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Nutritional Composition of Commercial Sweet Buns in Malaysian Market

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Abstract

Background: The major strategy for prevention and treatment of diet-related disease is lifestyle modification, including controlled diet and physical activities. Since bread had been listed as one of the top ten foods consumed by Malaysian, the information of nutrient content in buns is needed for consumer to be aware of the nutrient intake from their food choices. The main objective of this study is to determine the nutritional composition of varieties of sweet buns sold in Malaysia.

Method: A total of three to six brands from each type of bun (chocolate, coconut, kaya, potato and red bean) were sampled from local supermarkets in the Klang Valley, Malaysia using stratified sampling. The proximate composition, minerals, vitamins C, fatty acids, trans fatty acids and cholesterol were analysed using standard methods with the application of internal quality controls.

Results: Carbohydrate was the major macronutrient in commercial buns ranging from 46.93 ± 3.72 to 54.73 ± 2.46 g/100 g. The highest protein content was found in the potato bun (9.15 ± 0.56 g/100 g) and the lowest protein content was in the kaya bun (7.13 ± 0.32 g/100 g). Fat content was in the range of 2.90 ± 1.37 to 8.98 ± 1.61 g/100 g. Major minerals content detected in buns were sodium, followed by potassium and calcium. Chocolate buns showed higher content of vitamin C ($p<0.05$) compared to kaya bun. Trans fatty acids were at trace level in all buns.

Conclusion: These findings indicate that Malaysian commercial buns are good source of carbohydrates and with negligible level of trans fatty acids.

Keywords: Nutrients; Buns; Carbohydrate; Fatty-acids

Introduction

The increased of the diet-related diseases such as diabetes is on the rise from merely 6.3% in 1986 to a whopping 17.5% in 2015 [1]. This elevation shows the urgent need of releasing nutrient content of popular food among Malaysian. The major strategy for prevention and treatment of NCDs is lifestyle modification, including controlled diet and physical activities [2]. Since bread has been listed as one of the favourite foods consumed by Malaysian [1], detail information given will improvise their food choices, increasing the effectiveness of nutritional advices by the nutritionist and dieticians, and can contribute to updating the content of Malaysian Food Composition Database which were not included in the first edition of the database. Baked products such as buns, bread, biscuits, cakes, pastries and pies are historically one of mankind's oldest food staples where both can give nourishment and enjoyment at the same time. Baked products are referred as all food products which are based on the use of wheat flour [3]. Buns was commonly sweet taste and come in many shapes and sizes. They are most commonly hand-sized or smaller which had been desirable and convenient for consumer. Since food consumption trends in Malaysia had been changes as typical of those in developing country, the role of rice as the main staple food and main calorie provider was offset even more by a strong growth in per capita consumption of wheat during rapid economic development within 1980s-2000s [4]. Therefore, the main objective of this study is to determine the nutritional composition of the six types of sweet buns (chocolate, coconut, kaya, potato and red bean) sold in Malaysia by conducting analysis of proximate, minerals, vitamin C, fatty acids and cholesterol.

Materials and Methods

Study design

We conducted a descriptive study comparing nutrient contents of commercialised sweet buns in Malaysia. Based on the protocol for Sampling and Methods Analysis for Malaysian Food Composition (2011), we selected Klang Valley as sampling point because it was known as the marketing centre for various food products in Malaysia, with list of suppliers available, representing most of the brands that were consumed by Malaysian. We used stratified random sampling to select three to six brands of each type of bun available in the supermarkets.

Samples collection and preparation

Five types of sweet buns that were available in Malaysian market: chocolate bun, coconut bun, kaya bun, potato bun and red bean bun were collected. Each kilogram of the same type of bun from the same brand was homogenised thoroughly using a food grinder and transferred into air tight containers and stored at room temperature (25°C ± 2°C). Each brand was analysed individually within two weeks after homogenisation with analysis of each nutrient carried out in duplicate.

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Proximate analysis

The determination of moisture content was performed by the drying method. Protein content was determined using the Kjedahl method. A conversion factor of 6.25 was used to convert the measured nitrogen content to protein content. Fat content was determined by semi-continuous solvent extraction method. Available carbohydrate content was calculated by subtracting the sum of protein, fat, moisture, ash and total dietary fibre from 100%. Total dietary fibre (TDF) was determined using enzymatic gravimetric method. For TDF, enzyme digestate was treated with alcohol to precipitate soluble dietary fibre (SDF) before filtering and TDF residue was washed with alcohol and acetone, dried and weighed. For insoluble dietary fibre (IDF) and SDF, enzyme digestate was filtered and IDF residue was washed with warm water, dried and weighed. For SDF, combined filtrate and washes were precipitated with alcohol, filtered, dried and weighed. TDF, IDF and SDF residue values were corrected for protein, ash and blank. Ash content was determined using dry-ash method.

Minerals analysis

Samples acquired were digested by using Microwave Digestion technique according to the standard method. The solution obtained from the digestion was used for determination of minerals. Major minerals elements such as Calcium (Ca), Iron (Fe), Magnesium (Mg) and Sodium (Na) were analysed according to the standard method by inductively coupled plasma-optical emission spectrometry (ICP-OES). Zinc (Zn) and Copper (Cu) were analysed using atomic absorption spectrophotometer (Pelkin Elmer, Germany).

Fatty acids analysis

Fatty acids in samples were determined by converting the triglycerides and phospholipids in the samples into fatty acids methyl esters (FAME) by the reaction of 1.0 mL methylation reagent (methanol containing 2% v/v H_2SO_4) at 50°C for 2 hours. After that, samples were removed from the heating block and allowed to cool at room temperature before adding 1.0 mL neutralising solution (0.25 M $KHCO_3$, 0.5 M K_2CO_3). Subsequently, 1.0 mL of hexane was added, and the mixture was centrifuged at 1000 rpm for two minutes at room temperature. The upper phase containing the FAMEs was transferred to a new round bottom glass tube and dried under nitrogen gas at 40°C. Then, 75 µL dry hexane was added twice, vortexed and transferred into the insert of a gas chromatography auto-sampler vial.

Saturated, monounsaturated, polyunsaturated and trans-fatty acids were determined by gas chromatography (GC) with flame ionisation detector (FID). Internal quality control materials prepared in the laboratory and NIST Standard Reference Material® (SRM) 1849a Infant/ Adult Nutritional Formula (USA) were used as control to monitor the quality of the resulting data for each sample. Results for all nutrients analysed were only accepted if they were within the control limits of the quality control material.

Vitamin C analysis

The analysis for vitamin C was carried out using High Performance Liquid Chromatography (HPLC) with Diode Array Detector. The method involved dissolution of sample in Tris (2-carboxyethyl)-phosphine hydrochloride acid and simple removal of protein using trichloroacetic acid (TCA) followed by reversed phase LC. Five grams of sample was weighed into a 100 mL flask and then dissolved and acidified in 20 mL Tris (2-carboxyethyl)-phosphine hydrochloride solution. This solution was then made up to 100 mL with 1% TCA solution and shaken for about 1 min. The resulting mixture was filtered into an HPLC vial and vitamin C content determined by Diode Array Detector against the standard solution. Internal quality control materials prepared in the laboratory and multivitamin tablets SRM 3280 were used as control to monitor the quality of the resulting data for each sample. Results for all nutrients analysed were only accepted if they were within the control limits of the quality control material.

Data analysis

All data were analysed using Statistical Package for Social Science (SPSS) version 18.0 for Windows. Data are presented as mean with standard deviation of mean (SD). Significance difference at $P<0.05$, was analysed by One-way Analysis of Variance (ANOVA) followed by Duncan Multiple Range Test.

Results and Discussion

This study offers a comparison of nutrient content in five different types of sweet buns: chocolate, coconut, kaya, potato and red bean buns in Malaysian market. The nutrients content between the different brands of the same type of bun did not vary statistically. This may be related to the same ingredients used for the buns filling of the same type. However, the nutrients between five different types of buns showed significant different for certain nutrients.

Proximate analysis

The major macronutrient present in the five types of buns was carbohydrate that ranged from 46.93 to 54.73 g /100g (Table 1). Fat and protein content varied between the buns with the highest content

Proximate parameter (g/100g)	Chocolate Bun *n*=4	Coconut Bun *n*=6	*Kaya* Bun *n*=3	Potato Bun *n*=6	Red Beans Bun *n*=3
Moisture	29.90 ± 3.55 (25.40-34.00)	29.37 ± 2.10 (26.50-31.70)	30.40 ± 3.08 (27.60-33.70)	29.65 ± 1.30 (28.30-31.80)	29.90 ± 3.55 (26.80-30.30)
Protein	8.70 ± 1.36^{b} (7.70-10.70)	7.22 ± 0.41^{a} (6.60-7.80)	7.13 ± 0.32^{a} (6.90-7.50)	9.15 ± 0.56^{b,c} (8.50-10.00)	7.93 ± 0.40^{a,b} (7.50-8.30)
Fat	7.43 ± 3.68^{b} (2.80-11.80)	6.88 ± 2.60^{b} (4.40-10.10)	2.90 ± 1.37^{a} (1.40-4.10)	8.98 ± 1.61^{b} (7.20-11.00)	5.83 ± 1.16^{a,b} (4.50-6.60)
Carbohydrate	47.43 ± 1.67^{a} (45.8-49.4)	51.05 ± 3.07^{b} (45.70-54.20)	54.73 ± 2.46^{c} (52.40-57.30)	46.93 ± 3.72^{a} (43.40-53.80)	52.4 ± 0.95^{b,c} (51.30-53.00)
Total Dietary Fibre	4.95 ± 1.03 (4.40-6.50)	4.43 ± 1.364 (2.20-5.90)	3.93 ± 0.60 (3.30-4.50)	4.65 ± 0.76 (4.00-5.70)	4.70 ± 0.44 (4.40-5.20)
Ash	1.60 ± 0.42^{c} (1.20-2.10)	1.05 ± 0.15^{a,b} (0.90-1.30)	0.90 ± 0.10^{a} (0.80-1.00)	1.30 ± 0.18^{b,c} (1.10-1.60)	1.10 ± 0.10^{a,b} (1.00-1.20)

*Different letters ^{a,b,c} within the same row indicate significant different ($p<0.05$). Results are expressed in mean ± SD and range.

Table 1: Proximate composition of selected commercial bun in Malaysia (g/100g).

of fat and protein found in potato bun (8.98 ± 1.61, 9.15 ± 0.56) and the lowest was in kaya bun (2.90 ± 1.37, 7.13 ± 0.32). The varying amount of fat and protein content could be attributed to the different ingredients in the filling of buns as we assumed because the content of the bread was similar between all types of buns.

Moisture plays a critical role in determining the quality and shelf life of sugar-based confections [5]. Among the selected sweet buns there were no significant different of moisture content between the five types of buns. The total dietary fibre in all samples ranged from 3.93 to 4.95 g/100g. The highest fibre content was in the chocolate bun and the lowest fibre was in kaya bun. Fortifying bread with dietary fibre could be a satisfactory method for nutritional enrichment [6]. Therefore, commercialised sweet buns in Malaysian market may also contribute in increasing dietary fibre intake.

Minerals analysis

The results of minerals content of commercialised sweet buns in Malaysia are summarised in Table 2. The data indicated that sodium, potassium, calcium, phosphorus and magnesium were the major mineral-constituents in the five types of sweet buns. Iron, zinc, copper, selenium and manganese were also detected. Sodium was the predominant mineral in the five types of buns. The mean of sodium content ranged from 170.33 ± 24.64 mg/100g to 274.20 ± 53.82 mg/100g. The sodium contents of five types of sweet buns in Malaysia were significantly different ($p<0.05$). According to Sillow et al. [7], bread and other cereal products contribute about 30% to the daily intake of sodium in human diet. Sodium was also the principle cation in extracellular fluid in the body and essential nutrient necessary for maintenance of plasma volume, acid-balance, transmission of nerve impulse and normal cell function [8]. Based on Recommended Nutrient Intake (RNI) for Malaysia, 2017 suggested intake of sodium for adults was 1500 mg/day. Therefore, commercialised sweet buns in Malaysian market may contribute as a good source of sodium.

Regarding potassium contents, the highest value was found in chocolate bun (141.75 ± 12.38 mg/100g) followed by potato bun (140.57 ± 23.80 mg/100g), red beans bun (130.20 ± 8.28 mg/100g), coconut bun (105.87 ± 9.41 mg/100g) and kaya bun (80.47 ± 21.15 mg/100g). Potassium was a cofactor for many enzymes and it is also required for creatine phosphorylation, carbohydrate metabolism and protein synthesis [9]. Eating diets high in potassium has been linked to reducing blood pressure, decreasing the risk of stroke, improving bone health and reducing the risk of nephrolithiasis [10]. In this study, chocolate bun had the highest potassium contents and therefore it could contribute more potassium in dietary intake compared to other types of sweet buns in Malaysia.

The calcium contents ranged from 45.15 ± 16.83 mg/100g to 137.40 ± 79.84 mg/100g. The highest content of calcium in this study was found in chocolate bun. This may be related to the chocolate filling that may contain milk as one of the sources of calcium. Several clinical and other studies have also shown calcium to be effective as pressure lowering agents [11,12]. The highest magnesium content was also in chocolate bun (24.30 ± 2.92 mg/100 g) while the lowest magnesium content was found in potato bun (16.92 ± 8.83 mg/100 g).

The iron contents ranged from 0.67 ± 0.06 mg/100g to 1.98 ± 1.06 mg/100g. In this study, chocolate bun was highest in iron. Meanwhile, the zinc and copper found in all the five different types of buns were not statistically significantly different. Zinc in food is nutritionally essential for all organisms for several reasons, among them being its role in the immune system: the secretion of insulin, the release of vitamin A from liver stores and key enzymes such as superoxide dismutase [13]. Copper is also an essential trace element that is required in the cellular processes of electron transfer in humans. Most copper in foods is found in the cupric state (Cu^{2+}) bound to organic compounds especially amino acids. Based on Recommended Nutrient Intake for Malaysia (RNI) 2017, recommended intake for zinc in adult is 4.3-6.6 mg/day and copper is 0.7 mg/day with the upper level for zinc and copper are both 10 mg/day. Therefore, sweet buns in Malaysian market are in the safe range of zinc and copper to be consumed.

The selenium and manganese were also found in all the five types

Minerals (mg/100g)	Chocolate Bun *n*=4	Coconut Bun *n*=6	*Kaya* Bun *n*=3	Potato Bun *n*=6	Red Beans Bun *n*=3
Sodium	241.58 ± 35.31^{b,c} (213.50-288.90)	197.53 ± 44.19^{a,b} (136.70-229.60)	170.33 ± 24.64^{a} (144.90-194.10)	274.20 ± 53.82^{c} (198.00-339.30)	169.13 ± 32.55^{a} (133.80-197.90)
Calcium	137.40 ± 79.84^{b} (60.00-238.60)	65.27 ± 13.35^{a} (41.90-78.40)	61.90 ± 3.16^{a} (58.90-65.20)	45.15 ± 16.83^{a} (22.60-63.60)	79.97 ± 8.91^{a} (69.70-85.60)
Magnesium	24.30 ± 2.92 (21.00-26.90)	21.42 ± 1.42 (19.40-23.00)	17.20 ± 1.91 (16.10-19.40)	16.92 ± 8.83 (0.00-24.50)	21.67 ± 7.61 (12.90-26.50)
Potassium	141.75 ± 12.38^{c} (127.30-157.30)	105.87 ± 9.41^{b} (94.50-116.20)	80.47 ± 21.15^{a} (65.70-104.70)	140.57 ± 23.80^{c} (105.80-173.70)	130.20 ± 8.28^{b,c} (121.10-137.30)
Phosphorus	78.78 ± 8.89^{c} (66.60-87.90)	64.90 ± 2.61^{a,b} (61.90-68.80)	58.80 ± 4.27^{a} (53.90-61.70)	89.10 ± 7.11^{d} (81.20-99.50)	70.63 ± 2.57^{b,c} (67.80-72.80)
Iron	1.98 ± 1.06^{b} (1.20-3.50)	1.00 ± 0.33^{a} (0.70-1.50)	0.67 ± 0.06^{a} (0.60-0.70)	0.92 ± 0.29^{a} (0.70-1.50)	1.07 ± 0.21^{a} (0.90-1.30)
Zinc	0.90 ± 0.08 (0.80-1.00)	0.83 ± 0.16 (0.60-1.10)	0.73 ± 0.15 (0.60-0.90)	0.95 ± 0.12 (0.80-1.10)	0.93 ± 0.12 (0.80-1.00)
Copper	0.18 ± 0.05 (0.10-0.20)	0.15 ± 0.05 (0.10-0.20)	0.13 ± 0.06 (0.10-0.20)	0.10 ± 0.00 (0.10-0.10)	0.13 ± 0.06 (0.10-0.20)
Selenium (µg/100g)	2.75 ± 0.59^{a,b} (2.20-3.40)	2.85 ± 0.90^{a,b} (1.70-3.90)	1.97 ± 0.35^{a} (1.60-2.30)	3.38 ± 0.90^{b} (2.10-4.60)	2.80 ± 0.70^{a,b} (2.30-3.60)
Manganese (µg/100g)	0.50 ± 0.14^{c} (0.40-0.70)	0.47 ± 0.05^{c} (0.40-0.50)	0.33 ± 0.06^{a,b} (0.30-0.40)	0.28 ± 0.08^{a} (0.20-0.40)	0.43 ± 0.06^{b,c} (0.40-0.50)

*Different letters ^{a,b,c,d} within the same row indicate significant different ($p<0.05$). Results are expressed in mean ± SD and range.

Table 2: Mineral content of selected commercial bun in Malaysia (mg/100g).

Fatty Acid (g/100g)	Chocolate Bun *n*=4	Coconut Bun *n*=6	*Kaya* Bun *n*=3	Potato Bun *n*=6	Red Beans Bun *n*=3
SFA	4.80 ± 2.52^{c,d} (1.50-7.60)	4.85 ± 2.02^{d} (2.70-7.10)	1.70 ± 0.82^{b,c} (0.8-2.40)	4.63 ± 1.39^{a,b} (2.40-6.30)	3.30 ± 0.00^{a} (3.30-3.30)
MUFA	2.13± 1.18^{a,b} (1.0-3.70)	1.52 ± 0.49^{a} (1.0-2.30)	0.80 ± 0.36^{a,b} (0.40-1.10)	3.05 ± 0.68^{b,c} (2.10-4.00)	2.37 ± 0.12^{c} (2.30-2.50)
PUFA	0.48 ± 0.17^{a} (0.30-0.70)	0.48 ± 0.26^{a} (0.30-0.90)	0.40 ± 0.30^{b} (0.10-0.70)	0.85 ± 0.27^{a,b} (0.40-1.10)	0.83± 0.15^{b} (0.70-1.00)
TFA	0.00	0.00	0.00	0.00	0.00
Cholesterol	0.00^{a}	0.53 ± 1.31^{a} (0.00-3.20)	2.83 ± 1.86^{a} (1.10-4.80)	13.70 ± 7.87^{b} (6.80-24.90)	0.00^{a}

*Different letters ^{a,b,c,d} within the same row indicate significant different (p<0.05). Results are expressed in mean ± SD and range.

Table 3: Fatty acids content of selected commercial buns in Malaysia (g/100g).

	Chocolate Bun *n*=4	Coconut Bun *n*=6	*Kaya* Bun *n*=3	Potato Bun *n*=6	Red Beans Bun *n*=3
Vitamin C **(mg/100g)**	4.25 ± 1.73^{b} (2.10-5.80)	3.48 ± 1.13^{a,b} (2.30-5.30)	2.07 ± 0.95^{a} (1.10-3.00)	2.85 ± 0.91^{a,b} (1.80-4.20)	2.90 ± 0.70^{a,b} (2.40-3.70)

*Different letters ^{a,b} within the same row indicate significant different (p < 0.05). Results are expressed in mean ± SD and range.

Table 4: Vitamin C content of selected commercial buns in Malaysia (mg/100g).

of sweet buns in Malaysia. The range of selenium found was 1.97 ± 0.35 µg/100g to 3.38 ± 0.9 µg/100g and manganese was 0.33 ± 0.06 µg/100g to 0.50 ± 0.14 µg/100g. Most dietary selenium is highly bioavailable (50-80%) with absorption efficiency of selenium from usual diets is estimated at 70% [14]. The selenium is also involved in antioxidant activity against oxidative damage and inflammation, T-cell immunity for protection against infections, thyroid hormone metabolism, selenium homeostasis and transport, skeletal and cardiac muscle growth and function [15].

Fatty acids analysis

Saturated fatty acids (SFA) were the major fatty acids composition in all buns analyzed and ranged from 0.8 to 7.60 g/100 g (Table 3). The total SFA content showed a significant different ($p<0.05$) between different types of buns. Palmitic acid (C16:0) constitute the main component of the SFA, ranging from 0.01 to 5.6 g/100 g. The presence of high amounts of C16:0 indicates the use of palm oil and palm kernel oils as other sources of fat.

Total monounsaturated fatty acids (MUFA) ranged from 0.4 to 3.70 g/100g. Total MUFA composition for all buns analyzed were not significantly different ($p>0.05$). Among the MUFA, oleic acid (C18:1) constituted the highest component with content ranging from 0.05 to 2.1 g/100g. There are significant different ($p<0.05$) in the total polyunsaturated fatty acids (PUFA) content between different types of buns. Among the PUFA, linoleic acid (C18:2) was the highest component with content ranging from 0.05 to 0.65 g/100g followed by eicosadienoic acid (C20:2), ranging from 0.02 to 0.16 g/100g. Polyunsaturated fatty acids (PUFA) content were relatively low in this study ranging from 0.005 to 0.02 to g/100g. The low PUFA content indicates the use of concrete fats, often obtained by hydrogenation of refined vegetable oil [16]. Meanwhile, trans fatty acid (TFA) was at negligible level in Malaysian commercial buns. The World Health Organisation/Food and Agricultural Organisation (WHO/FAO) in 2003 had recommended less than 1% of daily energy intake of TFAs.

Cholesterol was not found in the chocolate bun or the red beans bun, but there were significant different ($p<0.05$) in the cholesterol content between the coconut bun, kaya bun and potato bun. The ranges of cholesterol content were from 0.53 to 24.90 mg/100g. The highest content of cholesterol was found in potato bun. This study reveals that the cholesterol amount in five types of buns is also under the WHO/FAO (2003) recommended nutrient intake of cholesterol that should be less than 300 mg per day.

Vitamin C analysis

There was a significant different ($p<0.05$) in vitamin C between different types of buns. Vitamin C content ranged from 1.10 to 5.80 mg/100 g (Table 4). Highest content of vitamin C in this finding was in chocolate bun. Vitamin C found in this study proved the usage of certain acidic ingredients as natural dough conditioner. Besides that, vitamin C also improves the quality of bread, making them lighter in texture while, at the same time, help to marginally decrease the overall mixing time, which is good for the dough. The benefits of vitamin C to human include protection against immune system deficiencies, cardiovascular diseases, prenatal health problems, eye diseases and even skin wrinkling [17-19].

The limitation of this study was in sample preparation because the buns and fillings were homogenised together and therefore the exact nutrient in the filling could not be specified. The ingredients for the buns were usually similar and therefore the difference in nutrient composition in this study could be related to the different contents of the fillings. It is recommended that separate fillings are investigated in future research [20-23].

Conclusion

In conclusion, this study showed that Malaysian commercial sweet buns are good sources of carbohydrates and minerals, all of which will benefit the human health. Malaysian sweet buns contain negligible level of trans fatty acids. These findings might assist the public in making healthy food choices. The findings have also been incorporated into the Malaysian Food Composition Database that is valued as a reference by nutritionists, dieticians and researchers.

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