30 - EFFECT OF SUPPLEMENTATION WITH CAFFEINE ON GLICEMIC LEVELS IN TYPE EXPERIMENTAL 2 DIABETES

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INTRODUCTION

The ergogenic nutritional supplements are those that can promote increased physical performance beyond the physiological capacity and have a thermogenic action in the body, or that promotes an incresing in the temperatura body. This causes increase basal metabolic rate and consequently contribute to weight loss and body fat (SAHLIN, 2014). In this sense, individuals with diseases that when practicing physical activity, have their needs increased considerably due to the conditions of disease the most peculiar energy expenditure. As for lipolytic supplements, trying to promote greater stimulus to lipolysis, many supplements are used for this purpose such as caffeine and guarana. Caffeine acts directly on beta-adrenergic receptors by promoting greater stimulation of lipolysis, or the breakdown of lipid reserves. Other metabolic responses, among them an increased heart rate and increased exercise tolerance. In excess, caffeine can promote greater cardiovascular risk factor, with increased exercise tolerance and cardiac overload becomes even more aggressive and dangerous (SUNIL, 2012).

The prevalence of diabetes is increasing in the worldwide, becoming the epidemic now as a result of aging. (ADA, 2004). However, physical inactivity, poor diet and rising obesity rates are also responsible for the global expansion of diabetes. Hospitalizations attributable to diabetes mellitus represent 9% of hospital expenses of the Health System. Diabetes type 2 or non-insulin dependent or adult onset diabetes and accounts for 90% of diabetes cases. Usually occurs in obese people over 40 years old and currently more frequently in young people, due to bad eating habits, physical inactivity and stress (DSBD, 2014). In this type of diabetes, is the presence of insulin, but its action is hampered by obesity, which is known as insulin resistance, one of the causes of hyperglycemia. Since symptomatic diabetes, genetrally remains for many years without diagnosis and treatment which favors the occurrence of complications in the heart and brain (ADA, 2004).

Thus, weight reduction and improved body aesthetics has often been used as food supplements, popularly considered safe, less invasive and inexpensive, when compared to other methods.However, the biological activity and scientific validation of these supplements still needs for his clinical studies about its thermogenic benefits evidence, thus putting into question the effectiveness of these substances.Furthermore, there is no evidence that these substências promote the reduction of body fat levels and may even promote the health risks and weight maintenance after use. Therefore, should be further evaluated the effects of such supplements for better information to health professionals involved in the prescribing of these food resources, especially for patients with chronic diseases (SAHLIN, 2014).

The objective of this study was to evaluate the effect of supplementation with a thermogenic substance, caffeine, on the glycemic levels in diabetic animals.

MATERIALS AND METHODS

ANIMALS

38 Wistar rats were used (weighing 216-258 g), 14 and 24 normoglycemic diabetics, from the Central Animal Facility of the State University of Maringa. The animals were kept in light / dark cycle (12 hours) with food and water ad libitum.

INDUCTION OF DIABETES

Diabetes mellitus was induced in newborn males (2 days old, weighing from 8 to 10 g) male Wistar rats with bolus injection of STZ (160 mg / kg, ip) dissolved in citrate buffer (10 mM, pH 4.5). The control rats were injected with the same volume of citrate buffer.

CAGE METABOLIC

The animals were placed in individual metabolic cages for 12 hours with known volume delivery of water during the 12 hour period, providing the known quantities ation Nuvilabdurante períodonoturno 12 hours, after 12 hours was determined by animal weight in grams the volume of water ingested, the amount of food consumed and the diuresis and was coletadode 10μL sample of urine for dosing glucosuria by spectrophotometry.

TREATMENT

Caffeine was commercially obtained by Dermatologic compounding pharmacy. The animals were divided into four groups: Group I - Diabetics (no treatment), group II - control (non-diabetic); group III - 250 mg / kg caffeine; Group IV - Caffeine 500 mg / kg. All drugs were orally administered according to their weights.

GTT TEST

After the animals are removed from the metabolic cage was collected syrup 20μL of blood from each animal for blood glucose levels. The spray of the animals were seared and performed treatment with caffeine. One hour after a loading of 0.5g / kg of glucose was administered after 30 minutes and 60 minutes was collected from the tail blood of 20μL for blood glucose levels.

STRENGTHS BIOCHEMICAL

After the GTT test the animals were anesthetized to collect blood from the vena cava and then killed. The blood was placed in falcon tubes and centrifuged type. Foiretirado plasma to the dosage of AST and ALT.

RESULTS AND DISCUSSION

Thirty-eight Wistar male rats, 14 normoglycemic (N) and 24 diabetic (D) were used. D animals showed a significant reduction in initial body weight (PI): D: 214.6 + 10,3g; N: 237.3 + 3.5g. Figure 1 shows the results obtained after the housing animals in metabolic cages. Food consumption, water consumption, urine volume and glucosuria were analyzed. No change in

food consumption in D (30.3 ± 0.9) and N (31.6 + 1.0) were observed in comparision with all groups There was no significant change in water consumption for animals D (52.1 ± 3.6) when compared to N (48.3 +2.4); urinary volume: D: 4.0 + 1.1; N: 4.5 + 1.6); and glycosuria animals: D: + 2.0 and 20.3 N: 17.5 + 3.4. The results obtained for the characterization of the diabetic state of these animals have demonstrated a compensated diabetes, as already described by Arulmozhi ET AL. (2004).

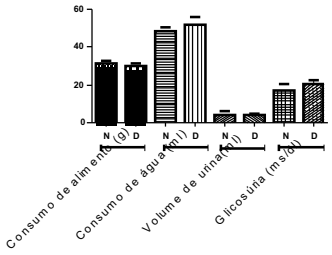

Figure 1 - Characterization of the diabetic state in streptozotocin treated and untreated animals. N = normoglycemic; D = diabetic.

The test oral glucose tolerance test (GTT) is used in the diagnosis of type 2 diabetes. Figure 4 shows the data relating to blood glucose concentration at time zero (baseline), 30 to 60 minutes after the oral administration of glucose. Time zero: N: 93.2 +1.0 mg / dL; D: 85.2 ± 3.1; D + Caffeine 250 g / kg: 92.4 + 2,6mg / dL; D + Caffeine 500 g / kg, 97.6 ± 4.6 mg / dL. Time 30 min .: C: 181.9 + 9.9 mg / dl; D: +9.6 155.5 mg / dL; D + Caffeine 250 g / kg: +34.0 226.0 mg / dL; D + Caffeine 500 g / kg: 285.8 +11.6 mg / dL. Time 60 min .: C: 172.4 + 16,7mg / dL; D: 121.1 + 6.0 mg / dl; D + Caffeine 250 g / kg: 274.7 + 9.1 mg / dl; D + Caffeine 500 g / kg: 327.6 + 0.1 mg / dL. Our results have shown that caffeine causes an increase in blood glucose during the GTT test, demonstrating that this substance presents hyperglycemic effect in diabetic animals.It is not described in the literature the exact mechanism of this change, however regulatory mechanisms involving hormones, such as cortisol, glucagon and insulin can not be discarded.

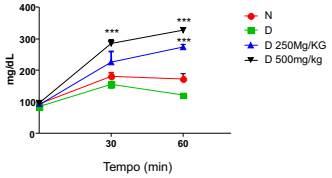

FIGURE 2 - Test glucose tolerance in normoglycemic animals either treated or untreated diabetics with caffeine.

To verify the acute toxicity of caffeine treatment, as were high doses, by determining liver function transaminases ALT and AST in both groups was assessed. There was no significant difference in the levels of ALT, for the group N animals treated with 250 mg caffeine / kg (54, 6 + 3.0 U / L) and D (49.4 + 1.5 U / l). Caffeine treatment at a dose of 500 mg / kg: C: 296.5 + 82.8 U / l; Diabetic animals treated with this ergogenic died, demonstrating the hepatotoxicity effect of this substance in the diabetic animals. The untreated diabetic group had ALT values of 44,1+ 3.1 U / l. In the evaluation of AST, the values of t N caffeine treated with 250 mg / kg was 144.1 + 6.7 U / l and group D: 166,0+ 6.3 U / l. In group D treated with caffeine 500 mg / kg values were 134.4 + 46.2 U / l. Group D showed AST value of 148.9 ± 13.9 U / l. Taken together the results, we observed that the determination of transaminases showed that there is a significant hepatotoxicity in animals induced diabetic.

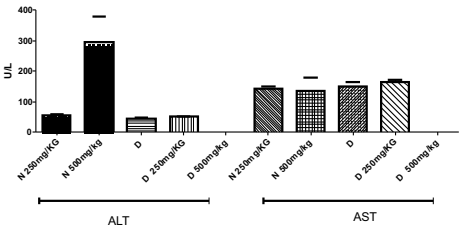

Figure 3 – Transaminases determination (ALT and AST) in normoglycemic and diabetics rats treated or untreated with caffeine.

CONCLUSION

Our results indicate that supplementation with caffeine, a thermogenic substance, often used in physical activities and exercises induces a state of hyperglycemia in diabetic animals. This prescription and use should be controlled diabetic patients. Clinical trials should be conducted to confirm this effect.

REFERENCES

AMERICAN DIABETES ASSOCIATION (ADA). Nutrition recommendations and interventions for diabetes. a position statement of the american diabetes association. Diabetes Care, [S.l.], v. 30, p. 48-65, jan. 2007.

DIRETRIZES DA SOCIEDADE BRASILEIRA DE DIABETES: 2013-2014/Sociedade Brasileira de Diabetes; [organização José Egidio Paulo de Oliveira, Sérgio Vencio]. – São Paulo: AC Farmacêutica, 2014.

D. K. ARULMOZHI, A. VEERANJANEYULU, AND S. L. BODHANKAR, "Neonatal streptozotocin-induced rat model of type 2 diabetes mellitus: a glance," Indian Journal of Pharmacology, vol. 36, no. 4, pp. 217–221, 2004.

K SAHLIN. Muscle Energetics During Explosive Activities and Potential Effects of Nutrition and Training. Sports Med, 2014

SUNIL K. PANCHAL, WENG-YEW WONG, KATE KAUTER, LEIGH C. WARD, LINDSAY BROWN. Caffeine

attenuates metabolic syndrome in diet-induced obese rats. Basic nutritional investigation. 2012

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EFFECT OF SUPPLEMENTATION WITH CAFFEINE ON GLICEMIC LEVELS IN TYPE EXPERIMENTAL 2 DIABETES

ABSTRACT

The prevalence of diabetes is increasing worldwide, becoming the epidemic now as a result, largely, of aging. However, physical inactivity, poor diet and rising obesity rates are also responsible for the global expansion of diabetes. The ergogenic nutritional supplements are those that can promote increased physical performance beyond the physiological capacity and have a thermogenic action in the body. However, the biological activity and scientific validation of these supplements still require studies for its clinical proof as to its thermogenic benefits, thereby casting doubt on the effectiveness of these substances. The objective of this study was to evaluate the effect of supplementation with thermogenic substance, caffeine, on the glycemic levels in type 2 diabetic animals For this 38 Wistar male rats were used, 14 of 24 normoglycemic and diabetic animals were subjected metabolic cage in order to verify the consumption of food and water, urine volume and glucosuria, after that were treated with caffeine and then subjected to biochemical tests. Our results indicate that supplementation with caffeine, a thermogenic often used in physical activities and exercises induces a state of hyperglycemia in diabetic animals and hepatotoxicity. So its prescription and use should be controlled diabetic patients.

KEYWORDS: Diabetes; caffeine; hyperglycemia.

EFFET DE LA SUPPLÉMENTATION AVEC DE LA CAFÉINE SUR LES NIVEAUX GLICEMIC DANS LE TYPE EXPÉRIMENTAL 2 DIABÈTE

RÉSUMÉ

La prévalence du diabète augmente dans le monde entier, en devenant l'épidémie maintenant de ce fait, en grande partie, du vieillissement. Cependant, l'inactivité physique, la mauvaise alimentation et la hausse des taux d'obésité sont également responsables de l'expansion mondiale du diabète. Les suppléments nutritionnels ergogènes sont ceux qui peuvent favoriser l'augmentation des performances physiques au-delà de la capacité physiologique et ont une action thermogénique dans le corps. Cependant, l'activité biologique et la validation scientifique de ces suppléments ont encore besoin d'études pour sa preuve clinique que de ses avantages thermogénique, jetant ainsi le doute sur l'efficacité de ces substances. L'objectif de cette étude était d'évaluer l'effet de la supplémentation en substance thermogénique, la caféine, sur les taux de glycémie chez les animaux diabétiques de type 2 pour ce 38 rats mâles Wistar ont été utilisés, 14 des 24 animaux à glycémie normale et diabétiques ont été soumis cage métabolique pour vérifier la consommation de nourriture et d'eau, le volume d'urine et glycosurie, après qui ont été traités avec de la caféine et ensuite soumis à des tests biochimiques. Nos résultats indiquent que la supplémentation avec de la caféine, un thermogénique souvent utilisé dans les activités physiques et des exercices induit un état d'hyperglycémie chez les animaux diabétiques et hépatotoxicité. Donc, sa prescription et l'utilisation doivent être contrôlées chez les patients diabétiques.

MOTS-CLÉS: diabète; la caféine; hyperglycémie.

EFECTO DE LA SUPLEMENTACIÓN EN NIVELES DE CAFEÍNA EN EL TIPO 2 DIABETES EXPERIMENTAL GLUCÉMICO

RESUMEN

La prevalencia de diabetes está aumentando en todo el mundo, convirtiéndose en la epidemia de ahora como resultado, en gran parte, del envejecimiento. Sin embargo, la inactividad física, la mala alimentación y el aumento de las tasas de obesidad son también responsables de la expansión mundial de la diabetes. Los suplementos nutricionales ergogénicos son aquellos que pueden promover el aumento de rendimiento físico más allá de la capacidad fisiológica y tienen una acción termogénica en el cuerpo. Sin embargo, la actividad biológica y la validación científica de estos suplementos todavía requieren estudios para su prueba clínica en cuanto a sus beneficios termogénicos, poniendo así en duda la eficacia de estas sustancias. El objetivo de este estudio fue evaluar el efecto de la suplementación con sustancia termogénica, la cafeína, en los niveles de glucemia en animales diabéticos tipo 2 para este 38 ratas macho Wistar se utilizaron, 14 de los 24 animales normoglucémicos y diabéticos fueron sometidos jaula metabólica con el fin de verificar el consumo de alimentos y agua, el volumen de orina y la glucosuria, después de que fueron tratados con cafeína y luego sometido a pruebas bioquímicas. Nuestros resultados indican que la suplementación con cafeína, un termogénico menudo utilizado en actividades físicas y ejercicios induce un estado de hiperglucemia en los animales diabéticos y hepatotoxicidad. Por lo que su prescripción y uso deben ser controlados los pacientes diabéticos.

PALABRAS CLAVE: Diabetes; La cafeína; hiperglucemia.

EFEITO DA SUPLEMENTAÇÃO COM CAFEÍNA SOBRE OS NÍVEIS GLICÊMICOS NO DIABETES TIPO 2 EXPERIMENTAL

RESUMO

A prevalência do diabetes vem crescendo mundialmente, configurando-se atualmente como uma epidemia resultante, em grande parte, do envelhecimento da população. Contudo, o sedentarismo, a alimentação inadequada e o aumento da obesidade também são responsáveis pela expansão global do diabetes. Os suplementos nutricionais ergogênicos são aqueles que podem promover aumento do desempenho físico além da capacidade fisiológica, e apresentam uma ação termogênica no organismo. Entretanto, a atividade biológica e validação científica destes suplementos ainda carecem de estudos para a sua comprovação clínica quanto aos seus benefícios termogênicos, colocando assim em dúvida a eficiência dessas substâncias. O objetivo deste trabalho foi avaliar o efeito da suplementação com o substância termogênica, a cafeína, sobre os níveis glicêmicos em animais diabéticos tipo 2. Para isso foi utilizado 38 ratos machos da linhagem Wistar, sendo 14 normoglicêmicos e 24 diabéticos, os animais foram submetidos a gaiola metabólica afim de verificar o consumo de água e alimento, volume de urina e glicosúria, após isto foram tratados com cafeína, e submetidos aos testes bioquímicos. Nossos resultados indicam que a suplementação com cafeína, um termogênico, frequentemente utilizado em atividades físicas e exercícios induz um estado de hiperglicemia e hepatoxicidade em animais diabéticos. Portanto, a sua prescrição e utilização deve ser controlada para pacientes diabéticos.

PALAVRAS CHAVE: Diabetes; Cafeína; hiperglicemia.