Artikel Asli/*Original Articles*

Formulation of Flakes with Red Kidney Bean and Red Palm Oil as a Potential Instant Breakfast for Type 2 Diabetes
(Perumusan Emping dengan Kacang Merah dan Minyak Sawit Merah sebagai Potensi Sarapan Segera untuk Diabetes Jenis 2)

REISYA RIZKI RIANTININGTYAS & SRI ANNA MARLIYATI

ABSTRACT

Diabetes is a metabolic syndrome characterized by hyperglycaemia and the number of people with diabetes continues to increase significantly in the last thirty years. Red kidney bean (RKB) and red palm oil (RPO) have potential properties which may be beneficial for managing diabetes. Empirical data suggest that RKB contains alpha-glucosides inhibitors and alpha-amylase inhibitors while RPO contains antioxidant. This study was aimed to formulate flakes with red kidney bean and red palm oil as a potential instant breakfast for type 2 diabetes. The flakes were formulated with different ratios of RKB flour to corn flour (30:70, 40:60, 50:50, 60:40, and 70:30) while the addition of RPO was the same in all formulas (7.5 g in 205 g mixture). The selected formula based on the sensory evaluation was F1 (30:70), with the acceptability level of 87%. The nutrient content of the selected product was analysed using proximate methods and resulted as follows: 5.8% (w/w) moisture, 0.6% (d/w) ash, 13.2% (d/w) protein, 16.5% (d/w) fat, 69.6% (d/w) carbohydrate, 10% (d/w) fibre. One serving size of the developed flakes (55 g) consumed along with milk provided 18% of the energy requirement as well as 23% fat, 21% protein, and 15% carbohydrates from the total daily requirements and has high fibre content. These findings suggest that the selected product is potentially suitable as an alternative ready-to-eat breakfast meal for people with diabetes.

Keywords: Diabetes; flakes; formulation; red kidney beans; red palm oil

ABSTRAK

Diabetes adalah satu sindrom metabolik yang dicirikan oleh hiperglisemia, jumlah penderita diabetes terus meningkat dengan ketara dalam tempoh tiga puluh tahun. Kacang merah dan minyak sawit merah (RPO) mempunyai potensi untuk membantu mengatasi diabetes. Kacang merah mengandung inhibitor alfa-glukosidase dan alfa-amilase sedangkan RPO memiliki potensi sebagai antioksidan. Penelitian ini bertujuan untuk merumuskan produk emping dengan kacang merah dan red palm oil sebagai alternatif sarapan segera yang berpotensi membantu pengendalian diabetes. Formulasi emping dibezakan berdasarkan nisbah tepung kacang merah terhadap tepung jagung, iaitu F1 (30:70), F2 (40:60), F3 (50:50), F4 (60:40), dan F5 (70:30). Formula terpilih merupakan F1 (30:70) dengan tahap penerimaan sebesar 87%. Kandungan gizi dari formula terpilih adalah air 5.8% (b/b), abu 0.6% (b/k), protein 13.2% (b/k), lemak 16.5% (b/k), karbohidrat 69.6% (b/k), dan serat 10.0% (b/k). Satu saiz hidangan emping (55 g) dengan satu gelas susu menyumbang 18% tenaga, 23% lemak, 21% protein, 15% karbohidrat, dan 24% serat dari keperluan sehari. Penemuan ini menunjukkan bahwa produk terpilih mempunyai potensi untuk dapat dijadikan sarapan segera bagi penghidap diabetes.

Kata kunci: Diabetes, emping; formulasi; kacang merah; minyak sawit merah

INTRODUCTION

Diabetes has become a growing concern in both developing countries and developed countries. In 2014, there were 422 million people diagnosed with diabetes, and this number has grown quadrupled since 1980 (WHO 2016). Along with that, the global prevalence of diabetes has additionally risen almost twice from 4.7% to 8.5% in thirty years. International Diabetes Federation (IDF) estimated that by 2035, there will be around 592 million people with diabetes. Prevalence of diabetes has risen more rapidly in middle and low-income countries. Diabetes type 2 accounts for almost 90% of diabetes worldwide (WHO 2016)

Diabetes is a degenerative disease indicated by the rise of blood glucose level and can lead to several outcomes such as kidney failure, heart attack, blindness, and lower limbs amputation (Escott-Stump 2012). WHO (2016) has set up several key actions in managing diabetes which include: healthy diet, regular physical activity, avoiding excessive weight gain, and following medical advises. In addition to that, Nelms et al. (2009) stated that balanced diet with high fibre, and moderate amount of carbohydrate is recommended for diabetic patients. One of

the pharmacological therapy for diabetes is by inhibiting enzymes such as maltase, isomaltase, sucrose, and alpha-glucosidase which in turn will result to slower absorption of carbohydrates therefore preventing significant rise in blood glucose level (DiPiro et al. 2011).

Red kidney bean (*Phaseolus vulgaris*) which contains 23 g of protein/100 g is a good source of plant protein, and has high content of fibre (Nurfi 2010). Research conducted by Yao et al. (2011) proved the alpha-glucosidase inhibiting activity of RKB was 51.74% while a review by Salle et al. (2012) showed alpha-amylase inhibiting activity of 45-75%. Enzyme inhibiting activities can defer carbohydrate digestion, resulting to constant blood glucose level (DiPiro et al. 2011). A study by Kowluru et al. (2001) and Ayeleso (2012), inferred that diabetic patients have increasing oxidative stress biomarkers and can possibly be reduced by antioxidants. Red palm oil is a potential antioxidant as it contains vitamin E (tocopherol and tocotrienol) which are lipid-soluble antioxidants (Atewodi 2011)

Nowadays people prefer to have instant breakfast which is easy and quick to prepare. In accordance to that, there is a huge variety of instant breakfast in the market such as ready-to-eat cereals. Among that, flake cereal is one of the most popular ready-to-eat breakfast cereals, but products available in the market are usually high in carbohydrate but low in other nutrients (Iriyani 2011). This results in limited choice of instant breakfast product for diabetic patients. Therefore, there is a need to formulate ready-to-eat cereal which is high in nutritional values and can be consumed by diabetic patients.

The main objective of this study was to formulate flakes with red kidney bean and red palm oil as a ready-to-eat breakfast cereal for managing diabetes. Sensory evaluation was conducted to determine the best formula. Nutrient content was analysed using proximate methods and was compared to the nutrient requirement of general consumers.

MATERIALS AND METHODS

MATERIALS

The materials used for formulating flakes were dried red kidney bean, yellow corn grain, tapioca flour, skimmed milk, white granulated sugar, table salt which were obtained from the local market and red palm oil was acquired from Southeast Asian Food and Agricultural Science and Technology (SEAFAST) Centre, Bogor Agricultural University.

RAW INGREDIENTS PREPARATION

The two main ingredients to formulate the flakes are corn and red kidney bean. Referring to the method used by Fauzan (2005), milling of red kidney bean involved removing dirt and other unwanted components and then drying using tray dryer for 12 hours at 60ºC. Next, the

red kidney beans were milled using disc mill and sifted with 60 mesh resulting in red kidney bean flour. The same procedures were done to yellow corn grain to obtain corn flour. From 2 kg of red kidney bean, 1.5 kg of red kidney bean flour was obtained, thus the flour production provided 75% yield.

FORMULATION OF FLAKES

The aim of formulation was to obtain the best formula which not only has satisfying nutritional qualities but also high acceptability level. The flakes was incorporated into 5 different ratios (30:70, 40:60, 50:50, 60:40, and 70:30) based on the proportion of red kidney bean flour to corn flour. The amount of red palm oil added to each formula was equal, which was 7.5 g in 205 g of total mixture.

PRODUCTION OF FLAKES

Method used in producing the flakes was modified from Fauzan (2005). The dry ingredients (corn flour, RKB flour, skimmed milk, sugar, tapioca, and salt) were mixed together and later RPO and water was added to the mixture. Next, the mixture was steamed for 15 minutes and then processed using noodle maker. After that, the dough was cut into size and pressed using roller machine to be shaped into thin flakes. The last steps were roasting in the oven at 150ºC for about 15 minutes and cooling down before storing in air-tight plastic containers.

SENSORY EVALUATION

Sensory evaluation was conducted to determine the best formula. The sensory evaluation used was affective test in which included hedonic test and hedonic quality test. Sixty-one semi-trained assessors participated in the sensory evaluation were students from Department of Community Nutrition, Bogor Agricultural University and consisted of both genders. Semi-trained assessor is a person who has taken part in a discriminatory sensory test; one previous testing experience is the minimum training required for a discrimination test (Vindras & Sinoir 2008). The sensory evaluation took place in Organoleptic and Sensory Analysis Laboratory, Department of Community Nutrition, Bogor Agricultural University.

Sensory evaluation is an experimental design which uses the five human senses to evaluate the sensory quality of a product. In this study, the sensory analysis involved affective test which were hedonic and hedonic quality test. The questionnaire used to administer the sensory evaluation referred to Vindras and Sinoir (2008). The result of hedonic test would determine the best formula which would be further analysed.

The five flakes were presented at the same time (monadic presentation) on a white plastic plate along with a small cup of milk and a plastic spoon. The assessors were instructed to first evaluate the flakes without the milk before evaluating the flakes with the milk. The assessors

were asked to give scores between 1 and 9 according to their level of preference (1 = dislike extremely; 9 = like extremely) for every attributes of each formula.

From the hedonic test we can also measure the acceptability of the products. The product is considered acceptable when given score $\geq$ 5. The percentage of people who had given hedonic score of $\geq$ 5 was divided by the total number of assessors to calculate the level of acceptability.

The nutrient content of the selected flakes was analysed using proximate composition analysis. Moisture, ash, fat, crude protein, and dietary fibre were determined using methods from AOAC (2005). Moisture content assay of the developed product was done using forced air oven method (AOAC 925.10), ash content assay using dry ashing method (AOAC 923.03), fat analysis using Soxhlet extraction method (AOAC 920.39), protein analysis using Kjeldahl method (AOAC 955.04), and dietary fibre using gravimetric method (AOAC 991.43). Carbohydrate content was calculated by difference from the moisture, ash, crude fat, and crude protein content. Caloric values were calculated using the Atwater general factor system: lipid (9 Kcal/g), protein (4 Kcal/g), and carbohydrate (4 Kcal/g) (Nielsen 2010). The chemical analysis were done in Chemical and Food Analysis Laboratory, Department of Community Nutrition, Bogor Agricultural University.

RESULTS AND DISCUSSION

FORMULATION OF FLAKES

The use of red kidney beans was expected to increase the protein and fibre content in flakes since red kidney bean contains 22 g of protein (Pangastuti 2013) and 22 g of

fibre per 100 g (USDA 2002). In addition, red kidney bean also has hypoglycaemic potential. The alpha-glucosidase and alpha-amylase inhibiting activity of the red kidney bean (Sales et al 2012; Yao et al. 2011) can be seen as a pharmacological therapy for diabetes by delaying digestion of carbohydrates hence preventing sudden increase in blood glucose level (DiPiro et al. 2011). The addition of red palm oil was intended to be used as source of fat with potential antioxidant properties (Ayeleso 2012) which can neutralise the increasing free radicals production by diabetes patient (Kowluru et al 2001).

SENSORY EVALUATION

The result of the affective test was important as the developed product must not only has satisfying nutritional value but also has high acceptability. The mean hedonic score of the five formulas ranged from 5.0 (neither like nor dislike) to 7.4 (like moderately). There was significant effect of increase in RKB flour proportion to appearance and aroma, but not on taste and texture. Flakes F1 scored highest in three of the attributes namely appearance, aroma, and texture (Table 1). The results from hedonic quality test explained the characteristics which were most favoured.

Flakes F1, which had the highest hedonic score, had the following characteristics: bright colour, slightly pleasant aroma, sweet and savoury taste, moderate aftertaste, and crunchy texture (Table 2). The bright colour was due to the low proportion of RKB, which was white-red in colour, and high proportion of corn flour, which was bright yellow. The slightly pleasant aroma was due to the considerably sweet aroma of the corn flour, while red kidney bean has a slightly musty aroma. In congruence with the hedonic score, flakes F1 had the highest acceptability level (Figure 1) of 87%. Based on these results, the selected formula was F1 due to its high acceptability and decent sensory qualities.

TABLE 1. Mean score of hedonic test for each formula

Formula	Attribute			
	Appearance	Aroma	Taste	Texture
F1 (30:70)	7.4 ± 1.0	6.0 ± 1.3	5.8 ± 1.7	6.2 ± 1.7
F2 (40:60)	5.8 ± 1.2	5.7 ± 1.1	6.0 ± 1.3	5.9 ± 1.5
F3 (50:50)	5.3 ± 1.3	5.7 ± 1.3	6.0 ± 1.3	6.0 ± 1.5
F4 (60:40)	5.0 ± 1.4	5.8 ± 0.9	5.6 ± 1.6	5.8 ± 1.5
F5 (70:30)	5.0 ± 1.5	5.1 ± 1.1	5.3 ± 1.6	5.5 ± 1.6

TABLE 2. Mode characteristics for each formula

Formula	Characteristic				
	Appearance	Aroma	Taste	After taste	Texture
F1	Bright	Slightly pleasant	Sweet & savoury	Moderate	Crunchy
F2	Slightly dark	No aroma	Sweet & savoury	Slight	Not crunchy
F3	Neither bright nor dark	No aroma	Sweet & savoury	Moderate	Not crunchy
F4	Slightly dark	No aroma	Sweet & savoury	Slight	Slightly crunchy
F5	Moderate dark	No aroma	Sweet & savoury	Moderate	Not crunchy

Proximate composition analysis was done to analyse the nutrient content of the food. The nutrient composition analysis was done to the selected formula (F1) which included moisture, ash, crude fat, crude protein, carbohydrate, and dietary fibre content assay. The results were compared with the Indonesian National Standard of cereal (SNI 01-4270-1996) to know whether the developed product has complied with the given standard. Alongside, the results were also compared with the two commercial flakes available in the market which were flakes K and flakes N. This was done to understand the effect of using red kidney bean and red palm oil to the nutrient content of cornflakes.

Ash, fat, protein, and carbohydrate of the formulated were in compliance with the Indonesia National Standard (INS) for cereal. Only moisture content exceeded the established standard, but according to Nielsen (2010), cereals with moisture content of 4-8% is considered to have good quality. In general, the developed product had comparatively higher content of moisture, protein, fat, and dietary fibre than the commercial products (flakes K and flakes N) but lower in the ash and carbohydrate content (Table 3).

The moisture content of the developed flakes was 5.8% which was quite high compared to both the INS and the commercial flakes (Table 3). According to Pangastuti (2013), not removing the RKB seed coat before milling will raise the amount of moisture in RKB flour and this is due to the great proportion of fibre in the seed coat which has water-absorbing property.

Ash content assay was done using dry ashing method because of its ease and safety. Ash content of a food product can show the amount of crude mineral. The ash content of the developed product was 0.6% which was almost eight times less than the commercial product (Table 4), this was mainly due to mineral enrichment in the commercial

TABLE 3. Nutrient content of developed product compared with Indonesian National Standard and commercial products

Nutrient	Formulated flakes/%	National Standard/%	Flakes K/%	Flakes N/%
Moisture (w/w)	5.8	Max. 3.0	3.0	–
Ash (d/w)	0.6	Max. 4.0	4.7	–
Fat (d/w)	16.5	Min. 7.0	0.4	1.7
Protein (d/w)	13.2	Min. 5.0	7.5	6.7
Carbohydrate (d/w)	69.6	Min. 60.0	84.4	80.0
Dietary Fibre (d/w)	10.0	–	1.2	3.3

TABLE 4. Contribution of flakes to Indonesian Daily Value

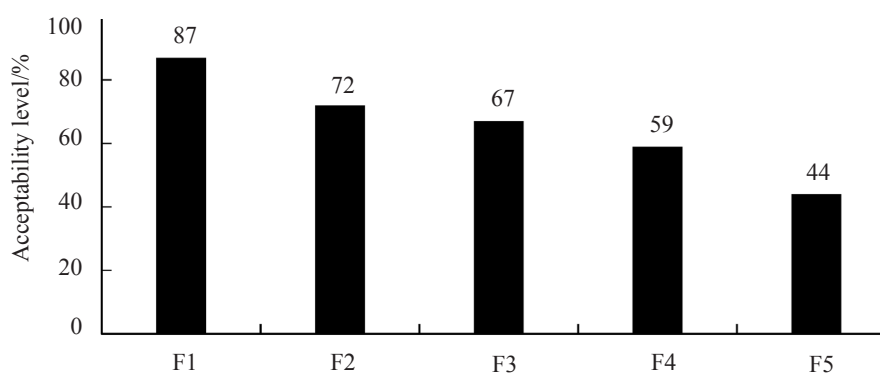| Nutrient	Per serving	Contribution to Daily Value/%	Flakes + 150 ml milk	Flakes + milk contribution to Daily Value/%
Energy/kcal	260	13	356	18
Total fat/g	9	15	14	23
Protein/g	7	12	12	21
Carbohydrate/g	38	13	45	15
Dietary fibre/g	6	24	6	24

FIGURE 1. Acceptability level of flakes

flakes. The food label on the commercial flakes cited the use of mineral mix as one of the ingredients used for both flakes K and flakes N. Food enrichment is the process of adding micronutrients to food with the purpose of restoring the micronutrient lost during processing or adding micronutrients which were not originally there (Taormina 2013).

Fat analysis was done using Soxhlet extraction method, this method is relatively simple and safe but takes quite a lot of time and needs constant monitoring. Fat content of the developed product was 16.5% which was evidently higher than both of the commercial products (Table 3). This was due to the use of red palm oil as the main source of fat. Whereas the commercial products did not include fat-source ingredients (corn, sugar, salt, and malt extract) as cited in the food label of both products and were processed without using any form of lipid/fat.

Protein analysis was done using Kjeldahl method because it is relatively simple and suitable for any sample but only determine amount of crude protein. Protein content of the developed product was 13.2% and this value was twice higher than the commercial products (Table 3). This was due to the use of red kidney bean which is a source of plant protein (USDA 2002); according to Pangastuti (2013), red kidney bean contains 22.5% of protein. In addition to red kidney bean, the use of skimmed milk also contributes to higher protein content of the formulated product, skimmed milk contains 15.6% protein (USDA 2002).

Carbohydrate content was determined by difference from the moisture, ash, crude fat, and crude protein content. Carbohydrate content of the developed flakes was 69.6% which was about 10% lower than those in commercial flakes. Of the carbohydrate content in the newly developed product include 10.0% of dietary fibre which was far greater (by 6.7% compared to flakes K and 8.8% compared to flakes N) than those of the commercial flakes. This was mainly due to RKB which was not only high in protein but also high in dietary fibre. The formulated flakes provided 10 g of dietary fibre which can be categorized as high in fibre (more than 6 g per 100 g) according to BPOM (2011).

The recommended portion size of ready-to-eat cereals weighing more than 43 g per cup (8 oz) was 55 g (FDA 2008). According to the Indonesian Daily Value (BPOM 2007) fat, protein, and carbohydrate requirements for general consumer are 62 g, 60 g, and 300 g respectively. Flakes is usually consumed for breakfast which accounts for 15-30% of the total daily intake (Hardinsyah and Aries 2012). The developed flakes consumed along with 150 ml of milk, could contribute to 18% of the total energy requirement (Table 4). It also provided 23% of fat, 21% of protein, and 15% of carbohydrates from the total daily requirements of general consumers (Table 4).

All of the macronutrients contributed between 15 and 30% of the daily nutrient requirement. The developed flakes consumed along with milk, can be considered as alternative breakfast for diabetic patients as it provides the required amount of energy and macronutrients needed in addition to the high fibre content.

CONCLUSION

This study formulated flakes with red kidney bean and red palm oil as a ready-to-eat breakfast for diabetic patients. Red kidney bean has alpha-glucosidase and alpha-amylase inhibiting activity which delays carbohydrate digestion while red palm oil has antioxidant activity which helps to neutralise oxidative stress in diabetic patients. The selected product (F1) with proportion of RKB flour to corn flour 30:70 was determined through sensory evaluation. The nutrient content of the developed product was analysed using proximate methods and resulted as follows: 5.8% (w/w) moisture, 0.6% (d/w) ash, 13.2% (d/w) protein, 16.5% (d/w) fat, 69.6% (d/w) carbohydrate, 10% (d/w) fibre. It presented high fibre content and 10% lower amount of carbohydrates compared to those in commercial cornflakes. One serving size (55 g) of developed flakes consumed along with milk, contributed to 18% of the energy requirement. It also provided 23% fat, 21% protein, and 15% carbohydrates from the total daily requirements. These findings suggest that the developed product can be considered as an alternative breakfast for diabetic patients, as it exhibits potential hypoglycaemic and antioxidant properties as well as provide high fibre content and the required amount of energy and macronutrients. However, this study is limited to only formulation and nutrient content analysis of the product whereas the effect on diabetic patient has not been examined. Future studies would need to analyse the alpha-amylase and alpha-glucosidase inhibiting activity as well as the antioxidant activity of the formulated product. Clinical studies should be conducted in order to confirm the beneficial effects and its efficacy as a nutrition therapy for diabetes.

REFERENCES

[AOAC] Association of Official Analytical Chemists. 2005. *AOAC Official Methods of Analysis*. Washington DC, USA: Association of Official Analytical Chemists

Atewodi, S. 2011. Phenolic compounds and antioxidant potential of Nigerian red palm oil (Elaeisguineensis). *International Journal of Biology* 3(2): 153-161

Ayeleso, A. 2012. Influence of two plant products (red palm oil and rooibos) on Streptozotocin-induced hyperglycaemia and its implications on antioxidant status and other biochemical parameters in an animal model. Thesis. Cape Town, tZA: Cape Peninsula University of Technology.

Barret, L. Marilyn, Udani, K. Jay. 2011. A proprietary alpha-amylase inhibitor from white bean (*Phaseolus vulgaris*): A review of clinical studies on weight loss and glycemic control. *Nutr J.* 10(24): 1-10. doi: 10.1186/1475-2891-10-24.

[BPOM] Badan Pengawasan Obat dan Makanan. 2011. *Peraturan Kepala Badan Pengawas Obat dan Makanan Nomor. HK.03.1.23.11. 11.09909 Tahun 2011 tentang Pengawasan*

Klaim dalam Label dan Iklan Pangan Olahan. Jakarta, ID: BPOM.

[BPOM] Badan Pengawasan Obat dan Makanan. 2007. Keputusan Kepala Badan Pengawas Obat dan Makanan Nomor. HK.00.05.52.6291 Tahun 2007 tentangAcuan Label GiziProdukPangan. Jakarta, ID: BPOM

DiPiro, J., Talbert, R., Yee, G., Matzke, G., Wells, B., Posey, L. 2011. *Pharmacotherapy: A Pathophysiological Approach.* New York, USA: McGraw-Hill.

Escott-Stump, S. 2012. *Nutrition and Diagnosis –Related Care.* Philadelphia, USA: Lippincott Williams & Wilkins.

Fauzan, F. 2005. Formulation of composite flakes from taro flour, tempe flour, and tapioca. Thesis. Bogor, ID: Bogor Agricultural University

[FDA] Food and Drug Administration. 2008. *Guidance for Industry: A Food Labelling Guide.* College Park, USA: Food and Drug Administration.

Hardinsyah, Aries M. 2012. Type of food for breakfast and its roles in daily nutrient intakes of school age children 6—12 years in Indonesia). *Jurnal Gizi dan Pangan.* 7(2): 89-96.

Iriyani Newi. 2011. Cereal with high antioxidant bekatul substitution. Tesis. Semarang, ID: Universitas Diponegoro Semarang.

Juntachote, T. & Berghofer, E. 2005. Antioxidative, properties and stability of ethanolic extracts of Holy Basil and Galangal. *Food Chemistry* 92: 193-202.

Kamaruzaman, N., Babji, A., Ismail, W. & Peng, F. 2015. Vitamin e contents and oxidative stability of red palm oils blended chicken nuggets during frozen storage. *Malaysian Journal of Analytical Sciences.* 19(1): 202 – 212.

Kowluru, R.A., Tang, J. & Kern, T.S. 2001. Abnormalities of retinal metabolisme in diabetes and experiment galactosemia. *Diabetes*. 50:1938-42.

Nelms, M., Long, S. & Lacey, K. 2009. *Medical Nutrition Therapy.* Wadsworth, USA: Cengage Learning.

Nielsen, S. 2010. *Food Analysis.* Berlin, DE: Springer

Nurfi, A. 2010. *Red Kidney Bean Reduces Cholesterol and Blood Glucose.* Jakarta, ID: Department of Health Republic of Indonesia.

Pangastuti, H., Affandi, D. & Ishartani, D. 2013. Physical and chemical characteristics of red kidney bean (*Phaseolus vulgaris L.*) flour with several pre-treatments. *Jurnal Teknosains Pangan.* 2(1): 20 – 29.

Sales, M., Souza, M., Simeoni, L., Oliveira, P. & Silveira D. 2012. α-Amylase inhibitors: A review of raw material and isolated compounds from plant source. *J. Pharm. Pharmaceut. Sci.* 15(1): 141-183.

Taormina, J. 2013. *Microbiological Research and Development for the Food Industry.* Florida, USA: CRC.

[USDA] U.S Department of Agriculture. 2012. *Nutritive Value of Foods.* Washington D.C, USA: U.S Department of Agriculture.

Vindras Camille, Sinoir Nicolas. 2008. *Tasting Guide: Tools to Integrate Organoleptic Quality Criteria in Breeding Programs*. Paris, FR: Institut Technique de l' Agriculture Biologique

[WHO] World Health Organization. 2016. *Global Report on Diabetes.* Geneva (CH): World Health Organization

Yao, Y., Cheng, X., Wang, L., Wang, S. & Ren, G. 2011. Biological potential of sixteen legumes in China. *Int. J. Mol. Sci.* 12:7048–7058. doi:10.3390/ijms12107048

Reisya Rizki Riantiningtyas
Sri Anna Marliyati
Department of Community Nutrition
Faculty of Human Ecology
Bogor Agricultural University
Indonesia

Corresponding author: Reisya Rizki Riantiningtyas
Email: reisyarizki@gmail.com

Tel: +6281 3821 35390