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Effects of Different Resistance Training Methods on Agility Performance of Male Athletes

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Abstract: *Strength and conditioning coaches frequently concentrate on developing athletes' force capability, essential for agility. Agility is a multifaceted quality that includes reflexes, strength, endurance, balance, coordination, speed, and the capacity to accelerate and decelerate. This study compares resistance band training versus resistance training using dumbbells on the agility performance of male track and field athletes. A randomized controlled trial design was used, having n=60 in three groups, i.e. one control and two experimental groups. The participants' agility performance was measured using the Quick Feet test. Both the resistance band group and the dumbbells group had a substantial increase in agility ($p < 0.001$) from the pre-test (3.45 ± 0.23) to the post-test (3.08 ± 0.24) ($p = 0.009$). The results validate the effectiveness of resistance training in improving male athletes' agility performance. Coaches should incorporate resistance training into their programs to develop athletic performance.*

Key Words: Resistance Band Training, Dumbbells, Athletes, Agility, Quick Feet Test, Performance

Introduction

One of the main focuses of strength and conditioning coaches is to increase their athletes' force capability. Agility is determined by the force applied to the ground, its direction, and the duration of its action (Chelly et al., 2009). Usually, this is accomplished by increasing coordination between and within muscles. For the development of intramuscular coordination, athletes must increase the recruitment of motor units, activation frequency, timing, and reflex activity (Hammett & Hey, 2003).

Nowadays, agility is considered a multifaceted quality that includes reflexes, strength, endurance, balance, coordination, speed, and the capacity to accelerate and decelerate. The capacity to alter bodily posture or agility calls for a blend of strength, balance, coordination, speed, and reflexes. When athletes utilize their ATP_PC or lactic acid (anaerobic) systems, they are typically able to attain agility. It is explained as a moving target in response to an opponent, similar to what happens in field and racquet sports.

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Agility development is essential in most of the fields and court team sports because of the requirement to react and modify direction in response to external stimuli. Since agility requires a response to an external stimulus, numerous systematic studies have investigated resistance training on direction change and agility in young athletes. The experimental efficacy of the research conducted examined the association of change of direction with other athletic performance assessments along with the trainability of change of direction utilizing specified and non-specified training techniques (Faigenbaum et al., 1999). Although not proposed as a standalone model, the narrative review suggested three key elements of agility training i.e. foundation movement skill (FMS), change of direction (COD) speed, and reactive agility training, and tried to provide how training efforts can be modified with improvement in technical capability (Lloyd et al., 2014).

Numerous skill applications have historically been viewed as agility in combination with an instinctive response as a result, and therefore with little or no danger. These skills are closed from a cognitive standpoint, and risk is constrained. Players who use open skills must react to sensory input from their environment; the response is neither automatic nor practiced (Cox, 2002).

The sprint start example is helpful to provide further clarification. When a sprinter is lined up in the blocks, they will begin to move in reaction to an audible stimulus (starter's pistol). Nevertheless, the reaction appears to have been premeditated and so preplanned. Despite the fact this is an agility challenge rather than an open skill; it is not an agile work (Chelladurai et al., 1977). This justification takes into account the cognitive abilities of visual scanning and decision-making that contribute to agility performance in sports, as well as the physiological abilities of acceleration, deceleration, and direction variance in evading an opponent, sprints with direction variance to connect a player or ball or starting of the entire movement of the body in response to a stimulus (Young et al., 2022). A systematic review found that elastic resistance band training improved agility performance in various sports (de León et al., 2019). Another study demonstrated that adding elastic resistance bands to agility drills enhanced changes of direction and cutting performance in female soccer players (Falatic et al., 2015).

A study by (Hammami et al., 2018) explored the effects of combined resistance and plyometric training, which often include free weight exercises, on athletic performance, including agility, in young male soccer players. The findings showed significant improvements in agility, indicating that free weight training within a comprehensive program can positively impact agility in young male athletes. A study by (Alcaraz et al., 2011) examined the effects of a 12-week resistance training program, including free weight exercises, on agility performance in young male soccer players. While not exclusively focused on agility, the improvements in strength and power observed in the study may contribute to enhanced agility as well (Shi et al., 2022). However, it is essential to note that the effectiveness of agility training with elastic resistance bands can be influenced by factors such as an athlete's training status, the specific exercises used, the resistance levels applied, and the frequency and duration of training.

Methodology

Study Design

A prospector randomized controlled trial design was used to examine the effects of resistance band training versus dumbbell resistance training on the agility performance of male track and field athletes.

Study Setting

The trials were carried out at AWKUM Athletics Academy, Khyber Pakhtunkhwa, in Pakistan, in the physical education and sports department.

Inclusion and Exclusion Criteria

For participants, eligibility criteria include male athletes aged (18 and above), training age from up to one to seven years, participating at Club level, and Provincial and University level athletics Competitions. However, those athletes participating at a professional level, injured, or who did not wish to participate were excluded.

Ethics and Dissemination

The study's procedure was approved by the University of Lahore's Ethics and Research Committee. Following an explanation of the purpose and process, each Participant provided a well-informed written consent. Participants understood that they might voluntarily discontinue the research project at any time.

Throughout the study, each participant was assigned a unique identity number that they may use for future reference. All the data was maintained in strict confidence to reduce potential bias.

Sample Size

No previous research has been done that satisfies the current study criterion to determine the effect size for calculating sample size. To determine the effect magnitude and sample size for the main investigation, the piloting study was conducted. The pilot study's effect size was 0.6. Using a G*power, a total of 48 participants were needed to consider the 0.6 effect size at an alpha level of 0.05 and with 95% power (Faul et al., 2009).

Hence, 16 participants were included in each group, for a total sample size of n=48. A total of 60 participants were recruited, that include 20 participants in each group with a 20 % dropout rate.

With 20 participants in each group, a total of 60 participants were recruited, indicating a 20% dropout rate in each group.

Participants Recruitment

Participants meeting the inclusion criteria and providing written consent before enrollment were recruited for the study. Information regarding demographics, including their age, body weight, height, and BMI was recorded. Each participant received detailed information about the study's purpose, along with a participant information sheet emphasizing confidentiality, voluntary participation, and the freedom to discontinue at any stage of the study. A baseline assessment was conducted at zero weeks.

Training Interventions

To ensure confidentiality, athletes picked a numbered envelope from a basket. The participants were then divided into three groups randomly. one control group and two experimental groups. The experimental groups go under periodized training, one using resistance bands and the other utilizing dumbbells for resistance training, while the control group continues their routine training. The investigator used a set of five resistance bands with a progressive loading procedure; each resistance band was unique in terms of color, dimensions, and resistance level. These bands had a thickness of 4.5mm, a circumference of 208cm (6.8 feet), and a resistance that varied from Yellow (8-15lbs) to Purple (30-60lbs). Using the Yellow band for the first week, followed by Green for the second and third, Blue for the fourth and fifth, Orange for the sixth and seventh, and Purple for the eighth week.

Intervention group two was given treatment in terms of conventional resistance training exercises using dumbbells (half squats, deadlifts, lunges, lateral lunges, hip thrust) for 8 weeks. The weight of the dumbbells in kg was estimated according to the mean of tension (minimum and maximum value) of the resistance bands. Below is the table for comparing the weight of the dumbbells with the tension of the resistance bands. Both Intervention Group 1 (Resistance Band Training (RBTG and Intervention Group 2

(Conventional Resistance Training Group (CRTG) performed exercises twice a week.

Training Protocols

Table 1

Training protocols for experimental groups

Exercise	Equipment	Sets	Reps (Week 1-2)	Reps (Week 3-4)	Reps (Week 5-6)	Reps (Week 7-8)	Work/Rest Interval	Frequency
Half Squats	Resistance Bands / Dumbbells	3 – 4	8-10	6-8	6-8	4-6	1:03 (60-70 Sec)	Twice a Week
Dead Lifts	Resistance Bands / Dumbbells	3 – 4	. 8-10	6-8	6-8	4-6	1:03 (60-70 Sec)	Twice a Week
Lunges	Resistance Bands / Dumbbells	3 – 4	8-10	6-8	6-8	4-6	1:03 (60-70 Sec)	Twice a week
Lateral Lunges	Resistance Bands / Dumbbells	3 – 4	8-10	6-8	6-8	4-6	1:03 (60-70 Sec)	Twice a week

Statistical Analysis

For data statistical analyses SPSS version 22 was used. To assess the data for normality, the Shapiro-Wilk test was used, ANOVA along with post-hoc Tukey analyses to assess the groups for agility. Paired t-tests were used for pre & post-analysis. The Kruskal-Wallis test along with post hoc analysis was applied. The results were reported using descriptive statistics and effect sizes.

Performance Assessment Criteria

Quick Feet Test (Agility)

The quick feet test is used to measure the quickness of feet on an exercise ladder (an exercise tool for agility). Place a 10-yard long 20-rug exercise ladder on a plan (non-slippery) surface. It should be firmly fixed on the ground to avoid movement during testing. To conduct this test, the researcher arranged smooth and flat surfaces, an exercise ladder, a stopwatch, and an assistant.

Procedure for Quick Feet Test

When given the command "go" by the assistant, the athlete starts sprinting along the ladder's rungs, putting a foot in each opening without touching the rungs. The athlete starts at one end of the ladder. To take time from start to stop, the participant's foot must initially contact the ground between the first rung and stop when the participant touches the ground beyond the last rung of the ladder. Participants then rest for two minutes and repeat the test three times. The researcher used the Android app Photo Finish (+/- 0.01s accuracy) by (Voig 2021), for taking accurate timing. The best results of three trials were recorded.

Results

The use of resistance training has become increasingly popular among athletes, bodybuilders, and fitness enthusiasts seeking to enhance their athletic performance. However, there is limited research on the comparison of the effects of training with resistance band dumbbells on the agility of male track and field athletes. The purpose of the study was to address the gap in the literature by examining the effectiveness of resistance training from the Perspective of agility performance of male track & field athletes. The study consisted of three groups: an experimental group-1 (n=20) that performed training with a resistance band and an experimental group-2 (n=20) that performed training with dumbbells. The control group (n=20) continue its routine training. All three groups followed an 8-week resistance training program. The agility of all the participants was assessed at baseline (pre-test) and the end of week 8th (post-test) through a quick feet test.

Table 2

Pre & Post-test comparison for quick feet in resistance band group

Quick Feet test	pre-test	post est	95% CI	Mean difference	T	Df	P.value
Mean	3.45	3.08	0.315 -0.413	0.36	15.58	19	<0.001*
Standard Deviation (SD)	0.23	0.24		0.1			

** Shows statistically significant as p=<0.05.*

Paired t-test was performed to see whether there was any significant difference between the pre and post-test among the resistance band group (RBG) for Agility (Quick Feet test). The result reveals that the Mean ± SD for the pre (Quick Feet test) was 3.45 ± 0.23, similarly, the Mean ± SD for the post (Quick Feet test) was 3.08 ± 0.24. The mean difference among the group was 0.36 ± 0.10 having t-value (t= 15.58), df value (df=19), and p-value (p-value = <0.000). Overall, the results show that there is a significant difference with p-value <0.001 among pre-post-Quick Feet tests.

Table 3

Pre & Post comparison for quick feet test in dumbbells group

Quick Feet Test	Pre Test	Post Test	Mean difference	95% CI	T	Df	P-value
Mean	3.45	3.08	0.36	0.315 - 0.413	15.58	19	<0.001*
Standard Deviation (SD)	0.23	0.24	0.1				

** Shows statistically significant as p=<0.05.*

A paired t-test was performed to see whether there was any significant difference between the pre and post-test among the resistance band group (RBG) for Agility (Quick Feet test). The result reveals that the Mean ± SD for the pre (Quick Feet test) was 3.47 ± 0.19, similarly, the Mean ± SD for the post (Quick Feet test) was 3.31± 0.35. The mean difference among the group was 0.15 ± 0.23 having t-value (t= 2.907), df value (df=19), and p-value (p-value = 0.009). Overall, the results show that there is statistical significance among pre and post-Quick Feet tests.

Table 4

pre-quick feet test comparison among the groups

Groups	N	Mean	SD	F	Df	p-value

Control Group	20	3.8340	0.25960			
Resistance Band Group	20	3.4485	0.22859	18.472	2	<.001
Dumbbells Group	20	3.4620	0.18925			

A Kruskal-Wallis test was performed and the result revealed a statistically significant variance in the Quick Feet test within the groups (i.e., control, resistance band, dumbbells). F statistics = 18.472, df = 2, P-value = 0.000, with a mean and SD was 3.8340 ± 0.25960 for the control group, 3.4485 ± 0.22859 for resistance band, and 3.4620 ± 0.18925 for dumbbells group.

Table 5

Post-quick feet test comparison among the groups

Groups	N	Mean	SD	Df	F	p-value
Control Group	20	3.82	0.26			
Resistance Band Group	20	3.08	0.24	2	34.123	<.001
Dumbbells Group	20	3.31	0.35			

An ANOVA test was performed, and the outcomes demonstrated a statistical significance in the quick feet test between the groups (control, resistance band, and dumbbells). F statistic = 34.123, df = 2, P-value = 0.000, with a mean and SD was 3.82 ± 0.26 for the control group, 3.08 ± 0.24 for the resistance band, and 3.31 ± 0.35 for the dumbbells group.

A Post hoc Tukey test was performed to see the difference among the groups. The results indicated a statistically significant difference/improvement in

Resistance band versus Control group P-value = <0.001

Dumbbells versus control group P-value = <0.001

Resistance band versus Dumbbells group P-value = 0.215

Discussion

Sheppard & Young, (2006) define agility as a quick whole-body movement with rapid change in direction of velocity to a stimulus. Agility is correlated with the block start in track and field sprint races. Particularly actions like block start in track & field, which are considered agility tasks (Chelladurai et al., 1977), could be explained as a relationship between velocity and reaction to a stimulus. The pace at which a location changes concerning time is known as velocity(Enoka, 2002). A study by Christou et al. (2006) on the effects of 8 weeks of strength training showed no improvement in agility.

In a research study by Ozsu (2018) with six weeks of elastic resistance band exercises, no statistical significance was observed between the control and experimental group in agility skills with a p-value = 0.706, the study was done in children 8 to 9 years of age. For Agility, the current study findings showed that in the resistance band group, a statistically significant difference with the mean ± SD at baseline was 3.45± 0.23 while at the end of week 8th, the mean ± SD was 3.08 ± 0.24 with a p-value of < 0.001. While in the Dumbbells group, the results also showed a significant difference with mean ± SD at the baseline were 3.46 ± 0.19 and at the 8th-week mean ± SD was 3.31 ± 0.35. The difference in the results (Özsu, 2018) may be due to the age difference between the participant's experiences and their strength level. The current study results were not consistent with the aforementioned study, as both resistance band training and resistance training with dumbbells showed improvement in agility.

However, the present study is in line with the results of (Parry & Hayyat, 2019) which showed that eight weeks of resistance training had significant effects on improving agility performance. The results of another study showed that no significant difference was found between traditional strength training and mixed power-band training to improve agility (Katushabe & Kramer, 2020).

Conclusion

The results of the study highlight how resistance training, whether done with dumbbells or resistance bands, can help male track and field players become more agile. Both training modalities produced statistically significant increases in agility. These findings are consistent with earlier studies showing the beneficial effects of resistance training on agility performance. The study highlights the significance of including such training methods in athletic performance development programs and provides insightful information about the effectiveness of various resistance training methods for improving athletic agility. More investigation into the specific mechanisms and long-term impacts underpinning the reported increases in agility could yield a more thorough knowledge of the evolution of agility in athletic performance.

References

Alcaraz, P. E., Perez-Gomez, J., Chavarrias, M., & Blazevich, A. J. (2011). The similarity in adaptations to high-resistance circuit vs. traditional strength training in resistance-trained men. *The Journal of Strength & Conditioning Research, 25*(9), 2519-2527. https://doi.org/10.1519/JSC.0b013e3182023a51

Chelladurai, P., Yuhasz, M., & Sipura, R. (1977). The reactive agility test. *Perceptual and motor skills, 44*(3_suppl), 1319-1324. https://doi.org/10.3390/ijerph17113839

Chelly, M. S., Fathloun, M., Cherif, N., Amar, M. B., Tabka, Z., & Van Praagh, E. (2009). Effects of a back squat training program on leg power, jump, and sprint performances in junior soccer players. *The Journal of Strength & Conditioning Research, 23*(8), 2241-2249. https://doi.org/10.1519/JSC.0b013e3181b86c40

Cox, M. (2002). The evaluation of key comparison data. *Metrologia, 39*(6), 589. https://doi.org/10.1088/0026-1394/44/3/005

De León, A. G. P., Vega, J. E. C., & Fernández, A. E. A. (2019). Program of exercises with elastic resistance bands for the increase of the speed in the home-first base race with junior baseball players from Matanzas. *Revista PODIUM, 14*(1), 5-24.

Enoka, R. M. (2002). Activation order of motor axons in electrically evoked contractions. *Muscle & nerve, 25*(6), 763-764. https://doi.org/10.1002/mus.10117

Faigenbaum, A. D., Westcott, W. L., Loud, R. L., & Long, C. (1999). The effects of different resistance training protocols on muscular strength and endurance development in children. *Pediatrics, 104*(1), e5-e5. https://doi.org/10.1542/peds.104.1.e5

Falatic, J. A., Plato, P. A., Holder, C., Finch, D., Han, K., & Cisar, C. J. (2015). Effects of kettlebell training on aerobic capacity. *The Journal of Strength & Conditioning Research, 29*(7), 1943-1947. https://doi.org/10.1519/JSC.0000000000000845

Hammami, M., Negra, Y., Billaut, F., Hermassi, S., Shephard, R. J., & Chelly, M. S. (2018). Effects of lower-limb strength training on agility, repeated sprinting with changes of direction, leg peak power, and neuromuscular adaptations of soccer players. *The Journal of Strength & Conditioning Research, 32(*1), 37-47. https://doi.org/10.1519/JSC.0000000000001813

Hammett, J. B., & Hey, W. T. (2003). Neuromuscular adaptation to short-term (4 weeks) ballistic training in trained high school athletes. *The Journal of Strength & Conditioning Research, 17*(3), 556-560. https://doi.org/10.1519/1533-4287(2003)017<0556:natswb>2.0.co;2

Katushabe, E. T., & Kramer, M. (2020). Effects of combined power band resistance training on sprint speed, agility, vertical jump height, and strength in collegiate soccer players. *International Journal of Exercise Science, 13*(4), 950. https://doi.org/10.1519/R-14944.1

Lloyd, R. S., Faigenbaum, A. D., Stone, M. H., Oliver, J. L., Jeffreys, I., Moody, J. A., Howard, R. (2014). Position statement on youth resistance training: the 2014 International Consensus. *British journal of sports medicine, 48*(7), 498-505. https://doi.org/10.1136/bjsports-2013-092952

Özsu, İ. (2018). Effects of 6-Week Resistance Elastic Band Exercise on Functional Performances of 8-9 Year-Old Children. *Journal of Education and Training Studies, 6,* 23-28. https://doi.org/10.11114/jets.v6i12a.3887

Parry, M. A., & Hayyat, F. S. (2019). Effect of 12 weeks of plyometric and resistance training on agility, speed and explosive power in kabbadi players. *Online Journal of Multidisciplinary Subjects, 13.* https://doi.org/10.37506/ijpot.v15i3.16181

Shi, L., Cai, Z., Chen, S., & Han, D. (2022). Acute effects of variable resistance training on force, velocity, and power measures: a systematic review and meta-analysis. PeerJ, 10, e13870. https://doi.org/10.7717/peerj.13870

Young, W., Dos' Santos, T., Harper, D., Jefferys, I., & Talpey, S. (2022). Agility in invasion sports: Position stand of the IUSCA. *International Journal of Strength and Conditioning, 2*(1). https://doi.org/10.47206/ijsc.v2i1.126