World Scientific Research Journal Volume 11 Issue 4, 2025
ISSN: 2472-3703 DOI: 10.6911/WSRJ.202504_11(4).0004

# Research on Pull-up Training Based on TRX Suspension Training

Jiazhu Ma
Noncommissioned Officer Academy of PAP, Hangzhou 311400, China

## Abstract

**This study aims to explore the intervention effect of TRX suspension training on pull-up performance. By recruiting 30 healthy adult males with no systematic training experience, they were randomly divided into an experimental group (TRX suspension training) and a control group (traditional training) for an 8-week intervention experiment to compare the effects of the two groups after the intervention. The test results showed that the experimental group significantly outperformed the control group in terms of the number of standard pull-ups completed and the qualification rate ($p<0.05$). The research indicates that TRX suspension training can effectively improve pull-up performance by enhancing neuromuscular coordination and eccentric control abilities, providing a scientific basis for breaking through traditional training bottlenecks. It is suggested that TRX be incorporated as an auxiliary training means into strength training programs.**

## Keywords

**TRX suspension training; pull-up; effect; training instruction.**

## 1. INTRODUCTION

The pull-up, as a classic exercise for assessing and enhancing upper body pulling strength, is an important component of the physical training system. However, traditional pull-up training often faces issues such as unstable movement patterns and insufficient eccentric control, making it difficult for beginners to break through strength plateaus or avoid compensatory movements. In recent years, the rise of functional training tools has provided new ideas for strength training, among which the TRX suspension training system, with its unique dynamic instability, has been proven to effectively enhance core stability and neuromuscular coordination. Existing research has mostly focused on the application of TRX in rehabilitation or core training, but its value in specific pull-up training has not been fully explored [1]. Traditional bar pull-ups can develop basic strength but are limited by fixed trajectories and static support, making it difficult to specifically improve movement control deficiencies. Based on this, this study hypothesizes that the open kinetic chain environment provided by TRX suspension training can optimize the pull-up movement pattern, strengthen eccentric muscle control ability, and thus enhance overall training efficiency. To verify this hypothesis, this study designed a controlled experiment to systematically compare the impact of TRX suspension training and traditional training on pull-up performance, aiming to provide empirical evidence for the innovation of strength training methods.Organization of the Text

## 2. DEVELOPMENT OF TRX SUSPENSION TRAINING METHODS

### 2.1. Principles of Training Cycle Design

Firstly, progressively increase training intensity in stages (adaptation phase → advanced phase → intensification phase). Secondly, increase movement difficulty or reduce stable support weekly (e.g., shorten the length of suspension straps, adjust body angles). Thirdly, emphasize

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202504_11(4).0004

eccentric control, core stability, and scapular dynamic coordination. Fourthly, train three times a week, with rest days in between to ensure muscle recovery.

## 2.2. Specific 8-Week Intervention Plan

This study designed an 8-week TRX suspension training program to improve pull-up ability and optimize training effects through a gradual progression. The training cycle is divided into four stages: basic adaptation phase (weeks 1-2), advanced intensification phase (weeks 3-4), strength breakthrough phase (weeks 5-6), and movement integration phase (weeks 7-8).

During the basic adaptation phase, the main goal is to establish TRX movement patterns and activate core muscle groups. Training includes TRX-assisted eccentric pull-ups (body leaning back at 60°, feet supporting, 5-second slow descent), TRX rows (45° incline) (emphasizing scapular retraction, gradually adjusting to a 30° incline), and TRX plank holds (feet suspended, core tightened, preventing lower back sagging). The training intensity is set at 3 sets of 8-10 repetitions, with a rest period of 60-90 seconds between sets.

Entering the advanced intensification phase, the training focus shifts to improving dynamic stability and muscular endurance. It includes TRX single-arm eccentric pull-ups (single arm controls descent for 6-8 seconds, the other arm assists), TRX explosive rows (body incline at 20°, 1-second concentric explosion + 3-second eccentric control), and TRX dynamic core anti-rotation (alternating knee-to-elbow lifts, maintaining trunk stability). The training intensity is increased to 4 sets of 8-12 repetitions, with a rest period of 60-120 seconds between sets. The core goal of the strength breakthrough phase is to simulate standard pull-up movements and reduce assistance. It adopts TRX jump pull-ups (ground push-off for concentric phase, full suspension control for eccentric phase ≥5 seconds), TRX inverted rows (horizontal position) (full rowing movement, scapular full participation), and TRX lateral stability suspension (static maintenance on one-side suspension for 10 seconds). The training volume remains at 3-4 sets of 6-8 repetitions, gradually reducing ground push-off assistance and transitioning to pure upper body force generation.

The focus of the movement integration phase is to bridge to standard pull-ups and improve transferability. Main training includes TRX eccentric-concentric combination training (TRX-assisted 5-second descent during eccentric phase, attempting bar pull-ups during concentric phase with appropriate elastic band assistance), TRX explosive circuit training (TRX jump pull-ups → TRX mountain climbers → TRX plank twists), and simulation testing (once a week, recording maximum pull-up repetitions RM and movement scores). Training emphasizes controlling movement quality, avoiding compensatory movements, and ensuring gradual improvement in the completion rate of standard pull-ups[2].

Throughout the training process, attention should be paid to scapular stability, core tightening, and eccentric control. Training difficulty should be adjusted according to individual adaptation, such as shortening suspension strap length, adjusting body angles, or reducing support. After training, dynamic stretching and foam rolling relaxation are used to promote muscle recovery and reduce injury risk..

## 2.3. Key Intervention Details

To ensure the scientificity and safety of TRX suspension training, in terms of movement standardization, professional coaches supervise subjects' movement patterns throughout the training, requiring subjects to maintain scapular depression and core muscle group tightening to avoid incorrect force generation patterns or potential injuries due to compensatory movements. The design of prioritizing eccentric control runs throughout the entire cycle, with the proportion of eccentric phase duration not less than 60%, such as requiring subjects to descend slowly for 5-8 seconds during the pull-down phase to strengthen muscle endurance and neuromuscular control under tension. After each training session, subjects need to perform

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202504_11(4).0004

TRX suspension static stretching (e.g., latissimus dorsi, biceps brachii suspension stretch) and use a foam roller to relax the upper limbs and back muscle groups to relieve muscle tension and promote waste metabolite removal [3].

### 2.4. Expected Risks and Countermeasures

Shoulder joint pressure may increase due to excessive backward leaning or shoulder hyperextension during suspension training, especially in the initial stages when subjects may have insufficient core strength, leading to compensatory anterior shoulder drawing. Therefore, the intervention plan strictly limits the initial body backward lean angle (≤45°) and includes shoulder rotator cuff muscle activation exercises (e.g., elastic band external rotation, "lucky cat" movements) in the warm-up session to improve shoulder joint stability.

Grip fatigue is another common issue, with prolonged suspension leading to excessive tension in the forearm muscle groups, affecting movement sustainability. Countermeasures include using anti-slip chalk to enhance grip friction and alternately using overhand, underhand, or neutral grips to distribute forearm load. Wrist flexion and extension relaxation exercises (e.g., finger squeeze ball) are arranged during rest periods between sets to delay grip failure.

## 3. EXPERIMENTAL VERIFICATION OF TRX SUSPENSION TRAINING EFFECTIVENESS

### 3.1. Research Subjects and Methods

This study recruited 60 participants with no systematic strength training experience. Subjects were randomly divided into an experimental group (30 subjects) and a control group (30 subjects). The experimental group received TRX suspension training as described earlier, while the control group underwent traditional training focusing on push-ups and hanging bar adaptation in weeks 1-4, transitioning to one-leg-assisted pull-ups and standard pull-ups in weeks 3-4. There were no significant differences in age, height, weight, and baseline strength levels between the two groups ($p>0.05$). Data analysis was performed using SPSS 26.0 software, with independent sample t-tests used to compare post-experimental data.

### 3.2. Discussion

This study found that after an 8-week intervention, the participants in the experimental group demonstrated a significantly higher number of standard pull-ups (6.32±1.21) and a 100% success rate, compared to the control group (4.21±1.01 pull-ups, 66.67% success rate). This validates the advantage of TRX suspension training in enhancing pull-up performance. This outcome can be attributed to the following mechanisms: The TRX suspension system, through an open kinetic chain, forces subjects to continuously adjust their body posture, activating deep stabilizing muscles (such as the rotator cuff muscles and transverse abdominis), thereby optimizing the coordinated control of the scapula and core. The experimental group emphasized a eccentric phase duration accounting for ≥60% (e.g., a slow lowering phase of 5-8 seconds), enhancing eccentric strength reserves by prolonging muscle lengthening time. Previous studies have confirmed that eccentric training can increase the number of sarcomeres in series and tendon stiffness, which may be the key reason why the experimental group significantly outperformed the control group in straight-arm hang time (212.25 seconds versus 195.58 seconds). TRX training simulates the multi-joint linkage requirements of pull-ups (such as scapular retraction and core anti-rotation), whereas traditional training (such as straight bar hangs and single-leg assisted pull-ups) is limited by fixed trajectories, making it difficult to specifically address movement compensation issues [4]. The control group's use of straight bar hangs and single-leg assisted pull-up training, while developing basic strength, is constrained by a static support pattern. In traditional training, subjects rely on lower limb assistance to

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202504_11(4).0004

complete the concentric phase, limiting the extent of scapular retraction. In contrast, TRX rows (horizontal pull) and inverted rows (horizontal position) force the scapula to be fully engaged through dynamic loading, significantly improving the activation efficiency of the latissimus dorsi muscle. Participants in the control group had a higher incidence of lumbar hyperlordosis, whereas the experimental group, through TRX plank and anti-rotation training, strengthened the ability to maintain intra-abdominal pressure, reducing the risk of lumbar compensation. During horizontal bar training, the palms are prone to severe wear and tear, which may hinder participants' continued participation in training. Therefore, effective preventive measures must be taken when teaching horizontal bar pull-ups. During training, overzealous and excessive practice should be avoided to prevent adverse effects on subsequent training [5]. For participants with weaker upper body strength, suspension training can be used in the early stages of training. This approach ensures the necessary training volume while effectively protecting the participants' palms, which is positive for ensuring the smooth progress of training.

## 4. CONCLUSION

This study confirms that TRX suspension training can serve as an effective means of breaking through the plateau in pull-up performance, particularly suitable for beginners with weak strength foundations. By adjusting the length of the suspension straps and the body angle, TRX allows subjects to perform standard movement patterns (such as assisted eccentric phases) under low load, avoiding the force deviations caused by uneven vertical loads in traditional elastic band training.

## REFERENCES


[1] Zhao Huigang. An Empirical Study on the Teaching of Pull-ups in High School: Strategy Innovation and Exploration of Training Methods [J]. Track and Field, 2024, (09): 14-16.

[2] Zhang Yujing, Xu Lijuan, Wang Haidi. Application of Assistant Training in Improving Pull-up Performance [J]. Track and Field, 2024, (05): 79-80.

[3] Pang Ran. A Study on the Effect of TRX Suspension Training on the Core Stability of Aerobic Gymnastics Athletes [J]. Contemporary Sports Technology, 2023, 13(24): 28-31.

[4] Tian Liang, Xu Lei. A Study on the Effect of TRX Suspension Training on Shoulder Joint Stability in Bodybuilding and Fitness [J]. Bulletin of Sports Science and Technology, 2023, 31(06): 275-277.

[5] Cao Yixin, Wang Xiaoqin. Progress in the Application of TRX Suspension Training in the Field of Sports [J]. Cultural and Sporting Goods & Technology, 2023, (01): 123-125.