The Comparation Of White Rice Glucose Levels Between Rice Cooker And Traditional Equipment

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ABSTRACT

Introduction

Rice is one of the staple foods which are mostly consumed by Indonesian people. The white rice consists of carbohydrates, protein, fat, and water. Content of the rice can be changed depending on the processing method. Especially in Indonesian society, there are two ways of rice processing including using traditional tools (steaming) and the rice cooker

Methods

The study was an *experimental research* in the laboratory investigating a comparison between the traditional (steaming) and rice cooker cooking methods. Each method involving 11 samples of rice. The bivariate analysis used unpaired t-test.

Results

Glucose levels in rice cooked using traditional tools (steaming) had an average value of 235.6364 (ppm/100gr) while glucose levels in rice cooked using rice cooker has an average value of 840.3818 (ppm/100gr). The bivariate analysis showed that there was a differences of white rice glucose levels between rice cooker and traditional tools (steaming) cooking methods with a significance p value 0.00

Conclusion

It could be concluded that there was a significant difference of white rice glucose levels between rice cooker and traditional tools (steaming). It is suggested to applied appropriate cooking method for better healthy life style.

Keywords

Rice; Cooking Methods; Glucose level

BACKGROUND

Rice is one of the most basic staple foods consumed by the people of Indonesia whose primary function is used as a major source of carbohydrates in the daily diet. There are various ways in the processing of rice, both in the traditional way and in a modern way that is using a *rice cooker*. But the use of traditional tools in cooking rice now has started to be

used rare by the community (Widhyasari, Putri & Parwati, 2017).

According to the results of a survey conducted by researchers to the community in the village of Sumbersari RT 05 that a number of 15 heads of households conducted interviews directly on each home citizens. Then for each head of the family who cooks using *rice cooker* that is as much as 10 heads of families, while the cooking using traditional tools by steaming (dandang) there are 4 heads of families. Furthermore, to change the pattern of rice processing in the community that is switching the use of traditional cooking utensils (dandang) to the *rice cooker has* many reasons, such as cooking using *rice cooker* rice more durable, more practical and save time.

Dandang is a traditional cooking tool where the community mostly uses to cook rice while *rice cooker* is an electric household appliance that works on the basis of heating elements and the main focus of *rice cooker* is for cooking and food warmers. Storage of rice in *rice cooker is* assisted by using electricity, therefore the resulting temperature will be higher than cooking rice by way of steamed or steamed. Although cooking rice using traditional tools (dandang) there is no process of warming to cooked rice, it is better to eat, because according to research Haryono, (2011), conducted in Jakarta, stated that hot rice has carbohydrate or higher glucose than cold rice. The use of rice heater with *rice cooker* by the community that is as an option to keep the rice remain hot and warm, also for the rice remains soft. However, unwanted storage of rice for too long in the heater will be able to reduce the quality of nutrition in the rice including glucose content (Stall, 2016, Suranny, 2015; Widhyasari, Putri & Parwati, 2017; Islamiyah, Gonggo & Pursitasari, 2013).

Glucose is the most important monosaccharide that serves as a source of energy for humans. In all types of carbohydrates be it monosaccharides, disaccharides or polysaccharides that have been consumed by humans, it will be converted into glucose in the liver. In addition, glucose also has a role as one of the major molecules in the process of energy formation in the body. Carbohydrates in the form of glucose are not only used as an active skeletal muscle fuel but are also used as fuel for metabolism of nerve cells and red blood cells. Based on the above statement can be concluded that the consumption of glucose is very important because it is needed by the body but there are limitations that must be known in food consumption that has a high glycemic index because it can affect the process of metabolism and blood glucose levels (Islamiyah, Gonggo & Pursitasari, 2013; Septianingrum, Liyanan & Kusbiantoro, 2016; Suryani, Abdurrchim & Alindah 2016).

The effect of food consumption on blood glucose levels over a certain period is called the glycemic response. A good knowledge and understanding of the glycemic response is very important, both for healthy people is to avoid DM disease, as well as in patients with DM. Food consumed will be digested at different speeds, so the response to blood glucose levels will also be different. The glycemic index (IG) can provide clues to the effects of dietary fats on blood glucose levels and also on the insulin response as well as an easy and effective way to control blood glucose fluctuations. According to (Ragnhild

et al, 2004; Foresters & Siagian, 2004; Atkinson *et al*., 2008) In general, foods that can elevate fast blood glucose levels have high IG content, whereas foods that can raise blood sugar levels slowly have a low glycemic index (IG) (Arif, Budianto & Hoeruddin, 2013).

The study was conducted by comparing two groups, namely rice group cooked by *rice cooker* and rice group cooked using traditional tools to differentiate the amount of glucose levels in different cooking processes.

METHODS

This research is anresearch *experimental* in laboratory that is by comparing the content of glucose in rice with different processing methods. Type of rice used was white rice and processing methods in**g**unakan is using traditional tools (steaming) and *a rice*cooker.The experimental design was 2 experiments and repeated 11 times in each cooking method calculated using the Gomez formula (1999). Samplingis by *techniquesimple random sampling*. Measurement of glucose level on rice using sulfuric acid phenol method. Equipment used in this research is spektofotometri, digital balance, centrifugation tools and other glassware. Data analysis used univariate and bivariate analysis**.** Univariate analysis was used to know the average result of the amount of glucose in rice obtained from different cooking process and bivariate analysis used to know the difference of glucose level in cookedwith *ricerice cooker* with cooked using traditional tool then used *t-Independent Samples Test* test by preceded by normality test and homogeneity test.

RESULTS

1. Glucose Level on Rice Processed by Traditional Method (Steaming)

Table 1. Average Rice Glucose Level Processed by Traditional Method (Steaming) Per 100 grams of rice.

Experiment	Temperature Heating	Time	Glucose (ppm / 100gr)
MT (1)	$\pm 100^\circ$C	19 minutes	246.1
MT (2)	$\pm 100^\circ$C	16 minutes	284.6
MT (3)	$\pm 100^\circ$C	19 minutes	169.2
MT (4)	$\pm 100^\circ$C	18 minutes	130.8
MT (5)	$\pm 100^\circ$C	19 minutes	169.2
MT (6)	$\pm 100^\circ$C	19 minutes	246.1
MT (7)	$\pm 100^\circ$C	18 minutes	207.7
MT (8)	$\pm 100^\circ$C	16 minutes	246.1
MT (9)	$\pm 100^\circ$C	19 minutes	246.1
MT (10)	$\pm 100^\circ$C	19 minutes	169.2
MT (11)	$\pm 100^\circ$C	18 minutes	476.9
Average			235.6364

Table 1 it can be seen that the results of the analysis of glucose levels in rice treated with traditional methods (steaming) obtained the results of the experiments 1 through 11, the maximum value lies in the trials MT (11) with a yield of 476.9ppm / 100gr 100ºC with a cooking time of 18 minutes. And the minimum value is in the MT experiment (4) with the result of 130.8 with the cooking time of 18 minutes. Differences in cooking time is different because influenced by various factors one of them is the size of the fire used in the process of cooking rice.

2. Glucose Levels of Rice Cooked Rice Cookies

Table 2. Average Rice Cooked Rice Levels With *Rice Cooker* Per 100 gram Rice

Experiment	Temperature Heating	Time	Glucose (ppm / 100gr)
MT (1)	90-97°C	40 minutes	515.4
MT (2)	90-97°C	40 minutes	1707.7
MT (3)	90-97°C	40 minutes	2592.3
MT (4)	90-97°C	35 minutes	284.6
MT (5)	90- 97°C	40 minutes	284.6
MT (6)	90-97°C	35 minutes	707.7
MT (7)	90-97°C	39 minutes	438.5
MT (8)	90-97°C	39 minutes	784.6
MT (9)	90-97°C	40 minutes	476.9
MT (10)	90-97°C	39 minutes	630.8
MT (11)	90-97°C	39 minutes	821.1
Average			840.3818

Based on table 2 above it can be seen that the results of the analysis of glucose levels on rice processed by the method of *rice cooker* in experiments 1 to 11 obtained the results of the maximum value in RC experiments (3) with the result 2592.3ppm / 100gr with the temperature of boiling point of water reach 90-97ºC with the average of cooking process that is 40 minutes. And the minimum value is in RC (4) and RC (5) experiments with the result of 284.6 with the temperature of the boiling point of water reaching 90-97ºC with each cooking time of 35 and 40 minutes. The difference in time spent on the cooking process is influenced by electric power used by researchers.

Table 3. Comparison of Average Glucose in rice is cooked using traditional tools (steaming) with Cooked Using the Rice Cooker

Repetition	Glucose (ppm / 100gr)	
	Traditional methods (steaming)	Rice Cooker
1.	246.1	515.4
2.	284.6	1707.7
3.	169.2	2592.3
4.	130.8	284.6
5.	169.2	284.6
6.	246.1	707.7
7.	207.7	438.5
8.	246.1	784.6
9.	246.1	476.9
10.	169.2	630.8
11.	476.9	821.1
Average	235.6364	840.3818

Based on table 3 it can be seen that in the average yield of glucose on rice cooked by *rice cooker* has a higher value compared to cooked rice using traditional tools (steaming) that is on the tool *rice cooker* has an average value (840.3818) and on the traditional tool (steaming) that is (235.6364).

The sample in this study amounted to less than 50 samples so that in the normality test the researchers used Shapiro-Whilk. The result of the analysis using normality test showed that the data distribution is not normal because its significance value> 0.05, Therefore the data is transformed using Ln. After the data is transformed the results obtained show the data is normal because the significance value> 0.05, that is the method of cooking using traditional tools (steaming) the value of the significance of 0.301 and the cooking method using the *rice cooker* value significannya 0.377. Result of homogenity test analysis or homogenity test of variance indicate that probability value at *Levene's test is* 0,112 and sig value is> 0.05, hence can be concluded that variant of data population for glucose level is homogen. Result of *Test of t-Independent Independent Test Test* of significan value show 0 , 00 which means there is a difference in glucose levels between cookedwith *ricerice cooker* with. Where the level of glucose in cookedusing *ricerice cooker* value is higher than cooked rice using traditional tools (steaming).

DISCUSSION

Cooking rice using traditional tool processing process is quite different from cooking rice using *rice cooker*. The process of cooking rice by using traditional tools (steaming) is done with two cooking process that is cooked rice boiling in hot water (dikaru) until the water is absorbed by rice, then the half- cooked rice is put again on the steamer (dandang) which is filled with water boil and wait for a few minutes to produce ready-to-eat rice. Cooking heating temperature using traditional tool (steaming) reaches $\pm 100 \degree C$ with the average time spent during the cooking process is 19 minutes with the amount of cooked rice is 100gram.

The value of glucose produced in the cooking process using this traditional means is influenced by processing factors, high cooking temperature, and repeated heating when the rice is cooked until the water is absorbed by rice (dikaru) and yields half cooked rice until it is transferred to the tool steaming with high boiling water temperature. According to Nurhidajah *et al., (*2015) the way of processing can change the nature and content of a food such as fat content, protein and glucose content in the foodstuff.

In addition, according to research conducted by Syafutri *et al.* (2016) mentioned that cooking rice using traditional tools (steaming) has a high texture value because at the time of boiling water reaches $100\degree C$ water it will be absorbed by rice. In addition to the process when the rice is cooled it will re-occur the amylose arrangement leading to retrograde and consequently the resulting rice texture will become harder. According to Winarno, (2004, in Syafutri *et al.,* 2016) retrograde is the process of re- crystallizing starch that undergoes gelatinization. One that affects the texture of rice in cooking using traditional tools (steaming) is in the process of gelatinization that occurs during heating of rice in water until rice becomes rice. Because the temperature also affects the duration of cooking time and the gelatinization process that occurs in heated rice (Syafutri *et al.,* 2016).

Cooking rice using *rice cooker* is first washed rice and then washed rice added water in accordance with the dosage and cooked until the light on the *rice cooker* shows moving from the *cook* to move to *warm* that indicates cooked rice. Heating temperature when cooking rice using *rice cooker* reach 90- $97\degree C$ with time spent on average reach 40 minutes. The value of glucose produced in the cooking process using *rice cooker* is also influenced by several factors such as the process of processing and the temperature used during the cooking process. Cooking with *rice cooker* process is quite practical and does not require repeated process with a heating temperature that does not reach $100\degree C$ makes the value of glucose produced is quite high compared to the process of cooking rice using traditional tools. However, according to research conducted by Islamiyah et *al.* (2013) cooking rice using *rice cookers* can also produce low glucose levels with over time of warming to warm the rice in *rice cooker*, glucose levels in rice decrease by 0.5ppm every 1 hour. . However, according to research conducted by Sari *et al.,* (2012) too long heating in *rice cooker* can also mengonsumsikan rice contains microbes which is certainly not good for consumption. Heated rice with heating time for 12 hours has an

average amount of 537.000 microbes (colonies / grams) and will increase the number of microbes with the duration of heating in the *rice cooker.* In addition, according to research Gunathilaka & Eknayake (2015), said that cooking rice using *rice cooker* has a higher glucose level compared with cooking rice using a microwave (Islamiyah, Gonggo & Pursitasari, 2013; Sari, Sirajuddin, & Hendrayati, 2012; Gunathilaka & Ekanayake (2015).

The difference between traditional cooking processes using 100ºC and the time spent during the average cooking process is 19 minutes resulting in lower glucose than cooking using *rice cooker*Differences in glucose levels in rice with different treatments are due to differences in cooking process and temperature used.According to Kurniawan *et.al,* (2015) the higher the temperature used during the cooking process it will cause damage to starch molecules in rice or so-called *leaching,* Therefore the resulting glucose levels will decrease with the length of heating and the temperature used.Cooking rice using traditional tools (steaming) undergoes a recurring heating process while cooking using *rice the cooker is* quite practical and the temperature used moments cooking rice higher when cooking using traditional tools. Therefore the resulting glucose levels are quite different because the processing is also different. Decreased glucose levels in rice after processing due to heating process. According to Kurniawan *et al.* (2015), at the time of heating in the cooking process will occur the breakdown of complex sugars into simple sugars, including glucose, fructose and invert sugar. This invert sugar can not be crystalline because its solubility is very large. The higher the temperature the more carbohydrates in the damaged rice and resulting in a decrease in glucose in the rice (Kurniawan *et al.*, 2015).

The process of decreasing glucose levels in rice after processing related to the process of starch gelatinization and hydrolysis of starch. Starch is a major component of rice that forms texture on food and also carbohydrates class of polysaccharides containing amylose and amylopectin which will be broken down into glucose by undergoing several processes. According to Nurhijadah *et al.,* (2015), the method of processing during cooking process of rice can change the physicochemical properties of food such as on the content of glucose in the foodstuff. Heating to starch by using excess water can lead to starch undergoing gelatinization and structural changes and will further affect the starch digestibility. The starch digestibility is related to the cooking method and its processing time (Nurhijadah *et al.,* 2015).

Of the two types of rice cooking methods used in this study showed decreased levels of glucose in processed food that is rice into rice because the temperature used during the cooking process is also different. The heating process with higher temperatures will change the shape of the starch is tergelatinasi so that broken starch granules will be more and more. The amount of amylose-amylopectin fraction greatly influences the starch gelatinization profile. Gelatinination is a process whereby the starch granules can be made to enormous swell, but are non-recoverable. This can happen because in accordance with the increase or high temperature used during cooking process of rice, the granule which is the storage of starch substances in the cell will be enlarged so it can mix

with water and can form a paste. Higher cooking temperatures can lead to the development of more swollen starch granules, then the dissolution of the lower amylose fraction will occur and the breakdown of starch granules and then spread evenly. According to Nelis (2010), on the outside of the granule the amount of free water becomes reduced while the amount of amylose released will increase. In this process, the polymer will be hydrolyzed and ruptured causing damage to carbohydrates or glucose in the rice (Widhyasari, Putri & Parwati, 2017; Nelis 2010).

Researchers assume that the process of cooking rice in the traditional way has a good effect for health because rice produced by traditional methods produces lower levels of glucose compared to cookedusing *ricerice cookers* that have higher glucose levels. Foods that can raise blood sugar levels quickly have a fairly high glucose content, whereas foods that can boost blood sugar levels slowly have a low glucose content. In line with that with low food consumption of glucose can control blood glucose levels, especially in patients with diabetes mellitus. Based on the research of Pateda *et al.* (2009) consuming foods with a low glycemic index content may help to lower levels of fructosamine in patients with diabetes mellitus while according to Heather *et al.* (2001) also showed that foods with low glycemic index contents may help improve metabolic control in people with diabetes mellitus because patients with diabetes mellitus have metabolic disorders resulting in unstable glucose levels in their blood (Septianingrum, *et al.,* 2016).

CONCLUSIONS

From the above discussion about the difference of glucose content in rice between cooked cooked with *rice cooker* with traditional tool (steaming) can be concluded that the glucose content of rice processed by traditional method (steaming) has an average value of 235.6364 (ppm / 100gr). Glucose levels in rice treated with *rice cooker* have an average value of 840.3818 (ppm / 100gr), it can be said there is a difference in the effect of processing on glucose levels in rice between cooked *rice cooker* and cooked using traditional tools.

This study provides an indication that in people or people who have a high risk of DM should consume cooked rice using traditional tools to avoid the risk of high glucose consumption in rice. And for health workers to be a reference for nurses, especially in carrying out its role is as an educator to the public with diabetes mellitus to consume low-glucose food and pay attention to the way of processing staple food is rice because the same food if processed with different methods will produce nutritional value different also including glucose content.

REFERENCES
1. Arif, A. B., Budiyanto, A., & Hoerudin. (2013). Nilai Indeks Glikemik Produk Pangan dan

Faktor- faktor yang Mempengaruhinya. *J. Litbang Pert.* 32(3),91-99.

2. Gunathilaka, M., & Ekanayake, S. (2015). Effect of different cooking methods on glycaemic index of Indian and Pakistani basmati rice varieties . *Ceylon Medical Journal* 60(2) , 57-61.

3. Islamiyah, U., Gonggo, S. T., & Pursitasari, I. D. (2013). Profil Kinetika Perubahan Kadar Glukosa Pada Nasi Dalam Pemanas . *Jurnal Akademika Kimia* 2(3) 160-165.

4. Kurniawan, F., Hartini, S., & Hastuti, D. K. (2015). Pengaruh Pemanasan Terhadap Kadar Pati dan Gula Reduksi Pada Tepung Biji Nangka (Artocarpus heterophyllus lamk). *Prosiding Seminar Nasional Sains danPendidikan Sains X.*

5. Nelis, I. (2012). Profil Gelatinisasi Beberapa Formulasi Tepung-Tepungan Untuk Pendugaan Sifat Pemasakan. *Penel Gizi Makan* 35 (1), 13-22

6. Nurhidajah, Astuti, M., Sardjono, Murdiati, A., & Marsono, Y. (2015). Kadar Serat Pangan dan Daya Cerna Pati Nasi Merah Yang Diperkaya Kappa-Karagenan dan Ekstrak Antosianin Dengan Variasi Metode Pengolahan. *The 2nd University Research Coloquium,* 207-214.

7. Sari, D., Sirajuddin, S., & Hendrayati. (Agustus 2012). Pengaruh Lama Pemanasan Dalam Rice Cooker Terhadap Kandungan Zat Besi (Fe) dan Total Mikroba Nasi Putih. *Media Gizi Masyarakat Indonesia,* 2(1),22-26.

8. Septianingrum, E., Liyanan, & Kusbiantoro, B. (Juni 2016). Review Indeks Glikemik Beras: Faktor- Faktor yang Memperngaruhi dan Keterkaitannya Terhadap Kesehatan Tubuh. *JURNAL KESEHATAN,* 1(1),1-9.

9. Stall, S., MPH, RD, CSR, & CDN. (Vol 26, No 2 (March), 2016). The Rice Cooker and the Renal Diet.*Journal of Renal Nutrition*, e5-e6

10. Suranny, L. E. (2015). Peralatan Dapur Tradisional Sebagai Warisan Kekayaan Bangsa Indonesia. *Jurnal Arkeologi Papua,* 7(1),47-62.

11. Suryani, N., Abdurrachim, R., & Alindah, N. (November 2016). Analisis Kandungan Karbohidrat, Serat Dan Indeks Glikemik Pada Hasil Olahan Beras Siam Unus Sebagai Alternatif Makanan Selingan Penderita Diabetes Mellitus. *Jurkessia,* 7(1), 1-9

12. Syafutri, M. I., Pratama, F., Syaiful, F., & Faizal, A. (23(5) 2016). Effects of Varieties and Cooking Methods on Physical and Chemical Characteristics of Cooked Rice. *Rice Science*, 282−286.

13. Widhyasari, M. L., Putri, N. N., & Parwati, A. P. (Vol 4, No 2 (2017). Penentuan Kadar Karbohidrat Pada Nasi Putih Dalam Proses Pemanasan Rice Cooker Dengan Variasi Waktu. *Bali Medika Jurnal*, 115-125