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Rice and Bean: Glycemic Index and Glycemic Load of the "Baião de Dois"

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Abstract

The "baião de dois" is a typical Brazilian dish and a rich combination of rice and beans. This preparation has a high nutritional value but its effect on glycemic response is not yet studied. To determine the glycemic index and glycemic load of foods can help prescribing diets and as a result, improving the treatment and prevention of chronic diseases. This study aimed to access the glycemic index (GI) and glycemic load (GL) of "baião de dois". Following the protocol recommended by the Food and Agriculture Organization, 6 volunteers were recruited to perform blood glucose tests. Each volunteer performed three glucose tolerance tests and a test with "baião de dois". All tests were undertaken in separate weeks. Through the calculation of the areas under each of the curves, it was possible to access the GI of "baião de dois" by the average values of six GIs found for each volunteer. It was calculated that the GL of each portion tested and recommended servings per capita. It was found that "baião de dois" had low GI (44) and GL (6) at the recommended per capita, but high GL (22) at the portion tested (bigger than the recommended). The "baião de dois" do not present a potential risk for developing chronic diseases, but it is recommended consumption to be monitored.

Keywords

Glycemic Index, Glycemic Load, Regional Food, Baião de Dois, Chronic Disease

1. Introduction

Rice (*Oryza sativa*) is a food consumed over half the population in the world. Also as a consequence of being

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one of the most produced cereal in the world, it is an excellent source of carbohydrates, fiber and various vitamins and minerals and it is easily accessible for most people due to the low cost [1]. The beans, like the rice, have a privileged nutritional composition in terms of vitamins and minerals, in addition to being an excellent source of carbohydrates, fiber and protein. It is popularly recognized as "strong" food, because it can prolong satiety [2].

In the twentieth century, the rice was introduced present in the daily diet of Brazilians, in typical dishes, such as the "baião de dois". The combination of rice and beans became one of the most traditional Brazilian dishes. It is a food combination that features the daily life, independently of regional, social or ethnic differences [3].

The "baião de dois" is rich in carbohydrates and represents an important nutrient association of its basic ingredients once the protein in rice is low in lysine, but is an excellent source of sulfur amino acids such as methionine and cysteine. On the other hand, bean protein is relatively rich in essential amino acids, especially lysine, but deficient in methionine and cysteine. Thus, there is an excellent protein arrangement plus a preparation containing a mixture of soluble and insoluble fiber and low levels of sodium, fat acids and rich in bioactive compounds [4].

Given the benefits mentioned, a question arises about the glycemic impact of the "baião de dois", because rice and beans are excellent sources of complex carbohydrates and fiber too, especially the last one. There are isolated studies that show a glycemic index (GI) and glycemic load (GL) differentiated for rice and beans. Rice, on average, has a moderate upper to high GI and high GL, and beans, on average, has a low GI and GL. All these values were calculated considering healthy portions of consumption [5] [6].

The question should be "Combination of rice and beansis healthy in terms of glycemic response?" There are several recipes of "baião de dois", with the addition of many ingredients, such as sausage and meats. However, among the more traditional recipes the addition of "coalho cheese" is the most usual one. This addition which is contributed to the enrichment of the preparation, however, may lead to a more or less healthy recipe, depending on the situation [2].

Glycemic index and glycemic load are dietetic proposals that have been supported by major organizations as a strategy of good metabolic control in diabetic patients and a favorable alternative to prevent non-communicable chronic diseases [7]. However, although there are universally known and consumed foods such as rice, there are several regional preparations whose studies are still rare, especially regarding the GI and GL. Thus, although these preparations are healthy in many aspects already studied, gaps still have to be clarified which could make the dietary prescription even more precise and safer.

Considering all the benefits and also the questions raised, the objective of this research was to determine the glycemic index and glycemic load of the "baião de dois".

2. Materials & Methods

The study was conducted at the Laboratory for Nutrition in Chronic Diseases ("Nutrindo"), State University of Ceará (UECE). It was approved by the Ethics Committee in Research of the State University of Ceará and the participants who agreed to participate in the study signed an informed consent.

The sample consisted of 6 volunteers, students of the institution responsible for the study. This number was defined based on the protocol of the FAO/WHO Expert Consultation [8] that every food should be tested at a minimum of 6 people. In addition, before the test with the food, the volunteer should make the blood glucose curve with glucose (50 g in 500 ml of water) for three times on three non-consecutive weeks. The volunteer should be fasting for 12 hours and have their blood glucose measured before ingestion of glucose diluted in water. Soon after eating, their blood sugar was checked (capillary blood glucose testing) during the two hours after at 15, 30, 45, 60, 90 and 120 minutes in order to create their glycemic response curve.

According to the same protocol, the amount of food and standard of the food being tested must ensure availability of 50 g of glycemic carbohydrate (carbohydrate minus fiber). It was considered as standard food to glucose, as mentioned above.

To determine the level of glycemic carbohydrate of the "baião de dois", initially it had to be set a standard recipe, given that there are variations in the method of preparation. We opted for a traditional recipe with rice and "feijão de corda" (a kind of bean), referenced in a book of regional cuisine [9], as itemized below.

Ingredients:

2 cups of rice

2 cups of "feijão de corda"

1/2 cup of "manteiga da terra" (a kind of butter)
200 g of "coalho cheese" (a kind of cheese)
1 yellow pepper ("pimento de cheiro")
1 green pepper, chopped
1 large onion, chopped
4 cloves garlic, minced
Scallions and chopped cilantro
Preparation:

Cook the beans in water and salt. Cook rice normally, so that it is white and loose. Heat a large frying pan and put the butter. Fry the peppers, onion and garlic last. Add the scallions and chopped cilantro and then baked beans without the bouillon. Sauté. Add the rice, mix well and add 2 ladles of bouillon from the cooked beans. Half cup grated cheese and reserve. Cut the rest into chips and add to mixture in skillet. Mix slowly so that all the ingredients are incorporated well and stay moist. Place the preparation on a platter and sprinkle with the scallions, cilantro and cheese chopped.

From the definition of the ingredients of the preparation test, we investigated the nutritional composition of carbohydrates and fibers thereof, by means of a composition table [10], reaching a value of 326 g of "baião de dois" being tested by volunteers (**Figure 1**). According to the composition table [10], 100 grams of "baião de dois" contains 20.4 grams of carbohydrate and 5.0 grams of fiber.

After the three-week test with glucose, the volunteers, in a fourth week, performed the test with the "baião de dois", using the same protocol. The "baião de dois" portion was weighed on digital scales Plenna®, nutri sub-type, with capacity 2.000 g and graduation 1 g.

After determining the glycemic index of each volunteer with the "baião de dois", the areas under the curves of these responses (with glucose and the "baião de dois") were calculated and compared, the mathematical calculations being performed to determine the GI and GL [8]. It was also conducted an analysis of the glycemic response curve for the "baião de dois".

Following the determination of the glycemic index, it was categorized as low, medium or high based on the classification of Brand-Miller *et al.* [11], which provides: low GI less than or equal to 55; moderate GI 56 - 69 and high GI higher than 70, considering the healthy low GI. The glycemic load was also identified by the product of glycemic carbohydrate of the "baião de dois" in grams determined by glycemic index divided by 100, as recommended by Burani [12]. In order to calculate the portion of "baião de dois" used, it was determined in Brazilian guidelines, 87.5 grams [13]. The GL was categorized as low, moderate or high, if it had respectively the lowest or equal to 10, 11 - 19, or greater than or equal to 20 [12].

General data were analyzed descriptively using parametric measures (mean). The data were analyzed using the program Excel.

Figure 1. "Baião de Dois".

3. Results & Discussion

Rice is a food of high nutritional value, containing protein, vitamins and minerals, especially rich in carbohydrates. Therefore, it is necessary to highlight the importance of the effect of their consumption on blood glucose. The carbohydrate in rice is complex a type and there is considerable amount of fibers, however prevails a quantity of glycemic carbohydrate (total carbohydrate minus fiber) which suggests that rice has significant glycemic impact. This is confirmed in the assessment of their glycemic index, an average of types of rice equals 64, a moderate GI. However, this does not make rice an unhealthy food, because the GI is only one item of dietary rating, which needs to be supplemented by other information food. Furthermore, there is the concept of GI of food and GI of meal. Thus, it is necessary to consider the fact that rice is hardly consumed alone. Rice is almost always present in a meal and this combination of rice with other foods can bring further benefits, as occurs with the addition of rice with beans [1] [14] [15].

Besides the combination of nutrients, the union rice with beans leads to a complement of amino acids, increasing the protein quality of the preparation, because the rice protein is rich in sulfur amino acids such as methionine and cysteine, and low in lysine; and beans are rich in lysine, but deficient in methionine and cysteine. Thus it is configured an excellent protein arrangement. In addition to this nutritional characteristic, it is worth noting that the combination of rice with beans has low sodium levels as well as and fat and is rich in bioactive compounds. Additionally, studies have shown that the consumption of beans, given its high fiber content, may be conducive to health in relation to the lower glycemic impact. Potentially the whole consumption of rice and beans may have lower glycemic index than rice intake alone [4] [5].

Thus, linking the consumption of rice with other foods can enhance and optimize their nutritional benefits. The results of this study showed that. To prepare the "baião de dois", it was used the "feijão de corda" (Vigna unguiculata), typical type of beans from Brazil and the most common species for the recipe of the "baião de dois". According Passos [5], the "feijão de corda" has a low GI and low GL in healthy portions, 50 and 4, respectively. As mentioned, this may have influenced the results of this research.

The glycemic index was low "baião de dois" (44) and glycemic load was high (22) in the tested portion (325.5 g). However, when evaluating the GL for a healthy portion [13], which is usually oriented to consumption, it was low and therefore appropriate (6).

Thus, it is clear that "baião de dois" is, in fact, a healthy food, even under the aspect of glycemic potential when consumed in moderate amounts. If overconsumed, this food it will be a risk for chronic diseases.

Despite being a healthy food, it has been observed a decrease in food consumption of cereals and vegetables group in recent years, especially of rice and beans. On the other hand, it has increased consumption of fast foods and other unhealthy foods [16].

Figure 2 below presents the glycemic curves with the mean blood glucose levels regarding ingestion of glucose and "baião de dois" by healthy volunteers (n = 6).
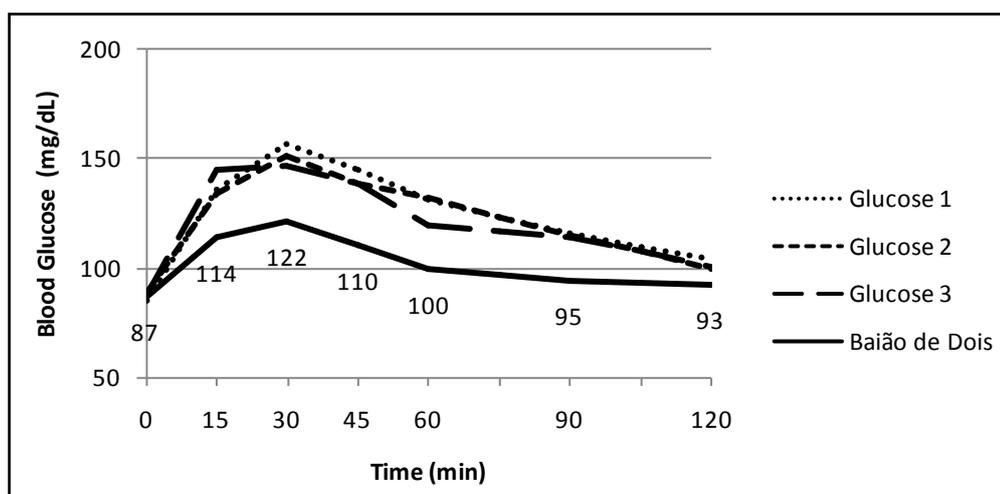
Figure 2. Glycemic curves with the mean blood glucose levels regarding ingestion of glucose and "baião de dois" by healthy volunteers (n = 6).

The "Glucose 1" curve represents the average of the first 6 tests with concentrated glucose achieved by the 6 volunteers. The "Glucose 2" curve represents the average of the second tests and the "Glucose 3" curve represents the average of the third tests with concentrated glucose conducted by the 6 volunteers. The "baião de dois" curve is the average of 6 tests with the ingestion of food for all the volunteers. Analyzing the average glycemic curve of the "baião de dois", it was find a similar route to that obtained with glucose, although with a more attenuated elevation. This attenuation must have been influenced by the beans, due to its composition. As mentioned by Brand-Miller, Foster-Powell and Colagiuri [17] and Guttierres and Alfenas [18], the fibrous coating foods such as beans may act as a physical barrier, delaying the access of digestive enzymes to the starch inside. Additionally, there is a significant protein content in its composition, also potentially influential characteristic of the glycemic index [19].

The concentration of starch in rice may vary due to genetic and environmental factors. When processing, raises the percentage amount of starch. So this value is greater at the polished white rice and parboiled polished compared to the whole rice. In this research, it was use the polished white rice, which is the most used in Brazil. It has been shown that after polishing, there is a significant reduction of the levels of glucose and sucrose, contributing to lower GI, but the data is still inconclusive [1] [4].

A highlight of this study is that the union of rice and beans produced a preparation with a lower GI than rice and beans alone, which shows that there was a good optimization of the nutritional qualities of rice. However, it is important to note a limitation of this study, once the preparation used for the test has cheese in its composition. Cheese is a protein-rich food, a nutrient that may interfere with glycemic impact. Moreover, the glycemic index of cheeses is zero, so that if there was interference, this probably was not significant. The researchers of this study opted to use a recipe with cheese in order to preserve the characteristics of the dish that is commonly consumed by the population [19] [6].

Thus, the results of this study demonstrated that the combination of rice and beans generates interesting nutritional associations, both in terms of vitamins, minerals and amino acids, known in literature, and from the point of view of the glycemic impact.

The limitations of this research are related to the number of volunteers. Although this research is supported by the FAO protocol [8], the accuracy of the results could have been greater if the sample were larger. Another limitation of the results is related to the Baião de Dois' revenue. There are some variations in regional cuisine, which can modify the beneficial effects found in this study.

4. Conclusion

As a conclusion of this study, we have that the "baião de dois" presents adequate glycemic load glycemic index and healthy portion. Thus, the "baião de dois" does not present a potential risk for chronic diseases, but it is recommended consumption to be monitored.

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