Comparison of Glycemic Behavior between Strength Training, High Intensity Resistance Training (HIRT), High Intensity Interval Training (HIIT): A Case Study

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Abstract

Serum proteins designated as liver function biomarkers are used to evaluate patients for hepatic dysfunction. Type 2 Diabetes Mellitus (DM2) is generally a defect in insulin action and secretion and in the regulation of hepatic glucose production. Exercise to treat type 2 diabetes has had positive impacts on the lives of diabetics. The aim of this study is to analyze the effects of the glycemic curve in three different types of training: Strength Training (TF), High Intensity Resistant Training (HIRT) and Interval High Intensity Training (HIIT). The sample is a 57-year-old, sedentary type 2 diabetic who underwent the training method - Strength Training (TF), High Intensity Resistant Training (HIRT), and High Intensity Interval Training (HIIT) once a week at night. Pre-study anamnesis, pre- and post-exercise glycemia were performed. The overall results were satisfactory presenting HIIT as the most effective method for acute post-exercise blood glucose reduction (reducing 29.62%, 34.25%, 38.89 and 36.11% immediately at 10, 20, 30 minutes after exertion respectively). It was concluded that physical training positively influenced the reduction of blood glucose as an acute effect, but HIIT was the most effective method.

Keywords: Diabetes mellitus • Blood glucose • High intensity • Physical exercise • Glycemia

Introduction

Diabetes mellitus (DM) is a chronic non-communicable disease (NCD) that affects about 425 million adults worldwide (INTERNATIONAL DIABETES FEDERATION, 2019), 90% of diabetics are type 2 (DM2). Guidelines of the Brazilian Diabetes Society (SOCIEDADE BRASILEIRA DE DIABETES, 2019) point out that there are four types of diabetes, Diabetes Mellitus type 1 (DM1), Gestational Diabetes Mellitus (DMG).

Therefore, DM2 is characterized by the fact that insulin unable to perform its functions normally. Evidence suggests that type 2 diabetes can often be prevented, while early diagnosis and access to appropriate care for all types of diabetes can prevent or delay complications in people living with the disease (IDF, 2019) Physical exercise brings several benefits to diabetics, this is due to the improvement in blood glucose uptake, increase in muscle mass, improvement in body composition, biochemical aspects (cholesterol, glycated hemoglobin). Some authors such as Maiorana et al. [1] presente in their study the relationship of glycemic control and physical exercise (circuit combining aerobic and resistance training) in diabetic individuals.

High-intensity interval training (HIIT) refers to training that involves alternating periods between vigorous (intense) exercise and rest or recovery. According to Lanzi et al. [2] HIIT quickly induces adaptations that are linked to improved aerobic fitness and health-related outcomes in sedentary and overweight/obese individuals as it is a growing chronic disease in the world population, further studies on training methods, physical exercise related to chronic diseases, especially DMS, are needed. This article is relevant for comparing and discussing methods that are still little used in DM2 people. The aim of this study is to analyze the effects of the glycemic curve in three different types of training: Strength Training (ST), High Intensity Resistance Training (HIRT) and High Intensity Interval Training (HIIT).

Case Study

In this case study, a type 2 diabetic adult man (C.C.S) was selected, with (Table 1).

After being informed about the objectives and possible risks, benefits and discomforts of the study, the volunteer signed the term informed consent (TIC). This study was approved by the Research Ethics Committee of the Federal University of Goiás (CAAE: 50717115.4.0000.5083).

The volunteer performed three training sessions with a week recovery between each one as described in (Table 2).

Muscle strength measurements were performed using a 10 RM strength testo n the Leg 45° and the bench press [3]. The execution techniques for the Leg 45° and bench press exercises followed the guidelines of the NSCA (National Strength and Conditioning Association) [4].

Exercises protocol

The resistance exercise protocol consisted of three sets at 60% of RM with

| Age (years) | 57 |
| Body Mass (kg) | 83 |
| Height (m) | 1.72 |
| BMI (kg/m2) | 26.2 |
| Ears Diabetics | 32 |

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Table 1. Participant Characteristics.
The HIIT protocol training sessions involved a 5-minute warm-up moderate load – 4 shots of 30 seconds of high intensity duration separated by 4 minutes of rest to light cycling, for a total time of 23 minutes per training session [6].

The HIRT protocol consisted of three sets with six repetitions at 80% of 1RM followed by rest for 20 seconds, the individual performs another series with the same load until reaching the point of failure again. The rest of one exercise and another is 2’30” [7]. Leg press, stiff, bench press, supine pull exercises were used.

**Materials used**

To assess blood glucose, the glucometer (Accu Check Active, mod. 18946, Brazil) was used to measure body mass using na analog scale (Filizola®, mod. Personnal 7708, Brazil) Height was obtained using a stadiometer (Seca®, Brazil) with no accuracy of 0.1 cm, respectively according to the procedures described by Lohman [8]. From the division of body mass by the square of height, the body mass index (BMI) was obtained [9].

**Results**

The behavior of glycemia was observed pre and post effort in ST, HIRT and HIIT training and the material show the results obtained in each of the methods used.

**Discussion**

The aim of this study was to analyze the effects of the glycemic curve in three types of training: ST, HIRT and HIIT, from the evaluations of the three methods, HIIT was the training that had a greater reduction in blood glucose of 38.8% before and after.

The ST showed reductions in post-physical exertion assessments even with a single training session. A study by Castaneda et al. [10], with the objective of verifying the effectiveness of resistance training in the glycemic control of DM2 adults, performed in 16 weeks with 62 adults of both sexes, resulted in the reduction of plasma levels of glycated hemoglobin and increased lean mass.

In this case study, HIRT was not very efficient in reducing post-exercise blood glucose, despite no assessment of the acute effect, but a study by Dunstan et al. [11] for 6 months showed that HIRT was effective in improving other aspects such as muscle strength. Probably this difference between the studies occurred due to the time of training, the first being only one session and the second for 6 months.

The HIIT was the most effective method among the three methods used, with the highest levels of reduction compared to pre-effort, some studies also point out the effectiveness of HIIT in more training sessions and also no assessment over 30 minutes. In the study by Francois et al. [12], it shows that training HIIT for two weeks, with three weekly sessions were effective in reducing the average of 24 hours of blood glucose.

Despite the different data for each training method the three caused changes in blood glucose levels corroborating with the studies previously presented, in which regardless of the method directly influences blood glucose homeostasis, in addition, insulin promotes the uptake of glucose by cells of muscle and adipose tissue, that is, when the individual performs the exercise of the cells increase the uptake of circulating glucose, transforming them into energy that will be used by the muscle and improving glyceric rates and insulin metabolism that is increasing muscle mass, the better the use of glucose and the lesser the use for adipose tissue [13].

As a limitation of the study we had only one sample, short duration and there was no greater control over the eating plan, as this study is a case study and uses only one sample the results are restricted due to the number of individuals evaluated. For future research it is interesting to evaluate a larger number of people to obtain results at a macro level of the Evolution of the disease and how exercise can assist or not in the treatment and control of DM2.

**Conclusion**

With this work it can be concluded that the physical exercise being resisted and the high intensity exercise has a positive effect on the blood glucose of an individual with DM2, promoting the reduction of blood glucose, but this case study showed that HIIT was more beneficial in reducing blood glucose compared to HIRT and strength training.

**References**


11. Dunstan, David, Robin M Daly, Neville Owen and Damien Jolley et al.
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