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EFFECTS OF AN EIGHT-WEEK ELASTIC BAND RESISTANCE TRAINING PROTOCOL ON SPRINT PERFORMANCE IN YOUTH BASKETBALL PLAYERS

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ABSTRACT

Professional basketball places significant stress on the lower extremities, necessitating systematic resistance training to enhance athletic performance and mitigate injury risk. This study aimed to evaluate the effects of an eight-week standardized elastic band resistance training protocol on sprint performance in youth basketball players. Twenty-seven participants (n=13 experimental; n=14 control) completed an eight-week intervention. Sprint performance (5m and 10m) was measured pre- and post-intervention. Results indicated that the experimental group achieved statistically significant improvements in 5m sprint times (p=0.015; d=0.78), reflecting moderate effect sizes. While 10m sprint times showed a positive trend, these changes did not reach statistical significance (p=0.106; d=0.48). The control group exhibited no significant changes, with trivial effect sizes across all metrics. These findings demonstrate that a standardized elastic band training protocol is an effective, scalable strategy for enhancing explosive initial acceleration in youth athletes. Due to the portability and cost-effectiveness of elastic resistance, this protocol represents a highly practical solution for off-season conditioning. Future research should investigate long-term neuromuscular adaptations across broader athletic populations to further optimize athletic development.

Key words: Elastic bands, sprint performance, youth basketball, resistance training

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INTRODUCTION

Professional basketball is a physically demanding sport characterized by high-intensity actions and the necessity to generate maximal force within the shortest possible timeframe (Santos & Janeira, 2012). These physiological demands place significant stress on the lower extremities, resulting in a high incidence of injuries. Epidemiological studies indicate that 62% of all basketball-related injuries affect the lower limbs, with knee injuries predominating (17.8%), alongside frequent pelvic and hip injuries (Jackson et al., 2013; Andreoli et al., 2018). To address these demands, systematic resistance training has become an indispensable component of injury prevention and athletic performance enhancement (Emery et al., 2022; Barrera-Domínguez et al., 2023). Substantial evidence confirms that adequate resistance training not only increases muscle mass but also directly improves crucial basketball-specific variables, including explosive power, vertical jump height, and sprint speed (McQuilliam et al., 2020; Yáñez-García et al., 2022). Specifically, for youth athletes, resistance training executed with controlled loads and higher movement velocities can yield substantial benefits in overall athletic development (Meylan et al., 2014).

A wide array of equipment is utilized for strength development; however, elastic band resistance training is increasingly recognized as a versatile, portable, and cost-effective alternative to traditional isotonic machines and free weights (Iversen et al., 2017). Unlike conventional modalities that rely exclusively on gravitational force, elastic bands utilize the tensile properties of the material, providing variable resistance throughout the entire range of motion (Mascarin et al., 2017). Although they provide increasing resistance along a curvilinear path, elastic bands generate a bell-shaped torque curve that is highly compatible with the biomechanical characteristics of human movement, thereby optimizing muscle activation (Aboodarda et al., 2016). Recent meta-analyses have corroborated that elastic band training induces similar upper- and lower-body strength adaptations compared to traditional resistance training across diverse populations (Lopes et al., 2019; Colado et al., 2020). This biomechanical adaptability makes elastic bands a highly practical tool for load modulation and the development of neuromuscular performance.

Given their proven efficacy, sports scientists and practitioners demonstrate a growing interest in incorporating elastic bands to optimize athletic performance (Wilson & Kritz, 2014). Previous research indicates that variable resistance training positively affects lower-limb strength, vertical jump height, and sprint speed in athletes (Strokosch et al., 2018; Liao et al., 2022; Shi et al., 2023). Nevertheless, the current literature frequently highlights the lack of strict load standardization during elastic resistance training as a methodological limitation (Lopes et al., 2019). Furthermore, there is a scarcity of studies examining the isolated effects of highly controlled elastic band protocols on youth basketball players. Considering explosive lower-limb strength and acceleration are crucial for basketball, it is essential to rigorously determine the efficacy of standardized elastic band interventions. Therefore, the aim of this study was to determine the effects of an eight-week elastic band resistance training program on sprint performance in youth basketball players.

METHODS

Participants

The sample comprised 31 youth basketball players (aged 16–18 years) with a minimum of three years of competitive experience, recruited from registered clubs in Niš, Serbia. This specific age group was selected to ensure a relatively uniform stage of biological maturity (Lloyd & Oliver, 2012; Torres-Unda et al., 2016). To ensure baseline equivalence between the groups, a rank-order matching procedure was employed. Following the initial testing, participants were ranked in ascending order based on their mean lower-limb strength scores (hip adduction, hip abduction, knee flexion, and knee extension), measured using a handheld digital dynamometer. Based on this ranking, participants were alternately assigned to either the experimental group (n = 16) or the control group (n = 15).

Exclusion criteria included any lower back, groin, hip, or knee injuries sustained within the previous six months, as well as participation in targeted hip or adductor strengthening programs during the same period. Additionally, participants excluded if their overall training attendance fell below 75% or if they missed more than two consecutive sessions. Throughout the study, all subjects maintained a standard training frequency of four basketball sessions per week. The research was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the Faculty of Sport and Physical Education. This study represents a partial presentation of data from a broader doctoral dissertation project.

Experimental programme

An eight-week lower-limb resistance training intervention was conducted, consisting of two supervised sessions per week. Participants were assigned to either a control group, which engaged exclusively in four standard basketball training sessions per week without systematic lower-body strength training or an experimental group, which additionally performed an elastic band resistance program. The experimental protocol involved four unilateral isometric and dynamic exercises using elastic bands (Tuber-Band, Tuber sport DOO, Belgrade, Serbia): hip adduction, hip abduction, knee flexion, and knee extension. Each exercise was performed for three sets utilizing a high-repetition range (12–15 RM per set). Band resistance was individualized and progressively adjusted using the OMNI-RES scale and Repetitions in Reserve (RIR ≤ 1) to ensure continuous muscle tension throughout the concentric and eccentric phases. Rest intervals were strictly maintained at three minutes between sets and five minutes between exercises.

Sprint Performance

Participants began from an upright starting stance, positioning their dominant foot 0.2 m behind the initial photocell gate (Microgate, Bolzano, Italy). They performed a 15-m sprint, with split times recorded at the 5-m and 10-m intervals (Chaouachi et al., 2009). To ensure measurement reliability, the same starting foot placement was strictly maintained across both initial and final testing sessions. Each participant completed three sprint trials, and the fastest time (expressed in seconds) was retained for statistical analysis.

Statistical analysis

All statistical analyses were performed using IBM SPSS Statistics (Version 26.0; IBM Corp., Armonk, NY, USA). Descriptive statistics were calculated for all variables and presented as mean and standard deviation (SD). The normality of the data distribution was verified using the Shapiro-Wilk test. To evaluate the within-group pre-to-post intervention changes for both the experimental and control groups, a paired-samples t-test was employed. The magnitude of the changes was determined using Cohen's *d* effect size (Cohen, 2013). Effect sizes were classified as small (0.00 to 0.49), medium (0.50 to 0.79), and large (≥ 0.80). The criterion for statistical significance was set at $p < 0.05$.

RESULTS

Twenty-seven participants manage to complete the experimental programme. Sprint performance outcomes are summarized in Table 1. The experimental group demonstrated statistically significant improvements in 5m sprint times from pre- to post-intervention (p=0.015), with a moderate effect size (d=0.78). Although a decrease in 10m sprint times was observed in the experimental group, this change did not reach statistical significance (p=0.106, d=0.48).

In contrast, the control group exhibited no significant changes in either 5m or 10m sprint performance (p>0.05). Furthermore, the control group showed trivial negative changes in both metrics, with effect sizes of −0.26 and −0.24 for the 5m and 10m sprints, respectively. Sprint performance data are visualized in Figure 1.

Table 1. Descriptive statistics and pre-to-post intervention changes in sprint performance (5m and 10m) for the experimental and control groups.

	N	Mean	SD	Mean difference	P value	Effect size
Experimental						
Pre_5m	13	1.15	0.09	0.039	0.015	0.78
Post_5m	13	1.11	0.06			
Pre_10m	13	1.92	0.1	0.047	0.106	0.48
Post_10m	13	1.88	0.09			
Control						
Pre_5m	14	1.19	0.01	-0.02	0.35	-0.26
Post_5m	14	1.21	0.09			
Pre_10m	14	1.98	0.11	-0.02	0.38	-0.24
Post_10m	14	2.00	0.11			

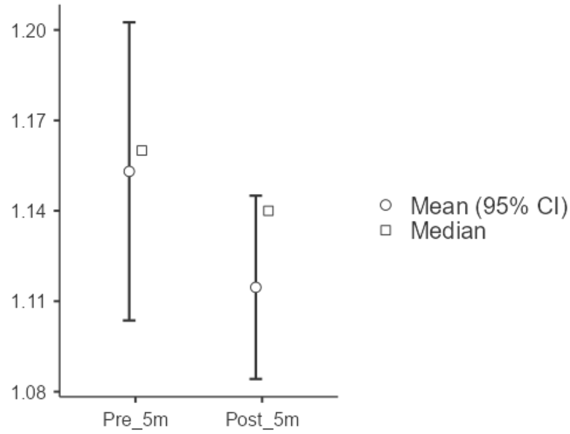

Figure 1. Graphical representation of sprint performance (5m) pre- and post-intervention in Experimental group.

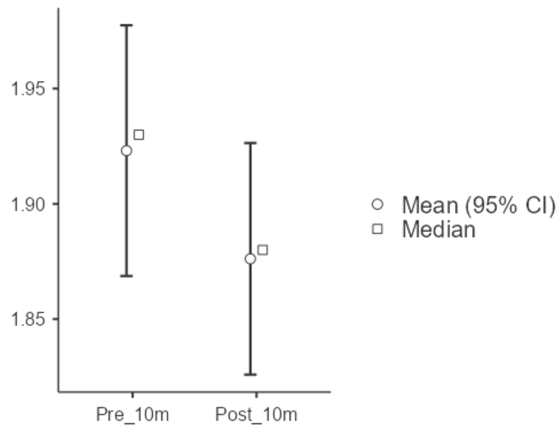

Figure 2. Graphical representation of sprint performance (10m) pre- and post-intervention in Experimental group.

DISCUSSION

The aim of this study was to evaluate the impact of an eight-week elastic band resistance training program on the sprint performance of youth basketball players. Our findings indicate that incorporating this standardized, high-repetition elastic resistance protocol significantly improved 5m sprint times in the experimental group. While the 10m sprint times also showed a positive trend, these improvements did not reach statistical significance.

These results align with previous literature suggesting that variable resistance training can optimize neuromuscular responses in athletes (Shi et al., 2023; Aboodarda et al., 2016). Moreover, our results are consistent with previous research (Aloui et al., 2019), showing that knee extension and hip extension exercises using elastic bands can improve sprint performances in team sport athletes. The observed gains in 5m acceleration are likely attributable to the biomechanical properties of elastic bands, which generate a bell-shaped torque curve that closely mirrors human muscle force generation during explosive movements. This resistance profile potentially facilitates a greater rate of force development (RFD) during the initial push-off compared to constant-load resistance training. In contrast, the lack of significant change in the 10m sprint distance might suggest that the training volume or specific exercise selection, which focused on hip and knee stabilization, primarily targeted the muscles involved in the initial drive phase rather than the mechanics required for sustaining velocity over 10m. Furthermore, our study addresses the critical gap identified by Lopes et al. (2019) regarding the lack of load standardization; by utilizing a strictly controlled protocol with OMNI-RES and RIR, we successfully demonstrated that elastic band resistance is a potent, scalable conditioning tool. These findings support the integration of elastic band training as a highly effective strategy for developing explosive acceleration in youth basketball players.

Strength and conditioning coaches and basketball practitioners should consider the current findings when designing conditioning programs. The eight-week elastic band resistance protocol demonstrated efficacy in enhancing explosive acceleration (5m sprint), which is a critical determinant of basketball performance. Given the portability, cost-effectiveness, and ease of implementation of elastic resistance, this method provides a scalable solution for teams with limited access to traditional weight room equipment. Coaches can utilize the reported protocol as a time-efficient intervention, allowing for precise load modulation based on individual athlete readiness, thereby facilitating systematic athletic development.

Several limitations must be acknowledged when interpreting the current findings. The intervention period was confined to eight weeks; therefore, the long-term retention of these neuromuscular adaptations remains to be established. While the training was strictly controlled, the study did not account for external variables such as nutritional intake, sleep quality, or daily stress levels, which could potentially influence physiological recovery and performance outcomes. Future research should involve larger, more diverse cohorts and investigate the long-term effects of elastic band training.

CONCLUSION

In conclusion, the findings of this study demonstrate that a standardized eight-week elastic band resistance training protocol significantly enhances initial acceleration (5m sprint) in youth basketball players. By providing a rigorous and scalable approach to variable resistance training, this intervention proves to be a potent tool for athletic conditioning. These results support the integration of elastic band training into basketball conditioning programs as a time-efficient and effective method for developing explosive power. Future studies should continue to explore the long-term adaptations and the specific influence of different elastic resistance profiles on broader athletic performance metrics.

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