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Nutritional properties and organoleptic acceptability of traditional cakes made from MR 220 rice flour

(Nilai permakanan dan penerimaan organoleptik kuih tradisional yang diperbuat daripada tepung beras MR 220)

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Keywords: rice flour properties, sensory evaluation, rice-based traditional cakes, MR 220

Abstract

MR 220 rice flour which was prepared by dry milling using air-isolating cyclone was used in this study. The moisture content of the rice flour ranged from 6.5 – 8.9% and the water and oil absorption capacity were between 0.8 and 1.2 g/g and 0.5 and 0.8 g/g respectively. The MR 220 rice flour had lower bulk density and a soft gel compared to the commercial rice flour. The particle size distributions of MR 220 rice flour showed that a higher percentage of the particles were retained on the larger meshes. A total of 15 traditional cakes were prepared from MR 220 and a commercial rice flour. Organoleptic evaluation was carried out to compare the sensory attributes of traditional cakes produced from both flours. The assessment was made based on taste, aroma, texture, colour and overall acceptability. Generally, all attributes had higher scores given to the traditional cakes made from MR 220 rice flour. Results showed that the carbohydrate content and energy values ranged from 17 – 78% and 80.42 – 609.38 Kcal/100 g samples respectively.

Introduction

Malaysia is famous for its variety of traditional cakes or *kuih-muih*. *Kuih* are bite-sized snacks or desserts found in the Malay Archipelago as well as the Southern China provinces of Fujian and Canton (Khatijah et al. 1992). *Kuih* is a fairly broad term which may include items such as cakes, cookies, dumplings, pudding, biscuit or pastries usually made from rice or glutinous rice. Malaysia's style of *kuih* are usually steamed rather than baked. It is different in texture, taste and appearance from western pastries or cakes (Khatijah et al. 1992).

Rice is an optimal food ingredient used in entrees, side dishes, soups, snacks, baby foods, health foods, confections and beverages (Yeh 2004). Rice is used in product development as it is versatile and economical. It is a complex carbohydrate which is fat, cholesterol and sodium free. It is also non-allergenic, which is good for people with celiac spruce disease (Schober et al. 2003). Rice starch and flour are useful ingredients because they function as an emulsifier, a leavening balancer, thickener, texture enhancer and fat-reducing agent (Shih and Daigle 2002).

One of the most important macronutrients of rice is protein due to its ability to bind starch and form starch granules, which influences the pasting

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properties of rice flour. The content of lipids in rice is about 1% and they are bound very tightly to the proteins and starch in the rice endosperm (Shih and Daigle 1999). This results in the formation of an amylose-lipid complex which affects the pasting properties of rice flour.

In Malaysia, the use of rice flour in making traditional cakes is not new. The common flavouring ingredients are coconut milk, grated coconut, pandan (screw pine) leaves, palm sugar and white sugar. Rice flour is made from finely milled rice (Becker et al. 2001). It is distinct from rice starch, which is usually produced by steeping rice in lye. Rice flour can be made from either white or brown rice. To make the flour, the rice husk is removed and the raw rice obtained is ground into flour.

Most of the rice flour available in the market is blended with corn or tapioca flour. The size, structure and shape of the starch granules affect the flour characteristics such as the swelling power, solubility and gelatinization temperature (Juliano 2003). Rice flours with different physicochemical properties yield products with different textural qualities. Therefore, an appropriate rice variety must be selected as a raw material to produce food products such as desserts and noodles. Although the food industries have developed several traditional cakes from commercial rice flour, the use of MR 220 rice flour for making them is relatively rare.

The main objective of this study was to determine the proximate and nutritional properties of 15 traditional cakes made from the local MR 220 rice flour. For purpose of acceptability, traditional cakes made from MR 220 and a commercial rice flour were evaluated in terms of organoleptic properties such as taste, texture, aroma, colour and overall acceptability. This paper also discusses the physical and functional properties of both rice flours.

Materials and methods

The local rice variety MR 220, supplied by MARDI Tanjung Karang, was used in the preparation of the rice flour which was processed by dry milling using an air-isolating type grinding machine. The rice flour was then kept in a sealed plastic bag (orientated polyethylene) at room temperature of 28 °C until further usage. All other ingredients for processing of traditional cakes such as commercial rice flour (CF), sugar, eggs and coconut milk were obtained from the local market.

Physical properties of rice flour

The physical properties of the rice flours were determined in terms of particle size, colour, bulk density, moisture content, gel consistency, gelatinization temperature, water absorption capacity and oil absorption capacity. Particle size analysis was carried out to determine the size distribution of the flour particles to ensure consistent particle size. The procedure was carried out on a Rotap device (Endocott test sieve shaker, London, England) with six screens ranging from mesh number 20 to 120, whereby the larger the mesh number will indicate a smaller particle size. The unit was shaken for 5 min.

A chroma meter was used to measure the colour of the flour. Thirty g of flour was placed on the granular attachment of the chroma meter and compacted. The colour was measured using 3-dimensional values based on the CIE 1976 L*a*b* colour system.

Triplicate readings of moisture content and bulk density of the rice flour were determined according to AOAC Official Methods (AOAC 1990) and Kim and Teledo (1987) respectively. To determine the bulk density, a known weight of the flour was added to a graduated measuring cylinder, tapped gently and the volume occupied by the sample was determined. Bulk density was recorded as weight per unit volume (g/ml).

The gelatinization temperature was estimated from alkali spreading value of 10 rice grains soaked in 15 ml of 1.7% KOH for 23 h at room temperature (Little and Hilder 1958). The gel consistency was determined based on the length of cold horizontal gel expressed in mm in a 13 mm x 100 mm test tube according to the method of Cagampang et al. (1973). The rice samples were classified as hard (26 – 40 mm), medium (41 – 60 mm) or soft (61 – 100 mm).

Water and oil absorption capacity were determined according to a modified method as described by Tsai et al. (1997). A sample of 0.5 g was taken and mixed with 3 ml of distilled water or refined groundnut oil. The slurry was centrifuged at 750 x g for 15 min. The pellet was drained for 30 min and the gain in weight per unit weight was reported as water or oil absorption capacity (g/g) respectively.

Traditional cakes formulation and preparation

The basic formulations for 15 popular traditional cakes (*Table 1*) were determined based on several preliminary studies using MR 220 rice flour and a commercial rice flour as control. The ideal proportions of the main ingredients and types of cooking are stated in *Table 1*. The preparation methods were established in earlier preliminary work which started by weighing all ingredients. The next step was the mixing of the ingredients following a specific sequence beginning with the addition of the dry ingredients, followed by addition of liquid ingredients such as eggs, water and coconut milk. After homogenisation, the mixtures were transferred to the cooking pan or mould and cooked either by baking, deep frying or steaming. The preparation of each traditional cake was done in two replicates.

Sensory analysis

The traditional cakes were evaluated by a sensory panel of 15 experienced panellists. The characteristics assessed were aroma, taste, colour, texture and overall acceptability (Meilgaard et al. 1999). Sensory evaluation scores were determined using a 9-point hedonic rating scale ranging from 1 to 9. The samples were rated for aroma with score 1 as no aroma and 9 with good aroma. The taste was rated 9 for a perfectly balanced taste and good sweetness while 1 as extremely bad taste, uncooked, over cooked or bitter products. For colour, score 1 indicated too light (unbaked) or too dark and burnt product while 9 was for brown, shiny and uniform coloured product. For texture, score 1 denotes too dry or too soft cohesive (uncooked) product and 9 as tender (soft) crumb and very good cohesiveness. Each sample was assessed for overall acceptability which covered these attributes.

Chemical analysis

Samples of traditional cakes were analysed for moisture, protein, crude fibre, fat, ash, phosphorous, potassium, sodium, calcium, iron, retinol, carotene, thiamine, niacin, pyridoxine and riboflavin. Moisture, protein, fat and ash were determined using standard AOAC methods (AOAC 1990). Moisture determination was done by drying samples in an oven at 105 °C for 3 h. Protein was determined by Kjeldahl nitrogen method using Kjeltec system 1026 (Tecator 1978). Fat was determined by Soxhlet extraction while ashing was done at 550 °C to constant weight.

Determination of crude fibre was carried out by Weende method using fibertec system (Tecator 1978). Minerals, vitamins and dietary fibre were analysed by an accredited company Edtech Associates Sdn. Bhd. (Penang) according to the method by AOAC (1993). Carbohydrate was calculated by subtracting the values of moisture, protein, crude fibre, fat and ash from 100. Each analysis was carried out in duplicate.

Table 1. Formulations of 15 traditional cakes using MR 220 rice flour

Traditional cakes	% of ingredients									
	MR 220 rice flour	Corn flour	Tapioca flour	Sugar	Brown sugar	Coconut milk	Water	Salt	Other ingredients	Method of cooking
Bingka tepung beras	19.0	–	–	9.5	-	31.6	31.6	0.4	7.9	Steaming
Kuih lompang	18.5	1.2	–	6.2	12.3	–	61.6	–	0.2	Steaming
Kuih lapis	12.4	1.5	–	11.9	–	12.4	61.5	0.2	0.03	Steaming
Apam beras	30.1	–	–	12.1	–	–	39.2	0.3	1.8	Steaming
Serabai	35.0	–	–	–	–	26.0	39.0	0.5	0.3	Steaming
Tepung pelita	10.0	1.0	–	7.7	–	9.0	64.0	0.3	7.7	Steaming
Tepung bungkus	9.1	–	0.9	–	–	45.0	45.0	–	–	Steaming
Tepung talam	12.4	4.5	–	1.0	9.8	11.0	62.0	–	–	Steaming
Rice pudding	5.3	0.1	–	1.5	–	5.0	87.1	0.3	0.1	Steaming
Putu mayam	45.0	5.0	–	–	–	–	50.0			Steaming
Sagun	45.0	–	–	24.0	–	–	–	0.6	30.0	Steaming
Rempeyek	29.3	–	–	–	–	11.7	46.9	0.6	6.1	Deep-frying
Peniaram	40.0	4.0	–	11.0	24.0		20.0	0.8		Deep-frying
Kuih ros	33.0	–	–	17.0	–	7.0	26.0	0.1	17.0	Deep-frying
Baulu	21.0	–	–	25.0	–	–	8.0	–	44.0	Baking

Data analysis

The experiment was conducted using the completely randomized design (CRD) and data were analysed using Analysis of Variance (ANOVA). The Duncan Multiple Range Test (DMRT) was used to detect differences between the two flours at p <0.05 (Gomez and Gomez 1984).

Results and discussion

Rice flour properties

The physical properties of the rice flour include particle size, colour, bulk density, moisture content, gel consistency, water absorption capacity and oil absorption capacity (*Tables 2* and *3*). The particle size distribution of the rice flour is important for processing because it provides consistency in material specification. In addition to that, particle size distribution determines the percentage frequency of distribution of particles size (Lachman et al. 1986).

The particle distribution of MR 220 rice flour showed that less than 5% was retained on mesh 20 – 100 (*Table 2*). About 95.07% of the particles were retained on mesh 120 indicating more fines were produced. Weight fraction of the smallest particles in MR 220 flour was the highest. Results suggested that the cyclone mill probably produced flour with smaller particle size. In the commercial rice flour (CF), a higher percentage of the particles were retained on the smaller numbered meshes and only about 44 % was retained on mesh 120 indicating less fine particles were found in CF. According to Bushuk (1998), flour particle size significantly affected the performance and functional properties of good quality food products. It determined the interaction of the flour particles with other ingredients during processing.

The moisture content of the rice flour ranged from 6.5 – 8.5%. The low levels of moisture were expected as the flour gave good separation in the particle distribution test and also no damp spots were observed. Moisture level is generally the factor most responsible for controlling the rate of flour

Table 2. Particle size distribution of rice flour

	% retained						
Mesh no.	20	30	50	80	100	120	Pan
MR 220	0.12	0.59	0.6	2.89	0.76	95.07	–
CF	0	2.21	5.23	19.55	28.84	44.18	–

Table 3. Mean values of physical and functional properties of rice flour

Properties	MR 220 rice flour	Commercial rice flour
Moisture content	6.5b	8.5a
Bulk density (g/ml)	0.62b	0.87a
Gel consistency	Soft	Hard
Gelatinization temperature	High	High
Water holding capacity (g g^{-1})	1.2a	0.8b
Oil absorption capacity (g g^{-1})	0.8a	0.5b
Colour		
L*(lightness)	96.77a	94.22b
a*(red to green)	– 4.97a	–5.10a
b*(yellow to blue)	7.39a	7.20a

Mean values in the same row with different letters are significantly different using DMRT with p <0.05

deterioration (Hanson 1974). The bulk density, a measure of heaviness of flour, was shown to be in the range of 0.62 – 0.87 g/ml. This falls under the category of food powders which have densities in the range of 0.3 – 0.8 g/ml (Chen et al. 1999). Results showed that the finer MR 220 rice flour had lower bulk density than CF indicating that CF was heavier than the MR 220 flour. The low bulk density of MR 220 rice flour might be due to the higher particle density and the smaller particle size (Oladele and Aina 2007).

The MR 220 rice flour produced by dry milling had softer gel while the commercial flour had a hard gel. Results suggested that the soft gel of MR 220 rice flour may be due to the variety which is different from the commercial rice flour. The presence of smaller particles could also be a contributing factor. This was supported by the higher amount of smaller particle size presence in the MR 220 rice flour. In addition to that, some studies had shown that flour particle size appeared to be associated with the flour texture (Bushuk 1998). All flours had high gelatinization temperature indicating that at low temperature, the starch was not affected or had partial disintegration and took a longer time to swell.

The water absorption capacity of MR 220 rice flour and CF were 1.2 g/g and 0.85 g/g respectively and were significantly different (p <0.01). It was observed that MR 220 rice flour which had more fine particles had higher water uptake than CF. According to Chen et al. (1999), the smaller flour particle surface area is easily hydrolysed by enzyme and thereby allowed the particles to absorb water at a higher rate. Other findings also showed that the finer flour swelled to a higher extend than the coarse flour indicating that the starch granules were weaker in the finer flour (Grant 1998). This was attributed by the higher starch damage that occurred in finer flour due to disruption of the crystalline structure which allowed water permeation on the whole granules. Oil absorption capacity (OAC) of MR 220 rice flour and CF were significantly different with values of 0.8 g/g and 0.5 g/g respectively. The higher OAC of MR 220 rice flour might have resulted from the protein and fat contents which can entrapp more oil. According to Chen et al. (1999), the hydrophobicity of proteins plays a major role in oil absorption.

The results indicated that MR 220 (L* = 96.77, a* = – 4.97 and b* = 7.39) is lighter in colour than CF (L* = 94.22, a* = – 5.10 and b* = 7.20) and statistically, it was found that the colour of MR 220 was significantly different from CF (*Table 3*). A study by Mok and Dick (2002) indicated that the finer flour was brighter. Accordingly, the L* value of the coarse CF was significantly lower than the finer flour of MR 220. Generally, a bright white coloured flour is more desirable for many products.

Sensory evaluation

All product characteristics such as colour, aroma, texture, taste and acceptability gained preference scores of 6 – 7 (*Table 4*). It was found that the panellists could not define and differentiate the taste and flavour between traditional cakes made from both MR 220 rice flour and commercial rice flour. Generally, steamed traditional cakes such as *kuih lapis, apam beras, serabai, tepung pelita, tepung bungkus* and *tepung talam* prepared using MR 220 flour obtained higher scores in texture than those prepared using commercial flour. The same trend was observed in *peniaram, baulu* and *sagun*. Earlier results had indicated that MR 220 rice flour had softer gel with higher water absorption capacity than commercial flour. Juliano (2003) reported that rice flour which has different physicochemical properties yielded products with different textural qualities. These findings may explain the differences in the texture of traditional cakes made from both flours. The panellists gave higher scores for overall acceptability to the fried products made from MR 220 rice flour such as *rempeyek* and *peniaram*. *Baulu* made from MR 220 rice flour also obtained a

Table 4. Mean values of sensory evaluation scores of 15 traditional cakes

Traditional cakes	Flour	Organoleptic properties				
		Colour	Flavour	Texture	Taste	Overall acceptability
Bingka tepung beras	MR 220	7.5a	7.8a	7.9a	7.9a	7.9a
	CF	7.6a	7.6a	7.8a	7.9a	7.9a
Kuih lompang	MR 220	7.9a	7.8a	7.1a	7.5a	7.5a
	CF	7.8a	7.8a	6.5a	7.6a	7.4a
Kuih lapis	MR 220	8.0a	7.6a	7.88a	7.7a	7.7a
	CF	7.9a	7.5a	7.0b	7.8a	7.8a
Apam beras	MR 220	8.2a	7.8a	7.8a	8.0a	7.6a
	CF	8.0a	7.8a	6.5b	7.9a	7.8a
Serabai	MR 220	7.9a	7.9a	7.9a	7.8a	8.1a
	CF	7.8a	7.8a	6.5b	7.8a	7.8a
Tepung pelita	MR 220	6.5a	6.9a	6.9a	6.8a	7.0a
	CF	6.6a	6.8a	6.2b	6.8a	6.9a
Tepung bungkus	MR 220	7.3a	7.5a	7.6a	7.6a	7.8a
	CF	7.5a	7.7a	6.8b	7.8a	7.8a
Tepung talam	MR 220	7.9a	7.1a	7.6a	7.3a	7.5a
	CF	7.8a	6.8a	6.8b	7.2a	7.8a
Rice pudding	MR 220	7.1a	6.9a	6.9a	6.4a	7.0a
	CF	7.2a	6.8a	6.4a	6.5a	6.8a
Putu mayam	MR 220	7.3a	6.6a	6.9a	7.5a	7.3a
	CF	7.5a	6.8a	6.5a	7.8a	7.6a
Sagun	MR 220	7.0a	7.4a	7.4a	7.6a	7.6a
	CF	7.1a	7.6a	7.0b	7.8a	7.8a
Rempeyek	MR 220	6.6a	6.8a	7.0a	6.8a	8.1a
	CF	6.6a	6.8a	6.8a	7.7a	7.1b
Peniaram	MR 220	7.3a	7.3a	7.8a	7.8a	8.0a
	CF	6.9b	7.2a	7.2b	7.8a	7.2b
Kuih ros	MR 220	7.6a	6.6a	7.2a	7.5a	7.2a
	CF	7.8a	6.9a	6.8a	7.8a	6.7b
Baulu	MR 220	7.6a	7.6a	7.6a	7.6a	7.4a
	CF	7.8a	74a	6.8b	7.8a	6.2b

*CF = Commercial flour. For each traditional cake, the mean values in the same column with different letters are significantly different using DMRT with $p < 0.05$

higher overall acceptability score compared to *baulu* made from commercial rice flour. The results reflected the differences in the physical and functional properties of both flours.

Proximate composition of traditional cakes

The energy content of the 15 traditional cakes ranged from 80.42 – 609.38 Kcal/100 g sample (*Table 5*). The deep-fat fried traditional cakes were found to have higher energy due to the high fat content (Khatijah et al. 1992). *Baulu*, cooked by baking, contained slightly lower energy at 281.02 Kcal/100 g sample. Steamed cakes and those cooked into paste had the lowest calorie content between 80.42 and 205.23 Kcal/100 g sample. Traditional cakes which had the highest energy content were *kuih ros* and *rempeyek* at 497.33 Kcal/100 g and 609.38 Kcal/100 g respectively. This is mainly due to their high fat and low moisture contents.

Table 5. Mean values+ of proximate composition of 15 traditional cakes

Traditional cakes	Moisture (g/100 g)	Protein (g/100 g)	Fat (g/100 g)	Carbohydrate (g/100 g)	Crude fibre (g/100 g)	Ash (g/100 g)	Energy (Kcal/100 g)
Bingka tepung beras	52.06 ± 0.08	2.45 ± 0.00	2.46 ± 0.08	38.58 ± 0.00	3.67 ± 0.10	0.77 ± 0.08	186.18 ± 0.10
Kuih lompang	61.09 ± 0.08	1.49 ± 0.10	0.24 ± 0.03	36.42 ± 0.50	0.29 ± 0.22	0.48 ± 0.10	153.74 ± 0.10
Kuih lapis	64.90 ± 0.08	1.38 ± 0.10	0.41 ± 0.10	30.92 ± 0.00	2.02 ± 0.10	0.38 ± 0.22	132.83 ± 0.08
Apam beras	55.59 ± 0.00	2.71 ± 0.22	0.08 ± 0.22	40.66 ± 0.08	0.53 ± 0.08	0.44 ± 0.00	174.18 ± 0.50
Serabai	60.17 ± 0.03	3.01 ± 0.10	0.78 ± 0.00	34.85 ± 0.50	0.37 ± 0.22	0.83 ± 0.22	158.42 ± 0.50
Tepung pelita	76.92 ± 0.10	0.96 ± 0.22	0.96 ± 0.50	17.00 ± 0.50	3.86 ± 0.00	0.31 ± 0.00	80.42 ± 0.03
Tepung bungkus	56.39 ± 0.10	3.71 ± 0.22	0.04 ± 0.10	39.51 ± 0.00	0.27 ± 0.10	0.08 ± 0.00	205.23 ± 0.08
Tepung talam	65.21 ± 0.00	2.23 ± 0.10	1.67 ± 0.00	29.07 ± 0.10	1.15 ± 0.00	0.67 ± 0.10	140.23 ± 0.50
Rice pudding	75.39 ± 0.03	0.97 ± 0.22	0.94 ± 0.10	18.57 ± 0.10	3.90 ± 0.20	0.23 ± 0.10	168.23 ± 0.50
Putu mayam	56.31 ± 0.10	3.68 ± 0.08	0.03 ± 0.10	39.59 ± 0.22	0.32 ± 0.10	0.08 ± 0.00	173.33 ± 0.08
Sagun	0.99 ± 0.00	7.41 ± 0.10	10.19 ± 0.00	78.69 ± 0.03	1.49 ± 0.00	1.24 ± 0.00	436.09 ± 0.22
Rempeyek	1.71 ± 0.10	25.42 ± 0.22	47.66 ± 0.22	19.71 ± 0.22	2.47 ± 0.10	3.05 ± 0.00	609.38 ± 0.75
Peniaram	66.13 ± 0.08	3.51 ± 0.22	22.33 ± 0.50	66.35 ± 0.10	0.84 ± 0.00	0.84 ± 0.00	480.41 ± 0.22
Kuih ros	1.55 ± 0.10	6.61 ± 0.10	21.45 ± 0.08	69.46 ± 0.10	0.31 ± 0.00	0.62 ± 0.10	497.33 ± 0.50
Baulu	31.6 ± 0.03	7.91 ± 0.22	2.26 ± 0.22	57.26 ± 0.08	0.22 ± 0.00	0.75 ± 0.22	281.02 ± 0.03

+Average of two analysis

There is a wide range of protein content in the 15 traditional cakes ranging from 0.97% to 25.42% (*Table 5*). High protein was present among the deep-fat fried traditional cakes especially *rempeyek*. The high protein level in *rempeyek* could be contributed by the ingredients used such as peanut and anchovies. In *baulu*, the eggs were the ingredients that contributed to the high protein content. The steamed traditional cakes had the lowest protein ranging from 0.97 to 3.71 g/100 g sample. These findings were in agreement with Khatijah et al. (1992) who stated that most steamed traditional cakes had ingredients such as coconut milk and eggs without addition of peanut and anchovies. They also reported that the deep-fat fried *rempeyek* had high protein content (17.4%) while steamed traditional cakes (*kuih lapis, kuih talam, tepung pelita, tepung bungkus* and *kuih lompang*) had the lowest protein ranging from 1.4 to 2.9 g/100 g sample.

As expected, the deep-fat fried traditional cakes were high in fat ranging from 21.45 to 47.66 g/100 g sample while the steamed traditional cakes had the lowest fat content ranging from 0.04 to 2.26 g/100 g sample. Coconut milk used in *kuih bingka, serabai, tepung pelita, kuih lapis* and *kuih tepung talam* may contribute to the fat content in the end products. Work by Khatijah et al. (1992) also stated that the boiled or cooked into paste traditional cakes had lower fat than those prepared by deep-fat frying.

Proximate analysis of the 15 traditional cakes showed that the major component was total carbohydrate which ranged between 17% and 78.65%. This is due to the fact that starch is the major constituent of rice. Khatijah et al. (1992) reported that most traditional cakes contained high amounts of carbohydrate. The crude fibre contents of the traditional cakes were low, i.e. less than 4% of the sample. The overall results were in agreement with the results of previous studies conducted by Khatijah et al. (1992) which reported that the crude fibre contents of the traditional cakes were generally low, i.e. less than 2% of the sample. The levels of ash content varied from 0.08 to 3.50%. Ogunsola and Omojola (2008) reported that a high ash content in products is indicative of the individual mineral levels of the raw material which gives a cumulative mineral level during processing.

Minerals and vitamins

The various mineral compositions of the 15 traditional cakes are presented in *Table 6*. The calcium content of all samples did not exceed 50 mg/100 g sample. Traditional cakes with high calcium content of 40 and 45 mg/100 g sample were found in *kuih lompang* and *apom beras* respectively. The lowest amount of 5 mg/100 g sample was detected in *kuih lapis*. The phosphorus level of the samples varied vastly from 3 to 298 mg/100 g. Highest level of phosphorus was found in r*empeyek*, a deep-fried traditional cake. *Rempeyek* and *peniaram* contained higher levels of iron (>3 mg/100 g sample) and all the traditional cakes exceeded the minimum iron level in varying amounts from 0.8 to 3.6 mg/100 g sample. All the samples analysed had relatively low sodium content. Potassium was present in the range of 6 mg/100 g to 463 mg/100g sample. High potassium was found in *rempeyek*. Variations in vitamins and mineral contents in the various traditional cakes may be due to different ingredients being used in the preparation of the products. The calcium, iron and phosphorus contents were lower than the values reported by Khatijah et al. (1992).

The levels of vitamins were generally low and had no distinct trend (*Table 7*). *Tepung talam* and *rempeyek* were found to have an appreciable amount of retinol. Tee et al. (1997) indicated that carotene may contribute to the total vitamin A content in cereal products. The thiamine content was considered low, ranging from 0 to 0.50 μg/100 g. Similarly with riboflavin levels, the amount ranged from 0.01 to 0.50 μg/100 g. Pyridoxine ranged from

Table 6. Mean values+ of mineral compositions of 15 traditional cakes (mg/100 g)

Traditional cakes	Calcium	Phosphorus	Iron	Sodium	Potassium
Bingka tepung beras	14.00 ± 0.22	18.00 ± 0.50	0.80 ± 0.22	164.00 ± 5.25	98.00 ± 1.25
Kuih lompang	40.00 ± 1.10	8.00 ± 0.22	1.20 ± 0.10	98.00 ± 1.25	135.00 ± 0.22
Kuih lapis	5.00 ± 0.22	92.00 ± 0.80	1.50 ± 0.00	46.00 ± 1.25	27.00 ± 1.10
Apam beras	45.00 ± 2.25	67.00 ± 1.25	1.80 ± 0.00	143.00 ± 1.75	56.00 ± 1.25
Serabai	34.00 ± 1.25	67.00 ± 0.75	0.90 ± 0.00	211.00 ± 2.25	62.00 ± 1.10
Tepung pelita	10.00 ± 2.25	3.00 ± 0.22	0.60 ± 0.00	201.00 ± 2.25	6.00 ± 1.25
Tepung bungkus	8.00 ± 0.25	4.00 ± 0.75	0.80 ± 0.22	195.00 ± 1.75	45.00 ± 0.22
Tepung talam	12.00 ± 2.25	15.00 ± 1.10	1.30 ± 0.22	154.00 ± 3.25	11.00 ± 1.25
Rice pudding	30.00 ± 0.22	291.00 ± 2.25	0.22 ± 0.00	180.00 ± 2.25	160.00 ± 0.22
Putu mayam	30.00 ± 2.25	57.00 ± 1.25	1.00 ± 0.22	129.00 ± 2.25	52.00 ± 1.10
Sagun	28.00 ± 1.25	62.00 ± 2.25	0.89 ± 1.25	155.00 ± 5.25	187.00 ± 1.25
Rempeyek	38.00 ± 0.22	298.00 ± 1.25	3.10 ± 0.22	329.00 ± 2.25	463.00 ± 2.15
Peniaram	6.00 ± 0.20	68.00 ± 1.25	3.60 ± 0.22	207.00 ± 2.25	80.00 ± 2.25
Kuih ros	5.40 ± 0.22	54.00 ± 1.25	0.40 ± 0.10	189.00 ± 1.25	97.00 ± 1.10
Baulu	12.00 ± 1.10	40.00 ± 2.25	2.20 ± 0.22	93.00 ± 2.25	53.00 ± 0.22

+Average of two analysis

Table 7. Mean values+ of vitamin compositions of 15 traditional cakes (µg/100 g)

Traditional cakes	Retinol	Carotene	Thiamine	Riboflavin	Pyridoxine	Niacin
Bingka tepung beras	4.00 ± 0.25	5.00 ± 0.25	0.16 ± 0.00	0.05 ± 0.00	0.60 ± 0.00	0.20 ± 0.01
Kuih lompang	2.00 ± 0.00	0	0.04 ± 0.00	0.07 ± 0.00	0.56 ± 0.00	0.10 ± 0.02
Kuih lapis	11.00 ± 0.75	0	0.01 ± 0.00	0.03 ± 0.00	0.72 ± 0.05	0.02 ± 0.00
Apam beras	2.00 ± 0.00	0	0.01 ± 0.00	0.09 ± 0.01	0.56 ± 0.02	0.20 ± 0.00
Serabai	3.00 ± 0.25	0	0.05 ± 0.00	0.50 ± 0.02	0.66 ± 0.05	0.10 ± 0.00
Tepung pelita	26.00 ± 0.25	1.00 ± 0.00	0.01 ± 0.00	0.08 ± 0.00	0.76 ± 0.00	0.20 ± 0.01
Tepung bungkus	5.00 ± 0.00	23.00 ± 0.50	0.08 ± 0.00	0.05 ± 0.00	0.80 ± 0.00	0.04 ± 0.01
Tepung talam	9.00 ± 0.00	5.00 ± 0.00	0.14 ± 0.00	0.02 ± 0.00	0.82 ± 0.00	0.62 ± 0.01
Rice pudding	7.00 ± 0.75	9.00 ± 0.75	0.51 ± 0.00	0.02 ± 0.00	1.44 ± 0.25	0.29 ± 0.00
Putu mayam	0	0	0.04 ± 0.00	0.26 ± 0.00	0.98 ± 0.00	0.40 ± 0.00
Sagun	5.00 ± 0.01	12.00 ± 0.25	0.07 ± 0.00	0.05 ± 0.00	0.67 ± 0.00	0.03 ± 0.00
Rempeyek	26.00 ± 0.25	2.00 ± 0.01	0.23 ± 0.00	0.15 ± 0.00	0.80 ± 0.00	5.70 ± 0.05
Peniaram	6.00 ± 0.01	0	0.02 ± 0.00	0.09 ± 0.00	0.70 ± 0.05	0.41 ± 0.00
Kuih ros	5.00 ± 0.01	0	0.09 ± 0.00	0.04 ± 0.00	0.12 ± 0.05	0.15 ± 0.01
Baulu	11.00 ± 0.25	3.00 ± 0.10	0	0	0.20 ± 0.01	0

+Average of two analysis

0.2 to 1.44 µg/100 g sample. The niacin levels were low except for *rempeyek* which contained 5.7 µg/100 g samples. Khatijah et al. (1992) also reported that a considerable amount of variation in vitamins was observed in various traditional cakes and there appeared to be no trend.

Conclusion

Quality analysis of rice flour samples indicated that some differences existed in physical and functional characteristics of MR 220 and commercial rice flours. MR 220 rice flour is whiter than the commercial flour and had a soft gel. In general, there were no significant differences between products developed using MR 220 rice flour and commercial rice flour in terms of taste and flavour. The results indicated that MR 220 rice variety can be used for making traditional cakes as sensory evaluation showed that MR 220 rice flour was acceptable in traditional cakes. Most commercial rice flours sold in the market are mixtures of unknown ratios with other flours such as corn and tapioca flours. The study showed that rice flours with different physicochemical properties yielded products with different textural qualities. Therefore, an appropriate rice variety must be selected as raw material to produce food products.

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Abstrak

Tepung beras MR 220 yang telah disediakan dengan kaedah kering menggunakan pengisar tepung jenis *air-isolating cyclone* telah digunakan dalam kajian ini. Kandungan lembapan tepung beras ialah 6.5 – 8.9% dan kapasiti penyerapan air serta minyak masing-masing ialah 0.8 – 1.2 g/g dan 0.5 – 0.8 g/g. Tepung beras MR 220 mempunyai ketumpatan pukal yang lebih rendah dan menghasilkan gel yang lembut berbanding dengan tepung beras komersial. Taburan saiz partikel tepung beras MR 220 menunjukkan bahawa peratusan partikel lebih tinggi tertahan di jaring yang bernombor besar. Sebanyak 15 jenis kuih tradisional telah disediakan daripada tepung beras MR 220 dan tepung beras komersial. Penilaian organoleptik telah dijalankan untuk membandingkan ciri–ciri deria kuih tradisional yang dihasilkan daripada kedua-dua tepung. Penilaian dibuat berdasarkan rasa, aroma, tekstur, warna dan penerimaan keseluruhan. Secara umumnya, skor yang lebih tinggi diberikan kepada ciri-ciri kuih tradisional yang dibuat daripada tepung beras MR 220. Keputusan menunjukkan bahawa kandungan karbohidrat dan nilai tenaga masing-masing ialah 17 – 78% dan 80.42 – 609.38 Kcal/100 g sampel.

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