

MALAYSIAN READY-TO-EAT COOKED DISHES: CONSUMPTION PATTERNS AMONG ADULTS AND NUTRIENT COMPOSITION OF SELECTED HIGHLY CONSUMED DISHES

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ABSTRACT

Malaysian main dishes have been related to high carbohydrate and protein contents, and lack of vegetables. However, consumption patterns and nutrient composition of these types of dishes were scarcely reported. This study was conducted to determine consumption patterns and nutrient composition of Malaysian ready-to-eat cooked dishes. Consumption patterns were assessed using a food frequency questionnaire among 432 adults. The nutrient composition of the eight selected highly consumed dishes was determined by proximate analysis. The results showed that from 89 listed ready-to-eat cooked dishes, four dishes had moderate consumption levels, which were fried *bihun* (36.9), *nasi lemak* (34.7), *roti canai* (33.1) and Pattaya fried rice (30.2). The rest of the dishes had low consumption levels (<29.9). The nutrient composition was significantly different ($p < 0.05$) between the dishes. Chinese fried rice had the highest carbohydrate content ($33.65 \pm 8.04\%$) whilst chicken burgers had the highest protein ($7.57 \pm 0.63\%$), fat ($11.02 \pm 1.27\%$) and energy (235.43 ± 7.68 kcal) contents. No dishes were found to have a crude fibre content of more than 1.0%. In conclusion, Malaysian adults had a controllable consumption of local ready-to-eat cooked dishes as most of the dishes were consumed in low quantities. Nutrient compositions of dishes from this study are suggested to be added in Malaysian Food Composition Database for future reference of authorities and public for diet planning.

Key words: Consumption patterns, nutrient composition, Malaysian ready-to-eat cooked dishes, fried *bihun*, *nasi lemak*, *roti canai*

INTRODUCTION

Malaysia is known for its numerous gastronomic delights. As a multi-racial country, the intermingling between ethnic groups particularly the major ones: Malays, Chinese and Indians, has amalgamated the flavours of Malaysian foods and led the Malaysian population to eat similar dishes, no matter of their ethnicity. Examples of the iconic Malaysian dishes are *nasi lemak* and *roti canai*. Also, Malaysian dishes are influenced by a myriad of other cultures particularly from neighbouring countries such as Indonesia and Thailand. Dishes such as *nasi ayam penyyet* and *tom-yum* have become Malaysian daily meals. As a result, there are a

vast array of dishes in Malaysia. However, the consumption frequencies or patterns of these dishes were scarcely reported.

There is a strong demand to study about this matter as Malaysian dishes have been related with high carbohydrate and fat contents as common ingredients of a Malaysian dish would consist of rice, deep-fried meat/poultry/fish and a small amount of vegetables. Indeed, Zainal Badari *et al.* (2012) reported that typical Malaysian diets are energy-based, high in protein, and lack of fruits and vegetables. Malaysian Adults Nutrition Survey (MANS) 2014 reported that in addition to an increase of rice consumption by 19% (Noraida *et al.*, 2018), the increase of total energy intake in 2014 was also due to the significant intake of fat and protein (fat = 31% and protein = 16% of total energy

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intake) compared to MANS 2003 (fat = 28% and protein = 15% of total energy intake) (Ahmad *et al.*, 2019). These findings suggested that Malaysian adults have an energy-dense food intake pattern.

High energy intake has been related to obesity. Ng *et al.* (2014) reported that the prevalence of overweight and obesity in Malaysia is the highest in Southeast Asia. Indeed, National Health and Morbidity Survey (NHMS) also showed that the prevalence of overweight and obesity has risen drastically from 16.6% and 4.4%, respectively in 1996 (Fatimah *et al.*, 1999) to 30.4% and 19.7%, respectively in 2019 (Institute for Public Health, 2019). Therefore, understanding the consumption patterns of Malaysian main dishes and their nutrient composition would help to provide Malaysians better insights to regulate their food intake. Additionally, data of the nutrient composition of Malaysian dishes in the Malaysian Food Composition Database (FCD) is still lacking and needs to be updated. Generally, FCD was last updated in 1997, with a limited amount of food items (Malaysia FCD, 2015). Therefore, it is a strong need to update Malaysian FCD with a variety of food items and its nutrient compositions particularly foods that are commonly or highly consumed to increase the quantity and quality of the database. Currently, the consumption patterns and nutrient composition of Malaysian ready-to-eat cooked dishes are scarcely studied. Therefore, the objectives of this study were to evaluate the consumption frequency of Malaysian dishes and determine the nutrient composition of the eight selected highly consumed dishes among Malaysian adults. A Malaysian ready-to-eat cooked dish is a term referred to a dish that is eaten in combined forms, in which specific food ingredients are served together with the main source of carbohydrates such as rice and noodles. For example, *nasi lemak* is a dish that specifically cooked in coconut milk and eaten in combination with a gravy, slices of boiled eggs and cucumbers, peanuts and fried anchovies. The similar term was also used to describe this type of food in other studies (Sandra *et al.*, 2012; Salau & Hasan, 2014).

MATERIALS AND METHODS

Sampling size and subjects

This cross-sectional study was performed among 432 adults aged 20 to 50 years old. Sample size calculation was based on Krejcie and Morgan (1970) with an additional of 10% of the sample population in consideration of dropout cases. The sampling size of adults lived in Bangi and Kajang was obtained from the Department of Statistics of Malaysia, which

were 62496 people. Data collection was carried out between June to December 2018.

Food frequency questionnaire of Malaysian ready-to-eat cooked dishes

The food consumption patterns of adults were determined using a semi-quantitative Food Frequency Questionnaire (FFQ). Before the data collection, a dietary assessment survey using 3 days Food Record was performed among 100 subjects to acquire dishes list that commonly consumed among adults. From this assessment, a total of 40 dishes were obtained. Then, the list was improved with dishes obtained from Malaysian Food Album (Aris *et al.*, 2011), Nutrient Composition of Malaysian Foods (Tee *et al.*, 1997) and restaurant menus to ensure that all commonly consumed dishes were not left out from the list. There were 100 dishes obtained at this stage. The FFQ of these dishes was then developed, pre-tested and analysed using Cronbach alpha. The pre-test was conducted among 30 subjects (10 Malays, 10 Chinese and 10 Indians) aged 26.2 ± 5.3 years old. The pre-test result showed that the Cronbach alpha value was 0.93, which indicated good internal consistency. A total of 11 dishes had to be excluded from the list as no consumption was reported from these dishes. According to Gunes *et al.* (2015), the listed foods in the FFQ study must be commonly consumed by the study population. The removed dishes were (1) Hailam noodles, (2) prawn noodles, (3) Ladna kuey teow, (4) Bandung kuey teow, (5) Hailam kuey teow, (6) Laksa Johor, (7) *roti boom*, (8) Sardine thosai, (9) banana thosai, (10) *roti canai* with cheese and (11) rabbit satay (Refer to Table 2 for details). Therefore, the final list of the dishes in the FFQ was 89.

During the data collection, FFQ was administered by a trainer interviewer on a one-to-one basis. Subjects were asked to recall the consumption frequency of the listed dishes either in a day, week or month in the past month. They were only required to provide one answer of these options. The FFQ has 4 main columns. It started with a list of the dishes at the right end of the questionnaire column, followed with the standard and the serving size in the second and third columns, respectively, and lastly the consumption frequency, which divided into the day, week and month in the left end of the column. The standard serving size of the dishes was based on Malaysian Food Album (Aris *et al.*, 2011), Nutrient Composition of Malaysian Foods (Tee *et al.*, 1997) and Nutritionist Pro™ software (Axxya Systems LLC., USA). The serving size was based on the common household appliances including plates, bowls and scoops. However, some of them were in pieces, whole and skewers as the

dishes generally consumed based on these sizes. Subjects were requested to state the number of serving size of each dish they consumed. The frequencies vary from 1 to 7, which are '1' for never or rarely, '2' for once a month, '3' for two to three times a month, '4' for once a week, '5' for two to three times a week, '6' for once daily and '7' for two to three times daily (Chee *et al.*, 1996). Food consumption frequency was categorised as low, medium and high if it is scored between 0 to 29.9%, 30.0 to 79.9% and 80.0 to 100%, respectively (Chee *et al.*, 1996). The frequency of consumption of these dishes was then converted to the amount of food intake in grams by multiplying the frequency of intake (conversion factor) with serving size, the total number of servings and weight of food in one serving using the formula by Wessex Institute of Public Health (1995).

Food samples preparation for proximate analysis

A total of eight dishes from the 4th to 11th position (refer to Table 2) of highly consumed dishes were selected for proximate analysis, which were Pattaya fried rice, chicken rice, egg *roti canai*, char kuey teow, chicken burgers, Hokkien fried noodles, Chinese fried rice and thosai. The dishes were bought from cafes and restaurants, which were cooked and prepared by a similar person, in the same manner, to avoid inconsistencies in the preparation. The first three highly consumed dishes, fried *bihun*,

nasi lemak and *roti canai* were not included as the analyses of these dishes have been performed in the previous studies (Tee *et al.*, 1997; Nik Shanita *et al.*, 2011; Dora *et al.*, 2018). Table 1 shows the ingredients of the dishes. Each sample was prepared from three different cycles, which provided a total of six duplicate (Nik Shanita *et al.*, 2011). Samples were blended homogenously using Kenwood kitchen blender (BLP406WH, Kenwood Limited, Woking, United Kingdom) at a speed of 2 for 5 min. Each of the blended sample was then weighed to 70 g (wet weight) and dried at 105°C in an air oven (Carbolite, England) for an overnight. Samples were stored in 23 × 11 cm air-tight polyethylene plastic bags at room temperature for analysis.

Proximate analysis of Malaysian dishes

Proximate analysis was performed in duplicate to minimize experiment or systemic error. Results were reported as percentages. The moisture, ash, protein, fat and crude fibre contents were determined according to the Association of Analytical Chemists (AOAC) (1995). The moisture and ash contents were measured using the weight different method. Protein content (N × 6.25) was determined by the Kjeldahl method. Fibre content was determined using the Fibertec method. Total carbohydrate content was determined by calculating the percentage remaining after all other components were measured.

Table 1. List of ingredients for selected Malaysian ready-to-eat cooked dishes

Dishes	Ingredients	Method of preparation
Pattaya fried rice	Rice, sliced chicken, a fried egg, mixed vegetables (carrots, corns, and green beans), chillies, chili sauce, oyster sauce, seasonings, cooking oil, onions, and garlic.	Pan-frying
Chicken rice with soup	Rice, sliced chicken, onions, garlic, ginger, salt, seasonings, cooking oil, cabbage, cucumber, salads, soup spices, soy sauce, and chili sauce.	Deep frying Boiling
Egg <i>roti canai</i> with dhal	Wheat flour, margarine, salt, condensed milk, egg, pigeon pea, turmeric powder, carrots, potatoes, chillies, brinjal, onions, garlic, mustard seeds, and ginger.	Pan-frying
Char kuey teow	Flat rice noodles, seasonings, oyster sauce, fish sauce, soy sauce, chili sauce, chili paste, an egg, sugar, garlic, onions, prawns, bean sprouts, cooking oils, cockle, chives, limes, and fermented chillies.	Stir-frying
Chicken burgers	Bun bread, chicken patties, margarine, cabbage, cucumber, onions, chili sauce, black pepper sauce, and mayonnaise.	Grilling
Hokkien fried noodles	Noodles, prawn, mustard, garlic, soy sauce, oyster sauce, chicken stock, cornflour, and chili powder.	Stir-frying
Chinese fried rice	Rice, cooking oils, garlic, an egg, mixed vegetables (carrots, corns, green beans), salt, garlic.	Pan-frying
Thosai	Rice, pigeon pea, salt, cooking oils, onions, grated coconut, ginger, garlic, dried chili, mustard seeds, curry leaves, tamarind.	Pan-frying

DATA ANALYSIS

Data were analyzed using the Statistical Package of Social Sciences (SPSS) version 21.0 (IBM Corp., Armonk, NY, USA) and presented as mean \pm standard deviation. The distribution of data was checked using the Shapiro-Wilk Test. One-way ANOVA test was used to compare mean and the significant difference was set at $p < 0.05$ and $p < 0.001$. Duncan test was used to compare the mean of proximate composition between eight dishes.

RESULTS AND DISCUSSION

Subjects characteristics

A total of 432 subjects (144 subjects of Malays, Chinese and Indians, respectively) with the mean age of 35.5 ± 12.0 years old involved in this study. There was no significant difference ($p > 0.05$) of age between the races (Malays = 35.5 ± 11.0 , Chinese = 34.5 ± 12.0 and Indians = 36.4 ± 12.9 years old). The proportion number of the subject between men and women were also equal ($n = 216$, respectively).

Food frequency questionnaire analysis

Table 2 shows the results of the consumption frequency of Malaysian ready-to-eat cooked dishes among adults. The top 10 of highly consumed dishes in the descending order were (1) fried *bihun* (36.94), (2) *nasi lemak* (34.72), (3) *roti canai* (33.13), (4) Pattaya fried rice (30.16), (5) chicken rice (29.10), (6) egg *roti canai* (28.01), (7) char kuey teow (27.02), (8) chicken burgers (26.42), (9) Hokkien fried noodles (25.86) and (10) Chinese fried rice (25.69). However, only 4 dishes (fried *bihun*, *nasi lemak*, *roti canai* and Pattaya fried rice) were consumed at moderate levels (30.0 – 79.9%) whilst the rest of the dishes were consumed at low levels (0 – 29.9%) in the range of 0.1 g/day to 35.5 g/day. Similar to our finding, previous studies also showed that *nasi lemak* was consumed at moderate levels (Marlia *et al.*, 2011; Norhayati *et al.*, 2012). Fried *bihun*, *nasi lemak* and *roti canai* are generally consumed during breakfast (Nur Hafizah *et al.*, 2013). Lipoeto *et al.* (2013) reported that *nasi lemak* was the primary choice for breakfast in their study. However, nowadays it seems that *nasi lemak* is not just consumed for breakfast, but also taken during lunch and dinner. Currently, only *nasi lemak* was commonly investigated in previous studies related to Malaysian dish consumption (Marlia *et al.*, 2011; Norhayati *et al.*, 2012; Lipoeto *et al.*, 2013; Nur Hafizah *et al.*, 2013). However, no studies on determining its consumption frequency particularly in comparison with other ready-to-eat Malaysian cooked dishes have been found. To our knowledge, this is the first study that comparing consumption

frequency of Malaysian ready-to-eat cooked dishes among the adult population.

The consumption frequency list also showed that 4 of the 10 dishes were rice-based dishes, 5 dishes were flour-based dishes and 1 dish was semi fast-food (chicken burgers). The frequency of consumption per month showed that rice-based dishes were consumed between 99 to 124 servings, flour-based dishes were between 116 to 177 servings and semi fast-food dishes were 149 servings. This result shows that the meal consumption patterns of Malaysian adults nowadays are more dominated by flour-based meals and semi fast-food meals, than rice-based dishes. Our finding is in agreement with Warr *et al.* (2008) which reported that there was an inverse relationship between rice and flour consumption among Malaysians in 2005 compared to 1990. Whilst the rice consumption per capita was declined by approximately 15%, the wheat consumption per capita was found to be increased by almost 76%. Traditionally, rice was usually consumed at all mealtimes particularly among the rural population. However, the consumption pattern of rice seemed to be shifted to once (53%) and twice daily (45%) with lunch as the priority mealtime and dinner as a second mealtime (Marlia *et al.*, 2011). It is usually eaten with a scoop of vegetable and, either chicken or fish as a protein source (Lipoeto *et al.*, 2013). The reduction intake of rice among Malaysians can be seen from MANS reports in which the prevalence of white rice in daily consumption has reduced from 96.7% (MANS 2003) to 86.9% (MANS 2014) (Noraida *et al.*, 2018).

Nonetheless, it is important to note that this study only focusing on the consumption of ready-to-eat cooked dishes. Besides these types of dishes, Malaysians also take their main meals from buffet-style dishes particularly for rice-based dishes (Lipoeto *et al.*, 2013). This means that rice is eaten with individual dishes that cooked separately with no limitation of quantity and specific type of condiments. This type of dish is called *nasi campur* (mixed rice). However, it is impossible to conduct an FFQ study of buffet meal as the number of the dishes are just too overwhelmed with different cooking styles and preparation of vegetables and protein dishes. Nevertheless, these types of dishes can be studied individually for their nutritional contents, to be included in Malaysian FCD for the reference of the public.

Proximate composition of ready-to-eat cooked dishes

Table 2 shows the proximate composition of selected Malaysian ready-to-eat cooked dishes. Fried *bihun*, *nasi lemak* and *roti canai* were not undergoing this analysis as their proximate compositions had been determined in the previous

Table 2. Consumption frequency of Malaysian ready-to-eat cooked dishes among 432 adults in Bangi and Kajang, Selangor

No	Dishes	Serving size (g)	Total intake (g/day)	Frequency			Scores (%)
				Daily (n)	Weekly (n)	Monthly (n)	
1	Fried <i>bihun</i>	170 ¹	17.3 ± 28.1	10	114	177	36.94
2	<i>Nasi lemak</i>	230 ¹	10.5 ± 18.0	9	109	118	34.72
3	<i>Roti canai</i>	95 ¹	12.7 ± 27.8	11	99	155	33.13
4	Pattaya fried rice	320 ^{2,3}	26.4 ± 56.8	9	81	111	30.16
5	<i>Nasi ayam</i>	250 ¹	35.5 ± 86.8	6	69	124	29.10
6	Egg <i>roti canai</i>	135 ¹	8.0 ± 16.7	2	69	116	28.01
7	Char kuey teow	220 ^{2,3}	10.1 ± 19.8	1	60	142	27.02
8	Chicken burgers	156 ^{2,3}	6.4 ± 12.3	1	50	149	26.42
9	Hokkien fried noodles	480 ³	20.9 ± 42.8	0	56	127	25.86
10	Chinese fried rice	180 ^{2,3}	8.5 ± 20.0	2	62	99	25.69
11	Thosai	80 ¹	7.7 ± 19.4	7	51	85	25.43
12	Rojak noodles	554 ³	22.8 ± 75.7	3	46	90	23.68
13	Fried noodles	170 ¹	5.8 ± 15.0	2	45	93	23.41
14	Chicken satay	150 ¹	2.6 ± 7.4	0	18	171	23.31
15	Noodle soup	563 ¹	13.0 ± 27.4	0	30	127	22.59
16	Beef porridge	500 ^{2,3}	17.2 ± 59.1	5	29	106	22.42
17	Chapati	100 ¹	4.1 ± 13.6	5	30	72	21.63
18	Tom yum <i>bihun</i>	375 ³	9.8 ± 30.8	1	37	70	21.63
19	Mamak fried noodles	170 ^{2,3}	4.4 ± 12.5	1	29	89	21.33
20	Biryani rice	245 ¹	4.7 ± 11.4	0	22	95	20.54
21	Singapore <i>bihun</i>	190 ^{2,3}	4.3 ± 15.6	2	27	69	20.30
22	Egg burger	180 ¹	4.1 ± 14.6	0	27	70	20.11
23	Fried chicken with fried rice	300 ³	7.4 ± 26.8	1	32	53	20.11
24	Mushroom fried rice	325 ³	5.6 ± 17.8	0	27	61	19.78
25	Cockle kuey teow	170 ^{2,3}	2.6 ± 6.9	1	25	65	19.54
26	Plain fried rice	330 ¹	5.7 ± 19.7	0	24	64	19.51
27	Fermented fish fried rice	180 ^{2,3}	6.5 ± 19.4	0	24	64	19.51
28	Chicken steam rice	334 ³	8.8 ± 48.6	3	25	39	19.28
29	<i>Nasi bujang</i>	371 ³	11.6 ± 47.2	3	25	35	19.25
30	Kuey teow soup	320 ^{2,3}	5.4 ± 18.0	0	26	47	18.95
31	<i>Kampung</i> fried rice	325 ^{2,3}	6.5 ± 25.5	1	26	42	18.92
32	<i>Nasi kerabu</i>	180 ^{2,3}	3.3 ± 12.9	1	18	50	18.72
33	Laksa Penang	500 ³	8.6 ± 37.5	1	14	67	18.72
34	Beef burger	180 ¹	2.8 ± 10.0	0	12	65	18.62
35	Cantonese kuey teow	450 ³	5.7 ± 17.1	0	22	44	18.42
36	Beef burger with cheese	141 ¹	1.6 ± 4.8	0	16	60	18.25
37	<i>Nasi tomato</i>	240 ^{2,3}	2.7 ± 8.3	0	11	67	18.12
38	<i>Kerabu</i> fried rice	330 ³	4.4 ± 20.1	1	19	44	17.99
39	Ladna fried rice	484 ³	7.1 ± 33.3	1	19	36	17.89
40	Spicy fried rice	330 ³	3.9 ± 13.6	0	18	38	17.76
41	Paprik fried rice	297 ^{2,3}	3.9 ± 16.6	0	18	37	17.69
42	Black pepper fried rice	150 ³	1.8 ± 7.1	0	19	31	17.66
43	USA fried rice	414 ^{2,3}	4.7 ± 17.4	0	14	42	17.56
44	Beef satay	159 ¹	0.5 ± 2.2	1	14	45	17.56
45	Kolok noodle soup	342 ^{2,3}	4.4 ± 21.5	0	8	61	17.56
46	<i>Nasi minyak</i>	245 ¹	2.2 ± 6.6	0	10	54	17.53
47	Tom yum fried rice	180 ³	1.9 ± 8.0	0	18	33	17.49
48	Siam noodles	204 ³	2.1 ± 7.3	0	17	35	17.49
49	<i>Roti nan</i>	80 ^{2,3}	0.9 ± 4.8	1	9	47	17.33
50	Bandung noodles	450 ¹	4.6 ± 21.1	0	11	47	17.16
51	Cheese <i>roti nan</i>	181 ³	2.0 ± 10.7	1	8	39	17.13
52	Laksam	300 ^{2,3}	3.0 ± 16.7	1	11	39	17.10
53	Lontong	160 ^{2,3}	1.7 ± 9.4	1	10	34	17.03
54	Kungfu kuey teow	370 ^{2,3}	3.1 ± 12.6	0	10	39	16.90
55	<i>Mee rebus</i>	428 ^{2,3}	3.2 ± 12.0	0	11	37	16.87
56	Egg <i>roti nan</i>	134 ³	2.2 ± 13.9	2	14	18	16.87
57	Curry noodles	410 ¹	1.1 ± 6.3	2	9	32	16.83
58	Seafood fried rice	180 ³	2.0 ± 12.2	1	10	34	16.77
59	Thai fried rice	180 ³	1.6 ± 6.8	0	12	28	16.73
60	Beef fried rice	180 ¹	1.5 ± 8.1	0	13	24	16.60

Table 2 continued...

61	Chicken Soto	493 ¹	3.8 ± 16.8	0	8	35	16.60
62	Onion <i>roti canai</i>	95 ³	0.7 ± 3.0	0	13	26	16.60
63	Sardine <i>roti canai</i>	123 ³	0.8 ± 3.4	0	11	31	16.57
64	Fish burger	145 ¹	1.0 ± 5.6	0	8	33	16.37
65	Egg thosai	134 ³	0.9 ± 4.4	0	12	18	16.30
66	<i>Roti tisu</i>	130 ³	0.8 ± 3.2	0	7	34	16.27
67	<i>Roti planta</i>	95 ³	0.8 ± 4.4	0	8	29	16.24
68	Prawn fried rice	180 ³	1.1 ± 5.7	0	10	20	16.20
69	Bandung <i>bihun</i>	450 ¹	2.0 ± 8.4	2	8	18	16.17
70	Beef burger with cheese and egg	161 ^{2,3}	0.8 ± 3.8	0	8	25	16.10
71	Ladna noodles	324 ³	1.1 ± 6.3	0	9	22	16.01
72	Chicken murtabak	142 ^{2,3}	0.6 ± 2.8	0	7	26	15.84
73	Kungfu noodles	480 ^{2,3}	1.9 ± 8.9	0	7	23	15.81
74	Double cheese beef burger	187 ¹	0.8 ± 4.1	0	7	21	15.81
75	<i>Nasi ambeng</i>	300 ^{2,3}	1.3 ± 6.7	0	6	23	15.81
76	Fried kuey teow	170 ¹	0.9 ± 6.5	0	8	18	15.74
77	Squid fried rice	180 ³	0.9 ± 4.7	0	7	19	15.74
78	Onion thosai	108 ³	0.9 ± 7.7	2	5	15	15.67
79	<i>Nasi dagang</i>	250 ¹	1.4 ± 9.8	0	8	13	15.61
80	Laksa Sarawak	470 ^{2,3}	2.1 ± 12.4	0	6	19	15.61
81	Fish porridge	63 ¹	0.2 ± 1.1	0	4	22	15.54
82	Mutton satay	11 ¹	0.1 ± 0.6	0	4	24	15.51
83	Corn rice	225 ³	0.8 ± 4.4	0	7	12	15.41
84	Planta thosai	108 ³	0.3 ± 1.8	0	5	15	15.41
85	Wantan noodles	342 ^{2,3}	1.1 ± 6.6	0	6	11	15.34
86	Banana <i>roti canai</i>	95 ³	0.3 ± 1.9	0	4	19	15.34
87	Beef murtabak	146 ¹	0.4 ± 2.1	0	3	20	15.34
88	Chicken porridge	500 ^{2,3}	1.4 ± 7.6	0	4	17	15.28
89	Beef tripe satay	15 ¹	0.03 ± 0.20	0	2	9	14.78
90	Hailam noodles	250 ^{2,3}	0	0	0	0	14.29
91	Prawn noodles	480 ^{2,3}	0	0	0	0	14.29
92	Ladna kuey teow	300 ^{2,3}	0	0	0	0	14.29
93	Bandung kuey teow	450 ¹	0	0	0	0	14.29
94	Hailam kuey teow	500 ³	0	0	0	0	14.29
95	Laksa Johor	524 ^{2,3}	0	0	0	0	14.29
96	<i>Roti boom</i>	95 ³	0	0	0	0	14.29
97	Sardine thosai	108 ³	0	0	0	0	14.29
98	Banana thosai	157 ³	0	0	0	0	14.29
99	<i>Roti canai</i> with cheese	123 ³	0	0	0	0	14.29
100	Rabbit satay	11 ³	0	0	0	0	14.29

Source of referred serving size: ¹Nutrient Composition in Malaysian Foods (Tee *et al.*, 1997); ²Malaysian Food Album (Aris *et al.*, 2011); ³Nutritionist Pro™ (Axya Systems LLC., USA).
Food frequency categories: low (0.0 – 29.9%); Medium (30.0 – 79.9%); High (80.0 – 100.0%) (Chee *et al.*, 1996).

studies (Dora *et al.*, 2018; Nik Shanita *et al.*, 2011; Tee *et al.*, 1997). However, the proximate analysis of these foods is also included in the table for results comparison.

Moisture analysis showed a significant difference ($p < 0.001$) between the samples. In general, the moisture content of the dishes was in the range between 53 to 75%. However, chicken rice had the highest moisture content ($75.33 \pm 2.22\%$) and significantly different ($p < 0.001$) compared to other dishes as it contains soup and sauces. These condiments are important ingredients in chicken rice as they are a part of the dish, and commonly served and eaten together with other components. Generally, the moisture content of a dish is

influenced by the cooking method, i.e. dishes cooked by boiling method would have a higher moisture content than frying or grilling method. Also, a dish's recipe also able to affect moisture content particularly if the dishes need watery type of ingredients such as water, coconut or dairy milk. Indeed, the present study showed that Hokkien fried rice and char kuey teow had a high moisture content as water was added during the cooking process. On the contrary, chicken burgers had the lowest moisture content ($52.55 \pm 2.42\%$) compared with other dishes, which possibly due to the absence of watery ingredients as well as being grilled at a high temperature.

Table 3. Proximate composition of selected Malaysian ready-to-eat cooked foods

Type of food	Proximate composition (per 100 g)							
	Moisture (%)	Ash (%)	Crude Fiber (%)	Protein (%)	Fat (%)	Carbohydrate (%)	Energy (kcal)	
Fried <i>bihun</i> ¹	63.74 ± 7.61	1.42 ± 0.20	NR	3.11 ± 0.38	7.52 ± 1.82	24.20 ± 6.49	177 ± 35	
<i>Nasi lemak</i> ¹	58.38 ± 6.89	1.06 ± 0.15	NR	4.11 ± 1.57	5.42 ± 1.62	31.01 ± 6.21	189 ± 31	
<i>Roti canai</i> with dhal ²	57.20 ± 0.99	1.21 ± 0.03	NR	6.28 ± 0.28	2.47 ± 0.33	32.84 ± 1.62	169.13 ³	
Pattaya fried rice	59.58 ± 1.07 ^{de}	0.83 ± 0.23 ^a	0.6 ± 0.1 ^{ab}	6.43 ± 0.41 ^b	6.85 ± 1.14 ^b	26.24 ± 1.49 ^b	192.20 ± 1.65 ^{abc}	
Chicken rice with soup	75.33 ± 2.22 ^a	1.00 ± 0.20 ^a	0.4 ± 0.1 ^c	4.96 ± 0.68 ^{cd}	2.40 ± 0.53 ^e	23.56 ± 1.30 ^d	153.99 ± 7.21 ^d	
Egg <i>roti canai</i> with dhal	63.93 ± 0.24 ^{cd}	1.18 ± 0.09 ^a	0.7 ± 0.1 ^a	6.42 ± 0.15 ^b	3.53 ± 0.47 ^{de}	24.86 ± 0.10 ^b	156.99 ± 4.52 ^{bcd}	
Char kuey teow	67.43 ± 0.66 ^{bc}	1.14 ± 0.52 ^a	0.4 ± 0.1 ^c	3.79 ± 0.22 ^e	4.37 ± 0.73 ^d	23.24 ± 0.99 ^{bc}	147.38 ± 3.91 ^{de}	
Chicken burgers	52.55 ± 2.42 ^f	2.10 ± 0.38 ^a	0.6 ± 0.2 ^{abc}	7.57 ± 0.63 ^a	11.02 ± 1.27 ^a	26.68 ± 0.37 ^b	235.43 ± 7.68 ^a	
Hokkien fried noodles	69.80 ± 3.48 ^b	1.61 ± 0.27 ^a	0.4 ± 0.1 ^{bc}	5.51 ± 0.55 ^c	4.75 ± 1.36 ^{cd}	21.06 ± 1.74 ^{cd}	158.67 ± 20.01 ^{cd}	
Chinese fried rice	55.75 ± 7.44 ^{ef}	1.74 ± 1.35 ^a	0.6 ± 0.2 ^{ab}	3.28 ± 0.10 ^e	6.48 ± 1.35 ^{bc}	33.65 ± 8.04 ^a	207.32 ± 82.59 ^{ab}	
Thosai with dhal and chutney	58.24 ± 1.02 ^{def}	2.05 ± 0.38 ^a	0.7 ± 0.1 ^a	4.60 ± 0.35 ^d	4.75 ± 1.24 ^{cd}	30.29 ± 0.59 ^{ab}	182.43 ± 11.32 ^{abc}	
<i>p</i> value	<0.001	0.097	0.019	<0.001	<0.001	<0.001	0.002	

Value in mean ± standard deviation (g) (*n*=3).

NR = not reported.

^{a-f} Different alphabets in the same column indicate a significant difference (*p*<0.05) via one-way ANOVA test.Proximate composition refers to ¹Dora *et al.* (2018); ²Nik Shanita (2011); ³Tee *et al.* (1997).

Cooking temperature is another factor that can cause moisture loss from foods. Essentially, cooking temperature has a reverse relationship with moisture loss in which the higher the temperature uses during the cooking process, the greater moisture will lose from a food (Kassama & Ngadi, 2016). This is because as the heat from the cooking process gets into the food, moisture would dry out from the food. This process would also result in increasing fat content of that particular food (Krokida *et al.*, 2000). Indeed, our result showed that chicken burgers had a significantly higher ($p < 0.001$) fat percentage ($11.02 \pm 1.27\%$) compared with other dishes. However, the high amount of fat content in chicken burgers is also contributed by fats from the patty and oils that permeated into the food, as it was used during the cooking process. Contradictory, dishes cooked by a pan-frying method including fried *bihun*, Pattaya fried rice and Chinese fried rice had a lesser amount of fat content than chicken burgers in the range of 6.48 to 7.52%. This could also be related to cooking temperature effect. This is because these dishes were cooked at a lower temperature than chicken burgers. Therefore the lower amount of moisture loss and fat content these foods would have. Chicken rice had the lowest fat content ($2.40 \pm 0.53\%$) as it has the highest moisture content among all dishes due to the presence of water as an ingredient during the cooking process and, in soup and sauces, which are the side dishes.

There was no significant difference ($p = 0.097$) of ash content between the dishes, which ranged between 0.83 to 2.10%. Other studies reported that Malaysian ready-to-eat cooked foods had ash content between 0.68 to 1.21% (Nik Shanita *et al.*, 2011) and 1.05 to 1.90 g/100g (Dora *et al.*, 2018). Chicken burgers had the highest amount of ash content ($2.10 \pm 0.38\%$), which possibly contributed by the meat, spices and salt (Fernandez-Lopez *et al.* 2006) whilst Pattaya fried rice had the lowest amount of ash content ($0.83 \pm 0.23\%$). In contrast with other compositions, crude fibre was the lowest component can be found in the dishes, which in the range of 0.4 to 0.7%. The low amount of crude fibre in this study can be related to the absence or lack of vegetables and fruits in Malaysian ready-to-eat cooked dishes. Generally, Malaysian ready-to-eat cooked dishes contain only a small portion of vegetables. For example, a serving of fried *bihun* normally contains 20% of vegetables, a plate of *nasi lemak* only has a few slices of cucumbers and *roti canai* does not contain vegetables at all. Fruits were also not a part of these dishes. Saupi *et al.* (2019) revealed that crude fibre content in Malaysian indigenous leafy vegetables is between 9.2 to 26.1%. Therefore, the amount of vegetables in these dishes needs to be increased to maximise dietary fibre intake as suggested by Malaysian

Recommended Nutrient Intake (RNI) 2017. RNI 2017 suggested that Malaysians should consume between 20 to 30 g/day of dietary fibre as a prevention measure from chronic illnesses including obesity, cancers and cardiovascular diseases (Reynolds *et al.*, 2019). Therefore, high consumption of foods containing low fibre content will not allow one to achieve the recommendation, and therefore should be controlled. On the contrary, consumption of vegetables, whole fruits and whole grains would help to increase daily fibre intake and ultimately fulfil the recommendation. Malaysian Dietary Guidelines (2010) suggested Malaysians consume three servings of vegetables and two servings of fruits per day (400 g altogether) and this can be achieved by practising *suku-suku separuh* (quarter-quarter-half, Malaysian Healthy Plate) eating pattern in which half of the plates would consist vegetables and fruits and another two quarters are for proteins and grains.

Protein content was significantly different ($p < 0.001$) among the dishes in the range of 3.28 to 6.43%. Chicken burgers had the highest content of protein ($7.57 \pm 0.63\%$) compared to other dishes possibly due to the presence of chicken meat, soy protein, vegetable protein and flours. However, the result of this study was much lower than reported by Ramadhan *et al.* (2011). There are two possible reasons for the discrepancy between the two studies. Firstly, the result of the previous study was based on raw meat whilst our study used cooked meat. Secondly, it might be possible that patty burgers consumed by participants in this study were made from the combination of meat and non-meat protein source. The usage of non-meat protein source including eggs and whey proteins in meat by-products has become a common practise in the food industry as it could improve physicochemical features of the product such as flavour and texture as well as to reduce the price of the products (Kassem & Emara, 2010; Ramadhan *et al.*, 2011). Chinese fried rice had the lowest content of protein ($3.28 \pm 0.10\%$) but not significantly different ($p > 0.05$) than char kuey teow ($3.79 \pm 0.22\%$). This is possibly because both products have a small amount of vegetables and protein source such as chicken slices and cockles.

Carbohydrate content was in the range of 21.06 to 33.65%. From the analysis, Chinese fried rice had the highest carbohydrate content and significantly different ($p < 0.001$) compared with other dishes except with thosai with dhal and chutney. This is possibly because the main ingredient in the dish is rice (70%) compared with other dishes that have various kinds of components. Gross energy content was significantly different ($p = 0.002$) between the dishes in the range of 158.67 to 235.43 kcal. Chicken burgers had the highest energy content

compared with other dishes. This is expected as it contains the highest fat content among the dishes. The lowest energy content was recorded for char kuey teow and chicken rice with soup and sauces, with the percentages of $147.38 \pm 3.91\%$ and $153.99 \pm 7.21\%$, respectively.

CONCLUSION

The top ten most commonly consumed Malaysian ready-to-eat cooked dishes were fried *bihun*, *nasi lemak*, *roti canai*, Pattaya fried rice, chicken rice, egg *roti canai*, char kuey teow, chicken burgers, Hokkien fried noodles and Chinese fried rice. However, only the first four dishes were consumed moderately whilst the rest of the dishes had a low-frequency level. This possibly because besides ready-to-eat cooked dishes, Malaysians also consumed buffet meals as their main dishes particularly during lunch. The proximate composition showed that Chinese fried rice had the highest carbohydrate content whilst chicken burgers had the highest protein, fat and energy contents. The result of the nutrient composition of eight dishes in this study is recommended to be included in Malaysian Food Composition Database and ultimately can be used as a reference in choosing local dishes based on their nutritional composition in order to control daily food consumption.

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