RESEARCH ARTICLE

Evaluating a novel dual-modality self-care protocol: Integrating tactile stimulation and progressive resistance exercises for muscular health in competitive track and field

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Musculoskeletal injuries pose a significant challenge in competitive track and field athletics with current prevention strategies showing limited effectiveness in reducing injury rates. While various interventions exist, there is a notable gap in self-administered therapeutic approaches that combine multiple modalities. This study aimed to assess the efficacy of an innovative self-administered therapeutic regimen combining tactile stimulation of specific body points and progressive resistance exercises in mitigating muscular injuries among competitive track and field athletes. The study recruited 120 track and field competitors, randomly allocated into three equivalent groups including experimental intervention cohort (EIC) (n = 40), standard practice cohort (SPC) (n = 40), and reference cohort (RC) (n = 40). The EIC participated in a 12-week self-administered therapeutic regimen integrating tactile stimulation and progressive resistance exercises alongside their standard training. The SPC adhered to their established training protocols, while the RC maintained their routine practices without additional interventions. Outcome parameters encompassed muscular capacity, kinetic range, fatigue resilience index, incidence of muscular injuries, and subjective athlete feedback. Evaluations were conducted at inception, mid-point (6 weeks), and conclusion (12 weeks) of the study. The post-intervention analysis at 12 weeks revealed that the EIC demonstrated statistically significant enhancements in muscular capacity (*P* < 0.01), kinetic range (*P* < 0.01), and fatigue resilience (*P* < 0.05) compared to both SPC and RC. The incidence of muscular injuries was markedly lower in the EIC (7.5%) juxtaposed against the SPC (20%) and RC (27.5%) (*P* < 0.01). Athletes in the EIC reported superior satisfaction levels and perceived efficacy regarding injury mitigation. The novel self-administered therapeutic regimen significantly reduced muscular injury rates and improved physiological parameters in track and field athletes, offering a promising and practical approach for injury prevention in competitive athletics.

Keywords: rehabilitation; training; prevention; athletics; biomechanics; performance.

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Introduction

Musculoskeletal injuries, particularly those involving soft tissue damage, pose a significant challenge in the realm of track and field athletics. These injuries frequently lead to substantial interruptions in training regimens and competitive schedules [1]. The inherent high-intensity nature of track and field disciplines characterized by repetitive motions and a constant drive for performance enhancement predisposes athletes to an elevated risk of soft tissue trauma [2]. Mitigating these injuries is paramount, not only for maintaining peak athletic performance but also for safeguarding the long-term well-being and career sustainability of competitors [3].

Conventional approaches to soft tissue injury prevention in athletics have typically centered on pre-exercise preparatory routines, flexibility enhancement protocols, and muscular development programs [4]. While these methodologies have demonstrated a degree of efficacy, the persistent high incidence of soft tissue injuries in track and field suggests a need for innovative preventive strategies [5]. In recent years, a growing interest has been observed in integrating complementary and alternative techniques with traditional training methodologies to enhance injury prevention outcomes [6]. Manual stimulation of specific anatomical points, a practice rooted in Eastern therapeutic traditions, has garnered attention for its potential applications in sports medicine [7]. This technique involves the application of targeted pressure to precise locations on the body, which are theorized to correspond to various physiological functions [8]. Emerging research suggests that this form of manual therapy may enhance circulatory function, alleviate muscular tension, and potentiate the body's innate recuperative processes [9]. These effects could potentially contribute to soft tissue injury prevention by enhancing tissue resilience and recovery mechanisms. Conversely, resistance training is a well-established component of athletic conditioning programs [10], which plays a pivotal role in enhancing muscular strength, power output, and endurance capacity, all of which are critical factors in preventing soft tissue injuries [11]. Well-designed resistance training protocols can address muscular imbalances, improve joint stability, and elevate overall athletic performance [12]. The concept of integrating targeted manual therapy with resistance training in a self-administered rehabilitation program represents an innovative approach to soft tissue injury prevention. This integrated methodology aims to leverage the complementary benefits of both techniques, potentially offering a more comprehensive and effective prevention strategy [13]. By empowering athletes to implement these techniques independently, such a program could foster a proactive approach to injury prevention and self-care [14].

Despite the potential advantages of this combined approach, there is a dearth of empirical evidence examining its effectiveness in preventing soft tissue injuries, particularly among track and field athletes. Most of the existing research has focused on either manual therapy or resistance training in isolation, leaving a significant gap in the understanding of how these techniques might function synergistically [15, 16]. This study aimed to investigate the efficacy of a self-administered rehabilitation program, combining targeted manual therapy and resistance training, in mitigating soft tissue injuries among competitive track and field athletes to bridge the existing knowledge gap and provide valuable insights into innovative injury prevention strategies in elite athletics.

Materials and methods

Participant selection

A total of 120 competitive track and field athletes including 63 males and 57 females, aged from 19 to 32 years old, from the Department of Physical Education, Changzhou Institute of Technology, Changzhou, Jiangsu, China were recruited in this study. The inclusion criteria encompassed (1) age range of 18-35 years old, (2) active participation in collegiate or professional track and field competitions, (3) minimum two-year competitive experience, (4) training frequency of at least five days weekly, while the exclusion criteria comprised (1) history of significant musculoskeletal trauma within the preceding six months, (2) current use of pharmacological agents potentially affecting muscular function or recovery, (3) concurrent participation in other experimental treatments or rehabilitation protocols. This research employed a randomized controlled trial design, conducted from January 2024 to April 2024. Participants were allocated to one of three cohorts with 40 athletics in each cohort using a computer-generated randomization algorithm as integrated intervention cohort (IIC), standard practice cohort (SPC), and reference cohort (RC). Participants were stratified by gender and age before randomization to ensure balanced distribution across cohorts with IIC having 21 males, 19 females, mean age 23.7 ± 3.8 years, SPC consisting of 21 males, 19 females, mean age 24.1 ± 4.2 years, and RC having 21 males, 18 females, mean age 23.9 ± 3.9 years. All procedures of this study were approved by Ethical Review Board of Changzhou Institute of Technology (Changzhou, Jiangsu, China). All participants were provided informed consent prior to enrollment.

Intervention protocols

The study implemented three distinct intervention protocols across the participant cohorts. The IIC underwent a comprehensive 12-week program that combined manual therapy and resistance training components. The manual therapy component consisted of daily 15-minute self-administered sessions focusing on targeted anatomical points along the lower limbs and torso. During these sessions, participants applied specific techniques including circular friction, sustained pressure, and kneading, maintaining pressure application for 60-120 seconds at each designated point. The resistance training component of the IIC protocol comprised tri-weekly 45-minute sessions incorporating compound movements and unilateral exercises. This training followed progressive overload principles with particular emphasis on muscle groups prone to injury. To maximize the therapeutic benefits, participants performed the manual therapy immediately following their resistance training sessions with additional manual therapy sessions scheduled on recovery days. Weekly monitoring sessions were conducted to ensure proper technique maintenance and address any participant concerns. The SPC maintained their established training protocols throughout the study period, which included regular sport-specific conditioning, basic resistance exercises, and standard recovery practices as prescribed by the coaching staff. This approach allowed for comparison with conventional training methodologies while controlling for the effects of regular athletic preparation. The RC continued the routine training schedule without any additional interventions or modifications to the existing practices. This group served as a control to assess the natural progression of athletic performance and injury occurrence under standard conditions. All participants, regardless of group assignment, maintained detailed training logs and underwent regular assessments throughout the study period.

Muscular capacity

The Isokinetic assessment was performed using a Biodex System 4 Pro dynamometer (Biodex Medical Systems Inc., Shirley, NY, USA). Participants were seated with hip angle at 85° and stabilized with straps across the chest, pelvis, and tested thigh. After a standardized warm-up of 5 submaximal repetitions, participants performed 5 maximal reciprocal knee extensions and flexions at 60°/s and 180°/s with 2-minute rest intervals between sets. Peak torque was recorded as the highest value achieved. Hip strength assessment was conducted using a microFET2 handheld dynamometer (Hoggan Scientific LLC, Salt Lake City, UT, USA). Measurements were performed with participants in side-lying position for abduction and adduction. Following 3 practice trials, participants performed 3 maximal 5-second contractions with 30-second rest intervals. The highest value was recorded.

Kinetic range

Modified sit-and-reach testing was performed using a standardized protocol with participants seated, shoes removed, and knees extended. After 2 practice attempts, the best of 3 trials was recorded. Goniometric measurements followed standardized protocols from the American

Academy of Orthopaedic Surgeons (https://www.aaos.org/). Three measurements were taken for each motion with the mean value recorded.

Fatigue resilience

The Wingate anaerobic test was performed on a Monark 894E Peak Bike (Monark Exercise AB, Vansbro, Sweden). The protocol consisted of a 5-minute warm-up at 50 W followed by a 30-second maximal sprint against resistance set at 7.5% body mass. Peak power at the highest 5-second output, mean power, and fatigue index were calculated.

Incidence of muscular injuries

All muscular injury incidents were documented throughout the 12-week period. Injuries were diagnosed and classified by sports medicine specialists using standardized criteria.

Participant feedback

A customized questionnaire was applied to assess participants' perceptions of the intervention including perceived efficacy, implementation feasibility, and overall satisfaction. The questionnaire utilized a 5-point Likert scale and incorporated open-ended items for qualitative feedback.

Statistical analysis

Sample size determination was based on an anticipated 50% reduction in muscular injury incidence in the IIC compared to the RC with an alpha level of 0.05 and statistical power of 80%. Accounting for an expected attrition rate of 10%, 40 participants per cohort were recruited. SPSS 27.0 (IBM Corporation, Armonk, NY, USA) was employed for the statistical analysis of this study. Data were presented as mean ± standard deviation for continuous variables and frequencies (percentages) for categorical variables. Normality of data distribution was assessed using the Shapiro-Wilk test. Inter-group comparisons of continuous variables were conducted using one-way ANOVA for normally distributed data or Kruskal-Wallis test for non-parametric data. Post-hoc analysis with Bonferroni correction were performed when significant group differences were identified. Chi-square analysis was employed to compare the incidence of muscular injuries between groups. Repeated measures ANOVA examined changes in outcome measures over time within and between groups. Effect sizes were quantified using partial eta-squared (η^2) for ANOVA and Cohen's d for pairwise comparisons. Qualitative data from open-ended responses underwent thematic analysis. The statistically significant difference was defined as the *P* value less than 0.05.

Results

Participant demographics and protocol adherence

Chi-square analysis confirmed no significant differences in gender and age distributions between groups. Of the 120 athletes initially enrolled, 114 completed the full study duration with 38 in IIC, 37 in SPC, and 39 in RC, respectively, yielding a 95% retention rate. Attrition was attributed to scheduling conflicts (n = 3), non-study related injuries (n = 2), and personal circumstances (n = 1). No significant disparities in baseline characteristics were observed between study completers and non-completers. The baseline characteristics of study completers showed no statistically significant inter-group differences in age distribution, gender composition, anthropometric measures, or competitive experience duration at study commencement (Table 1). Compliance with the intervention protocol in the IIC was robust with participants completing an average of 89.7 ± 6.3% of prescribed manual therapy sessions and 92.4 ± 5.1% of resistance training sessions.

Muscular capacity alterations

Both IIC and SPC exhibited significant enhancements in muscular capacity over the 12-week intervention period with the IIC demonstrating superior gains compared to that in both SPC and RC (Table 2). Peak torque of the knee extensors at 60°/s increased by 18.7% in the

Table 1. Baseline characteristics of study participants.

Characteristic	IIC (n = 38)	SPC (n = 37)	RC (n = 39)	*P* value
Age (years)	23.7 ± 3.8	24.1 ± 4.2	23.9 ± 3.9	0.912
Gender (M/F)	20/18	19/18	21/18	0.983
Height (cm)	175.3 ± 8.2	174.9 ± 7.8	175.6 ± 8.5	0.935
Weight (kg)	68.4 ± 7.6	67.9 ± 8.1	68.7 ± 7.9	0.904
BMI (kg/m²)	22.2 ± 1.8	22.1 ± 1.9	22.3 ± 1.7	0.889
Years of experience	6.8 ± 2.5	7.1 ± 2.3	6.9 ± 2.6	0.867

Note: Data were presented as mean ± SD or count. BMI: body mass index.

Table 2. Changes in muscle strength after 12 weeks.

Measure	IIC (n = 38)	SPC (n = 37)	RC (n = 39)	*P* value
Knee extensor PT 60°/s (Nm)	+18.7%*	+10.3%*	+2.1%	< 0.01
Knee flexor PT 60°/s (Nm)	+16.9%*	+9.8%*	+1.8%	< 0.01
Knee extensor PT 180°/s (Nm)	+15.4%*	+8.7%*	+1.5%	< 0.01
Knee flexor PT 180°/s (Nm)	+14.2%*	+7.9%*	+1.3%	< 0.01
Hip abductor strength (N)	+12.8%*	+6.5%*	+0.9%	< 0.01
Hip adductor strength (N)	+11.6%*	+5.9%*	+0.7%	< 0.01

Note: Data were presented as percentage change from baseline. Nm: newton-meters for torque measurements. N: newtons for force measurements. PT: peak torque. *: significantly different from RC ($P < 0.01$).

Table 3. Changes in flexibility measures after 12 weeks.

Measure	IIC (n = 38)	SPC (n = 37)	RC (n = 39)	*P* value
Sit-and-reach (cm)	+22.4%*	+9.8%*	+1.5%	< 0.01
Hip flexion ROM (°)	+11.7%*	+5.6%*	+0.8%	< 0.01
Hip extension ROM (°)	+9.8%*	+4.7%*	+0.6%	< 0.01
Ankle dorsiflexion ROM (°)	+13.5%*	+6.9%*	+1.1%	< 0.01
Ankle plantarflexion ROM (°)	+8.7%*	+4.2%*	+0.5%	< 0.01

Note: Data were presented as percentage change from baseline. ROM: range of motion. *: significantly different from RC ($P < 0.01$).

IIC compared to 10.3% in the SPC and 2.1% in the RC ($P < 0.01$). Analogous trends were observed for knee flexor strength and at higher angular velocities (180°/s). Hip abductor and adductor strength similarly showed significant improvements in the IIC compared to both SPC and RC ($P< 0.01$).

Kinetic range modifications

The IIC demonstrated significant improvements in kinetic range measures compared to both SPC and RC (Table 3). Modified sit-and-reach test scores improved by 22.4% in the IIC compared to 9.8% in the SPC and 1.5% in the RC ($P < 0.01$). Hip and ankle range of motion also exhibited greater enhancements in the IIC compared to the other cohorts ($P < 0.01$).

Fatigue resilience index alterations

The Wingate anaerobic test revealed significant improvements in fatigue resilience in the IIC compared to both SPC and RC (Table 4). The fatigue index decreased by 15.3% in the IIC compared to 7.2% in the SPC and 0.8% in the RC ($P < 0.05$).

Table 4. Changes in Wingate anaerobic test parameters after 12 weeks.

Parameter	IIC (n = 38)	SPC (n = 37)	RC (n = 39)	*P* value
Peak power (W)	+9.8%*	+5.2%*	+0.7%	< 0.05
Average power (W)	+11.3%*	+6.1%*	+0.9%	< 0.05
Fatigue index (%)	-15.3%*	-7.2%*	-0.8%	< 0.05
Total work (J)	+10.7%*	+5.7%*	+0.8%	< 0.05

Note: Data were presented as percentage change from baseline. W: watts for power output. J: Joules for work performed. *: significantly different from RC ($P < 0.05$).

Table 5. Incidence of muscle strain across groups over 12 weeks.

Group	Number of cases	Incidence rate	Average days lost per injury
IIC (n = 38)	3	7.9%*	3.7 ± 1.2*
SPC (n = 37)	8	21.6%	6.2 ± 2.1
RC (n = 39)	11	28.2%	7.5 ± 2.4

Note: *: significantly different from SPC and RC ($P < 0.01$).

Incidence of muscular injuries

The occurrence of muscular injuries over the 12-week intervention period was significantly lower in the IIC with only 3 cases or 7.9% compared to the SPC with 8 cases or 21.6% and RC with 11 cases or 28.2% ($P < 0.01$) (Table 5). The severity of injuries, as assessed by training time loss, was also reduced in the IIC with an average of 3.7 ± 1.2 days lost per injury compared to 6.2 ± 2.1 days lost in the SPC and 7.5 ± 2.4 days lost in the RC ($P < 0.05$).

Participant feedback

The athletes in the IIC reported high satisfaction with the integrated intervention program as the mean satisfaction score of 4.6 out of 5. Key themes emerging from the qualitative feedback included enhanced proprioception and self-management capabilities, accelerated recovery and diminished muscular discomfort, heightened confidence in injury mitigation, and seamless integration into existing training protocols. Notably, 90% of participants in the IIC expressed the intent to continue utilizing the integrated program beyond the study conclusion.

Discussion

This controlled experimental study investigated the efficacy of a novel self-administered therapeutic regimen integrating targeted soft tissue manipulation and progressive neuromuscular conditioning in mitigating musculotendinous injuries among elite track and field competitors. The results revealed that this multifaceted approach yielded significant enhancements in neuromuscular performance, biomechanical efficiency, and fatigue tolerance alongside a marked reduction in the prevalence of musculotendinous trauma compared to conventional training paradigms. The pronounced gains in neuromuscular performance observed in the experimental intervention group (EIG) corroborated previous investigations, suggesting that strategically applied soft tissue manipulation could amplify the adaptive responses to resistance training [17]. The physiological mechanisms underpinning this synergistic effect might encompass enhanced microvascular perfusion of muscle tissue, optimized motor unit recruitment patterns, and attenuation of myofascial hypertonicity [18]. By integrating soft tissue manipulation protocols immediately following resistance training sessions, athletes in the EIG might have accelerated their recovery kinetics, thereby potentiating greater adaptations to the imposed training stimuli [19]. The significant improvements in biomechanical efficiency within the EIG warranted particular attention. While resistance training alone had been demonstrated to enhance joint mobility to a certain extent [20], the incorporation of targeted soft tissue manipulation appeared to have magnified these effects. This augmented range of motion could be attributed to the modulation of myofascial tension and disruption of fascial adhesions through specific mechanical stimulation [21]. Enhanced biomechanical efficiency was paramount for track and field athletes, as it might contribute to optimized movement economy and reduced susceptibility to musculotendinous injuries [22]. The observed enhancements in fatigue tolerance, as quantified by the Wingate anaerobic test, suggested that the integrated intervention bolstered the athletes' capacity to sustain power output during high-intensity exertions. This finding carried substantial implications for track and field performance, particularly in events necessitating repeated bouts of maximal effort [23]. The underlying mechanisms facilitating this improvement might include enhanced metabolic efficiency, optimized motor unit synchronization, and improved regulation of myofascial tension [24].

The most clinically relevant outcome of this investigation was the substantial reduction in musculotendinous injury incidence within the EIG, demonstrating a 72% lower prevalence compared to the control cohort and a 63% reduction relative to the standard practice group. The results underscored the potential of this integrated approach as an effective prophylactic strategy. Several factors might contribute to this diminished injury risk, which included enhanced neuromuscular function through improvements in strength, biomechanical efficiency, and fatigue tolerance, potentially better equipping the musculotendinous units to withstand the high intensity demands of track and field activities [25]; augmented proprioceptive acuity and kinesthetic awareness stemming from soft tissue manipulation enabling athletes to more accurately gauge their physiological limits and respond proactively to potential injury-inducing scenarios [26]; more comprehensive addressing of neuromuscular imbalances, a recognized risk factor for strains in track and field athletes [27]; enhanced inter-session recovery, mitigating cumulative fatigue, and preserving musculotendinous integrity [28]; and potential reduction in psychological stress through the self-care component of the intervention, particularly the soft tissue manipulation element, which had been associated with reduced injury susceptibility in athletes [29].

The favorable subjective feedback from athletes in the EIG provided valuable insights into the practical implications of this integrated approach. The reported enhancements in proprioceptive acuity and self-management capabilities suggested that the intervention not only conferred physical benefits but also empowered athletes to adopt a more proactive stance in their injury prevention and overall well-being. This heightened sense of autonomy and self-efficacy could have far-reaching implications for athlete health and performance longevity [30]. The reported ease of integration into existing training regimens was a crucial factor favoring the potential widespread adoption of this approach. Unlike some injury prevention strategies that necessitated substantial time commitments or specialized equipment, this self-administered therapeutic program could be seamlessly incorporated into athletes' daily routines.

While the outcomes of this study were promising, several limitations should be considered, which included that the relatively brief intervention period of 12 weeks might not fully capture the long-term effects of the integrated program. Future investigations should consider extended follow-up periods to assess the sustainability of the observed benefits and the impact on long-term injury profiles. Despite efforts to standardize the soft tissue manipulation techniques through comprehensive instruction and regular monitoring, there might have been some variability in the application of pressure and technique among participants. Subsequent research could explore the utilization of pressure-sensing technology or other instrumental aids to ensure more consistent application of soft tissue manipulation. Further, this study focused exclusively on track and field athletes, and the results might not be directly extrapolated to other sporting disciplines. However, the fundamental principles underlying the integrated approach could potentially be adapted for athletes in other sports, warranting further investigations. While significant reductions in musculotendinous injury incidence were observed, the study was not statistically powered to detect differences in other injury categories. A more extensive, multi-center study could provide insights into the potential broader injury prevention benefits of this integrated approach. Notwithstanding these limitations, the robust positive outcomes observed in this study suggested that the integration of targeted soft tissue manipulation and progressive neuromuscular conditioning in a self-administered therapeutic program held considerable promise for preventing musculotendinous injuries in track and field athletes. The multifaceted benefits, encompassing improvements in neuromuscular performance, biomechanical efficiency, fatigue tolerance, and overall injury risk reduction indicated that this approach addressed multiple facets of athlete health and performance.

Conclusion

This study provided robust evidence for the effectiveness of a self-administered therapeutic program combining targeted soft tissue manipulation and progressive neuromuscular conditioning in mitigating musculotendinous injuries among elite track and field athletes. The significant improvements in neuromuscular performance, biomechanical efficiency, and fatigue tolerance coupled with a substantial reduction in musculotendinous injury incidence, highlighted the potential of this integrated approach as a valuable tool in athlete care. The positive subjective experiences reported by the athletes further supported the feasibility and acceptability of this method, paving the way for its broader implementation in high-performance sports settings.

References

1. Edouard P, Alonso JM. 2013. Epidemiology of track and field injuries. New Stud Athlet. 28(1):85-92.
2. Kalkhoven JT, Watsford ML, Impellizzeri FM. 2020. A conceptual model and detailed framework for stress-related, strain-related, and overuse athletic injury. J Sci Med Sport. 23(8):726-734.
3. Bahr R, Krosshaug T. 2005. Understanding injury mechanisms: A key component of preventing injuries in sport. Br J Sports Med. 39(6):324-329.
4. Lauersen JB, Bertelsen DM, Andersen LB. 2014. The effectiveness of exercise interventions to prevent sports injuries: A systematic review and meta-analysis of randomized controlled trials. Br J Sports Med. 48(11):871-877.
5. Opar DA, Williams MD, Shield AJ. 2012. Hamstring strain injuries: Factors that lead to injury and re-injury. Sports Med. 42(3):209-226.
6. Kietrys DM, Barr AE, Barbe MF. 2011. Exposure to repetitive tasks induces motor changes related to skill acquisition and inflammation in rats. J Mot Behav. 43(6):465-476.
7. Zhang H, Zhao M, Wu Z, Wang X, Jiang Y, Liang J, *et al*. 2022. Effects of acupuncture, moxibustion, cupping, and massage on sports injuries: A narrative review. Evid Based Complement Alternat Med. 2022:9467002.
8. Lin ZP, Chen YH, Fan C, Wu HJ, Lan LW, Lin JG. 2011. Effects of auricular acupuncture on heart rate, oxygen consumption and blood lactic acid for elite basketball athletes. Am J Chin Med. 39(06):1131-1138.
9. Cen SY, Loy SF, Sletten EG, Mclaine A. 2003. The effect of traditional Chinese therapeutic massage on individuals with neck pain. Clin Acupunct Orient Med. 4(2-3):88-93.
10. Suchomel TJ, Nimphius S, Stone MH. 2016. The importance of muscular strength in athletic performance. Sports Med. 46(10):1419-1449.
11. Askling C, Karlsson J, Thorstensson A. 2003. Hamstring injury occurrence in elite soccer players after preseason strength training with eccentric overload. Scand J Med Sci Sports. 13(4):244-250.
12. Myer GD, Ford KR, Palumbo JP, Hewett TE. 2005. Neuromuscular training improves performance and lower-extremity biomechanics in female athletes. J Strength Cond Res. 19(1):51-60.
13. Wang YT, Qi Y, Tang FY, Li FM, Li QH, Xu CP, *et al*. 2017. The effect of cupping therapy for low back pain: A meta-analysis based on existing randomized controlled trials. J Back Musculoskelet Rehabil. 30(6):1187-1195.

14. Brewer BW. 2010. The role of psychological factors in sport injury rehabilitation outcomes. Int Rev Sport Exerc Psychol. 3(1):40-61.
15. Hides JA, Stanton WR, Mendis MD, Sexton MJ. 2011. The relationship of transversus abdominis and lumbar multifidus clinical muscle tests in patients with chronic low back pain. Man Ther. 16(6):573-577.
16. Ekstrand J, Hägglund M, Waldén M. 2011. Epidemiology of muscle injuries in professional football (soccer). Am J Sports Med. 39(6):1226-1232.
17. Chang WG, Chen CY, Li WF, Chou CC, Liao YH. 2020. Traditional Chinese acupressure massage ameliorates systemic inflammatory responses and joint mobility limitation after acute repeated jumping exercise. Explore. 16(1):26-34.
18. Zainuddin Z, Newton M, Sacco P, Nosaka K. 2005. Effects of massage on delayed-onset muscle soreness, swelling, and recovery of muscle function. J Athl Train. 40(3):174-180.
19. Pearcey GE, Bradbury-Squires DJ, Kawamoto JE, Drinkwater EJ, Behm DG, Button DC. 2015. Foam rolling for delayed-onset muscle soreness and recovery of dynamic performance measures. J Athl Train. 50(1):5-13.
20. Simão R, Lemos A, Salles B, Leite T, Oliveira É, Rhea M, *et al*. 2011. The influence of strength, flexibility, and simultaneous training on flexibility and strength gains. J Strength Cond Res. 25(5):1333-1338.
21. Cao H, Li X, Han M, Liu J. 2013. Acupoint stimulation for fibromyalgia: A systematic review of randomized controlled trials. Evid Based Complement Alternat Med. 2013:362831.
22. McHugh MP, Cosgrave CH. 2010. To stretch or not to stretch: The role of stretching in injury prevention and performance. Scand J Med Sci Sports. 20(2):169-181.
23. Billaut F, Bishop DJ, Schaerz S, Noakes TD. 2011. Influence of knowledge of sprint number on pacing during repeated-sprint exercise. Med Sci Sports Exerc. 43(4):665-672.
24. Jones AM, Carter H. 2000. The effect of endurance training on parameters of aerobic fitness. Sports Med. 29(6):373-386.
25. Croisier JL, Ganteaume S, Binet J, Genty M, Ferret JM. 2008. Strength imbalances and prevention of hamstring injury in professional soccer players: A prospective study. Am J Sports Med. 36(8):1469-1475.
26. Li X, Wang R, Xing X, Shi X, Tian J, Zhang J, *et al*. 2016. Acupuncture for myofascial pain syndrome: A network meta-analysis of 33 randomized controlled trials. Pain Physician. 20(6):E883-E902.
27. Yeung SS, Suen AM, Yeung EW. 2009. A prospective cohort study of hamstring injuries in competitive sprinters: Preseason muscle imbalance as a possible risk factor. Br J Sports Med. 43(8):589-594.
28. Best TM, Hunter R, Wilcox A, Haq F. 2008. Effectiveness of sports massage for recovery of skeletal muscle from strenuous exercise. Clin J Sport Med. 18(5):446-460.
29. Ivarsson A, Johnson U, Andersen MB, Tranaeus U, Stenling A, Lindwall M. 2017. Psychosocial factors and sport injuries: Meta-analyses for prediction and prevention. Sports Med. 47(2):353-365.
30. Podlog L, Eklund RC. 2007. The psychosocial aspects of a return to sport following serious injury: A review of the literature from a self-determination perspective. Psychol Sport Exerc. 8(4):535-566.