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Utilization of Banana Peel Flour As Fibre Ingredient in the Waffle Cones

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Abstract
Banana fruits are the most eatable fruits in Malaysia. However, its beneficial skin mostly will be thrown away. The fibrous peels have slightly bitter taste with its good nutritional food attraction. They rich in starch and non-starch polysaccharides including food fiber, antioxidants, polyphenols, essential minerals such as potassium, provitamin A, carotenoids, B1, B2 and C that are acts as dietary roles in human health. In this study, Saba banana peel flour (BPF) sifted to 0.012 inch will convert into waffle cones. Preliminary study on the protein, moisture, crude fiber and fat were carried out for first stages of maturity. First stage BPF acts as water binding agent in food due to its high water holding capacity and have low oil holding capacity. BPF's pH (6.15-6.46) is in standard wheat flour acidity range. Then, the BPF was substituted for 5%, 10%, and 20% of the wheat flour in a batter mix to make waffle cones. The substitution of BPF will affect the physicochemical properties by the pH, colour, odour and tensile strength. As the results, waffle cones of BPF had lower value of L and b* which turned darker than controlled sample. The odour of banana smells in this waffle cones are sweet and fresh but only acceptable physical analysis for 5% and 10% substitution BPF. While for 20% substitution of BPF gave poor result in tensile strength and the sensory analysis but there also can be utiise for making dietary cookies.*

Keywords: Saba banana, banana peel powder, banana peel flour, waffle, banana peel waffle cones

Introduction

Saba banana (Musa balbisiana), is a triploid hybrid banana cultivar originating from the Philippines, primarily a cooking banana, it is usually boiled, steamed and fried. It is one of the most important banana in the Philippine Cuisine. The high demand for banana in the Filipino diet owing to its nutritive value and affordable price compared to mango and pineapple. It is commonly used in processing banana chips and catsup. With the growing awareness on healthy food consumption, substantial increase in value added products derived from banana encouraged the banana industry to augment the raw material production.(Food Development Center, National Food Authority) Banana (*Musa spp*.) is one of the tropical fruits that belongs to the Musaceae family (Chakraborty, Mukherjee, Banerjee, Mukkherjee, & Bandyopadhyay, 2017). Among many species of banana, 'Saba' is the name given in the Philippines to a cooking banana belonging to the Saba subgroup. Saba bananas are classified as *Musa acuminata* x *balbisiana* crossed species. Saba bananas are a popular cooking variety used and known around the world by different names such as *Pisang Nipah* and *Pisang Abu* in Malaysia, *Pisang Kepok* in Indonesia and Kluai Hin in Thailand.

In this study, Saba bananas have been used instead of Cavendish bananas in the making of banana peel waffle cone. Some parameters that need to study to define the acceptance of waffle cones based on its batter are including pH, colour, tensile strength and nutritional values. pH plays an important role in food as it measures the acidity or alkalinity of food and it also measured acid content [H+] directly. Besides, the colour of the food will determine its composition and can be an attraction factor for food consumptions. The strength of the food also needs to be considered because it will affect the handling and storage of the food. Depend on how the food is consumed, the strength will cause changes in shape and texture of foods. Eating a balanced diet is vital for good health and wellbeing. Thus, nutritional values of food will provide the information of energy, protein, essential fats, vitamins and minerals needed by humans to live, grow and function properly.

Materials and methods

Materials

Basic ingredients for banana peel waffle cone preparation were obtained from a local supermarket. The experiments was conducted in the Faculty of Engineering Lab in University Putra Malaysia, Selangor, Malaysia.

Preparation of Banana Peel Flour

The hands of Saba banana were randomly picked from banana bunch. The banana fingers were then separated from its hand and removed its stalk end and blossom end. Then, the banana was rinsed several times with tap water and last rinsed by distilled water. After that, the banana was then peeled and immersed in 0.5% citric acid solution. The peels were then cut and immersed back into citric acid solution and drained after 10 minutes. Next, the peels were dried in the oven (Noxxa Oven) about 72 hours at 60°C. Then, the banana peels were milled for about 30 minutes with interval. The milled powder was then sieved with 50 mesh sifter that gave 126-**250μ**m in size particles. The samples were then stored in ziplock bag in an airtight package at 5$\pm$2 °C for further analysis.

Preparation of Banana Peel Waffle Cones

Formulations for the waffle cones are shown in Table 1. The basic waffle formula consisted of 120 g of wheat flour, 80 g of sugar, 112 g of eggs white, 2 g of salt, and 3 g of essence vanilla. Three additional waffle samples were prepared by substituting wheat flour with 5%, 10% and 20% of banana peel flour. White eggs and essence vanilla were stirred first until bubbles formed. Then dry and wet ingredient were added one by one starting from wheat flour, banana peel flour, sugar, salt, and fresh milk were added and continuously. The parameters involved in the batter analysis are pH, density and viscosity. The analysis is done immediately after the mixing activity is done.

Table 1: Formulation of waffle samples.

Ingredients (g)	Types of waffle			
	Control	5% BPF	10% BPF	20% BPF
Wheat flour	120	114	108	96
Sugar	80	80	80	80
Egg white	112	112	112	112
Salt	2	2	2	2
Essence vanilla	3	3	3	3
Milk	109	109	109	109
Banana peel flour	0	6	12	24

Proximate Analysis

Moisture content was determine with A&D MX50 moisture analyser. Crude protein (AOAC 988.05)., fat (AOAC 963.15), and fibre (AOAC 978.10). The carbohydrate content was determined by using difference meaan. While, the ash was identified by inserting the sample of 5 g into muffle furnace at 600°C until grayish colour obtained.

Water holding and oil holding capacity

a)Water holding

The WHC determination was referred and modified from method applied by (Wachirasiri, Julakarangka, and Wanlapa 2009). The 2g of banana peel powder sample was weight on electronic balance. Then the sample was put into the centrifugal tube with 25 m distilled water. Then, the lid was closed and vortex for about 5 minutes until the water and banana peel powder was mix well. Then the centrifuge tube was heated at 40℃ of water bath. After that, the mixture was centrifuge for 25 minutes at 3000 rpm in room temperature (25℃). The supernatant was decanted carefully and the mass leave in the tube was measured by using electronic balance. Another test with similar method was carried out by replacing the heating temperature from 40℃ into 60℃ and 80℃.

b)Oil holding

The 2g of banana peel powder sample was weight on electronic balance. Then the sample was put into the centrifugal tube and with 25 m cooking palm oil (Seri Murni). Then, the lid was closed and vortex for about 5 minutes until the water and banana peel powder was homogenised. Then the centrifuge tube was heated at 40℃ of water bath. After that, the mixture was centrifuge for 25 minutes at 3000 rpm. The supernatant was decanted carefully and the mass leave in the tube was measured by using electronic balance. Another test with similar method was carried out by replacing the heating temperature from 40℃ into 60℃ and 80℃ . All analysis was done in triplicate.

pH

4% mass of banana peel powder was weight by using weighing balance. Then, the powder was poured into the centrifuge tube and added with 15 ml of distilled water. After that the mixture was vortex for 5 minutes and let it stand for another 30 minutes (Savlak, Türker, and Yes 2016). The acidity of the supernatant was measured by using pH meter. The measurement was done in triplicate.

Results and discussion

Proximate Analysis

Moisture content of banana peel flour is suitable for long time storage as it is in range of standard moisture content of flour.

Table 2: The proximate composition of moisture, crude protein, fat and crude fibre (%w/w)

Proximate component	Saba peels
Moisture (%w/w)	9.18
Crude protein (%w/w)	4.4
Fat (%w/w)	4.8
Crude fibre (%w/w)	1.3

The amount of crude fibre have close similarity as the finding by A et al., (2006) at 1.6±0.03 % at fresh state of mature green and 2.51 ± 0.01 % of ripe Saba banana peels. However, the crude fibre content in this study was lower than the report from Dibanda Romelle et al. (2016) that evaluate the crude fibre of banana peel of Cavendish and obtain value in the range of 11.81 ± 0.06 at 50 ℃ for 24 hours. B.A., Ugye, and Nyiaatagher (2009) also report the value of Musa Sapentium banana's fibre at 31.70 ± 0.25%. It is important to note that the method of preparation of dry banana peel do affect the crude fibre deterioration in banana peel (Wachirasiri, Julakarangka, and Wanlapa 2009).

The amount of protein in banana peel as in Table 2 was much lower compared to the 11.5% quantity of protein proposed by Salehifar, Ardebili, and Azizi (2010) to produce bread with better sensory

characteristics and storage time. Although the quantity of protein in banana peel flour is low, Toufeili et al. (1999) asserted that the same bread quality produced is not necessarily due to the same amount of protein. Therefore, the development of banana peel powder in food products blend have good potential as we are rich with resources and able to reduce the dependency of wheat import. It also have potential in non-gluten product development. This is because the protein composition increases as the maturity stage increases. This is in agreement with (A et al. 2016) as the stage of ripeness increases, the protein contents in banana peel of Saba also increases. The effect of stage of fruit maturity on protein composition in banana peels is also reported by (Khawas and Deka 2016).

Contradictory, the amount of fat contents of *Saba* is not detected at premature and mature stage of banana as reported by A et al.(2016). The percentage of fat in this study was detected because the moisture content in sample was lower than their sample study. Longer heating time also influenced the removal of volatile fat from the sample.

The pH ranging from 6.16 to 6.46 in which was acidic. The acidity of green banana peel powder also can be supported by similar finding in Cavendish banana varieties with 8% powder suspension in water(Salih et al. 2017). Paliyath and P. Murr (2007) confirmed earlier by stating that the young fruit tend to be more acidic and it is reduced as the ripening process occur.

pH standard of wheat flour is in range 6 to 6.8 that put it as an acidic food (Pearson 2003). Since the banana peel powder's pH was in the same range as standard flour, it have good potential as wheat substitute of food products.

Conclusions

Utilization of banana peel powder on some food like waffle cones will need extra care on the formulation as it have small diameter. High water holding capacity will cause the banana peel powder volume to lower the tensile strength of wafer cone. The high water holding capacity characteristics is suitable for the food product that need to restore moisture such bread, waffle, cake, biscuit and cookies. The low oil holding capacity characteristic is also beneficial to reduce the absorption of oil during frying. Lastly, 5% and 10% substitution BPF are acceptable because of the sweet and fresh odour of banana smells and acceptable in physical analysis. While for 20% substitution of BPF gave poor result in tensile strength and the sensory analysis but there also can be utiise for making dietary cookies.

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