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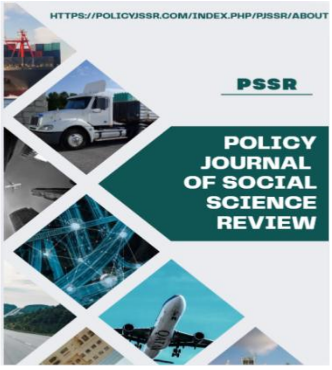

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EFFECT OF ELASTIC BAND RESISTANCE TRAINING ON BOWLING SPEED OF CRICKET FAST BOWLERS

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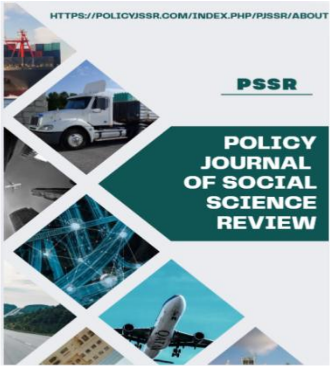
ABSTRACT

Background: Fast bowling is a physically demanding skill in cricket, with bowling speed identified as a critical determinant of performance. Traditional resistance training has been shown to improve explosive power; however, the specific application of elastic band resistance training (EBRT) to enhance bowling speed remains insufficiently studied in the cricket context. **Objective:** This study aimed to investigate the effect of an eight-week elastic band resistance training program on the bowling speed of male club-level fast bowlers. **Methods:** A pre-test post-test experimental design with a matched control group was employed. Thirty male fast bowlers (age: 20.6 ± 2.1 years) were randomly allocated to an experimental group ($n = 15$), who undertook EBRT three sessions per week alongside conventional cricket training, or a control group ($n = 15$), who performed conventional training only. Bowling speed was measured using a calibrated radar gun at baseline and post-intervention. **Results:** The experimental group demonstrated a statistically significant increase in mean bowling speed from 119.8 ± 6.4 km/h to 128.6 ± 5.9 km/h ($p < 0.001$), representing a 7.3% improvement. The control group showed no significant change (120.1 ± 5.8 km/h to 121.3 ± 6.1 km/h; $p = 0.312$). Between-group differences were significant ($p < 0.001$). **Conclusion:** Eight weeks of elastic band resistance training, integrated with conventional cricket training, produced meaningful and statistically significant gains in fast bowling speed. Coaches and conditioning specialists are encouraged to incorporate structured EBRT protocols into cricket-specific conditioning programs.

Keywords: *elastic band training, cricket, fast bowling, bowling speed, resistance training, sports performance*



1. Introduction

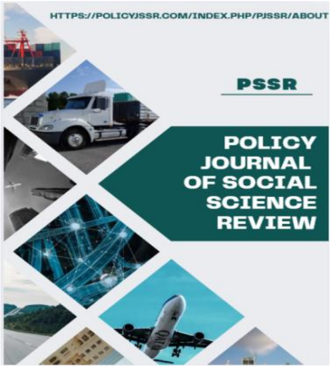
Cricket fast bowling is one of the most biomechanically complex and physically demanding skills in sport. The fast bowler must generate, transfer, and release energy through a coordinated kinetic chain spanning the lower limbs, pelvis, trunk, shoulder girdle, and upper extremity, all within a delivery stride lasting approximately 0.18 to 0.22 seconds (Glazier et al., 2000). Bowling speed the velocity of the ball at the point of release is widely regarded as a primary determinant of a fast bowler's effectiveness, influencing both the batsman's available response time and the probability of dismissal (Portus et al., 2004).

The biomechanics of fast bowling involve a run-up phase, a delivery stride, a front-foot contact phase, and the arm-acceleration and follow-through phases. At front-foot contact, ground reaction forces of up to eight times body weight are transmitted through the lead leg, and peak internal shoulder distraction forces can exceed 1,500 N (Fleisig et al., 2006). The rotator cuff musculature, scapular stabilizers, spinal erectors, gluteal complex, and hip flexors each contribute to the explosive energy transfer necessary for maximizing ball release velocity. Consequently, conditioning programs designed to improve fast bowling performance must address the musculature of the shoulder, core, and lower limb within sport-specific movement patterns.

Strength and power training have an established evidence base in the enhancement of throwing and overhead athletic performance (Escamilla & Andrews, 2009). Programs incorporating free weights, plyometric, and medicine ball exercises have demonstrated improvements in peak power output and functional strength among overhead athletes. However, conventional resistance training modalities are not always accessible to cricket bowlers competing at district and club levels, where equipment availability and coaching expertise may be limited.

Elastic band resistance training (EBRT) represents an accessible, low-cost, and biomechanically versatile modality for developing sport-specific strength and power. Elastic bands also referred to as resistance bands or thera-bands provide variable resistance across the full range of motion, accommodating the ascending strength curve characteristic of explosive athletic movements (Andersen et al., 2010). This accommodating resistance property allows maximal muscle activation across the entire movement arc, which may be particularly advantageous for ballistic movements such as bowling. Furthermore, elastic bands permit three-dimensional, sport-specific training patterns that closely replicate the mechanics of the bowling action, a principle aligned with the concept of training specificity.

Despite growing interest in EBRT among sporting populations, evidence specifically addressing its utility for cricket fast bowling speed enhancement is sparse. Studies in baseball pitching, handball throwing, and javelin throwing have demonstrated positive effects of elastic band programs on throwing velocity; however,



direct extrapolation to cricket is problematic given the unique kinematic and kinetic demands of the cricket bowling action. This gap in the evidence base necessitates an investigation specifically tailored to the cricket context.

Research Hypothesis: It was hypothesized that an eight-week elastic band resistance training program , when added to conventional cricket training, would produce a statistically significant increase in bowling speed compared with conventional training alone in male club-level fast bowlers.

2. Literature Review

The relationship between musculoskeletal strength, explosive power and throwing or bowling velocity has been extensively documented across a range of overhead sports. Escamilla and Andrews (2009) conducted a systematic review of shoulder muscle activity in overhead athletes and identified that rotator cuff and scapular muscle strength are fundamental determinants of both throwing velocity and injury resistance. Their findings underscore the importance of targeted upper-extremity and scapular conditioning within athlete preparation programs.

In baseball pitching a skill that shares several biomechanical characteristics with cricket fast bowling Lehman et al. (2013) demonstrated that a six-week program of rotator cuff and scapular strengthening using elastic resistance bands produced a 5.8% improvement in pitch velocity among collegiate pitchers. The authors attributed the observed gains to improvements in late-cocking and acceleration phase musculature, particularly the external rotators and serrates anterior. Similarly, Prokopy et al. (2008) reported that closed-kinetic-chain upper-extremity elastic band exercises produced meaningful gains in shoulder strength and functional power when applied to division-I collegiate overhead athletes.

Research among handball athletes, whose throwing mechanics involve a pronounced hip-to-shoulder energy transfer sequence analogous to cricket bowling, has produced consistent findings. Tillaar and Ettema (2009) found that athletes with greater trunk rotational power generated significantly higher ball release velocities. Marques et al. (2011) subsequently demonstrated that a targeted resistance training program incorporating elastic bands for the shoulder internal and external rotators resulted in significant velocity improvements in elite handball players, with effect sizes ranging from moderate to large. Importantly, the elastic band modality produced comparable gains to those achieved with free-weight protocols, while permitting more sport-specific movement patterns.

Within the cricket literature, Pyne et al. (2006) examined the physical characteristics of elite Australian fast bowlers and identified that shoulder rotational power, hip abductor strength, and core stability were significantly correlated with bowling speed. These findings provided a mechanistic basis for targeted conditioning of these muscle groups. Referencing similar methodology, Portus et al. (2004) analysed the kinematic contributors to fast bowling performance and identified front-foot bracing, trunk forward flexion velocity, and bowling arm speed as primary mechanical determinants of ball velocity. Both investigations implicitly support the rationale for a conditioning approach targeting the hip-trunk-shoulder kinetic chain precisely the muscle groups addressed by the EBRT protocol employed in the present study.

Andersen et al. (2010) conducted a randomized controlled trial comparing elastic band resistance training with conventional dumbbell training for shoulder muscular endurance and strength. Results demonstrated equivalent strength gains between modalities, with the elastic band group showing superior improvements in shoulder abduction endurance a quality of direct relevance to the repeated bowling demands of a cricket match. The authors concluded that elastic bands represent a valid and practical alternative to conventional resistance training for shoulder conditioning.

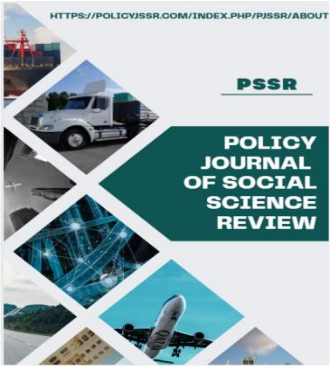
The variable resistance characteristic of elastic bands has received specific mechanistic attention. Israetel et al. (2010) demonstrated that the application of accommodating resistance resistance that increases proportionally with joint extension to conventional barbell squats produced significantly greater gains in peak power output compared with constant-load training. While this study was conducted within a lower-extremity strength context, the principles of accommodating resistance have been applied to upper-extremity elastic band protocols with similar theoretical justification (Cormie et al., 2011).

Core stability has been identified as a critical intermediary in the proximal-to-distal energy transfer sequence underlying fast bowling performance. Nesser et al. (2008) found that core stability measures, including anterior and lateral trunk endurance, were significantly associated with ball release velocity in cricket bowlers. A subsequent intervention study by Tong et al. (2014) demonstrated that an eight-week core stability program incorporating elastic band resistance exercises improved bowling speed by approximately 5% in male amateur cricket bowlers, providing preliminary support for the efficacy of EBRT-inclusive conditioning programs.

Despite the accumulating body of evidence from analogous sports and preliminary cricket-specific data, systematic investigation of a structured, multi-joint elastic band resistance training program targeting the shoulder, core, and hip complex the full kinetic chain relevant to bowling speed remains absent from the peer-reviewed literature. Furthermore, existing studies have frequently examined elastic band training in isolation from sport-specific training, limiting ecological validity. The present study addressed these gaps by employing a comprehensive EBRT protocol integrated within a conventional cricket training context.

3. Methodology

3.1 Study Design



A pre-test post-test experimental design with a matched control group was employed. Participants were assessed at baseline (Week 0) and post-intervention (Week 9) for bowling speed. The study conformed to the principles of the Declaration of Helsinki, and ethical approval was granted by the institutional review board prior to participant recruitment. Written informed consent was obtained from all participants prior to enrolment.

3.2 Participants

Thirty male cricket fast bowlers were recruited from district and club-level cricket programs in a major urban region. Inclusion criteria were: age 18–25 years; active participation in competitive cricket for a minimum of three years; classification as a fast or fast-medium bowler by their respective team coach; and an absence of any upper or lower limb injury in the six months preceding the study. Participants were excluded if they had prior formal experience with structured elastic band resistance training, were currently engaged in supplementary strength training programs, or had any cardiovascular or musculoskeletal contraindication to vigorous exercise.

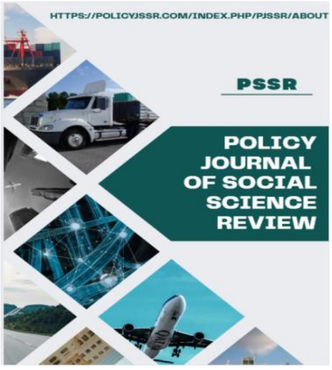
Following baseline assessment, participants were stratified by pre-test bowling speed and randomly allocated to either the experimental group (EG; n = 15) or the control group (CG; n = 15) using a computer-generated randomization sequence. Stratified randomization ensured baseline equivalence between groups. All participants continued their regular cricket training schedules throughout the study duration. The EG additionally completed the EBRT protocol three times per week; the CG performed only conventional cricket training.

Participant characteristics: EG age 20.4 ± 1.9 years, body mass 74.3 ± 7.8 kg, height 178.2 ± 5.6 cm, training experience 5.1 ± 2.0 years; CG age 20.8 ± 2.3 years, body mass 73.8 ± 8.1 kg, height 177.9 ± 6.2 cm, training experience 4.9 ± 1.8 years. No significant between-group differences were observed in baseline characteristics ($p > 0.05$).

3.3 Intervention Protocol

The EG completed an eight-week, three-session-per-week EBRT program targeting the shoulder complex, core musculature, and hip complex the principal contributors to the bowling kinetic chain. All sessions were supervised by a certified strength and conditioning coach. Each session was conducted following the team's regular cricket training and lasted 40–50 minutes. A progressive overload approach was implemented, with resistance band tension increased from light-moderate resistance (Thera-Band red) in Weeks 1–2, to moderate resistance (green) in Weeks 3–4, to moderate-heavy (blue) in Weeks 5–6, and heavy resistance (black) in Weeks 7–8, contingent upon the athlete maintaining full range of motion and correct technique.

The EBRT protocol comprised eight exercises organized into three functional categories:



Shoulder Complex Exercises: (1) Standing Internal/External Rotation with band anchored at elbow height 3 sets × 15 repetitions each direction; targeted the rotator cuff musculature responsible for arm acceleration and deceleration. (2) Diagonal Pull-Down (D2 Flexion/Extension pattern) 3 × 12 repetitions; replicated the shoulder acceleration and follow-through pattern of the bowling arm. (3) Seated Row with band 3 × 15 repetitions; targeted rhomboids and lower trapezius for scapular retraction and stabilization.

Core and Trunk Exercises: (4) Standing Trunk Rotation with band anchored at shoulder height 3 × 15 repetitions per side; trained the transverse-plane rotational power critical to the trunk drive phase. (5) Pallof Press (anti-rotation core stabilization) 3 × 12 repetitions per side; enhanced transverse-plane stability and transfer of rotational forces. (6) Hip-to-Shoulder Throw Pattern with band 3 × 10 repetitions per side; a composite movement replicating the full kinetic chain of the bowling action.

Hip Complex Exercises: (7) Lateral Band Walk 3 × 20 steps per direction; developed hip abductor strength and frontal-plane stability, addressing the high ground reaction forces sustained at front-foot contact. (8) Resisted Hip Extension 3 × 15 repetitions per leg; targeted gluteus Maximus and hamstrings, important for drive and bracing phases of the delivery stride.

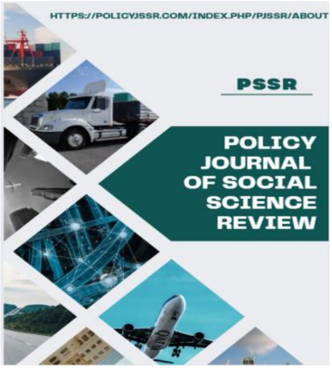
A standardized warm-up of ten minutes (dynamic stretching and light jogging) and a five-minute cool-down (static stretching) were completed at each session. Rest intervals of 60–90 seconds were observed between sets. All exercises were performed in a controlled, rhythmical manner with emphasis on full range of motion and maintenance of sport-specific posture.

3.4 Bowling Speed Measurement

Bowling speed was measured using a Stalker Pro II radar gun (Applied Concepts Inc., Texas, USA), which has a reported accuracy of ± 0.5 km/h. Measurement was conducted by a trained assessor blind to group allocation. At each assessment occasion (baseline and post-intervention), each participant delivered ten consecutive full-effort deliveries from a run-up of their preferred length at a standard cricket net. The mean of the five fastest deliveries was recorded as the participant's bowling speed score, a procedure consistent with previous research in this domain (Portus et al., 2004). Testing was conducted at the same time of day (9:00–11:00 AM) and under standardized environmental conditions (indoor facility, temperature 22 ± 2°C) to minimize confounding variation.

3.5 Statistical Analysis

All statistical analyses were performed using SPSS (version 28.0, IBM Corp., Armonk, NY). Data were first assessed for normality using the Shapiro-Wilk test. Descriptive statistics (mean and standard deviation) were calculated for all continuous variables. Paired-samples t-tests were used to assess within-group changes from pre-test



to post-test. Independent-samples t-test was used to compare between-group differences in post-test bowling speed, with pre-test scores included as a covariate in an analysis of covariance (ANCOVA) to control for baseline variation. Cohen's d effect sizes were calculated to evaluate the practical magnitude of observed differences (small: $d < 0.5$; medium: 0.5–0.8; large: $d > 0.8$). The level of statistical significance was set at $p < 0.05$ for all analyses.

4. Results

All 30 participants completed the study. No adverse events or injuries attributable to the EBRT protocol were reported. Attendance at EBRT sessions in the experimental group was 94.7% (mean 22.7 of 24 sessions completed). Both groups demonstrated normal distribution of bowling speed data (Shapiro-Wilk, $p > 0.05$).

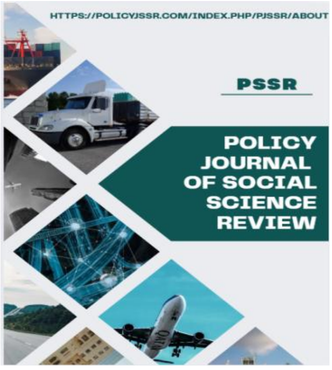
Table 1. Pre-test and Post-test Bowling Speed Data for Experimental and Control Groups

Group	Pre-test Mean ± SD (km/h)	Post-test Mean ± SD (km/h)	Mean Change (km/h)	% Change	p-value
Experimental (n=15)	119.8 ± 6.4	128.6 ± 5.9	+8.8	7.3%	< 0.001
Control (n=15)	120.1 ± 5.8	121.3 ± 6.1	+1.2	1.0%	0.312
Between-Group Difference	—	7.3 km/h	—	—	< 0.001

*Note: SD = Standard Deviation. * = statistically significant at $p < 0.05$. Cohen's d for experimental group within-group change = 1.42 (large effect).*

As presented in Table 1, the EG demonstrated a mean bowling speed increase of 8.8 km/h, from 119.8 ± 6.4 km/h to 128.6 ± 5.9 km/h over the eight-week intervention ($p < 0.001$). This represented a 7.3% improvement in mean bowling speed and corresponded to a large effect size (Cohen's d = 1.42). In contrast, the CG showed a non-significant mean increase of 1.2 km/h (120.1 ± 5.8 km/h to 121.3 ± 6.1 km/h; $p = 0.312$; Cohen's d = 0.20). The ANCOVA revealed a statistically significant between-group difference in post-intervention bowling speed when controlling for pre-test values ($F(1, 27) = 18.64$, $p < 0.001$, partial $\eta^2 = 0.408$), indicating a large practical effect attributable to the EBRT intervention.

Figure 1 Description Pre-Post Bowling Speed Comparison Bar Chart: A clustered bar graph with error bars (± 1 SD) depicting pre-test and post-test mean bowling speed (km/h) for both the Experimental Group (EG) and Control Group (CG). The x-axis displays the two measurement occasions (Pre-test, Post-test) with two bars per



occasion representing EG and CG respectively. The y-axis ranges from 110 to 135 km/h. The EG post-test bar is visibly and substantially higher than all other bars. Error bars overlap between groups at pre-test but are clearly separated at post-test, visually reinforcing the statistical significance of the between-group difference. An asterisk above the EG post-test bar denotes statistical significance ($p < 0.001$).

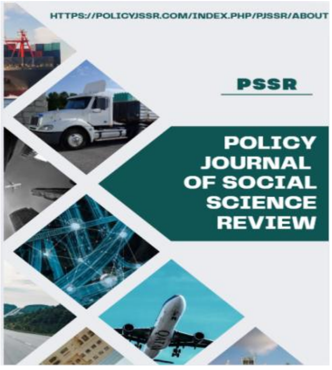
5. Discussion

The primary finding of this study was that an eight-week elastic band resistance training program, implemented in addition to conventional cricket training, produced a statistically significant and practically meaningful improvement in fast bowling speed among male club-level cricketers. The EG demonstrated a 7.3% mean improvement in bowling speed, corresponding to a large effect size, while the CG exhibited no significant change. These findings align with the stated hypothesis and extend the evidence base for EBRT as a viable modality for cricket-specific conditioning.

The magnitude of improvement observed in the present study (7.3%) is consistent with, and in some respects exceeds, findings from analogous research in comparable overhead sports. Lehman et al. (2013) reported a 5.8% improvement in baseball pitch velocity following a six-week elastic band rotator cuff program; the present eight-week intervention targeting the broader kinetic chain encompassing hip, core, and shoulder may account for the relatively greater improvement. Similarly, Marques et al. (2011) reported gains of 4.9–6.2% in handball throwing velocity after elastic band shoulder training, further corroborating the present findings. Tong et al. (2014), in the only directly comparable cricket-specific study, reported a 5% improvement in bowling speed following an elastic band-inclusive core stability program, though that investigation did not employ a randomized controlled design or address the full bowling kinetic chain.

The physiological mechanisms underlying the observed improvements in bowling speed are multifactorial. First, the accommodating resistance property of elastic bands ensures increasing resistance as the limb approaches full extension or elevation the position of peak velocity during explosive movements. This stimulus recruits high-threshold motor units across a greater proportion of the range of motion compared with constant-load free-weight exercises, promoting greater neuromuscular adaptation (Israetel et al., 2010). Second, the three-dimensional, sport-specific nature of the elastic band exercises particularly the diagonal pull-down, standing trunk rotation, and hip-to-shoulder throw pattern stimulates neuromuscular coordination along the precise movement pathways of the cricket bowling action. This specificity of training is mechanistically consistent with the principles of the SAID (Specific Adaptation to Imposed Demands) model (Cormie et al., 2011).

Third, the targeted strengthening of the rotator cuff and scapular musculature components shown to be predictive of bowling velocity by Escamilla and Andrews



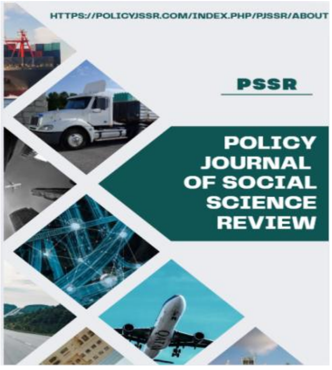
(2009) likely improved the proximal shoulder stability necessary for efficient distal energy transfer. A more stable proximal segment permits greater muscular force to be transmitted distally as ball release velocity, rather than being absorbed by passive restraint structures. Fourth, the hip complex exercises lateral band walks and resisted hip extension directly addressed the gluteal and hip abductor musculature responsible for frontal-plane stability at front-foot contact. As Pyne et al. (2006) demonstrated, hip abductor strength is a significant correlate of bowling speed in elite cricketers, and its development through targeted EBRT likely contributed to improvements in ground reaction force utilization and proximal-to-distal energy transfer efficiency.

The practical implications of these findings are of direct relevance to coaches, strength and conditioning specialists, and governing bodies responsible for player development at sub-elite cricket levels. Elastic bands are inexpensive, portable, and require minimal space characteristics that render the present EBRT protocol particularly accessible to district and club-level programs operating with limited resources. The progressive overload framework employed, advancing from light-moderate to heavy resistance over eight weeks, provides a replicable structure that practitioners can directly apply. Furthermore, the integration of EBRT sessions within existing training schedules conducted immediately following conventional cricket training demonstrated feasibility and did not appear to compromise participation or produce overuse injury, as evidenced by the high session attendance rate (94.7%) and absence of adverse events.

Several limitations of the present study warrant acknowledgement. First, the sample comprised male club-level fast bowlers aged 18–25 years, limiting generalization to female cricketers, youth athletes, and elite professional bowlers. Second, the relatively small sample size (n = 15 per group), while adequate for the detection of large effects, may be insufficient for the detection of smaller, yet practically meaningful, inter individual differences. Third, the absence of kinematic data (e.g., motion capture analysis of joint angles and angular velocities) precluded a mechanistic confirmation of which specific components of the bowling action were altered by the EBRT program. Future research should incorporate three-dimensional motion analysis to elucidate the biomechanical pathways underlying speed improvements. Fourth, dietary intake and sleep quality factors known to influence training adaptation were not controlled or assessed. Fifth, the absence of a follow-up assessment means that the persistence of speed gains following cessation of the EBRT program me is unknown.

6. Conclusion

The present study demonstrated that an eight-week elastic band resistance training program, targeting the shoulder complex, core musculature, and hip complex, produced a statistically significant and practically meaningful improvement in bowling speed (7.3% mean increase) in male club-level cricket fast bowlers. The control group,



which undertook conventional cricket training only, showed no significant speed improvement over the same period. The findings support the integration of structured EBRT protocols into cricket-specific conditioning program, particularly at sub-elite levels where resource limitations may preclude access to conventional gym-based resistance training equipment.

On the basis of the current evidence, the following practical recommendations are offered for coaches and conditioning practitioners: (1) Implement a progressive eight-week elastic band program targeting the rotator cuff, scapular stabilizers, trunk rotators, and hip abductors, commencing pre-season or during off-season conditioning blocks. (2) Employ a progressive overload framework, advancing band resistance approximately every two weeks in line with athlete adaptation. (3) Priorities movement specificity exercises that replicate the kinematic patterns of the bowling action appear to maximize transfer of training to bowling performance. (4) Conduct EBRT sessions three times per week, supplementing (not replacing) conventional cricket training. Future research should examine the effects of EBRT on female cricketers and elite populations, incorporate biomechanical outcome measures, and investigate the duration of training-induced speed gains following program completion.

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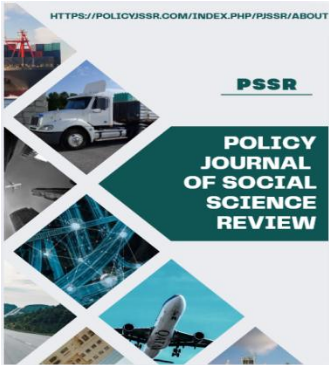

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