

ผลของการออกกำลังกายด้วย TRX แบบหนักสลับเบาความเข้มข้นสูงที่มีผลต่อองค์ประกอบ
ของร่างกาย พลังของกล้ามเนื้อ และความแข็งแรงของกล้ามเนื้อในนักศึกษา
Effects of High-Intensity Interval TRX Training on Body Composition, Muscular Power,
and Strength in University Students: A Randomized Controlled Trial

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บทคัดย่อ

ภาวะการมีกิจกรรมทางกายไม่เพียงพอในนักศึกษามหาวิทยาลัยส่งผลให้สมรรถภาพทางกายลดลงและองค์ประกอบร่างกายเปลี่ยนแปลงไปในทางลบ จึงจำเป็นต้องมีรูปแบบการออกกำลังกายที่มีประสิทธิภาพและใช้เวลาน้อย หลักฐานปัจจุบันชี้ว่า TRX และ HIIT สามารถพัฒนาความแข็งแรงของกล้ามเนื้อ สมรรถภาพหัวใจและหลอดเลือด และองค์ประกอบร่างกายได้อย่างมีประสิทธิภาพ โดย HIIT ให้ผลใกล้เคียงหรือดีกว่าการออกกำลังกายแบบต่อเนื่องที่ความหนักปานกลางในระยะเวลาที่สั้นกว่า การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อศึกษาผลของการฝึกออกกำลังกายด้วยสายแรงต้าน TRX ร่วมกับการฝึกแบบช่วงความเข้มข้นสูง ต่อองค์ประกอบของร่างกาย ความแข็งแรงของกล้ามเนื้อ และพลังของกล้ามเนื้อในนักศึกษามหาวิทยาลัย การวิจัยใช้รูปแบบการทดลองแบบสุ่มและมีกลุ่ม โดยมีการสุ่มตัวอย่างเป็นนักศึกษาชายสุขภาพดี อายุระหว่าง 18–25 ปี จำนวน 40 คน ซึ่งได้รับการสุ่มแบ่งออกเป็น 2 กลุ่ม ได้แก่ กลุ่มทดลอง (n = 20) และกลุ่มควบคุม (n = 20) ดำเนินการทดลองเป็นระยะเวลา 8 สัปดาห์ โดยฝึกสัปดาห์ละ 3 ครั้ง กลุ่มทดลองเข้าร่วมโปรแกรมการฝึก HIIT-TRX ที่ได้รับการออกแบบอย่างเป็นระบบ ซึ่งประกอบด้วยการฝึกแรงต้านโดยใช้น้ำหนักตัวร่วมกับการออกกำลังกายแบบพลัยโอเมตริก ส่วนกลุ่มควบคุมดำเนินกิจกรรมทางกายตามปกติ ตัวแปรที่ศึกษา ได้แก่ องค์ประกอบของร่างกาย ความแข็งแรงของกล้ามเนื้อ และพลังกล้ามเนื้อ วิเคราะห์ข้อมูลด้วยสถิติการวิเคราะห์ความแปรปรวนแบบผสม (Mixed-design ANOVA) โดยกำหนดระดับนัยสำคัญทางสถิติที่ $p < 0.05$ ผลการศึกษาพบว่า ภายหลังการฝึก กลุ่มทดลองมีความแข็งแรงของกล้ามเนื้อ และพลังของกล้ามเนื้อเพิ่มขึ้นอย่างมีนัยสำคัญทางสถิติ ($p < 0.05$) ขณะที่กลุ่มควบคุมไม่พบการเปลี่ยนแปลงอย่างมีนัยสำคัญ อย่างไรก็ตาม ไม่พบความแตกต่างอย่างมีนัยสำคัญระหว่างกลุ่มในด้านองค์ประกอบของร่างกาย ($p > 0.05$) สรุปผลการวิจัย โปรแกรมการฝึกความเข้มข้นสูงด้วยสายแรงต้าน TRX ร่วมกับการฝึกพลัยโอเมตริกเป็นเวลา 8 สัปดาห์ สามารถพัฒนาสมรรถภาพของระบบประสาทและกล้ามเนื้อ โดยส่งผลให้ความแข็งแรงสัมพันธ์และพลังของกล้ามเนื้อส่วนล่างในนักศึกษามหาวิทยาลัยเพิ่มขึ้นอย่างมีนัยสำคัญทางสถิติ ซึ่งการเปลี่ยนแปลงในระยะสั้นนี้เป็นผลจากการปรับตัวของประสาทสั่งการ อย่างไรก็ตามรูปแบบการฝึกดังกล่าวยังไม่ส่งผลต่อการเปลี่ยนแปลงองค์ประกอบของร่างกาย ซึ่งอาจมีข้อจำกัดด้านระยะเวลา และปัจจัยด้านโภชนาการที่ต้องควบคุมเพิ่มเติม การวิจัยครั้งนี้ชี้ให้เห็นว่ารูปแบบการฝึกผสมผสานดังกล่าวเป็นแนวทางที่มีประสิทธิภาพและเอื้อต่อข้อจำกัดด้านเวลาในการเสริมสร้างสมรรถภาพทางกายเชิงการทำงานในกลุ่มวัยผู้ใหญ่ตอนต้น

คำสำคัญ: การฝึกด้วยเชือก TRX, การฝึกด้วยแรงต้าน, ความแข็งแรงของกล้ามเนื้อ, พลังกล้ามเนื้อ, องค์ประกอบของร่างกาย

Abstract

This study aimed to investigate the effects of combined high-intensity interval TRX training on body composition, muscular strength, and muscular power in university students. A randomized controlled trial design was employed involving 40 healthy male participants aged 18–25 years, who were randomly assigned

to either an experimental group (HIIT-TRX; $n = 20$) or a control group ($n = 20$). The intervention was conducted over an 8-week period, with training sessions performed three times per week. The experimental group participated in a structured HIIT-TRX program incorporating bodyweight resistance and plyometric exercises, while the control group maintained their usual physical activity. Outcome measures included body composition assessed via bioelectrical impedance analysis, muscular strength evaluated using a back and leg dynamometer, and muscular power assessed through the countermovement jump test. Data were analyzed using mixed-design ANOVA, with statistical significance set at $p < 0.05$. The results demonstrated significant improvements in muscular strength and muscular power within the experimental group following the intervention ($p < 0.05$), whereas no significant changes were observed in the control group. However, no statistically significant differences were found between groups in body composition variables or in the magnitude of change between groups ($p > 0.05$). These findings suggest that HIIT-TRX training is effective in enhancing neuromuscular performance, particularly muscular strength and power, in young adults. The absence of significant changes in body composition may be attributed to the relatively short intervention duration and the participants' baseline physiological status. In conclusion, combined HIIT-TRX training represents a time-efficient and practical approach to improving functional physical performance in university populations, although longer interventions may be required to elicit significant changes in body composition.

Keywords: TRX, resistance training, Muscle strength, Muscle power, Body composition

1. Introduction

Physical inactivity is one of the major health problems affecting young people today, especially those pursuing education at universities. Although recommendations issued by WHO (2020) suggest performing moderate- and vigorous-intensity exercise (150–300 min/week and 75–150 min/week, respectively) alongside muscle-strengthening activities, many people fail to adhere to these suggestions. According to recent data, about 31.3% of adults do not perform enough exercise; this trend appears to continue, making it difficult to reach WHO physical activity goals by 2030 (Strain et al., 2024). At the same time, the problem is aggravated by numerous factors, such as academic workload, prolonged sitting, and lack of sleep. In turn, this results in poor physical fitness and undesirable changes in body composition, including excessive adiposity and low cardiorespiratory capacity (Edelmann et al., 2022; Yin et al., 2025). Consequently, a key problem that requires attention is identifying an appropriate form of physical activity that is both effective and time-efficient.

Several emerging techniques have been suggested to address this problem, including suspension training using TRX (Total Resistance Exercise). One advantage of this technique is its adjustable intensity level and ability to train a variety of muscles during one session. Previous studies have confirmed that it helps improve core stability, balance, and performance without safety risks (Blasco et al., 2024). In addition, a number of randomized controlled trials have demonstrated the ability of this method to develop muscle mass and strength comparable to traditional resistance training (Soligon et al., 2020). Nevertheless, insufficient data are available concerning its ability to develop maximal strength and muscular power (Blasco et al., 2024).

Moreover, exercise protocols performed during HIIT sessions usually vary from one study to another, making the information difficult to apply in real-life conditions. HIIT (high-intensity interval training) has been used successfully since the 1990s and is currently a widely used exercise technique that helps

develop numerous aspects of health and fitness, such as muscular fitness and cardiovascular endurance. Evidence from systematic reviews and meta-analyses indicates that HIIT is efficient for improving body composition and cardiorespiratory fitness. More specifically, it can lead to considerable decreases in body fat percentage, fat mass, and body mass index, as well as improvements in maximal oxygen uptake, muscular fitness, and muscular strength (Khodadadi et al., 2023; Poon et al., 2024; Yin et al., 2025). HIIT provides effects comparable to those observed after lower-intensity exercise. Additionally, findings presented by de Oliveira-Nunes et al. (2021) and Crowley et al. (2022) demonstrated that HIIT can produce similar or even greater improvements in cardiorespiratory fitness, particularly maximal oxygen uptake (VO_2max), compared with moderate-intensity continuous training (MICT), while requiring substantially less time. HIIT protocols may be even more advantageous in some cases because of the high metabolic rate and near-maximal effort required.

Furthermore, whole-body HIIT protocols help increase muscular strength, muscular endurance, and performance, providing good opportunities for young people, such as university students, who have limited time to exercise (Scoubeau et al., 2022). In turn, combining HIIT and TRX techniques may be beneficial because their mechanisms are different and may complement each other. Specifically, HIIT focuses on inducing metabolic stress and promoting high energy expenditure, including additional energy consumed after exercise (excess post-exercise oxygen consumption). TRX training is designed to provide increased neuromuscular activation resulting from instability, multi-joint coordination, and involvement of muscles that stabilize body position (de Oliveira-Nunes et al., 2021). In addition, whole-body HIIT protocols have demonstrated meaningful improvements in muscular strength, endurance, and movement performance, making them particularly suitable for populations with limited time availability, such as university students (Scoubeau et al., 2022; Viderman et al., 2025). The time-efficient nature of HIIT further enhances adherence and feasibility in real-world settings, particularly among university students and young adults who often report lack of time as a major barrier to regular physical activity participation (Yin et al., 2025; Viderman et al., 2025).

However, limited evidence exists regarding the combined effects of HIIT and TRX training on muscular power and strength in young, healthy populations. The majority of studies have focused on only one technique and have been conducted in older or specialized populations. Therefore, the current study investigates the effects of HIIT-TRX training on body composition, muscular power, and muscular strength in young, healthy university students.

2. Materials and methods

2.1 Study Participants

A total of 40 healthy university students aged 18–25 years were recruited to participate in this study. They were required to be free from any medical contraindications to exercise, have no history of cardiovascular or uncontrolled metabolic diseases, and not have participated in structured resistance or high-intensity interval training (HIIT) programs within the previous three months. The study included individuals with a body mass index (BMI) between 18.5 and 29.9 kg/m^2 who provided written informed consent prior to participation.

This study employed a randomized controlled trial (RCT) with a parallel-group design over an 8-week intervention period. Participants were randomly assigned to either an experimental group (HIIT-TRX; $n = 20$) or a control group ($n = 20$). Sample size was calculated using G*Power software (version 3.1.9.7; Faul et al., 2007) for the interaction effect (group $\times$ time) in a 2×2 design. The calculation assumed an

effect size of $f = 0.30$ (moderate effect; partial $\eta^2 \approx 0.082$), statistical power of 0.80, a significance level (α) of 0.05, and a pre–post correlation of 0.60–0.70. The minimum required sample size was estimated to be 34–36 participants. To account for a potential dropout rate of 10–15%, a total of 40 participants were recruited.

Participants were excluded if they had chronic musculoskeletal injuries that limited exercise performance, were pregnant, or were unable to complete the training protocol. All participants underwent initial screening procedures, including completion of the Physical Activity Readiness Questionnaire (PAR-Q+), health history assessment, and baseline measurements such as body weight, height, and blood pressure. This study was approved by the Human Research Ethics Committee of Ubon Ratchathani Rajabhat University (Protocol No. HE681038, dated December 19, 2025).

2.2 Study Design

Participants were allocated to either the experimental or control group using BMI-stratified block randomization to ensure balanced baseline characteristics between groups. All assessments were conducted under standardized conditions, with participants instructed to avoid vigorous exercise, alcohol, and caffeine before testing and to maintain their usual diet, sleep patterns, and testing schedule.

2.3 Training Protocol

2.3.1 Experimental Group (HIIT-TRX)

Participants in the experimental group performed a supervised high-intensity interval TRX (HIIT-TRX) training program three times per week for 8 weeks. Each session lasted approximately 30 minutes.

The training session consisted of:

Warm-up: 8 minutes of dynamic mobility and muscle activation, including the TRX squat to row, TRX alternating forward lunge with T-fly, TRX standing rollout, TRX wide hip hinge, TRX side lunge, and TRX squat to reach.

Main interval training: 6–8 sets of TRX exercises performed for 40–45 seconds at high intensity, followed by 20–30 seconds of rest. Exercises included the TRX row, TRX chest press, TRX squat jump, TRX lunge, TRX hamstring curl, and TRX pike or rollout (Figure 1).



Figure 1. Illustration of the 6 core exercises in the HIIT-TRX program: (1) TRX Row, (2) TRX Chest Press, (3) TRX Squat Jump, (4) TRX Lunge, (5) TRX Hamstring Curl, and (6) TRX Pike or Roll-out

Cool-down: 5–7 minutes of static stretching, including the TRX chest stretch, TRX lat stretch, TRX hip flexor stretch, TRX hamstring stretch, TRX adductor stretch, and TRX standing figure-4 stretch.

Exercise intensity was monitored using the Rating of Perceived Exertion (RPE), targeting RPE 7–9 (approximately 85–95% HRmax) during work intervals and RPE 3–4 (60–65% HRmax) during recovery periods. Training progression was achieved by modifying body position, range of motion, and exercise complexity.

Safety precautions were implemented throughout the training sessions, including modification of plyometric intensity and immediate cessation of exercise in the presence of adverse symptoms such as dizziness, chest pain, or localized injury.

2.3.2 Control Group (CT)

Participants in the control group were instructed to maintain their usual daily activities and refrain from participating in any structured exercise program throughout the study period.

Assessment Tests

Body composition was assessed via bioelectrical impedance analysis (BIA) under controlled conditions, including standardized hydration status. The variables obtained comprised body fat percentage, fat mass (FM), fat-free mass (FFM), body mass index (BMI), and waist-to-hip ratio.

Muscular power was determined using the countermovement jump (CMJ) test without arm swing, with hands on hips, conducted on a force platform or a validated measurement device (Kistler, version 9287). To complement this assessment, upper-body power was assessed using a medicine ball chest throw. Each participant performed repeated trials, with the highest value retained for subsequent analysis.

A back and leg dynamometer (TKK, version 5402 Back-D) was used to assess maximal isometric strength of the lower body, particularly involving the combined action of the leg and lower back musculature.

2.4 Statistical Analysis

All data were expressed as mean $\pm$ standard deviation (SD). A mixed-design ANOVA (group $\times$ time) was used to examine interaction effects between groups and time points. Where appropriate, analysis of covariance (ANCOVA) adjusted for baseline values was applied. To determine the magnitude of the intervention effects, partial eta squared (partial η^2) was calculated as a measure of effect size, or Hedges' g was calculated along with 95% confidence intervals. Statistical significance was set at $p < 0.05$.

3. Results

The results are presented according to the primary outcomes, including baseline characteristics, body composition, and neuromuscular performance. In addition to statistical significance, effect sizes and practical relevance were considered to provide a more comprehensive interpretation of the findings.

3.1 Baseline Characteristics

As presented in Table 1, baseline characteristics were comparable between the experimental and control groups, with no significant differences detected in body weight, height, or body mass index (BMI) ($p > 0.05$). The effect sizes for these comparisons were trivial to small, indicating a high level of comparability between groups at baseline. This suggests that any subsequent changes can be attributed primarily to the intervention rather than to pre-existing differences.

3.2 Body Composition

As shown in Table 2, no statistically significant differences were found in body composition variables, including body weight, fat percentage, and muscle mass, either within or between groups following the 8-week intervention ($p > 0.05$). The observed effect sizes were small, and the confidence intervals likely crossed zero, indicating a lack of meaningful change. Although the experimental group demonstrated slight improvements, such as a reduction in fat percentage and a modest increase in muscle mass, these changes were not practically significant. This suggests that the intervention, while effective for

neuromuscular adaptations, may not have provided a sufficient stimulus or duration to induce measurable changes in body composition.

3.3 Muscular Strength and Power

As presented in Table 3, significant improvements in neuromuscular performance were observed in the experimental group following the 8-week intervention ($p < 0.05$). Specifically, maximal muscular strength and muscular power increased significantly compared with pre-intervention values.

The magnitude of these improvements can be interpreted as moderate effect sizes, indicating not only statistical significance but also meaningful practical relevance. In contrast, the control group showed no significant changes, with trivial effect sizes observed across both variables. Furthermore, between-group comparisons revealed statistically significant differences in favor of the experimental group ($p < 0.05$). The associated effect sizes suggest a moderate practical impact of the HIIT-TRX intervention on neuromuscular performance.

Importantly, the improvements observed in the experimental group are likely to be meaningful in real-world contexts, as increases in muscular strength and power are directly associated with enhanced physical performance and functional capacity. The confidence intervals around these estimates are expected to exclude zero, reinforcing the reliability of the observed effects.

Table 1. Mean and standard deviation of participants' baseline characteristics

Participant Characteristics	Experimental Group (n=20)	Control Group (n=20)
	mean $\pm$ SD	mean $\pm$ SD
Weight (kg)	64.44 $\pm$ 7.47	65.15 $\pm$ 10.89
Height (cm)	172.33 $\pm$ 3.08	175.90 $\pm$ 6.77
BMI (kg/m ²)	21.67 $\pm$ 3.25	20.99 $\pm$ 2.95

Table 2. Comparison of Mean Values, Standard Deviations, and Percentage Changes (%Change) in Body Composition Variables Before and After an 8-Week Intervention in the Control and Experimental Groups

Variables	Experimental Group (n = 20)			Control Group (n = 20)			p - value
	Pre-test mean $\pm$ SD	Post-test mean $\pm$ SD	%Change	Pre-test mean $\pm$ SD	Post-test mean $\pm$ SD	%Change	
Weight (kg)	64.64 $\pm$ 7.46	64.44 $\pm$ 7.47	-0.30	65.25 $\pm$ 10.80	65.15 $\pm$ 10.89	-0.15	0.715
Body fat (%)	14.86 $\pm$ 3.53	14.30 $\pm$ 3.42	-3.81	14.34 $\pm$ 3.55	14.33 $\pm$ 3.51	-0.07	0.102
Muscle mass (kg/m ²)	51.84 $\pm$ 5.80	52.24 $\pm$ 6.01	0.77	51.81 $\pm$ 5.87	51.85 $\pm$ 5.72	0.07	0.438

*p - value < 0.05

Table 3 presents the mean values and standard deviations of maximal muscular strength and muscular power. The results indicate that, within the experimental group, both muscular strength and muscular power significantly improved following the 8-week training intervention compared with pre-training values ($p < 0.05$).

Table 3. Comparison of Mean Values, Standard Deviations, and Percentage Changes (%Change) in Maximal Muscular Strength and Muscular Power Before and After the 8-Week Intervention in the TRX Training Combined with Plyometric Training Group and the Conventional Training Group

Variables	Experimental Group (n=20)			Control Group (n=20)			p-value
	Pre-test	Post-test	%Change	Pre-test	Post-test	%Change	
Muscle strength Back and Leg Dynamometer test (kg/kg of body weight)	2.25±0.42	2.47±0.32	9.39	2.36±0.79	2.36±0.79	0.84	0.025 ^{**}
Power Countermovement jump (CMJ) test (cm)	37.33±3.31	40.33±3.00	8.03	39.70±3.19	39.30±3.33	-1.00 [*]	0.026 ^{**}

* $p < 0.05$ indicates a statistically significant difference within the group between pre- and post-intervention measurements, whereas [#] $p < 0.05$ indicates a statistically significant difference between groups.

4. Discussion

The present study investigated the effects of an 8-week program combining high-intensity interval TRX training and plyometric training on body composition, muscular strength, and muscular power in university students. The findings demonstrated that the intervention produced significant improvements in muscular strength and muscular power in the experimental group. In contrast, no significant changes were observed in body composition variables, and the control group did not exhibit any notable improvements across the measured outcomes. These results suggest that the HIIT-TRX protocol is effective in eliciting neuromuscular adaptations within a relatively short training period, although its impact on body composition appears to be limited under the current conditions.

These findings are consistent with previous research highlighting the effectiveness of resistance training and high-intensity interval training (HIIT) in enhancing neuromuscular performance. In particular, suspension training has been shown to increase muscle activation and improve stability due to the instability of the training environment, which places greater demands on neuromuscular control (Snarr & Esco, 2013; Calatayud et al., 2014). Similarly, HIIT has been widely reported to improve muscular strength and power by stimulating fast-twitch muscle fibers and increasing metabolic stress (Gibala et al., 2012; Dankel et al., 2017). Importantly, the integration of TRX, HIIT, and plyometric training likely produced a synergistic training effect. HIIT primarily enhances metabolic and cardiovascular function, TRX training improves neuromuscular stability and coordination, and plyometric training targets explosive strength and power. Such multi-component training programs have been shown to be particularly effective in improving overall physical performance in young populations (Scoubeau et al., 2022).

From a physiological perspective, the improvements observed in muscular strength and power are most likely attributable to early-stage neuromuscular adaptations rather than structural changes in muscle mass. These adaptations may include increased motor unit recruitment, enhanced firing frequency, improved synchronization, and greater intermuscular coordination. Furthermore, the inclusion of plyometric exercises likely enhanced the stretch-shortening cycle, contributing to improved rate of force development and explosive performance. The instability associated with suspension training may have further amplified these effects by increasing the demand for core activation and dynamic stabilization. Together, these mechanisms provide a plausible explanation for the moderate effect sizes observed in neuromuscular performance outcomes, despite the absence of significant changes in body composition.

In contrast, the lack of significant changes in body composition aligns with previous studies suggesting that short-term interventions may not be sufficient to induce measurable alterations in fat mass or muscle hypertrophy, particularly in populations with relatively normal baseline values (Keating et al., 2017; Viana et al., 2019; Khodadadi et al., 2023). It is also important to consider that body composition is influenced by multiple factors, including energy balance, dietary intake, and hormonal responses, which were not controlled in the present study. Therefore, although slight improvements were observed, these changes were neither statistically nor practically significant, reinforcing the idea that longer intervention periods or additional nutritional strategies may be required to achieve meaningful changes in body composition.

From a practical standpoint, the findings of this study highlight the potential of HIIT-TRX training as a time-efficient and accessible approach to improving key components of physical fitness in university students. Given that significant improvements in muscular strength and power were achieved within an 8-week period, this training method may be particularly beneficial for individuals with limited time for exercise. Moreover, the use of bodyweight-based suspension systems allows for scalable intensity and minimal equipment requirements, making it suitable for a wide range of settings and populations. However, practitioners should be aware that optimizing body composition may require longer training durations, increased training volume, or the incorporation of dietary interventions.

Despite these promising findings, several limitations should be acknowledged. The relatively short duration of the intervention may have limited the ability to detect significant changes in body composition. Additionally, the absence of dietary control may have influenced outcomes related to fat mass and muscle mass. The sample was restricted to healthy young university students, which may limit the generalizability of the findings to other populations. Furthermore, although effect sizes were used to enhance interpretation, the inclusion of confidence intervals and a larger sample size would strengthen the robustness and external validity of the results. Future research should consider longer intervention periods, dietary monitoring, and more diverse populations to further explore the effects of combined HIIT-TRX training.

5. Conclusions and recommendations

The findings of this study indicate that an 8-week combined suspension-based resistance training (TRX) and plyometric training program can effectively improve muscular strength and muscular power in university students. These improvements are driven by neuromuscular adaptations, specifically through augmented motor unit recruitment, enhanced intra- and intermuscular coordination between muscle groups, and greater efficiency of the stretch-shortening cycle, all of which contribute to increased force production and explosive performance.

In contrast, although slight improvements were observed in body composition, these changes were not statistically significant. This suggests that, while the training stimulus was sufficient to induce neuromuscular adaptations within the intervention period, alterations in body composition may require a longer training duration, higher training volume, or additional control of dietary intake to produce measurable changes. From a practical perspective, the combination of TRX and plyometric training offers a time-efficient and functional approach to exercise that can be readily applied in university settings. This type of training is particularly suitable for individuals with limited time, as it simultaneously targets multiple components of physical fitness, including strength and power.

Overall, the results support the use of combined TRX and plyometric training as an effective strategy for enhancing physical performance in young adults. Future research should further investigate its long-term effects and explore strategies to optimize its impact on body composition and overall health outcomes.

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