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SYSTEMATIC REVIEW

Effectiveness of resistance exercise compared to aerobic exercise without insulin therapy in patients with type 2 diabetes mellitus: a meta-analysis

Cybelle Da Silva Nery[a], Silvia Regina Arruda De Moraes[b], Karyne Albino Novaes[a], Márcio Almeida Bezerra[c], Patrícia Verçoza De Castro Silveira[a], Andrea Lemos[a,*]

[a] *Departamento de Fisioterapia, Universidade Federal de Pernambuco (UFPE), Recife, PE, Brazil*
[b] *Departamento de Anatomia, Universidade Federal de Pernambuco (UFPE), Recife, PE, Brazil*
[c] *Departamento de Medicina, Universidade Federal do Ceará (UFC), Rodolfo Teófilo, Ceará, Brazil*

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Abstract
Background: Physical exercise has been used to mitigate the metabolic effects of diabetes mellitus (DM).
Objective: To evaluate the effect of resistance exercise when compared to aerobic exercise without insulin therapy on metabolic and clinical outcomes in patients with type 2 DM.
Methods: Papers were searched on the databases MEDLINE/PubMed, CINAHL, SPORTDiscus, LILACS, and SCIELO, without language or date of publication limits. Clinical trials that compared resistance exercise to aerobic exercise in adults with type 2 DM who did not use insulin therapy were included. The quality of evidence and risk of bias were assessed using the GRADE system and the Cochrane Risk of Bias tool, respectively. Meta-analysis was also used, whenever possible. Two reviewers extracted the data independently. Eight eligible articles were included in this study, with a total of 336 individuals, with a mean age of 48–58 years. The protocols of aerobic and resistance exercise varied in duration from eight to 22 weeks, 30–60 min/day, three to five times/week.
Results: Overall the available evidence came from a very low quality of evidence and there was an increase in VO_{2max} (mean difference: −2.86; 95% CI: −3.90 to −1.81; random effect) for the resistance exercise and no difference was found in HbA1c, BMI, HDL, LDL, triglycerides, and total cholesterol.
Conclusions: Resistance exercise appears to be more effective in promoting an increase in VO_{2max} in protocols longer than 12 weeks and there is no difference in the control of glycemic and lipid levels between the two types of exercise.

* Corresponding author at: Avenida Professor Morais Rego, 1235, Cidade Universitária, CEP 50670-901 Recife, PE, Brazil.
E-mail: andrealemos4@gmail.com (A. Lemos).

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Introduction

Increasing life expectancy associated with a change in lifestyle contributed to the prevalence of chronic degenerative diseases, especially diabetes mellitus (DM). Data from the International Diabetes Federation[1] estimate that more than 387 million people worldwide are diagnosed with this disease and by 2035 this number will rise to 592 million people. About 90% of the population with DM is affected by type 2 form.[1]

The relationship between regular physical activity, a proper diet, and restriction in the use of tobacco and alcohol is being increasingly discussed and scientifically analyzed to improve the quality of life of this population. There is already a consensus that physical activity has positive effects on prevention and/or maintenance of glycemic control and on the cardiovascular risk factors in this type of patient.[2,3]

In this sense, there are systematic reviews that compare resistance exercise versus control and aerobic exercise versus control, highlighting controversies about the benefits provided by each mode.[4–10] One review[10] evaluated the difference between aerobic and resistance exercises in this population; however, the inclusion criteria allowed the entry of papers that used insulin therapy. This fact may have introduced unreliability in the result, as the medication interferes with the patient's response to exercise not only by promoting normalization of glycemic levels but also of all metabolic aspects of diabetes.

Given the above, this systematic review aims to evaluate, through the GRADE system,[11] the quality of the evidence of the published clinical trials investigating the effectiveness of resistance exercise when compared to aerobic exercise on clinical and metabolic outcomes in adults with type 2 DM who did not use insulin therapy during the studies. In addition, this review aims to investigate the prescribed exercise protocols with respect to frequency, intensity, and duration to guide evidence-based practice.

Methods

Data sources and searches

For this systematic review, searches were conducted in the electronic databases MEDLINE/PubMed (1966 – April/2016), CINAHL (1981 – April/2016), SPORTDiscus (1985 – April/2016), LILACS (1986 – April/2016), and SciELO (1998 – April/2016). There were no restrictions to language or time of publication, and the search strategies for each database (presented on the Table of Appendix A) took into account their specific descriptors through the Medical Subject Headings (MeSH), CINAHL Subject Headings, and Health Sciences Descriptors (DeCS). In addition, we screened from the reference lists of the eligible trials.

Study selection

The articles selected for a more specific analysis included randomized controlled clinical trials published as full papers, studies that involved patients with type 2 DM over 19 years old, and articles which compared resistance exercise against aerobic exercise through a structured protocol with detailed description of both modalities.

The following were considered as primary outcomes: long-term glycemic control assessed by glycated hemoglobin (HbA1c) or short-term glycemic control assessed through postprandial or fasting blood glucose (FBG) concentration; cardiorespiratory fitness through maximal oxygen consumption (VO_{2max}); and body mass index (BMI). As secondary outcomes, we considered blood lipid profile [total cholesterol, high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL), triglycerides] and the presence of adverse effects such as episodes of hypoglycemia, muscle fatigue, and mortality.

The following types of documents were excluded: letters, editorials, extended abstracts, studies that included patients with ulceration, skin lesions and/or rheumatic disease, the presence of chronic conditions, as well as patients with gestational diabetes and type 1 DM. Studies which involved prior or on-going insulin therapy, change in the use of corticosteroids, oral hypoglycemic drugs, or any kind of hypoglycemic diet two months before the start of the exercise protocol were also excluded.

Data extraction and quality assessment

The searches, data collection, and content analysis of the selected studies were performed by two independent reviewers (CSN and KA), and the differences were discussed by a third evaluator (SRAM) using an eligibility criteria of a previously established protocol for the elaboration of the systematic review.

The quality of evidence for the outcomes HbA1, VO_{2max}, BMI, total cholesterol, HDL, LDL, and triglycerides was assessed using the GRADE system and presented through the Summary of Findings Table (Table 1). The GRADE proposal classifies the level of evidence as high, moderate, low, or very low considering five factors that can affect the quality of the evidence of the outcomes of a clinical trial: design, risk of bias, inconsistency, indirectness, and imprecision.[11] A review of the evidence for each factor followed the subsequent classification: no (no reduction in points), serious (reduction of 1 point), and very serious (reduction of 2 points),[12] being scored by reviewers according to the interference biases detected in these items.

For the specific GRADE item 'risk of bias', the Cochrane Collaboration's risk of bias tool was used, which takes into consideration the items: randomization, allocation concealment, blinding, loss to follow up, selective outcome reporting, and early stopping of trials. The established guidelines to assess the risk of bias were high, low, or unclear.[13] Risk was considered high when the item was not fulfilled, when the method by which the item was carried out was not reported, or when the method was not valid.[14] Low risk of bias was considered when the item was fulfilled and reported inadequately,[15] and unclear risk of bias when the available information was insufficient for a high or low risk of bias account is made, when information about the conduct was sufficient, but the risk of bias was really unknown, or when the analyzed item did not apply to the study in question.[16]

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