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Analysis of Glucose Levels in White Glutinous Rice Bran: A Systematic Literature Review

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A B S T R A C T

White glutinous rice bran has lower glucose levels than white glutinous rice. This could be relevant for glycemic management in diabetes sufferers. Lower glucose levels can help reduce blood sugar spikes after food consumption. White glutinous rice bran, with its low glucose content, can be considered a safe and beneficial food alternative for diabetes sufferers. The literature search process was carried out on various databases (PubMed, Web of Sciences, EMBASE, Cochrane Libraries, and Google Scholar) regarding the analysis of glucose levels in white glutinous rice bran. This study follows the preferred reporting items for systematic reviews and meta-analysis (PRISMA) recommendations. The glucose content in rice bran ranges from 1.5 to 2.5%, a lower value compared to the glucose content in white glutinous rice which reaches around 7.5%. White glutinous rice bran has relatively low glucose levels, making it a potential food option for consumption by diabetes mellitus sufferers.

1. Introduction

White glutinous rice, with its high starch content, has long been an important part of various culinary cultures around the world. The traditional process of processing involves milling to produce white rice, removing the protective layer known as bran. Although rice bran is often considered a waste byproduct of this process, recent research highlights the potentially valuable nutritional value of white glutinous rice bran. Rice bran, previously overlooked, has been shown to contain a number of important nutritional components, including glucose. Glucose, as a simple form of sugar, has a central role as an energy source for the human body. Understanding the glucose content in white glutinous rice bran not only provides new insights regarding the nutritional composition of this food ingredient but also opens up opportunities to utilize it more optimally in the context of nutrition and health.[1-4]

Knowing that white glutinous rice bran has lower glucose levels than white glutinous rice, this could be relevant for glycemic management in diabetes sufferers. Lower glucose levels can help reduce blood sugar spikes after food consumption. White glutinous rice bran, with its low glucose content, can be considered a safe and beneficial food alternative for diabetes sufferers. This opens up opportunities for the development of food products or diet formulations that can help meet their nutritional needs without compromising glycemic control. Understanding the nutritional differences between rice bran and white glutinous rice can also increase awareness about other nutritional components in rice bran, such as fiber, antioxidants, and vitamins. This can have a positive

impact on overall health.[5-9] This study aims to present an exploratory analysis of glucose levels in white glutinous rice bran.

2. Methods

The literature search process was carried out on various databases (PubMed, Web of Sciences, EMBASE, Cochrane Libraries, and Google Scholar) regarding the analysis of glucose levels in white glutinous rice bran. The search was performed using the terms: (1) "analysis" OR "glucose content" OR "rice bran" OR "rice" AND (2) "glucose" OR "white sticky rice." The literature is limited to preclinical studies and published in English. The literature selection criteria are articles published in the form of original articles, an experimental study about analysis of glucose levels in white glutinous rice bran, studies were conducted in a timeframe from 2013-2023, and the main outcome was analysis of glucose levels in white glutinous rice bran. Meanwhile, the exclusion criteria were studies that were not related to the analysis of glucose levels in white sticky rice bran and duplication of publications. This study follows the preferred reporting items for systematic reviews and meta-analysis (PRISMA) recommendations.

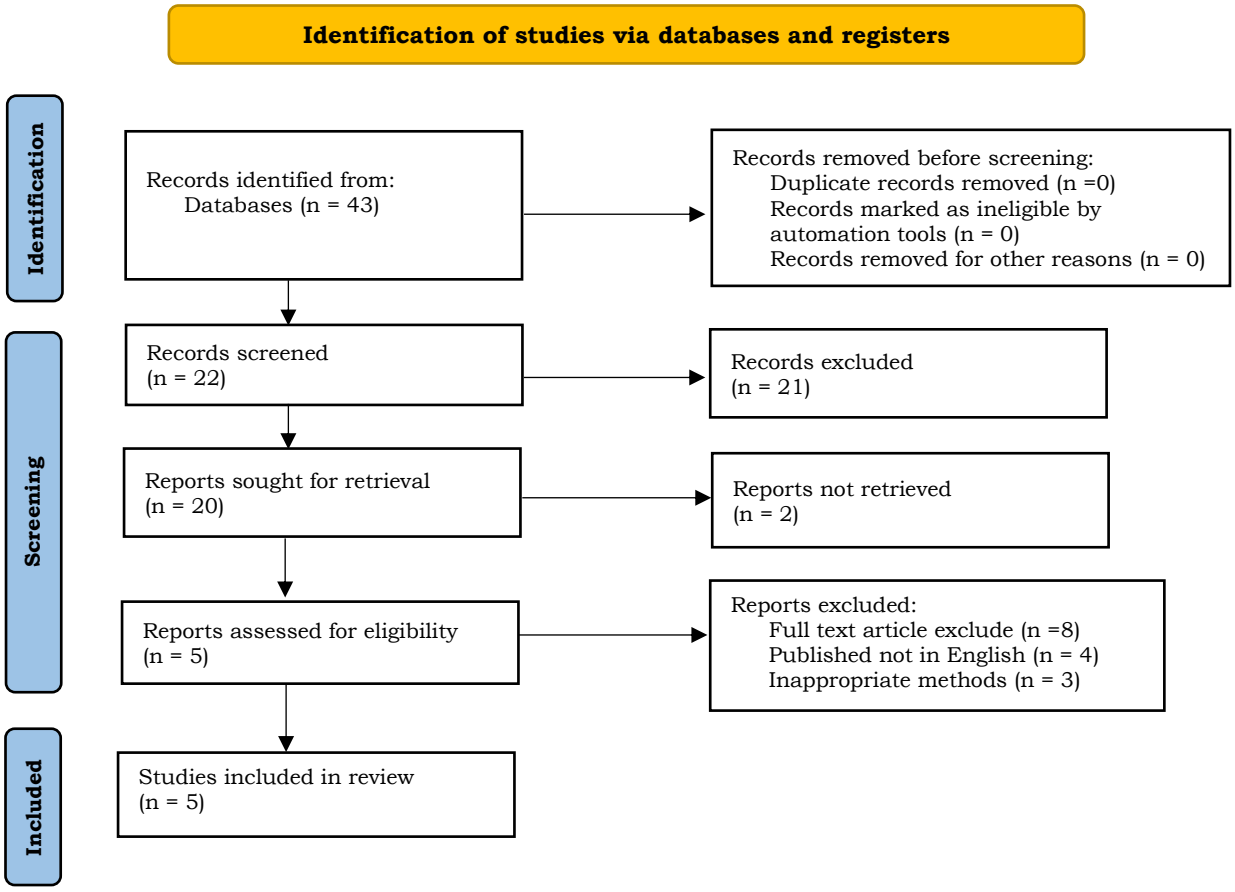

Figure 1. PRISMA flowchart.

3. Results and Discussion

White glutinous rice bran, which was initially thought to be milling waste, actually contains a number of beneficial nutrients. With the various nutritional components contained in it, rice bran can contribute to a person's nutritional intake. Carbohydrates are the main component of rice bran. Carbohydrate levels in rice bran can vary depending on the type of white glutinous rice used. Carbohydrates provide an important source of energy

for body function. Protein is present in rice bran and can contribute to a person's daily protein intake. Although protein levels tend to be lower compared to main protein sources, such as meat or beans, its presence is still significant. Fat is also a component of rice bran. Even though the fat content may not be as high as in some other fat sources, the presence of fat still contributes to the calorific value and texture of the food. Fiber is one of the key components contained in rice bran. The fiber content in rice bran can help improve digestion, reduce the risk of chronic disease, and maintain intestinal health. Rice bran also contains important minerals such as magnesium, phosphorus, and selenium. These minerals have an important role in maintaining the body's mineral balance and supporting the function of various body systems.[10-13]

Glucose levels in white glutinous rice bran can be analyzed using enzymatic methods. This method uses the enzyme glucose oxidase to oxidize glucose into gluconic acid and hydrogen peroxide. Hydrogen peroxide is then measured using an enzymatic reaction with peroxidase and thiosulfate indicator.

The following are the steps for analyzing glucose levels in white sticky rice bran using the enzymatic method: Weigh 1 gram of white sticky rice bran and dissolve it in 50 mL of distilled water; add 1 mL of phosphate buffer solution pH 7.0; add 0.5 mL of glucose oxidase enzyme solution; Incubate for 30 minutes at 37°C; add 1 mL of peroxidase solution; add 1 mL of 0.05 M thiosulfate solution; measure the absorbance of the solution at a wavelength of 490 nm using a spectrophotometer. The reaction equation that occurs is as follows[14-16]:

$$\text{Glucose} + O_2 \rightarrow \text{Gluconate acid} + H_2O_2$$

$$H_2O_2 + 2\ I^- + 2\ H^+ \rightarrow 2\ H_2O + I_2$$

$$I_2 + 2\ S_2O_3^{2-} \rightarrow 2\ I^- + S_4O_6^{2-}$$

The absorbance of the thiosulfate solution formed is proportional to the glucose content in the sample. Glucose levels can be calculated using the following equation: Glucose levels (mg/g) = (Absorbance x 1.052 x 0.00082 x 1000) / 1.

The glucose content in white glutinous rice bran ranges from 1.5 to 2.5%, which is lower than the glucose content in white glutinous rice (around 7.5%). These findings provide an indication that bran from white glutinous rice has the potential to be a food ingredient suitable for consumption by diabetes mellitus sufferers. The low glucose content in white glutinous rice bran is caused by the high fiber content in the bran. Fiber can slow the body's absorption of glucose so that blood glucose levels do not increase quickly. Fiber, especially water-soluble fiber, can form a gel in the digestive tract. This can inhibit the absorption of nutrients, including glucose, in the small intestine. Thus, glucose is not absorbed quickly into the blood. Fiber can also slow the speed of food digestion, including carbohydrates such as glucose. With a decrease in the rate of digestion, the process of releasing glucose into the bloodstream becomes more controlled. Foods with high fiber content tend to have a lower glycemic index. The glycemic index measures how quickly a food can increase blood glucose levels. Foods with a low glycemic index can help maintain stable glucose levels. Fiber can also provide a longer satiety effect after eating. This can help control appetite and regulate food intake, which in turn can contribute to the management of glucose levels. Adequate fiber consumption has been associated with a reduced risk of insulin resistance. Insulin resistance can cause increased blood glucose levels, and fiber can help protect the body against this condition.[17,18]

The low glucose content in white glutinous rice bran makes it a food ingredient that has the potential to be consumed by diabetes mellitus sufferers. Diabetes mellitus sufferers have high blood glucose levels. Consuming foods with low glucose levels can help diabetes mellitus sufferers control their blood glucose levels. White glutinous rice bran has relatively low glucose levels, helping to reduce the risk of significant blood sugar spikes after consumption. This is consistent with recommendations for diabetes mellitus sufferers who need to limit sugar intake. The high fiber content in rice bran can help slow glucose absorption, causing a more gradual increase in blood

sugar. Fiber can also provide a longer feeling of fullness, helping control appetite. Foods with a low glycemic index tend to cause a slower increase in blood sugar. White glutinous rice bran, with its low glucose content, can have a low glycemic index. The fiber in rice bran can help in weight management, which is also an important factor in managing diabetes mellitus. Good weight control can improve insulin sensitivity. Rice bran also contains various nutrients, such as vitamins, minerals, and antioxidants, which can contribute to overall health. Diabetics need to ensure a balanced nutritional intake.[19,20]

4. Conclusion

The glucose content in rice bran ranges from 1.5 to 2.5%, a lower value compared to the glucose content in white glutinous rice, which reaches around 7.5%. White glutinous rice bran has relatively low glucose levels, making it a potential food option for consumption by diabetes mellitus sufferers.

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