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Chemical compounds identification of Rice cultivars in West Sumatra

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Chemical compounds identification of Rice cultivars in West Sumatra

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Abstract. In West-Sumatra, rice farming commonly uses five significant cultivars, namely Simauang; Randa Pulau; Bakwan; Junjuangan; and Mundam. They are superior in yields and adaptable to the local climate. In this study, the chemical properties of five cultivars were investigated to identify the composition of protein, carbohydrate, ash, and moisture content. Furthermore, the effects of heat exposure to rices were observed as well, where products typically untreated when being stored. The research investigated how heat exposure may influence shelf life and rice quality. Results show that there are significant differences in chemical contents that occur due to differences in cultivars, storage treatment, and mechanical damage. The most chemical composition that changed when given treatment was Mundam and Simaung cultivars. The chemical composition that changed in Mundam cultivar is MC, Fat, and, Carbohydrate while in Simaung Fat, Ash, and Carbohydrate. Before giving heat treatment, Mundam rice contained the highest and lowest protein 9,617% and 79.37%. Simauang rice has low protein with a high carbohydrate of 6,343% and 81,472%. After giving heat treatment, the protein and carbohydrate of the Mundam changed to 10.207% and 78.666%. Simaung's protein did not change but protein, 6.284%, and 81.541% for carbohydrates. Carbohydrate has changed due to size and type of cultivar. The protein has changed due to cultivar influence, treatment, and size.

1. Introduction

Rice is the main staple food and commodity in Indonesia. Average rice consumption is 31.3 million tons annually [1]. West Sumatra has indigenous rice cultivars, namely Simauang, Randa Pulau, Bakwan, Junjuangan, and Mundam. Each cultivar has a unique chemical compound. Post-harvest handling of this product may influence the alteration of chemical composition. Rice is the main source of nutrition. It contains various chemical components required by the human metabolism process. The main compositions are Moisture Contents (MC), Protein, Fat, Ash, and Carbohydrates. The MC was significantly correlated to rice quality. The higher MC results, the lower rice quality, and the more easy to break and fragile. Rice water content will affect the price. The higher the water content, the more expensive the price of rice. This is caused by inappropriate rice weight.

The function of proteins as forming the bone organic matrix [2]. Another function of protein is to protect the immune system when foreign objects enter the body. Besides protein, another chemical composition of rice is fat. Fat has a function as an energy reserve for the human body, regulating body temperature, and as a solvent for vitamins A, D, E, and K. The need for fat in the human body is at least 20% of the total energy [3]. The highest chemical composition of rice contained in cereals, especially rice is carbohydrates. Carbohydrates have a function as the main source of metabolic energy for humans, structural materials (cellulose), and components of energy transportation [4]. The body's need to consume carbohydrates every day reaches 58.75% [5]. Excessive carbohydrate intake and not accompanied by dietary management will contribute to obesity and the risk of cardiovascular disease [6]. The choice of carbohydrate sources in Indonesia deped on the level of income. Low-income people cannot meet their basic needs, so they choose cheap food to fulfill their calories. No matter the nutrition of the food they eat, this causes the risk of obesity to increase

Post-harvest rice in Indonesia is still largely classified as a traditional process. Rice will be harvested using simple tools and then threshed and dried. The process of drying rice will affect the chemical composition content. Rice exposed to heat will influence the chemical composition, this occur if the content of rice is unable to withstand the heat received. furthermore, the process of rice milling will also affect the quality of rice. Milled will produced by rime milling will have various sizes of rice (broken). Changes in rice size will also affect the chemical composition of rice.

From the description above, this research aims to find out the chemical composition of local rice on the storage conditions and size of rice. Five local rice cultivars are Mudam, Simaung, Bakwan, Randa Pulau, and Junjuangan. Then it can be determined the type of rice cultivar that has a chemical composition according to the needs of the people of West Sumatra.

2. Material and Method

The research sample consist os five local rice cultivars (Simauang, Randa Pulau, Bakwan, Junjuangan, and Mundam) of West Sumatra. Samples are obtained from a rice milling unit. The rice was milled from 30 days after harvesting. Rice was planted at location (1 ° 19′41.7′′S 100 ° 57′10.9′′E) which is rain-fed rice field. 150 gr of each cultivar was given heat treatment using an electric oven for 8 hours at 32 ° C. The same amount of samples is stored at room temperature (25 °C). Then each sample is grouped into 3 categories, namely 0% broken rice (Premium), less than 50% broken rice (economy), and greater than 50% broken rice (substandard). All samples were tested for their chemical content to determine MC, Protein, Fat, Ash, and Carbohydrate content. The chemical compound of the sample was tested at the Livestock Biotechnology Laboratory, Andalas University, Padang, West Sumatra.

Moisture content is measured using the oven method by SNI-01-2891-1992. Determination of moisture content is done by first drying the empty cup for one hour at a temperature of 105 ° C. After that, the empty cup is put in the desiccator to be cooled for 15 minutes then weighed. The sample is weighed as much as 5 grams on a porcelain cup, then put in an oven at 105 ° C for 4 hours and cooled in a desiccator for 15 minutes then the sample and the cup were weighed. This process is repeated until a constant weight is obtained.

Rice protein was tested using a protein analyzer (Kjeltec ™ 8400, Foss, Myanmar) with the Kjeldahl method (1883). The steps in protein measurement are: the sample is weighed as much as 1 gram and then mashed using mortars and put into a Kjeltec tube. After that 1 gram of selenium is added and concentrated H_2SO_4 of 15 ml. Subsequently the material was degraded at 400 ° C for 1 hour, then the protein was calculated using the Kjeltec ™ 8400 tool within 5 minutes then the protein of rice would be obtained.

Rice Fat was tested using the Auto Fat Extraction System (Soxtec ™ 2050, Foss, Denmark) with the crude fat method (AAFCO, 2014). Samples weighed as much as 3 grams in filter paper then put into Soxtec. After that, the lead is heated in an oven at 105 ° C for 15 minutes and cooled in a desiccator for 15 minutes then the lead is weighed. Furthermore, the lead has been weighed and then added as much as 80 ml Benzene solution. The lead was put into the Soxtec ™ 2050 extractor for 75 minutes. The remaining solvent in the lead is distilled and then the flask is heated in an oven at 105 ° C to remove the remaining solvent, then cooled in a desiccator then weighed.

Ash was determined by SNI-01-2891-1992, the sample was weighed as much as 3 grams and then put in a weighted porcelain cup. Porcelain samples and plates are burned using a stove until they do not emit smoke. Then the sample and the cup are put into an electric furnace with a temperature of 500-600 ° C until complete ignition occurs. Then cool in a desiccator for 30 minutes and weigh. Carbohydrate is calculated by reducing the sample weight to the MC, Protein, Fat, and Ash by difference method.

Then the T-Test is used to determine the real difference between storage requirements. ANOVA test was used to determine the effect of cultivars, storage and size treatments on the chemical composition of rice, Duncan test was used to classify the chemical composition of samples based on cultivars, storage treatments, and cultivar differences. The significant value used is 0.05

3. Results and Discussion

In this study has observed five local rice cultivars (Simauang, Randa Pulau, Bakwan, Junjuangan, and Mundam) of West Sumatra. 150 gr from each cultivar were given heat treatment using an electric oven for 8 hours at 32 °C. With the same amount the samples were put at room temperature (25 °C). Furthermore, each sample is grouped into 3 categories, they are 0% broken rice (Premium), less than 50% damaged rice (economy), and greater than 50% broken rice (substandard). All samples were tested for their chemical content to determine MC, Protein total, Fat total, Ash, and Carbohydrate total. The chemical compounds of the sample was tested at the Livestock Biotechnology Laboratory, Andalas University, Padang, West Sumatra. The results of the analysis can be seen in the table below

Table 1. Chemical Properties of Five Local Rice Based on Cultivars

		Chemical Properties				
Cultivars	N	MC	Protein	Fat	Ash	Carbohydrate
Mundam	18	10.50^{a}	9.91^{d}	0.23^{a}	0.34^{b}	79.02^{a}
Bakwan	18	11.88^{b}	7.19^{c}	0.22^{a}	0.39^{b}	80.32^{b}
Randa Pulau	18	10.63^{a}	8.19^{d}	0.2^{a}	0.47^{c}	80.51^{b}
Simauang	18	11.89^{b}	6.31^{a}	0.18^{a}	0.28^{a}	81.34^{c}
Junjuangan	18	11.00^{a}	6.94^{b}	0.26^{a}	0.39^{b}	81.40^{c}

Table 2. Chemical Properties of Five Local Rice Based on Cultivars and Treatment

		Chemical Properties				
Cultivars	Treatments	MC	Protein	Fat	Ash	Carbohydrate
Mundam	Control	10.545 ^{abc}	9.617 ^{f}	0.119 ^{a}	0.348 ^{bcd}	79.371 ^{ab}
	32°C	10.462 ^{ab}	10.207 ^{g}	0.333 ^{b}	0.332 ^{abc}	78.666 ^{a}
Simauang	Control	11.704 ^{d}	6.343 ^{a}	0.229 ^{ab}	0.252 ^{a}	81.472 ^{de}
	32°C	12.086 ^{d}	6.284 ^{a}	0.129 ^{a}	0.295 ^{ab}	81.206 ^{de}
Bakwan	Control	11.848 ^{d}	7.044 ^{c}	0.233 ^{ab}	0.390 ^{cd}	80.485 ^{cd}
	32°C	11.922 ^{d}	7.329 ^{d}	0.204 ^{ab}	0.398 ^{cd}	80.147 ^{bc}
Randa Pulau	Control	11.415 ^{cd}	8.194 ^{e}	0.217 ^{ab}	0.443 ^{de}	79.731 ^{bc}
	32°C	9.857 ^{a}	8.178 ^{e}	0.187 ^{ab}	0.497 ^{e}	81.280 ^{de}
Junjuangan	Control	11.335 ^{bcd}	6.760 ^{b}	0.259 ^{ab}	0.387 ^{cd}	81.260 ^{de}
	32°C	10.675 ^{abc}	7.119 ^{cd}	0.269 ^{ab}	0.396 ^{cd}	81. 541 ^{e}

*Means followed by the same letter within the column are non-significant at P = 0.05 by Duncan‟s

Table 1 shows the influence of chemical properties of five local rice based on cultivars. Mundam, Randa Pulau, and Junjuangan have the same MC but are different for Bakwan and Simauang rice. Both types of rice have the same level. The highest MC of rice is Randa Island 10.63% and the lowest is Mundam 10.5%. Mundam and Randa Pulau have the same protein subset. But it is different from Bakwan, Simauang and Junjuangan rice. Mundam rice has the highest protein value of 9.91% and Simauang has the lowest protein value of 6.31%.

The fat in the five cultivars has no difference, they have a uniform value. The Ash of Mundam, Bakwan, and Junjuangan they are not different but different from Randa Pulau and Simauang. Bakwan and Junjuangan have the highest Ash value of 0.39%. The lowest Ash is 0.28% Simauang rice. Carbohydrate of Bakwan rice and Randa Pulau has the same value, but it is different from Simauang and Junjuangan. Mundam rice has the lowest carbohydrate of 79.02% and Junjuangan rice has the highest value of 81.40%.

Table 2 shows the influence of cultivars and treatment of the chemical properties of five local rice. Protein and fat of Mundam rice are affected by heat treatment. Simauang rice after heating treatment does not affect to chemical content of the sample. For Bakwan rice the protein and carbohydrate content changed after being treated. Protein of Bakwan increased from 7,044% to 7,329% and carbohydrates decreased to 80.147%. Randa Pulau after being given heat treatment affects the MC and carbohydrate of rice. The MC of Randa Pulau rice has decreased to 9,857% while carbohydrates have increased to 81,280%. Junjuangan rice after being given heat treatment affected for protein, protein increased to 7.119%. Next, the chemical content of five local rice cultivars will be explained

3.1 Moisture Content (MC)

Based on the measurement of the MC of five local rice shows, the MC influences the quality of rice. According to SNI 6128: 2015 the MC of rice is 14%. From the research, it was found that MC rice ranged between 9,858 -12,086%. Storage gives effect to the MC of a material. The longer the rice is stored, the MC will increase and the ability of rice to absorb water will decrease [7]. The difference in water content of a material is influenced by cultivars, environmental conditions, and maturity [8]. Heat treatment will result in decreased MC and cause the protein content of a material to increase [9].

From the results obtained the MC of each cultivar has not exceeded the specified standard. The difference in MC caused by environmental conditions, varieties, grain collection, and post-harvest handling [10]. In rice, the physical properties are important but don't affect the MC of the sample [11]. High or low MC, affects chemical contents such as fat, protein, and carbohydrate content in food [12].

After storing rice in two treatments that are stored at room temperature without being exposed to the sun and outside the room the presence of the sun, the temperature of the material increases to 32 ° C for 8 hours. The results of the T-Test analysis showed a difference in MC for Mundam and dandelion types of rice which was stored at room temperature and given heat treatment while for Bakwan, Junjuangan, and Simauang there were no differences. The influence of MC on cultivars and treatment avalaible in Table 2.

ANOVA test of all samples showed that cultivar and storage treatment is given had an effect on the MC of rice while it did not affect the grade of rice MC. For cultivars, storage conditions and the size of rice affect MC rice. Duncan's test analysis results on the influence of cultivars on rice MC are available in Table 1. The influence of cultivars and size avalaible in Table 3. The influence of cultivars, storage conditions, and size are available in Table 4.

3.2 Protein

Protein is a source of amino acids contained in the elements of hydrogen, carbon, nitrogen, and oxygen. Protein is needed by the body for building and energy regulators. Rice protein contains albumin, prolamin, glutelin, globulin [13]. The protein content of rice is 7.8 grams per 100 grams [14]. Protein content in rice at room temperature storage around 9.618 – 11.848%. After heating is stored there is an increase in rice protein content about 10.207 – 12.086%.

The increase in protein is due to decreased water levels in all rice cultivars without denaturation of the rice. Decreased protein in material occurs when the temperature is higher, causing denaturation [15]. Denaturation is the change or modification of secondary, tertiary, and quaternary protein structures, without the occurrence of covalent bonds [16]. Cultivars with the highest protein were found in Bakwan with storage treatment in control that was 11.848%, while in the heat storage treatment of Simaung cultivars was 12.086%. Consumption of protein needed by the human body is 59.7 grams per day [17]. Protein is useful as forming the bone organic matrix, lack of protein will inhibit the formation of the organic matrix in bone [2].

Based on the T-test for all rice cultivars, there are differences in protein in control storage and heating in Junjuangan rice. while other cultivars there is no difference. Based on the Anova test, all tests affect rice protein. Such as each cultivar, storage treatment, and grade of rice. Duncan's test was then performed to see the group differences between treatments. The influence of cultivars on rice protein can be seen in Table 1. The influence of cultivars and storage treatments on heavy protein can be seen in Table 2. The influence of cultivars and grades are available in Table 3. The effects of cultivars, storage treatments, and sizes are available Table 4.

3.3 Fat

Fat is a multifunctional food component that is very important for life, but fat also has a negative side. The function of fat as a source of parts of cell membranes, mediators of biological activity between cells, isolators in maintaining body temperature balance, protective organs, and solvents of vitamins A, D, E, and K [18]. The fat contained in all rice cultivars shows different values. The fat content in all cultivars with control ranged from 0.119 to 0.259%, while the heat treatment ranged from 0.129 to 0.332%. The fat in rice is 0.7 grams per 100 grams [14]. The cultivar with the highest fat in the control treatment was the Junjuangan cultivar while the heat treatment was in the Mundam cultivar.

Processed food will damage the fat contained therein. The degree of damage to fat varies, depending on the temperature used and the length of time of processing. The higher the temperature used, the risk of fat damage is also high. [15]. The Fat in the study did not affect heat treatment, because the temperature used is still in the range can be held by fat in rice.

The Fat in this research is in the range of 0.119 - 0.332 per 100 grams of rice. According to WHO, the maximum recommended total fat consumption is 20% of the total energy of about 60 gr/day. Consumption of fat for the human body is recommended a maximum of 30% of total energy, which includes 10% saturated fatty acids, 10% monounsaturated fatty acids, and 10% polyunsaturated fatty acids [19]. in terms of local rice, fat can be consumed by the community. Excessive fat consumption causes an increase in cholesterol [18]. In epidemiological studies found that high-fat foods associated with colon cancer and breast cancer. Low-fat intake accompanied by high fiber consumption can minimize cancer sufferers [20]. Based on the T-test there is a difference between control with the heating on Mundam and Simauang. while for the variety of Bakwan, Junjuangan, and Randa Pulau there is no difference. Based on the Anova Test all treatments did not affect the fat content of rice

3.4 Ash

The chemical properties of rice are one of the Ash. Ash obtained from all rice cultivars has a difference. Ash shows the amount of inorganic mineral content found in food. The value of Ash in the control and heating range between 0.252 - 0.443% and 0.295 - 0.497%. The lowest Ash is in the Simaung cultivar while the highest Ash in rice is in Randa Pulau. The Ash of rice is still in the standard that is 0.3 - 0.8 gram [21]. The heat treatment of all rice samples has an influence on the value of the Ash produced. The value of Ash with heat treatment is higher than the control. Ash in rice is influenced by the degree of rubbing and nutrient content in the soil [22].

T-test showed that Ash in heat-treated rice had a difference with storage control. Mundam, Bakwan, Junjuangan, and Randa Pulau cultivars don't have differences between the two storages, but Simauang varieties have differences. Based on the Anova test, cultivar influences Ash of rice. Storage conditions and treatment affect the Ash of rice. Cultivars and size matter. Cultivars, storage conditions, and size affect the content of rice ash. Duncan's test was used to see the effect on the content of rice ash available in Table 1. Storage conditions and treatments affect the content of rice ash available in Table 2. Effect of cultivars and sizes available in Table 3, as well as the influence of cultivars, storage conditions and measurements on levels of rice ash available in Table 4.

3.5 Carbohydrate

Measurement of rice carbohydrate total using the by difference method. Carbohydrates are macromolecules consisting of two simple and complex components. Simple carbohydrates include monosaccharides which cannot be broken down into smaller units [24]. Carbohydrates function as the main source of metabolic energy for humans, structural material (cellulose), and component of energy transporters [4].

The results of testing carbohydrate levels of rice are influenced by the type of cultivar. Mundam rice has different carbohydrates than Bakwan rice, Randa Pulau, Simauang, and Junjuangan. Cultivar rice, Bakwan, and Randa pulau have the same carbohydrate, as well as Simauang and Junjuangan. Junjuangan has the highest carbohydrate of 81.40%, while Mundam has the lowest carbohydrate of 70.02% (Table 1). From the research results obtained, Mundam rice is more recommended for consumption because it is low in sugar. Sugar is generally in monosaccharide-shaped rice and is dominated by glucose and fructose [11]. When consumed in excess, monosaccharides can increase blood sugar rise and then be followed by a sudden decrease [24]. If the condition occurs frequently, it can cause obesity and diabetes mellitus [3].

The average human carbohydrate consumption per day is 58.75 [5]. The results of measurements of carbohydrates produced by local rice are known that, West Sumatra rice has a higher carbohydrate compared to its daily carbohydrate needs. Glucose consumption in the city of Padang is almost twice higher than in normal conditions. When accompanied by low activity and metabolism, this excessive glucose intake will accumulate in the body into a layer of fat that is difficult to digest. In the long run, this condition will cause obesity which in turn increases the risk of DM in humans [11].

Changes in lifestyle and patterns of consumption of sugar that is still high, further increasing the risk of degenerative diseases, such as Diabetes Mellitus. Diabetes sufferers in Indonesia are expected to more than double by 2030, which is to be around 21.3 million people [25]. Consuming less white rice can reduce sugar intake in the body. Sugar-rich rice such as Basmati, or rice contains fewer carbohydrates such as brown basmati or low glycemic rice. Sugar in rice is in the form of monosaccharides, specifically glucose and fructose [26].

The T-Test results showed differences in the carbohydrate of Mundam, Randa Pulau, and Siamauang rice carbohydrates in the control storage and heating while Bakwan and Junjuangan were no different. ANOVA results found that cultivars and size affect total carbohydrates in rice but do not affect storage conditions. Cultivars [27], storage conditions, and size [28] affect the total carbohydrate rice.

Analysis of the Duncan test on cultivars influences the total carbohydrate rice available in table 1. Effect of cultivars and storage conditions available in Table 2. Effect of cultivars and measures on the total carbohydrate of rice available in Table 3. Effect of cultivars, storage conditions, and size on total carbohydrates Rice is available in Table 4.

The following table presents the Duncan Test on the influence of cultivar and grade on the chemical compound of five local rice and influence of cultivar, treatments, and grade on the chemical compounds of five local rice

Table 3. Chemical Compound of Five Local Rice Base on Cultivar and Grade

		Chemical Properties				
Cultivars	Grade	MC	Protein	Fat	Ash	Carbohydrate
Mundam	Premium	10.288 ^{ab}	9. 983 ^{f}	0.178 ^{a}	0.323 ^{abc}	79.096 ^{ab}
	Economy	10.419 ^{ab}	9.865 ^{f}	0.299 ^{a}	0.320 ^{abc}	79.096 ^{ab}
	Substandard	10.804 ^{bc}	9.888 ^{f}	0.200 ^{a}	0.377 ^{abcd}	78.703 ^{a}
Simauang	Premium	11.918 ^{c}	6.425 ^{a}	0.236 ^{a}	0.257 ^{a}	81.166 ^{efgh}
	Economy	11.953 ^{c}	6.327 ^{a}	0.145 ^{a}	0.284 ^{ab}	81.290 ^{fgh}
	Substandard	11.815 ^{c}	6.190 ^{a}	0.155 ^{a}	0.279 ^{ab}	81.561 ^{gh}
Bakwan	Premium	11.880 ^{c}	7.593 ^{c}	0.160 ^{a}	0.385 ^{bcde}	79.982 ^{bcd}
	Economy	11.857 ^{c}	7.022 ^{b}	0.216 ^{a}	0.397 ^{bcde}	80.507 ^{cdef}
	Substandard	11.919 ^{c}	6.945 ^{b}	0.277 ^{a}	0.399 ^{bcde}	80.460 ^{cdef}
Randa Pulau	Premium	10.920 ^{bc}	8.293 ^{e}	0.227 ^{a}	0.421 ^{cde}	80.139 ^{bcde}
	Economy	9.576 ^{a}	7.895 ^{d}	0.129 ^{a}	0.488 ^{de}	81.915 ^{h}
	Substandard	11.414 ^{bc}	8.372 ^{d}	0.249 ^{a}	0.501 ^{e}	79.465 ^{abc}
Junjuangan	Premium	11.062 ^{bc}	6.998 ^{b}	0.251 ^{a}	0.433 ^{cde}	81.255 ^{fgh}
	Economy	10.874 ^{bc}	6.892 ^{b}	0.216 ^{a}	0.377 ^{abcd}	81.641 ^{gh}
	Substandard	11.079 ^{bc}	6.928 ^{b}	0.324 ^{a}	0.364 ^{abc}	81.304 ^{fgh}

*Means followed by the same letter within the column are non-significant at P = 0.05 by Duncan‟s

Table 3 shows the effect of cultivars and grades on local rice chemical compound. The table can be seen if the MC does not affect the grade on Mundam, Simauang, Bakwan, and Junjuangan rice. Moisture content and grade only affect the Randa Pulau rice. Rice protein influences Bakwan with premium-grade but the same for economy and substandard grade. Likewise, with the island's double rice, MC affects the premium grade but the same for economy and substandard grades. Fat doesn't affect the grade and type of cultivar from local rice, it can be seen from the results obtained Duncan, has the same subset. Ash in rice does not significantly affect the size and type of cultivars, can be seen from the results of the analysis. Ash is in the same subset. The value of Simauang ash and island dowels showed significant differences. The value of Ash and Simauang is 0.257%, 0.501%, respectively. Carbohydrates affect the size of Randa Pulau rice. Rice with economy grade has the highest value at 81,915%. for other types of cultivars, the grade doesn't affect the carbohydrate value of rice.

Table 4. Chemical Compound of Five Local Rice Base on Cultivar, Treatments, and Grade

			Chemical Properties				
Cultivars	Treatments	Grade	MC	Protein	Fat	Ash	Carbohydrate
Mundam	Control	Premium	10.490 bcde	9.601 j	0.131 abc	0.374 abcd	79.398 abcde
	Control	Economy	10.511 bcde	9.613 j	0.165 abc	0.293 ab	79.409 abcde
	Control	Substandard	10.633 bcdef	9.633 j	0.052 a	0.377 abcd	79.304 abcd
	32°C	Premium	10.085 b	10.143 k	0.226 abc	0.272 a	79.057 abc
	32°C	Economy	10.328 bc	10.117 k	0.424 c	0.347 abcd	78.784 ab
	32°C	Substandard	10.975 bcdef	10.360 k	0.348 bc	0.377 abcd	78.156 a
Simauang	Control	Premium	11.580 bcdef	6.433 bc	0.356 bc	0.222 a	81.409 gh
	Control	Economy	12.008 def	6.280 ab	0.134 abc	0.262 a	81.316 fgh
	Control	Substandard	11.523 bcdef	6.317 ab	0.196 abc	0.272 a	81.692 gh
	32°C	Premium	12.251 f	6.417 bc	0.116 ab	0.293 ab	80.922 efgh
	32°C	Economy	10.899 cdef	6.373 bc	0.137 abc	0.307 abc	81.264 fgh
	32°C	Substandard	12.107 ef	6.063 a	0.114 ab	0.285 ab	81.430 gh
Bakwan	Control	Premium	11.894 cdef	7.410 g	0.107 ab	0.388 abcd	80.201 bcdefgh
	Control	Economy	11.894 cdef	6.95 ef	0.233 abc	0.382 abcd	80.541 cdefgh
	Control	Substandard	11.756 cdef	6.773 de	0.358 bc	0.399 abcd	80.713 defgh
	32°C	Premium	11.865 cdef	7.777 h	0.214 abc	0.382 abcd	79.762 bcdef
	32°C	Economy	11.820 cdef	7.093 f	0.202 abc	0.412 abcd	80.472 cdefgh
	32°C	Substandard	12.081 ef	7.117 f	0.196 abc	0.399 abcd	80.206 bcdefgh
Randa Pulau	Control	Premium	10.998 bcdef	8.203 i	0.289 abc	0.343 abcd	80.167 bcdefgh
	Control	Economy	7.960 a	7.893 h	0.120 ab	0.484 cd	83.542 i
	Control	Substandard	12.056 def	8.487 i	0.241 abc	0.501 d	78.715 ab
	32°C	Premium	10.841 bcdef	8.383 i	0.165 abc	0.498 d	80.111 bcdefg
	32°C	Economy	11.192 bcdef	7.897 h	0.137 abc	0.492 cd	80.282 bcdefgh
	32°C	Substandard	10.771 bcdef	8.257 i	0.256 abc	0.501 d	80.214 bcdefgh
Junjuangan	Control	Premium	11.720 bcdef	6.880 def	0.284 abc	0.399 abcd	80.716 defgh
	Control	Economy	11.188 bcdef	6.627 cd	0.182 abc	0.397 abcd	81.606 gh
	Control	Substandard	11.097 bcdef	6.773 de	0.310 abc	0.364 abcd	81.455 gh
	32°C	Premium	10.404 bcd	7.117 f	0.218 abc	0.467 bcd	81.795 h
	32°C	Economy	10.560 bcde	7.157 fg	0.251 abc	0.357 abcd	81.675 gh
	32°C	Substandard	11.061 bcdef	7.083 f	0.339 abc	0.364 abcd	81.152 fgh

*Means followed by the same letter within the column are non-significant at P = 0.05 by Duncan"s

Table 4 shows the effect of cultivars, treatments, and grades on the chemical content of rice. The results obtained, only the MC of the island's double rice affected by cultivar, treatment, and grade. Moisture content changes after being given heat treatment. Cultivars, treatments and sizes influence the protein content. The highest protein value is in premium grade Mundam rice which is 10.360% and the lowest one is in economy class Randa Pulau rice which is 7.960%. In this analysis cultivars, treatments, and grades didn't affect Ash and Fat. Carbohydrates only affect Mundam rice while for Simauang rice, Bakwan, island dandies, and Junjuangan don't have an effect. The highest carbohydrate in Junjuangan rice, after being treated with premium grade is 81.795. The lowest carbohydrate is in mundam rice, after being treated at substandard size with a value of 78.156%. The value of Simauang ash and island dowels showed significant differences. The value of Ash and Simauang content is 0.257%, 0.501%, respectively. Carbohydrates affect the size of Randa Pulau rice. Rice with economy grade has the highest value at 81.915%. For other types of cultivars, the grade does not affect the carbohydrate value of rice.

4. Conclusion

From this study, it can be concluded that the chemical composition content in rice at the time of storage is different. Mundam and Simaung cultivars have changes in chemical content after being treated. The chemical composition that changes in Mundam cultivars is MC, Fat, Ash, and Carbohydrate, while in Simaung cultivar in fat, ash, and carbohydrate. Biggest changes occur in protein and carbohydrate. Before being given heat treatment, mundam rice had the highest protein and low carbohydrate, 9.617%, and 79.37%. Simauang rice has a low protein with a high carbohydrate of 6.343% and 81.472. After giving heat treatment the protein and carbohydrate of the Mundam changed to 10.207% and 78.666%. Protein for simauang rice did not change but still had the lowest protein of 6.284% and 81.541% for carbohydrates. From the results obtained, the people of West Sumatra are advised to consume Mundam cultivar rice because it has low carbohydrates. Because consuming excessive sugar can increase the risk of obesity and Diabetes Miletus (DM).

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