T.	The statistical decision.
pre-test.	45.54	4.07	6.20	2.77	Statistically significant
post-test.	49.72	4.48			

Through the results shown in Table (4), we notice that the mean value reached 45.54 with a standard deviation of 4.07 in the pre-test, while the mean value reached 49.72 with a standard deviation of 4.48 in the post-test. After calculating the "t" test for significance of differences, we found that the calculated "t" value was 6.20, which is greater than the tabulated "t" value of 2.77 at a significance level of 0.05 and 4 degrees of freedom. Therefore, there are significant differences between the mean values, indicating a statistically significant difference between the pre-test and post-test in the Sargent test in favor of the post-test.

Table 5. The significance value "t" for the differences between the average results of the 3 kg medicine ball throw test for the pre-test and post-test of the experimental sample

The test.	The arithmetic mean.	Standard deviation	The value of T. The calculated.	The value of T.	The statistical decision.

pre-test.	379.10	27.23	08.01	2.77	Statistically significant
post-test.	390.40	29.40			

Through the results shown in Table (5), we notice that the mean reached a value of 379.10 with a standard deviation of 27.23 in the pre-test, while the mean reached a value of 390.40 with a standard deviation of 29.40 in the post-test. After calculating the "t" test for significance of differences, we found that the calculated "t" value was 8.01, which is greater than the tabulated "t" value of 2.77 at a significance level of 0.05 and with 04 degrees of freedom. Therefore, there are significant differences between the means, indicating a statistically significant difference between the pre-test and post-test in the medicine ball throw test in favor of the post-test.

Discussions

From the results obtained in the previous tables:

- Rubber bands affect the development of strength endurance in female taekwondo players from 14 to 18.

-Rubber bands affect the development of explosive strength in female taekwondo players from 14 to 18.

This study investigates the effect of using elastic bands with different resistance values during Taekwondo training sessions on muscular strength, thereby enhancing the athletes' striking power through different techniques over a period of 8 weeks. The study found that men generate strength faster and more powerfully than women. Furthermore, it was found that Twit Shaggy was the strongest striking technique while Dulio Shaggy was the fastest. There was no clear difference in relative speed. (Pieter F. & Pieter W. 1995).

From the results of our study, it is clear that the use of elastic bands with varying flexibility according to each taekwondo technique is essential to maximise the effect of striking techniques during taekwondo competition. Depending on where the blows are directed - either to the face or the torso - the elasticity of the band may change. Since technical Taekwondo training with elastic bands is aligned with the kinetic and kinetic chain, it will undoubtedly enhance the power of the striking effect. (i.e. hip, knee and ankle mobility). According to Chiu et al (2007), there is a parallel increase in strike velocity that is dependent on strike force.

Since elite athletes must be able to demonstrate significant striking power, taekwondo training with elastic bands will promote the development of muscular strength in athletes and enable them to increase their technical striking speed (Falco et al., 2009).

Conclusions

The elastic band provides resistance to muscle movement. The degree of resistance depends on the stretching properties of the band material. Elastic bands are currently used in physiotherapy and rehabilitation to improve individual functional capacity, for chronic diseases and to develop the functional capacity of athletes. The opportunity to set individual strength and traction ratios is favoured. Elastic bands can be used to strengthen specific muscle groups and also affect flexibility and balance. The benefits of resistance bands have been shown to be real when used by athletes, and their use has a high level of safety if supervised by a trainer. Exercising with resistance bands has been shown to increase muscle activation and is an effective way to increase muscle mass. The stronger an athlete's muscles are, the greater the athlete's ability to perform technical movements in sport, because it is recognised that strength will allow the muscles to do the physical work explosively

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