

Process of cooking to reduce sugar from jasmine rice

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ABSTRACT

In this study, we improved different rice cooking methods to reduce the sugar in rice. The improvement of jasmine rice will lead to the development of products suitable for people suffered from diabetes. The aim of this investigation was to study the method of cooking rice to reduce sugar amount and study the sensory properties of jasmine rice. Jasmine Rice brand of Royal Umbrella were cooked with five different methods, then the Glucose Tolerance Test measured sugar content, and taste acceptance was measured. Jasmine rice was soaked before cooking and had the least sugar out of all five cooking methods at 0.04%. The soaking made the rice sticky and softer than cooking rice with a normal rice cooker (hot). The hardness was 19.71 ± 0.73 (N) and 23.73 ± 2.60 . The difference was statistically significant ($p < 0.05$). Sensory quality tests and acceptance of jasmine rice cooking were found to be depending on soaking the rice before cooking. The sugar content, sensory qualities, and acceptance of jasmine rice cooking were found to be depending on soaking the rice before cooking. Soaking jasmine rice before cooking effectively decreased sugar levels while preserving its sensory properties and overall taste. This technique can be beneficial for individuals who have diabetes or are interested in reducing sugar intake. It is worth mentioning, however, that this method results in a stickier and softer texture than traditional rice cooking methods.

Keywords: Jasmine rice, Cooking, Sugar amount.

Article type: Short Communication.

INTRODUCTION

Rice is a carbohydrate food consumed by more than half of the world's population as a staple food. Starch (a carbohydrate) is a major constituent of rice. It consists of amylose and amylopectin, the main factors affecting the amount of sugar in the blood (Udomsak *et al.* 2018). Thai people suffer from chronic non-contagious diseases, such as diabetes, cancer, heart disease, blood pressure, and kidney disease. In 2015, more than 1 billion people worldwide, over 4 million Thai people had diabetes, and over 2 million people had diabetes at an early stage. There is a burden of medical expenses of at least 46,000 million baht per year. The main reason for this is the consumption of foods that contain carbohydrates that are "High" in starch and sugar but "Low" in fibre and antioxidants (Sribureeruk *et al.* 2020). Therefore, developing rice types and products with a low glycemic index can help prevent diabetes. Patients with diabetes should focus on their food consumption. Food made from flour and sugar accumulates in the blood, and there is a risk of complications. White rice is a simple carbohydrate, whereas unpolished rice is a complex one. The simple carbohydrates are immediately converted to sugars, causing the sugar in the starch to be released into the body excessively and unevenly. As a result, the sugar content in the body rises quickly and steadily. In contrast, by consuming complex carbohydrates, sugars are released gradually, evenly, and not too fast. Therefore, if there is more sugar in the blood, more insulin will be required, causing the pancreas to work harder, and leading to serious consequences of the disease. As a result, rice cooking methods should be considered to reduce the sugar content of rice (Bumrungrad Hospital 2021). Jasmine rice has a high

sugar amount and a risk of diabetes. However, Thai people are still addicted to smelling goods. It is still difficult for many people to change their behaviour to eat brown rice. Moreover, it is more difficult to reduce the amount of rice linked to the risk of vascular disease, diabetes, and obesity (Panthep 2015). Based on the above importance, researchers are interested in studying the method of cooking jasmine rice to reduce the sugar amount by bringing jasmine rice cooked using different methods. Finally, it is expected to be an alternative for people with diabetes.

MATERIALS AND METHODS

Materials used in the experiment

- Jasmine Rice: Jasmine Rice brand of Royal Umbrella, purchased from Makro Samsen, Samsen Road, Thanon Nakhonchaisri Subdistrict, Dusit District, Bangkok.
- Glucose Tolerance Test: 3,5-Dinitrosalicylic acid Bought from Lab Valley Ltd., Part. 111 1/32 Sriwara Road, Phlapphla Sub-district, Wang Thong Lang District, Bangkok.

Method of operation

- Methods for cooking rice to reduce sugar content in five methods of cooking jasmine rice.
- Method 1: A standard rice cooker,
- Method 2: Soak before cooking SGE.
- Method 3 Steaming
- Method 4 Rice Cooker (Frozen)
- Method 5: The rice cooker reduces the glycemic index content.

Table 1 presents the results of the experiment using a Completely Randomized Design (CRD). Three experiments were performed to compare mean differences.

Table .1Process for cooking jasmine rice.

Ingredient	Ingredient weight) g)				
	Method 1	Method 2	Method 3	Method 4	Method 5
jasmine rice	150	150	150	150	150
water from washing rice	300	300	300	300	300
fresh water	150	150	150	150	1,500
ice soaking water	0	150	0	0	0

Source: Methods 1-2: SGE ; (2022)Method :3 Vitawin (2022) ; Method :4Patcharee (2010) ; Method 5: Luch)2021).

Chemical Analysis

The sugar content was measured by the DNS method using jasmine rice cooked by all five methods. The samples were placed in test tubes at room temperature for 20 min before dilution. The sugar content was determined using a Milton Roy Company Spectronic 20 Plus UV-VIS spectrophotometer at a wavelength of 540 nm.

Physical property analysis

Texture analysis

To compare the amount of sugar, the least amount of sugar was used with the most popular rice cooking method (Method 1: normal rice cooking). Measurements were performed using a Texture Analyzer (TA XT2i, Texture Analyzer). This was a simulation of using teeth to measure the hardness and stickiness of cooked jasmine rice. Four grains of the rice sample were placed in one row and pressed on the sample at 90% of the height using a cylindrical probe with a diameter of 35 mm. The speed before, during, and after the test was 10 mm/s. The first and last pressure values represent the hardness and stickiness values, respectively. This test was repeated 30 times for each sample.

Sensory assessment

Standardization is the most popular rice cooking method. Method 1: Normal rice cooking. Sensory assessment was performed by planning a Randomized Complete Block Design (RCBD). Thirty untrained testers were used in terms of appearance, colour, smell, taste, texture, and overall preference. Each serving of cooked jasmine rice (100 g) was evaluated for sensory quality using a 9-point hedonic scale. The results were analyzed using a Paired t-Test statistical comparison between soaking and normal rice cookers. The acceptance of jasmine rice cooking

reduces the sugar amount: A consumer questionnaire of 100 adolescents was used to examine consumer acceptance of cooking jasmine rice with reduced sugar content. In terms of overall preferences, the results were analysed as percentages.

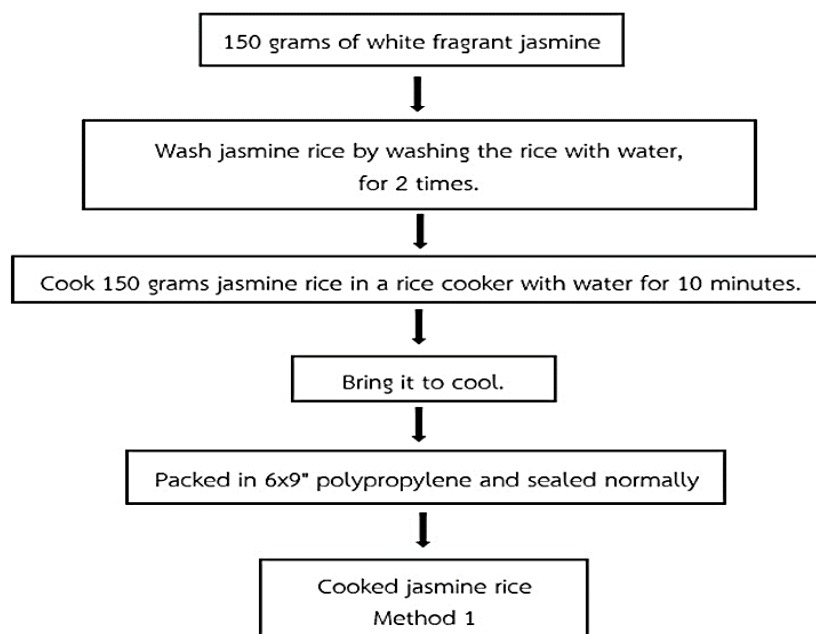


Fig. 1. Shows the flow chart of Method 1 :Normal cooking; Source :SGE.(2022)

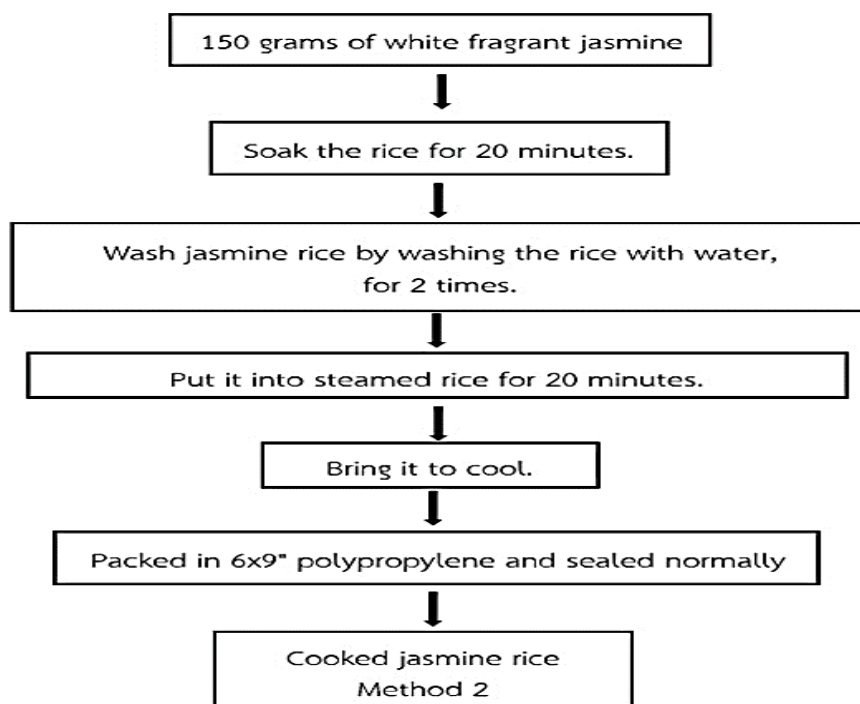


Fig. 2. Shows flow chart of Method 2 :Soak before cooking; Source :SGE (2022).

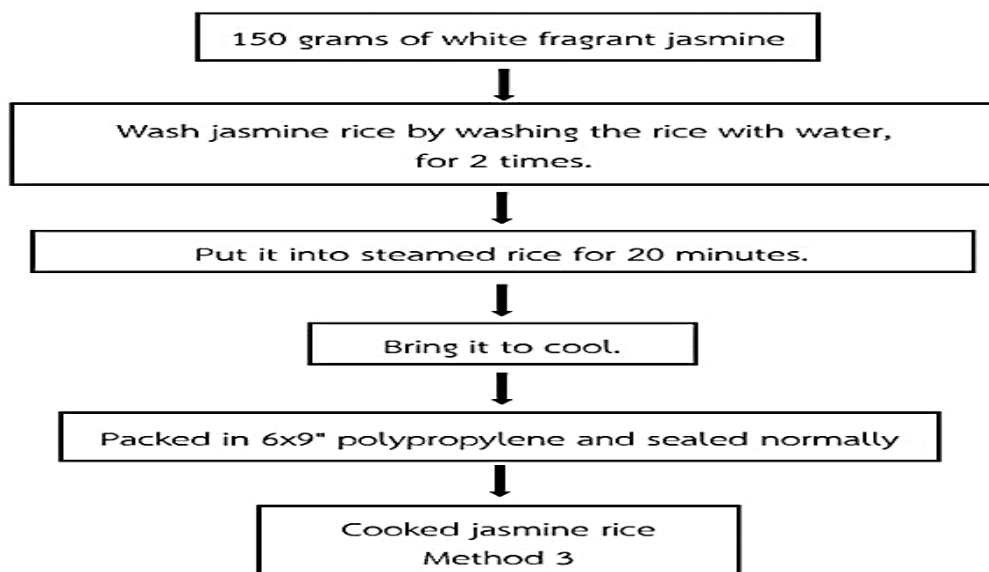


Fig. 3. Flow chart of method 3: Steam; Source :Vitawin. .(2022)

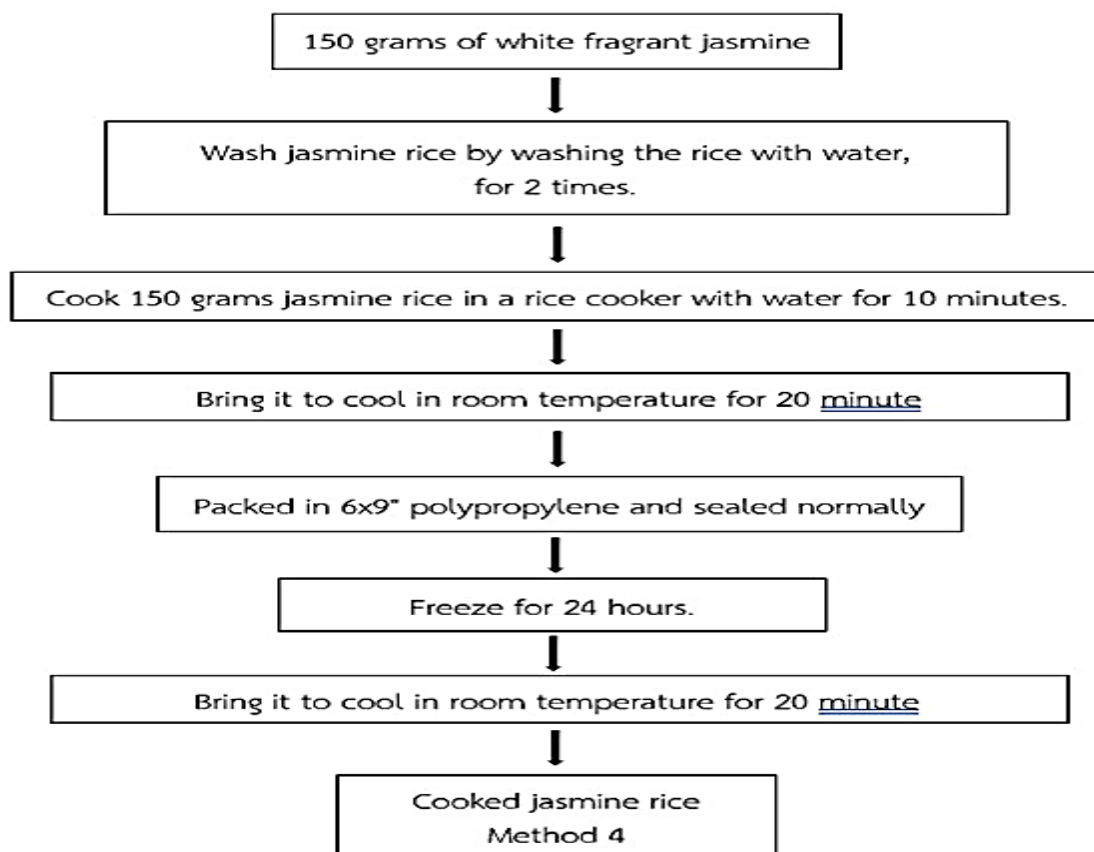


Fig. 4. Flow chart of Method 4: Freeze rice; Source :Patcharee .(2010)

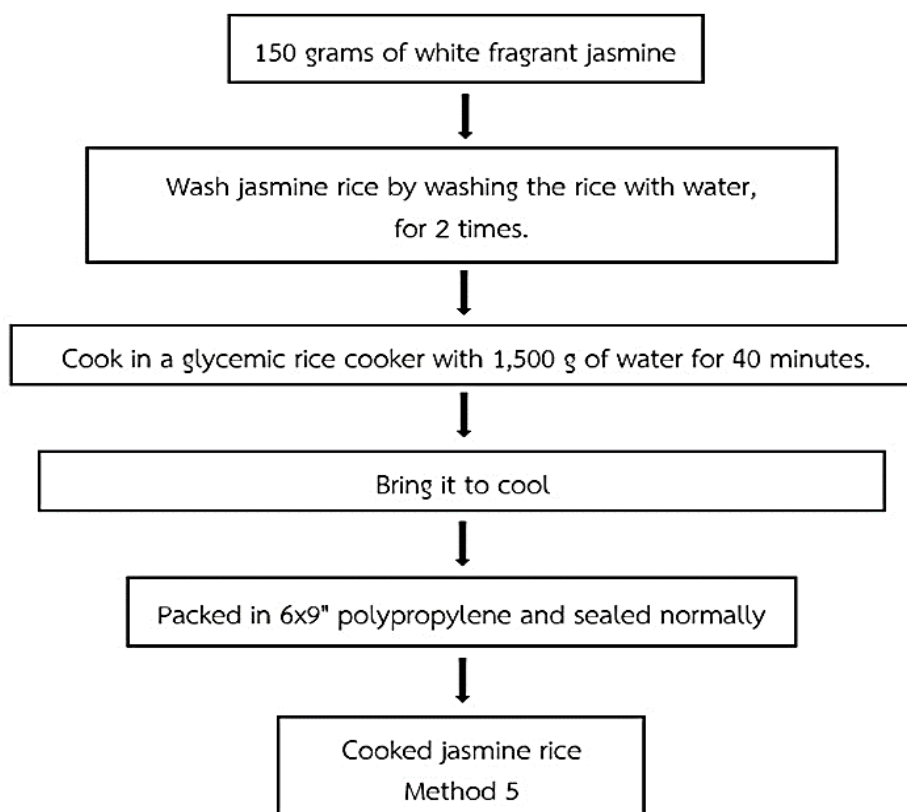


Fig. 5. Flow chart of Method 5 :Rice cooker reduces glycemic index content; Source :Luch (2021).

RESULTS

Results of examining the methods of cooking rice

After conducting a study on five different methods of cooking jasmine rice, including normal rice cooking (hot), soak before cooking, steamed, normal rice cooker (frozen), and reduced glycemic index rice cooking, it was found that soaking the rice before cooking resulted in the lowest amount of glucose in the cooked jasmine rice. This method produced only 0.04% glucose compared to the other four cooking ones. The reduced-sugar rice cooking method produced the highest amount of glucose.

Table .2Analysis of sugar content in cooked jasmine rice.

Method for cooking jasmine rice	Glucose content (%) ^{ns}
normal rice cooking)hot(0.10 ± 0.06
soak before cooking	0.04 ± 0.03
steamed	0.10 ± 0.05
normal rice cooking)frozen(0.08 ± 0.02
reduced glycemic index rice cooker	0.21 ± 0.18

From the results of the analysis of sugar content in all five jasmine rice cooking methods, it was found that there was no statistically significant difference ($p > 0.05$). In addition, it was found that the second method, soaking before cooking, was the method for cooking jasmine rice that resulted in the least amount of glucose in cooked jasmine rice at $0.04 \pm 0.03\%$ out of the five methods and also compared to rice cooker, which sugar content with glucose content was $0.21 \pm 0.18\%$. The second method involves soaking the rice 20 min before cooking, causing it to absorb water. The amount of sugar in rice depends on the amount of water used to soak the rice. The frozen rice showed a statistically significant reduction ($p < 0.05$). When examined for texture characteristics, it was found that normal rice cooking (frozen), when frozen through defrosting, rice with high moisture content also affected the hardness value. However, different cooking methods and different amounts of water in each method cause the internal structure of the rice grains to be different. Water absorption increases rice's moisture content, causing the grain's internal structure to loosen. It can absorb water inside the structure, thus making rice grains hard. In

addition, the loss of water after defrosting occurred, since during freezing, jasmine rice cells were destroyed due to ice crystals and some water moving out of the cells. In contrast, the defrosting of the liquid in the cells was lost in jasmine rice.

Table. 3 Characteristics of texture of different cooked jasmine rice.

Texture characteristics	Method for cooking	
	Soak before cooking	Normal rice cooker) hot(
Hardness)N(19.71 ± 0.73 ^b	23.73 ± 2.60 ^a
Stickiness)N.s)	92.53 ± 14.22	88.61 ± 18.48

Texture characterization of the hardness value and stickiness of cooked jasmine rice were found using both rice methods. The hardness values after soaking before cooking and after normal rice cooking (hot) were significantly different ($p < 0.05$). Meanwhile, soaking before cooking and soaking in a normal (hot) rice cooker was not significantly different ($p > 0.05$). This may be caused by the amount of water used to cook amylose correlating with the texture of rice when rice with high amylose content has a hard texture. Given the rice cooking process, moisture content was found to be the most crucial factor affecting the quality of jasmine rice and consumer acceptance. The moisture content was low, which resulted in the texture of jasmine rice being quite hard. In contrast, the moisture was too high, and the texture of the jasmine rice was watery.

Sensory quality test

Table 4 depicts the results of the sensory quality analysis of the cooked jasmine rice. The participants liked the reduced sugar content of the jasmine rice products. When cooking jasmine rice using the normal rice cooker (hot) method and soaking the rice before cooking, it was found that the participant gave the most favorable results in all aspects. Both jasmine rice cooking methods were compared with the differences in soaking methods before cooking. The normal rice cooker (hot) method showed that the preference for soaking before cooking was statistically significant ($p < 0.05$).

Table 4. Average scores of various sensory quality tests of jasmine rice cooking methods.

Features sensory	Favour score	
	Soak before cooking	Normal rice cooker) hot(
Appearance	8.10 ± 0.60 ^a	6.83 ± 0.99 ^b
Color	8.00 ± 0.58 ^a	7.20 ± 0.99 ^b
Smell	8.73 ± 0.52 ^a	6.90 ± 0.84 ^b
Taste	8.30 ± 0.65 ^a	6.93 ± 0.94 ^b
Texture characteristics	8.23 ± 0.72 ^a	6.96 ± 0.80 ^b
Overall preference	8.60 ± 0.62 ^a	7.00 ± 0.78 ^b

As the texture characteristics of soaking before cooking are softer, it does not appear as hard as rice that has been used in a normal rice cooker (hot). This is a common and popular rice-cooking method. Corresponding to the obtained texture characteristics, the soaking before cooking method had a statistically significant difference in texture and hardness compared to the normal rice cooker (hot) method ($p < 0.05$).

Consumer acceptance of jasmine rice product with reduced sugar content

A survey of 100 individuals found that consumers had a positive attitude towards using jasmine rice with reduced sugar content by soaking it before cooking. This method was accepted at the highest level across all aspects. Interestingly, 56% of respondents were female. Furthermore, 52% were between the ages of 15-24, with most respondents being single (73%) and holding a bachelor's degree (60%). The survey also revealed that 41% of the respondents had an average monthly income ranging from 5,001 to 7,500 baht.

Table 5. Consumer acceptance of jasmine rice with reduced sugar amount.

List	Extremely satisfied (%)	Very satisfied (%)	Moderate satisfied (%)
Appearance	53	45	2
Colour	36	60	4
Texture	56	38	6
Taste	64	31	5
Overall	54	35	11

The data presented in Table 5 demonstrate that consumers are generally satisfied with jasmine rice, which has a reduced sugar content. Regarding appearance, 53% of the consumers reported feeling satisfied, while 60% were pleased with the colour. The texture was rated positively by 56% of the consumers, and the taste was enjoyed by 64%. Overall satisfaction with the product was 54%. These results suggest that reducing the sugar content in jasmine rice may be a viable option for improving consumer satisfaction.

DISCUSSION

In the study of cooking methods of jasmine rice, we presented the results of the studies on five cooking methods of jasmine rice including normal rice cooker (hot), soaking before cooking, steaming, normal rice cooker (frozen), and rice cooking to reduce sugar content. The second method, soaking before cooking, was the method of cooking jasmine rice that made the least amount of sugar when cooked at 0.04%. It was found that when jasmine rice was cooked with a normal rice cooker (hot) and soaked before cooking, soaking made jasmine rice was stickier than rice cooked with a normal rice cooker (hot). The hardness values were 19.71 ± 0.73 (N) and 23.73 ± 2.60 (N), respectively, which were significantly different ($P < 0.05$). In terms of stickiness, soaking before cooking was 92.14 ± 14.22 (N.s), and that of the normal rice cooker (hot) was 88.61 ± 18.48 (N.s), which was not significantly different ($p > 0.05$). The process of soaking rice before cooking reduces its hardness. This makes rice softer and faster to cook. Thus, consumers answered it as their preferences more than for un-soaked rice. Moreover, the amount of sugar in rice decreased when the rice was soaked before cooking. This is in line with the study of Song *et al.* (2003), who investigated the effect of soaking rice using cold and hot soaking methods. In addition, Shao *et al.* (2011) examined the effects of soaking and cooking methods on the glycemic index. It was found that soaking the rice before cooking reduced the sugar content related to the soaking time. Lee *et al.* (2005) found that soaking rice in low-temperature water lowered the sugar content. Similarly, Topping *et al.* (2003) examined the effects of acidic soaking of rice before cooking and found that it had a lowering effect on the sugar content of rice. In summary, soaking before rice cooking affects sugar content. However, the sugar produced depends on the soaking and processing conditions. Soaking before cooking resulted in the least amount of sugar out of all five cooking methods at 0.04%. When using both jasmine rice methods, consisting of cooking rice with a normal rice cooker (hot) and soaking before cooking, it was found that soaking made the rice sticky and softer than cooking rice with a normal rice cooker (hot). The hardness values were 19.71 ± 0.73 (N) and 23.73 ± 2.60 (N), respectively, which were statistically significantly different ($p < 0.05$). In the case of stickiness, the soaking before cooking was 92.14 ± 14.22 (N.s), and that of the normal rice cooker (hot) was 88.61 ± 18.48 (N.s), which was not significantly different ($p > 0.05$). The sensory quality tests and acceptance of jasmine rice cooking depend on soaking the rice before cooking, making the rice soft, and reducing the amount of sugar.

CONCLUSION

Based on the study, it can be concluded that soaking jasmine rice before cooking is an effective method to reduce sugar content while maintaining its sensory qualities and acceptance. This method can be beneficial for individuals with diabetes or those looking to reduce their sugar intake. It is important to note that the soaking method resulted in a stickier and softer texture compared to traditional rice cooking methods. The findings of this study have significant implications for individuals with diabetes and for public health. By the development of the low-glycemic index rice products, there is hope that diabetes can be prevented, and the burden of medical expenses associated with chronic non-communicable diseases can be reduced. This is especially important for those who are at risk of developing diabetes as well as for those who already have the disease. By incorporating low-glycemic index rice into their diet, individuals with diabetes can better manage their blood sugar levels and reduce the risk of complications. From a public health perspective, the development of such products could have a significant

impact on reducing the overall incidence of diabetes and related diseases, ultimately leading to better health outcomes and a more sustainable healthcare system.

Conflict of Interest

The authors declare that there are no conflicts of interest.

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