

Determination of Proximate Composition of Local Corn Cultivar from Kisar Island, Southwest Maluku Regency

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Abstract. As a staple food, which consumed by many peoples in almost all places world wide, corn (*Zea mays* L.) has become very important. As well as in Indonesia, especially in Kisar Island, Southwest Maluku regency, corn already be the one of the most important food crops. The purpose of this study was to determine proximate content of local corn kernels from Kisar Island Maluku. Proximate analysis included content of water, fat, protein, ash, crude fiber, total carbohydrate and total sugar. Data collected are presented in form of table and analyzed descriptively. The data obtained were compared to the Indonesian national standard (SNI) of proximate content for corn kernels as well as to other results that have been reported by several researchers. The results of seven local corn cultivars from Kisar Island were in accordance with SNI standards about content of ash (1.13-2.04%), protein (9.14-13.02%), crude fiber (2.17 - 2.72%), fat (3.47-5.10%), total carbohydrate (69.7% -75.74%), and total sugar (58.66% -68.7%). The novelty of this research is to reveal the proximate content of local corn kernels from Kisar Island. This research is expected to be useful as a source of information about the proximate content of local corn seeds, and for instance it can be considered in the utilization and development of local corn in Kisar Island.

Key words: determination, proximate content, local corn, Kisar Island

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INTRODUCTION

Corn (*Zea mays* L.) is a member of the Gramineae or Poaceae. Corn kernels are used as a food source of carbohydrate (Ranum et al., 2014), and globally ranks the third place after rice and wheat as a food source of carbohydrates (Gurung et al., 2018; Kabir et al., 2019). In Africa and Latin America, corn is in the first position as a food source of carbohydrate, and in some developing countries, corn is used as a staple food (Ranjeeta, 2016). In Indonesia, corn is also the second important food crop after rice (Nurwahidah, 2014; Aldillah, 2017).

Corn is also be an important commodity in the world economy, because it is widely used in the food industry such as in the manufacture of corn flour, corn sugar, corn oil, and the basic ingredients of making alcoholic beverages such as beer and whiskey. Corn is also used in the textile and paper industry, as well as for animal feed (Dhami et al., 2015; Dowswell et al., 2019).

In many regions of Indonesia, there are local types of corn with a variety of seed colors. In Maluku, one of the regions that is the main contributor of corn is the Kisar Island, which is located in Southwest Maluku Regency. Peoples in this area consume corn as a staple food, so corn becomes the main commodity in farming activities

which carried out by the community. Previous exploration was carried out by Alfons et al. (2003) and seven local corn cultivars have been found in Kisar Island, namely (1) *Merah Delima Tongkol Cokelat*, (2) *Merah Delima Tongkol Putih*, (3) *Merah Darah*, (4) *Putih*, (5) *Pulut*, (6) *Kuning Genjah*, and (7) *Kuning Dalam* (Sinay & Karuwal, 2018).

These local corn cultivars have ability to adapt to dry environmental conditions. This feature was reported by Sinay in several publications (Sinay & Karuwal, 2014; Sinay et al., 2015; Sinay et al., 2016; Sinay & Karuwal, 2017; Sinay & Arumingtyas, 2018; Sinay & Karuwal, 2018; Sinay & Suripatty, 2019; Sinay & Tanrobak, 2020). This characteristic is indicated by the various responses such as growth, production, biochemical, physiological, anatomical, agronomic, and molecular responses which usually drought responses.

Although various studies have been conducted regarding with the response of growth, production, biochemistry, physiology, anatomy, agronomy, and molecular, however, the nutritional content of the corn has never been investigated. In the field, the Kisar corn-cultivar has a wide variety of seed colors. It is suspected that the color variations represent variations in the level of nutritional content. Therefore, research on nutritional content through proximates needs to be done. The results are expected

to be used for consideration of local corn cultivars which are worthy of consideration as a potential source of corn germplasm as a staple food.

The nutritional profile related to the nutritional content of food, usually analyzed in form of proximate analysis. The analysis includes water content, carbohydrate content, crude fiber content, ash content, protein content, fat, vitamins, and minerals, as well as amino acids (Nunes et al., 2017). Corn is a horticulture plant that has high nutrient content, especially protein and carbohydrates. However, the nutritional content and chemical composition of each type of corn varies according to the type of corn such as hybrid corn (Indriyani et al., 2018), local corn (Lalujan et al., 2017; Suleman et al., 2019), sweet corn (Budak & Aydemir, 2018) and common corn (Wahyudi, 2006), and also the environmental condition in which it is grown (Szeles & Harsanyi, 2018).

In order to further enhance the potential of local corn cultivars and their development as a candidate for assembling national superior corn cultivars, plant characteristics related to nutrient content must be known. The objectives of this research was to determine the proximate composition of seven local corn cultivars from Kisar Island, Southwest Maluku Regency. This research is the first to be conducted to reveal the nutritional content of corn kernels consumed by the people in Kisar, Maluku Barat Daya Regency. The advantage expected from this study is that it could provides data that will be a source of information for the people in Kisar Island, as well as for the scientific community about the nutritional content of local corn kernels from Kisar Island. The nutritional data can be used as information in the context of selecting and assembling these local corn cultivars into superior cultivars.

METHOD

Sample Preparation

The materials included the seeds of seven local corn cultivars from Kisar Island, Southwest Maluku Regency, namely (1) *Merah Delima Tongkol Cokelat*, (2) *Merah Delima Tongkol Putih*, (3) *Merah Darah*, (4) *Putih*, (5) *Pulut*, (6) *Kuning Genjah*, and (7) *Kuning Dalam*. Corn kernels were ground to become a powder, and prepared for the determination of proximate composition.

Determination of Proximate Content

Measurement of proximate content which include water content, ash, fat, protein, and crude fiber content were carried out by the AOAC method (2012). Total carbohydrate content was determined by the *by difference* method, while the total sugar

content was analyzed by the method of National Standar of Indonesia (SNI) 01-2892-1992.

Measurement of water content

As much as two grams of corn kernels were weighed and then dried for three hours in the oven at 105°. This drying is carried out until a constant weight is obtained. Determination of water content was done by the formula:

$$\text{Water content (\%)} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100 \%$$

Determination of ash content

As much as two gram of sample was put into a special cup and then burned in the furnace for three hours at 650°C. The ash was then cooled first, before weighed. The ash content was calculated using following formula:

$$\text{Ash content (\%)} = \frac{\text{Final weight} - \text{Initial weight}}{\text{Sample weight}} \times 100 \%$$

Determination of fat content

The mashed kernel was weighed as much as two gram then put into the timple. Extraction for fat content was carried out for 6 hours by inserting timple into the flask soxhlet. In this process, fat flask whose weight was known is a reservoir. After that, the timple then taken, and the distilled petroleum ether is filled in to the fat flask, then inserting it into the oven for one hour with temperature about 103-105°C. After reach a cooling time for about 30 minutes in a desiccator, the fat flask then weighed and repeated until a constant weight is obtained.

Fat content was calculated by the formula:

$$\text{Fat content (\%)} = \frac{\text{Final weight} - \text{Initial weight}}{\text{Sample weight}} \times 100 \%$$

Determination of crude fiber

A total of two gram of sample was wrapped in filter paper. The wrapped sample was put in a distillation flask, then 200 mL of 0.2 M HCl was added and simmered for thirty minutes. After 30 minutes the sample was removed and rinsed with boiling distilled water for up to five times, until the water was not acidic. Then the sample was added with 200 mL of 0.3 M NaOH then simmered for 30 minutes. After 30 minutes the sample was removed then rinsed with boiling distilled water 5 times until the rinse water was not alkaline. The following step, the sample was oven-dried in the 105°C for 1-2 hours, then put into a desiccator. The first filter paper difference was weighed and the crude fiber content was calculated as follows:

$$\text{Crude Fiber content}(\%) = \frac{\text{Final weight} - \text{Initial weight}}{\text{Sample weight}} \times 100 \%$$

Determination of protein content

Samples of corn kernels that have been mashed were weighed (two grams) and put into the Kjeldahl flask. Ten grams of Selenium and 30 ml of concentrated Sulfuric Acid (H₂SO₄) were added. Then the flask was boiled in an acid chamber to destroy the sample until the solution became clear green.

After that, the liquid is cooled and diluted with aquadest. The liquid was then transferred to a container (boiling flask) with boiling stone and 120 ml of 30% NaOH solution were added. Then continued with distillation until as much as 75 ml of distillate volume was obtained. The distillate was then titrated with 0.5 N NaOH solution (a ml). The blank was done with the same ways to the sample and counted as (b ml). Protein content was calculated with the following formula:

$$\text{Protein content}(\%) = \frac{(b-a) \times N \times 0.014 \times 5.95}{\text{Sample weight}} \times 100 \%$$

Note: a-is the titration volume of sample (mL), b- is the titration volume of blank (mL), and N is the Normality of NaOH.

Determination of total carbohydrate

The determination of total carbohydrate was calculated using *by difference* method with the following formula:

$$\text{Carbohydrates}(\%) = 100\% - (\text{water content} + \text{protein content} + \text{ash content} + \text{fat content}).$$

Determination of total sugar content

Five grams of mashed solids were weighed and put into a 250 mL of beaker glass. Then 100 mL of distilled water was added to dissolved, and purified by adding Lead Acetate. To remove excess of the Lead, Na₂CO₃ and distilled water were added until it

reached a volume of 250 ml. As much as 25 mL of Luff-Schroll and 25 ml of aquadest were added into the erlenmeyer. Then some boiling stones was added and simmered for 10 minutes. Luff scroll and distilled water with the same volume (25 ml) were also mixed and used as a blanks. After cooling rapidly, 15 mL of 20% Potassium Iodide was added and also 25 mL of 26.5% Sulfuric Acid was slowly added. Titration of Iodium was done with 0.1 N Na-Thiosulfate solution, with 1% of starch as an indicator. If the color looks like creamy milk, titration is stopped. Total sugar content was determined by the formula:

$$\text{Total sugar content}(\%) = \frac{(\text{Titration of blank} - \text{Titration of sample})}{\text{Sample weight}} \times 100 \%$$

Data Analysis

The results of the proximate composition were the average of three repetition, and were presented in Mean±SD (standart error). As a comparison standard values for corn kernels based on the Indonesian National Standard (*Standar Nasional Indonesia/SNI*) was used for the variable of water content, fat, protein, ash, and crude fiber, while for the total carbohydrate and total sugar content, the result were compared with references from some research results previously reported by other researchers.

RESULT AND DISCUSSION

The purpose of proximate analysis was to determine the main nutritional components contained in a food. This analysis is important because it can provide data on the main content of a food ingredient and was related to the nutrient content contained in that foodstuff. Proximate values analyzed include water content, fat content, total protein content, ash content, crude fiber content, total carbohydrate, and total sugar (Table 1). The appearance of seven local corn cultivars is showed in Figure 1.

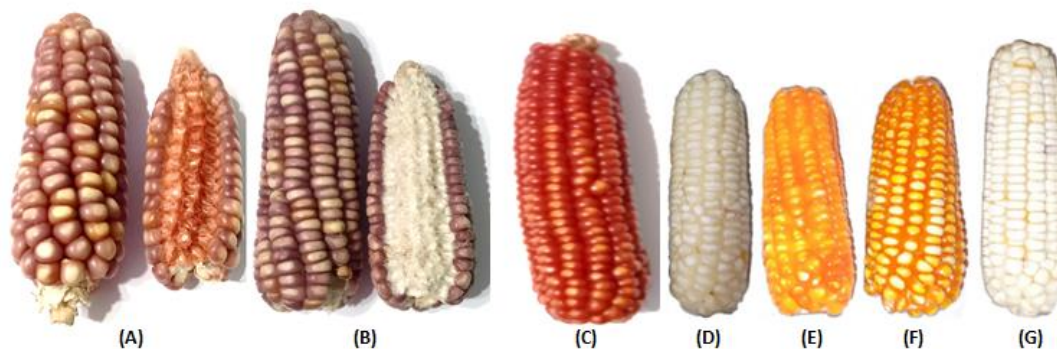


Figure 1. Seven local corn cultivars from Kisar Island, Southwest Maluku. (A) *Merah Delima Tongkol Cokelat*, (B) *Merah Delima Tongkol Putih*, (C) *Merah Darah*, (D) *Pulut*, (E) *Kuning Genjah* (F) *Kuning Dalam*, and (G) *Putih*

Table 1. Results of proximate content on seeds of seven local corn cultivars from Kisar Island, Southwest Maluku Regency

Local corn cultivar	Proximate content						
	Water (%) (SNI Max 14%)	Fat (%) (SNI Min 3.0%)	Protein (%) (SNI Min 7,5; FAO 8-11%)	Ash (%) (SNI Max 2.0%)	Crude fiber (%) (SNI Max 3.0%)	Total carbohydrate (%)	Total sugar (%)
<i>Merah Delima Tongkol Cokelat</i>	10.39 ±0.03	4.95±0.03	11.5±0.26	1.57±0.05	2.72±0.09	71.59±0.68	63.93±0.19
<i>Merah Delima Tongkol Putih</i>	11.6 ±0.06	4.24±0.02	13.02±0.03	2.04±0.04	2.17±0.03	69.7±0.02	58.66±0.66
<i>Merah Darah Pulut</i>	10.52 ±0.08	3.47±0.02	9.14±0.03	1.13±0.02	2.63±0.06	75.74±0.62	63.54±0.21
<i>Kuning Genjah Kuning Dalam Putih</i>	10.85 ±0.02	4.7±0.02	10.04±0.01	1.69±0.02	2.23±0.01	72.95±0.44	60.91±0.23
	11.2 ±0.01	5.1±0.11	11.33±0.03	1.23±0.08	2.49±0.03	71.14±0.05	68.7±0.43
	10.7 ±0.02	3.9±0.01	9.53±0.04	1.39±0.02	2.48±0.04	72±0.17	68.6±0.42
	14.02 ±0.05	3.57±0.02	10.5±0.02	1.43±0.09	2.55±0.02	70.28±0.15	63.83±0.28

The results showed that the proximate levels of the seven local corn cultivars varied and none of the cultivars was the most prominent or highest in terms of their proximate levels (Table 1). The results of measurement of water content showed that *Putih* cultivar was the highest, and the lowest was *Merah Delima Tongkol Cokelat*. From Table 1, it can also be seen that the high water content was not proportional to the fat content. *Putih* cultivar had the lowest fat content, while the highest was *Kuning Genjah* cultivar. The results of measurement of protein and ash contents showed that the highest is *Merah Delima Tongkol Cokelat*, and the lowest was *Merah Darah*. For the crude fiber content, the highest was *Merah Delima Tongkol Cokelat* cultivar, and the lowest was *Merah Delima Tongkol Putih*. The results of measuring the highest total carbohydrates and total sugar were provided by the *Merah Darah* and *Kuning Genjah* cultivar respectively, while the lowest were in *Merah Delima Tongkol Putih* cultivar.

Water content

Water content refers to the presence of water in a material or substance, and expressed as a percentage of both the wet weight or dry weight of a material. The presence of water in an ingredient, especially foodstuffs, is a very important indicator, because the

presence of water greatly affects the quality of these foodstuffs such as appearance, texture, aroma, color, and taste of food, as well as the durability during storage.

High water content allows bacteria and fungi growing easily, and can cause changes of food quality. The moisture content of each ingredient differs depending on the water of a material. According to Zambrano et al. (2019) ingredient with high moisture content, tended to have a high percentage of water content.

The value of water content of local corn cultivars from Kisar Island ranged from 10.39% - 14.02%. According to SNI, the maximum moisture content of corn kernels is 14% (SNI, 1998). Based on the results, it can be seen that for all local corn cultivars, the water content was in line with the SNI quality requirements. Water content in a food is related to the stability index of the food, especially related to food storage. If the water content is higher, the quality and storability of food will be lower. This means that local corn cultivar are very possible to store.

Fat content

The results of fat content of seven local cultivars ranged from 3.47-5.10%. The minimum quality requirement of corn kernels according to SNI (1998)

is 3.0%. The fat content of local cultivar corn kernels from Kisar Island, Southwest Maluku Regency is in accordance with SNI standards. This result was lower than the fat content of *Manado Kunig* (6,01%) as previously reported by Landeng et al. (2017). The low fat content would greatly affect the quality of corn, especially if it has been processed into flour, because it does not cause flour to be easily damaged or experience rancidity (Augustyn et al., 2019).

In general, corn kernels contain about 1.2-5.0% fat and almost 85% of the corn kernels consist of endosperm. Corn fat contains essential unsaturated fatty acids, especially linoleic acid (18:2). The level of fat and its fatty acid composition are influenced by agronomic and genetic factors. Although corn fat contains unsaturated fatty acids in quite high levels, corn oil is relatively stable to oxidation because it contains natural antioxidants and contains very little (less than 1.0%) linolenic acid (18:3) (Lalujan et al., 2017).

Protein content

Analysis of protein in food is important to determine the total protein content in these foods. The results of protein content of corn seeds of seven local cultivars showed a range of 9.14 - 13.02%. This value, very fulfilled the SNI quality requirements (1998) in corn kernels which is a minimum of 7.5%, and FAO standard which is 8-11%. Landeng et al. (2017) reported that the protein content in *Manado Kuning* cultivar was 7.71%. While the results of Hanifa & Hidayah (2016) research on local sticky rice corn and *Jeneponto* flour in South Sulawesi had protein content of 7.65% and 7.11% respectively. The results of the study which has done by Augustyn et al. (2019) in local corn from Moa Island, Southwest Maluku Regency showed the protein content of 8.01-8.39%. Based on these results, we can exactly conclude that the protein content of local corn seeds from Kisar Island are very high (9.14 - 13.02%).

Ash content

The results of the ash content analysis of local cultivar corn seed powder from Kisar Island ranged from 1.13-2.04%. The ash test results also meet SNI quality requirements for corn kernels, which is a maximum of 2.0% (1998). Although there is a slight excess of 0.4% in the *Merah Delima Tongkol Putih* cultivar, is consider very small value, so the ash content still does not exceed to what was stipulated by SNI.

Ash content is a mixture of inorganic components or minerals found in a food (Ahmed et al., 2017). Organic materials that are burned will produce inorganic substances. The type of organic matter determines the composition of the ash. mineral

content related to the ash content in a material. Where ash is composed by various types of minerals with diverse compositions of a food. Ash is an inorganic residue from a combustion process at 650°C. A food contains mostly organic material and water, and the rest is inorganic compounds which called minerals and ash. inorganic components or minerals left in the combustion of organic matter can also be identified by knowing the ash content (Baraem, 2017). According to Liu (2019) high ash content in the sample is due to the presence of unburnt mineral content such as Natrium, Calcium, and Phosphor. Monti et al. (2008) stated that through the ash content, it can be estimated also the total mineral content in food, while Aufari (2013) stated that food with high ash content, must be high in minerals content.

In this study, the value of ash content obtained in all cultivars was in accordance with the SNI standard of ash content for corn which was a maximum of 2%. Ash content of 2% indicates that in the foodstuffs such as corn kernels there are excellent minerals such as macro minerals (Carbon, Hydrogen, Oxygen, Nitrogen, Sulphur, Phosphor, Kalium, Calcium, and Magnesium), and also micro minerals or trace elements such as Zinc, Manganese, Boron, and others.

Crude Fiber content

The level of crude fiber in corn kernels of seven local cultivars from Kisar Island ranged from 2.17 to 2.72%. These results are in accordance with the quality requirements of SNI for corn kernels i.e a maximum fiber content of 3% (SNI, 1998). This means that the fiber content contained in kernels of local corn cultivars from Kisar Island has met the standards set by SNI.

Fiber is a type of carbohydrate that belongs to complex carbohydrates. In food, fiber consists of two types namely crude fiber which is insoluble, and food fiber which commonly known as dietary fiber which is the total amount of fiber (left over from the hydrolysis of digestive enzymes/components that cannot be digested) from both water-soluble (food fiber) and water-insoluble (crude fiber) foodstuffs (Dhingra et al., 2012).

Food fiber is often distinguished by its solubility in water. Total food fiber consists of water soluble food fiber (Soluble Dietary Fiber/SDF) and water insoluble food fiber (Insoluble Dietary Fiber). SDF is a food fiber that can dissolve in warm or hot water and can be precipitated by water or ethanol, while fiber that is not soluble in water. Insoluble fiber is mostly found in wheat, seeds, vegetables and nuts (Amiarsi et al., 2015).

The presence of dietary fiber in the daily food can maintain and improve gastrointestinal function and maintain a healthy body, especially to avoid various degenerative diseases, such as obesity, diabetes mellitus, and cardiovascular disease (Lattimer & Haub, 2010). The required value of the recommended dietary fiber intake for adults people in Indonesia is 20-35g/day. Although the recommended value for adults in Indonesia is quite high, the results of field surveys indicate that the average intake of dietary fiber of adult people in Indonesia is only 10.5 g/day (Shanti et al., 2017).

Total carbohydrate content

Corn is the main source of carbohydrates which is very important after rice and wheat, and used as a staple food in many regions of the world. Total carbohydrate is the total amount of carbohydrates contained in a food. Carbohydrates consist of simple carbohydrates such as monosaccharides and disaccharides, as well as complex carbohydrates or

polysaccharides such as starch, amylopectin, cellulose, and also food fiber or dietary fiber.

Carbohydrates are the most abundant component in corn kernels. Carbohydrates in corn are mainly starches. Starch is a glucose polymer consisting of two types, namely amylose and amylopectin (Roscamp & Santos, 2015). Table 2 shows the total carbohydrate content of local corn from Kisar Island and others corn carbohydrate levels such as local *Manado Kuning*, local *Gorontalo*, sweet corn, *Gumarang* and *Lamuru* as a superior varieties. Based on the results of this comparison, it can be seen that the carbohydrate content of local corn cultivars from Kisar Island is still higher than the local corn from Manado, Gorontalo, common corn, sweet corn, and *Lamuru*, while superior varieties of *Gumarang* have the highest total carbohydrate content. Actually the value of corn carbohydrate content does not have a specific reference, or a benchmark of how high or how low, it is just that some references find corn carbohydrate levels range between 60-80% (Table 2).

Table 2. Comparison of local corn carbohydrate content from Kisar Island with several other varieties

Local corn cultivar from Kisar Island	carbohydrate content (%)	The value of carbohydrate content of several types of corn (all units in %)							
		<i>Manado Kuning</i> (Lalujan et al., 2017)	Local <i>Momala</i> from Gorontalo (Suleman et al., 2019)	Local <i>Pena Tunu Ana</i> ' from Gorontalo (Suleman et al., 2019)	Local <i>Kuning</i> var. Piet from Gorontalo (Suleman et al., 2019)	Superior varieties : <i>Gumarang</i> (Suleman et al., 2019)	Superior varieties: <i>Lamuru</i> (Suleman et al., 2019)	Common corn (Wahyudi, 2006)	Sweet corn (Wahyudi, 2006)
<i>Merah Delima Tongkol Cokelat Merah Delima Tongkol Putih Merah darah Pulut Kuning Genjah Kuning Dalam Putih</i>	71.59								
Average	71.91	75.64	67.68	70.69	74.92 %	76.35	75.05	30.3	22.8

Total Sugar content

Total sugar content is the sum of all types of sugar in the sample. It may include glucose. Fructose. Galactose. Lactose. Sucrose. and Maltose (Erickson & Slavin, 2015). The total sugar content of seven local corn cultivars from Kisar Island then compared with the value of sweet corn sugar levels from the following references (Table 3).

Total sugar content in grains such as corn is usually dominated by Glucose, and is often used as an indicator of the determination of the glycemic index

in corn kernels. As with carbohydrate levels. Basically, there is no limit or benchmark of the total sugar content in corn. However. the results of this study can be compared with sugar levels in sweet corn which has a sweeter taste compared to common corn. Because sweet corn is not able to produce starch so the seeds taste sweeter when they are young. and the sweet taste can decrease if the age of the fruit is getting older or the age of the harvest is longer (Surtinah & Lestari, 2016).

Table 3. Comparison of total sugar content between local corn from Kisar and several other varieties

Local corn cultivars from Kisar Island	Value of total sugar content (%)	Value of total sugar content of several types of corn (all units in%)					
		Sweet corn var. V75 (Surtinah & Lestari, 2016)	Sweet Corn var. Asian Stars (Surtinah & Lestari, 2016)	Sweet corn var. Bonanza (Surtinah & Lestari, 2016)	Sweet corn var. Sagita (Surtinah & Lestari, 2016)	Sweet Corn var. Master Sweet (Surtinah & Lestari, 2016)	Sweet Corn var. Sweet & Lestari, 2016)
<i>Merah Delima</i>							
<i>Tongkol</i>							
<i>Cokelat</i>	63.93						
<i>Merah Delima</i>		15.12	15.03	14.95	15.12	14.95	
<i>Tongkol Putih</i>	58.66						
<i>Merah darah</i>	60.91						
<i>Pulut</i>	63.54						
<i>Kuning Genjah</i>	68.7						
<i>Kuning Dalam</i>	68.6						
<i>Putih</i>	63.83						

The total sugar content of local corns from Kisar Island as shown in the Table 3, ranges from 58.66 to 68.7%. This is higher four to five times than the sweet corn referred from several references. Actually the sugar content of sweet corn is the highest among all types of corn. However, the results of this study found that total sugar content of local corn from Kisar Island were very high compared to all types of sweet corn reported by several researchers.

The novelty of this research is that it reveals the proximate content of local corn kernels from Kisar Island. This research is expected to be useful as a source of information about the proximate content of local corn seeds, and for instance it can be considered in the utilization and development of local corn in Kisar Island. The advantage expected from this study is that it could provide data that will be a source of information for the people in Kisar Island, as well as for the scientific community about the nutritional content of local corn kernels from Kisar Island. The nutritional data can be used as information in the context of selecting and assembling these local corn cultivars into superior cultivars.

CONCLUSION

Based on the results of research and discussion. It was concluded that the proximate levels of local corn cultivars from Kisar Island Southwest Maluku Regency are as follows: water content (10.39-14.02%), fat content (3.47-5.10%), protein content (9.14-13.02%), ash content (1.13-2.04%), crude fiber content (2.17-2.72%), total carbohydrate content (69.7-75.74%), and total sugar content (58.66 - 68.7%).

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