GLYCEMIC INDEX OF PRE-EXERCISE MEAL IN DIABETES MELLITUS: A SYSTEMATIC REVIEW

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ABSTRACT

Physical exercise and diet quality are essential for glycemic control of diabetic patients, but consideration must be given to the risk of hypoglycemia in response to exercise. Therefore this study aims at 1) conducting a systematic review of the glycemic index (GI) of the pre-exercise meal and of glycemic behavior during and after aerobic exercise in diabetic subjects, and 2) discussing the safest and most appropriate pre-exercise nutritional guidance for this population. In accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), two researchers independently undertook a systematic search. A third researcher participated in the selection of articles due to the presence of discrepancies. We selected two studies which both suggest that a low glycemic index (GI) meal is the best pre-exercise option, one of which suggests that the optimal time for food intake is 30 minutes before exercise. However, these results are not sufficient to define a clinical conduct, and other studies are needed to elucidate whether GI is a relevant parameter for pre- and post-exercise clinical monitoring of patients with diabetes mellitus (DM), particularly as regards to the different guidelines for type 1 and type 2 DM. Level of Evidence II; Prognostic Study.

Keywords: Diabetes mellitus; Aerobic exercise; Feeding behavior; Carbohydrate; Glycemic index; Hypoglycemia.

RESUMO

Exercício físico e qualidade da alimentação são fundamentais para o controle glicêmico dos pacientes diabéticos, porém é necessário considerar o risco de hipoglicemia em resposta ao exercício. Dessa forma, os objetivos deste estudo são: 1) conduzir uma revisão sistemática sobre o índice glicêmico (IG) da refeição pré-exercício e do comportamento glicêmico durante e após exercício aeróbico em diabéticos e 2) discutir qual orientação nutricional pré-exercício seria mais adequada e segura nessa população. Em concordância com os itens de Relatório Preferidos para Revisões Sistemáticas e Metanálises (PRISMA), dois pesquisadores independentes realizaram uma busca sistemática. Um terceiro pesquisador participou da seleção dos artigos por causa da presença de discrepâncias. Foram selecionados dois estudos e ambos sugerem que a refeição de baixo índice glicêmico (IG) é a melhor opção pré-exercício, e um deles sugere que o tempo ideal para ingestão alimentar é 30 minutos antes do exercício. Porém, esses resultados não são suficientes para definir uma conduta clínica, sendo necessários outros estudos para elucidar se o IG é um parâmetro relevante para o monitoramento clínico do paciente com diabetes mellitus (DM) antes e depois do exercício, principalmente com relação às orientações distintas às do DM tipo 1 e tipo 2. Nível de evidência II; Estudo Prognóstico.

Descritores: Diabetes mellitus; Ejercicio aeróbico; Conducta alimenticia; Carbohidratos; Índice glucémico; Hipoglucemia.

RESUMEN

El ejercicio físico y la calidad de los alimentos son esenciales para el control glucémico de la diabetes, sin embargo, es necesario prestar atención al riesgo de hipoglucemia en respuesta al ejercicio. Por lo tanto, los objetivos de este estudio son: 1) Realizar una revisión sistemática del índice glucémico (IG) de la comida previa al ejercicio y del comportamiento de la glucemia durante y después del ejercicio aeróbico en los diabéticos y 2) discutir qué orientación nutricional previa al ejercicio sería más apropiada y segura en esta población. En conformidad con los ítems de Informe Preferido para Revisiónes Sistemáticas y Meta-análisis (PRISMA), dos investigadores llevaron a cabo, de forma independiente, una búsqueda sistemática y observaron divergencia; y un tercer investigador participó en la selección de artículos. Se seleccionaron dos estudios, y ambos sugieren que la comida de bajo índice glucémico es la mejor opción antes del ejercicio; uno de ellos sugiere que el tiempo antes de la ingesta de alimentación adecuada es de 30 minutos. Sin embargo, estos resultados no son suficientes para definir una conducta clínica y se necesitan otros estudios para dilucidar si IG es un parámetro relevante para el monitoreo clínico del paciente con diabetes mellitus (DM), durante y después del ejercicio, principalmente en relación con las diferentes orientaciones de DM tipo 1 y tipo 2. Nivel de evidencia II; Estudio Pronóstico.

Descritores: Diabetes mellitus; Ejercicio aeróbico; Conducta alimenticia; Carbohidratos; Índice glucémico; Hipoglucemia.
INTRODUCTION

Diabetes mellitus (DM) is a disease characterised by chronic hyperglycaemia, secondary to insufficient production of insulin by the β cells of the pancreas (type 1 DM), the ineffective action of this hormone (type 2 DM) or both.1,2

The global population with DM is currently estimated to be 387 million, and is expected to reach 471 million in 2035.1 This increase is due to many factors such as population growth and aging, increased urbanisation, advances in disease treatment resulting in greater survival, and especially, the increased prevalence of obesity and sedentary lifestyles.1

Obesity and physical inactivity are the main risk factors for type 2 DM, and with established disease, these become the focus of non-pharmacological treatment, in order to control hyperglycaemia.3-5

In combatting obesity, changing the quality of the carbohydrate during feeding rather than the amount ingested has emerged as a better strategy for glycaemic control.6 From this perspective, the glycaemic index (GI) of food becomes an option for the control of diet quality, and has been considered a relevant parameter for clinical monitoring of the patient with DM.2,8

Regarding sedentary lifestyle, exercise, especially aerobic, has emerged as an excellent strategy to control postprandial blood glucose peaks, by making the body preferentially use the meal-derived glucose for carrying out the proposed activity.9,10

The individual benefits of these two strategies are relevant; however, when evaluated together, it is important to consider that the greatest risk in exercise training for a patient with DM is hypoglycaemia,1 which can transform a healthy practice into an activity that could ultimately be damaging to your health. Therefore, according to the characteristics of the exercise to be performed, it is essential to pay attention to prior food intake.2 Thus, the aims of this study were 1) to conduct a systematic review of the glycaemic index of the pre-exercise meal and of glycaemic behaviour during and after aerobic exercise in diabetics and 2) to discuss what pre-exercise nutritional guidance would be more appropriate and safe in this population.

METHODS

For this review, the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) were observed.11

Search strategy

Two researchers independently performed a systematic search for articles that addressed the issue of the glycaemic index of the pre-exercise meal and glucose metabolism in DM, as there was divergence, a third researcher participated of the selection of articles. The search for articles was based on the Medline database by combining the following MeSH keywords: aerobic exercise, glycaemic index, blood glucose and diabetes mellitus. Clinical trials and sample populations were used as search filters. Exclusion criteria were articles that used exercise without aerobic predominance and those that included non-diabetic individuals.

RESULTS

Figure 1 shows the stages of the adopted search strategy, the justification of the exclusions of some studies during the process and the total number of articles selected for analysis. Due to the initial divergence of the number of articles selected, it was necessary to perform an analysis with a third researcher.

The methodological characteristics and the main results of the glycaemic behaviour of the two articles selected for analysis are presented in Table 1.

DISCUSSION

It is well established in the literature that physical exercise is one of the non-pharmacological strategies to prevent and treat DM,14 and for exercise to be safely attempted without the occurrence of hypoglycaemia, prior supplementation with a carbohydrate base is recommended.15

The GI appears as a useful and reliable tool in planning the pre-exercise meal, because the GI of the food reflects the postprandial glycaemic response.16 This index is categorised into low GI (LGI) (<55), moderate GI (MGI) (56–70) and high GI (HGI) (70–100), differing by absorption speed and glycaemic stability.17

The objective of this review was to discuss the ways in which pre-exercise nutritional strategy could be made safer and more appropriate for those with diabetes with respect to the GI concept. However, even without restricting the publication period, the number of studies addressing this issue remained limited. This was due to the fact that most articles found from the search strategy did not contain the main points of the question of this review: composition of the pre-exercise meal and glycaemic behaviour during and after aerobic exercise; this resulted in only two articles being appropriate for analysis.

These studies9,11 suggested that the LGI meal is the best pre-exercise option12,13 and that the time for adequate food intake is 30 minutes prior to exercise,13 indicating that this nutrition strategy is more suitable for glycaemic control of patients with DM during and after exercise. These results are in agreement with previous studies conducted by our research group, however, evaluating healthy individuals.18,19

As recommended by studies about nutritional care in glycaemic control of DM,16,21 West et al.13 adopted an LGI meal as a pre-exercise food.
strategy. The sample of this study was composed of individuals with type 1 DM; people in this category have a higher risk of hypoglycaemia associated with exercise, which was found in the 60-min, 90-min and 120-min periods after exercise in experimental conditions. This behaviour can be explained by the lengthy without-food-intake period associated with high glucose uptake as a consequence of exogenous insulin and the action of the GLUT 4 receptors, translocated to membrane muscle cells in response to exercise.

In a study by Ferland et al., the sample was composed of individuals with type 2 DM, and unlike the previous study, for the more extensive food intake time was adopted before exercise (135 min), and the study did not report any cases of hypoglycaemia. This behaviour may have occurred due to inefficiency of insulin action, characteristic of people in this category, and because the population in the sample had been advised not to make use of oral hypoglycaemics the morning of the exercise session (50% of the sample). Even though this methodological orientation facilitated glycaemic control, the LGI meal presented the lowest initial glycaemic value and less decline after exercise, remaining more stable.

Recent studies show the benefits of different types of physical exercise and highlight LGI foods as part of the nutritional intervention in individuals with type 2 DM. In contrast, in recent studies of exercise and DM type 1, pre-exercise food GI is not clearly considered as a nutritional care option for glycaemic control during physical exercise. This current view may reflect that the relevance of GI to clinical practice is not yet clear.

The selected studies differ in various methodological aspects, such as category of DM, physical status of the pre-exercise meal, ergometer used, duration and intensity of exercise, age and fitness of participants, and restriction to male sex. All of these factors influence the interpretation of the results and prevent the generalisation of these conclusions to the entire population with DM. Given this and because they are only two studies, we can highlight as limitation of our study the use of only one database, restricting the number of articles available for analysis. However, we suggest that further studies should be conducted to elucidate whether GI is a relevant parameter for clinical monitoring of the patient with DM during exercise, especially in relation to different guidelines for individuals with type 1 and type 2 DM.

CONCLUSIONS

Although LGI meal offered 30 min before aerobic exercise seems to be a proper and safe nutritional intervention for glycaemic behaviour, these results are not sufficient to define a clinical conduct.

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