

Knowledge, attitude and practice regarding dietary fibre intake among Malaysian rural and urban adolescents

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ABSTRACT

Introduction: Awareness of the importance of dietary fibre (DF) in health among adolescents is seldom reported in Malaysia. This study aimed to compare the knowledge, attitude and practice (KAP) of DF intake between Malaysian rural and urban school-going adolescents. Pulau Pangkor in Perak and Damansara in Selangor were randomly selected as rural and urban schools, respectively. **Methods:** A total of 305 school adolescents with a mean age of 13.5 ± 0.6 years were randomly selected from rural (72 Malay, 85 Chinese) and urban (86 Malay, 62 Chinese) schools completed socio-demographic, validated KAP on DF intake questionnaire, as well as a 24-hour dietary recall. **Results:** Adolescents from both areas have moderate knowledge ($54.4 \pm 11.3\%$), positive attitude ($78.7 \pm 13.1\%$) and good practice ($65.8 \pm 19.9\%$) scores towards DF intake. Although rural adolescents had significantly ($p=0.022$) higher DF intake (7.8 ± 3.5 g) compared to urban adolescents (6.9 ± 3.5 g), their DF intake was still lower than the Malaysian recommendation of 20-30 g/day. The attitude of DF intake of rural ($r=0.390$) and urban ($r=0.370$) adolescents showed significant positive correlations with practice score of DF intake. While a significant correlation was found between the practice score and DF intake ($r=0.191$, $p=0.017$), no significant correlation was found between knowledge and attitude scores with DF intake. **Conclusion:** Public health authorities and schools should raise awareness on health benefit of consuming DF to promote an increase in DF consumption among school adolescents.

Keywords: Dietary fibre intake, KAP, rural, urban, school adolescents

INTRODUCTION

Overweight and obesity among children and adolescents have become worse in recent times. Globally, WHO (2016) stated that over 340 million children and adolescents aged 5-19 years were overweight or obese. The prevalence has increased from 4% in 1975 to 18% in 2016 (WHO, 2016). A national survey conducted in the United States revealed that the prevalence of overweight and obesity among American adolescents

aged 12 to 19 years old were 34.5% and 20.5% respectively (Ogden *et al.*, 2014). In Malaysia, the prevalence of overweight and obesity among adolescents aged between 7-13 years old has increased from 5.4% and 6.1% in 2006 to 15.4% and 8.5% respectively in 2014 (Majid *et al.*, 2014). The rise in overweight and obesity rates among adolescents will subsequently increase the risk of serious health problems including diabetes, high blood pressure, heart diseases,

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and breathing difficulties (WHO, 2016). Thus, overweight and obesity prevention during adolescence are crucial to reduce present and future health risks.

Intake of fibre-rich diet has been suggested to reduce the prevalence of obesity. Fibres have the ability to displace the energy from other nutrients by adding bulk and weight to the meal (Dhingra *et al.*, 2012). Likewise, low energy density and glycaemic load in fibre-rich diet appear to affect satiety and satiation that may help in body weight reduction (Papathanasopoulos & Camilleri, 2010). Dietary fibres (DF) often known as non-starch polysaccharides can be found in all plant-derived foods such as vegetables, fruits, whole grains and legumes. Miketinas *et al.* (2017) reported that addition of 10 g of DF into a diet could reduce about 2.2 kg of body weight. Lower body mass index, waist circumference and percentage of overweight or obese were reported among adults (19-50 years) who consumed whole grains more than three servings per day compared to those with lower intake of whole grains (<0.6 servings/day, O'Neil *et al.*, 2010). Fruits and vegetables also have low energy density and glycaemic index, which potentially controls body weight by increasing satiety as well as reducing the energy intake (Berleere & Dauchet, 2017). Epuru, Eideh & Alshammari (2014) stated that risk of obesity was two times lower for subjects with higher intake of vegetable compared to subjects with lower vegetable intake.

However, data on the intake of DF among Malaysian adolescents were scarcely reported. Low intake of DF (2.7±7.6 g/day) was reported among 170 Malay adolescents in Kelantan, Malaysia (Nurul-Fadhilah, Teo & Foo, 2012). A recent study by Ng *et al.* (2016) also revealed that the mean daily intake of DF among Malaysian adolescents (aged 14.8±1.5 years) were still lower than the

recommended DF daily intake (20-30 g/day) (NCCFN, 2017) with a mean of 12.4±5.3 g/day DF. Rapid urbanisation with variety of food sources has changed adolescents current food intake as the adolescents were likely to have poor eating habits by consuming high fat foods, processed food or fast foods, high calorie snacks, excessive intake of calorie, having irregular mealtime, skipping breakfast and eating an unbalanced diet (Nemnunhoi & Sonika, 2016). In addition, the geographical differences are likely to affect the exposure to different food intake among adolescents. In Bangladesh, people from urban areas frequently consumed expensive food items such as meat, fish, egg and milk regularly whereas rural society consumed more calorie-rich foods like rice, potato and vegetables (Sadika, Mohd Isa & Wan Abdul Manan, 2013). Zhang *et al.* (2017) also found that Chinese children (4-17 years) in the urban areas with higher-income families have a significantly higher ($p<0.05$) total energy intake compared to rural children. To date, there is no comparative study being carried out on DF intake between rural and urban areas in Malaysia. Therefore, this study was conducted to determine the knowledge, attitude and practice (KAP) and the DF intake among Malaysian rural and urban school adolescents. The correlations between these factors were also investigated.

MATERIALS AND METHODS

Subjects and study location

This cross-sectional study was conducted among school adolescents who gave their informed consent to participate. The schools were selected based on the urban and rural definition from the Department of Statistics in Malaysia. Sekolah Menengah Kebangsaan Damansara Damai 1 (Damansara, Selangor) was purposively

selected to represent the urban area, while Sekolah Menengah Kebangsaan Pangkor (Pulau Pangkor, Perak) was chosen to represent the rural area. The adolescents were eligible for the study if they were apparently healthy. Adolescents who were under medical treatment and extreme diet plan were excluded from this study. Prior to the start of the study, a written approval was obtained from the Ministry of Education Malaysia, State Education Departments and schools administrators.

The sample size of 305 was calculated according to Godden (2004), $S = Z^2p(1-p)/C^2$ where S is the desired sample, Z represents confidence level, p indicates the percentage of population picking a choice (50%) and C is confidence interval (5%). Assuming 95% of confidence level, the sample size for this study is calculated as $S = (1.96^2)(0.5)(1-0.5)/(0.05^2)$. According to this formula, the actual needed sample size was 384 adolescents. However, only 305 students successfully participated in this study. This was because the school authorities only allowed students from Forms 1, 2 and 4 to participate in this study, thus limiting the number of adolescents involved in this study.

KAP questionnaire

The KAP of adolescents on the importance of DF was assessed using a validated questionnaire. This was performed by pre-testing a set of questionnaire on 30 students of Universiti Kebangsaan Malaysia in Bangi, Selangor. The reliability of the questionnaire was then analysed using Cronbach's Alpha analysis. The results showed that the reliability of the KAP scores were good (Cronbach's $\alpha > 0.07$), in which the Cronbach's α for KAP were 0.733, 0.814 and 0.736, respectively. Then, this questionnaire was used to evaluate the KAP of school adolescents towards the importance of DF intake.

The knowledge and practice domains comprised of seven and 12 multiple choice questions respectively, which consisted of 'yes' and 'no' options. The correct answer was scored as one point and the wrong answer as zero point. A total of 13 questions on attitude towards DF intake were assessed based on a five-point Likert scale consisted of 'strongly disagree', 'disagree', 'neutral', 'agree' and 'strongly agree'. The score for each question was categorised from lowest to the highest score (0 point for negative scale, 1 point for neutral and 2 point for positive scale). The total KAP scores were presented as percentages. Adolescents who scored <40% for the KAP domains were placed in the low category, while for those scoring between 40-80% were categorised as medium, and high category was classified as scores higher than 80%.

DF intake assessment using 24-hour dietary recall

The 24-hour dietary recall was used to investigate daily average DF intake. This method was considered as one of the best self-reported dietary assessment methods available for children and adolescents because of its simplicity in recording food intake compared to food record method for multiple days. During the assessment, a comprehensive list of food model photos and common household measurements (plates, bowls and spoons of different serving size) were used to help adolescents to quantify food items with the assistance of trained interviewers. Each subject was asked to report detailed descriptions as well as amount of serving size for all foods and beverages consumed in the assigned day. DF intake was reported as the mean intake.

Statistical analysis

All statistical analysis was performed using Statistical Package for the Social

Sciences (SPSS) version 20.0 for Windows (SPSS Inc, Chicago, IL, USA). The DF intake was analysed using Dietplan6 (Forestfield Software Ltd, West Sussex, United Kingdom). Data were presented as mean±SD. Independent *t*-test was used to examine the differences of the mean score of KAP towards the importance of DF intake and total DF intake between rural and urban adolescents. Relationship between KAP domains and the DF intake were determined using Pearson correlation. The significance level for all analysis was set at *p*<0.05.

RESULTS

General characteristic of study population

The age range of the subjects was between 13-15 years, with a mean age of 13.5±0.6 years. (Table 1). A total of 148 (73 male, 75 female) were from urban and 157 (62 male, 95 female) were from rural area. Most of the parents of urban adolescents (75.6%) earned between RM1,000-RM3,000 per month. In contrast, the adolescents in rural area came from low-income parents

(<RM1,000) who work as fishermen, hotel workers and a few of them owned small businesses.

Knowledge on DF intake

Overall, the knowledge on the importance of DF intake of school adolescents from both areas was at moderate level, with a mean value of 54.4±11.3% (Table 2). Rural adolescents had significantly (*p*=0.011) higher knowledge level (56.0±11.8%) of DF intake compared to urban adolescents (52.7±10.5%). Based on Table 3, adolescents have good knowledge about food source of DF in which 86.6% of rural and 77.7% of urban adolescents answered correctly that fruits, vegetables and bean products are the source of DF in our diet. More than half of the adolescents knew the role of DF on health in which they have answered ‘correct’ for DF to act as laxative, reduce cholesterol level, prevent colon cancer and obesity. However, only 45.9% of rural and 27.1% of urban adolescents knew that the recommended intake of DF is 20-30 g/day. The majority of the adolescents (70.7% rural and 61.5%

Table 1. Distribution of socio-demographics characteristics of adolescents (n=305)

Characteristics	Total (n=305)		Urban (n=148)		Rural (n=157)	
	n	%	n	%	n	%
Gender						
Male	135	51.5	73	54.1	62	44.1
Female	170	48.5	75	45.9	95	55.9
Ethnic group						
Malay	158	51.8	86	58.1	72	45.9
Chinese	147	48.2	62	41.9	85	54.1
Household income(RM) ^a						
< RM 1000	131	42.9	13	8.8	118	84.2
RM 1000 – RM 3000	149	48.9	112	75.6	37	23.6
RM 3001 – RM 5000	21	6.9	20	13.5	1	0.6
> RM 5000	4	1.3	3	2.0	1	0.6

^a Ringgit Malaysia, RM 1 = 0.25 USD

urban) also did not know that the recommended intake of fruits according to the food pyramid is two serving sizes. A total of 60.5% of rural adolescents answered correctly for three servings of vegetables consumption based on the food pyramid. However, majority of urban adolescents (72.3%) answered the question wrongly (Table 2).

Practices towards DF intake

Generally, the practice towards DF intake was classified as moderate for both areas as the adolescents scored $65.9 \pm 19.9\%$. No significant difference ($p=0.152$) was shown for DF practices from both areas (Table 2). The summary of DF practice of adolescents is presented in Table 3. Adolescents were relatively

Table 2. KAP score (%) towards the importance of DF intake among adolescents

Questionnaire	Percentage scores (Mean±SD)			p value
	Total (n=305)	Urban (n=148)	Rural (n=157)	
Dietary fibre knowledge	54.4±11.3	52.7±10.5	56.0±11.8	0.011*
Dietary fibre attitude	78.7±13.1	75.4±14.9	81.8±10.1	<0.01**
Dietary fibre practice	65.9±19.9	64.2±19.9	67.5±19.9	0.152

Indicates significant difference between urban and rural percentage KAP score, * $p<0.05$, ** $p<0.01$. Significant difference between KAP score determined by independent samples *t*-test.

Attitudes towards DF intake

Table 2 shows that adolescents from both areas scored $78.7 \pm 13.1\%$ for attitude towards importance of DF intake on health. Nevertheless, rural adolescents showed a significantly ($p<0.01$) higher positive attitude ($81.8 \pm 10.1\%$) compared to urban adolescents ($75.4 \pm 14.9\%$). A summary responses of self-reported attitudes related to DF intake is presented in Table 4. Majority of the adolescents from both areas (98.7% rural, 85.8% urban) strongly agreed that eating more fruits and vegetables would make them healthier. They also believed that an adequate DF intake can give a positive impact on health such as preventing constipation and having a healthier-looking skin. However, less than half of them (27.4% rural, 33.1% urban) believed that consumption of DF could prolong the feeling of satiety. In addition, only 36.3% of rural and 46.6% of urban school adolescents personally believed that they could influence people around them to consume fruits and vegetables.

good in consumption practices on DF intake as most of them (59.2% rural and 74.3% urban) consumed vegetables in every meal and high percentages of adolescents (86.6% rural and 69.6% urban) liked to eat salad. In addition, 58.6% of rural and 60.8% of urban adolescents claimed that they included fruits in their daily meals. At the same time, 90.4% of rural and 74.3% of urban adolescents were more likely to eat bean products rather than snacking on junk food. In contrast, more than half of the adolescents (70.7% rural and 61.5% urban) preferred carbonated drinks rather than fruit juices and most of them (61.1% rural and 60.8% urban) were likely to separate the vegetables from their food while having meal. Moreover, most of the adolescents (57.3% rural and 55.4% urban) had chosen nasi lemak or other foods compared to cereals when having breakfast in the morning. In addition to that, 50.3% of rural and 60.8% of urban adolescents preferred white bread compared to whole meal bread. Most of them (61.3% rural and

Table 3. Knowledge and practice towards DF intake adolescents (n=305)

Questions	Urban (n=148)		Rural (n=157)	
	Answer, n (%)			
	Correct	False	Correct	False
Knowledge				
Fruits, vegetables and bean products contain fibre	115 (77.7)	33 (22.3)	136 (86.6)	21 (13.4)
Recommended intake of fibre for adults is 20-30 gram per day	40 (27.0)	108 (73.0)	72 (45.9)	85 (54.1)
Consumption of fruits based on food pyramid is 2 servings	57 (38.5)	91 (61.5)	46 (29.3)	111 (70.7)
Consumption of vegetables based on food pyramid is 3 servings	41 (27.7)	107 (72.3)	95 (60.5)	62 (39.5)
What is the role of fibre to humans?				
<i>Fibre acts as laxative</i>	120 (81.1)	28 (18.9)	139 (88.5)	18 (11.5)
<i>Fibre can reduce sinus disease</i>	64 (43.2)	84 (56.8)	78 (49.7)	79 (50.3)
<i>Fibre can increases body metabolism</i>	45 (30.4)	103 (69.6)	23 (14.6)	134 (85.4)
<i>Fibre can helps in weight reduction</i>	111 (75.0)	37 (25.0)	90 (57.3)	67 (42.7)
<i>Fibre can strengthens teeth and bones</i>	41 (27.7)	107 (72.3)	60 (38.2)	97 (61.8)
<i>Fibre can provides collagen</i>	58 (39.2)	90 (60.8)	45 (28.7)	112 (71.3)
<i>Fibre can increases red blood cells</i>	48 (32.4)	100 (67.6)	53 (33.8)	104 (66.2)
<i>Fibre can reduces cholesterol level</i>	112 (75.7)	36 (24.3)	114 (72.6)	43 (27.4)
<i>Fibre can increases white blood cells</i>	72 (48.6)	76 (51.4)	105 (66.9)	52 (33.1)
<i>Fibre can improves blood circulation</i>	30 (20.3)	118 (79.7)	31 (19.7)	126 (80.3)
In your opinion, which of the following diseases can be prevented by consuming fibre?				
<i>Colon cancer</i>	94 (63.5)	54 (36.5)	120 (76.4)	37 (23.6)
<i>Migraine</i>	96 (64.9)	52 (35.1)	114 (72.6)	43 (27.4)
<i>Obesity</i>	108 (73.0)	40 (27.0)	121 (77.1)	36 (22.9)
<i>Gout</i>	88 (59.5)	80 (40.5)	109 (69.4)	48 (30.6)
<i>Coronary heart disease</i>	87 (58.8)	61 (41.2)	92 (58.6)	65 (41.4)
<i>Diabetes</i>	80 (54.1)	68 (45.9)	87 (55.4)	70 (44.6)
<i>Jaundice</i>	85 (57.4)	63 (42.6)	80 (51.0)	77 (49.0)
<i>Asthma</i>	96 (64.9)	52 (35.1)	109 (69.4)	48 (30.6)
<i>Hypertension</i>	97 (65.5)	51 (34.5)	109 (69.4)	48 (30.6)
<i>Kidney failure</i>	69 (46.6)	79 (53.4)	64 (40.8)	93 (59.2)
Practice				
I eat vegetables every meal.	110 (74.3)	38 (25.7)	93 (59.2)	64 (40.8)
I eat fruits every day.	90 (60.8)	58 (39.2)	92 (58.6)	65 (41.4)
I choose carbonated drinks rather than fruit juices.	91 (61.5)	57 (38.5)	111 (70.7)	46 (29.3)
I will choose snack junk food rather than fruits.	53 (35.8)	95 (64.2)	22 (14.0)	135 (86.0)
I like to eat salads.	103 (69.6)	45 (30.4)	136 (86.6)	21 (13.4)
I will separate the vegetables in my food.	90 (60.8)	58 (39.2)	96 (61.1)	61 (38.9)
I do not like to eat fruits.	48 (32.4)	100 (67.6)	51 (32.5)	106 (67.5)
I prefer to eat beans products rather than snack junk food.	110 (74.3)	38 (25.7)	142 (90.4)	15 (9.6)
I do not like to eat fibre-enriched food because the taste is not delicious.	95 (64.2)	53 (35.8)	99 (63.1)	58 (36.9)
I will eat fibre-enriched supplement every day.	66 (44.6)	82 (55.4)	52 (33.1)	105 (66.9)
I will choose wholemeal bread rather than white bread.	58 (39.2)	90 (60.8)	78 (49.7)	79 (50.3)
I do not like to eat side dishes.	93 (62.8)	55 (37.2)	103 (65.6)	54 (34.4)
I will eat cereals as breakfast rather than nasi lemak and others.	66 (44.6)	82 (55.4)	67 (42.7)	90 (57.3)

Table 4. Attitude towards dietary fibre intake among adolescents (n=305)

Questions	Urban (n=148)			Rural (n=157)		
	Answer choices, n (%)					
	Strongly agree	Do not know	Strongly disagree	Strongly agree	Do not know	Strongly disagree
Eating more fruit and vegetables will make me healthier.	127 (85.8)	14 (9.5)	7 (4.7)	155 (98.7)	2 (1.3)	0 (0.0)
Eating more fast foods and sweet snacks will make me have lighter weight.	14 (9.5)	27 (18.2)	107 (72.3)	12 (7.6)	19 (12.1)	126 (80.3)
Eating more fruits and vegetables will make me feel fresher.	107 (72.3)	28 (18.9)	13 (8.8)	140 (89.2)	15 (9.6)	2 (1.3)
Eating more fruits and vegetables will give me have a healthier skin.	102 (68.9)	33 (22.3)	13 (8.8)	137 (87.3)	16 (10.2)	4 (2.5)
Eating more fruits and vegetables will make me feel not full.	32 (21.6)	52 (35.1)	64 (43.2)	16 (10.2)	57 (36.3)	84 (53.4)
Eating more fruits and vegetables will prevent constipation.	95 (64.2)	46 (31.1)	7 (4.7)	129 (82.2)	21 (13.4)	7 (4.5)
Eating more fast foods, sweet and savoury snacks, and sweet drinks will make me at higher risk of some diseases such as heart disease, diabetes and high blood pressure.	107 (72.3)	29 (19.6)	12 (8.1)	139 (88.5)	9 (5.7)	9 (5.7)
I believe that adequate fibre intake can have a positive impact on health.	101 (68.2)	32 (21.6)	15 (10.1)	142 (90.4)	12 (7.6)	3 (1.9)
I believe that daily fibre intake can increase weight	15 (10.1)	68 (45.9)	65 (43.9)	22 (14.0)	61 (38.9)	74(47.1)
I feel that I can influence the people around me to eat fruits and vegetables.	69 (46.6)	53 (35.8)	26 (17.6)	57 (36.3)	70 (44.6)	30 (19.1)
I feel that daily fibre intake is not important.	9 (6.1)	44 (29.7)	95 (64.2)	13 (8.3)	18 (11.5)	126 (80.3)
I feel that fibre intake will prolong the feeling of satiety.	49 (33.1)	76 (51.4)	23 (15.5)	43 (27.4)	79 (50.3)	35 (22.3)

64.2% urban) reported that they do not like to eat fibre-enriched food because of the unpalatable taste (Table 3 & 4).

DF intake of rural and urban adolescents

Based on the recommended nutrient

intake (RNI) for Malaysia (NCCFN, 2017) and Malaysian Dietary Guidelines (NCCFN, 2010), the recommended DF intake for adolescents is 20-30 g/day. However, the adolescents' intakes of DF reported in this study were lower than the recommendation even though DF

Table 5. Pearson correlation between KAP domains, KAP and DF intake among adolescents in rural and urban areas (n=305)

	Pearson Correlation of KAP					
	Total (n=305)		Urban (n=148)		Rural (n=157)	
	r-value	p-value	r-value	p-value	r-value	p-value
KAP Domains						
Knowledge, attitude	0.133	0.020*	0.127	0.125	0.077	0.339
Knowledge, practice	0.032	0.580	0.099	0.230	-0.046	0.566
Attitude, practice	0.382	<0.001**	0.390	<0.001**	0.370	<0.001**
KAP and DF intake						
Knowledge, DF intake	0.012	0.829	-0.107	0.197	0.076	0.345
Attitude, DF intake	0.025	0.667	-0.043	0.601	0.041	0.614
Practice, DF intake	0.096	0.095	-0.026	0.758	0.191	0.017*

Statistically significant at * $p < 0.05$, ** $p < 0.01$

intake of rural adolescents (7.8 ± 3.5 g/day) was significantly ($p = 0.022$) higher compared to urban adolescents (6.9 ± 3.5 g/day).

Correlation between knowledge, attitude and practice of DF intake

The correlation coefficient between KAP domains are presented in Table 5. Cohen (2013) stated that the strength of correlation between variables can be divided into three categories which are weak ($r = 0.10-0.29$), moderate ($r = 0.30-0.49$) and strong ($r = 0.50-1.00$). With regards to the KAP towards DF, it was found that there was a moderate correlation between the attitude and practice of DF intake among adolescents from urban ($r = 0.390$, $p < 0.001$) and rural ($r = 0.370$, $p < 0.001$) areas. These positive correlations showed that adolescents who personally believed that DF intake can have a positive impact on health will consume high fibre food in their daily consumption. However, the knowledge about DF intake does not affect either the attitudes or practices of adolescents

on importance of DF intake from both areas.

The relationship between KAP and DF intake

Rural adolescents have a significant weak correlation ($r = 0.191$; $p = 0.017$) between the practice score and the DF intake. However, no significant correlation ($p > 0.05$) was found for other parameters (Table 5).

DISCUSSION

In this study, KAP toward the importance of DF intake between urban and rural adolescents was assessed. The results showed that in general, the rural and urban adolescents have moderate knowledge level ($54.4 \pm 11.3\%$). Most of the adolescents were knowledgeable about the source and role of DF in human health including its role as a laxative and assists in the reduction of body weight and cholesterol level. However, they had less knowledge about the recommended intake of DF (20-30

g/day) (NCCFN, 2017) and the serving sizes of fruits and vegetables based on the food pyramid. Rural adolescents ($56.0 \pm 11.8\%$) were significantly ($p=0.011$) more knowledgeable about DF compared to those from urban area ($52.7 \pm 10.5\%$). In contrast, Ahmed et al. (2013) study among Bangladeshi adults (21-30 years) found that the urban respondents had higher knowledge about DF (96%) compared to rural respondents (74%). Adolescents possibly obtained nutritional information from several ways including their teachers, family members and textbooks. Moreover, nowadays the ability to access nutritional information is much easier using internet and 24-hour television regardless of whether people live in urban or rural area. Most of the teenagers spent their time more than three hours daily surfing social websites such as Facebook, Twitter and playing games (Wong *et al.*, 2011). Hence, there are many opportunities and resources for them to access in order to obtain nutritional information.

Nutritional knowledge potentially enables a person to practice healthy eating habits and ensure the welfare and health of the body. Spronk *et al.* (2014) revealed that respondents with higher knowledge of food and its nutrients were positively correlated with their food consumption. However, there were no significant correlations between knowledge of DF towards the attitude ($r=0.093$) as well as practice ($r=-0.049$) in this study. These findings coincide with Florida (2013) which showed that there was no significant correlation ($r=0.177$; $p>0.05$) between nutritional knowledge towards the dietary practices. In addition, Banwat *et al.* (2012) reported that nutritional knowledge alone could not ensure a good practice of healthy eating. The majority of the respondents (92.4%) in the study reported that they have moderate knowledge level on fruits and vegetables intake. However,

only 69.2% of them actually consumed fruits and vegetables in their daily meal (Banwat *et al.*, 2012). Therefore, nutrition education promoting the importance of DF intake should be implemented among adolescents to increase their DF intake. Fruits, vegetables and legumes should be consumed daily as these foods contain high amount of DF. According to food pyramid, adolescents are encouraged to eat at least five servings of vegetables and fruits, which were three servings of vegetables and two servings of fruits per day (NCCFN, 2010).

The adolescents in this study also expressed the importance of DF intake with moderate score of attitude and practice ($78.7 \pm 13.1\%$ and $65.9 \pm 19.9\%$ respectively). These results were expected because of their moderate score on their knowledge. Adolescents with positive attitudes towards DF intake presumably will have good practices in consuming high fibre diet. Both adolescents from urban and rural areas showed positive correlation ($r=0.416$ and $r=0.363$ respectively) between attitude and practice on DF intake. Zhang *et al.* (2013) reported that attitude towards healthy eating ultimately influence on diet practice of an individual. Shaziman *et al.* (2017) also reported that positive attitude significantly ($p=0.006$) influences the dietary practices of an individual. In recent years, the awareness on nutritional aspects and the effects of the food on health has increased among consumers, particularly in adults. The study revealed that DF intake may provide benefits on health among adults. In fact, high intake of DF from fruits, vegetables and cereal fibre or mixtures of whole grains has the potential in controlling body weight, lowering the risk of obesity, cardiovascular disease and type 2 diabetes (Cho *et al.*, 2013).

Geographic differences are likely to affect the exposure to different food intake among adolescents. Mean daily

DF intake of rural adolescents (7.8 ± 3.5 g/day) reported was significantly ($p=0.022$) higher compared to urban adolescents (6.9 ± 3.5 g/day). This might be due to the high availability of plant sources in rural areas (Downs *et al.*, 2012). In contrast, urban adolescents were more exposed to high availability of fast foods, which have less DF content but high in fat. However, this result contradicts with the findings of Downs *et al.* (2012), which demonstrated that urban adolescents in America have high DF intake compared with rural adolescents due to the lower quality of fresh food in rural area. Although DF intake among rural adolescents in this study was higher compared to urban adolescents, the intake was still low with regards to the Malaysian RNI (NCCFN, 2017) and Dietary Guidelines (NCCFN, 2010), which recommend 20-30 g DF per day. Lower practice score of DF intake for urban adolescents in this study may also be affected by the absence of parents at mealtimes as family meal frequency increase the quality of dietary intake among adolescents (Neumark-Sztainer *et al.*, 2010). In addition, adolescents are more likely to eat readily available and prepared food such as fast food and instant noodles. These foods usually contain less DF content and will lead to unhealthy diet. Majority of the adolescents from both areas (60.8% urban and rural 61.1%) in this study claimed that they tend to avoid taking vegetables in their meals. Refusal intake of leafy vegetables was common in childhood and adolescents. Lack of DF intake among adolescents may also be caused by a dislike of the taste of high fibre foods. Most vegetables have a bitter taste because of thiourea and certain compounds that make it unpalatable for

children (Bell & Tepper, 2006). Besides, most high fibre foods are lacking in taste and less preferred in comparison to other snacks (Kamar, Evans & Hugh-Jones, 2016). Thus, the intake of vegetables and fruits should be encouraged from childhood, in order to nurture and create healthy food practices in the future.

There were few limitations identified in this study. This study was only carried out in one school from each urban and rural area due to time and logistic constraints. In addition, the application for authorities' approval to conduct this study has taken considerably longer than expected. The number of adolescents' participation were also limited as the school authorities only allowed subject recruitment within forms 1, 2 and 4 students as students in forms 3 and 5 were preparing for major examinations, the Lower Secondary Evaluation (PMR) and Malaysian Education Certificate (SPM). Hence, the findings cannot be generalised to represent a larger population of adolescents in Malaysia. However, it does provide a view on how the difference in geographical living areas contributes towards the KAP level and DF intake of adolescents.

CONCLUSION

Rural adolescents showed higher DF intake compared to urban adolescents. However, the DF intake of adolescents from both areas was still low compared to the Malaysian dietary recommendation. Therefore, both rural and urban adolescents should be exposed to the benefits and importance of consuming high fibre foods in achieving a good health status.

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Conflict of interest

There was no conflict of interest involved.

Authors' contributions

Norlida MD, principal investigator, conceptualized and designed the study, prepared the draft of the manuscript, reviewed the manuscript; Nor Izati F, conducted the study, data analysis and interpretation; Lam KY, conducted the study, data analysis and interpretation; Ika Aida AM, prepared the draft of the manuscript, data analysis and interpretation and reviewed the manuscript; Noor Fairuzi SY, assisted in drafting of the manuscript, reviewed the manuscript; Arnida Hani T, advised on the data interpretation, reviewed the manuscript; Hafeedza AR, advised on the data interpretation, reviewed the manuscript.

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