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WHOLE GRAIN CONSUMPTION AND ITS DETERMINANTS IN MALAYSIAN MEDICAL STUDENTS

Shobha Subramanian[1], Sapna Patil[2*], Suresh Ponnusamy[3], Ameya Hasamnis[4], Loh Keng Yin[5] and Nageswari Santosh[6]

[1]*Clinical Skills Unit, School of Medicine, Taylor's University, Malaysia*
[2] *Department of Public Health, School of Medicine, Taylor's University, Malaysia*
[3] *Department of Internal Medicine, School of Medicine, Taylor's University, Malaysia*
[4] *Department of Pharmacology, School of Medicine, Taylor's University, Malaysia*
[5] *Department of Family Medicine, School of Medicine, Taylor's University, Malaysia*
[6] *Ecron Acunova, Malaysia*

*Email: *SapnaShridhar.Patil@taylors.edu.my*

Abstract: Whole grain consumption is associated with several health benefits. Little is known however, about whole grain consumption patterns in medical students in Malaysia. The objective of this study was to assess whole grain intake pattern and its determinants amongst Malaysian medical students. A cross sectional study investigating whole grain intake amongst 151 medical students in a private medical University in Malaysia was conducted. A self-administered questionnaire was used to assess sociodemographic variables, the whole grain intake pattern and the knowledge and attitudes towards whole grain intake. The prevalence of reported whole grain intake in the past 3 months was 51%.Chinese ethnicity, readiness to adhere to Malaysian food pyramid and self-preparation of food and eating at home were significantly associated with whole grain consumption. However, the primary determinants of food choice like education, knowledge and affordability did not seem to influence whole grain consumption. Whole grain consumption is relatively low amongst Malaysian medical students. Cultural background and self-belief influence this practice despite being from the medical fraternity. Efforts are needed to bridge the knowledge – practice gap by assessing the barriers to whole grain consumption in order to design effective initiatives to promote an increase in whole grain consumption.

Keywords: whole grain consumption, medical students, practice

Introduction

A whole grain is defined as consisting of the intact, ground, cracked or flaked kernel after removal of inedible parts such as the hull and husk (Björck I *et al*, 2012,Nutrition Society of Malaysia,2012). The principal anatomical components namely the endosperm, germ and bran are to be present in the same relative proportions as they exist in the intact kernel. Small losses of components, around < 2% of the germ or <10% of the bran, which may occur through processing methods consistent with safety and quality, are allowed.

A significant body of research indicates that whole grain consumption has been associated with greater nutrient intakes and enhanced dietary quality (O'Neil CE *et al*, 2010, Hur IY and Reicks M, 2012).Observational studies involving large populations have consistently shown an inverse relationship between whole grain intake and disease risk, with health benefits proportional to the amount of whole grain consumed (Yee EQ et al, 2012).

Consumption of 2-3 servings per day (~48 g) of whole grains may reduce risk of cardiovascular disorders (CVD), type 2 diabetes mellitus (T2DM), overweight and obesity. This dietary practice has shown to lower the risk of certain cancers also. The current evidence shows that 3-5 servings of the whole grains per day reduces not only the risk of ischemic heart diseases (IHD) and CVD, but also causes a 21-30% reduction in risk of T2DM compared to those who rarely or never consume whole grains(Liu S *et al*,1999,2000,2002,

Meyer KA *et al,*2000, Parker ED *et al*,2013). Ye EQ *et al* (2012) proposed that whole grains also aid in the maintenance of glucose and insulin homeostasis, lowering of serum cholesterol and low density lipoprotein (LDL) cholesterol concentration, and reducing inflammation and oxidative stress.

Background

Whole grains and their products form the base of the Malaysian food pyramid. Whole grains are included in one of the food groups that form the main constituent of daily diet with recommendations of 4-8 servings per day, as recommended by the Malaysian dietary guidelines (2010). As tomorrow's doctors, it is crucial for medical students to have sound knowledge of healthy lifestyles as well as practice optimal dietary habits in order to maintain their own health and well-being.

There is lack of published evidence regarding the pattern of whole grain consumption among medical students in Malaysia. Very few studies have been conducted among medical students to evaluate the dietary pattern, life style, factors affecting eating habits, attitude on nutrition intake, obesity indices and relationship between dietary habits and prevalence of fatigue (Tanaka M et al,2008, Boo NY et al, 2010, Ganasegeran K et al,2012, Crowley J et al, 2014). However, many studies have been conducted to explore whole grain intake, its likeability and association with body mass index, amongst university students and school children (Bisanz et al, 2007, Rose N et al,2007, Mellette TJ,2015,Norimah AK et al, 2015)

Nonetheless, a number of studies have evaluated the nutritional knowledge, eating habits and obesity indices of university students in general (Ruka Sakamaki et al, 2005, Sen R, 2007,Yahia N et al, 2008,Gan WY et al, 2011,N.H.Abdull Hakim et al,2012, Aaron O. Amankwaa and Reginald A. Annan, 2014,Kiranni D et al,2008, Salameh P et al,2014).

The purpose of this study was to understand the whole grain consumption pattern amongst medical students and determine the factors influencing the practice of whole grain consumption.

Materials and Methods

Study design

A cross-sectional study was conducted in a private University in Malaysia amongst medical students from both pre-clinical and clinical phases of the course. The sample size calculated to using the formula given by Krejcie and Morgan(1970) was 178, out of which 151 students completed the study giving a response rate of 84.8%.Students were invited to participate in the study after explaining the purpose of the study and the method of completing the questionnaire. Written, informed consent was obtained from the students who volunteered to participate in the study. Confidentiality of collected information and anonymity of the participants was maintained throughout the conduct of the study.

Definition of terms

Pre-Clinical phase – Defined as students who were in Year 1 (Semester 1 & 2) and Year 2 (Semester 3 & 4).

Clinical phase – Defined as students who were in Year 3 (Semester 5 & 6), Year 4 (Semester 7 & 8) and Year 5 (Semester 9 & 10).

Breakfast consumers are defined as the respondents who took breakfast every day or > 3 times / week.

Breakfast skippers are defined as the respondents who took breakfast < 3 times / week and those who never had their breakfast.

Study instrument

We used a self – administered questionnaire comprising two sections. The questionnaire was circulated online using google forms to ensure completeness of information.

Section 1 included information on sociodemographic variables like age, gender, ethnicity, phase in the MBBS programme, parents' level of education, monthly household income and living arrangement. In this section, students were also asked to report their height (in centimeters) and current weight (in kilograms), based on which their body mass index (BMI) was calculated.

Section 2 comprised information regarding breakfast related habits, dietary habits with reference to the Malaysian food pyramid, whole grain consumption, its patterns and questions pertaining to assessing the students' knowledge (both perceptual and actual)and attitude towards whole grains. Assessment of the perceptual knowledge was based on the level of confidence in the topic of whole grains answered as 'Yes' and 'No'. Actual knowledge was tested by asking questions on whole grain anatomy, their benefits and food items containing whole grains.

Statistical analysis

The Statistical Package for Social Sciences (SPSS) version 20.0 was used for data analysis. The BMI was calculated as weight in kilograms divided by height in square meters (kg/m2). In this study, based on the WHO BMI cut-offs for the Asian population, a BMI < 18.5 kg/m2 was categorized as underweight, 18·5–22·9 kg/m2 as the normal range, 23.0–27.4 kg/m2 as pre-obese, and >27.5kg/m2 as obese. The relationship between whole grain consumption and factors influencing it was assessed using the Chi square test. All reported p values were two-tailed and p values < 0.05 were considered statistically significant.Multiple logistic regression analysis was performed to determine the predictors(determinants) of the practice of whole grain consumption.

Results

Sociodemographic characteristics

Table 1 shows the sociodemographic characteristics of the participants. Majority of the respondents were in the age group of 21 to 23 years (104, 68.9%). There were 102(67.5%) females and 49 (32.5%) were males. The majority were Malays (70, 46.4%), followed by Chinese (51, 33.8%), Indians (15, 9.9%) and other ethnic groups (15, 9.9%). Thirty one students (20.5%) were from pre-clinical phase and 120 (79.5%) were from clinical phase.

Regarding mother's education level, 80 (53.0%) had completed tertiary education, 65 (43%) had high school or less and the rest 6 (4%) had non-formal education. For the father's education, 98 (64.9%) had tertiary education, 48 (31.8%) had high school or less and 5 (3.3%) had non-formal education. Majority of the students (89, 58.9%) reported a monthly household income more than RM 5000 per month and most of them (91, 60.3%) were living with their friends.

Table 1 Socio-demographic characteristics of respondents (n=151)

Characteristics	Number	Percentage
Age		
19 – 21 years	27	17.9
21 – 23 years	104	68.9
≥ 23 years	20	13.2
Gender		
Male	49	32.5
Female	102	67.5
Ethnicity		
Malay	70	46.4
Indian	15	9.9
Chinese	51	33.8
Others	15	9.9
Phase of MBBS programme		
Preclinical	31	20.5
Clinical	120	79.5
Mother's education		
Non-formal	6	4
High school	65	43
Tertiary	80	53
Father's education		
Non-formal	5	3.3
High school	48	31.8
Tertiary	98	64.9
Monthly household income(RM)		
≤ 3000	35	23.2
3001 – 4999	27	17.9
≥ 5000	89	58.9

Living arrangement		
Living alone	11	7.3
Living with friends	91	60.3
Living with family	49	32.4

Whole grain consumption and its pattern

Figure 1 illustrates the whole grain consumption of the participants in the last three months. The prevalence of reported whole grain consumption in the last three months was 51% (77).

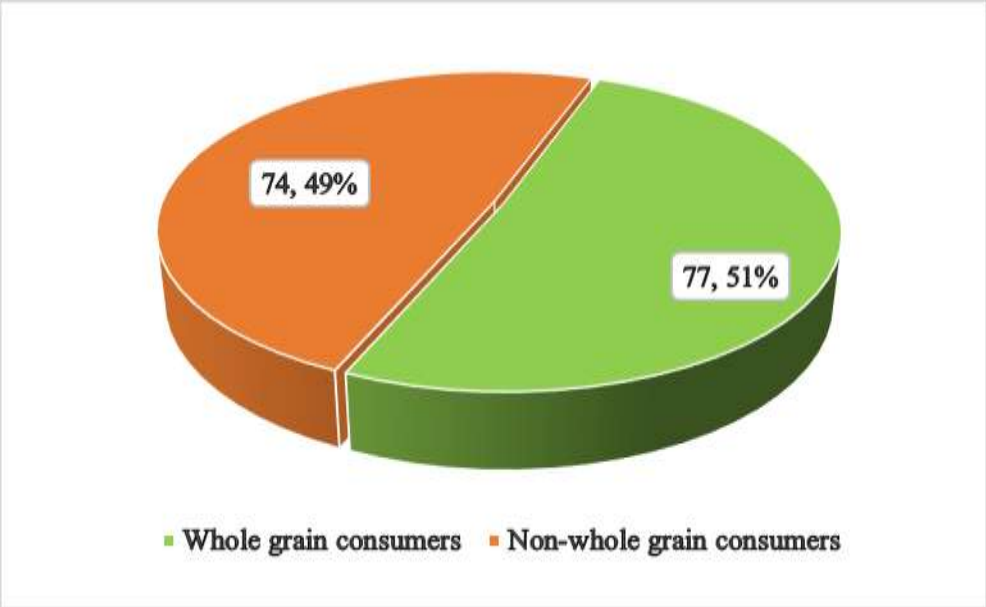

Figure 1 Prevalence of whole grain consumption amongst the participants

Figure 2 depicts the frequency of whole grain intake amongst the participants. Of the 77 participants who reported that they consumed whole grains, the proportion of those who consumed whole grains daily was 13 % (10). About 26% (20) ate whole grains >3 times a month, 23.3% (18) took > 3 times per week, 22% (17) had < 3 times per week and 15.6% (12) ate < 3 times a month.

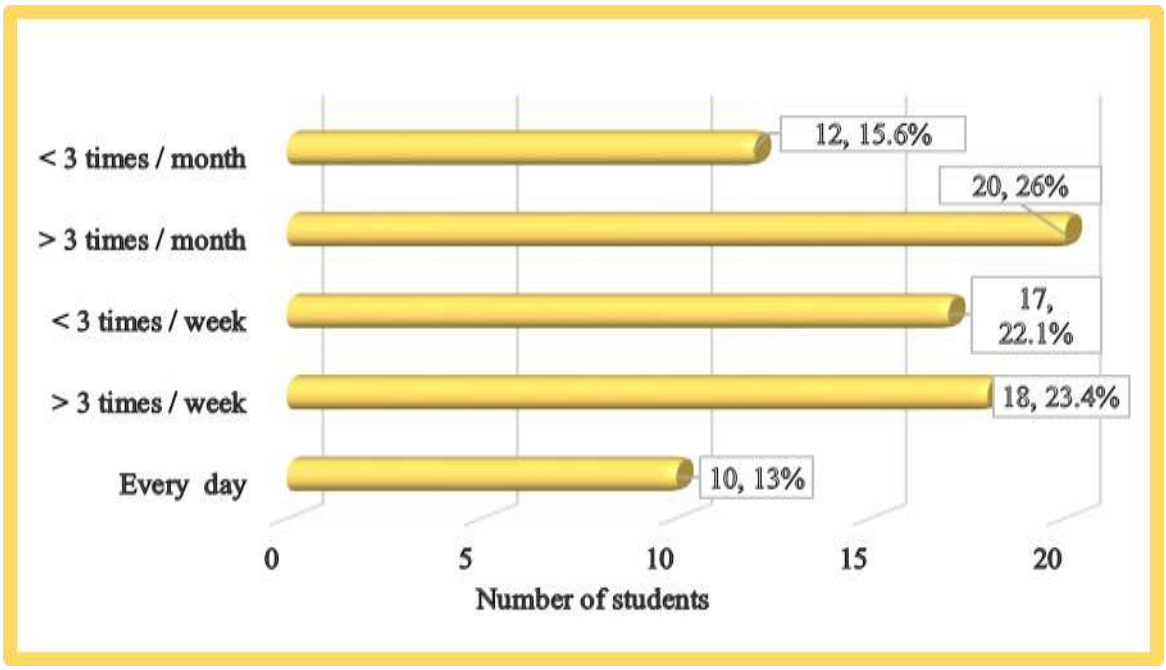

Figure 2 Frequency of intake amongst the whole grain consumers (n = 77)

Figure 3 shows the preferred whole grain choices of the whole grain consumers. Assessment of the type of whole grain consumed in the last 3 months revealed that 44.1% (34) consumed oat meal, 35.1% (27) took whole grain / whole meal bread, 10.4% (8) took brown rice and the rest 10.3% (8) ate either biscuits or bars enriched with whole grains such as granola bar etc.

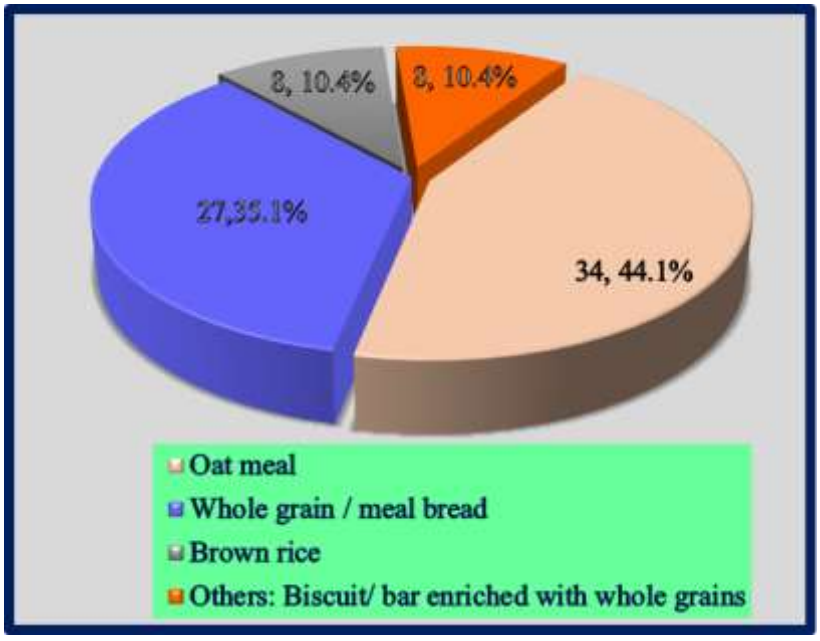

Figure 3 Preferred whole grain choices of the whole grain consumers (n = 77)

Comparison between socio-demographic factors and whole grain consumption

Table 2 presents the comparison of the socio-demographic factors with the habit of whole grain consumption.

As seen in table 2, a the proportion of whole grain consumption is higher amongst females (51,66.2%) than males (26, 33.8%) and those students in the age group of 21-23 years (47, 61%) compared to other age groups, however, these results were not statistically significant.

The practice of whole grain consumption was significantly higher amongst the Chinese students (33, 42.9%) than other ethnic groups such as Malay (25, 32.5%), Indian (10, 12.9%) and others (9, 11.7%). On the other hand, the practice of consuming non-whole grain foods was highest amongst Malay (45, 60.8%) and lower amongst other ethnic groups such as Chinese (18, 24.3%), Indian (5, 6.8%) and others (6,8.1%).

A higher proportion of students in the clinical phase were whole grain consumers (60, 77.9%) than the pre-clinical phase (17, 22.1%).

Respondents of mothers who had tertiary education (44,57.1%) had slightly higher rates of whole grain consumption compared to the respondents whose mothers had only high school or less (31, 40.3%) and non-formal (2, 2.6%) education. Meanwhile, the students whose fathers had tertiary level education (50, 64.9%) were mostly whole grain consumers in comparison with the students whose father had high school or less (25, 32.5%) and non-formal education (2, 2.6%).

Students who lived with their friends (41, 53.2%) preferred whole grain food slightly higher compared to others who stayed with family (30, 39%) and stayed alone (6, 7.8%). A majority of the respondents with mean household income ≥5000 RM (50, 64.9%) showed preference to whole grain foods.

However, the factors such as phase of MBBS programme, parental education, mean household income, and living arrangement did not reveal any statistically significant association with the practice of whole grain consumption.

Table 2 Comparison of the socio-demographic characteristics with the practice of whole grain consumption.

Socio- demographic characteristics		Whole grain consumption		Chi square value	P-value
		Yes (77)	No (74)		
Gender	Male	26 (33.8%)	23(66.2%)	0.124	0.725
	Female	51 (66.2%)	51(33.8%)		
Age	19 – 21 years	16 (20.8%)	11 (14.9%)	5.030	0.081
	21 – 23 years	47 (61.1%)	57 (77.0%)		
	>23 years	14 (18.1%)	6 (8.1%)		
Ethnicity	Malay	25 (32.5%)	45 (60.8%)	12.338	0.006
	Chinese	33 (42.9%)	18 (24.3%)		
	Indian	10 (12.9%)	5 (6.8 %)		
	Others	9 (11.7%)	6 (8.1%)		
Level of MBBS programme	Pre-clinical	17 (22.1%)	14(18.9%)	0.231	0.391
	Clinical	60 (77.9%)	60 (81.1%)		
Mother's	Non formal	2 (2.6%)	4 (5.4%)	1.546	0.462

education	High school	31(40.3%)	34 (45.9%)		
	Tertiary	44 (57.1%)	36 (48.7%)		
Father's education	Non formal	2 (2.6%)	3 (4.1%)		
	High school	25 (32.5%)	23(31.1%)	0.265	0.876
	Tertiary	50 (64.9%)	48 (64.8%)		
Living arrangement	Living alone	6 (7.8%)	5 (6.7 %)		
	Living with friends	41(53.2%)	50 (67.6%)	3.392	0.183
	Living with family	30 (39%)	19 (25.7%)		
Monthly household income(RM)	≤ 3000	13 (16.9%)	22 (29.7 %)		
	3001 – 4999	14(18.2%)	13(17.6%)	3.392	0.183
	≥ 5000	50 (64.9%)	39 (52.7%)		

Comparison between nutritional characteristics and whole grain consumption

Table 3 depicts the relationship between the various nutritional characteristics of the participants with the practice of whole grain consumption.

Regarding the breakfast consumption, regular breakfast consumers (37, 71.2%) had a significantly higher whole grain consumption compared to the breakfast skippers (10, 30.3%). The respondents who not only had food at home but preferred to prepare it themselves (45, 58.4%) took more whole grain foods compared to the ones who only had food at home (13, 18.2%) and those who had food outside (12, 15.6%).This difference was found to be statistically significant.

Based on the World Health Organization's BMI cut offs for the Asian population (Normal: 18.5 – 22.9 kg / m^2, Over weight: 23 – 24.9 kg / m^2, Pre-obese: 25-29.9 kg / m^2, Obese: ≥30 kg / m^2), our study revealed that only 48.3% (73) of students fell in the normal range. Around 16.6% (25) were underweight and, 22.5% (34) were in the pre-obese category and 12.6% (19) were in the obese range.

Comparison of BMI and whole grain consumption revealed that respondents with normal BMI were found to be slightly high in whole grain consumption (43, 55.8%) than non-whole grain consumers (30, 40.5%); Pre-obese and obese range showed not much difference. However, the data showed that a significantly greater percentage of the ones who were underweight did not seem to consume whole grains (19, 76%) compared with the ones who consumed whole grains (6, 24%).

Table 3 Comparison of the nutritional characteristics with the practice of whole grain consumption.

Nutritional characteristics		Whole grain consumption		Chi square value	P-value
		Yes	No		
Breakfast habit	Skip everyday	10 (30.3%)	23(69.7%)	20.30	0.00

	At least 3 times a week	49 (74.2%)	17(25.8%)		
	Consume everyday	37 (71.2%)	15(28.8%)		
Source of breakfast consumed	Prepare and eat at home	45 (68.2%)	21(31.8%)	7.66	0.02
	At home	13(61.9%)	8 (38.1%)		
	Outside	12(38.7%)	19(61.3%)		
Body mass index (kg / m2)	Underweight	6(24.0%)	19(76.0%)	9.49	0.02
	Normal	43(58.9%)	30(41.1%)		
	Pre-obese	17(50.0%)	17(50.0%)		
	Obese	11(57.9%)	8(42.1%)		

Knowledge, belief and attitudes towards whole grain consumption

Table 4 shows the comparison between students' perceptual and actual knowledge about wholegrains. Analysis of the perceptual knowledge was based on the level of confidence in the topic of whole grains answered as 'Yes' and 'No'. Of the 121 respondents who felt confident about their knowledge of whole grains, 98(81%) were able to correctly respond to the question on anatomy of whole grains whereas 23(19%) gave incorrect answer. Interestingly, of the 30 students who stated that they were not confident majority (23, 76.7%), gave a correct response to the question testing the actual knowledge.

Regarding the health benefits of consuming whole grains, 125 were confident while 26 were not confident. Comparison between perceptual and actual knowledge on this aspect revealed results similar to the earlier question.

Regarding the familiarity with the common whole grain foods consumed, of the 110 students who were confident, only 50% (55) were able to give correct response. Out of the 41 students who stated that they were not confident about the familiarity with common whole grain foods, 27(65.9%) gave an incorrect response. None of the differences between the perceptual and actual knowledge were statistically significant.

Table 4 Association of the students' perceptual and actual knowledge about whole grains.

Students' perceptual knowledge on whole grains		**Students' actual knowledge about whole grains**		**Chi square value**	**P-value**	**95% CI**
		Correct response	**Incorrect response**			
		Which of the following is NOT part of the edible whole grain kernel?				
I know what a whole grain is.	**Yes**	98 (81%)	23 (19%)	0.282	0.595	0.49 - 3.38
	No	23 (76.7%)	7 (23.3%)			
		Which of the following is a health benefit of eating whole grains?				
I know the health benefits of eating whole grain.	**Yes**	93 (74.4%)	32(25.6%)	0.020	0.888	0.41 –2.78
	No	19 (73.1%)	7 (26.9%)			
		Which of the following is NOT a whole grain?				

I am familiar with common whole grain foods.	**Yes**	55 (50%)	55 (50%)	3.025	0.082	0.91 –4.06
	No	14 (34.1%)	27(65.9%)			

As seen in table 5, assessment of the students' attitude towards whole grain consumption with the practice, reveals that there is a positive shift amongst participants who consume whole grains as well as those who do not.

Regarding the likeliness to adherence towards the food group in the Malaysian food pyramid, majority 108 (71.5%) expressed the wish to adhere while 43 (28.5%) said that they were less likely to adhere to the food group provided in the Malaysian food pyramid. However, we found significant differences in the attitude to adherence to food group in Malaysian food pyramid, amongst the whole grain consumers and the non-whole grain consumers (P=*0.004,95% CI 0.16 – 0.72*).

Majority of the students 117 (77.5%) expressed that they would include whole grains in their regular meals, but 34 (22.5%) said that they were not keen to change their regular food habit and move towards whole grains. Amongst the 74 respondents who did not consume whole grains, 70.2 % (52) have expressed their willingness to include whole grains in their regular diet while 22 (29.7%) still remain unchanged. This difference is statistically significant (P=*0.04, 95% CI 0.19 – 0.96*).

Out of the 151 respondents, 129 (85.4%) were willing while 22(14.6%) were not willing to encourage their family and friends to include whole grain into their meal. Even though majority of the respondents who were not whole grain consumers expressed more willingness to encourage their family and friends towards whole grain consumption, the difference was not statistically significant.

Table 5 Association of the students' beliefs and attitudes towards whole grain consumption.

Attitude towards whole grain consumption		Whole grain consumption		Chi square value	P-value	95% CI
		Yes	No			
Self-perception on likeliness to adhere to food group in Malaysian food pyramid	Not likely	14(32.6%)	29(67.4%)	8.17	0.004	0.16 – 0.72
	Likely	63 (58.3%)	45(41.7%)			
How likely are you to include more whole grains in your diet?	Not likely	12(35.3%)	22(64.7%)	4.32	0.04	0.19 – 0.96
	Likely	65(55.6%)	52(44.4%)			
How likely are you to encourage your family members or friends to include whole grains in your regular meals?	Not likely	8(61.9%)	14(38.1%)	2.20	0.13	0.19 – 1.26
	Likely	69(68.2%)	60(31.8%)			

Determinants of whole grain consumption

Table 6 shows the analysis of determinants or factors influencing the practice of whole grain consumption amongst the respondents by applying multiple logistic regression.

It is seen that ethnicity (P = *0.00, 95% CI 1.12 – 2.30,* breakfast habits (P = *0.00, 95% CI 1.39 – 3.63)* and source of breakfast consumed (P = *0.04, 95% CI 0.31 – 0.90)* are significantly associated with the practice of whole grain consumption.

Table 6 Multivariate logistic regression analysis of factors influencing whole grain consumption. (Significant)*

Variable	Standard error	Significance	Odds ratio	95% CI
Age	0.29	0.64	1.14	0.60 – 2.03
Gender	0.35	0.72	0.88	0.44 – 1.75
Ethnicity	0.18	0.00*	1.60	1.12 – 2.30
Level of MBBS programme	0.40	0.63	0.80	0.37 – 1.82
Monthly household income	0.19	0.06	1.44	0.97 – 2.13
Mother's education	0.28	0.23	1.41	0.80 – 2.48
Father's education	0.29	0.86	1.05	0.58 – 1.87
Living arrangement	0.28	0.19	1.44	0.87 – 2.53
Breakfast habit	0.24	0.00*	2.24	1.39 – 3.63
Source of breakfast consumed	0.29	0.04*	0.56	0.31 – 0.90
Body mass index	0.19	0.10	1.30	0.94 – 1.95
Self -perception of likeliness to adhere to food groups	0.41	0.06	2.14	0.95 – 4.18
Likely to encourage family and friends	0.47	0.14	2.0	0.79 – 5.12

Discussion

The prevalence of whole grain consumption amongst medical students was 51%, which is slightly less compared to prevalence (60%) of whole grain consumers among medical students in Karachi as reported by Nisar N *et al.* (2000).However, a study conducted among University students of Nebraska by Rose *et al*. (2007) found that 86% of students reported eating whole grains which is high compared to our results.

However, there is lack of evidence from studies conducted on medical students regarding the information on their pattern, frequency, preferred food and the determinants that may or may not influence whole grain consumption. Although the study done by Nisar N *et al.* (2000 on Karachi medical students reported the prevalence rate.In our study we tried to explore in detail the whole grain food pattern and its determinants. Accordingly, we found that the main sources of whole grains in medical students to be oat meal and whole meal bread; these food items are ready-to-eat food and have less preparation time and can be easily consumed at home. These findings were similar to those in the study conducted by Rose *et al*. (2007). The same study also reported that 64% of the whole grains consumers did not consume an average of at least 3 servings of whole grains per day, as per the RDA. In comparison, to this value our study shows a very low percentage, as majority of the whole grain consumers did not consume whole grain every day.

Boon NY *et al*.(2010) found that only slightly more than half (55.0%) of the students were in the normal weight category, while the rest were either overweight/obese (30.1%) or underweight (15.0%) which are

similar to our results wherein 48% were in the normal weight category, while rest were either pre-obese/obese (35.1%) or underweight (16.6%).

An individual's choice of food is being influenced by many interrelating factors. The factors influencing food choice are categorized as those related to the food, to the individual making the choice and to the external economic and social environment within which the choice is made (European Food Information Council 2004). A review of EUFIC reports that even though the key driving force to eat is hunger, there are some other factors that influence the food choice; biological determinants such as hunger, appetite, taste; economic determinants such as cost, income, availability; physical determinants such as access, education, skills (e.g. cooking) and time; social determinants such as culture, family, peers and meal patterns; psychological determinants such as mood, stress and guilt; behavioural determinants such as attitudes, beliefs and knowledge about food[32].

Subsequently, to evaluate the factors that influence whole grains as food choice in this study population (medical students), we have discussed and analyzed under different food determinant below.

Economic determinants

One of the primary determinants of the food choice is cost of the food and the affordability depends mainly on the income and socio-economic status. In our study, we assessed the affordability, socioeconomic status and parental education; they did not seem to influence whole grain consumption, although we did not assess the influence of cost of the food in this study.

Accessibility to shops is another important physical factor influencing food choice, which is dependent on resources such as transport and geographical location. The study conducted by Rose et al. (2007), attributed the high percentage of whole grain consumption to the dining centers within the campus that served mainly whole grain foods. A similar finding was reported another study that increases the whole grain consumption is influenced by the dining centers in the campus conducted by Bisanz et al. (2007). Our study included pre-clinical group at lakeside campus, a locality that had easy access to a variety of shops/supermarket and food outlet that served whole grains and clinical group at a sub-urban area that had food outlets serving food which include local, traditional food and less of whole grain and few shops/super markets that were far away. However, we did not find any influence of accessibility on the practice of whole grain consumption.

Physical determinants

Kearney *et al*. (2000) proved that level of education to influence the dietary behaviour during adulthood. Our study showed no significant influence of parents' education on the practice of whole grain consumption in their children. Though the study included the students from different level of the MBBS programme, the data showed no significant influence of the respondent's level of education on their practice of whole grain consumption. So, our study shows there is no influence on the level of education (self and parental) with the practice of whole grain consumption.

Cooking skills, method involved and preparation time are one of the important physical determinants of food choice. This study showed that respondents who prepared and had food at home were more likely to be whole grain consumers. The observation of the different choice of whole grain food consumed by the students (oat meals 44.1% (34), 35% (27) whole grain / whole meal bread, 10.3% (8) brown rice and the rest 10.3% (8) consuming either biscuits or bars enriched with whole grains such as granola bar etc.). This finding helps us to understand that they preferred food that mostly requires less cooking time or instant ready-to-cook food and also think that they have less time for food preparation. Lappalainen R *et al*. (1997) reported lack of time as a frequent attribute for not following nutritional advice, particularly by the young and well educated. They also addressed that the issue of lack of time is met with a shift in the fruit and vegetables market, from loose to pre-packed, prepared and ready-to-cook products.

Social determinants

Our study revealed a significant finding with the practice of whole grain consumption and the ethnic or cultural background. We found that the Chinese students were the highest among the whole grain consumers and Malay were the highest in the non-whole grain consumer group. This shows the influence of the cultural background and tradition on the food intake reported by a theory of planned behaviour exhibited by the students. Ajzen I & Fishbein M (1980) and Ajzen I (1988) have stated that the theory of reasoned action or its extension and the theory of planned behaviour, have been used to help explain as well as predict the intention of a certain behaviour. This model proposes that an individual's behaviour intention is jointly derived from three components; attitudes, perception of social pressure to perform the behaviour and perceived control over the behaviour (Shepherd R 1997, European Food Information Council 2004)

It has been shown that social factors impact an individual's or a group's eating behaviour directly (buying food) or indirectly (learning from peer's behaviour), either consciously (transfer of belief) or sub-consciously (Ajzen I & Fishbein M 1980) Family is widely recognized as being significant in food decisions. Research shows the shaping of food choices taking place in the home. Because family and friends can be a source of encouragement in making and sustaining dietary change, adopting dietary strategies which are acceptable to them may benefit the individual whilst also having an effect on the eating habits of others (Anderson AS *et al*.1998) However, our study shows no significant influence of the living arrangements (alone, with family or with peers) with the practice of whole grain consumption.

Behavioural determinants

We found that even though the students had high confidence level on the nutritional knowledge about the basic information on whole grain, the common whole grains available and its health benefits, this did not influence them to consume whole grains. Our findings are similar to those in the study conducted by De Almeida MDV *et al*. (1997) which suggested that that nutritional knowledge and good dietary habits are not strongly correlated.

A significant proportion of the respondents in our study who reported that they adhere to the food groups in the Malaysian pyramid were more likely to be whole grain consumers In our study we found a significantly positive attitude amongst majority of them who did not consume whole grains at present, and expressed their willingness to include whole grains in their regular diet whilst a significant percentage still remain unchanged. Gibney MJ (2004) reported that if people believe that their diets are already healthy it may be unreasonable to expect them to alter their diets, or to consider nutrition/healthy eating as a highly important factor while choosing their food. Although these consumers have a higher probability of having a healthier diet than those who recognize their diet is in need of improvement, they are still far short of the generally accepted public health nutrition goals. It is also unlikely that these groups will be motivated further by dietary recommendations.

Conclusion

Our study revealed that almost half of the medical students are whole grain consumers, but only a small percentage consumed whole grains every day. Even though there are many factors that influence the food choice, we found a striking influence of ethnic background, cooking skills and method, self-perception to adhere to food groups in the Malaysian food pyramid.

The practice of whole grain consumption was more prevalent among the Chinese, the ones who prepared and had food at home and the ones who believed they adhere to the food groups in Malaysian food pyramid. Other important food determinants such as affordability, accessibility, education, knowledge did not seem to influence whole grain intake. Majority of the Malay students were not whole grain consumers which can be

attributed to the strong cultural and traditional values influenced within the community, even in medical students.

Further, this study highlights and stresses the consistent increase in the status of being underweight among the medical schools over the past decade. Nonetheless, our study would like to put forth a hypothetical fact of consumption of more non-whole grain foods can present with population with underweight BMI, which gives scope to further research.

Finally, dynamic approaches need to be formulated that would encourage the medical students to have regular whole grains in their food and lead a healthier way. In order to achieve this goal, a multi-dimensional and multi-sectoral approach needs to adopted that should involve the

- education system to include whole grains as an important module in nutrition and its basic knowledge and health benefits emphasized not only in college schools but school level as well.
- health system to introduce a unit whose main objective must be to organize campaigns to target groups to encourage them to become whole grain consumers, and
- the mass media to disseminate information to the masses regarding health eating and the significance of whole grains.

However, further studies need to be conducted to investigate in detail the biological, psychological, motivating and hindering factors that influence whole grain consumption among medical students.

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