

## THE EFFECT OF TECHNOLOGICAL PROCESSING ON THE GLYCAEMIC INDEX OF RICE PORRIDGE

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**Abstract:** Food with high glycemic index ( $GI > 70$ ) is a risk factor of developing the chronic diseases specific to contemporary society: obesity, diabetes, cardio-vascular diseases. In this respect the investigation and identification of technological processes that contribute to reduction of GI is of utmost importance. Rice is a high GI cereal widely used in nutrition. This study aims to investigate the effect of some technological parameters for rice porridge cooking (ratio of groats to water, heat treatment duration, fat combination) on the glycemic index value. The experimental results show that combination of boiled rice with butter reduces the GI value more effectively as compared to thermal treatment duration and the groats to water ratio.

**Keywords:** rice porridge, glycemic index, technological parameters

### Introduction

Cereals are very important in the human diet due to high nutrient content, covering about 50% of energy and 80% of the carbohydrates. Currently knowledge of glycemic index (GI) of food rich in carbohydrates is of great importance. High-glycemic index food ( $\geq 70$ ) are quickly digested and absorbed in the human body, producing a sharp and high levels of glucose in blood [1, 2]. Frequent consumption of high GI foods is a risk factor for developing chronic diseases of the civilization: obesity, diabetes, cardio-vascular diseases, cancer.

Rice, as the main food for half the world's population, is a cereal with high GI because of significant quantities of starch (3, 4). Different types of rice have different GI. White rice, for example, obtained by peeling of the entire grain, when only the endosperm remains, which is rich in starch and has a low content of fiber and vitamins, is food with high GI (70-90) compared with brown rice, husked from only external skin containing vitamin B complex and more dietary fiber (GI 50-60). Technological parameters applied to the product that influence the degree of starch gelling (ratio groats:water during heat treatment), occurrence of other nutrients in the food as fat or protein influence GI of the finished product (5). Addition of fats into glucidic foods reduces GI and causes a slower discharge of the stomach and moderation of digestion [7, 8].

The aim of this study was to identify and assess the technological parameters with a reduction effect on GI of boiled rice. For this purpose the GI was calculated for rice porridge of different consistency (friable, dense and thin) and also for the rice cooked with butter at different stages of the technological process.

### Materials and Methods

As materials there were used samples of different consistency of boiled rice (friable, dense and thin) commonly used in catering (6). Parameters of boiled rice samples are shown in Table 1.

**Table 1.** Parameters of boiled rice samples.

No	Sample name (consistency)	Ratio groats:water r	Volume coefficient after bolinig, Kv	Mass coefficient of water absorbtion, Km	Time of thermal treatment, min
1.	Boiled rice (friable)	1:2,0	3,32	2,20	25-35
2.	Boiled rice (dense)	1:3,8	4,40	3,60	35-45
3.	Boiled rice (thin)	1:5,8	6,40	5,51	50-60

Also, for the research there have been used three samples of boiled rice (thin) with butter (fat content in butter 72.5%) added when serving (5 g/100 g of porridge, 10 g / 100 g of porridge, 15 g / 100g of porridge) and a sample where the butter (10g / 100g of porridge) was added when boiling.

The glyceimic indices of the samples tested in vivo was determined by monitoring the blood glucose levels in 10 volunteers participating in the experiment before and after consumption of researched food ISO 26642: 2010. Glyceimic response after consumption of each product was compared with that stimulated by glucose consumption as a reference substance. [7]. Glucose in capillary blood of the researched participants was determined by the method of glucose oxidase-endpoint in the Stat Fax 1904 Chemistry Analyzer [8].

Principle of the method: Glucose, under the action of the glucose is converted into gluconic acid. The resulting hydrogen peroxide is decomposed by peroxidase after reaction with the participation of Trinder indicator (phenol and 4-aminoantipyrine), resulting in a red coloured condensation product of absorption maxima at  $\lambda = 505$  nm. Extinction is directly proportional to the glucose concentration.

The data obtained were used for the construction of the glyceimic result curves of the participants after consumption of the tested samples. The surface area under the curve was determined by mathematical method using Autocad via the "Inquiry" program to calculate the exact surface area. Finally glyceimic indices were calculated using the following formula 1:

$$GI = \frac{S_a}{S_g} \times 100 \quad (1)$$

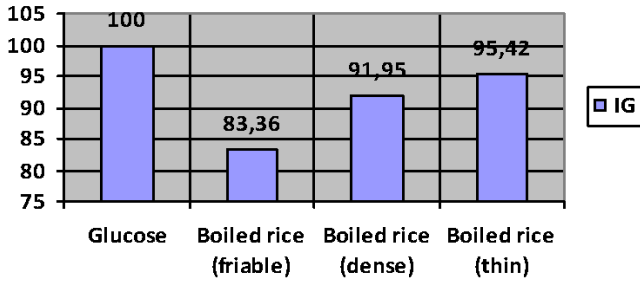
where: GI- glyceimic indices of the analyzed food;

Sa - surface area under the glyceimic curve of the studied food;

Sg - surface area under the glyceimic curve of glucose.

### Results and discution

As a result of the research and calculations there were determined the GI of rice porridge with different consistency (friable, dense and thin) (Fig.1). The experimental results showed that liquid rice porridge had the highest glyceimic index (95.42) .The lowest glyceimic index was obtained in friable rice porridge (83.36) and dense porridge had an intermediate level of GI - 91.95. as showed in Figure 1.

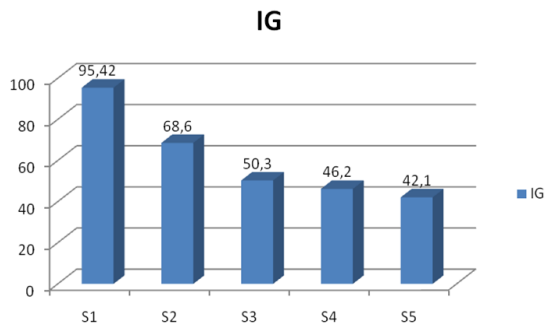


*Fig. 1.* GI of glucose and of rice porridge with different consistency

GI value of boiled rice porridge was influenced by used technological parameters. It has been found that reducing the time of the heat treatment (from 50-60 min to 25-35 min), of the ratio groats: water (1:5.8 to 1:2) and, consequently, the volume coefficients (from 6.40 to 3.32) and mass coefficients (from 5.51 to 2.20) of cooked rice decreased GI value of the finished product from 95.42 till 83.36. Theoretically this can be explained by the different starch gelling in the rice which can influence their speed of digestion and absorption (6). At the same time, all samples of boiled rice had GI levels more than 70 and can be classified as high GI foods.

Figure 2 presents the research results of influence of butter added to boiled rice porridge of thin consistency on GI of the preparation. It demonstrates that the combination of butter with boiled rice by serving significantly influences the glycemic index of the finished product. Thus, boiled rice without butter, falls within the category of high GI foods (95.42), addition of butter by serving in quantities 5g, 10g or 15g per 100g of the finished product, had lower coefficient of GI (respectively 68.6, 46.2 and 42.1) and became a preparation with moderate glycemic index (68.6) or reduced (46.2 and 42.1) depending on the amount of added butter. Theoretically this can be explained by decreased rate of digestion and absorption of carbohydrates over lipids.

It was also found that the combination of butter (10g / 100g of the product) at the stage of serving boiled rice decreased GI more efficiently (46.2) than if adding it at the stage of boiling (GI 50.3). Possibly, fat of butter added at the stage of rice boiling hydrolyzes in the heat treatment process and causes a faster digestion and absorption of nutrients than in the case of butter added at the stage of serving.



*Fig.2.* Influence of butter added to boiled rice porridge of thin consistency on GI of the preparation. (S1 - boiled rice (thin) without butter; S2 - boiled rice (thin) with addition of butter

by serving in quantities 5g per 100g of the finished product; **S 3** –boiled rice (thin) with addition of butter by boiling in quantities 10g per 100g of the finished product; **S 4** – boiled rice (thin) with addition of butter by serving in quantities 10g per 100g of the finished product; **S5** - boiled rice (thin) with addition of butter by serving in quantities 15g per 100g of the finished product ).

### Conclusions

The results of the present research has confirmed that rice belongs to a category of high GI foods (> 70) and, as recommended by nutritionists, has to be limited in a healthy diet. Such technological parameters as the ratio groats:water and heat treatment duration does not essentially influence the glycemic index of boiled rice compared to glucose (95.42 to 83.36). At the same time, rise cooked for less time and in less water has a lower GI value (83,36) as compared to well cooked rice (95,42), thus bearing a lower risk for developing diabetes and cardiovascular diseases.

Combination of boiled rice with butter significantly reduces the GI of boiled rice (from 95.42 to 58.9 to 44.5). Addition of butter at the stage of serving is preferable to reduce the GI of the preparation than its incorporation during the boiling process.

Boiled rice served with butter (15g / 100g porridge), which has the lowest GI (44.5), does not carry a risk for the development of diabetes and is preferred for consumption.

### Acknowledgements

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### References:

1. Emil Rădulescu, *Alimenta ție inteligentă*, București, 2003, pp 376;
2. Tattersall, Robert, *Diabetes: The Biography*, Biographies of Disease Series (Oxford: Oxford University Press, 2009), pp. 223,;
3. Bologa, N., Burda, A. *Merceologie generală*. București: Editura Universitară, 2006, pp 278;
4. *Rice Today* Vol. 12, No. 1, trends in global rice consumption, pp 30;
5. Montignac, Michel .*Indicele glicemic în dieta Montignac*. București: Editura Litera, 2009, pp. 148;
6. Jennie Brand Miller, Kaye FASTER Pavel, *Noua revolu ție a glucozei. IG - o solu ție pentru sanatatea ideală*, Editura Litera 2006, pp 412;
7. Barbara Rovage, *Ghidul indicelui glicemic*, Editura Litera 2008, pp 176;
8. Ратушный А. *Сборник рецептур блюд и кулинарных изделия для предприятий общественного питания*. Москва: Экономика 1982, pp 717;
9. ISO 26642:2010 Food products - Determination of the glycaemic index (GI) and recommendation for food classification.