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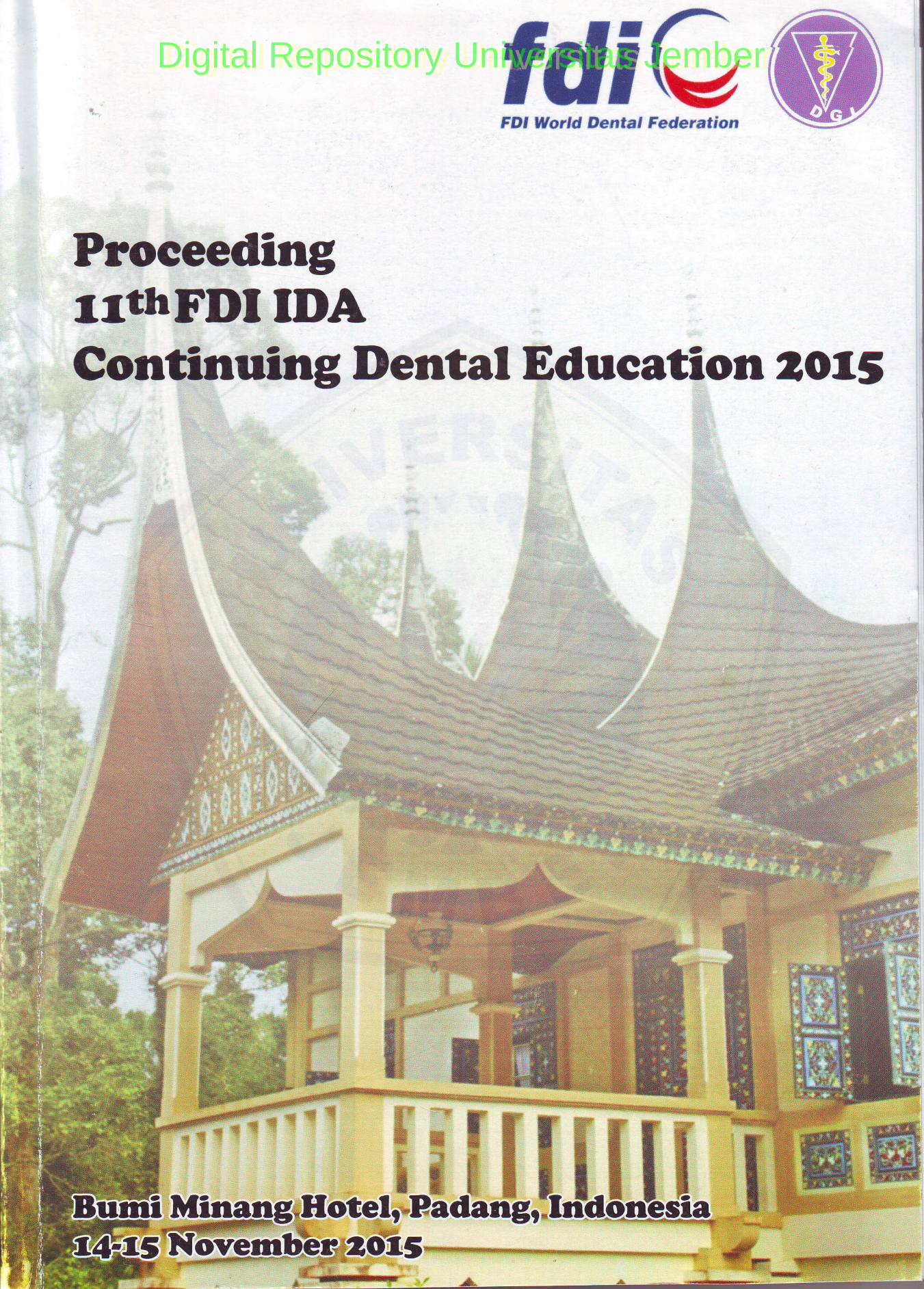

Bumi Minang Hotel, Padang, Indonesia
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Editor :

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Abu Bakar
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Preface

Fdi Continuing Dental Education is an international forum for worldwide dentists t gather, share and exchange the latests science in dentistry. The speaker in this forum will present the update information in dental science.

For Indonesian Dental Assosiation, this Fdi Continuing Dental Education is an excellence program in developing dental science. Threfore, this program has become our priority and need especially for dentist to develop and increase our knowledge.

Committee

CONTENT

The difference between saliva ph and blood glucose levels before and after consuming white rice (oriza sativa) and casava (manihot esculenta crantz)

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Abstract

Background. *Energy need is generally derived from carbohydrates. The ability of carbohydrate to increase blood glucose levels is affected by some factors such as individual variation, long chain carbohydrate molecules and its fiber content. White rice and cassava are some of many sources of carbohydrates consumed by Indonesian society. Both of these foods have advantages and disadvantages. Judging from the content of fiber, is expected to have a different glycemic index and the ability to increase the pH saliva. Cassava contains low carbohydrates and high amount of fiber which are so beneficial for dental health.The longer mastication process will stimulate the more saliva saliva flow lead to optimize the washing and diluting acidic substances that eppear in the oral cavity, cause the decreasing in the pH of saliva.However, casava is sticker than that of rice.* ***Objectives.*** *The aimed of this study is determine differences in salivary pH and blood glucose levels after consuming white rice and cassava during a two hours post prandial.* ***Method.*** *This study used an experimental design with pre-post test time series. The study involved 10 male dental students of University of Jember, with body mass index between 18-22. A 100 gram steam rice and a 100mg steam casava were used for the study. For the rice study, the students were adviced to fast for 12 hours before the assessment.Saliva pH was assessed at 0 and 5, 10, 20, 30 post prandial, while blood glucose tests was performed 0, and 30, 60, 90 and 120 minutes post prandial.A similar study for the casava was conducted a week after the rice study.* ***Results.*** *Results show that salivary pH from casava is significantly higher that the that of the rice at 5, 10 and 20 minutes pst prandial, but produces lower blood glucose at 60 and 90 minutes post prandial.* ***Conclusion.*** *It is concluded that cacava produces higher saliva pH than that for rice but produces lower blood glucose level than that of rice for the same weight food sample.*

Keyword : *blood glucose levels, Saliva pH, casava and white rice,.*

INTRODUCTION

Energy requirements are in general derived from carbohydrates. Carbohydrates are the main source of energy for the human body. The ability of carbohydrates in a food ingredient in improving blood glucose levels is affected by many factors such as individual variation, length of carbohydrate molecule chain and level of fiber content[1].

Indonesian people, in meeting the needs of carbohydrate, commonly eat white rice. White rice contains high carbohydrate (79 grams) but low fiber. This causes the white rice to be able to immediately improve blood glucose, which increases the risk of diseases such as diabetes mellitus. In addition, white rice may also cause changes in the pH of saliva to be lower and acidic [1].

To reduce the risk of diseases such as diabetes mellitus, it is recommended to replace white rice with foods containing lower carbohydrateand high fiber such as cassava. Cassava is lately more and more popular as a source of carbohydrate substituting white rice. Besides the very cheap price, people with diabetes are also advised to consume cassava because it is believed to help control blood glucose levels [2].

In addition, because cassava contains higher fiber, then it can be beneficial for dental health. The longer mastication process will stimulate the flow of higher amount of saliva, which optimizes the work in washing and dilutingthe existing acidic substances, so that the decrease in pH of saliva can be reduced [1].

Based on the description above, this research was conducted in purpose of identifyingthe differences in the pH of saliva and blood glucose levels in the subjects consuming white rice and cassava. Theb benefitsof this research were as the information on difference in pH of saliva and blood glucose levels after consuming white rice and cassava, as well as additional information to clinicians in determining diet.

METHODS

The research type used was clinical experimental type with pre-post test time series design. The research was conducted at Bioscience Laboratory, Faculty of Dentistry, University of Jember in December 2014

The samples consisted of 10 male students of Dentistry Faculty, University of Jember, who had a BMI of 18-22 category and met the study criteria as well as had been willing to become the research samples and fill informed consent.

On the first day of the study, each sample was first instructed to fast for 12 hours before the study was done, that is, the sample was only allowed to drink fresh water and then the fasting glucose levels of each sample were measured first by using glukostick and glukotest meter branded*Easytouch* and blood lancet branded One med.

After the measurement of fasting glycemic index, each sample was treated to the consumption of white rice weighing 100g and after that the salivary pH of each sample was measured at minutes 5, 10, 20 and 30 by using pH meter brandedBoeco and salivacontainer.

One week later, the treatment of consuming boiled cassava was given back to the research samples, who had previously been fasting for 12 hours, and obtained the same treatment, that is, measurement of the pH of saliva and blood glucose levels. Once all the data from each sample had been collected, then the data were analyzed. To test the data obtained from the research, SPSS 17.0 software was used. Data were tested by statistical test of Mann-Whitney U test to determine the differences in each observation point on white rice and cassava.

Results

The research results on the 10 subjects in Bioscience Laboratory, Dental Hospital of Faculty of Dentistry, University of Jember showed the calculation of weight, height, and body mass index shown in Table 1.

Table 1. Description of subjects based on weight, height, and body mass index.

No.	Weight (Kg)	Height (m)	Body Mass Index
1	58.00	1.65	21.30
2	65.00	1.72	22.00
3	62.00	1.72	21.00
4	53.00	1.66	19.20
5	60.00	1.69	21.00
6	60.00	1.71	20.50
7	74.00	1.82	22.30
8	61.00	1.65	22.40
9	60.00	1.75	19.60
10	61.00	1.69	21.40
Average	61.00	1.70	21.07

The average results of the subjects' body mass index were in line with the criteria predeterminedsubjects. The average value of the subjects' body mass index is 21.07 with the highest body mass index value of 22.4 and the lowest one of 19.2. The data show that the amount of fat reserves of the subjectswas similar, so the condition of basal energy needs was also the same [3].

The observation of Salivary pH on each subject at the observation points after consuming the tested food ingredients presented in Table 2 and Table 3.

Table2 showsan increase inthe pH of salivaafter consumingwhite riceat minute5by 7.61, after thatthere isan increase in salivary pHper minuteequal to7.44(minute 10), 7.27(minute 20), and7.10(minute 30) butstill in theneutral limit.

Table3 showsan increase insalivary pHafter consuming cassava, that is, at minute5by 7.82, after thatthere are decreases in the pH ofsalivaper minuteequal to7.64(minute 10), 7.37(minute 20), and7.18(minute 30), butstillin the neutrallimit.

The calculation resultsof blood glucose levelsin testedfoodstuffson eachsubjectat observation pointsata certain timeare presentedin Table4andTable5.

Table 2. The value of salivary pH on the subjects after consuming white rice in the interval of 0 to 30 minutes.

No.	Time(minute)				
	0	5	10	20	30
1	6.98	7.46	7.33	7.24	7.08
2	7.18	7.36	7.25	7.21	7.15
3	7.1	7.3	7.12	7.11	6.97
4	7.18	7.81	7.55	7.2	7.01
5	6.89	7.7	7.47	7.3	7.11
6	6.99	7.66	7.17	7.02	7.02
7	7.2	7.85	7.78	7.43	7.15
8	7.15	7.66	7.66	7.5	7.19
9	7.18	7.6	7.61	7.41	7.22
10	7.05	7.71	7.5	7.33	7.12
Everage	7.09	7.61	7.44	7.27	7.1

Table3.The value ofsalivarypH on subjectsafter consuming boiled cassavain theintervalof 0 to30minutes.

No.	Time(minute)				
	0	5	10	20	30
1	6.93	7.6	7.76	7.45	7.25
2	7.4	8.17	7.83	7.41	7.22
3	7.37	7.98	7.6	7.59	6.26
4	7.22	8.01	7.87	7.34	7.25
5	6.94	7.68	7.52	7.36	7.18
6	7.12	7.94	7.63	7.33	7.28
7	7.18	7.8	7.64	7.25	7.1
8	6.94	7.56	7.34	7.1	7.05
9	6.99	7.62	7.7	7.51	7.18
10	7.38	7.85	7.59	7.38	7.09
Average	7.14	7.82	7.64	7.37	7.18

Table 4.Blood glucose levels(mg/dL) in subjectsafterconsumingwhite ricein theintervalof 0 to120minutes.

No.	Time(minute)				
	0	30	60	90	120
1	85	128	130	121	105
2	83	130	134	115	101
3	79	124	128	117	111
4	72	120	135	111	96
5	71	102	125	108	94
6	75	141	143	132	107
7	73	128	136	118	98
8	87	129	138	115	96
9	79	135	141	125	93
10	88	130	125	122	116
Average	79.2	126.7	133.5	118.4	101.7

Table4 showsan increase inthe glycemicindexafter consumingwhite rice, that is, at minute30by 126.7andminute60by 133.5. Afterthat, declines happened at minute90 by 118.4andminute120by 101.7.

Table 5.Blood glucose levels(mg/dL) in subjectsafter consuming cassavain theintervalof 0 to120minutes.

No.	Time(minute)				
	0	30	60	90	120
1	88	118	105	99	95
2	89	127	118	98	105
3	80	128	93	89	85
4	80	118	93	90	85
5	89	115	125	110	95
6	81	97	92	90	82
7	88	117	100	101	91
8	89	118	120	103	98
9	86	109	97	92	88
10	90	138	119	115	94
Everage	86	118.5	106.2	98.7	91.8

Table 5 shows an increase in blood glucose levels after eating cassava, that is, at minute 30 by 118.5. After that, the blood glucose level declinesat minute60 by 106.2, at minute 90 by 98.7, and at minute 120 by 91.8. This study shows a graph of blood glucose levels due to consumption of white rice and cassava presented in the graph in Figure 1.

Figure 1 shows that the blood glucose levels due to white rice consumption are higher than blood glucose levels due to cassava consumption. It can be seen in the graph that blood glucose levels after consuming white rice occurat minute 30 and minute 60 by 126.7 and 133.5, and there are significant differences from minute 0 to minutes 30 and minute 60. Then, it continuesat minute 90 in which there is a drop amounted to 118.4 and there is a significant difference from minute 0 to minute 90. In minute 120, there is a decrease in blood glucose levels at 101.7 and there is still significant difference from minute 0 to minute 120. Meanwhile, the increasesin blood glucose levels after consuming cassavaoccurred only in minute 30 by 118.5 and there are significant differencesfrom minute 0 to minute 30. After that, a decline in every minute, that is, at minute 60 by 106.2 and at minute 90 by 98.7 and still there are still significantdifferences from minute 0 to minute 60 and 90. In the mean time, at minute 120 there is a decrease by 91.8 but there is no significant difference from the minute 0 to minute120.

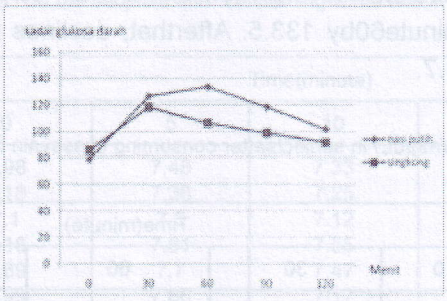

Figure 1. The graph of blood glucose levels of white rice and cassava.

Data analysis

The normality test results of salivary ph and blood glucose levels with Shapiro-Wilk test showed that the significant value was greater than 0.05 (p> 0.05); therefore, the resulted data had a normal distribution. Data analysis was followed by a variant homogeneity test using Levene-Statistictest. The results showed that the significance value was lower than 0.05; it means that the data were not homogeneous.

Normality test results showed that the data had normal distribution, and the homogeneity test showed that data were not homogeneous, so that the data obtained were analyzed using non-parametric test with Mann-Whitney test with 95% confidence level (α = 0.05). Before using the Mann-Whitney test, Kruskal-Wallis test was made first to see if there was a different treatment. TheKruskal-Wallis test resultsobtained sigvalue 0f less than 0.05 which indicated one or more different treatments. To identify which treatment was the same or different, it was then followed by the comparative testing one by one for each treatment with Mann-Whitney test. If sig is less than 0.05, the treatment is significantly different; whereas, if sig is greater than 0.05, then the treatment is not significantly different.

Table 6. Analysis Results of Mann-Whitney U test of salivary pH after consuming white rice.

Time (Minute) White Rice	WhiteRice				
	0	5	10	20	30
0	-	0.000*	0.001*	0.003*	0.971
5	-	-	0.089	0.001*	0.000*
10	-	-	-	0.075	0.000*
20	-	-	-	-	0.007*
30	-	-	-	-	-

Note: *Significantlydifferent(p <0.05)

Table6 showsa significant difference(p <0.05) in salivary pHafter consumingwhite riceat minutes0and5, 0and10, 0and20, 5and20, 5and30, 10and30, 20and30.Meanwhile,at minutes0and30, 5and10, 10and20there was nosignificant difference(p> 0.05).

Table 7.Analysis results ofMann-Whitney Utestof salivary pHbetweenwhite riceand cassava.

Time (minute) White Rice	Cassava				
	0	5	10	20	30
0	0.579	0.000*	0.000*	0.000*	0.043*
5	0.000*	0.075	0.912	0.007*	0.000*
10	0.009*	0.001*	0.035*	0.436	0.011*
20	0.123	0.000*	0.000*	0.143	0.165
30	0.796	0.000*	0.000*	0.000*	0.043*

Note: *Significantlydifferent(p <0.05)

Table 7shows nosignificant difference(p <0.05) betweensalivary pHafter consumingwhite riceandcassavaat minutes 0and0, 5and5, 5and10, 10and20, 20and0, 20and20, 20and30, and30and0, whileat otherminutesthere was a significant difference(p> 0.05) in salivary pHbetweenconsumingwhite riceandcassava.

Table 8. Analysisresults ofMann-Whitney testof salivapH after consuming cassava.

Time (minute) Cassava	Cassava				
	0	5	10	20	30
0	-	0.000*	0.000*	0.019*	0.579
5	-	-	0.089	0.000*	0.000*
10	-	-	-	0.001*	0.000*
20	-	-	-	-	0.002*
30	-	-	-	-	-

Note: * Significantlydifferent (p <0.05)

Table 8 shows that a significant difference (p <0.05) in salivary pH after consuming cassava at minutes 0 and 5, 0 and 10, 0 and 20, 5 and 20, 5 and 30, 10 and 20, 10 and 30 and 20 and 30. Meanwhile, at minute 0 and 30, 5 and 10 there is no significant difference (p> 0.05).

Table 9. Analysis results of Mann-Whitney U test of blood glucose levels after consuming white rice.

Time (minute) White rice	White rice				
	0	30	60	90	120
0	-	0.000*	0.000*	0.000*	0.000*
30	-	-	0.123	0.029*	0.000*
60	-	-	-	0.000*	0.000*
90	-	-	-	-	0.000*
120	-	-	-	-	-

Note: *Significantly different(p <0.05)

Table 9shows a significant difference($p < 0.05$) in glycemic indexafter consumingwhite riceat minutes0and30, 0and60, 0and90, 0and120, 30and90, 30and120, 60and90, 60and120, and90and120.Whilewhile,at minutes30and60there is nosignificant difference($p > 0.05$).

Table10.Analysis results ofMann-Whitney Utestof bloodglucose levelsbetweenwhite riceand cassava.

Time (minute) White rice	Cassava				
	0	30	60	90	120
0	0.007*	0.000*	0.000*	0.000*	0.001*
30	0.000*	0.035*	0.000*	0.000*	0.000*
60	0.000*	0.003*	0.000*	0.000*	0.000*
90	0.000*	0.853	0.075	0.000*	0.000*
120	0.000*	0.001*	0.631	0.393	0.009*

Remarks: *Significantly different($p < 0.05$)

Table10shows nosignificant difference($p < 0.05$) in blood glucose levelsafter consumingwhite riceandcassavaat minutes90 and30, 90and60, 120and60and120and90. Meanwhile,at otherminutesthere is no significantdifferences($p > 0.05$) in blood glucose levelsafter consumingwhite riceandcassava.

Table11.Analysisresults ofMann-Whitney Utestof blood glucose levelsafterconsuming cassava

Time (minute) Cassava	Cassava				
	0	30	60	90	120
0	-	0.000*	0.000*	0.000*	0.075
30	-	-	0.123	0.001*	0.000*
60	-	-	-	0.143	0.015*
90	-	-	-	-	0.089
120	-	-	-	-	-

Note: * Significant different ($p < 0.05$)

Table 11 shows that there is a significant difference ($p < 0.05$) in blood glucose levels after eating cassava at minutes 0 and 30, 0 and 60, 0 and 90, 30 and 90, 30 and 120, and 60 and 120. Meanwhile, at minutes 0 and 120, 30 and 60, 60 and 90, and 90 and 120 there is no significant difference ($p > 0.05$).

DISCUSSION

Thestudy results of salivary pH and blood glucose levels showed differences at some observation points after consuming white rice and boiled cassava. Based on these results, the average value of salivary pH after consuming white rice was lower than that after consuming boiled cassava. Meanwhile, the calculation showed that the average increase in blood glucose levels after consuming white rice was higher than that after consuming boiled cassava.

The value of salivary pH after consuming white rice and boiled cassava

The value of salivary pH after consuming white rice and boiled cassava in this study initially increased compared to unstimulated conditions. The first observations were carried out at minute 5 compared with salivary pH value under normal conditions showed an increase, with an average value of 7.61 for rice originating from white rice and 7.82 for boiled cassava. This pH increase at the beginning was due to the increased flow of saliva which made an increase in bicarbonate ions. Salivary flow might increase due to stimulation of mastication and the flavor of foodstuffs testing [4].

The observation results for the next minutesshowed a decrease if compared to the average salivary pH value in previous observations. The value of salivary pH after consuming white rice and cassava decreased after minute 5. The results obtained in this experiment are in line with the theory which states that pH and buffering capacity of saliva will be high after a quarter of an hour (15 minutes) eating (mechanical stimulation) and then will decrease after half to one hour (30-60 minutes) [5].

Based on the statistical test results using Mann-Whitney test, there is a significant difference in salivary pH after consuming white rice and cassava. However, the research results showed the pH of saliva by boiled cassava was higher. Thisis because the texture of cassava is rougher that can lead to the increase in production of saliva stimulated by the mechanical stimulus of food because of mastication. The increased production of saliva also increases the rate of bicarbonate ions and ptyalinenzymes. Bicarbonate ion can neutralize the acidity of salivary pH due to hydrolysis of carbohydrates. Thus, the increase in pH is be higher [6].

The observations in this study lasted only 30 minutes, so that the value of salivary pH in this study did not decrease until it reached the critical pH. This is because the good rice originating from white rice and cassava is a complex carbohydrate. Despite the breakdown of complex carbohydrates by ptialin enzymes into simpler molecules, this did not cause a drasticdecrease in salivary pH. This is probably due to the fermentation of complex carbohydrates by the bacteria in the oral cavity which takes a longer time because the breakdown process of complex carbohydrates is longer. Complex carbohydrates are usually sticky and sandwiched between the teeth and the gums which allow bacteria to have time to ferment complex carbohydrates [8].

Blood glucose levels after consuming white rice and boiled cassava

Blood glucose levels of white rice and boiled cassava are calculated from the difference between the increase in glucose levels before and after consuming the foodstuff. Therefore, in the research to determine glucose levels before eating the tested foods, subjects were selected normal fasting blood glucose concentration not more than 90mg/dl[8]. The results of calculation of glycemic index of white rice that has been averaged between white rice and boiled cassava showed the difference in the whole observation time, that is, minutes 30, 60, 90 and 120.

Boiled cassava still has layer which is rich of fiber that does not disappear during the

boiling process. Fiber serves as a barrier to the digestive process, so that the absorption of glucose in the intestines is obstructed. Fiber also increases the density and thickness of the food, so that the fiberslowly passes through the digestive tract and inhibits the work of enzymes. The slow process of digestion and absorption leads to an increase in blood glucose foods with high fiber which tends to be low [1]. The higher blood glucose levels of white rice are allegedly because white rice tends to be soft and easy to digest, so the ability to improve glucose levels is higher. In addition, white rice has a lower fiber, causing a high glycemic index value. Since the amount of fiber in foods is higher and higher, so the rate of monosaccharide absorption by the intestinal wall will be slower [9].

The results of this research support the previous theory, but it cannot be denied that there are obstacles which become weakness and may lead to bias in the study. The first weakness is that the treatmentson the subjects were not done simultaneously due to limitation of tool availability, so that for each subject was given a 2-minute break in each observation point. The second weakness is that the ingestion process of food made by the subjects could not be controlled. The third weeakness is that the study was conducted in 3-day interval, so there was possibly psychological change in subjects that might affect the study. Besides, errors in interpretation of research datapossibly happened. All the weaknesses found in this study might also affect the purity of the research results.

CONCLUSIONS AND RECOMMENDATIONS

From the research that has been conducted, it can be concluded that the decrease in salivary pH due to consumption of cassava is longer than that of white rice. Meanwhile, the blood glucose levels after consuming white rice are higher than after consuming cassava. It is suggested to consume foods that have a low glycemic index and high fiber content such as cassava in order to maintain the stablility of salivary pH and blood glucose levels. Besides, it is necessary to study in longerperiod of observation.

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