

# BREAKFAST CONSUMPTION PATTERNS, KNOWLEDGE, ATTITUDE, PRACTICE AND BARRIERS AMONG MALAYSIAN UNIVERSITY STUDENTS

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## ABSTRACT

Breakfast is the most important meal of the day. However, university students tend to skip breakfast due to their hectic lifestyles. Therefore, the patterns, knowledge, attitude, practice (KAP), and barriers of breakfast consumption were investigated in this study via questionnaires among 396 students of Universiti Kebangsaan Malaysia. Results showed that only 35.9% of students had breakfast between 6 to 7 days per week. Chinese students had a significantly higher ( $p < 0.001$ ) breakfast consumption compared with other groups. These results were consistent with the KAP scores in which Chinese students had the highest scores compared to their counterparts. However, the overall KAP scores were still at moderate levels with significant ( $p < 0.001$ ) positive correlations were found between knowledge and attitude ( $r = 0.421$ ), knowledge and practice ( $r = 0.166$ ), and attitude and practice ( $r = 0.443$ ). Malay students acknowledged the high cost of breakfast as a significant ( $p = 0.03$ ) barrier for breakfast consumption compared to other groups. No significant difference ( $p > 0.05$ ) was shown in other parameters. In conclusion, the frequency of breakfast consumption among the students was still low. The focus should be emphasized on practical strategies to address the barrier and encourage behavioral change for the students.

**Key words:** Attitude, barriers, breakfast consumption, knowledge, practice, university students

## INTRODUCTION

Healthy eating habit is extremely crucial and breakfast has been considered as an important dietary factor for energy regulation. However, according to Pendergast *et al.* (2016), breakfast is more commonly missed compared to other meals. Various studies have reported that skipping breakfast has been linked with the risk of mortality from cardiovascular disease (Chen *et al.*, 2020), cancer (Yokoyama *et al.*, 2016), diabetes (Ballon *et al.*, 2019), and obesity (Ma *et al.*, 2020). For university students, breakfast consumption is associated with a range of positive outcomes, including better academic performance (Javaid, 2020; Pengpid & Peltzer, 2020), vitamins and minerals intake (Sangwantha & Thongprasert, 2019), physical performance (Najwa & Appukutty, 2018) and ideal

body weight (Mansouri *et al.*, 2020). Consistent breakfast consumption is considered a healthy eating habit that will help students in improving their cognitive function (Brandley & Holton, 2020). Pedersen *et al.* (2013) reported that adolescents who had low frequencies of breakfast consumption at the age of 15 years old would still have low breakfast consumption during young adulthood, 19 and 27 years old. Indeed, Pendergast *et al.* (2016) reported that breakfast is the least consumed meal (14-88%) compared to lunch (8-57%) and dinner (4-57%) among people aged between 18 to 30 years old.

More importantly, there is much evidence that shows the relationship between the low frequencies of breakfast consumption with higher body mass index (BMI) (Mathiyalagen *et al.*, 2019; Ma *et al.*, 2020; Mansouri *et al.*, 2020; Wicherski *et al.*, 2021). In addition to weight management, breakfast consumption has also been positively correlated with most micronutrients, including vitamin B<sub>12</sub>, C, D,

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folate, iron, iodine, magnesium, vitamin A, calcium, and dietary fiber, and negatively correlated with dietary fats, sodium and added sugar (Fayet-Moore *et al.*, 2017; Pereira *et al.*, 2018; Ramsay *et al.*, 2018; Gaal *et al.*, 2018). Therefore, individuals who skip breakfast would not be able to have optimal nutrient intake and potentially expose themselves to unhealthy metabolic conditions. Furthermore, skipping breakfast has also been closely associated with unhealthy lifestyles, which include poor food choices and a lack of physical activities among university students (Pengpid & Peltzer, 2020).

University students, particularly first-year students experience significant changes from living under the supervision and care of parents to independent living on their own. In addition, to adapt to an independent life, they are also searching for self-reliance, including finding the dietary lifestyle that fits them (Das & Evans, 2014). Thus, students are more likely to practice unhealthy eating habits (Tok *et al.*, 2018; Bede *et al.*, 2020). A study conducted among Italian university students showed that students who lived with their parents had a healthy diet and more exercise than students who lived alone (Lupi *et al.*, 2015). Many factors influence breakfast consumption among university students. However, lack of time to prepare or eat breakfast has been identified as the primary factor (Pendergast *et al.*, 2016; Awang Damit *et al.*, 2019; Chawla *et al.*, 2019; Javaid, 2020). Additionally, lack of appetite, not hungry and weight control were few of the reasons of breakfast skipping (Pendergast *et al.*, 2016; Chawla *et al.*, 2019; Javaid, 2020).

To date, a few studies have investigated the role of breakfast consumption on academic performance (Chawla *et al.*, 2019), its association with snacking behavior (Isa & Masuri, 2011), and BMI (Isa & Masuri, 2011; Sundaram *et al.*, 2018), and breakfast skipping and its associated factors (Moy *et al.*, 2009) among Malaysian university students. However, no studies have looked into the knowledge, attitude, practice (KAP), and barriers of breakfast consumption among them. Assessment of these parameters is needed as it would help to identify gaps in KAP between the races and evaluate information between what is said (from knowledge and attitudes) and what is done (practice). Possible factors and reasons for their attitudes towards breakfast consumption can also be determined. In the future, this information can be used to design specific interventional strategies in increasing awareness and optimizing breakfast consumption tailored to the needs of Malaysian university students. Therefore, this study was conducted to determine the breakfast consumption patterns, KAP, and barriers for students to optimize their breakfast consumption.

## MATERIALS AND METHODS

### Subject selection and sampling procedure

This cross-sectional study was conducted among 396 students of Universiti Kebangsaan Malaysia (UKM), Bangi, Selangor, Malaysia, comprised of 132 Malay, Chinese, and Indian, respectively. The population size was based on the 2017 UKM student population of 22540 people. The sampling size was calculated according to the formula by Krejcie and Morgan (1970),  $n = [(X^2)(N)(P)(1-P) / (d^2)(N-1)] + [(X^2)(P)(1-P)]$  in which  $n$  is the required sample,  $X^2$  is table value of chi-square for 1 *df* at the desired confidence level,  $N$  represents the population size,  $P$  indicates the population proportion (50%) and  $d$  is the level of accuracy of the estimate expressed as a proportion. Assuming 95% of confidence level, the sample size for this study was calculated as  $n = [(3.841)(25525)(0.5)(1-0.5)] / [(0.05^2)(25525-1) + (3.841)(0.5)(1-0.5)]$ . After the consideration of 10% dropout cases, the total sample size needed for this study was 396 students. Students were selected through a convenience sampling method from all faculties (eight) in the Bangi campus. Data collection was carried out between June to December 2018.

### Questionnaires and data collection

The self-administrated questionnaire comprised of 4 sections, including sociodemographic, breakfast consumption patterns, KAP, and barriers related to breakfast consumption. The KAP questionnaire was pre-tested among 30 students and validated using the Cronbach alpha test before the start of the study to evaluate the effectiveness and suitability of the questionnaire. The classification of Cronbach alpha is low (<0.60), acceptable (between 0.60 - 0.80), and good (>0.80) (George & Mallery, 2003). The pre-test result showed that the Cronbach alphas for KAP were in the acceptable range of 0.722, 0.705, and 0.784, respectively. There were 13 (K), 10 (A), and 11 (P) questions respectively. For (K) section, 2, 1, and 0 marks were given if correct, not sure and wrong answers, respectively whilst questions for (A) and (P) sections were given 4 marks for the most ideal attitude and practice and 0 marks for unideal attitude and practice behaviors. The total scores in each category were scored and categorized based on Perumal *et al.* (2013) (<40% = low, 40-80% = moderate & > 80% = high). Breakfast barriers were assessed based on how strongly disagree or agree using a Likert scale of 1 to 4 (strongly disagree = 1, strongly agree = 4). The Cronbach's alpha for the scale was 0.771. Questionnaires were adapted from Hearst *et al.* (2016).

Height and weight were measured to the nearest 0.1 cm and 0.1 kg using a measuring tape body meter (SECA, Hamburg, Germany) and portable mechanical lithium scale HD-312 (Tanita Corp., Tokyo, Japan). BMI was calculated based on the World Health Organisation (WHO) classification (WHO 1995).

### Data analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 21.0 (SPSS Incorporation, Chicago, IL, USA) and expressed as mean  $\pm$  standard deviation (SD), frequency, and percentage. Before the analysis, the distribution of the data was checked using the Kolmogorov-Smirnov test. Only parametric tests were used in the analysis as all data were normally distributed. Chi-square test was used to compare the frequency of breakfast consumption and analysis of KAP questionnaires whilst one-way analysis of variance was used to compare the means of KAP and barriers scores of breakfast consumption. Pearson correlation was used to determine the relationship between KAP variables. The significant level was considered at  $p < 0.05$  and  $p < 0.001$ .

## RESULTS AND DISCUSSION

### Sociodemographic characteristics of the subjects

In general, a total of 198 male and female subjects (66 males and females in each race) were involved in this study. They were aged between 21 to 23 years old. The mean age of subjects was  $21.1 \pm 1.6$  years and no significant difference ( $p > 0.05$ ) was found between the races. The students of this study had normal BMI,  $20.0 \pm 4.5$  kg/m<sup>2</sup>. However, Chinese students ( $21.4 \pm 3.4$  kg/m<sup>2</sup>) had significantly lower ( $p = 0.01$ ) BMI than Indian ( $22.1 \pm 3.9$  kg/m<sup>2</sup>) and Malay students ( $23.0 \pm 5.7$  kg/m<sup>2</sup>). A similar trend whereby the BMI of Chinese students was the lowest compared to their counterparts was also reported elsewhere (Yap *et al.*, 2019; Yahya *et al.*, 2021). Most of the subjects were in the first year of their studies (40.2%) and a majority of them were single (99.5%). On average, most of the students (50%) spent only RM5 to RM10 (RM 1 = USD 0.24 [24 May 2021]) daily on foods as just over half of the students (58.8%) had a monthly allowance of below RM500, which usually financed from scholarship/bursary/loan or parents/guardians.

**Table 1.** Sociodemographic characteristics of the subjects

Characteristics	Overall (n=396)	Malay (n=132)	Chinese (n=132)	Indian (n=132)
Gender				
Males	198 (50)	66 (50)	66 (50)	66 (50)
Females	198 (50)	66 (50)	66 (50)	66 (50)
Age groups				
18 – 20 years	166 (41.9)	68 (51.5)	54 (40.9)	44 (33.3)
21 – 23 years	193 (48.7)	44 (33.3)	69 (52.3)	80 (30.6)
24 – 26 years	37 (9.3)	20 (15.2)	9 (6.8)	8 (6.1)
Average age (years)	21.1 $\pm$ 1.6	21.1 $\pm$ 1.9	21.0 $\pm$ 1.5	21.0 $\pm$ 1.5
Body mass index classification				
Underweight (< 18.5 kg/m <sup>2</sup> )	24 (17.9)	23 (17.4)	27 (20.5)	21 (15.9)
Normal (18.5 – 24.9 kg/m <sup>2</sup> )	80 (60.4)	72 (54.5)	86 (65.2)	81 (61.4)
Overweight (25.0 – 29.9 kg/m <sup>2</sup> )	21 (15.7)	23 (17.4)	16 (12.1)	23 (17.4)
Obese (> 30.0 kg/m <sup>2</sup> )	8 (6.1)	14 (10.6)	3 (2.3)	7 (5.3)
Average body mass index (kg/m <sup>2</sup> )	20.0 $\pm$ 4.5	23.0 $\pm$ 5.7	21.4 $\pm$ 3.4	22.1 $\pm$ 3.9
The academic year of study				
Year 1	159 (40.2)	66 (50.0)	60 (45.5)	33 (25.0)
Year 2	129 (32.6)	40 (30.3)	54 (40.9)	35 (26.5)
Year 3	96 (24.2)	23 (17.4)	18 (13.6)	55 (41.7)
Year 4	12 (3.0)	3 (2.3)	–	9 (6.8)
Marital status				
Single	394 (99.5)	130	132	132
Married	2 (0.5)	2	–	–
The daily budget on foods (Ringgit Malaysia)				
RM5 – RM10	198 (50.0)	92 (69.7)	48 (36.4)	58 (43.9)
RM10 – RM15	166 (41.9)	36 (27.3)	68 (51.5)	62 (47.0)
More than RM15	32 (8.1)	4 (3.0)	16 (12.1)	12 (9.1)
Monthly allowance (Ringgit Malaysia)				
< RM500	233 (58.8)	92 (69.7)	76 (57.6)	65 (49.2)
RM500 – RM1000	122 (30.8)	29 (22.0)	43 (32.6)	50 (37.9)
> RM1000	41 (10.4)	11 (8.3)	13 (9.8)	17 (12.9)

Data are expressed as number (percentage), *n* (%), and mean  $\pm$  standard deviation.

### Breakfast consumption habits of the subjects

The breakfast consumption habits are presented in Table 2. Overall, more than half of the sample population (68.2%) took breakfast in a week. Previous studies reported that the frequencies of breakfast consumption among Malaysian university students were 59.7% in Kutty *et al.* (2015), 62% in Chawla *et al.* (2019), 70.8% in Moy *et al.* (2009), and 73.6% in Isa and Masuri (2011). Our data seems to fit the trend too. Globally, a wide range of breakfast consumption patterns was reported among university students, ranging from 48.1% to 87.6% (Javaid, 2020). When compared between the races, the consumption was higher among Chinese (75.8%) compared to Malay (63.6%) and Indian students (65.2%) but no significant difference ( $p>0.05$ ) was demonstrated. Additionally, Chinese students also had significantly higher ( $p<0.05$ ) breakfast frequencies (between 6-7 times per week) (50%) compared to their counterparts. By our findings, Moy *et al.* (2009) also reported that Chinese undergraduate students had the highest breakfast consumption (81.7%) compared to other groups (Malay = 65.7%, Indian = 70%). The fact that Malay and Indian had lower breakfast consumption than Chinese is a matter of concern as they were the main groups that related with higher cases of obesity and diabetes type 2 in Malaysia (National Health & Morbidity Survey, 2019), health

conditions that have been reported with breakfast skipping in many studies (Ballon *et al.*, 2019; Ma *et al.*, 2020). Therefore, it is important to understand the underlying factors for both groups to skip breakfast consumption.

When categorized into the timeframe, subjects generally had their breakfast between 8.00 to 10.00 am (64.4%) whilst the very least of them (10.4%) had breakfast before 8.00 am. Contradictory, 58.5% of undergraduate students in a study reported by Cebirbay *et al.* (2011) took breakfast between 6.00 to 8.00 am. Our study also found that 25.3% of the subjects took their breakfast after 10.00 am. It might be possible that this group of students took their breakfast only after they had their early morning class. Delaying breakfast time could result in delaying lunch and dinner times, an eating pattern known as “eating jet lag”. This eating behavior has been demonstrated to have an association with weight gain, in which the longer eating jet lag, the higher chances a person to gain weight (Zeron-Ruggerio *et al.*, 2019). People need to be educated to eat at a similar time daily as misalignment of mealtime could affect our peripheral clocks, one of the main components that regulate our circadian rhythms (Moreno *et al.*, 2019), this leads to disruption of metabolic process in our body, one of which is body weight regulation.

**Table 2.** Breakfast consumption patterns of the subjects

Variables	Total, n (%)				p-value
	Overall (n=396)	Malay (n=132)	Chinese (n=132)	Indian (n=132)	
Are you a breakfast consumer?					
Yes	270 (68.2)	84 (63.6)	100 (75.8)	86 (65.2)	–
No	126 (31.8)	48 (36.4)	32 (24.2)	46 (34.8)	–
Frequency of breakfast consumption in a week					
0 - 1 time	27 (6.8)	8 (6.1)	6 (4.5)	13 (9.8)	0.212
2 - 3 times	116 (29.3)	48 (36.4)	30 (22.7)	38 (28.8)	0.050
4 - 5 times	111 (28.0)	38 (28.8)	30 (22.7)	43 (32.6)	0.199
6 - 7 times	142 (35.9)	38 (28.8) <sup>a</sup>	66 (50.0) <sup>a</sup>	38 (28.8) <sup>a</sup>	<0.001**
Time taking breakfast					
Before 8.00 am	41 (10.4)	9 (6.8)	22 (16.7)	10 (7.6)	–
8.00 to 10.00 am	255 (64.4)	91 (68.9)	88 (66.7)	76 (57.6)	–
After 10.00 am	100 (25.3)	32 (24.2)	22 (16.7)	46 (34.8)	–
Amount spent on breakfast (Ringgit Malaysia)					
Less than RM2	131 (33.1)	45 (34.1)	38 (28.8)	48 (36.4)	–
RM2 - RM5	220 (55.6)	74 (56.1)	80 (60.6)	55 (50.0)	–
RM5 - RM8	36 (9.1)	10 (7.6)	11 (8.3)	15 (11.4)	–
RM8 and more	9 (2.3)	3 (2.3)	3 (2.3)	3 (2.3)	–
The place to take breakfast					
Cafeteria in college / faculty	260 (65.7)	88 (33.8)	76 (29.2)	96(36.9)	–
Restaurant / food stall	80 (20.2)	27 (33.8)	31 (38.8)	22 (27.5)	–
Fast food restaurant	13 (3.3)	3 (23.1)	4 (30.8)	6 (46.2)	–
Home / Hostel	205 (51.8)	72 (35.1)	90 (43.9)	43 (21.0)	–
With whom having breakfast					
With friends	149 (37.6)	64 (48.5)	33 (25.0)	52 (39.4)	–
Alone	247 (62.4)	68 (51.5)	99 (75.0)	80 (60.6)	–

<sup>a</sup>bSignificant difference between ethnic groups at \*\* $p<0.001$ , tested using Chi-square test.

**Table 3.** Knowledge, attitude, and practice scores of the breakfast consumption

Variables	Means $\pm$ standard deviation (%)				p-value
	Overall (n=396)	Malay (n=132)	Chinese (n=132)	Indian (n=132)	
Knowledge	64.2 $\pm$ 21.1	63.5 $\pm$ 22.0	67.6 $\pm$ 18.8	61.7 $\pm$ 21.1	0.06
Attitude	68.8 $\pm$ 10.5	67.2 $\pm$ 11.4	69.9 $\pm$ 9.6	69.4 $\pm$ 10.4	0.08
Practice	51.1 $\pm$ 23.1	44.7 $\pm$ 23.0 <sup>a</sup>	57.2 $\pm$ 23.1 <sup>b</sup>	51.4 $\pm$ 21.9 <sup>ab</sup>	<0.001**

<sup>a,b</sup>Different alphabet in the same column shows a significant difference between ethnic groups at \*\* $p < 0.001$ , tested using analysis of variance.

Most of the subjects (55.6%) spent between RM2 to RM5 for breakfast, which suggested that breakfast was generally purchased and seldomly self-catered at their residence (51.8%). In general, the amount spent on breakfast can be considered affordable for students compared to the breakfast price outside of the university. Indeed, more than half of the subjects (65.7%) reported that they usually had their breakfast at college or faculty cafeterias than other eateries. Subjects of this study also reported that they usually had their breakfast on their own (62.4%) than with friends (37.6%). This is because students need to rush in the morning and have different classes to attend, therefore having breakfast on their own seems to be more convenient. However, Chin and Mohd Nasir (2009) suggested that individuals who eat alone tend to skip meals. In contrast, students in this study would not mind eating breakfast alone as 66.5% disagreed with the statement “I think that I would not eating breakfast if I am alone” (KAP attitude question). No significant difference ( $p > 0.05$ ) between races was seen.

### Knowledge, attitude, and practice scores and correlations

Overall, KAP scores were at moderate levels (Table 3). However, the practice score (51.1  $\pm$  23.1) was the lowest compared to attitude (68.8  $\pm$  10.5) and knowledge (64.2  $\pm$  21.1) scores. This means that students had good knowledge and positive attitudes towards optimal breakfast consumption, but still unable and not as good as their attitudes to consuming breakfast accordingly. Comparison between groups demonstrated that Chinese students had the highest KAP scores compared to other races. However, only practice scores (57.2  $\pm$  23.1) were significant ( $p < 0.001$ ) when compared with Malay (44.7  $\pm$  23.0), but not with Indian (51.4  $\pm$  21.9). This finding has mirrored the analysis of breakfast habits among the groups in which the Chinese had the highest breakfast consumption followed by Indian and Malay.

There was a positive significant correlation ( $p < 0.001$ ) between KAP variables. Similar findings were also shown by Sukkrachang (2017) in which a significant positive correlation was demonstrated between KAP variables of breakfast consumption

behaviors among primary school children in Songkhla, Thailand. Alves and Precioso (2020) also found a significant correlation between the variables in their study on healthy diet among university students in Portugal. In our study, the correlation between attitude and practice was found to be the highest ( $r = 0.443$ ;  $p < 0.01$ ) compared to knowledge and attitude ( $r = 0.421$ ;  $p < 0.01$ ) and knowledge and practice ( $r = 0.166$ ;  $p = 0.001$ ). This means that knowledge, positive attitudes, and belief on the benefits of breakfast on health would increase the frequency of breakfast consumption. Contradictory, people with negative attitudes would not necessarily increase their breakfast consumption although they have good knowledge of it (Sukkachang, 2017).

### Analysis of knowledge, attitude and practice questionnaires

Analysis of knowledge questionnaires (Table 4) showed that there were significant differences for statements; “breakfast provides numerous vitamins and minerals for our body” ( $p = 0.006$ ), “high-fiber breakfasts help me to feel full for longer” ( $p = 0.006$ ), and “eating breakfast will lead to a consumption of unhealthy snacks” ( $p = 0.002$ ). Generally, between 52.5% to 81.6% of students able to answer correctly all questions, which means students did have a basic and good knowledge about the importance of breakfast on health.

In the attitude questionnaire analysis section, questions of “I think it is difficult to get well-balanced nutritious food for breakfast in the university” and “I think university cafeteria sell similar and typical food for breakfast” were significantly different ( $p = 0.020$  and  $p = 0.022$ , respectively). This would mean that students are looking for a variety of foods as usually university cafeteria only provides typical Malaysian breakfast such as nasi lemak, nasi goreng, roti canai, and others. As we know, these types of foods commonly lack vegetables, contain high carbohydrates and low dietary fiber (Tarmizi *et al.*, 2020). Therefore, caterers of university cafeterias need to be educated on the importance of providing healthy foods among the students and subsequently trained them to create healthy food choice sections in their cafeterias. Foods such as soups, cereals, sandwiches, vegetables, and fruits can be added to

this section to increase variability and availability of healthy food choices not just for students, but also for staff working on campus.

In the analysis, the question of “I skip breakfast to save money” ( $p < 0.001$ ) was also found to be highly rated by Malay students compared to Chinese and Indian students. A similar trend was also seen for the statement “I skip breakfast because I am lacking money” ( $p < 0.001$ ) in practice and “high cost of breakfast” ( $p = 0.03$ ) in the barrier analysis section. These analyses could be related to the financial status of the subjects. In this study, 69.7% of Malay students reported that their monthly allowance was less than RM500 per month compared to 57.6% Chinese and 49.2% Indian. In Malaysia, university students generally received scholarships or study loans throughout their study period. However, they are students who have not received any kind of sponsorship and depend on parents’ supports, or received a scholarship but still need parents’ support (Wan Azdie *et al.*, 2019). Regrettably, as the information of the source of allowance was not investigated in this study, therefore the linkage between the allowance and its financial source cannot be verified. It is presumed that the students have saved up money for study purposes and other living expenses. These students could experience food insecurity if they had financial affordability problems during their studies. Wan Azdie *et al.* (2019) reported that 54.4% of university students had food insecurity problems and the problem was related to factors including time constraints, use of money on books, miscellaneous items, parents’ income, and scholarship type. Therefore, it is suggested that the relevant authorities including the student association could address this issue, perhaps one of the many ways, implementing a free food bank for the needed students.

In the analysis of practice questionnaires, significant differences were demonstrated for the questions of “I always take cereals for breakfast compared to local foods” (e.g. Nasi lemak) ( $p = 0.045$ ), “I substitute breakfast with snacking” ( $p < 0.001$ ), “I will have brunch if I did not have breakfast before 10.00 am” ( $p < 0.001$ ), “I only eat breakfast if I am at my parents’ home compared to in the campus” ( $p = 0.002$ ), “I only take breakfast if I am hungry” ( $p < 0.001$ ), “I skip breakfast if my class starts at 8.00 am” ( $p = 0.001$ ) and “I skip breakfast because I am lack of money” ( $p < 0.001$ ). From the analysis, about 50% of Malay and Indian students rated agreed to take cereals for breakfast than common Malaysian breakfast. Therefore, it is strongly suggested that university food caterers could also sell these foods in their cafeterias to give more breakfast choices to students. The most apparent analysis was 80.3% of Malay agreed that they would go for brunch if they do not have breakfast before 10.00 am compared to

their peers (Chinese: 53.8%, Indian: 65.9%). Similarly, they also rated high scores for taking breakfast only if they are hungry (Malay: 61.4%, Chinese: 31.8%, and Indian: 55.3%). In contrast, Indian students tended to skip breakfast (63.6%) for 8.00 am class (Malay: 56.1%, Chinese: 45.4%). These results demonstrated that these students need to be educated about healthy eating behavior particularly among first-year students who are still in the adapting process with university life. In this study, 40% of them were first-year students. Introducing Malaysian Dietary guidelines to students, adding an elective course in the university curriculum and effective awareness campaigns on healthy eating behavior and healthier food choice are some of the mechanisms that could be implemented to promote changes among them.

Table 5 shows the scores of barriers to breakfast consumption among subjects. The mean total score of  $25.55 \pm 4.35$  indicated that students acknowledged the barriers as moderate (total marks: 40). No significant difference ( $p > 0.05$ ) between the groups was found. Analysis of the barrier to breakfast consumption showed that “class started very early in the morning”, “limited choice of breakfast” and “not enough time were the most popular reasons that caused students to skip their breakfast. Awang Damit *et al.* (2019) also postulated that early morning class could be the reason that subjects in their study had no time for breakfast. The authors also suggested that classes during this hour should have a short break to allow students to have their breakfast. In UKM, most of the classes start at 9.00 am. However, students possibly prioritized their time to get ready to dress and get a transport to go to the class rather than eating breakfast particularly when they are rushing. Lack of time was consistently reported as a barrier to breakfast consumption in numerous studies among university students and young adults (Pendergast *et al.*, 2016; Javaid, 2020). Additionally, Malay students had significantly higher ( $p = 0.03$ ) scores ( $2.52 \pm 0.94$ ) compared with Chinese ( $2.27 \pm 0.83$ ) and Indian students ( $2.27 \pm 0.92$ ) on the reason of “high cost of breakfast”. In addition, the “breakfast will cause obesity” statement had the lowest overall score ( $1.62 \pm 0.68$ ). This means that students did aware that consumption of breakfast would not lead to obesity. Other studies also showed that obesity is not a reason university students skipped breakfast (Pendergast *et al.*, 2016; Javaid, 2020). The statements of “lack of food availability in UKM” and “lack of food choices in UKM” were also agreed by many students. Indeed, environmental factors such as food availability, food types, and breakfast places were reported to affect breakfast consumption among university students ( $p < 0.01$ ) (Mat Ludin *et al.*, 2016).

**Table 4.** Analysis of knowledge, attitude, and practice questionnaires of breakfast consumption among subjects

Variables	Total, <i>n</i> (%)				<i>p</i> -value
	Overall ( <i>n</i> =396)	Malay ( <i>n</i> =132)	Chinese ( <i>n</i> =132)	Indian ( <i>n</i> =132)	
<b>Knowledge</b>					
Breakfast consumption will increase calorie intake in the next meal					
Not sure	129 (32.6)	49 (37.1)	31 (23.5)	49 (31.7)	0.058
False	221 (55.8)	65 (49.2)	86 (65.1)	70 (53.0)	
True	46 (11.6)	18 (13.6)	15 (11.4)	13 (9.8)	
Breakfast provides numerous vitamins and minerals for our body					
Not sure	77 (19.4)	37 (28.0)	14 (10.6)	26 (19.7)	0.006*
False	24 (6.1)	9 (6.8)	6 (4.5)	9 (6.8)	
True	295 (74.5)	86 (65.1)	112 (84.5)	97 (73.5)	
High-fiber breakfasts help me to feel full for longer					
Not sure	79 (19.2)	26 (19.7)	19 (14.4)	34 (25.8)	0.006*
False	61 (15.4)	30 (22.7)	19 (14.4)	12 (9.1)	
True	256 (64.6)	76 (57.6)	94 (71.2)	86 (65.1)	
Eating breakfast helps students to concentrate and retain new information in class					
Not sure	46 (11.6)	17 (12.9)	16 (12.1)	13 (9.8)	0.116
False	32 (8.7)	14 (10.6)	4 (3.3)	14 (10.6)	
True	318 (80.3)	101 (76.5)	112 (84.8)	105 (79.5)	
Eating breakfast will lead to a consumption of unhealthy snacks					
Not sure	66 (16.7)	31 (2.6)	11 (8.3)	24 (18.2)	0.002*
False	281 (71.0)	88 (66.7)	108 (81.8)	85 (64.4)	
True	49 (12.4)	13 (9.8)	13 (9.8)	23 (17.4)	
Breakfast that high in fiber and protein, but low in fats and sugars can reduce concentration levels during the learning process					
Not sure	59 (16.0)	24 (18.2)	22 (16.7)	13 (9.8)	0.201
False	233 (58.8)	79 (59.8)	71 (53.8)	83 (62.9)	
True	104 (26.3)	29 (22.0)	39 (29.5)	36 (27.3)	
Regular consumption of a healthy breakfast will help to reduce body weight					
Not sure	146 (36.9)	39 (29.5)	52 (39.4)	55 (41.7)	0.092
False	42 (10.6)	11 (8.3)	14 (10.6)	17 (12.9)	
True	208 (52.5)	82 (62.1)	66 (50.0)	60 (45.5)	
Risks of heart diseases can be reduced by eating high energy and fibrous breakfast					
Not sure	96 (24.2)	32 (24.2)	32 (24.2)	32 (24.2)	0.911
False	29 (7.3)	12 (9.1)	8 (6.1)	9 (6.8)	
True	271 (68.4)	88 (66.7)	92 (69.7)	91 (68.9)	
The best time to have breakfast is between 6.00 to 10.00 in the morning					
Not sure	65 (16.4)	20 (15.2)	23 (17.4)	22 (16.7)	0.077
False	28 (7.1)	5 (3.8)	7 (5.3)	16 (12.1)	
True	303 (76.5)	102 (77.3)	102 (77.3)	94 (71.2)	
Breakfast will increase the consumption of food high in fat such as fried foods					
Not sure	75 (18.9)	30 (22.7)	22 (16.7)	23 (17.4)	0.345
False	256 (64.6)	80 (60.6)	93 (70.5)	83 (62.9)	
True	65 (16.4)	22 (16.7)	17 (12.9)	26 (19.7)	
Breakfast provides glucose as a fuel to our brain to function properly after a long overnight fasting					
Not sure	109 (27.5)	43 (32.6)	29 (22.0)	37 (28.0)	0.403
False	33 (8.3)	9 (6.8)	12 (9.1)	12 (9.1)	
True	254 (64.1)	80 (60.6)	91 (68.9)	83 (62.9)	
Eating breakfast helps to have a good mood and improve students' academic performance					
Not sure	49 (12.4)	15 (11.4)	16 (12.1)	18 (13.6)	0.903
False	24 (6.1)	9 (6.8)	9 (6.8)	6 (4.5)	
True	323 (81.6)	108 (81.8)	107 (81.1)	108 (81.8)	
Breakfast that high in fiber will helps indigestion					
Not sure	90 (22.7)	31 (23.5)	25 (18.9)	34 (25.8)	0.555
False	21 (5.3)	6 (4.5)	6 (4.5)	6 (4.5)	
True	285 (72.0)	95 (72.0)	101 (76.5)	89 (67.4)	
<b>Attitudes</b>					
I believe breakfast intake helps to maintain a healthy body					
Strongly disagree	16 (4.0)	7 (5.3)	3 (2.3)	6 (4.5)	0.679
Disagree	7 (1.8)	2 (1.5)	2 (1.5)	3 (2.3)	
Not sure	24 (6.1)	7 (5.3)	6 (4.5)	11 (8.3)	
Agree	191 (48.2)	68 (51.5)	67 (50.8)	56 (42.4)	
Strongly agree	158 (39.9)	48 (36.4)	54 (40.9)	56 (42.4)	

Table 1 continued...

I believe breakfast intake will increase the absorption of vitamins and minerals					
Strongly disagree	5 (1.3)	3 (2.3)	1 (0.8)	1 (0.8)	0.801
Disagree	9 (2.3)	3 (2.3)	3 (2.3)	3 (2.3)	
Not sure	64 (16.2)	22 (16.7)	18 (13.6)	24 (18.2)	
Agree	185 (46.7)	62 (47.0)	68 (51.5)	55 (41.7)	
Strongly agree	133 (33.6)	42 (31.8)	42 (31.8)	49 (37.1)	
I think breakfast intake will help me to meet my daily total dietary fiber intake					
Strongly disagree	6 (1.5)	4 (3.0)	1 (0.8)	1 (0.8)	0.672
Disagree	22 (5.6)	8 (6.1)	7 (5.3)	7 (5.3)	
Not sure	117 (29.5)	40 (30.3)	41 (31.1)	36 (27.3)	
Agree	151 (38.1)	46 (34.8)	55 (41.7)	50 (37.9)	
Strongly agree	100 (25.3)	34 (25.8)	28 (21.2)	38 (28.8)	
I believe that breakfast intake helps to reduce the risk of heart disease, diabetes, and high blood pressure					
Strongly disagree	9 (2.3)	3 (2.3)	1 (0.8)	5 (3.8)	0.645
Disagree	25 (6.3)	10 (7.6)	9 (6.8)	6 (4.5)	
Not sure	106 (26.8)	30 (22.7)	41 (31.1)	35 (26.5)	
Agree	156 (39.4)	53 (40.1)	51 (38.6)	52 (39.4)	
Strongly agree	100 (25.3)	36 (27.3)	30 (22.7)	34 (25.8)	
I believe that I will be more focused during studying if I consume breakfast					
Strongly disagree	2 (0.5)	1 (0.8)	0 (0.0)	1 (0.8)	0.67
Disagree	16 (4.0)	7 (5.3)	6 (4.5)	3 (2.3)	
Not sure	50 (12.6)	19 (14.4)	18 (13.6)	13 (9.8)	
Agree	180 (45.5)	60 (45.5)	62 (47.0)	58 (43.9)	
Strongly agree	148 (37.4)	45 (34.1)	46 (34.8)	57 (43.2)	
I prioritize my morning classes over-consuming breakfast					
Strongly disagree	36 (9.1)	12 (9.1)	11 (8.3)	13 (9.8)	0.819
Disagree	115 (29.0)	35 (26.5)	43 (32.6)	37 (28.0)	
Not sure	65 (16.4)	22 (16.7)	22 (16.7)	21 (15.9)	
Agree	121 (30.6)	38 (28.8)	42 (31.8)	41 (31.1)	
Strongly agree	59 (14.9)	25 (18.9)	14 (10.6)	20 (15.2)	
I think it is difficult to get well-balanced nutritious food for breakfast in the university					
Strongly disagree	43 (10.9)	23 (17.4)	4 (3.0)	16 (12.1)	0.020*
Disagree	122 (30.8)	41 (31.1)	40 (30.3)	41 (31.1)	
Not sure	79 (19.2)	23 (17.4)	33 (25)	23 (17.4)	
Agree	107 (27.0)	30 (22.7)	37 (28.0)	40 (30.3)	
Strongly agree	45 (11.4)	15 (11.4)	18 (13.6)	12 (9.1)	
I think that I would not eating breakfast if I am alone					
Strongly disagree	118 (29.8)	35 (26.5)	49 (37.1)	34 (25.8)	0.152
Disagree	146 (36.9)	52 (39.4)	47 (35.6)	47 (35.6)	
Not sure	55 (13.9)	14 (10.6)	17 (12.9)	24 (18.2)	
Agree	58 (14.6)	22 (16.7)	17 (12.9)	19 (14.4)	
Strongly agree	19 (4.8)	9 (6.8)	2 (1.5)	8 (6.1)	
I skip breakfast to save money					
Strongly disagree	98 (24.7)	22 (16.7)	39 (29.5)	37 (28.0)	<0.001**
Disagree	125 (31.6)	24 (18.2)	52 (39.4)	49 (37.1)	
Not sure	58 (14.6)	25 (18.9)	17 (12.9)	16 (12.1)	
Agree	84 (21.2)	41 (31.1)	19 (14.4)	24 (18.2)	
Strongly agree	31 (7.8)	20 (15.2)	5 (3.8)	6 (4.5)	
I think the university cafeteria sells similar and common Malaysian foods for breakfast					
Strongly disagree	32 (8.1)	14 (10.6)	10 (7.6)	8 (6.1)	0.022*
Disagree	43 (10.9)	12 (9.1)	14 (10.6)	17 (12.9)	
Not sure	66 (16.7)	17 (12.9)	28 (21.2)	21 (15.9)	
Agree	145 (36.6)	38 (28.8)	54 (40.0)	53 (40.1)	
Strongly agree	110 (27.8)	51 (38.6)	26 (19.7)	33 (25.0)	
I think early morning classes lead students to skip breakfast					
Strongly disagree	36 (9.1)	14 (10.6)	11 (16.7)	11 (16.7)	0.100
Disagree	53 (13.4)	17 (12.9)	15 (11.4)	21 (15.9)	
Not sure	65 (16.4)	21 (15.9)	25 (18.9)	19 (14.4)	
Agree	133 (33.6)	35 (26.5)	56 (42.4)	42 (31.8)	
Strongly agree	109 (27.5)	45 (34.1)	25 (18.9)	39 (29.5)	
<b>Practise</b>					
I substitute breakfast with snacking					
Strongly disagree	93 (23.5)	19 (14.4)	39 (29.5)	35 (26.5)	<0.001**
Disagree	183 (46.2)	53 (40.1)	53 (40.1)	56 (42.4)	
Agree	110 (27.8)	55 (41.7)	37 (28.0)	38 (28.8)	
Strongly agree	10 (2.5)	5 (3.8)	3 (2.3)	3 (2.3)	

Table 1 continued...

I will have brunch if I did not have breakfast before 10.00 am					
Strongly disagree	40 (10.1)	8 (6.1)	17 (12.9)	15 (11.4)	<0.001**
Disagree	92 (23.2)	18 (13.6)	44 (33.3)	30 (22.7)	
Agree	176 (44.4)	66 (50.0)	54 (40.9)	56 (42.4)	
Strongly agree	88 (22.2)	40 (30.3)	17 (12.9)	31 (23.5)	
I only take dairy products as breakfast					
Strongly disagree	41 (10.4)	12 (9.1)	14 (10.6)	15 (11.4)	0.913
Disagree	223 (56.3)	74 (56.1)	78 (59.1)	71 (53.8)	
Agree	119 (30.1)	40 (30.3)	37 (28.0)	42 (31.8)	
Strongly agree	13 (3.3)	6 (4.5)	3 (2.3)	4 (3.0)	
I only take protein-based food for breakfast					
Strongly disagree	42 (10.6)	13 (9.8)	13 (9.8)	16 (12.1)	0.686
Disagree	246 (62.1)	77 (58.3)	86 (65.1)	83 (62.9)	
Agree	95 (24.0)	35 (26.5)	30 (22.7)	30 (22.7)	
Strongly agree	13 (3.3)	7 (5.3)	3 (2.3)	3 (2.3)	
I always take cereals for breakfast compared to local foods (e.g. Nasi lemak)					
Strongly disagree	22 (5.6)	9 (6.8)	6 (4.5)	7 (5.3)	0.045*
Disagree	146 (36.9)	53 (40.2)	34 (25.8)	59 (44.7)	
Agree	171 (43.2)	52 (39.4)	70 (53.0)	49 (37.1)	
Strongly agree	57 (14.4)	18 (13.6)	22 (16.7)	17 (12.9)	
I only eat breakfast if I am at my parents' home compared to on the campus					
Strongly disagree	61 (15.4)	13 (9.8)	31 (23.5)	17 (12.9)	0.002*
Disagree	144 (36.4)	44 (33.3)	50 (37.9)	50 (37.9)	
Agree	112 (28.3)	43 (32.6)	38 (28.8)	31 (23.5)	
Strongly agree	79 (19.9)	32 (24.2)	13 (9.8)	34 (25.8)	
I only take breakfast if I am hungry					
Strongly disagree	73 (18.4)	12 (9.1)	35 (26.5)	26 (19.7)	<0.001**
Disagree	127 (32.1)	39 (29.5)	55 (41.7)	33 (25.0)	
Agree	140 (35.4)	57 (43.2)	35 (26.5)	48 (36.4)	
Strongly agree	56 (14.1)	24 (18.2)	7 (5.3)	25 (18.9)	
I skip breakfast if my class starts at 8.00 am					
Strongly disagree	54 (13.6)	9 (6.8)	27 (20.5)	18 (13.6)	0.001*
Disagree	124 (31.3)	49 (37.1)	45 (34.1)	30 (22.7)	
Agree	152 (38.4)	47 (35.6)	49 (37.1)	56 (42.4)	
Strongly agree	66 (16.7)	27 (20.5)	11 (8.3)	28 (21.2)	
I skip breakfast because I am lacking money					
Strongly disagree	82 (20.7)	12 (9.1)	33 (25.0)	37 (28.0)	<0.001**
Disagree	181 (45.7)	49 (37.1)	70 (53.3)	62 (47.0)	
Agree	100 (25.3)	50 (37.9)	23 (17.4)	27 (20.5)	
Strongly agree	33 (8.3)	21 (15.9)	6 (4.5)	6 (4.5)	
I do not have enough time to buy breakfast					
Strongly disagree	54 (13.6)	12 (9.1)	23 (17.4)	19 (14.4)	0.126
Disagree	128 (32.3)	42 (31.8)	42 (31.8)	44 (33.3)	
Agree	150 (37.9)	53 (40.2)	53 (40.2)	47 (35.6)	
Strongly agree	64 (16.2)	25 (18.9)	25 (18.9)	22 (16.7)	

Significantly difference between ethnic groups at \* $p < 0.05$  and \*\* $p < 0.01$ , tested using Chi-square test.

Table 5. Scores for barriers of breakfast consumption among subjects

Variables	Means $\pm$ standard deviation				p-value
	Overall (n=396)	Malay (n=132)	Chinese (n=132)	Indian (n=132)	
Class started very early in the morning	2.71 $\pm$ 0.98	2.80 $\pm$ 0.91	2.55 $\pm$ 1.00	2.79 $\pm$ 1.01	0.06
Limited choice of breakfast	2.68 $\pm$ 0.91	2.53 $\pm$ 0.93	2.86 $\pm$ 0.85	2.66 $\pm$ 0.93	0.13
Not enough time	2.62 $\pm$ 0.84	2.73 $\pm$ 0.87	2.65 $\pm$ 0.76	2.49 $\pm$ 0.89	0.07
Food is not palatable	2.38 $\pm$ 0.86	2.30 $\pm$ 0.85	2.48 $\pm$ 0.80	2.36 $\pm$ 0.93	0.19
High cost of breakfast	2.35 $\pm$ 0.91	2.52 $\pm$ 0.94 <sup>a</sup>	2.27 $\pm$ 0.83 <sup>b</sup>	2.27 $\pm$ 0.92 <sup>b</sup>	0.03*
Not feeling hungry	2.18 $\pm$ 0.94	2.31 $\pm$ 0.92	2.07 $\pm$ 0.94	2.16 $\pm$ 0.96	0.12
No appetite	2.18 $\pm$ 0.94	2.27 $\pm$ 0.89	2.10 $\pm$ 0.97	2.17 $\pm$ 0.96	0.34
Less of readily available food	2.15 $\pm$ 0.87	2.09 $\pm$ 0.84	2.22 $\pm$ 0.87	2.14 $\pm$ 0.91	0.48
Uncomfortable being watch during eating	1.67 $\pm$ 0.82	1.66 $\pm$ 0.87	1.64 $\pm$ 0.68	1.70 $\pm$ 0.91	0.82
Eating breakfast will cause obesity	1.62 $\pm$ 0.68	1.58 $\pm$ 0.68	1.67 $\pm$ 0.65	1.64 $\pm$ 0.72	0.55
Total score	22.55 $\pm$ 4.35	22.77 $\pm$ 4.06	22.51 $\pm$ 4.39	22.37 $\pm$ 4.60	0.75

<sup>a,b</sup>Different alphabet in the same column shows a significant difference between ethnic groups at \* $p < 0.05$ , tested using analysis of variance.

This study has several strengths. Primarily, this study specifically studied the KAP and barriers to breakfast consumption. Previous studies mostly focused on the prevalence of breakfast skipping and its relation to BMI. This study also used a larger sample of participants than all but one (Moy *et al.*, 2009) of the previous studies. Additionally, the ethnicities and gender ratio of subjects were also equal to avoid potential bias and generalize the findings. However, it also has some limitations. This study implemented a cross-sectional design, which limits us to establish causal relationships between the variables studied. Additionally, the student population was merely from one university only, which could limit the ability to represent students from other universities. Data on the patterns, KAP, and barriers of breakfast consumption were self-reported by the subjects, which depended on their memory and honesty in answering the questions. Therefore, the accuracy of the given information is not fully known. Nevertheless, the questionnaires were validated before the data collection. Additionally, data on the nutritional intake and quality of the breakfasts were not quantified in this study. A larger or longitudinal study aiming to explore how these parameters related to nutritional status and financial situation of the subjects, which now has been identified as a barrier among the Malay are needed and would be of value to breakfast consumption studies among the Malaysian population.

## CONCLUSION

It can be concluded that Chinese students had the most frequent breakfast per week and had high KAP scores compared to Malay and Indian students. Students generally had good knowledge about breakfast consumption, but still unable to practice it accordingly particularly among the Malay. In addition to financial constraints, practicing unhealthy eating behaviors and food choices are among the factors that influenced breakfast consumption. Healthy eating awareness campaigns, education, and interventions should be reinforced particularly for first-year students. Additionally, policies that focus on providing healthy food and affordable food price in university cafeterias, and implementing a free food bank for low-income students are among the ways that could be done to address barriers and encourage behavioral changes towards optimizing breakfast consumption and subsequently practicing a healthy lifestyle.

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