



Whole grains in Malaysia: Health benefits, regulations, dietary guidelines and consumption

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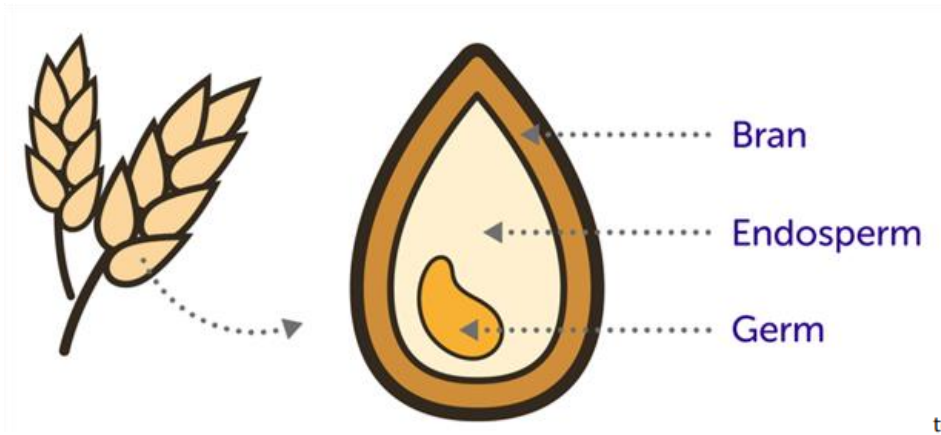


Southeast Asia Public Health Nutrition (SEA-PHN) Network Webinar Seminar

**Whole grains in Southeast Asia: Health Benefits, Regulations,
Dietary guidelines and consumption.**

**23 November 2023 (Thursday), 2.30pm–6.00pm (Kuala Lumpur Time), Zoom
Online Platform**

Definition of whole grains



21 Julai 2020
21 July 2020
P.U. (A) 209

WARTA KERAJAAN PERSEKUTUAN

*FEDERAL GOVERNMENT
GAZETTE*

PERATURAN-PERATURAN MAKANAN
(PINDAAN) (NO. 4) 2020

(12) For the purpose of subregulations (10) and (11), a reference to “wholegrain” or “wholemeal” is a reference to cereal grains that consist of intact, ground, milled, cracked or flaked kernel after the removal of the inedible parts.”

Cereal grains that consist of intact, ground, milled, cracked or flaked kernel after the removal of the inedible parts

Minimum requirement for whole grains and wholegrain products

01

Wheat flour, rice flour, rice and grains

100% whole grain ingredients

03

Other whole grain products

25% whole grain ingredients or 8 g per serving for other products

02

Bread

≥60% whole grain ingredients for bread.



Food requiring mandatory nutrition labelling

Regulation No	Food Category	Types of food
63-75	Prepared cereal food Pasta, prepared cereal food (including breakfast and bread	Pasta, prepared cereal food (including breakfast and bread cereals), bread (white bread, fruit bread, milk bread, meal bread, rye bread, wheat-germ bread, wholemeal bread, enriched bread).
26 (7)	Foods that “contain” or “added” (or words of similar meaning) or “enriched” or “fortified” (or words of similar meaning) with specific vitamins, minerals, amino acids, fatty acids, nucleotides or other food components (with permitted other function claims).	
18B (14)	Foods that make any nutrition claim on a label of a food product pertaining to its nutritional quality.	

Nutrition information on food label

Nutrition Information Panel (NIP)

Lists of the content of: energy, carbohydrate, protein, fat and sodium contained in the food.

Nutrition Claims

Content claim

Eg. Low in sugar, high in protein

Comparative claim:

Eg. Lower fat, higher calcium

Function claim:

Eg. Calcium helps in bone formation.



Front of pack labels

Energy icon, Healthier Choice Logo

Ingredient List

The whole grain ingredient(s) should ideally be listed as the first or second item in the list.

Whole Grains Food Frequency Questionnaire

Koo et al. *Nutrition Journal* (2020) 19:73
<https://doi.org/10.1186/s12937-020-00588-y>

Nutrition Journal

RESEARCH

Open Access

Development, validity and reproducibility of a whole grain food frequency questionnaire in Malaysian children



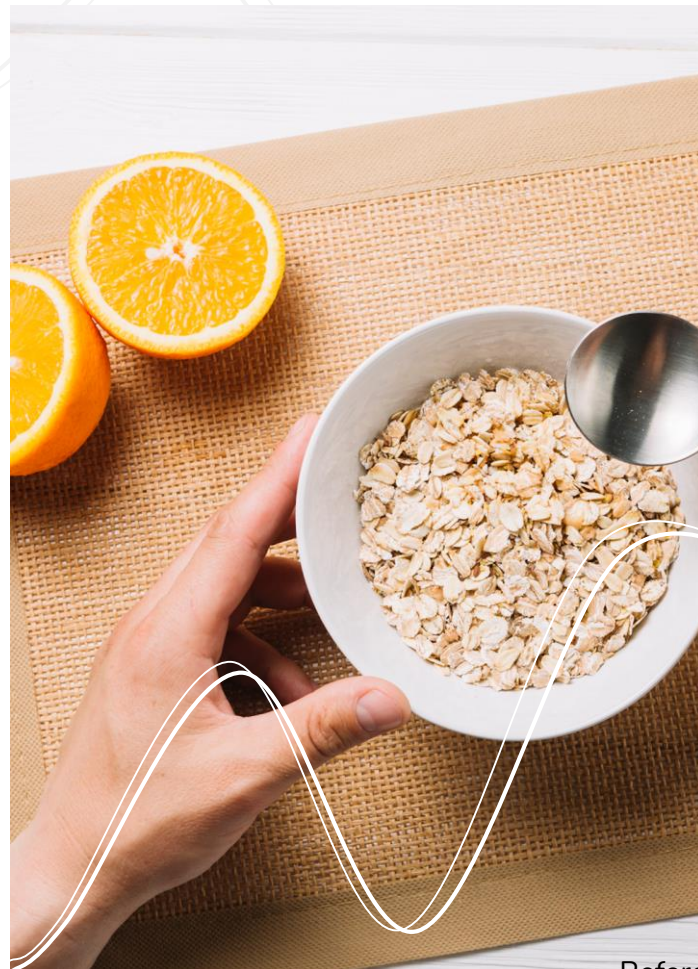
H. C. Koo^{1*}, G. P. Lim¹, Satvinder Kaur², K. Q. Chan¹, Y. X. Florence Tan¹, X. J. Pang¹ and L. Y. Tang¹

Abstract

Background: To date, there is no validated whole grain assessment tool for children in any Southeast Asian countries. Hence, there is a need for a valid tool to assess whole grain intake among Malaysian children. This study aimed to develop, validate and test the reproducibility of a food frequency questionnaire (FFQ) in estimating whole grain intake among Malaysian children.

Methods: A total of 392 children participated in the FFQ development and 112 children aged 9–12 years participated in the validation phase; with a subsample of 50 children participating in the reproducibility phase. Three-day diet record (3DR) as the reference method in validation phase. Spearman correlations, mean difference, Bland-Altman plot and cross-classification analyses were used to assess validity. The reproducibility was tested through a repeat administration of the FFQ, with 1 month time interval. Reproducibility analyses involved intra-class correlation coefficient (ICC), Cronbach's alpha and cross-classification analyses.

Results: The FFQ consisted of 156 whole grain food items from six food groups. Mean intake of whole grain in FFQ1 and 3DR were correlated well ($r = 0.732$), demonstrated good acceptance of the FFQ. Bland Altman plots showed relatively good agreement for both the dietary methods. Cross-classification of whole grain intake between



Reference:
Koo et al. 2020

The most common consumed grains in Malaysia

Major



Rice



Wheat

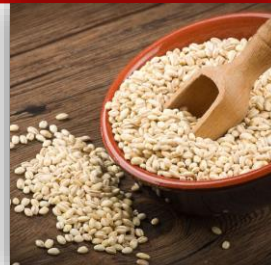


Maize

Minor



Oats



Barley



Millet

Types of whole grains consumption in Malaysian Children and Adolescents

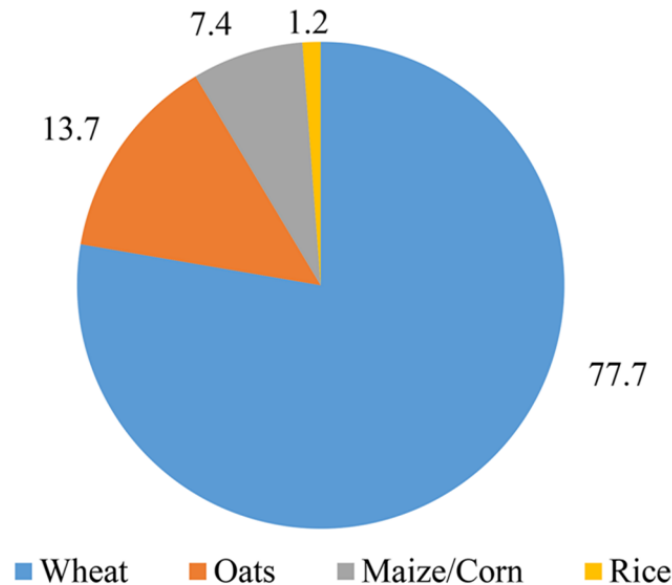


Fig 2. Distribution of types of whole grains consumed by a sample of 1,286 Malaysian children aged 6–12 years and 555 adolescents aged 13–17 years who were whole grain consumers. The main contributor was wheat (77.7%), followed by oats (13.7%), maize/ corn (7.4%) and rice (1.2%).

Health benefits of whole grains consumption

Whole grains

Brown rice as a staple food while maintaining normal daily life activities without restrictions

Meta-analysis



7 trials involving
417 adults with pre-
DM or T2DM

No effect on
HbA1c

↑ HDL

↓ Body weight

The benefits of a brown-rice diet on glycemic control may not be detected in short-term studies.

Health benefits of whole grains consumption

UKM Red rice

Thai red

Basmati white

Jasmine white

Using 50g carbohydrate equivalents provided to 12 normoglycemic adults in a crossover design

UKM red rice facilitated the most desirable gluco-metabolic responses, as compared to Jasmine white



Social Cognitive Theory

Personal Factors

Environmental Factors

Behavioural Factors

Six 30-min nutrition education lessons

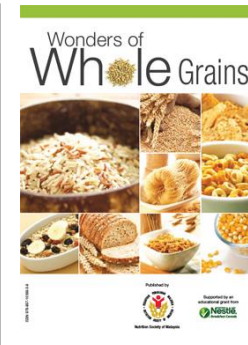
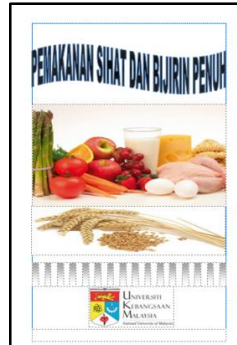
School delivery of whole grain food on daily basis

One hour individual dietary counselling for parents



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PEMAKANAN SIHAT DENGAN BIJIRIN PENUH



Great-Child Trial™

A Quasi-Experimental Dietary Intervention
among Overweight & Obese Children

Table 2. Comparison between groups in all outcome measures over the nine months ($n = 63$).

	Intervention Group-Control Group	
	Mean (95% CI)	p-Value
BMI-for-age z-score [†]	-0.12 (-0.21, -0.03)	0.009 **
Body fat percentage (%) ^{††}	-2.6 (-3.7, -1.5)	<0.001 ***
Waist circumference (cm) ^{†††}	-2.4 (-3.8, -1.0)	0.001 **
Pedometer step-count ^{‡,††††}	-4 (-73, 66)	0.919

[†] F-stat(df) = 7.35(1), p -value = 0.009; ^{††} F-stat(df) = 23.6(1), p -value < 0.001; ^{†††} F-stat(df) = 11.4(1), p -value = 0.001; ^{††††} F-stat(df) = 0.01(1), p -value = 0.919; Repeated measures ANCOVA between group analysis was applied followed by pairwise comparison; Household income and baseline variables were controlled by using repeated measures ANCOVA; [‡] involved 55 children (28 from intervention group and 27 from control group); ** significant at the 0.01 level; *** significant at the 0.001 level.

Table 3. Nine-month changes in all outcome measures within-group ($n = 63$).

	Comparison	Intervention Group		Control Group	
		Mean (95% CI)	p-Value	Mean (95% CI)	p-Value
BMI-for-age z-score	T1-T0	-0.07 (-0.15, 0.01)	0.092	0.07 (0.01, 0.14)	0.032
	T2-T0	-0.06 (-0.25, 0.13)	0.544	0.18 (0.10, 0.26)	<0.001 ***
	T2-T1	0.01 (-0.17, 0.19)	0.905	0.10 (0.05, 0.16)	0.001 **
Body fat percentage (%)	T1-T0	-3.4 (1.8, 5.0)	<0.001 **	0.4 (-0.1, 0.9)	0.081
	T2-T0	-1.6 (-3.8, 0.6)	0.154	2.2 (1.3, 3.0)	<0.001 ***
	T2-T1	1.8 (-0.5, 4.2)	0.127	1.7 (0.7, 2.7)	0.001 **
Waist circumference (cm)	T1-T0	-2.1 (-3.7, -0.5)	0.014 *	0.7 (-0.3, 1.7)	0.165
	T2-T0	-1.9 (-4.1, 0.3)	0.091	2.5 (0.9, 4.1)	0.002 **
	T2-T1	0.2(-1.5, 1.8)	0.812	1.8 (0.7, 3.0)	0.002 **
Pedometer step-count [‡]	T1-T0	-8 (-60, 45)	0.768	30 (-18, 78)	0.212
	T2-T0	35 (-31, 100)	0.290	51 (-83, 184)	0.440
	T2-T1	42 (-7, 91)	0.087	-21 (-109, 150)	0.742

T0—Baseline; T1—post intervention (thirteenth week); T2—follow up (ninth month); Repeated measures ANCOVA within group analysis was applied followed by pairwise comparison with confidence interval adjustment; Household income and baseline variables were controlled by using repeated measures ANCOVA; [‡] involved 55 children (28 from intervention group and 27 from control group); * significant at the 0.05 level; ** significant at the 0.01 level; *** significant at the 0.001 level.

Great-Child Trial™

A Quasi-Experimental Dietary Intervention among Overweight & Obese Children

Table 2. Changes in whole grain and nutrient intakes within group (*n* = 59).

	Comparison	Intervention Group		Control Group	
		Mean (95% CI)	<i>p</i> -Value	Mean (95% CI)	<i>p</i> -Value
Whole grain (g)	T1-T0	20.6 (13.4, 27.9)	<0.001 ***	0	-
	T2-T0	8.8 (4.2, 13.5)	<0.001 ***	0	-
	T2-T1	-11.8 (-18.4, -5.3)	<0.001 ***	0	-
Energy (kcal)	T1-T0	-63(-182, 55)	0.553	96 (-31, 223)	0.192
	T2-T0	-41 (-136, 55)	0.851	192 (72, 312)	0.001 **
	T2-T1	22 (-51, 96)	1.000	96 (-18, 211)	0.123
Protein (g)	T1-T0	-3.2 (-9.2, 2.7)	0.524	-1.3 (-8.4, 5.8)	1.000
	T2-T0	-12.6 (-20.2, -5.0)	0.001 **	-1.0 (-8.3, 6.4)	1.000
	T2-T1	-9.4 (-17.3, -1.5)	0.016 *	0.4 (-6.0, 6.7)	1.000
Carbohydrate (g)	T1-T0	-11.0 (-37.0, 15.0)	0.865	19.5 (-2.0, 41.0)	0.085
	T2-T0	26.9 (5.1, 48.7)	0.012 *	40.5 (20.9, 60.1)	<0.001 ***
	T2-T1	37.9 (11.7, 64.2)	0.003 **	21.0 (-3.3, 45.3)	0.108
Fat (g)	T1-T0	-0.3 (-8.6, 8.0)	1.000	2.4 (-6.4, 11.2)	1.000
	T2-T0	-3.2 (-10.7, 4.4)	0.879	3.1 (-3.7, 9.9)	0.749
	T2-T1	-2.9 (-12.3, 6.5)	1.000	0.7 (-7.6, 9.1)	1.000
Fiber (g)	T1-T0	10.7 (6.1, 15.4)	<0.001 ***	3.5 (1.0, 5.9)	0.004 **
	T2-T0	3.7 (1.3, 6.4)	0.002 **	2.6 (0.5, 4.7)	0.014 *
	T2-T1	-7.0 (-11.9, -2.1)	0.003 **	0.9 (-4.6, 2.8)	1.000
Thiamin (mg)	T1-T0	0.8 (0.6, 0.9)	<0.001 ***	0.2 (0.1, 0.4)	<0.001 ***
	T2-T0	0.6 (0.4, 0.8)	<0.001 ***	0.2 (0.1, 0.3)	<0.001 ***
	T2-T1	-0.2 (-0.5, 0.1)	0.138	0.1 (-0.2, 0.1)	1.000
Riboflavin (mg)	T1-T0	1.9 (1.4, 2.4)	<0.001 ***	0.4 (0.1, 0.7)	0.004 **
	T2-T0	1.7 (-0.1, 3.5)	0.056	0.4 (0.1, 0.6)	0.003 **
	T2-T1	-0.2 (-2.1, 1.8)	1.000	-0.1 (-0.4, 0.3)	1.000
Niacin (mg)	T1-T0	9.8 (7.6, 12.0)	<0.001 ***	2.7 (0.5, 4.8)	0.010 *
	T2-T0	5.3 (0.4, 10.2)	0.029 *	1.1 (-0.5, 2.6)	0.255
	T2-T1	0.3 (-0.6, -0.1)	0.014 *	-0.1 (-0.4, 0.2)	0.679
Calcium (g)	T1-T0	404.0 (268.4, 539.7)	<0.001 ***	23.1 (-66.1, 112.2)	1.000
	T2-T0	199.5 (82.6, 316.4)	0.001 **	2.5 (-55.1, 60.1)	1.000
	T2-T1	-204.6 (-394.1, -15.0)	0.031 *	-20.6 (-128.3, 87.1)	1.000
Iron (g)	T1-T0	8.1 (1.0, 15.1)	1.000	-0.8 (-6.8, 5.2)	1.000
	T2-T0	9.7 (1.3, 18.2)	0.020 *	-0.1 (-5.6, 5.3)	1.000
	T2-T1	1.7 (-9.1, 12.5)	1.000	0.7 (-6.7, 8.0)	1.000

T0—Baseline; T1—post-intervention (thirteenth week); T2—follow-up (ninth month); * statistically significant at *p*-value < 0.05; ** statistically significant at *p*-value < 0.01; *** statistically significant at *p*-value < 0.001; Repeated measures ANCOVA within group analysis was applied followed by pairwise comparison with confidence interval adjustment; Household income and baseline variables as covariate.

Table 3. Comparison of whole grain and nutrient intakes over nine months between intervention and control groups (*n* = 59).

	Intervention Group—Control Group		
	Mean (95% CI)	<i>p</i> -Value	F-Stat(df)
Whole grain (g)	9.9 (7.1, 12.8)	<0.001 ***	50.19(1)
Energy (kcal)	-126 (-121, -40)	0.005 **	8.69(1)
Protein (g)	-3.4 (-8.1, 1.3)	0.156	2.07(1)
Carbohydrate (g)	-12.3 (-27.1, 2.5)	0.102	2.77(1)
Fat (g)	-5.3 (-10.6, 0.1)	0.055	3.85(1)
Fiber (g)	3.1 (1.4, 4.7)	0.001 **	13.60(1)
Thiamin (mg)	0.3 (0.2, 0.4)	<0.001 ***	39.51(1)
Riboflavin (mg)	0.8 (0.4, 1.3)	0.001 **	12.71(1)
Niacin (mg)	0.4 (1.9, 5.2)	<0.001 ***	19.01(1)
Calcium (mg)	130.3 (74.2, 186.4)	<0.001 ***	21.64(1)
Iron (mg)	2.2 (-1.7, 6.1)	0.258	1.31(1)

Repeated measures ANCOVA between group analyses was applied followed by pairwise comparison; Household income and baseline variables as covariate; ** statistically significant at *p*-value < 0.01; *** statistically significant at *p*-value < 0.001.

Benefits of whole grains consumption

Table 3 Summary of linear regression for variables predicted by whole-grain intake

Dependent variables	Saturated fatty acid [†]			Monounsaturated fatty acid ^{††}			Polyunsaturated fatty acid ^{†††}		
	β coefficient	P-value	95% confidence interval	β coefficient	P-value	95% confidence interval	β coefficient	P-value	95% confidence interval
Whole grain	-0.143	0.004	-0.129, -0.025	-0.205	<0.001	-0.166, -0.058	-0.231	<0.001	-0.289, -0.116
Age	0.068	0.161	-0.304, 1.819	0.014	0.784	-0.948, 1.256	0.029	0.560	-1.240, 2.286
Sex	0.032	0.508	-0.661, 1.333	0.051	0.302	-0.491, 1.579	0.059	0.233	-0.649, 2.663
Ethnicity	-0.255	<0.001	-4.111, -1.862	-0.071	0.156	-2.012, 0.322	0.001	0.988	-1.853, 1.882

Sex: '0' represents boys and '1' represents girls. Ethnicity: '0' represents Malaysian and '1' represents Chinese, Indian and other ethnicity. Age: '0' represents 10 years old and '1' represents 11 years old. Dependent variable: fatty acids. Independent variable: whole-grain intake.

Model assumptions were fulfilled. No multicollinearity detected. All the fatty acids were adjusted for total energy according to the residual adjustment method¹⁵.

[†]R² = 0.102.

^{††}R² = 0.154.

^{†††}R² = 0.158.

Schoolchildren who consumed higher whole grains tend to reduce fat intake including SAFA; however, it would also reduce the MUFA and PUFA intakes

Whole grains recommendation from global dietary guidelines

Country	Issuing Organization and Year	Age Range	Quantitative Recommendation (Recommended Quantities in Amounts of WG Ingredients)	Qualitative Recommendation (Statement)	Source of Identified Data
USA	USDHHS/USDA 2015 (DGA 2015)	Whole population ≥ 2 y	≥3 oz-eq ¹ /2000 kcal	Consume at least half of all grains as WG.	[5]
UK	PHE 2018	Whole population	None	Choose WG versions/varieties. Make natural or minimally processed foods the basis of your diet.	[6]
Brazil	Ministry of Health 2014	Whole population ≥ 2 y	None	Starches can be consumed every day. It is recommended to consume the WG version when they are grain-based: WG bread, WG rice, WG pastas, etc.	[7]
France	Santé publique France 2019	Adults	At least one WG starch per day (no information vs. corresponding quantity of WG ingredients)	Use a combination of WG, grams (pulses) and greens. Increase consumption of WG. WG should be consumed regularly. Eat plenty of WG food. Choose WG foods.	[8]
India	Indian National Institute of Nutrition 2011	Whole population	None	Choose WG first—it's easy if you look for the WG logo when you shop.	[9]
Canada	Health Canada 2019	Whole population ≥ 2 y	None	Eat WG cereal products every day.	[10,11]
Denmark	Danish Veterinary and Food Administration 2013	Whole population	≥75 g/d	Choose WG varieties when you eat pasta, bread, grain and rice.	[12]
Norway	Norwegian Directorate of Health 2014	Whole population ≥ 1 y	70–90 g/d		[13]
Sweden	Swedish Food Agency 2015	Whole population ≥ 2 y	70 g/d in females—90 g/d in males		[14]

¹ 1 oz-eq = 1 serving ≈ 16 g of WG ingredients (approximate and most often used equivalence). DGA, Dietary guidelines for Americans; oz-eq, ounce equivalent; PHE, Public Health England; USDHHS, US Department of Health and Human Services; USDA, US Department of Agriculture; WG, whole grain; y, years.



Malaysia Dietary Guidelines

MDG 2020 focuses on :

- 1) Eat **3-5 servings** of **cereals, cereal-based products** and **tubers** daily according to your energy needs and physical activity level.
- 2) Choose $\geq \frac{1}{2}$ of your **cereals** and **cereal-based products** from whole grains.
- 3) Choose cereal-based products that are **high in fibre, low in fat, sugar** and **salt**.



One serving equivalent to...

Rice, brown/ multigrain/ unpolished/ parboiled/ white, cooked	1 cup/ 2 rice scoops	(100 g)
Noodles, mee-hoon made of brown/ white rice flour/ sago noodles (<i>tang-hoon</i>), soaked	1½ cups	(150 g)
Noodles, mee/ kuih-teow / laksa, wet	1 cup	(100 g)
Pasta/ spaghetti/ macaroni, cooked	1½ cups	(150 g)
Porridge, brown/ white rice, plain, cooked	2 cups	(330 g)
Com, without skin and cob, cooked	½ medium ear	(40 g)
Com kernel, without margarine, cooked	3 dessert spoons/ ½ commercial cup	(40 g)
Cornflake, without milk and added sugar	1 cup/ 8 dessert spoons	(30 g)
Bran, coarse, uncooked	1 cup/ 10 dessert spoons	(100 g)
Oats (rolled/ processed)/ wheat germ, uncooked	6 dessert spoons	(40 g)
Muesli, without milk	4 dessert spoons	(45 g)
Quinoa, cooked	1 cup/ 2 rice scoops	(150 g)
Wheat (<i>gandum</i>)/ barley, without gravy, cooked	12 dessert spoons/ ¾ cup	(150 g)

Potatoes, without skin, raw	2 whole medium sized	(160 g)
Sweet potato/ yam (<i>taro</i>)/ tapioca, without skin, raw (1 cm cube)	½ cup/ ½ of a whole medium sized	(70 g)
Bread, wholemeal/ ryemeal/ white	2 square slices	(60 g)
Roti canai	1 piece	(95 g)
Bread, pita, wholemeal	½ piece	(40 g)
Bun ^a	1 rectangular bun/ 2 small buns	(50g)
Capati (D= 20cm)	½ piece	(50 g)
Dosai/ rawa dosai (D=20cm)	1 piece	(80 g)
Idli (D= 6cm)	2 small pieces	(110 g)
Pau, with filling	½ piece	(40 g)
Putu mayam	2 pieces	(100 g)
Biscuit, wholemeal crackers/ Marie/ milk ^b	5 pieces	(30 g)
Biscuits, plain/ cream crackers/ oatmeal ^b	4 pieces	(45 g)

Malaysian Healthy Plate

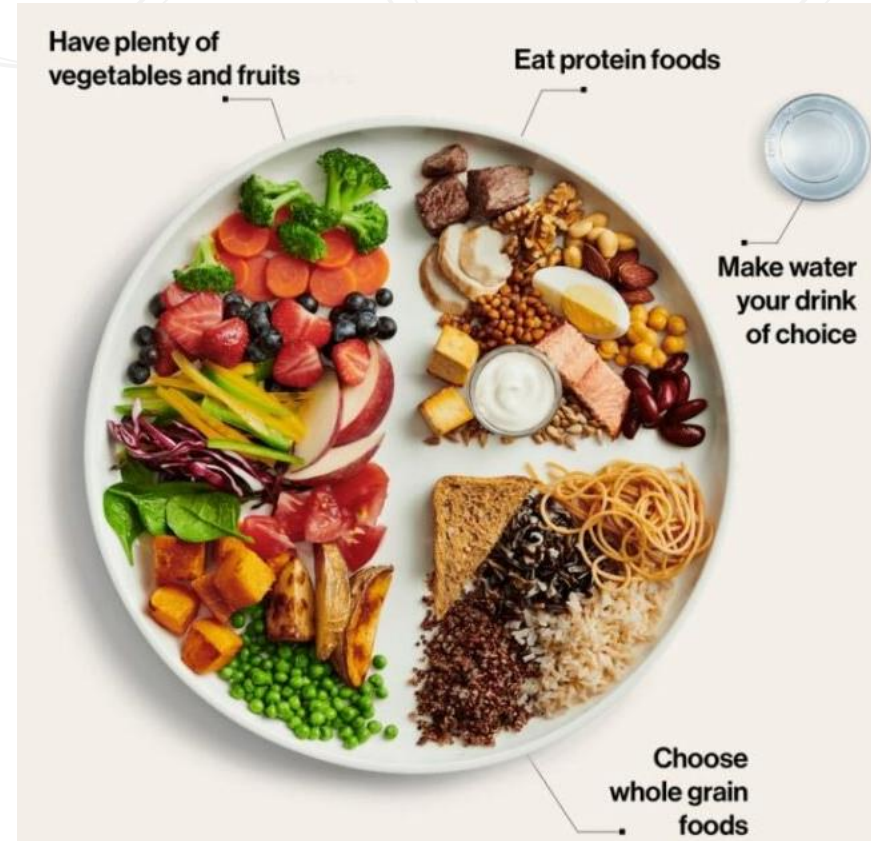


Fill in the first quarter of your plate with rice/ other cereals (e.g: meehoon)/ wholegrain cereal-based products (e.g: wholegrain bread)/ tubers (e.g: sweet potato). It is recommended to fill in this first quarter with whole grains.

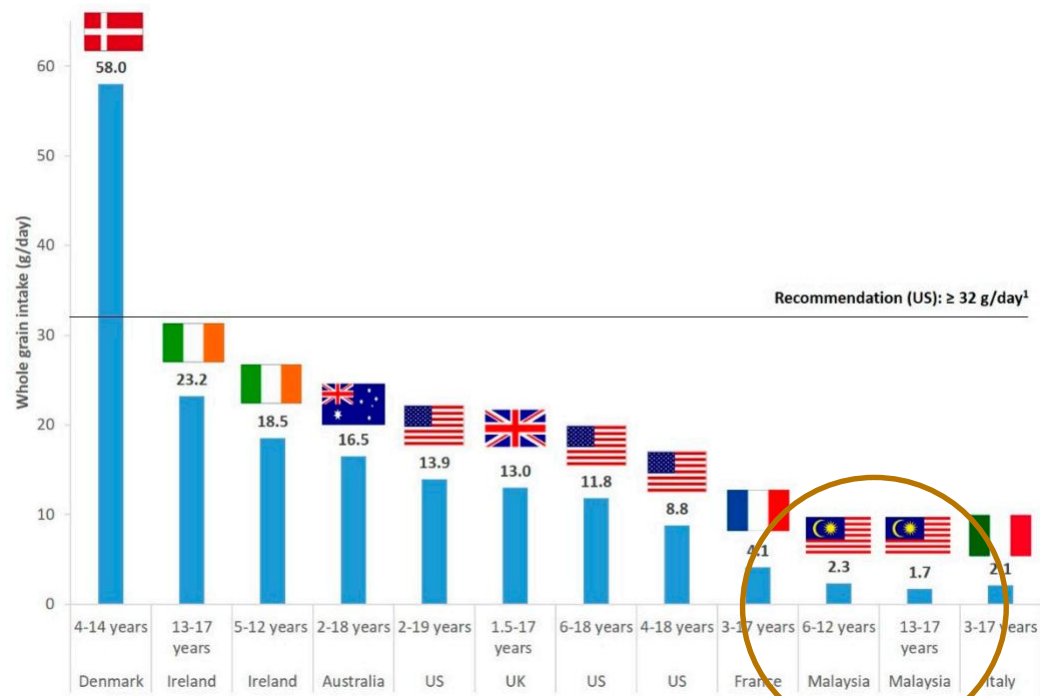
Explanation

- This food group is the major source of energy where rice is a staple food for Malaysians.
- The types of rice commonly consumed are brown/ white rice, and glutinous rice. Other grains and cereal products are noodles, pasta, breads, corns, barley and oats. Some examples of tubers are potatoes, sweet potatoes and cassava.

- Malaysians are encouraged to take whole grain to fill this quarter of this plate.



Summarize global surveys on daily whole grain intake in children and adolescents



Questionnaire to investigate the KAP towards whole grain

International Food Research Journal 23(2): 797-805 (2016)

Journal homepage: <http://www.iffj.upm.edu.my>



Development, validity and reliability of a questionnaire on knowledge, attitude and practice (KAP) towards whole grain among primary school children in Kuala Lumpur, Malaysia

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Abstract

This study aimed to develop and validate whole grain KAP questionnaire among children. A guided self-administered questionnaire was developed. In this cross sectional study, a total of 207 children aged 9 to 11 years in Kuala Lumpur, Malaysia were recruited. Knowledge domain was considered as optimal level of difficulty and able to discriminate performance of good and poor children. Construct validity was assessed using exploratory factor analysis with principle components method and varimax rotation. Four factor-solutions emerged for attitude domain whereas 3 factor-solutions were constructed for practice domain. Internal consistency was acceptable for knowledge (KR20=0.70), attitude (CA=0.72) and practice (CA=0.73). Test-retest reliability intra-class correlation coefficients for knowledge, attitude and practice domains were 0.80, 0.78 and 0.79 ($p < 0.001$), respectively. This is a feasible questionnaire which can be a useful tool for measuring whole grain KAP and assessment tool to evaluate the effectiveness of whole grain intervention among children in Malaysia.

Reference:
Koo et al. 2016

Knowledge towards whole grains consumption

Table 3

Proportion of respondents who responded correctly on various knowledge questions.

No.	Knowledge items	Correct n (%) ^a
Food pyramid		
K1	What is the shape of food pyramid?	350(93.2)
K2	Which level of the food pyramid consists of complex carbohydrate foods?	149(39.2)
K3	Based on the food pyramid, which group should be consumed adequately?	121(31.8)
Nutrient and function of complex carbohydrate		
K4	Complex carbohydrate is the main energy source required by our body?	107(28.2)
K5	Among the following, which is the complex carbohydrate?	236(62.1)
Nutrient and sources of whole grains		
K6	What is whole grain?	236(62.1)
K7	Among the following, which belongs to whole grains product?	214(56.3)
K8	Corn is a whole grain food.	340(89.5)
K9	Whole grains ready-to-eat cereals enriched with folic acid	188(49.5)
K10	Whole grains food enriched with zinc	271(71.3)
K11	Whole grains food high in fiber	334(87.9)
Nutrient and function of whole grains		
K12	Whole grains ready-to-eat cereals intake may increase the satiety	272(71.6)
K13	What is the function of fiber from whole grains ready-to-eat cereal?	194(51.1)
K14	Wholegrains food may help in	218(57.4)
K15	Taking whole grains ready-to-eat cereal as breakfast may stronger the bone?	273(71.8)

^a Percentage of respondents who gave the correct answers.

Attitude towards whole grains consumption

Table 4

Attitude items with percentage for positive attitude.

No.	Attitude items	Positive Attitude n (%) ^a
A1	I don't like to consume whole grains ready-to-eat cereal as my breakfast because it will increase my satiety and I have no appetite to enjoy fried chicken in the afternoon.	267 (70.3)
A2	I seldom take the whole grains foods because it is difficult to get in my neighborhood.	253 (66.6)
A3	I will choose cream biscuit if there is a choice between whole grains biscuit and cream biscuit.	167 (43.9)
A4	I don't like to eat whole grains ready-to-eat cereal with low fat milk because it is tasteless.	239 (62.9)
A5	I study hard to determine the function of whole grains.	260 (68.4)
A6	I try to spend more times on internet to search the advantages of eating whole grains foods.	233 (61.3)
A7	I try to spend more times on book reading to search the food which contains whole grains.	252 (66.3)
A8	I will buy whole grains ready-to-eat cereal as breakfast if it is sold at school canteen.	275 (72.4)
A9	I will finish all the whole grains foods despite I don't like it.	149 (39.2)
A10	I am not worried about the whole grains food choices because I am still healthy.	166 (43.7)
A11	I will choose whole grains ready-to-eat cereals as my breakfast if there is a choice between whole grains ready-to-eat cereal and coconut milk rice.	224 (58.9)
A12	I will seek for the advice from teacher and parents if encounter any problem regarding whole grains.	248 (65.3)
A13	I am interested to take whole grain foods if I am informed about the benefit of it.	290 (76.3)
A14	In my opinion, whole grains ready-to-eat cereals have more nutrients and healthier compared to non-whole grains food such as white bread, coconut milk rice and roti canai.	220 (57.9)
A15	I will choose white bread if there is a choice between whole grains bread and white bread at home.	75 (19.7)

^a Percentage of children who answered "strongly agree" or "agree" for attitude that they should have and "strongly disagree" or "disagree" for attitude that they should not have.

Practice towards whole grains consumption

Table 5
Frequency of consumption of various wholegrains foods in the last one month.

Food group	Everyday	Always ^a	Sometimes ^b	Seldom ^c	Never
	n(%)	n(%)	n(%)	n(%)	n(%)
Whole grain ready-to-eat cereal as morning or afternoon tea	34(8.9)	48(12.6)	127(33.4)	97(25.5)	74(19.6)
Whole grains ready-to-eat cereal as snack	37(9.7)	59(15.5)	114(30.0)	102(26.8)	68(18.0)
Corn as snack	31(8.2)	42(11.1)	110(28.9)	95(25.0)	102(26.8)
Whole grains biscuit as snack	70(18.4)	65(17.1)	104(27.4)	93(24.5)	48(12.6)
Barley as drink	62(16.3)	87(22.9)	102(26.8)	82(21.6)	47(12.4)
Brown rice as main meal	70(18.4)	33(10.0)	78(20.5)	87(22.9)	112(28.2)
Oat whenever hungry	59(15.5)	18(4.7)	50(13.2)	60(15.5)	193(50.8)
Whole grains ready-to-eat cereal with low fat milk as breakfast	81(21.3)	68(17.9)	107(28.2)	72(18.9)	52(13.7)
Whole grains ready-to-eat cereal with chocolate drink as breakfast	57(15.0)	55(14.5)	92(24.2)	86(22.6)	90(23.7)
Whole grains bread as my breakfast	92(24.2)	73(19.2)	91(23.9)	80(21.1)	44(11.6)

^a 1–6 days per week.

^b 14 days in a month.

^c Not in “always” and “sometimes” categories.



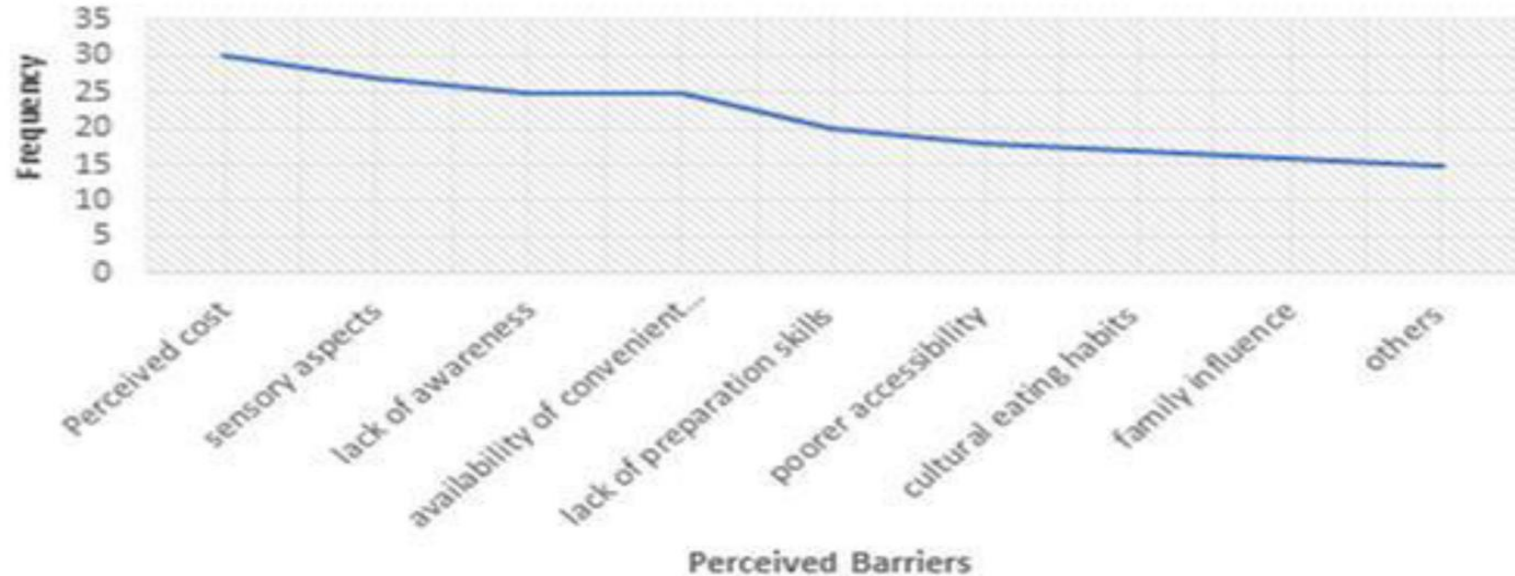
Breakfast habit affect whole grain consumption among medical student

Variable	B	SE	Wald	P	OR	95% CI
Age	-0.81	0.29	0.63	0.64	1.14	0.60-2.03
Gender	0.68	0.35	0.35	0.72	0.88	0.44-1.75
Ethnicity	0.09	0.18	4.27	0.00*	1.60	1.12-2.30
Level of MBBS program	-0.82	0.40	0.93	0.63	0.80	0.37-1.82
Monthly household income	0.37	0.19	3.21	0.06	1.44	0.97-2.13
Mother's education	-0.25	0.28	1.03	0.23	1.41	0.80-2.48
Father's education	0.70	0.29	0.05	0.86	1.05	0.58-1.87
Living arrangement	0.24	0.28	1.69	0.19	1.44	0.87-2.53
Breakfast habit	1.28	0.24	5.36	0.00*	2.24	1.39-3.63
Source of breakfast consumed	-0.23	0.29	3.91	0.04*	0.56	0.31-0.90
BMI	-0.72	0.19	1.69	0.10	1.30	0.94-1.95
Self-perception of likeliness to adhere to food groups	0.78	0.41	3.01	0.06	2.14	0.95-4.18
Likely to encourage family and friends	-1.18	0.47	1.01	0.14	2.0	0.79-5.12

Overall model Omnibus $\chi^2(13)=171.65, P<0.001$, Nagelkerke $R^2=0.903$. * $P<0.05$. SE: Standard deviation, OR: Odds ratio, CI: Confidence interval

Multivariable logistic regression analysis of factors predicting whole-grain consumption

Perceived barriers to whole grain consumption among Malaysian adults



Facilitators to Improve Wholegrain consumption

**Whole Grain
cookbook
development**

**Availability and
accessibility of whole
grain**

Peer encouragement

Cost reduction

**Product labelling
improvement**

**Education and
awareness towards
whole grain**

**Developing a habit or
lifestyle**



Malaysia's Whole grain

RECIPE COOKBOOK

Healthy and amazingly delicious wholesome Asian and Western-inspired whole grain recipes specially brought to you by a chef, dietician, and food technologist

Malaysia's Whole grain 25

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KOO HUI CHIN - MOHD NOR AHMAR BIN MOHD SANIP - UGUNESH DANASELVAM

Recipe Cookbook

Malaysia's Whole Grain Recipe Cookbook
ISBN 978-967-0115-11-5

KOO HUI CHIN - MOHD NOR AHMAR BIN MOHD SANIP - UGUNESH DANASELVAM

Menu

Nasi lemak with condiments

Chapati with chicken curry

Nasi Kerabu

Nasi Briyani

Nasi Ulam

Kuih Angkoo

Roti Jala

Tosai

Brown Burger

Wholemeal Pizza

Overnight Oats

**Banana Wholemeal
Pancakes**



Thanks!

Do you have any questions?

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