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Effect of Theraband Resistance Training of Hamstrings on its Strength among Young Male Recreational Sprinters with Hamstring Strength Deficit

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Abstract: ***Background: Hamstring strength is important for sprint performance and dynamic knee stability. Theraband resistance is portable and economical, but evidence in recreational sprinters with hamstring strength deficit is limited. Aim: To determine the effect of four weeks of Theraband hamstring resistance training on hamstring peak torque, quadriceps peak torque, and the conventional hamstring-to-quadriceps ratio. Methodology: Thirty young male recreational sprinters aged 18-25 years completed a single-group pre-test and post-test study. Participants received a progressive Theraband programme for four weeks, three sessions per week. Hamstring and quadriceps peak torque were measured with a Biodex isokinetic dynamometer, and the H:Q ratio was calculated. Paired t-tests compared pre-test and post-test values. Results: Hamstring peak torque increased from 89.93 ± 4.79 N·m to 102.48 ± 5.65 N·m (t=29.86, p<0.001). Quadriceps peak torque increased from 180.47 ± 7.99 N·m to 183.45 ± 8.82 N·m (t=3.81, p<0.001). The H:Q ratio increased from 0.50 ± 0.03 to 0.56 ± 0.04 (t=23.94, p<0.001). Conclusion: Four weeks of progressive Theraband hamstring training improved measured hamstring strength and the conventional H:Q ratio in young male recreational sprinters with hamstring strength deficit.***

Keywords: Theraband resistance training, hamstring strength, peak torque, H:Q ratio, recreational sprinters, isokinetic dynamometer

1. Introduction

Sprinting requires rapid acceleration, high force output, and coordinated lower-limb muscle activity. The quadriceps contribute to knee extension during stance, whereas the hamstrings contribute to hip extension and control forward movement of the lower leg during terminal swing [1]. Adequate hamstring strength is therefore important for both sprint performance and dynamic knee stability.

The conventional hamstring-to-quadriceps ratio describes the balance between concentric knee-flexor and knee-extensor peak torque. A reduced ratio may reflect comparatively weak hamstrings, but its interpretation depends on the contraction mode, angular velocity, sport, and test protocol; no single value should be treated as a universal injury threshold [2,6,13,17-24].

During isokinetic testing, muscle force acting through a moment arm produces torque around the knee. Peak torque is the maximum rotational torque generated during the test and is expressed in newton-metres. It provides an objective quantitative measure of the torque-producing capacity of the hamstrings and quadriceps [6,21].

Traditional strengthening with free weights or machines may not be available in every training environment. Elastic bands provide variable resistance through the range of motion and permit progressive loading with inexpensive, portable equipment. Systematic-review evidence indicates that elastic resistance improves muscular strength and may produce activation comparable with isoinertial resistance when the programme is adequately progressed [8,11,27-29].

Research has largely examined professional football and rugby athletes, while young recreational sprinters remain underrepresented [13-16]. This study therefore evaluated the effect of a four-week progressive Theraband hamstring programme on hamstring peak torque, quadriceps peak torque, and the conventional H:Q ratio in young male recreational sprinters with hamstring strength deficit.

2. Aim and Objectives

The primary objective was to evaluate the change in hamstring peak torque after four weeks of Theraband resistance training. Secondary objectives were to evaluate changes in quadriceps peak torque and the conventional H:Q ratio. The null hypothesis stated that pre-test and post-test hamstring peak torque would not differ.

3. Materials and Methodology

Study design and setting: A pre-experimental single-group pre-test and post-test study was conducted at the College of Physiotherapy, Sri Venkateswara Institute of Medical Sciences, and the Department of Physical Education, Sri Venkateswara University, Tirupati, India. The intervention duration was four weeks.

Ethical approval: Approval was obtained from the Institutional Ethics Committee, Sri Venkateswara Institute

of Medical Sciences, Tirupati (IEC No. 1968; approval dated 9 March 2026). Written informed consent was obtained from every participant before enrolment.

Participants and sampling: Thirty male B.P.Ed students who participated in recreational sprint training were recruited by convenience sampling. Participants were aged 18-25 years, trained at least three sessions per week for at least six months, had a hamstring strength deficit on screening, and could provide informed consent.

Exclusion criteria: A history of major knee injury or surgery, neurological or systemic conditions affecting movement, or concurrent participation in another strength or rehabilitation programme.

Materials: Theraband elastic resistance bands, yoga mat, stopwatch, and Biodex isokinetic dynamometer.

4. Assessment Procedure

Participants sat in the Biodex dynamometer chair with the hip flexed approximately 85-90°. Straps stabilized the trunk, pelvis, and thigh, and the dynamometer axis was aligned with the lateral femoral epicondyle. The knee moved from approximately 90° flexion to full extension. After familiarization trials, participants performed maximal voluntary knee flexion and extension. Peak torque was recorded for the hamstrings and quadriceps. The same procedure was repeated after four weeks. The primary outcome was hamstring peak torque (N·m). Secondary outcomes were quadriceps peak torque (N·m) and the conventional H:Q ratio, calculated as hamstring peak torque divided by quadriceps peak torque.

5. Intervention Protocol

Participants completed 12 sessions over four weeks, with three sessions per week. Each session lasted approximately 30-40 minutes and included 5-7 minutes of light aerobic activity and dynamic lower-limb stretching. Resistance was selected individually and progressed according to participant tolerance and performance; black and gold bands were used most often. Exercises were performed in a controlled manner, generally within 10-15 repetitions to fatigue and at Borg 12-14 or OMNI 5-7 where used for progression

Table 1: Four- Week Theraband Hamstring Training Protocol

Week	Exercise	Sets × repetitions
1-2	Prone hamstring curl	3 × 12
1-2	Standing hamstring curl	3 × 12
1-2	Supine bridge with band	3 × 10
1-2	Seated knee flexion	2 × 15
3	Eccentric prone hamstring curl	3 × 12
3	Standing single-leg curl	3 × 12
3	Bridge walk-outs with band	3 × 8
3	Band-assisted Nordic curl	2 × 6
4	Standing hamstring curl	3 × 15
4	Single-leg RDL with band	3 × 10
4	Bridge hold with knee flexion	3 × 30 s
4	Sprint-preparation hamstring pull	2 × 12

Exercise technique: Knee-flexion exercises were performed against a band anchored behind the ankle while the trunk and thigh remained stable. During bridging, participants maintained pelvic alignment and outward pressure against the band. The assisted Nordic curl emphasized a controlled forward lean from the knees with the hips extended. The single-leg Romanian deadlift used a hip hinge with a neutral trunk. The sprint-preparation pull combined hip extension and knee flexion in a forward-inclined sprint stance.

6. Statistical Analysis

Data were entered in Microsoft Excel and analysed using IBM SPSS Statistics version 20. Continuous variables are presented as mean ± standard deviation. The distribution was reported as normal. Paired-samples t-tests compared pre-test and post-test hamstring peak torque, quadriceps peak torque, and H:Q ratio. Statistical significance was set at $p<0.05$. SPSS values displayed as 0.000 are reported as $p<0.001$.

7. Results

All 30 participants completed the four-week programme and post-test assessment. No withdrawals or adverse events were reported.

Table 2: Demographic Characteristics of Participants

Variable	Mean ± SD	Unit
Age	21.90 ± 2.02	years
Height	174.20 ± 4.69	cm
Weight	69.80 ± 4.78	kg
Training experience	1.93 ± 0.68	years
Sprint frequency	3.90 ± 0.71	sessions/week

Table 3: Pre-test and Post-test Isokinetic Outcomes

Outcome	Pre-Mean ± SD	Post Mean ± SD	Difference	t	p
Hamstring peak torque	89.93 ± 4.79	102.48 ± 5.65	12.55	29.86	<.001
Quadriceps peak torque	180.47 ± 7.99	183.45 ± 8.82	2.98	3.81	<.001
H:Q ratio	0.50 ± 0.03	0.56 ± 0.04	0.06	23.94	<.001

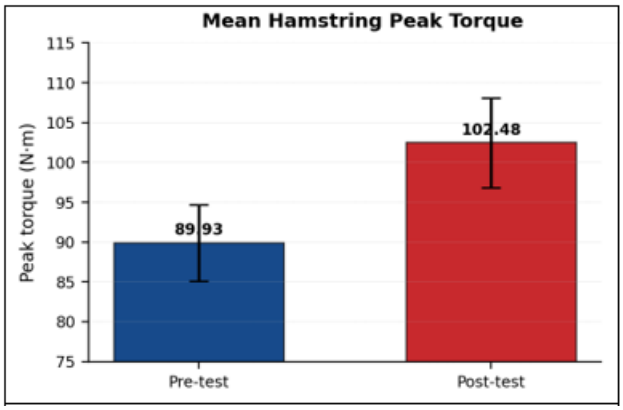


Figure 1: Pre-test and post-test hamstring peak torque

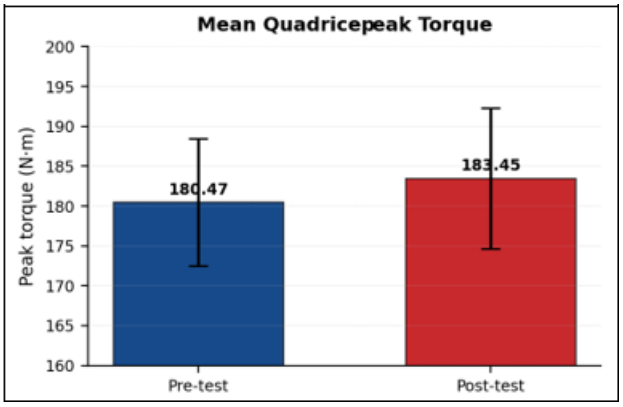


Figure 2: Pre-test and post-test quadriceps peak torque

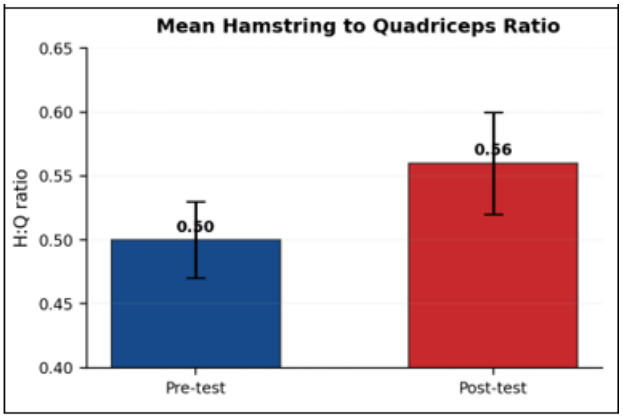


Figure 3: Pre-test and post-test H:Q ratio

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Hamstring peak torque increased by 12.55 N·m (approximately 14.0%), quadriceps peak torque increased by 2.98 N·m (approximately 1.7%), and the conventional H:Q ratio increased by 0.06 (approximately 12.0%). All three paired comparisons were statistically significant.

8. Discussion

The four-week progressive Theraband programme was associated with higher hamstring peak torque, a smaller increase in quadriceps peak torque, and an improved conventional H:Q ratio. Because the increase in hamstring torque was larger than the increase in quadriceps torque, the ratio rose from 0.50 to 0.56.

These findings agree with evidence that elastic resistance can improve muscular strength when progressive overload is maintained. Lopes et al. found comparable strength improvements with elastic and conventional resistance training [8]. Aboodarda et al. reported broadly comparable muscle activation between elastic and isoinertial resistance [11], and Colado et al. supported graded prescription of elastic-band intensity [27].

The intervention lasted only four weeks. Early strength gains during short resistance programmes are commonly attributed mainly to neural adaptations before substantial hypertrophy develops. Wilson et al. reported improvements in contractile function and corticospinal excitability before later architectural changes during lower-limb resistance training [33]. Neural activation and muscle architecture were not measured in this study, so this remains a possible explanation rather than a measured mechanism.

Quadriceps peak torque increased modestly despite the hamstring emphasis. Stabilization and co-contraction during bridge, single-leg, and closed-chain tasks may have contributed; repeated-test familiarization or measurement variation may also explain part of the change. The study did not use electromyography or a control group, so the mechanism cannot be determined.

The H:Q ratio is useful for describing relative knee-flexor and knee-extensor strength, but its clinical meaning depends on the angular velocity, contraction mode, sport, and test procedures [6,17-24]. The observed improvement should not be interpreted as proof of reduced injury risk because injuries were not measured.

The protocol provides a practical low-equipment progression from isolated knee flexion and bridging to eccentric Nordic work, hip-hinge loading, and sprint-related exercise. It may be useful where conventional resistance equipment is unavailable, provided resistance and technique are individually monitored.

9. Limitations and Recommendations

The study used a small convenience sample of 30 young men from one centre, a single-group design, and only four weeks of follow-up. Diet and activity outside the programme were not strictly monitored. Sprint speed, agility, jumping, electromyography, muscle architecture, and injury incidence were not assessed. The source record did not fully report the tested limb, angular velocity, number of maximal repetitions, rest interval, gravity correction, calibration procedure, or assessor blinding.

Future research should use a randomized controlled design, larger and more diverse samples, a prospectively calculated sample size, complete isokinetic reporting, standardized band resistance and progression, adherence and adverse-event monitoring, and follow-up of 6-12 weeks. Sprint, agility, jump, functional, and injury outcomes should also be included.

10. Conclusion

Four weeks of progressive Theraband hamstring resistance training significantly improved hamstring peak torque, quadriceps peak torque, and the conventional H:Q ratio in young male recreational sprinters with hamstring strength deficit. Controlled studies with longer follow-up are required before causal, performance, or injury-prevention conclusions can be made.

Declarations

Ethics approval and consent: Institutional Ethics Committee, SVIMS, IEC No. 1968, approved 9 March 2026. Written informed consent was obtained from all participants.

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