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Knowledge Level of Calories and BMI of the Students of the National University of Malaysia

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Abstract: The aim of this study was to determine the knowledge level of calories and body mass index (BMI) among students in the Faculty of Health Science (FHS), National University of Malaysia. This comprises of studying of the interactions and relationships between independent variables such as type of schools, age, BMI, education level, gender and family history of non-communicable diseases with the outcome variable of interest being knowledge score among subjects. To achieve this, an online questionnaire-based survey was conducted among students from different schools at FHS, National University of Malaysia (n = 179), regarding knowledge of calories and BMI. The results showed that only 10.6 % of subjects were able to obtained high scores (>70%). Overall, students from FHS had a poor knowledge on calories and BMI, with a lower mean score of knowledge (52.53±13.79) than expected score of 70%. Two-way analysis of variance showed that subjects from School of Healthcare obtained a significant higher score as compared to School of Diagnostic and Applied Health Sciences and School of Rehabilitation Sciences; while scores was lower among Malays as compared to non-Malays. However, the interaction between these two factors were not significant ($p = 0.911$). Binary logistic regression analysis revealed significant association between education level and knowledge on calories and BMI ($p<0.01$; $\beta = 15.31$); however, for the age, BMI, race, gender and family history of diseases, the association were not significant.

Key words: Calories, BMI, education level, knowledge

INTRODUCTION

Nutrition is a fundamental factor in maintaining and promoting better health in human life and a key determinant in preventing many human diseases (Siri-Tarino, 2010; Vartanian *et al*., 2007). In fact, nutrition has been a mode of therapy in treating various life-threatening diseases (Schindler and Ludvik, 2012; Sanchez-Lara *et al*., 2012; de Pee and Semba, 2010). However, the recent increase in obesity, diabetes mellitus, ischemic heart disease and cancer around the world due to lack of nutritional knowledge and poor lifestyle choices would increase health care spending and significantly impact the economy of the country (Clugston and Smith, 2002). Recently, the World Health Organization (WHO) has estimated that more than 1.4 billion adults are overweight and 42 million children under 5 years of age were overweight or obese (WHO, 2014). Among Asian countries, increase in trend of overweight prevalence was noted 44.2% among the Malaysian population (WHO, 2011). Therefore, it is imperative to have the prerequisite nutritional knowledge on food consumption to prevent and promote better health among the population.

A growing body of evidence shows that nutritional behavior and food choice were positive, but weakly correlated with nutritional knowledge among the population (Hoefkens *et al*., 2011). The dietary behavior and food choices are influenced by individual,

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environmental, cultural educational and socioeconomic factors. A previous study reported that the socioeconomic factors and dietary intake are positively associated with education and income of study population (Beydoun and Wang, 2008). Therefore, the nutrition knowledge may play a fundamental role in the adoption of healthier food habits. However, it must be noted that knowledge on its own cannot bring about the desired changes due to the complex nature of food behaviors, thus the importance of nutrition education should not be undermined (Alsaffar, 2012).

In nutrition, the calories are necessary to drive our cells' metabolic processes. High and low calories intake could impair cell metabolism and physical activities. Calories requirement depend on an individual's age, gender, Body Mass Index (BMI) and physical activities. Few studies have reported the knowledge of recommended calories and its impact on food behavior (Headrick *et al*., 2013; Yu-Chieh *et al*., 2012). Yu-Chieh *et al*. (2012), reported that over 80% of adults did not know their recommended calories levels and impact of calories knowledge on obesity prevalence in the United States. In spite of race, age, education, working experience, or training in the health fields, there is impairment in the knowledge of nutritional energy requirements among various BMI categories (Headrick *et al*., 2013).

The ability to select foods that fit within one's daily energy requirements assumes knowledge of how many calories are required per day. Few studies have examined required consumers' understanding of their daily energy requirements (Headrick *et al*., 2013). Food labeling is a community-based approach to providing information to consumers about the nutrient content of a food in order to make food selection environment more favorable to healthy choices and guide consumers about the calories values (Mahdavi *et al*., 2012). The food labeling has a role in educating nutritional awareness of products and a significant number of people often read it (Mahdavi *et al*., 2012; Satia *et al*., 2005).

Improving nutrition knowledge, attitude and dietary practices through nutritional education may help to prevent or mitigate against nutritional diseases. Several studies have reported misconceptions about nutrition, failure to make nutrition as a priority in food selection and poorly informed about dietary guidelines (Arazi and Hosseini, 2012). Nutrition education often improves the individual's knowledge and dietary habits. Thus, nutritional education improves the individual's knowledge, self-efficacy and positive change in perception towards food habits and attitudes (Arazi and Hosseini, 2012). Therefore, this study aims to determine the knowledge level of calories and BMI among students of Faculty of Health Science, National University of Malaysia and also look at how some variables (schools, age, BMI, education level, gender and family history) interact or interplay on knowledge score among participants.

MATERIALS AND METHODS

Study population and sampling frame: This is a cross sectional study using a web-based self-administered survey questionnaire. Population of the study were undergraduate and postgraduate students currently enrolled in Faculty of Health Science, National University of Malaysia. Inclusion criteria for subjects are full time and part time students enrolled and Malaysian citizen. Exclusion criteria are incomplete survey items and students who are on study leaves. The study was conducted over two months period from October to December 2014.

Sample size: The sample size needed for this study was calculated using the formula for a known population (N = 1500) based on Krejcie and Morgan (1970). Using a X^2 = 3.841, population proportion = 0.5, desired margin error = 0.05, confidence level = 95%, a sample size of 378 respondents was required. In order to achieve this target and expecting a 80% response rate, 150 web-based survey were sent randomly via-mails to participants from each schools (Diagnostic and Applied Health Sciences (150), Healthcare Sciences (150) and Rehabilitation Sciences (150)). However, only 278 responses were received out of 450 (62% of response rate). From this only 179 responses could be used for further analyses, as the remaining questionnaires did not meet the inclusion and exclusion criteria i.e., ninety seven responses were not complete and two responses were excluded as the participants were non-Malaysian. Although the expected sample sizes were not met, from each school a minimum of 31 samples were obtained, which was acceptable for using parametric statistical test.

Tools and instruments: The questionnaire was administered using Mi-UXLab tool version 1.0, which is user experience evaluation tools comprising of a survey module and has been validated and used widely (Sivaji and Soo, 2013). There are several advantages of using an automated survey such as Mi-UXLab 1.0. Firstly, an automated survey enables time savings during data collection, preliminary analysis and the overall administration of the survey. Secondly, it avoids miscoding when data is manually transferred from the survey (paper) into an electronic system (SPSS). Thirdly, Mi-UXLab 1.0 facilitates and ensures data completeness by having additional validation while filling up mandatory questions this way, the tool reminds the respondents to fill up the various questions that they might have missed before they could go to the next page.

The questionnaire is divided into three parts; the first part comprises of the knowledge on calories and contains twenty three multiple-choice questions (MCQ). The second part contained five MCQ on knowledge of BMI. Each question in part one and two has five options with only one correct option. The last part comprise of demographic characteristics of the participant. It is estimated that participants spend approximately 20 minutes to complete the questionnaire. In terms of assessing the knowledge score, for a correct answer, one mark is given while for a wrong answer, no marks were given. Some of the questionnaire items were adopted from a study done by Parmenter and Wardle (1999).

The high score was determined by adding the interquartile range (IQR) to the mean score i.e., Mean+IQR = 52.53+17.86% = 70.39% (rounded to 70%). A pilot survey was tested on 23 subjects drawn from same study population to ensure the validity and reliability of questionnaire. Reliability testing was performed using Cronbach/Coefficient alpha and test-retest method for the 23 subjects. There was a one week interval between the test and retest. The R value of slightly above 0.7 was obtained, indicated a highly reliable questionnaire items (Table 1). Paired-Sample t-test was t (23) = -0.591, p = 0.560, indicated no significant differences between test and retest. Hence, the questionnaire was considered reliable.

Table 1: Inferential analysis using two way ANOVA between groups

Method	Cronbach alpha (R)	**No.** of item
Test	0.771	23
Retest	0.714	23

The questionnaire items were validated using Flesch Reading Ease tool (Kincaid *et al*., 1975). The Flesch Reading Ease is a measure of readability of the questionnaire items. An initial readability level score of 55% was obtained, which is associated to a fairly difficult readability level. However, after modification of some questions based on proof reading, using shorter and simpler sentences and qualitative feedback, the score improved to 65.3%, which is considered a standard readability level (RFP Templates, 2009). The Flesch grade level also improved from grade 8.7 (Grade 9) to grade 6.7 (Grade 7), which is an indication that these questionnaire items are suitable for a seventh grader. Moreover, various feedbacks from the pilot study were used to improve the questionnaire. Table 2 shows the improvement in the readability score and grade before and after the proof reading and qualitative feedback improvements done on the survey (RFP Templates 2009).

Statistical analysis: Data were analyzed using the Statistical Package for Social Sciences (IBM SPSS version 22.0). Before the analysis, data is imported using SPSS (Sheridan, 2013) from Mi-UXLab 1.0. Descriptive statistics was performed to gain an overview of the data. The necessary assumptions for two-way between-groups ANOVA such as normality and homogeneity of variance (Sheridan, 2013) were checked using SPSS and the criterion met. Two-way analysis of Variance (ANOVA) between groups with a confidence level of 95% was used to investigate the interaction between race and school on the knowledge scores on calories and BMI among students of FHS. Furthermore, binary logistic regression (BLR) was conducted to determine the influence of age, gender, race, BMI, education level and family history in predicting knowledge scores on calories and BMI among FHS students. Before the BLR analysis, the various assumptions for BLR such as dichotomous dependent variable, having a large sample size, multicollinearity and outliers (Pallant, 2001) were checked using SPSS and met the criterions.

Table 2: Readability statistics before and after improvement of survey instrument

Readability statistics	Before improvement	After improvement
Flesch reading ease	55.0 (Fairly difficult)	65.3 (Standard)
Flesch grade level	8.7 (Grade 9)	6.7 (Grade 7)

RESULTS

Table 3 illustrates the descriptive analysis of the study sample. The mean age and BMI of students that participated in this study were 23.78±5.99 and 21.85±3.80, respectively. In addition, 81.6% of the study sample was female and the rest was male. Moreover, 59.8% of the participants were Malay and the rest were non-Malay. Also, student that enrolled for this study from school of Diagnostic and Applied Health Sciences, Healthcare Sciences and Rehabilitation Sciences were 33.5, 44.7 and 21.8%, respectively. The descriptive analysis result showed that slightly more than 60% of the participants' family members have non-communicable disease such as diabetes, hypertension and heart disease.

Results from the study showed that the mean score among all the subjects was 52.53±13.79%. Among all the subjects, only 19 subjects (10.6%) were able to score more than 70%, which was considered as high level of knowledge on calories and BMI in this study. The lowest score attained by a respondent is 25% while the highest score is 89.29%. Table 4 shows the higher range of scores obtained by respondents for selected questions. Out of the 23 questions, respondents showed excellent grasp of knowledge in 2 calorie based questions and 2 BMI based questions, with a score range of 83 to 91%.

Table 5 shows the questions with the lowest score ranging from 12 to 19%. All these questions are from the calorie category. The average score for the calories based questions is 49% while the average score for the

Table 3: Descriptive analysis of the study sample (n = 179)

Characteristics	Frequency n (%)	Mean±SD[a]
Age (years)		23.78±5.99
Gender		
Male	33 (18.4)	
Female	146 (81.6)	
BMI (kg/m^2)		21.85±3.80
Underweight (<18.5)	27 (15.1)	
Normal weight (18.5-24.9)	116 (64.8)	
Overweight (25.0-29.9)	29 (16.2)	
Obese (30.0-34.9)	7 (3.9)	
Race		
Malay	107 (59.8)	
Non-Malay	72 (40.2)	
School		
Diagnostic	60 (33.5)	
Healthcare	80 (44.7)	
Rehabilitation	39 (21.8)	
Education		
Graduate	68 (38.0)	
Undergraduate	111 (62.0)	
History of family disease		
Yes	109 (60.9)	
No	70 (39.1)	
Knowledge score		52.53±13.79
High score (≥70%)	19 (10.6)	
Low score (<70%)	160 (89.4)	

[a]SD: Standard deviation

BMI based questions are 68%. Although the numbers of questions are not divided equally, from the results obtained, it could be summarized as the respondents have higher knowledge on BMI as compared to calorie. Two-way ANOVA between groups used to determine the interaction between race and school on the knowledge scores on calorie and BMI among FHS students as shown in Table 4. The test of between subject effects, shows that there is no interaction effect for school and race, F (2, 173) = 0.093 (p = 0.911), as shown in Fig. 1. However, for the main effects, both school and race were significant (p<0.05) (Table 6). Post hoc analysis was performed. Since the sample size for respondents from schools are widely different, the Hochberg's GT2 post-test was used. It was found that the mean score from Diagnostic and Healthcare schools significantly differ and the mean score from Rehabilitation and Healthcare schools also significantly differ as shown in Table 7. Mean score±SD according to school. Groups not sharing the same letters significantly different to each other (p<0.001).

Table 8 shows the binary logistic regression analysis result depicting that only education was a good predictor in the model. This influence was statistically significant (p = 0.002) with an odd ratio of 15.310. Thus, when education level is raised by one level the odds ratio is 15 times more and therefore graduate are 15 more times likely to be more knowledgeable on calorie and BMI than undergraduate.

DISCUSSION

The purpose of this study was to determine the knowledge level of calorie and BMI among students of

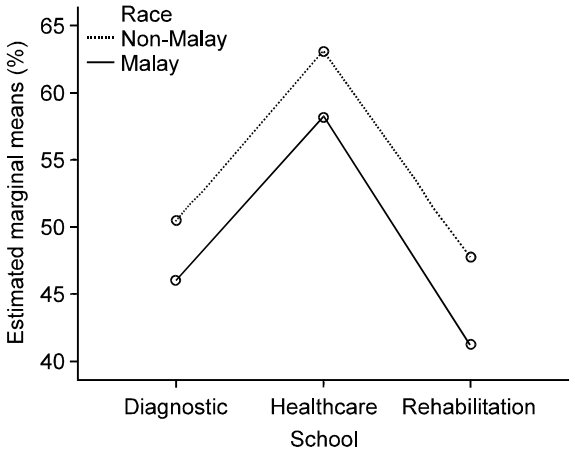

Fig. 1: Results from two-way ANOVA between group shows no interaction effect

Faculty of Health Sciences, National University of Malaysia and also look at how other variables (schools, age, BMI, education level, gender and family history) interact or interplay on knowledge score among participants. It was hypothesized that all the variables influences knowledge score on calorie and BMI.

Findings of this study revealed that population of FHS, UKM are lacking of knowledge in calorie and BMI as only 10.6% obtained a high score on the survey (more than 70%). Given that all of the subjects in this study were from those receiving higher educations and more specific, being enrolled in health science programmes, the mean score obtained was unexpectedly low. This study showed that, it could be inferred that a much lower score would be obtained if this study is to be carried out with the normal Malaysian population. Butriss (1997) stated that lack of knowledge in general nutrition are the main problems in promoting change in dietary habits. From our results, the low knowledge scores indicated that it will be challenging to change the food intake among the Malaysian population.

The type of schools was significantly associated with knowledge on calorie and BMI among FHS students using two way ANOVA. Students from School of Healthcare showed higher score compared with other schools because they learnt about calorie and BMI in their syllabus. Al-Naggar and Chen (2011) in their comparison between non-Medical and Health Sciences faculties showed an average of 0.13 points of lower score in knowledge from non-Medical faculties. Rahman *et al*. (2013) also found that sciences school score showed higher knowledge than non-sciences school because they learn about general health knowledge during class.

Our study showed 15 more times higher scoring in knowledge between graduate and undergraduate level. Higher education level showed better knowledge

Table 4: Questions with very high score

Question with very high scores (>80%)	Frequency (%)
Which one from the followings has the lowest amount of calories?	177 (91)
Calories is ----------	169 (87)
Body mass index is an indicator of ----------	162 (83)
What is Ali's body mass index (BMI)?	162 (83)

Table 5: Questions with very low score

Question with very high scores (<20%)	Frequency (%)
Hard (solid) fat is filled with	22 (12)
Which one of these statements is true	31(17)
Between saturated and unsaturated fat, which one contains more calories?	34 (19)
Butter (from animal source) and regular margarine, which one has more calories?	34 (19)

Table 6: Inferential analysis using two way ANOVA between groups

	F (df)	p-value
School	30.69 (2)	<0.001
Race	7.92 (1)	<0.001
School* race	0.093 (2)	0.911

Table 7: Post hoc test using Hochberg's GT2

Schools	Mean (SD)
Diagnostic	47.68 (10.79)
Healthcare	60.13 (13.21)
Rehabilitation	44.41 (10.99)

in calorie and BMI. This finding is supported with another study which found that better education level showed higher knowledge scores because of quite self-evident for education level (Dallongeville *et al*., 2000). The finding of this study is consistent with previous studies that indicated a positive association between educational level and nutritional knowledge (Mirsanjari, 2012; Parmenter *et al*., 2000).

Besides that, our results is also in agreement with previous study whereby Malays (50.73±14.50%) have lower nutritional knowledge as compared with other race groups (55.21±12.27%) (Rahman *et al*., 2013). Although, the knowledge score between Malay and other race groups was not significantly different (around 5%). This could be due to the fact that most of the subjects having a certain level of knowledge since they are all from the same educational level and health sciences background.

Gender did not show significant value (p>0.05) in predicting knowledge score on calorie and BMI. However, comparing between gender may not appropriate because number of female respondents was 81.6% whereas, the number of male respondents was 18.4%. This result is consistent with that of Rahman *et al*. (2013). However, Vriendt *et al*. (2009) found that there were association between knowledge and gender, female had higher knowledge than male. Another study among university students showed that female had an average of 0.16 points higher than male students in the prevention of cancer (Al-Naggar and Chen, 2011).

Subjects with family history of non-communicable diseases (diabetes, hypertension and heart disease) had the probability of being 1.4 times more likely to get higher knowledge compare to non-family history disease (p>0.05). They were at risk of inherited diseases, showed lack of concern about their health in terms of knowledge with calorie and BMI. Al-Naggar and Chen (2011) reported that subject without a family history of cancer had an average 0.22 points lower than those who reported positive family history (p = 0.013).

This study showed that older subjects had a likelihood of 0.177 (p>0.05) times to get lower knowledge than younger subjects. Vriendt *et al*. (2009) found that there was a relationship between knowledge and educational level and age illustrated the need of young and lower educated level people for more training on nutrition knowledge. This is in contrast with our study that showed higher knowledge is associated only with young subject.

Every increment in BMI predicts a likelihood of 0.927 (p>0.05) more times of getting lower knowledge. Previous studies also demonstrated a poor association between BMI and knowledge, which are consistent with our results (Vriendt *et al*., 2009; O'Brien and Davies, 2007). However, Rahman *et al*. (2013) found that respondents in underweight category significantly had least knowledge score compare with normal and overweight. Low knowledge on calorie and BMI can be related with inability to select food that fit with daily energy requirements and assume knowledge of how many calories are required per day which can result to under or overestimation of daily calorie intake.

Although this study has strength in revealing knowledge score and BMI among students in the particular population, it has several limitations. We only received 62% response rate (278 out of 450) but only 40% (179) were involved in the further analysis because about 22% did not complete the questionnaire. Although evidences found that e-mail surveys have superiority over postal surveys in terms of response speed and cost efficiency, however its response rate is usually not high (Cook *et al*., 2000; Sheehan, 2001). Another limitation of this study is the height and weight are self-reported and may introduce some bias when the participants filled their

Table 8: Analysis of variance table using binary logistic regression

Variable	b [95% CI]	Odds ratio	p-value
Education	2.739 [2.791-83.984]	15.310	0.002
Gender	0.509 [0.367-7.547]	1.664	0.509
Race	0.399 [0.470-4.720]	1.490	0.498
Family history disease	0.345 [0.417-4.782]	1.412	0.579
Age	-0.75 [0.845-1.018]	0.927	0.112
BMI	0.306 [0.990-1.524]	0.177	0.396

heights and weights by themselves. This study is focusing on the knowledge only, not on influences of food choice on subjects. Knowledge cannot be a good predictor in determining health food intake among subjects because other factors may have large influences, such as time constraints, the sensory appeal of food, cost, an individual's mood or family traditions, socio-demographics characteristics, vegetarianism, fast food or layout of dining tables (Spillmann *et al*., 2011).

Conclusion: Overall, students from FHS had a poor knowledge on calories and BMI, with a mean score of 52.53±13.79%. Students from School of Healthcare had significant higher knowledge level of calories and BMI as compared to the other schools. Malays seem to have lower knowledge level as compared to other race groups. Educational level was the only predictor of knowledge level of calories and BMI among others variables such as gender, race, family history of diseases, age and BMI. It is recommended that the basic nutrition education be enhanced, especially for the School of Diagnostic and Applied Health Sciences and School of Rehabilitation Sciences. Other measures such as implementing food labeling in terms of calorie contents within the cafeteria of FHS and food awareness nutritional program could also increase the calorie and BMI knowledge among the population of FHS.

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