REVIEW ARTICLE

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Training with elastic and conventional devices on body composition: systematic review and meta-analysis

Treinamento em dispositivos elásticos e convencionais sobre a composição corporal: revisão sistemática e meta-análise

Entrenamiento en dispositivos elásticos y convencionales sobre composición corporal: revisión sistemática y metaanálisis

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Abstract

Introduction: Given the practicality and low cost of elastic devices, a comparison with conventional devices may be able to quantify gains from both tools for further conclusions. **Objective:** Compare the effect of resistance training with elastic (tubes and resistance band) and conventional (weight machines and dumbbells) devices on body composition. **Method:** This is a systematic review and meta-analysis. The PubMed/MEDLINE, Embase, PEDro and CENTRAL databases were searched from the earliest records to July 25, 2018. Data were described in standardized mean difference (SMD) with a 95% confidence interval (95% CI). **Results:** Four studies were

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included. The results of the meta-analysis did not show superiority among the analyzed methods for the variables investigated (SMD = -2.04, 95% CI -7.56, 3.48, p < 0.00001, lean mass: SMD = 0.28, 95% CI -0.29, 0.85, p = 0.97, body fat: SMD = 2.77, 95% CI -0.05, 5.59, p = 0.92, body mass: SMD = 1.22, 95% CI -0.29, 2.74, p = 0.11). **Conclusion:** The results of the meta-analysis showed superiority of outcome from training in conventional devices only for the variable fat mass. For the other variables, no statistically significant differences were found. Elastic resistance can promote similar outcomes to resistance in different population profiles and from various protocols on variables related to body composition.

Keywords: Exercise. Physical Endurance. Body Weight. Physical Therapy Specialty.

Resumo

Introdução: *Tendo em vista a praticidade e o baixo custo dos dispositivos elásticos, uma comparação com dispositivos convencionais (halteres e máquinas de peso) pode ser capaz de quantificar os resultados observados para posteriores conclusões sobre eventual tendência de superioridade verificada entre os métodos investigados.* ***Objetivo:*** *Comparar o efeito do treinamento resistido em dispositivos elásticos (tubos e faixa elástica) e convencionais (máquinas de peso e halteres) sobre a composição corporal.* ***Método:*** *Trata-se de uma revisão sistemática e meta-análise. Foram pesquisadas as bases de dados PubMed/MEDLINE, Embase, PEDro e CENTRAL desde os registros mais antigos até 25 de julho de 2018. Os dados foram descritos em standardized mean difference (SMD) com intervalo de confiança de 95% (95% CI).* ***Resultados:*** *Quatro estudos foram incluídos. Os resultados da meta-análise não demonstraram superioridade entre os métodos analisados para as variáveis investigadas (massa gorda: SMD= -2.04; 95% CI 7.56, 3.48; p < 0.00001; massa magra: SMD = 0.28; 95% CI -0.29, 0.85; p = 0.97; gordura corporal: SMD = 2.77; 95% CI -0.05, 5.59; p = 0.92; massa corporal: SMD = 1.22; 95% CI -0.29, 2.74; p = 0.11).* ***Conclusão:*** *Houve superioridade de resultado apenas para a variável massa gorda, que demonstrou melhores resultados oriundos do treinamento em dispositivos convencionais. Para as demais variáveis, não foram identificadas diferenças estatisticamente significantes. A resistência elástica é capaz de promover desfechos similares a resistência convencional, em diferentes perfis de população e a partir de protocolos diversos sobre variáveis relacionadas a composição corporal.*

Palavras-chave: *Exercício. Resistência Física. Peso Corporal. Fisioterapia.*

Resumen

Introducción: *Debido a la practicidad y el bajo costo de los dispositivos elásticos, una comparación con los dispositivos convencionales (pesas y mancuernas) puede cuantificar los beneficios de ambas herramientas para obtener conclusiones adicionales.* ***Objetivo:*** *Comparar el efecto del entrenamiento de resistencia en dispositivos elásticos (tubos y banda elástica) y convencionales (pesas y mancuernas) en la composición corporal.* ***Método:*** *Esta es una revisión sistemática y metaanálisis. En las bases de datos PubMed/MEDLINE, Embase, PEDro y CENTRAL se buscaron desde los registros más antiguos hasta el 25 de julio de 2018. Los datos se describieron en la diferencia de medias estandarizada (DME) con un intervalo de confianza del 95% (IC del 95%).* ***Resultados:*** *Se incluyeron cuatro estudios. Los resultados del metaanálisis no mostraron una superioridad entre los métodos analizados para las variables investigadas (masa grasa, SMD=-2.04, IC 95% -7.56, 3.48, p < 0,00001, masa magra: SMD = 0.28, IC 95% -0.29, 0.85 , p = 0,97, grasa corporal: SMD = 2,77, IC 95% -0,05, 5,59, p = 0,92, masa corporal: SMD = 1,22, IC 95% -0,29, 2,74, p = 0,11).* ***Conclusión:*** *Hubo una superioridad de los resultados del entrenamiento en dispositivos convencionales solo para la variable masa grasa. Para las otras variables, no se encontraron diferencias estadísticamente significativas. La resistencia elástica es capaz de promover resultados similares a la resistencia convencional en diferentes perfiles de población y de varios protocolos sobre variables relacionadas con la composición corporal.*

Palabras clave: *Ejercicio. Resistencia Física. Peso Corporal. Fisioterapia.*

Introduction

Resistance exercises can be performed in different scenarios, with several implements such as dumbbells, weight machines, exercise balls, body mass and elastic devices [1-3]; and is an essential strategy in physical therapy rehabilitation protocols for any population profile as well as intended outcomes [4-8]. Studies have shown benefits from regular resistance exercise practice on cardiovascular parameters, quality of life, relief of chronic pain, increased functional independence, improved joint mobility, greater independence in daily activities, reduction in the incidence of injuries and self-esteem [9-11].

Despite the described benefits of using conventional devices for resistance training, their use comprise low accessibility conditions [12]. First, places that include such equipment often requires a monthly cost. Second, travel to these locations may be associated with logistical difficulties. Finally, it is worth highlighting the embarrassment that performing activities with other people may cause [13,14]. These factors may influence the dropout of a significant percentage of people who start this type of physical activity, and evidence shows that 50% of the public enrolled in gyms drop out during the first year [15].

In this scenario, an alternative method gaining popularity is the elastic device because of several advantages provided, such as its low cost, portability, accessibility, as well as the functional gains described in the literature [16-24]. Several studies highlight the effectiveness of elastic bands in therapeutic and preventive rehabilitation process under different conditions, in different profiles of healthy and sick population [11-19]. In addition, exercises with elastic devices can occur naturally, in places that provide greater comfort to the user [23].

Among the commonly described outcomes of resistance training, body composition represents an important parameter in disease control, treatment or prevention. This variable has been investigated in studies comparing elastic devices with conventional ones for resistance exercise [16,19], with results showing changes related to decreased fat mass and increased lean mass. A study by Neves et al [25] found that reducing fat mass was responsible for improving functional mobility, agility and motor coordination.

Therefore, considering the published literature on the subject and the benefits of using elastic devices in training protocols, review studies comparing both strategies are relevant to quantitatively measure the magnitude of effects of both methods analyzed on body composition. To the authors' knowledge, this is the first systematic review and meta-analysis on the proposed subject.

It is hypothesized that the outcomes observed between both devices will be similar, serving as a parameter for future discussions regarding the suggestion of protocols that present elastic resistance, to control variables also related to body composition. Thus, this review study aimed to compare the effect of resistance training with elastic (tubes and resistance band) and conventional (weight machines and dumbbells) devices on body composition.

Method

This study was registered in the International Prospective Register of Systematic Reviews (PROSPERO) under protocol CRD42016042152. The Preferred Reporting Items for Systematic Reviews and Meta-Analyzes (PRISMA) guidelines were followed in order to describe all the necessary items for a high quality systematic review and meta-analysis.

Search strategy

Studies were selected from the following databases: PubMed / MEDLINE, PEDro (Physiotherapy Evidence Database), EMBASE, and Cochrane Central Register of Controlled Trials (CENTRAL) from the earliest records to July 25th, 2018. Terms and keywords related to randomized controlled trial, elastic band, and body composition were used. Manual search in the eligible studies list of references was performed as a complement. No restriction on the condition of the sample (age, gender, clinical condition), publication date, or language was stablished for study inclusion.

Study selection

Studies that compared training performed by elastic devices (tubes and resistance bands)

with conventional devices (weight machines and dumbbells) were selected. Inclusion criteria were: 1) randomized clinical trial comparing training performed with elastic resistance and training on weight machines and/or free weights; 2) evaluated body composition as outcome. All types of elastic resistance were eligible for inclusion. The study selection process was conducted in stages (title, abstract and full text) by two independent evaluators.

Data extraction

Relevant information on study characteristics such as design, participant characteristics, description of training protocols for both groups, outcomes assessed, and PEDro scale were extracted from a standardized form (Table 1).

Methodological quality assessment

The included studies were evaluated for their methodological quality by the PEDro scale (0-10). Thus, each study was evaluated for eligibility criteria, random allocation, secret allocation, baseline comparison, subjects, therapists and evaluators blindly, follow-up with less than 15% loss, appropriate treatment according to allocation or intention to treat, intergroup statistical comparisons and measures of precision, and variability. For clinical trials already evaluated, the PEDro scale value contained in the database was used. Methodological quality was not considered an inclusion criterion.

Statistical analysis

Data were analyzed using the Review Manager (RevMan, version 5.3.5), grouped in meta-analysis and reported as standardized mean difference (SMD) with 95% confidence interval (CI).

Results

Study characteristics

The literature search obtained a total of 321 studies after duplicate exclusion, of which 18 were considered eligible after exclusion by title, abstract and full text. Of these, 14 studies were excluded for not comparing training between elastic devices and conventional machines (all compared elastic resistance with control condition). Thus, four articles (Table 1) met the inclusion criteria, comprising 182 individuals aged between 15 and 67 years old. Regarding health aspect, the sample ranged from physically active individuals [6, 16, 26] to individuals with moderate COPD [19]. Publication dates varied between 2008 and 2014. No articles were found in the manual search of the bibliographic references of the review.

The included studies were conducted in different countries, such as Brazil [19], Spain [6, 26] and Australia [16].

The duration of the training protocols used in the included studies ranged from 8 to 12 weeks with frequency of 2 to 3 times per week. The characteristics of the included studies are summarized in Table 1.

Table 1 – Characteristics of the included studies

Study, year	Characteristics of participants	Protocol used	Type of intervention	Outcomes analyzed	Variables analyzed	PEDro Score
Colado et al., 2008	N = 35 women 54.14±2.87 years old	10 weeks (2 sessions/ week)	CR: Weight machine; ER: thera band.	Body composition	Fat mass; Lean mass.	6
Colado et al., 2012	N = 35 women 54.14±2.87 years old	10 weeks (2 sessions/ week)	CR: Weight machine; ER: thera band.	Body composition	Fat mass; Lean mass.	6
Lubans et al., 2010	N = 36 adolescents Age: 15.0±0.7 years old	8 weeks (2 sessions/ week)	CR: Weight machine; ER: elastic tube	Body composition	Lean mass; Fat mass; Total fat; BMI;	7
Ramos et al., 2014	N = 34 patients diagnosed with COPD Average age: 66 years old	8 weeks (3 sessions/ week)	CR: Weight machine; ER: elastic tube	Body composition	Lean mass	8

Note: CR: conventional resistance training; ER: elastic resistance training.

Methodological quality of included studies

The methodological quality assessment of the included studies using the PEDro scale reported an 6.75 average. One study [19] scored 8; one [16] scored 7; and two scored 6 on the scale, if the articles were classified as "moderate quality" [6, 26].

Effects of resistance training and weight resistance on body composition

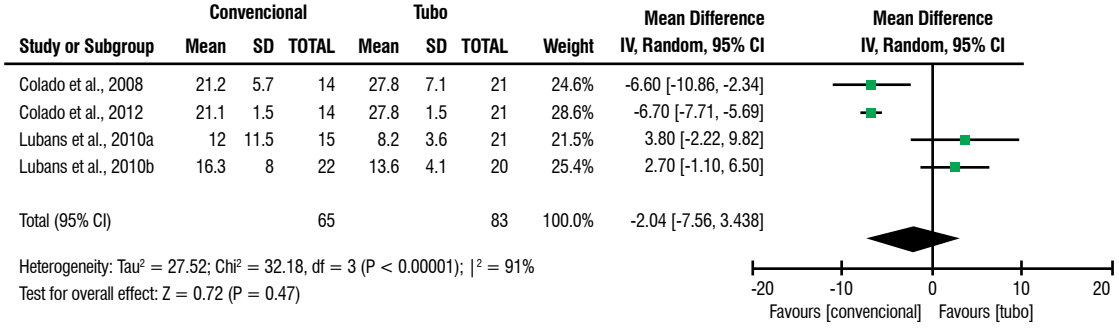
The outcomes analyzed refer to lean mass, fat mass, total body fat and body mass index (BMI).

Regarding fat mass, two studies showed superior results for fat mass reduction from conventional training whereas one study favored training with elastic resistance. A statistically significant difference was also observed, with a higher level of evidence for conventional training (SMD = -2.04; 95% CI -7.56, 3.48; p < 0.00001). The described values are shown in Figure 1.

The four studies favored training performed on elastic devices for the variable lean mass, but there was no statistically significant difference , as observed in Figure 2, with data showing similarity between the analyzed outcomes (SMD = 0.28; 95% CI -0.29, 0.85; p = 0.97).

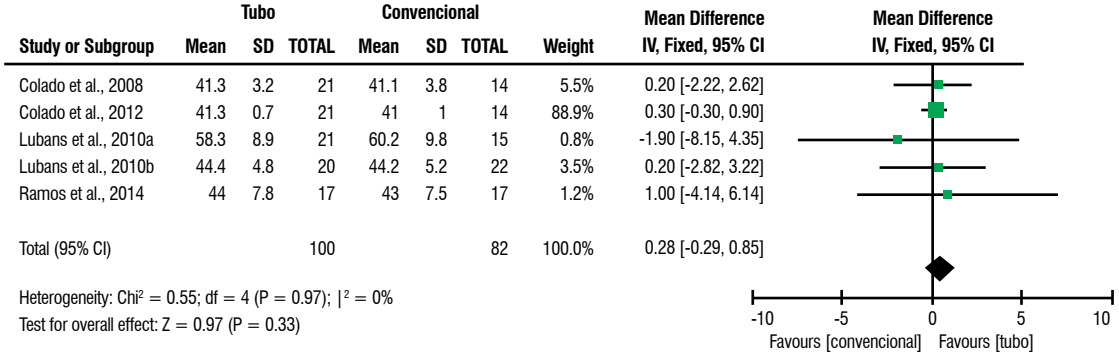
Regarding the total body fat percentage, only Lubans et al. [16] verified this variable. Comparing individuals of both sexes, the study found that training with elastic devices had superior results for both men and women, as shown in Figure 3. However, this data was insufficient to show a statistically significant difference (SMD = 2.77; 95% CI -0.05, 5.59; p = 0.92).

Finally, the analysis regarding body mass index (Figure 4) showed superior results for training with elastic devices, but no statistically significant difference was observed between the groups. This data shows similar results from the analyzed methods regarding physical training with conventional and elastic devices (SMD = 1.22; 95% CI -0.29, 2.74; p = 0.11).



Note: SD: standard deviation; Std: standardized; CI: confidence interval.

Figure 1 – Forest plot illustrating the effect of training with elastic versus conventional devices on fat mass outcome.



Note: SD: standard deviation; Std: standardized; CI: confidence interval.

Figure 2 – Forest plot illustrating the effect of training with elastic versus conventional devices on lean mass outcome.

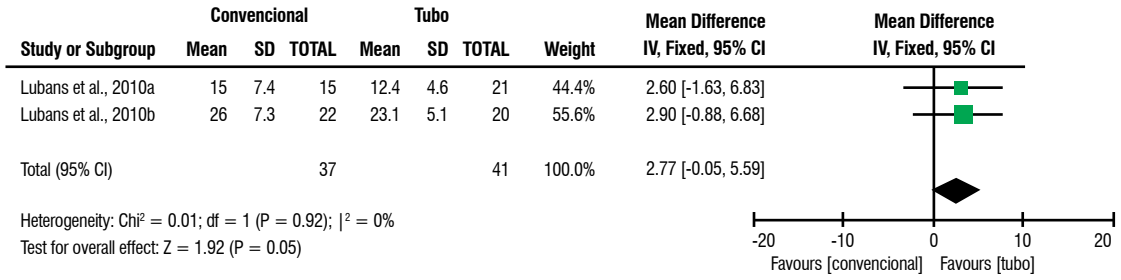
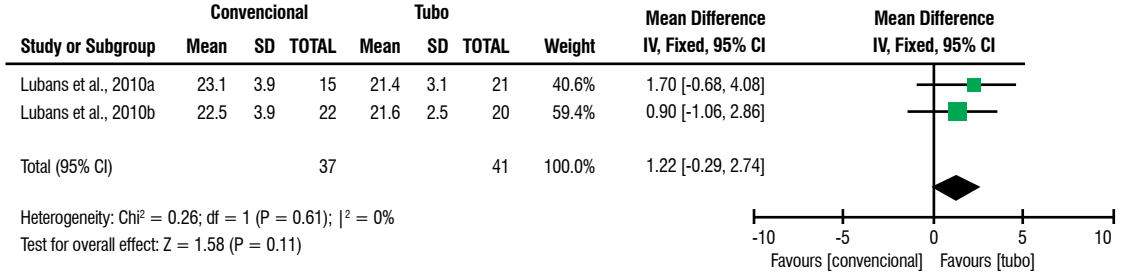


Figure 3 – Forest plot illustrating the effect of training on elastic versus conventional devices on body fat outcome.



Note: SD: standard deviation; Std: standardized; CI: confidence interval.

Figure 4 – Forest plot illustrating the effect of training with elastic versus conventional devices on body mass index (BMI) outcome.

Discussion

This systematic review and meta-analysis showed that resistance training with conventional devices had superior results only for fat mass reduction, where a statistically significant difference was observed. For the other analyzed variables (lean mass, total fat and BMI), no statistically significant differences were found between changes in body composition, based on resistance training in the analyzed devices.

Not defining a population with homogeneous characteristics allowed for holistic perception regarding the analyzed methods and similar conclusions to other studies [16, 19, 23]. Regarding this aspect, a recently published review and meta-analysis [27], when comparing different population profiles, found similar results between conventional and elastic devices for muscle strength gain.

Several studies use body composition analyzes as an important parameter on the effect of therapeutic interventions used in therapeutic and preventive programs [28, 29], to evaluate progress or worsening rates. In this respect, the results of this study provide evidence of an alternative method of practical applications, expanding the characteristics of individuals who may benefit from resistance training with elastic tubes.

Other studies have also found positive results regarding the use of elastic devices in resistance training protocols in different scenarios [18, 30-32]. This fact enhances the possibilities of its use in clinical and scientific contexts, in healthy and sick populations [33-35].

To the authors' knowledge, this is the first systematic review and meta-analysis to investigate the effect of resistance training on body composition comparing elastic and conventional devices. A limitation of this study is the lack of load standardization for elastic resistance training [36-38]. The gaps regarding the standardization of load dynamics and training prescription for this device are notorious.

Strengths of this study are the search strategy used, without restriction of sample or time, and despite the low number of included studies, the PEDro scale was used to ensure its high methodological quality to demonstrate reliable and well-founded scientific results that intend to fill gaps in the literature about the proposed topic.

The findings of this study are relevant for clinical and scientific practice [36-38] in providing important evidence on an alternative method considering low cost and accessibility. Seeing as these results are limited to the investigated populations; new studies should be conducted to stablish the dose response on different intensities and groups.

Conclusion

Data shows superior results for training with conventional devices only for fat mass. For the other variables, no statistically significant differences were found. Elastic resistance can promote similar responses to conventional resistance, in different population profiles and from different protocols, on variables related to body composition.

However, the benefits of this alternative method should the considered, which includes logistical ease, portability and low cost. Moreover, the presented data cannot be extrapolated to population profiles not included in the present study.

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