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RIZBRUNANA: ADVANCES IN HIGH-FIBRE BISCUIT USING BROWN RICE AND BANANA PEEL**Nurul Hafizah Mohd Yasin**Faculty of Hospitality, Tourism and Wellness, Universiti Malaysia Kelantan, Malaysia
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Highlights: Malaysian adults consumed less than the recommended dietary fiber intake of 20-30 g/day. Therefore, study was conducted to develop a product of high-fiber brown rice biscuits made from Saba' banana peel flour. This high fiber biscuit contained 463.40g/100 of energy, 9.23g/100 of protein, 18.98g/100 of fat, 60.16g/100 of carbohydrate, and 7.53g/100 of dietary fiber. The consumer test shows good potential of commercialization as 77% of respondents like and would buy this biscuit.

Keywords: High-fibre biscuit, brown rice, banana peel, commercialization, product development.

Introduction

The food industry is now primarily concerned with functional food ingredients that are high in fiber. In this light, the development of this product is sparked by the awareness on the importance and benefits of dietary fiber contents of food products available in the current market. Dietary fibers have been shown to have many health benefits. For instance, it can improve the function of the digestive system and are able to reduce the risk of many chronic diseases such as cancer, diabetes and heart disease (Cui & Robert, 2009). According to the American Dietetic Association (ADA), the proposed dietary fiber intake for adults is 20g to 35g/1000 Kcal for Americans. Meanwhile, the recommendations for fiber intakes among Malaysians are 20g to 30g per day for all ages. However, 77% of these populations failed to achieve the recommended average intake; Americans were found to take about 14g to 15g dietary fiber per day, while Malaysians consumed 13g to 16g per day. These figures are lower than the proposed recommendations (Ng et al., 2010).

Rice is an example of high-fiber cereals. There are more than 40,000 varieties of rice grown around the world. Rice is the staple food in Malaysia and white rice is commonly consumed. On the other hand, brown rice is rarely consumed because of its dreadful tastes and takes longer time to cook compared to white rice. However, brown rice has gained its popularity in recent years due to its health benefits, brown rice is recognized for its food value content and its potential as a source of antioxidants, anti-carcinogenic and others (Paretti et al., 2002).

Bananas are one of the foods with high fiber contents. They also have high nutritional values. Banana is easily reproduced at an optimal temperature of 27°C, easily grown and available in tropical Malaysia and could be bought at low prices. However, the high consumption of bananas also caused an increase by product of banana peel wastes. High amount of waste has been giving problems to the disposal system of this material without affecting the environment (Emaga et al., 2008). There are various studies conducted regarding the use of other waste products that has been utilized into marketable products, and reported that most of these waste materials contain greater nutritional value than its fruits and vegetables. A study by Emaga et al. (2008), found that 50% of the fibre in bananas are contained in the banana peel. Production of flour from banana peel is able to address the issues of minimizing food waste disposal and maximizing the use of natural resources. Therefore, this issue also provides an opportunity for researchers to develop a product that could solve this problem.

Methodology

The main raw materials in the production of the high-fiber biscuits are brown rice and banana peels. The details about the processing of biscuits are discussed as follows.

Processing of High-Fiber Brown Rice Biscuit and Banana Peel Flour Mixes

To ensure the quality of biscuits produced, brown rice flour and banana peel flour were sifted to remove the impurities. Each ingredient including the brown sugar, baking powder and butter, was weighed respectively. Then, the brown sugar, baking powder, egg yolks and butter were put into the mixer and mixed thoroughly until they become smooth. Brown rice flour and banana peel flour were added into the dough. The dough was refrigerated for 20 minutes, then, it was shaped and divided into portions weighting 10.0± 0.5g for each dough. The dough were then baked in the oven with a temperature of 170 ± 5°C for 20 minutes. The cooled biscuits were wrapped with plastic polypropylene (PP).

The basic formulation was modified from flour, brown sugar, butter and made into 8 new formulations using experimental design factorial 4 x 2 where 4 levels of the ratio of brown rice flour and banana peel flour and 2 levels of the ratio of brown sugar and butter. Based on the basic formulation by Nagao (2001), the ratio of butter and brown sugar is 2:2. The formulation developed in the initial test was changed based on the results obtained in all three best formulations with the butter and brown sugar ratio of 3:2. Thus, the ratio of butter and brown sugar formulations developed for the next test using the formulations with the butter and brown sugar ratio of 3:2 and 2:3

to test the formulation that will be most accepted by the expert panel. These formulations were modified to obtain the taste and texture to suit the developed product.

Findings

Sensory Evaluation

Sensory evaluation tests were carried out on eight biscuit formulations, which were divided into three sessions. Each session consists of four sample formulations. The data obtained from test using BIB designs were analyzed using Friedman test to get the T value on the degree of accuracy and the level of differences of 5% to determine significant differences between the data obtained. It was found that there was no significant difference ($p > 0.05$) between F6 samples and other samples. Three samples which had the lowest amount of the composition, as well as showing a significant degree of difference are sample 6, 8 and 4. These samples were selected to undergo Hedonic Test. Sample 6 was the sample that has the lowest score among respondents; this sample had the second largest banana peel content, which is 13.5% while the ratio of butter and brown sugar content was 2:3. In conclusion, majority of the respondents favoured the formulation containing a moderate amount of banana peel flour (7:3), and followed by formulation with the highest ratio of banana peel content (6:4).

Hedonic Test

Three best formulations of sample F4, F6 and F8 were selected to undergo Hedonic Test. Table 1 shows the results obtained from one-way ANOVA analysis for the Hedonic Test. Based on the results of sensory evaluation, the F6 formulation is the most accepted formulation by the panellists in all attributes tested and there were significant differences ($p < 0.05$) exists in every attribute tested. This means that there are significances in each attribute.

Nutrition Information

The energy content of the biscuits obtained is shown in Table 1 below.

Table 1: Nutrition information

| Nutrition | 100g | Serving size (10g) |
|-------------------|--------|--------------------|
| Energy (kcal) | 463.40 | 46.34 |
| Protein (g) | 9.23 | 0.92 |
| Fat (g) | 18.98 | 1.90 |
| Carbohydrate (g) | 60.16 | 6.02 |
| Dietary Fiber (g) | 7.53 | 0.75 |

Storage Quality Study

The storage quality study for high-fiber brown rice with banana peel flour biscuits was carried out for 8 weeks. Throughout this study, these biscuits were packed in polipropena plastic (PP) and stored at room temperature. In this study, physicochemical analysis, microbiological test and sensory evaluation tests were conducted on the biscuits during storage period.

Product Novelty and contribution to education/community

Dietary fiber have been studied in the prevention of cardiovascular and colon diseases, and diabetes; these consist about 50% of the dry matter of banana peel. Thus, there is a huge potential in the valorization of this food waste into value-added food products.

Transforming banana peels to powder extends its shelf-life, eases transportation and storage, and broadens its possible food applications.

A waste material such as banana peel can be transformed to a tasty and value-added product of high-fiber biscuit.

Commercial Value

This high-fiber biscuits has good commercial value as 77% of respondents said they would buy these biscuits.

Rizbrunana biscuits are a great start in exploiting the potential of this waste; other products such as cakes, breads can also be explored as food applications.

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