The Effects of a Training Belt on Performance and Perceptual Outcomes during Explosive Deadlift Exercise

Direct Original Research

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Abstract

Introduction: Training belts are commonly used by competitive and recreational lifters during heavy-load resistance exercise for support. While training belts have been reported to increase intra-abdominal pressure and spine stabilization, it is less clear if training belts influence performance and perceptual measures during explosive deadlift exercise at loads commonly used for hypertrophy training. The purpose of this study was to investigate the effects of a training belt on perceptual and performance measures during explosive dead-lift exercise.

Methods: Resistance-trained individuals participated in a crossover counterbalanced study design with 3 conditions: 1) No TB (NB), 2) Sham belt (SHAM; loose belt), 3) Tight training-belt (TB). Under each condition, participants completed 3 sets of explosive deadlift exercise at 70% 1-RM. Barbell velocity was monitored for each repetitions using a linear position transducer. Rating of perceived exertion (RPE), confidence, and feelings stability were assessed after each set using visual analog scales. Each trial was separated by 48 hours.

Results: Findings show that barbell velocity was significantly higher during the TB condition versus NB (p=0.025) and SHAM (p=0.037). RPE was lower during the TB condition compared to NB (p=0.016). Feelings of confidence (p=0.005) and stability (p=0.007) were higher with the TB condition versus NB.

Conclusions: Results suggest that tight training belts provide ergogenic effects towards explosive deadlift performance at submaximal loads and provide improved perceptions of stability and confidence.

Key Words: Deadlift, Stability, Barbell velocity

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Introduction

Training belts are commonly utilized during resistance exercise by athletes and recreational exercisers, particularly for near maximal loads or exercises which may induce lumbar stress. Wearing a training belt has been shown to increase intra-abdominal pressure during heavy deadlifts, which may impart performance enhancement by increasing spinal stiffness and force transfer [1,2]. Furthermore, training belts have been suggested to improve aspects of trunk biomechanics during near maximal lifting including increased mechanical stabilization and movement efficiency [3]. Training belts have also been shown to potentially improve perceptual responses during heavy lifting, namely decreasing rating of perceived exertion (RPE) [4]. While intriguing, the majority of studies focusing on training belt use have not investigated the effects on explosive ability at sub-maximal loads and other perceptual responses that may be performance limiting (i.e.

confidence, stability) during resistance exercise. Furthermore, it is unknown if the mere presence of a training belt without meaningful compression (i.e. sham or placebo) alters performance similarly. Therefore, the purpose of this study was to investigate the effects of a training belt on explosive ability and perceptual responses during deadlift exercise at submaximal loads. We hypothesized that a tight training belt would improve explosive deadlift performance compared to no belt and a sham belt condition. However, we also hypothesized that the presence of a training belt, both tight and sham belt conditions, would result in improved feelings of confidence and stability versus no belt.

Methods

Study Design

Using a counterbalanced crossover approach, resistance trained individuals (n=11) completed three experimental visits each with a different condition: 1) No belt, 2) Sham belt (SHAM; loose training belt), and 3) Tight training belt (TB). For each visit, participants completed a progressive warm-up followed by a battery of deadlift exercises performed at 70% of their one-repetition maximum (1-RM) with maximum explosive intent. After each set, RPE, feelings of stability, and feelings of confidence were documented. Visits were separated by at least 48 hours and were standardized for time of day (± 1 hour) to mitigate circadian interference on performance.

Participants

A convenience sample of young resistance trained adults (male=7, female=4) were recruited to participate. Descriptive characteristics of participants are shown in Table 1. To be included in the study, participants had to be over the age of 18, resistance trained, experienced at deadlift exercise, and free from injury in the past 6 months. Resistance trained was defined as accruing ≥2 days/week of resistance training [5]. Safety of exercise participation was screened using a physical activity readiness questionnaire (PARQ) [5]. Participants were instructed to refrain from stimulants, pre-workout supplements, nicotine, alcohol, and strenuous exercise 12 hours prior to each visit. Before commencement of data collection, all participants gave written and verbal informed consent. All procedures and study design were approved by the University of Alabama at Birmingham Institutional Review Board (IRB; UAB IRB-300014633; April 2025). Participants were masked to the hypotheses and purpose of conditions during the study.

Table 1. Descriptive characteristics of participants. Data are shown as mean ± SD.

	Total (n=11)	Males (n=7)	Females (n=4)
Age (yrs)	20.9 ± 1.3	21.4 ± 0.9	20.0 ± 1.4
Body mass (kg)	77.1 ± 13.6	83.7 ± 12.4	65.6 ± 6.0
Height (cm)	169.1 ± 11.1	174.2 ± 8.2	160.0 ± 10.0
Training experience (yrs)	5.9 ± 2.5	6.0 ± 3.1	5.75 ±1.5
1-RM (kg)	134.1 ± 50.2	153.5 ± 53.9	100.0 ± 13.0
Relative 1-RM (a.u.)	1.6 ± 0.3	1.7 ± 0.4	1.5 ± 0.1

yrs= years, kg= kilograms, cm=centimeters, a.u.= arbitrary units

Protocol

Prior to the experimental visits, participants completed a progressive warm-up, one-repetition maximum (1-RM), and familiarization visit for deadlift exercise adapted from methods by Ballmann et al. [6-8]. Participants completed the 1-RM protocol without a training belt. For subsequent experimental visits, participants completed 3 sets × 8 repetitions of deadlift exercise at 70% of their previously obtained 1-RM as explosively as possible under the following conditions: 1) NB, 2) SHAM, and 3) TB. Each set was separated by 3 minutes of rest. For the NB condition, participants did not wear a belt during the lift. For the SHAM condition, participants completed exercise with a loose training belt such that the belt provided no meaningful compression and sat on the hips. For the TB condition, participants were instructed to tighten the training belt as tightly as possible within comfort and was positioned to where the buckle of the belt was situated at the middle of the umbilical region [9,10]. Training belts were standardized using the lab-provided training belts. To minimize grip-strength limitations, lab-provided lifting straps/hooks were standardized and used for all sets and conditions. During the deadlift exercises, a linear position transducer (GymAware; Kinetic Performance Technology, ACT, Australia) was attached to the barbell which has been previously validated for measuring velocity during barbell resistance exercise [11,12]. Mean barbell velocity was monitored and averaged for each set for analysis. RPE was documented on a 1-10 scale after each set according to previous investigations [13,14]. Furthermore, feelings of stability and confidence were assessed using a visual analog scale as adapted from previous investigations [15,16]. After each set, participants marked the presence of feelings of confidence or stability on a 100 mm line where 0 indicated the absence of the feeling and 100 denoted extreme feelings perceived. The distance from 0 mm to the marking upon the line was measured using a ruler and used for analysis.

Statistical Analysis

All data were analyzed using open access statistical software (Jamovi v 2.3.28.0) [17]. Data are presented as mean ± standard deviation (SD). Data normality was confirmed using the Shapiro-Wilk method. For all data, a 3 × 3 [condition × set] repeated measures ANOVA was used for analysis. For significant main effects, a Bonferroni-holm post-hoc analysis was used to correct for multiple comparisons and determine potential differences between conditions. Estimates of effect size for main effects were calculated using eta squared (η^2) and interpreted as: 0.01—small; 0.06—medium; ≥0.14—large [18,19]. Significance was set at $p \leq 0.05$ prior to the commencement of data collection.

Results

Mean Velocity and Rating of Perceived Exertion (RPE)

Results of mean velocity (m/s) and RPE (arbitrary units; a.u.) are shown in Figure 1. For mean velocity (Figure 1a), there was a main effect for condition ($p=0.009;\eta^2=0.056$) but not set ($p=0.682;\eta^2=0.001$). No interaction for condition × set was observed ($p=0.131;\eta^2=0.003$). Post-hoc analysis of the main effect for condition showed that mean velocity was significantly higher with the TB condition compared to NB ($p=0.025$) and SHAM ($p=0.037$). No differences were observed for mean velocity between NB and SHAM conditions ($p=0.970$). For RPE (Figure 1b), there was a main effect for condition ($p=0.017;\eta^2=0.075$) and set ($p<0.001;\eta^2=0.103$). There was no interaction for condition × set ($p=0.384;\eta^2=0.004$). Post hoc analysis of condition showed that RPE was lower with TB versus NB ($p=0.016$). No differences in RPE were observed between TB ($p=0.522$) or NB ($p=0.175$) versus SHAM. Furthermore, RPE was significantly lower during set 1 compared to set 2 ($p=0.004$) and set 3 ($p=0.001$). RPE was also lower during set 2 compared to set 3 ($p=0.002$).

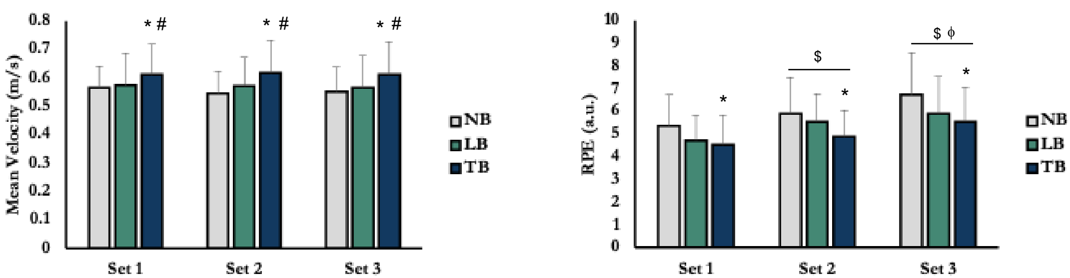

Figure 1. Comparisons of (a) mean velocity (m/s) and (b) rating of perceived exertion (RPE; a.u.) from set-to-set between no belt (NB), loose belt (LB), and tight belt (TB) conditions. * indicates significantly different from NB ($p \leq 0.05$). # indicates significantly different from LB. $ indicates significantly different from set 1 ($p \leq 0.05$). ϕ indicates significantly different from set 2 ($p \leq 0.05$).

Perceptions of Confidence and Stability

Results of confidence (arbitrary units;a.u.) and stability (arbitrary units;a.u.) are shown in Figure 2. For confidence (Figure 2a), there was a main effect for condition ($p=0.001$; $\eta^2=0.154$) but not set ($p=0.294;\eta^2=0.004$). No interaction for condition × set was observed ($p=0.096;\eta^2=0.008$). Post-hoc analysis of the main effect for condition showed that confidence was significantly higher with the TB condition compared to NB ($p=0.005$). No differences were observed for confidence between NB ($p=0.202$) or TB ($p=0.062$) versus the SHAM condition. For stability (Figure 2b), there was a main effect for condition ($p<0.001;\eta^2=0.192$) and set ($p=0.021;\eta^2=0.010$). There was no interaction for condition × set ($p=0.223;\eta^2=0.005$). Post hoc analysis of condition showed that perceptions of stability were higher with TB versus NB ($p=0.007$) and SHAM ($p=0.007$). No differences in stability were observed between NB versus SHAM ($p=0.458$). Furthermore, perceptions of stability were significantly higher during set 1 compared to set 3 ($p=0.038$). There were no differences in stability during set 1 versus set 2 ($p=0.189$) or set 2 versus set 3 ($p=0.215$).

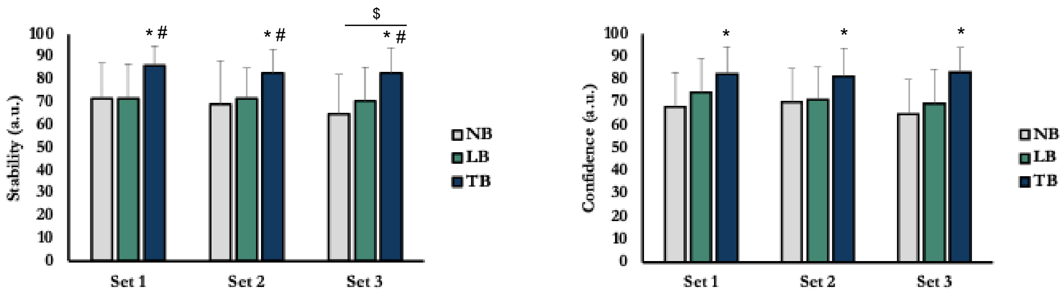

Figure 2. Comparisons of feelings of (a) stability (arbitrary units; a.u.) and (b) confidence (arbitrary units; a.u.) from set-to-set between no belt (NB), loose belt (LB), and tight belt (TB) conditions. * indicates significantly different from NB ($p \leq 0.05$). # indicates significantly different from LB. $ indicates significantly different from set 1 ($p \leq 0.05$).

Discussion

The use of a training belt during heavy load resistance training has been shown to increase intra-abdominal pressure and exercise performance, including during deadlifts [1,2]. However, it is unknown how training belts influence explosive ability and perceptual responses during deadlift exercise at sub-maximal loads commonly used for hypertrophy training. Therefore, the purpose of this study was to provide preliminary evidence on the effects of a training belt on explosive ability and perceptual responses during deadlift exercise. Current findings suggest that a tight training belt provides ergogenic benefits during explosive deadlift exercise as evidenced by increases in mean barbell velocity. Furthermore, TB resulted in decreased RPE, increased confidence, and enhanced feelings of stability during deadlift exercise compared to NB. However, both SHAM and TB conditions resulted in lower RPE and higher confidence levels compared to NB. While underpinning mechanisms are not fully clear from current data alone, these findings support previously reported ergogenic benefits of a TB during deadlift exercise, but some perceptual benefits may be mediated by the presence of a training belt regardless of tightness or compression.

Current findings of improvements in explosive performance during deadlift exercise with a TB support previous investigations [4,20,21]. For example, Fong et al. [4] showed that wearing a TB resulted in positive effects on the kinematics and speed at which deadlift exercise was performed, albeit lifting straps were also used. Furthermore, Chen et al. [22] showed that participants wearing a TB increased participant determination of maximal accepted weight of lift. Veltzke et al. [20] also showed improvements in repetition volume during back squats to exhaustion in resistance trained individuals. Although not currently measured, this supports previous evidence suggesting increases in intra-abdominal pressure and changes in muscle activity with TB. Indeed, use of a training belt has been suggested to increase intra-abdominal pressure during heavy lifts in particular, which likely results in increasing spinal stiffness and force transfer thereby enhancing performance [1,2]. Adaptative changes in trunk muscle activation and decreases in spinal load have also been observed with TB [1,2,23]. Current findings suggest that even at sub-maximal loads, compression from training belts may provide spine stabilization and improve explosive performance during resistance exercise although mechanistic underpinnings are largely uncertain at this point.

Although speculative, the current perceptual findings suggest the possibility that expectation-related effects contributed to some of the responses observed. Placebo effects are driven, at least in part, by conscious expectations about the benefit of an intervention [24]. Perceptions of confidence were higher in the TB condition than in the NB, but confidence in the TB condition did not differ significantly from the SHAM condition. This suggests that simply wearing a belt may have bolstered participants' belief that they were more likely to perform well, regardless of the belt's ability to increase intra-abdominal pressure. Perceptions of stability were more complex. Stability was greater in the TB condition as compared with the SHAM condition, suggesting that belt tightness may matter more for perceived stability. Caution should be taken when interpreting perceived stability, since objective stability was not measured. Interestingly, Veltzke et al. measured stability both objectively and subjectively while wearing a weightlifting belt during a squat exercise and found that wearing a belt improved perceptions of stability but not objective measures of stability [20]. Although the present findings suggest that training belts alters performance, the expectation or possibility of a placebo effect with training belt use is likely and may manifest in changes in confidence.

While the current study provides novel information on training belts, deadlift performance, and perceptual responses to exercise, there were a number of limitations. First, the current study did not survey participants on their regular use of training belts or their beliefs on training belt efficacy in the context of performance. It is possible that participants had pre-conceived notions of the efficacy of training belts thereby modifying their perceptual responses. However, participants were unaware of the study hypotheses or purpose of the conditions. Furthermore, only deadlift exercise was currently used. It is plausible that both objective performance and perceptual responses may vary with other exercises. Thus, current findings may only be applicable to deadlift exercise and not other forms of resistance exercise. Lastly, the tightness of the training belts was not objectively measured. The current data cannot confirm or refute specific details of training belt pressure and the effects on deadlift performance, but only general. Future studies should use more precise measurements of training belt pressure though inflatable cuffs or other technologies to understand threshold pressure levels for performance enhancement and perceptual response benefits.

Conclusions

In conclusion, TB provides ergogenic benefits during explosive deadlift exercise as evidenced by increases in mean barbell velocity. However, a TB provided increased confidence and lower RPE versus NB but was not superior to SHAM in this regard. These findings suggests that while training belt tightness modulates objective measures of explosive performance during deadlift exercise, perceptual responses of confidence and RPE may be modified by the mere presence of a training belt rather than functional compression of the abdomen. Overall, training belt tightness appears to alter performance during deadlift exercise, but "placebo" effects may mediate perceptual effects. Future research should identify what level of compression from training belts is necessary for objective performance enhancement and how beliefs of ergogenic potential of belts modify behavior and responses to exercise.

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Conflict of Interest. The authors declare no conflicts of interest.

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