113 - GLYCAEMIA CONTROL THROUGH MODERATE AND HIGH INTENSITY ACUTE RESISTANCE TRAINING IN DIABETICS

RICARDO AUGUSTO LEONI DE SOUSA[1];
MÁRCIO RABELO MOTA[2];
VICTOR HUGO-MELO[3];
EMERSON PARDONO[4].
1,3,4 - Universidade Federal de Sergipe (UFS),
Departamento de Pós-Graduação em Educação Física, São Cristovão, Sergipe. Brasil.
2 - Centro Universitário de Brasília (Uniceub), Brasília, Distrito Federal, Brasil.
ricardoaugustoleoni@gmail.com

INTRODUCTION

Diabetes mellitus is characterized by high level of glucose in the blood plasma (LIMA et al., 2011). In specific tests glucose tolerance, an increase can reach values of 140 mg/dL in the case of type I and 200 mg/dL in the case of type II at two different points of the test (SCRIVER et al. 1989).

The type II diabetes mellitus (T2DM) has as main feature the insulin resistance (SNEL et al., 2012; LIMA et al., 2011). Metabolic effects of insulin include immediate increase in glucose uptake, improved glucose homeostasis and also in insulin sensitivity, a sensible increase in the oxidative capacity, increased protein synthesis, glycogen and fatty acids (ROPELLE; PAULI; CARVALHEIRA 2005 , ZECCHIN; CARVALHEIRA; SAAD, 2004).

The insulin resistance involves molecular alterations in various points in the intracellular signaling of insulin receptor (IR) and IGF1 (IGF1R) as a reduction in the concentration of kinase activity and receptor concentration and phosphorylation of IRS-1 and -2 , the activity of PI 3-kinase, the translocation of glucose transporters (GLUT's) and the activity of intracellular enzymes. Genetic and acquired factors may influence insulin sensitivity (PEREIRA; FRANCISCHI; JUNIOR, 2003; PINHEIRO et al., 2009; ZECCHIN; CARVALHEIRA; SAAD., 2004; ZIERATH et al., 2002).

When the body is unable to deal adequately with insulin resistance will result in the development of hyperglycemia and diabetes and other microvascular and macrovascular complications (INZUCCHI et al. 2012). This rise in plasma glucose can lead to worsening or emergence of new diseases, where more than 50 are related to diabetes, such as heart failure, dyslipidemia, hypertension, obesity and others (SCRIVER et al., 1989). Several factors underlie the importance of studies of regular physical activity as a factor for control and prevention of some diseases, including the T2DM, considering that exercise can help in modulating glucose (INZUCCHI et al., 2012).

In this sense, It is also included strength training or resistance exercise which is characterized by constant contractions and intermittent voluntary skeletal muscles of a certain section body acting against some external resistance to the body. The possibilities are numerous combinations of the variables of training, the duration and intensity of exercise, as well as the frequency of the activity can provide positive outcomes for individuals with T2DM (CARVALHO et al., 1996; HOWLEY, 2001; ANDRADE; RIBEIRO; CARMO, 2006; PINTO; LUPI; BRENTANO, 2011).

AIM

The objective of this study was to assess whether acute resistance exercise high and moderate intensity would promote acute reduction of blood glucose in patients with T2DM.

MATERIAL AND METHODS

Once approved by the ethics committee of the Federal University of Sergipe, number 387.704, were selected a total of 20 individuals with T2DM and mean age 54 ± 8 years. All signed a consent form authorizing the participation and use of data collected in this study, according to Resolution 196/96 of the National Health Council of Brazil.The subjects were divided into two groups of 10, one of the groups being carried resistance exercise protocol to 60% (D-60) and the other 75% (D-75) of the load. This study was a pilot project.

The maximum load was obtained by testing one repetition maximum (1RM). The participant was entitled to 3 plays. When successfully obtained was added 10% of the load at failure withdrawing the same amount of cargo. The maximum load test was carried out 72 hours before the exercise protocol.

The inclusion criterion was the absence of physical activity or holding less than 150 minutes per week of aerobic activity or failure to hold three days of resistance exercise with moderate intensity, that they had the pathology for at least one year; had glucose levels controlled by metiformine; were not using insulin, not had any complications arising from the T2DM that could hamper the training protocol.

On the test day the participants remained at rest for 30 minutes before the protocol and immediately after it was collected by capillary puncture blood glucose using glucometer brand Accu-Chek Active, Roche.

A 5 minutes stretching session was done and a warm up for the major muscle groups. Six training exercises were performed in the following order: bench press, triceps pulley, rowing, barbell curls, lateral raises and barbell squats.

Data were expressed as mean and standard deviation, and for the statistical analysis we used the Student's t test for paired data (two-tailed) and the normality of the sample was evaluated by the Kolmogorov-Smirnov test. The absolute delta to show the variance between the pre-and post-training was also calculated. The significance adopted was $p < 0,05$.

RESULTS

In group D-60 glucose baseline obtained from the respective mean standard deviation was 127.4 ± 14.59 mg/dL, while the blood glucose after the test was 126.1 ± 12.59 mg/dL, and with a variation of -1.3 ± 2 mg/dL (figure 1). Same kinetics of reduction found in group D-75, but showing significant difference between blood glucose before and after exercise (Figure 1, $p < 0,05$). Basal blood glucose in this group was 134.4 ± 12.03 mg/dL, and after the completion of the protocol was checked a value of 129.1 ± 11.22 mg/dL, presenting a variation of ± -5.3 7.98 mg/dL.

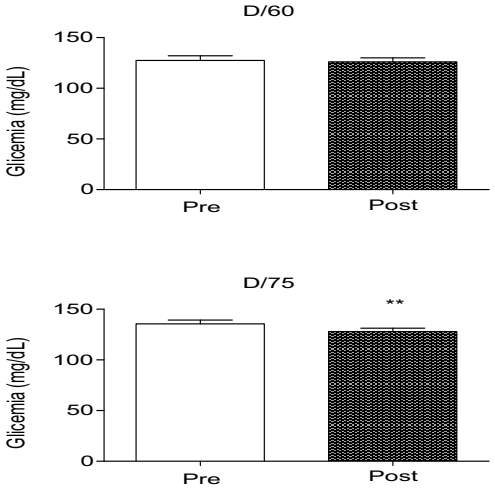

Figure 1. Mean and standard error of glycemia in diabetic groups exercised at 60% and 75% of 1RM. ** p <0.001 when compared posterior to pre-exercise at group D-75.

Figure 2 is a comparison of the acute resistance exercise of moderated to high intensity.

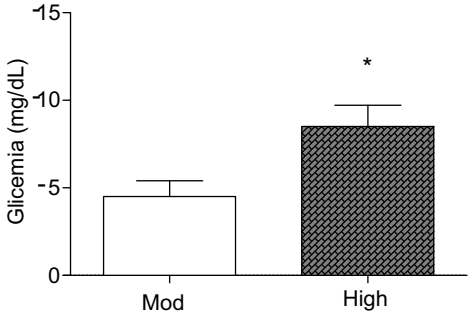

Figure 2.Mean and standard error of the variation of glucose lowering in diabetic groups exercised at 60% and 75% of 1RM when comparing intergroup * p <0,05. High and Mod represent the intensities of exercise where Mod = moderated.

Theacuteresistance exercise done in high intensity presented greater glycemic reductionwhen compared tomoderated(p <0,05).

DISCUSSION

The main result was found that both the acute resistance training in high or moderate intensity decreased blood glucose levels in the post-test, whereas at high intensity had a greater reduction in blood glucose and a significant difference when compared posterior to pre-exercise value (figure 1).Acute resistance training in high intensity also showed better results when compared to moderated (figure 2).

In general, there is a direct relation between physical inactivity and the presence of multiple risk factors such as those found in metabolic syndrome (KNOWLER et. al., 2002). Some studies have reported the association between physical inactivity and obesity and T2DM (GUSTAT et al., 2002; LAKKA et al., 2003).

For the control of obesity and T2DM only through the restriction of food intake occurs, besides weight loss, loss of muscle mass, and therefore there is a reduction of resting metabolic rate, with strong chances of returning to initial weight when arrived at the end of this procedure (ERIKSSON; TAIMELA; KOIVISTO, 1997). Beyondthecontrolof diet, it isreportedthatphysicalexercisewillbenefitpatientswith DM2 (SNEL et al., 2012).Tem sido demonstrado que a prática regular de exercício físico apresenta efeitos benéficos na prevenção e tratamento da hipertensão arterial, resistência à insulina, diabetes, dislipidemia e obesidade (ROPELLE; PAULI; CARVALHEIRA, 2005).

Exercise may help to prevent and fight the process of T2DM , as it increases the resting metabolic rate through the ability to oxidize substrates , the actions of catecholamines released during exercise and stimulation , therefore after exercise , where there will be proteins synthesis, thereby increasing the capitation of glucose (RODEN et al. 2,012 ; TREMBLEY et al. 1988). The aerobic and resistance exercise are different types of exercise and that can contribute to this process.

Resistance exercise is characterized by the exercise load (ANDRADE ; RIBEIRO ; CARMO , 2006) , which may promote better functioning of the biological control of glycemia . The absorption of glucose is increased muscle during exercise is aerobic or resistance , and this is due to an increase in skeletal muscle removal of this and the movement (McCONELLI et al. 2012). Immediately after exercise, insulin acts on the receptor located in the plasma membrane , triggering a cascade of intracellular signals . Thus, there is greater signaling to occur higher uptake and glucose transport favored by exercise (CARVALHEIRA ; ZECCHIN ; SAAD , 2002).

Improved regulation of glycemic status may improve muscle blood flow in patients with heart failure, reduce sympathetic nerve activity, improve the peak transient Ca2 + in cardiomyocytes, increasing ATP production, improve the control of mitochondrial respiration and all that impacts on the fact that exercise improves survival (SILVA; LIMA, 2002).Bigger and better metabolic responses seem to occur in highintensity exercise (PINHEIRO et al., 2009; PINTO; LUPI; BRENTANO, 2011).

CONCLUSION

It is suggested that acute resistance exercise done in high intensity is a better controller of the blood glucose level than the moderated in people with T2DM.

REFERENCES

ANDRADE, P.M.M.; RIBEIRO, B.G.; CARMO, M.G.T. Papel dos lipídios no metabolismo durante o esforço. MN - metabólica - abril/junho;8(2), 2006.

CARVALHEIRA, J.B.C.; ZECCHIN, H.G.; SAAD, M.J.A. Vias de Sinalização da Insulina. Arq Bras Endocrinol Metab;46/4:419-425, 2002.

CARVALHO, C.R; BRENELLI, S.L.; SILVA, A.C.; NUNES, A.L.; VELOSSO, L.A.; SAAD, M.J. Effect of aging on insulin receptor, insulin receptor substrate-1, and phosphatidylinositol 3-kinase in liver and muscle of rats.Endocrinology.137(1):151-9, 1996.

ERIKSSON J.; TAIMELA S.; KOIVISTO V.A. Exercise and the metabolic syndrome.Diabetologia.40:125-35, 1997.

GUSTAT J.; SRINIVASAN S.R.; ELKASABANY A.; BERENSON G.S. Relation of self-rated measuresof physical activity to multiple risk factors of insulin resistance syndrome in young adults: the Bogalusa Heart study. J ClinEpidemiol.55:997-1006, 2002.

HOWLEY, E.T. Type of activity: Resistance, aerobic and leisure versus occupational physical activity. Med and Sci in Sports and Exerc.33, 364-369, 2001.

INZUCCHI, S.E.; BERGENSTAL, R.M.; BUSE, J.B.; DIAMANT, M.; FERRANNINI, E.; NAUCK, M.; PETERS, A.L; TSAPAS, A; WENDER, R; MATTHEWS, D.R. Management of hyperglycaemia in type 2 diabetes: a patient-centered approach. Position statement of the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD).Diabetologia.55:1577–1596, 2012.

KNOWLER, W.C.; BARRET-CONNOR, E.; FOWLER, S.E.; HAMMAN, R.F.; LACHIN, J.M.; WALKER, E.A.; NATHAN, D.M. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. New England Journ Med, v.346, n.6, p. 393-403, 2002.

LAKKA, T.A.; LAAKSONEM, D.E.; LAAKA, H.M.; MANNIKO, N.; NISKANEN, L.K.; RAUMRAMA, A.R. Sedentary life style, poor cardiorespiratory fitness, and the metabolic syndrome. MedSci Sports Exerc.35:1279-86, 2003.

LIMA, D.B.; SANTOS, D.M.; RIBEIRO, L.T.R.; MATOS, S.S.M.; FIORETTO, E.T; ARAGÃO, J.A.; BASTOS, A.A.; BRITO, C.J.; CARVALHO, C.R.O.; RODRIGUES, T.M.A.; SANTOS, M.R.V; AIRES, M.B.; MARÇAL, A.C. Conhecimento dos estudantes do Ensino Médio quanto ao Diabetes na cidade de Itabaiana-Se. ScientiaPlena.v.7, n.7, 2011.

McCONELL, G.K.; RATTIGAN, S.; LEE-YOUNG, R.S.; WADLEY, G.D.W.; MERRY, T.L. Skeletal muscle nitric oxide signaling and exercise: a focus on glucose Metabolism. Articles in PresS. Am J PhysiolEndocrinolMetab, May 1, 2012.

PEREIRA, L.; FRANCISCHI, R.P.; JUNIOR A.H.L. Obesidade: Hábitos Nutricionais, Sedentarismo e Resistência à Insulina. ArqBrasEndocrinolMetab, v. 7, n.2, Abril, 2003.

PINTO, R.S.; LUPI, R.; BRENTANO, M.A. Respostas metabólicas ao treinamento de força: uma ênfase no dispêndio energético. RevBrasCineantroDesemp Humano.13(2):150-157.DOI: 10.5007/1980-0037.2011v13n2p150, 2011.

PINHEIRO C.H.J.; SOUSA FILHO W.M.;OLIVEIRA NETO J.D.; MARINHO M.J.; MOTTA NETO R.; SMITH M.M.; SILVA C.A. Exercise Prevents Cardiometabolic Alterations Induced by Chronic Use of Glucocorticoids. Universidade Federal de Fortaleza, Ceará, 2009.

RODEN M. Exercise in type 2 diabetes: to resist or to endure? Diabetologia55:1235–1239, 2012. DOI 10.1007/s00125-012-2513-5, 2012.

ROPELLE, E.R.; PAULI, J.R.; CARVALHEIRA, J.B.C. Efeitos moleculares do exercício físico sobre as vias de sinalização insulínica.Rev Motriz. Rio Claro, v.11 n.1 p. 49-55, jan, abr, 2005.

TREMBLAY, A.; NADEAU, A.; FOURNIER, G.; BOUCHARD, C. Effect of a three-day interruption of exercise training on resting metabolic rate and glucose-induced thermogenesis in trained individuals. Int J Obes, 12:163-8, 1988.

SILVA, C. A; LIMA W. C. Efeito Benéfico do Exercício Físico no Controle Metabólico do Diabete Mellitus Tipo 2 à Curto Prazo. ArqBrasEndocrinolMetab. v.46, n.05, Outubro, 2002.

SCRIVER, C.R; STANBURY, J. B; WYNGAARDEN, J. B; FREDRICKSON, D. S.The metabolic and molecular bases of inherited disease.Seventh edition,ISBN 0-07-909826-6, 1989.

SNEL, M.; GASTALDELLI, A.; OUWENS, D. M.; HESSELINK, M.K.C.; SCHAART, G.; BUZZIGOLI, E.; FRO¨LICH, M.; ROMIJN, J.A..; PIJL, H.; MEINDERS, A.E.; and JAZET, I.M. Effects of Adding Exercise to a 16-Week Very Low-Calorie Diet in Obese, Insulin-Dependent Type 2 Diabetes Mellitus Patients. J ClinEndocrinolMetab, 97(7):0000–0000, July, 2012.

ZECCHIN, HG; CARVALHEIRA, JBC; SAAD, MJA. Mecanismos Moleculares de Resistência à Insulina na Síndrome Metabólica. Rev. Soc. Cardiol. Estado de São Paulo, 4: 574-89, 2004.

ZIERATH, JR. Exercise training-induced changes in insulin signaling in skeletal muscle. Appl. Physiol93:773-781, 2002.

Rua Antonio José dos Santos. N 03.Cond. Bouganville Residence.Bl A. AP 306.
Jabotiana. São Cristovão – Sergipe. Brasil. CEP: 49.100-000.
ricardoaugustoleoni@gmail.com

GLYCAEMIA CONTROL THROUGH MODERATE AND HIGH INTENSITY ACUTE RESISTANCE TRAINING IN DIABETICS

ABSTRACT

Introduction: Diabetes is a world health problem and physical exercise can help at the treatment of it.Aim: The aim of this study was to evaluate if patients with diabetes mellitus type 2 (DM2) are able to reduce the blood glucose level after acute resistance training in high and moderate intensity. Methodology: A total of 20 male patients with DM2 were selected, 10 to each group, and with age between 54±8 years. One of the groups did the training protocol at a 60% (D-60) and the other at 75% (D-75) of the maximum load.Blood glucose was checked by capilaris using a glucose meter of the brand Accu-chek Active-Roche 30 minutes prior to the exercise protocol and right after the training. It was calculated the mean, standard deviation, standard error, and absolute delta to show the variance between before and after training. Kolmogorov-Smirnov was done to check the normality of the sample. Student T test was done. It was adopted $p<0,05$. Results: In group D-60 blood glucose level before training was 127,4±14,59 mg/dL and after 126,1±12,59 mg/dL, variation of -1,3±2 mg/dL. At D-75 the blood glucose before the exercise was 134,4±12,03 mg/dL and after 129,1±11,22 mg/dL, with a variation of -5,3±7,98 mg/dL. There was significative difference between

before and after the protocol training just in group D-75 (p<0,001). Theacuteresistance exercise done in high intensity presented greater glycemic reductionwhen compared tomoderated(p <0,05).Conclusion: High intensity acute resistance training is a better controller of blood glucose in people with DM2.

KEYWORDS: diabetes mellitus, blood glucose, resistance training.

LE CONTROLE DU GLUCOSE SANGUIN A TRAVERS DE EXERCICE WEATHERED AIGUË INTENSITÉ MODÉRÉE ET ELÉVÉE IN LES DIABÉTIQUES

RÉSUMÉ

Introduction: Le diabète est un problème de santé mondial et l'exercice physique peut aider dans le traitement.Objectif: L'objectif de cette étude était d'évaluer si les patients avec diabète de type 2 (DT2) réduisent le taux de glycémie après un exercise de résistance aiguë et d'intensité élevée et modérée. Méthodologie: Nous avons sélectionné un total de 20 patients masculins avec DM2, séparés en un montant de dix dans chaque groupe, avec des âges allant de 54 ± 8 ans. L'undesgroupes a réaliséle protocole de d'entraînement à 60 % (D- 60) et l'autre à 75% (D 75) de la charge maximale. La charge maximaleaétéévaluée en testantunerépétitionmaximale (1RM). Le participant a droit à troistentatives. Encas de succès 10% de la charge étaitajouté et encas d'échecétaitréduitdumêmemontant . Le test de charge maximale a étéeffectué3jours avant le protocole de entraînement . Étirementet d'échauffementontétéadministrés pendant 5 minutes chacunafin de préparerlesgrandsgroupesmusculaires de l'activité à développer. Le protocole de entraînement se composait de 6exercices. Le critère d'inclusionétaitl'absence ou la pratique non-régulière de l'activitéphysique; qu'ilsavaient DT2 pendant aumoinsunan et que lesniveaux de glucose étaitcontrôlés par lametformine , unmédicamentpourcontrôlerlediabète , qui n'utilisepasl'insuline externe, qui n'avaitpas de complicationsquiinterfèrentdanslaformationengénéral . Nousavonsrecueillidu glucose à l'aide d'unglucomètreautopiqueur marque Accu-Chek Active Roche danslespériodes de repos , 30 minutes avant et immédiatementaprèsl'entraînement. Nousavonscalculélamoyenne , écart-type , erreur standard et le delta absolupourmontrerl'écart entre lepré et post-entraînement, nousavonstenutest de Kolmogorov- Smirnovpourlanormalité et appliquéau T -testéchantillon; p < 0,05 a étéadopté. Résultats: Danslegroupe D-60 pourletaux de glycémiepré- exerciceétait 127,4 ± 14,59 mg / dL et aprèsétait 126,1 ± 12,59 mg / dL , lagamme -1.3 ± 2 mg / dL. Dans le D- 75 avantl'exerciceglycémieétait 134,4 ± 12,03 mg / dL et après 129,1 ± 11,22 mg / dL , la gamme -5.3 ± 7,98 mg / dL. Il y avait de différencesignificative entre pré et post- protocole groupe D- 75 (p < 0,001). L'exercice de la résistance aiguë fait à haute intensité a montré une plus grande réduction de la glycémie par rapport à modérée (p <0,05).Conclusion:La formation de résistance aiguë à haute intensité est un meilleur régulateur de la glycémie chez les personnes atteintes de Dt2.

MOTS-CLÉS: diabète mellitus,glycémie, l'exercice de larésistance.

CONTROL DE GLUCOSA DE SANGRE ATRAVÉSDEL EJERCICIO AGUDO DE RESISTENCIADE INTENSIDAD MODERADAY ALTA EN DIABÉTICOS

RESUMEN

Introducción: La diabetes es un problema de salud mundial y el ejercicio físico puede ayudar en el tratamiento.Objetivo: El objetivo de este estudio fue evaluar si los pacientes con diabetes mellitus tipo 2 (DM2) reducir la tasa de glucemia después de la intensidad del ejercicio de resistencia agudo de alto y moderado. Metodología: Se seleccionaron un total de 20 pacientes varones con DM2, separar la cantidad de diez para cada grupo , con edades comprendidas entre 54 ± 8 años. Uno de los grupos he hecho y 60 % (D - 60) y el otro 75 % (D - 75) de la carga. Se recogió para la glucosa con un glucómetro marca Accu - Chek Active, Roche en los períodos de descanso, 30 minutos antes e inmediatamente después del entrenamiento. Se calculó la media, desviación estándar, error estándar y el delta absoluta para mostrar la diferencia entre el pre y post-entrenamiento. Celebrada la prueba de Kolmogorov- Smirnov para la normalidad y se aplicó a la muestra de T -test. Se fijó en p< 0,05.Resultados: En el grupo D - 60 a la pre - ejercicio tasa glucémico fue 127,4±14,59 mg/dl y después fue 126,1±12,59 mg/dl, rango de -1,3±2 mg/dl. En la D-75 antes del ejercicio de glucosa en sangre fue 134,4±12,03 mg/dl y después de 129,1±11,22 mg/dl, rango -5,3±7,98 mg/dl. Hubo diferencia significativa entre el pre y el grupo post- protocolo del grupo D- 75 (p <0,001). El ejercicio de resistencia agudo hecho a alta intensidad mostró una mayor reducción de glucosa en la sangre en comparación a moderado (p <0,05).Conclusión: El ejercicio agudo de alta intensidad es mejor modelador de la glucosadesangre en personas con Dm2.

PALABRAS CLAVE: diabetes mellitus, glucosa, ejercicio de resistencia.

CONTROLE DA GLICEMIA ATRAVÉS DE EXERCÍCIOS RESISTIDOS AGUDOS DE MODERADA E ALTA INTENSIDADE EM DIABÉTICOS

RESUMO

Introdução: Diabetes é um problema mundial de saúde e o exercício físico pode ajudar no tratamento. Objetivo: O objetivo deste estudo foi avaliar se os portadores de diabetes mellitus tipo 2 (DM2) reduzem a taxa glicêmica após exercício resistido agudo de intensidade alta e moderada. Metodologia: Foram selecionados um total de 20 pacientes homens portadores de DM2, separados na quantidade de dez para cada grupo, e com idade variando entre 54±8 anos. Um dos grupos realizou o protocolo de treinamento a 60% (D-60) e o outro a 75% (D-75) da carga máxima. Foi coletada a glicemia por punção capilar utilizando um glicosímetro da marca Accu-chek Active-Roche nos tempos de repouso, 30 minutos antes, e imediatamente após o treino. Foi calculado a média, o desvio padrão, o erro padrão e o delta absoluto para mostrar a variância entre os valores pré e pós-treino. Realizou-se Kolmogorov-Smirnov para a normalidade da amostra e aplicado o teste T de Student. Foi adotado p<0,05. Resultados: No grupo D-60 a taxa glicêmica pré-exercício foi 127,4±14,59 mg/dL e após foi 126,1±12,59 mg/dL, variação de -1,3±2 mg/dL. Já no D-75 a glicemia pré-exercício foi 134,4±12,03 mg/dL e após 129,1±11,22 mg/dL, variação de -5,3±7,98 mg/dL. Houve diferença significativa entre o pré e pós-protocolo no grupo D-75 (p<0,001). Conclusão: O exercício resistido agudo de alta intensidade é melhor modelador da glicemia que o moderado em pessoas com DM2.

PALAVRAS-CHAVE:diabetes mellitus, glicemia, exercício resistido.