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Effect of Various Types of Herbs on Sensory Properties and Blood Glucosa Response Adan Instant Black Rice

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Abstract *- Management based on the carbohydrate diet is very important to do and not to be avoided but how diet and variations of carbohydrate consumed is set mainly the source of rice that does not fast respond to an increase in blood glucose. Therefore, Evaluation of nutritional and instant rice production that is the functional food and have a low glycemic index rice sourced locally as the East Kalimantan native rice black Adan will be very beneficial for health. The aim of this research was to evaluate of the nutritional and effect of various herbal on sensory properties and blood glucose response Adan instant black rice. Adan black rice has a protein content of 8.10%, Fe 3.61 mg/1000g and 3.33 g/100g total dietary fiber and includes a group of rice with low amylose. Organoleptic value of instant rice black Adan produced the most preferred by panellists also from the addition of ginger extract and pandan leaves , water, onion tiwai, tea and last turmeric. The digestibility of starch decreased 19.04 (mg/1000g) after being a functional of instant rice black Adan. Difference in reduction of blood glucose levels in volunteers who consumed black Adan instant rice by 14.20 mg/dL, whereas the provision of a reference food (glucose) of 71.50 mg/dL, this indicates of instant rice functional black Adan provide availability of glucose in the blood longer available.*

Keywords — *instant rice; herbal; blood glucose response;*

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I. INTRODUCTION

East Kalimantan province has a wide land resource is 2.511.167 hectare earmarked for the development of food crops and horticulture. Of the area available for 225.451 hectare of paddy fields and paddy field or dry land instead of 2.285.716 hectare (Department of Agriculture, 2011). One of the long-term program Department of Agriculture and Horticulture Kaltim Mayas is rice plant breeding and Adan. Adan is a type of rice paddy exotic East Kalimantan Krayan Nunukan district because it is not found in other areas. Adan rice has a high economic value compared to other types of rice and many sold to Malaysia. Another challenge of the East Kalimantan local rice is the claim Malaysia as their exotic products is therefore important to conserved as the original product Indonesia East Kalimantan.

Instant food is a food product which has the drying process, making it easy to absorb water and is served only by adding hot or cold water, so not too much of the time. Therefore, the availability of more information about black rice adan especially information and potential nutritional value of processed products such as instant rice that is functional then it is very important to do research to enrich the unique biodiversity of Indonesia. The results of research Choi *et al*. (2010) showed black rice bran were tested on mice skin dermatitis and edema can serve as an anti-inflammatory foods and antiallergic and possibly also as a therapeutic agent for the treatment and prevention of diseases associated with chronic inflammation.

Instanization is a term that encompasses a variety of treatments, either chemical or physical characteristics that will improve emergency hydration of a product. Characterization of hydration on a food product must have in order to establish instant food products are: a) the hydrophilic nature, which is easily water-binding properties, b) has no gel layer is not permeable before they are used so as to inhibit the rate of warming, c) hydration products not produce a clumping and settle (Widowati *et al.*, 2011).Instant rice functional processing can be done with the addition of various plant extracts that are beneficial to health to improve the functional properties of rice is processed into instant rice. In this

research the various extracts in the process of soaking and cooking the rice black adan tea, pandanus, ginger, turmeric, and onion tiwai (onion forests of Borneo).

The addition of plant extracts and functional properties found in adan black rice would be very good in the management of diet based on carbohydrates. Management carbohydrate diet mainly of rice is very important to do and not to be avoided but how diet and variations of carbohydrate consumed is set so as not to quickly respond to an increase in blood glucose. The purpose of this study to evaluate the nutritional value of rice black adan, instant rice sensory properties of various plant extracts and treatment response to blood sugar.

II. Materials and Methods

Materials and tools

Materials to be used in this study were black rice adan taken from Krayan Nunukan district of East Kalimantan, Na-citrate, Na_2HPO4, iodine, starch 1%, Potassium Iodide, glucose, sodium hydroxide, sulfuric acid, amylose standards all materials spec pro analysis (pa) from Merck, filter paper (Whatman), pepsin (Sigma), the enzyme pancreatin (Sigma), amiloglukosidase (Sigma) and aquades.

Proximate analysis

Moisture content, ash content, fat content and protein content of rice and instant rice samples were analyzed using the method (Apriyantono *et al*., 1989) and carbohydrate content by the method by difference.

Food fiber (Asp *et al*., 1983): Multi Enzyme-gravimetric method

Determination of soluble dietary fiber, insoluble dietary fiber and total dietary fiber made using an enzymatic method, as follows: a homogeneous dry sample was extracted fat with petroleum benzene at room temperature for 15 minutes, if the fat content of the samples exceed 6-8%. Removal of fat samples aims to maximize the degradation of starch. One gram of sample is introduced into the Erlenmeyer. There to was added 25 ml of sodium phosphate buffer, and made into a suspension. The addition of the buffer is intended to stabilize the enzyme termamyl. Added 100 mL termamyl, closed and incubated at a temperature of 100^{o}C for 15 minutes, while stirring occasionally. Additional goal is to termamyl and heating starch with gelatinization solve first. Removed and cooled. Distillation plus 20 ml of water and its pH adjusted to 1.5 by adding 4 M HCl, then added 100 mg of pepsin. Setting the pH to 1.5 is intended to condition that the maximum activity of the enzyme pepsin. Erlenmeyer was closed and incubated at 40 ° C and agitated for 60 minutes. Distillation added 20 ml of water and the pH was adjusted to 6.8 with NaOH. Setting a pH of 6.8 is intended to maximize enzyme activity pancreatin. Then added 100 ml of the enzyme pancreatin, closed and incubated at 40 ° C for 60 min while agitated. Subsequently the pH was adjusted to 4.5 with HCl, filtered through a crucible which has been weighed dry weight (porosity 2) containing 0.5 g of dry celites (exact weight unknown) and washed with 2 x 10 ml of water distillation. The residue (insoluble Dietary fiber=IDF) residue was washed with 2 x 10 ml of ethanol 95% and 2 x 10 ml of acetone. Then dried at a temperature of 105oC, until the weight remained (approximately 12 hours), and weighed after cooling in the desiccators (D1). Furthermore 500^{o}C in a furnace for at least 5 hours, then weighed after cooling in a desiccators (I1). Filtrate (soluble food fiber=SDF): filtrate volume adjusted to 100 ml with water, then added 400 ml of ethanol 95% warm (60° C), precipitated for 1 hour. Subsequently filtered through a dry crucible (porosity 2) containing 0.5 dry celite and washed with 2 x 10 ml of ethanol 78%, and 2x10 ml of acetone. After cooling, the mixture centrifuge 822x G for 10 minutes. Absorbance of the supernatant was measured at 532 nm. As the standard solution used TEP (tetra etoksi propane).

Analysis of amylose (Apriyantono *et al*., 1989): Spectrophotometric method

As much as 0.1 gram sample is inserted into a test tube, add 1 ml 95% ethanol and 1N NaOH, then heated at 100^{0}C for 10 minutes until the gel is formed. Move around the gel into a volumetric flask 100ml, shake and adjust to sign fix with distilled water, pipette 5 ml of solution and enter the volumetric flask 100ml, add 1ml of acetic acid 1N and 2 ml solution of iodine (0.2 g iodine and 2gram KI in 100ml). Measure the light intensity by using spectrophotometer (Spectronic D20^{+})at a wavelength of 625nm. Preparation of standard series by weighing 40 mg of pure amylose in a test tube, add 1 ml 95% ethanol and 1N NaOH, then heated at 100^{0}C for 10 minutes until the gel is formed. Move around the gel into a 100ml flask, shake and adjust to the mark with distilled water calibration, pipette 5 ml of solution and input in 100ml volumetric flask, add 1ml of 1N acetic acid and 2 ml iodine solution (0.2 grams of iodine and KI in 100ml 2gram). Measure the light intensity by using spectrophotometer at a wavelength of 625nm.

Analysis of Vitamin B1, Iron and Digestibility starch

Analysis of Vitamin B1 (Thiamin) using HPLC(High Performace Liquid Chromatography) (Agilent 1100 series), analysis of iron (Fe) by the method of AOAC Method 975.03 and AOAC method 965.09 using SAA (Spektrofotometer Serapan Atom) Hitachi Z-2000 series (AOAC, 2006). The digestibility of starch in the analysis by using a spectrophotometric (Spectronic D20^{+}) method (Apriyantono *et al*., 1989)

Treatment of various plant extracts as soaking and cooking rice black adan

The treatment process begins with soaking the rice instant rice black adan. Soaking rice black adan performed with various soaking treatments are: water (without addition of extract), 3% extract of ginger, garlic herbal extracts tiwai 3%, 3% extract of turmeric, pandanus, tea extract 3% and 3% with the ratio of rice to the extract is a: 2, soaking carried out for 2 hours, 2 replicates of each treatment performed. The process is then performed the process of draining and cooking. Comparison with the extract of rice in the cooking process is 1:2. Water used in

the cooking process is also adding water (without addition of extract), 3% extract of ginger, garlic herbal extracts tiwai 3%, 3% extract of turmeric, pandan tea extract 3% and 3%. Then performed using a rice cooker (Yong Ma) cooking and after cooking to let the temperature cool enough rice, then frozen (Freezer LG) at-40C for 24 hours, then thawing processing on bath at a temperature above 50-60^{0}C for 1-2 hours. Then performed with the oven (Sanyo Mov) drying temperature of 90^{0}C for 4 h and produced instant rice black adan then performed the test of time rehydration and organoleptic tests instant rice after soaking hot water into instant rice.

Rehydration time

Measurement time (min) rehydration is done by pouring hot water on the sample in a beaker glass of instant rice to water ratio of 2:1 with instant rice, then measurements were taken at exactly the time when the addition of hot water until water is absorbed.

Organoleptic test

Organoleptic test was conducted to determine the level of hedonic test consumer preferences for instant rice produced. Hedonic scale used had a range from very disliked (numerical scale=1) up to scale very liked (numerical scale=7). Each panellist is given a questionnaire form hedonic test to assess the resulting product. Quality attributes that were tested included color, flavor, aroma and texture. The results of the rehydration of instant rice fastest and the best of instant rice organoleptic tests of various herbal treatments continued testing the digestibility of starch, soluble dietary fiber, insoluble dietary fiber, total dietary fiber and blood glucose response.

Test blood glucose response (modified method of Miller *et al.*, 1996).

Instant rice produced blood glucose response is determined to give portion (50g instant rice) to the volunteers who have undergone a full fasting except for water during the night (around 20.00 to 08.00). Volunteers are individuals who used normal, no diabetes, as many as 10 people. With blood sampling tube 30 minutes 4 times (minutes to 30, 60, 90 and 120) as 50 l (finger-prick capillary blood samples method). Interval of 3 days later the same was done to give 50 g of pure glucose (as a reference food) this is done to reduce the effect of blood glucose variability from day to day. Then calculated the difference in blood glucose increases the difference in feeding rates with instant rice black adan.

Analysis of data

Data obtained by analysis of variance performed. If there is a noticeable difference continued to LSD test (least significant difference) with the significant expressed in α = 5%, to determine the effect of the addition of the extract types of rice during soaking and cooking on the sensory properties rice, instant rice and rehydration time.

III. Results and Discussion

Nutritional Value and Functional Properties of Rice Adan Black

Physicochemical properties of the seeds is also suspected to affect the resistance of rice against insect attack storage. High content of amylose starch granules associated with high compactness. Based on the analysis of the functional properties of the data (Table 1) adan rice black rice belonged beramilosa low at 10.81%. Amylose is the main parameter that determines the quality of flavor and cooking quality of rice. Containing high amylose rice when cooked rice texture will produce hard when cool, otherwise to the amylose content of rice that will produce a low rice fluffier and soft texture (Yusof *et al*., 2005).

Table 1. Nutritional Value and Functional Properties of Rice Adan Black

Nutrition Content	Unit	Value
Water	%	12,60
Ash	%	0,8
Fat	%	1,4
Protein	%	8,10
Carbohydrate	%	74,47
Calories	Cal/100g	342,88
Fe(iron)	mg/1000g	3.61
Vitamin B1(Thiamin)	mg/100g	0.23
Soluble dietary fiber	g/100g	2.42
Insoluble dietary fiber	g/100g	0.91
Fiber total	g/100g	3.33
Amylose	g/100g	10.81
Starch total	g/100g	76.28
Amyopectin	g/100g	65.47

Adan black rice has a lower calorie content (342.88 kcal) compared with 362.25$\pm$0.96 kcal black rice (Sompong *et al*., 2011). Availability of calories in food is closely associated with levels of carbohydrates (glucose) in the food and its response to blood glucose Adan iron content in rice black rice is still within the range of general, according to the results of a study conducted Brar *et al*. (2011) of 220 rice varieties were studied iron content ranged from 5.20 to 441.50 mg/g.

Effect of Herbs Types During Soaking and Cooking Time on the Sensory Properties and Rehydration Time Color

The results of the analysis of variance (ANOVA) showed there were significant differences ($p<0.05$) score of instant rice functional Adan color black with a variety of herbal treatments and control after brewed with hot water. The results of further analysis with LSD test at the 0.05 level scores showed significant differences Adan instant rice black color produced after brewed with the addition of ginger with turmeric, tea, onions tiwai and control during soaking and cooking rice black Adan (Table 2).

Table 2. Effect of Herbs Types During Soaking and Cooking Time on the Sensory Properties and Rehydration Time

Sensory Properties	Extract					
	Pandanus	Ginger	Tumeric	Tea	Water	Tiwai
Color	5,0±0,1^{cd}	5,5±0,5^{d}	2,75±0,9^{a}	3,25±1,5^{b}	4,25±0,5^{c}	3,0±0,1^{ab}
Aroma	5,0±0,1^{d}	4,7±0,5^{cd}	2,75±0,5^{a}	3,5±1,0^{a}	4,0±0,8b^{c}	3,5±0,6^{b}
Plavor	4,5±0,6^{bc}	4,8±0,5^{c}	3,0±1,4^{a}	3,5±1,0^{ab}	4,0±0,1^{abc}	3,5±0,6^{ab}
Texture	3,5±1,5	5,0±0,1	3,0±0,8	3,5±1,2	3,2±50,9	3,2±0,5
Rehydration time	5,6±0,4^{b}	5,2±0,2^{a}	6,2±0,7^{c}	6,1±0,6^{c}	5,8±0,6^{bc}	6,1±0,3^{c}

Note: Values followed by same letter in the same row indicate no significant difference (p> 0.05)

The addition of ginger 3% in water soaking and cooking rice black Adan has a score of instant rice Adan black color after brewed the highest with a score of 5.5 (like) than with other treatments. The addition of turmeric to the water soaking and cooking the panelists disliked the color black Adan instant rice produced. The addition of tea extract, turmeric tiwai and change the natural color of black rice Adan thus less favored by penelis. Methods of cooking (rice cooker) the excess water will affect the color (Garber *et al.*, 2012). Studies conducted by Panchan and Naivikul (2009) during the parboiling process starch granules having gelatinization and change color during parboling caused by the Maillard reaction, the pigment of rice into the rice

Aroma

The results of the analysis of variance (ANOVA) showed there is a very significant (p<0.05) score of instant rice aroma Adan functional black with various herbal treatments and control. The results of further analysis with LSD test at the 0.05 level scores showed significant differences Adan instant aroma of black rice produced after brewed with the addition of ginger extract with turmeric, tea, and tiwai in the process of soaking and cooking rice black Adan (Table 2). Treatment tiwai onions, tea and controls showed no real difference to the aroma of black rice produced instant Adan. Instant rice aroma score the highest black Adan obtained on the addition of pandanus but not significantly different with the addition of ginger in the process of soaking and cooking. Typical aroma of rice from several types aromatic rice in Asia exist because of the presence of 2-acetyl-1-pirolina that smells like popcorn. This compound is also the largest component of the volatile oil pandan leaves that contain 10-100 times more than the existence in rice. Pandan leaves are added by the Asians to fix non aromatic rice aroma (Laksanaalami and Ilangantileke, 1993 in Haryadi, 2006). Aroma in rice black adan also mainly caused by lipid components of lipid oxidation and 4-vinyl guaiacol, geranyl acetone (Tananuwong and Lertsiri, 2010)

Flavor

The results of the analysis of variance (ANOVA) showed there is a very significant (p<0.05) score of instant rice functional flavor Adan black with various herbal treatments and control. The results of further analysis with LSD test at the 0.05 level showed significant differences in flavor scores of black Adan instant rice produced after brewed in the process of soaking and cooking rice black Adan were subjected to the addition of ginger, turmeric, tea, and tiwai (Table 2). Treatment tiwai onions, tea and controls showed no significant difference to the aroma of black rice produced instant Adan. Score flavor instant rice black Adan the highest obtained in the addition of ginger but not significantly different from the treatment of pandanus. Cooking quality and flavor is determined more by the varieties and cultivation methods and the environment (soil type, fertilization, and climate) in which rice is planted (Haryadi, 2006). The study results Garber *et al*. (2012) showed by using as many as 10 panelists evaluated the flavor 22 samples of rice bran with white, light brown, dark brown, red and black. Brown rice has a much rougher texture. Black rice is higher in taste oily, dark rice varieties tend to have a more bitter taste.

Texture

The results of the analysis of variance (ANOVA) showed differences not significant (p>0.05) score of instant rice functional Adan texture black with various herbal treatments and control. Although the differences are not significant at the instant rice texture score Adan black but the average value of ginger texture with better treatment and most favored by a score of 5 (like) while the other treatments do not like (Table 2). These results are also supported from Adan black rice produced by treatment with ginger in a better texture than the other treatments. Study of Perdon et al (1999) shows the texture of the rice cultivars and mainly influenced by differences in the ratio of amylose and amylopectin. Different cultivars showed different kinetics retrogradation because of differences in the properties of starch, so that in this study showed no obvious differences in texture. Storage temperature and duration affect the hardness, adhesiveness and rate retrogradation rice starch. The study results Rwethong *et al*. (2011) showed that the rice is steamed tend to be harder texture than the rice cooker with the cooking method. Freshly cooked rice texture harder than the texture of instant rice after rehydration. Another study conducted by Prapluettrakul *et al*. (2012) instant rice prepared with boiled, pre-frozen for 24 hours before drying, and then rehydrated with boiling water for 3 minutes gives hardness, adhesiveness, and compactness values do not different significantly with rice from freshly cooked rice

Rehydration time

The results of the analysis of variance (ANOVA) showed there is a very significant (p<0.05) time instant rehydration functional Adan black rice with a variety of herbal treatments and control. The results of further analysis with LSD test at the 0.05 level showed significant differences rehydration time Adan instant rice produced in the treatment of black ginger with turmeric treatment, tea, tiwai and control resulting in instant rice (Table 2). Rehydration time is the time required to form the rice after the functional form of instant rice that has previously been performed on the drying process. Shortest rehydration time on Adan instant black rice is produced by treatment with ginger with a time of 5.2 minutes.

Rehydration time difference caused by the porosity of the resulting instant rice, this difference may be caused due to a stronger ginger component to open the pores of rice and rice both in the process of soaking and cooking rehydration time will be faster than the other treatments. Instant rice seeds that have small cracks is believed to facilitate the infiltration of water gets in the instant rice seeds to shorten the time of rehydration and the provision of instant rice.

Absorption of water by rice during cooking related to the ability to hydration as a result of its chemical characteristics (Haryadi, 2006). Sensory value with ginger extract treatment on average the most accepted by the panelists and the fastest time of rehydration. Prasert and Suwannaporn study results (2009) showed that the rehydration time is negatively related to the density of instant rice (r=-0.886) but positively associated with an increase in the volume of instant rice (r=0.637)

Digestibility and Fiber Instant Rice Adan Black

The analysis of the digestibility and fiber than rice black Adan Adan instant black rice with ginger extract treatment, a decrease in the digestibility of starch in rice mg/1000g 79.23 Adan mg/1000g black to 60.19, whereas an increase in dietary fiber late from 2.42 g/100g in black to 2.63 g/100g Adan instant rice black Adan. The same is also an increase in total dietary fiber instant rice functional black Adan 0.11 g/100g compared to Adan black rice (Table 3).

Table 3. Data Analysis Fibers and Starch Digestibility Instant and Rice Functional Black Adan

Nutrition	Unit	Rice Black Adan	Instant Rice Black Adan	Difference
Soluble fiber	g/100g	2.42	2.63	+0.21
Insoluble fiber	g/100g	0.91	0.81	-0.10
Fiber total	g/100g	3.33	3.44	+0.11
Starch digestibility	mg/1000g	79.23	60.19	-19.04

The digestibility of starch in rice of different varieties also the digestibility of different yield when processed into instant rice functional. A new theory of the starch that is resistant to change the views of experts on nutrition of white rice. The theory states that, by changing the method of cooking, the rice starch could be converted into resistant starch which will be released in the digestion and works like fiber. Interestingly, it helps you lose weight. The use of resistant starch is associated with a reduction in starch digestibility due to processing instant rice functional, especially in the freezing process, so that the results of this study was also a decline in the digestibility of rice functional instant adan 19.4 mg/100g. To obtain a resistant starch while cooking white rice, cooled rice after cooking. The process of heating starch and then cooling it will increase the substances mentioned starch.

The digestibility of starch is the ease of a type of starch is hydrolyzed by the enzyme for breaking starch into units of more simple. The digestibility of starch was calculated as a percentage relative to the pure starch (soluble starch). Pure Starch is assumed to be completely digested in the digestive tract. Modified Starch has a lower digestibility because it may contain a higher resistant starch. Resistant Starch can function as a prebiotic and has the potential to improve intestinal health (Alsaffar, 2011). Rice containing hydrophobic components in the form of protein glutein like prolamin (2-7%) and glutelin (77-78%) (Liang and King, 2003). Hydrophobic component proteins, glutelin and albumin to form a gel (Yang and Xu, 2007) and contribute to the binding of water and lower digestibility

Blood Glucose Response After Consumption of Instant Rice Functional Adan Black

Glycemic response of food is closely related to individual physiological responses. However, each component contributes food and each other synergistic effect between the properties of materials to produce a glycemic response. Blood glucose levels (Table 4) indicate that there are individual variations of instant rice is consumed as well as pure glucose consumed by the volunteers. Blood glucose at 30 minutes into the highest found in the first volunteers is 117 mg / dL and the lowest in the 66 volunteer numbers 5 mg/dL. Overall after 120 minutes of consumption of instant rice black adan decreased blood glucose levels.

Table 4. Blood glucose levels (mg/dl) after consumption of instant rice functional adan black, and pure glucose blood sampling intervals of 30 minutes

Volunteer	Taking the time interval of blood after consumption (minutes)							
	Instant rice functional adan black				Glucose			
	30	60	90	120	30	60	90	120
	Blood glucose mg/dL							
1	117	106	102	91	163	175	117	76
2	94	88	89	91	157	116	94	109
3	99	81	79	81	152	144	122	78
4	102	89	89	87	131	122	121	97
5	66	67	69	69	156	191	124	71
6	103	86	86	88	148	151	117	80
7	105	83	88	86	173	187	183	125
8	96	97	92	94	150	144	128	77
9	120	89	90	83	172	168	124	75
10	102	86	94	89	173	126	86	69
Average	100.5	87.4	88.1	86.3	157.6	152.6	121.9	86.1
Differences					57.1	65.2	33.8	-0.2

Difference in reduction of blood glucose levels in volunteers who consumed black Adan instant rice by 14.2 mg/dL, whereas the provision of a reference food (pure glucose) of 71.5 mg/dL, this indicates that the reference food provides a rapid rise in glucose levels and decreased back to near normal as well with a fast time. Instead of instant rice functional black adan provide availability of blood glucose in the blood longer available (slow release). It is also indicated in minutes on average to 120 blood glucose levels were higher in volunteers providing instant rice functional food compared with a reference to it in minute 30 to minute 90 to the reference food response to higher blood glucose levels.

Response to increases in blood sugar after food intake is influenced by several factors, among other types of materials, processing methods and the characteristics

(composition and biochemical properties) materials. The same kind of food when it is processed in different ways, could have different blood sugar responses. The results Astawan and Widowati, (2011) showed that the GI (glycemic index) sweet potatoes are boiled clone 00105.10 62 BB, 47 fried, and baked 80. Decline in rice IG can also be done with the pre cooked. Widowati *et al*. (2009) reported that the process of pre-cooked rice IG can be decreased by approximately 26-39%. This is because the treatment can cause changes in the structure and chemical composition of food.

The glycemic index (GI) food is food levels according to their effect on blood glucose levels rise. Food that raises blood glucose levels quickly have a high GI, whereas foods with low GI will raise blood glucose levels slowly. According Rewthong *et al*. (2011) that the cooling treatment in the processing of instant rice will lead to harder texture and a higher glycemic index. The results Hsu *et al.* (2008) showed that brown rice pre-germination given to diabetic patients for 6 weeks can control blood sugar levels to normal. Results of another study by Babu *et al*. (2009) in patients with type 2 diabetes who mengkosumsi brown rice has a lower glycemic index response of 35% compared to white rice. The results of research Indrasari (2008), showed a trend with low amylose rice has a high glycemic index (74-79), medium amylose rice has a moderate glycemic index (59-64), and high amylose rice has a low glycemic index (34-50). Whereas in this study adan black rice contains relatively low amylose rice and instant black adan has moderate glycemic response compared to the reference food. This is presumably due to a decrease in the digestibility of starch and increase in total dietary fiber adan instant rice (Table 3). In addition to the other components on the black adan rice as anthocyanins, sterols and other nutrients also play an important role in improving the health of people who consume them. Black rice has antioxidants from anthocyanins especially cyanindin-3-glucoside (Min *et al*., 2011) while according to Laokuldilok *et al*. (2011) black rice contains gallic acid, hydroxybenzoic, and protocatechuic higher than brown rice and ordinary rice. The results of research Chen and Cheng (2006) showed that the consumption of rice bran oil diet significantly suppressed hyperlipidemia and hiperinsulinemik to high-fat diet in diabetic rats. Hypocholesterolemic mechanism of rice bran oil rich in γ-oryzanol and γ-tocotrienols may occur with increased neutral sterol excretion of feces and bile acids, through the regulation of cholesterol synthesis and catabolism. The study Das *et al*. (2007) also proved that the more detailed dietary differ substantially in glycemic load induce long-term weight loss.

Potential utilization of rice black adan Krayan East Kalimantan is very good for health. The results of other studies on black rice by Xia *et al*., (2003) showed that rats fed a diet of black rice pigment fraction is able to reduce atherosclerotic lesions compared to mice fed a diet of white rice fractions. This observation is related to the increase in the concentration of HDL cholesterol (High Density Lipoprotein) mice fed a diet of black rice pigment. Inhibition of atherosclerotic lesions of black rice pigment fraction is caused by an increase in the accumulation of cholesterol and a decrease in oxidative stress and inflammation. Ability decreased oxidative stress is associated with antioxidant rice. Total antioxidant activity of black rice correlated with levels of total phenolics, total flavonoids, and total anthocyanins and also significantly correlated with the levels of cyanidin-3-glucoside, cyanidin-3-rutinosida, and peonidin-3-glucosida. Total antioxidant activity of black rice bran 6 times higher than that of white rice bran (Zhang *et al.*, 2010). The antioxidant activity of red rice is higher than that of black rice and black rice is higher than that of white rice (Muntana and Prasong, 2010; June *et al.*, 2012).

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