ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Amylose Content Of Several Local Genotypes Of Banana From District Of Agam-West Sumatera.

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ABSTRACT

Immature banana fruit contains resistant starch type II which is recommended to be consumed by diabetes and obesity patients due to its low glycemic index. Resistant starch content is positively correlated to the amylose content. This study was aimed to assess the amylose content of immature banana fruit from several local genotypes originated from District of Agam. Amylose content of immature banana fruits obtained from 20 local genotypes were measured and then further subjected into proximate assay. Of 20 local genotypes, five genotypes displayed high amylose content, as followed Jantan (12.48%), Mas (11.31%), Lidi (11.02%), Batu (10.33%), Gadang (10.33%). Regarding to these results, those five local genotypes could be developed as an alternative food to maintain the blood sugar level, especially for the diabetics.

Keywords: *amylose, banana, local genotypes, diabetes.*

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INTRODUCTION

Banana is a fruit containing various health benefits and nutritional values. Carbohydrate content composed in banana fruit can be utilized as functional food. Functional foods are described as a typical food that provides certain beneficial nutritions to support organ's functions and advantageous physiological effects for consumer's health [1]. Recently, functional foods have been widely used as a recommended diet to prevent some chronic diseases, such as diabetes, obesity, hypertension, coronary heart disease, and cancer.

Banana is one of prominent fruit comodities in Indonesia with total production about 7 million ton reported in 2014 [2](Statistics Indonesia, 2018). One of banana production and development center in West Sumatera is located in District of Agam and widely spread in 15 subdistricts [3] (Agriculture, Plantation, and Forestry Bureau of Agam District, 2006).Kusumawati and Syukriani [4] had collected and identified 15local genotypes of banana in District of Agam, while [5] had found 20 local genotypes.

The highest carbohydrate component in banana is composed by starch, particularly on its pulp. Banana is promising to be developed as a prebiotics functional food due to its resistant starch contents. Resistant starch is defined as fraction of non-digestible starch providing similar physiological impacts as well as dietary fiber. Immature banana fruit contains 50% resistant starch type II and 14,52% dietary fiber [6-7]. The presence of resistant starch in banana fruit may reduce cholesterol level and glycemic index, so that it is highly recommended to be consumed by people suffering from diabetes and digestion problems.

Level of resistant starch in a food product is affected by several factors, particularly ratio of amylose and amylopectin in the starch itself. Higher level of amylose can stimulate higher content of resistant starch. Asp *et al.* (1992) [8] proposed that the higher the amylose content of the starch, the higher the resistant starch. Starch molecules containing high amylose content gradually aggregate and form crystalline structure due to its strong hydrogen bonding. This condition enables the molecule to not swell and perfectly gelatinized during heating, known as retrogradation, leading to slower digestion.

The aim of this study was to evaluate the amylose content of banana fruit originating from several local genotypes in Agam District. This information could be a useful preliminary data for the development of banana fruit as functional food.

MATERIALS AND METHODS

Samples Collection

Twenty local genotypes of banana were collected from three subdistricts of Agam District. Samples used was stage-1-maturity level banana fruit collected from farmer's field showing overall green colored peel with tough pulp .

Determination of Fruit Amylose Content

This assay was conducted using protocol as proposed by Aliawati (2003) [9] with several modifications. About 100 mg of banana pulp was ground and dissolved using 1 ml 95% ethanol and 9 ml 1 N NaOH. Suspension was heated at 95^{o}C for 10 minutes until the gel was resulted then cooled.About 5 ml of yielding gel was placed into 100 ml flask and added with 1 ml 1 N acetic acid and 2ml iodine solution. A sufficient volume of distilled water was added into the flask up to 100 ml. The suspension was mixed through shaking for 20 minutes until become well-homogenized. The absorbance of the mixture was then measured using UV-VIS spectrophotometer at a wavelength of 625 nm. Amylose content was then determined based on the interpolation of sample absorbance value to the linear calibration curve.

Proximate Analysis

Proximate composition estimated in this study consisted of moisture, ash, lipid and protein content. The measurement of these parameters was performed using standard protocol of AOAC (2005) [10]. About 4 gram banana pulp was dried at 105^{o}C for six hours to obtain its constant weight. The estimated moisture contents were resulted from the ratio between its dry and wet weights. The determination of ash content was conducted by incinerating the pulp at550ºC in a furnace. The ratio between ash and sample weights determined the resulting ash content in percentage (%). The lipid content was measured through Soxhlet extraction method. Samples were extracted with hexane solution using Soxhlet apparatus for six hours. The remaining solution was then evaporated and dried to obtain a constant weight. The resulting dry weight was divided by the sample weight to determine its lipid content. The protein content measurement was proceed using Kjeldahl method. Samples were mineralized using concentrated sulfuric acid (H_2SO_4) and were distilled before being titrated using 0.02 N HCl. The ammonia content was subsequently determined and the protein content was determined by converting the nitrogen content to the protein using the factor 6.25.

RESULTS AND DISCUSSION

Twenty local genotypes of banana from District of Agam (Fig. 1) displayed various amylose and other nutrients contents (Table 1). Genotype *Jantan* exhibited the highest amylose content (12.48%) among other genotypes, while *Godok* appeared as the lowest one (3.4%) (Table 1). This variability might occur due to several factors, such as characteristic of the varieties, growing conditions, and maturity levels [11-12]. Amylose content from starchy diets was categorized into four levels [9], including very low (<10%), low (10-20%), moderate (20-24%), and high (>25%). Based on this standard, the resulting amylose contents from all local genotypes in this study (Table 1) was grouped as low and very low levels.

Table 1: Nutritional values of banana pulp from 20 local genotypes collected from District of Agam

Genotypes	Parameter of Chemical Compositions (%)				
	Amylose	Moisture	Ash	Crude Lipid	Crude Protein
Jantan	**12.48 ±0.49**	62.10±0.22	0.86±0.10	0.11±0.02	0.51±0.13
Mas	11.31± 1.32	67.56±1.06	0.96±0.11	0.11±0.02	0.86±0.18
Lidi	11.02 ±1.12	68.77±0.64	1.07±0.04	0.02±0.01	1.00±0.16
Batu	10.33 ±0.32	70.21±0.22	1.14±0.02	0.11±0.02	1.40±0.23
Gadang	10.33 ±0.77	71.00±1.82	1.69±0.11	0.04±0.03	0.11±0.04
SBR	9.68 ±0.62	71.43±1.30	1.34±0.16	0.22±0.05	0.01±0.01
SBT	9.19 ±0.85	69.76±0.53	1.63±0.10	0.01±0.00	1.55±0.08
Manis	8.35 ±0.47	64.93±0.35	1.91±0.15	0.01±0.00	1.26±0.06
Kalek	8.32 ±0.68	69.69±0.05	0.95±0.08	0.09±0.01	1.16±0.05
Keling	8.09 ±0.66	70.80±0.04	1.37±0.03	0.11±0.05	0.89±0.06
RJ sereh	7.95 ±0.55	68.86±0.50	1.11±0.00	0.14±0.02	0.64±0.05
Raja	7.74 ±0.66	69.72±0.53	1.22±0.11	0.18±0.02	1.27±0.12
Timbago	7.58 ±0.47	75.13±0.06	1.20±0.00	**0.43±0.04**	**1.59±0.05**
Pulut	7.45 ±0.32	75.99±0.06	**2.20±0.06**	0.06±0.01	1.00±0.12
Ambon	7.44 ±0.87	72.89±1.25	1.06±0.01	0.06±0.02	1.30±0.06
Tinalun	7.33 ±0.81	73.79±0.92	1.10±0.00	0.10±0.01	0.84±0.15
Mundam	7.27 ±0.13	70.86±0.91	1.13±0.02	0.15±0.03	1.49±0.22
Bawang	4.84 ±0.79	78.23±0.38	1.18±0.00	0.16±0.02	1.40±0.07
Rotan	4.53 ±0.67	72.07±1.31	1.74±0.02	0.34±0.06	1.42±0.23
Godok	3.43±0.26	**78.43±1.22**	1.43±0.08	0.30±0.02	0.59±0.06

The amylose level is associated with dietary glycemic index (GI). Lower value of GI could be achieved when the amylose content was increased[13]. GI value also correlated with resistant starch content. Diets containing higher amylose and resistant starch contents would result in lower metabolic response, thus leading to blood sugar decrease [14-15].

Regarding the nutritional value of these local genotypes, several chemical properties (moisture, ash, crude lipid, and crude protein) were assessed through proximate analysis. As seen in Table 1, banana pulp of these local genotypes contained high water content, ranging from 60 to 80%. Of all genotypes tested, the highest moisture content was obtained from genotype Godok (78.43%) and genotype Jantan appeared as the driest one (62.1%) (Table 1). Compared to the previous study, reported that genotype Nangka contained 60% moisture level [16].

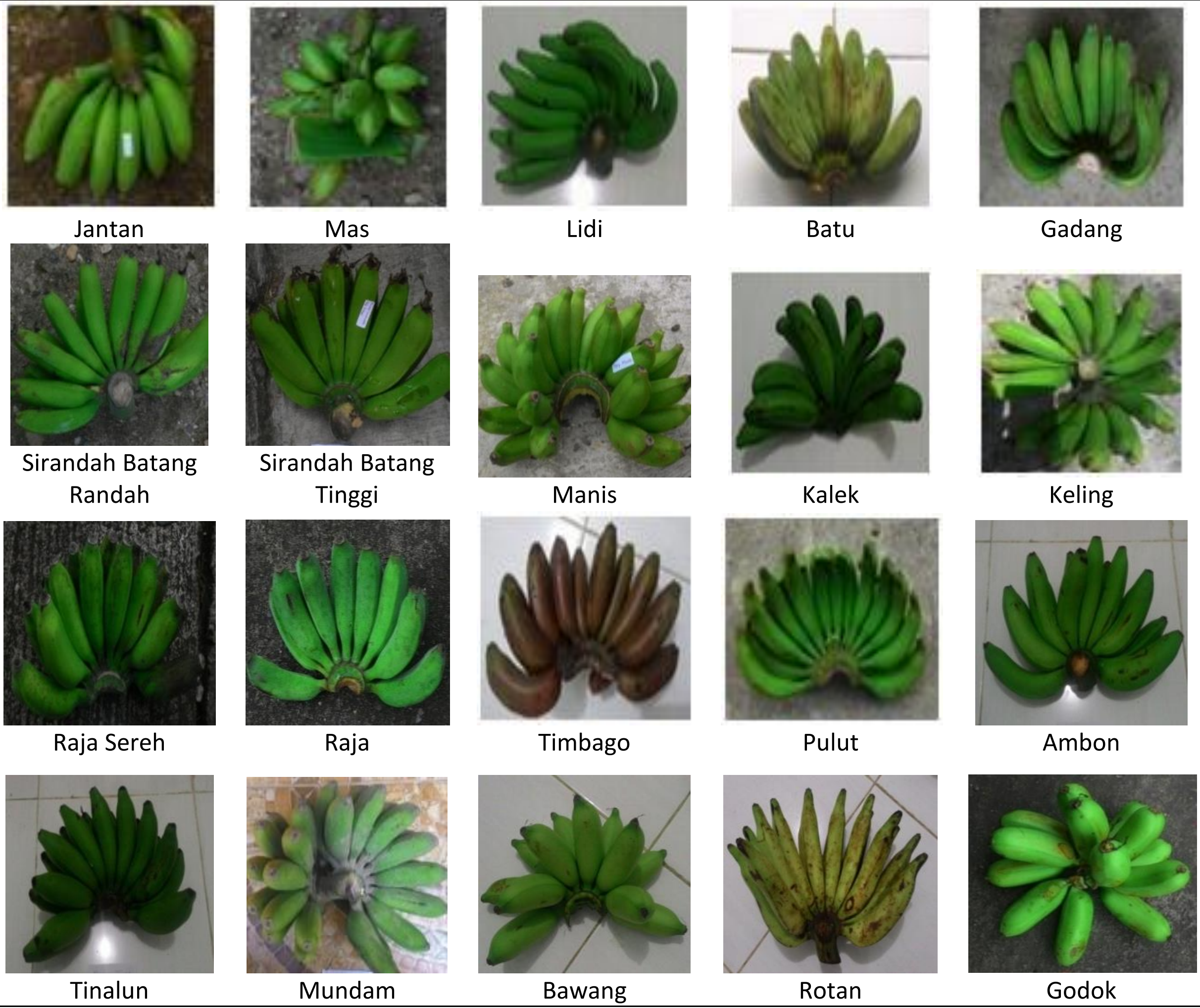

Figure 1: Twenty local genotypes of banana collected in District of Agam

The difference of moisture content between the same species and plant part is possibly related to its physiological factors. In this case, the difference in maturity level of the pulp may be associated with the resulted moisture content. As proposed by[12],along with the pulp ripened, the water content in the banana pulp increased significantly.Rajkumar *et al.* (2012 [17]) reported that pulp moisture content of banana reached 75% in maturation stage-1 and then become 85% in maturation stage-6. During ripening stage, ethylene was produced and starch was degraded completely into soluble sugar through set of enzymatic processes [18-19]leading to the increase of moisture content.This rising also affected the amylose level of the pulp. As shown in Table 1, genotypes exhibiting high moisture content showed less amylose level. It then implied that the amylose level depleted significantly under high moisture state. The higher the ripening stage, the more amylose were degraded resulting in higher moisture content. Aside from the maturity level, other factor causing variation in moisture content is the difference of banana cultivars.

Parameter of ash content are required to evaluate the mineral content present in food. Generally, ash content represents potassium content as its main mineral, complemented with other minerals in smaller amounts [20].Value of ash content presented in all local genotypes used in this study ranged from 0.86 to 2.20% (Table 1). The highest value was obtained from genotype *Pulut*, while the lowest ash was displayed by genotype *Jantan*. Compared to previous study, the range of ash value from this study remained higher than White Manzano (0.08%) and Dwarf Cavendish (0.09%) cultivars[11].This rising of ash content might occur when the material contained less moisture content [21] (Winarno, 1997). Ash content present in foods may vary due to enviromental and internal factors, such as varieties, soil fertility, plant maturity, climate, growing condition, and plant treatment[22].

Regarding the lipid content, all genotypes displayed relatively low lipid content in pulp ranged from 0.01 to 0.43% (Table 1). Genotype Pisang Timbago appeared as the highest, while the lowest lipid content was obtained from genotype Sirandah Batang Tinggi and Manis (Table 1). The difference in this lipid level might be associated with varieties (cultivars) differences. Nonetheless, the highest lipid content resulted from this study was higher than genotype Pisang Nangka yielding 0.39% lipid content in the previous study [16].Lipid is one of crucial chemical composition present in foods. Lipid is considered as more effective energy source compared to carbohydrate and protein. One gram of lipid could produce 9 kkal energy, while carbohydrate and protein only yielded about 4 kkal/gram [21].

Amount of protein presented in banana pulp of all local genotypes ranged from 0.01 to 1.59%. Genotype showing the highest protein level was Timbago (1.59%) while the lowest one was obtained from Sirandah Batang Rendah (0.01%) (Table 1). Value of protein content obtained fromgenotype Timbago remained higher than White Monzano (0.22%) and Dwarf Cavendish (0.34%) [11].

CONCLUSIONS

The results of this study proved that all local genotypes of banana from District of Agam were categorized as low amylose genotypes. The highest value of amylose exhibited by genotype Jantan was still considered as low level. Several critical optimizations are required to boost the amylose content of each genotype, thus it will be possible to utilize all these local genotypes as functional foods. As the functional foods were identical with high starch content, high level of amylose present in foods is a pre-requisite that must be achieved.

ACKNOWLEDGEMENTS

This research is fully funded by Andalas University through Professor Research Grant fiscal year 2016 (Contract no. 57/UN.16/HKRGB/LPPM/2016).

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