

Association between nutrition knowledge and attitudes
with intake of vegetables, fruits and dairy products
among students at the Asian University for Women
(AUW), Chittagong

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Abstract

Background: World Health Organization reports several diet related health issues, such as malnutrition, diabetes and cancer, which are associated with unhealthy eating. Several studies have been done to understand why people eat what they eat. Spronk writes that many studies have been done to assess people's food intakes; however, few studies have been done to explore the relationship between people's nutrition knowledge, attitudes and healthy eating (Spronk 2014). This study has been done to collect data on the association between AUW student's nutrition knowledge, attitude and food intakes. This study aims to contribute in achieving healthy food intakes among students at Asian University for Women (AUW) for better health outcomes.

Method: A cross-sectional study was conducted at the Asian University for Women. A total of 102 students from all the undergraduate years (UG1-UG4) were recruited via stratified random sampling. WHO's standard "Nutrition Knowledge, attitude and practice (KAP) model" questionnaire was used with some modifications to fit the context.

Results: This data showed that less than 50% of the students took vegetables, fruits and dairy products every day. Again, less than 50% of the students had good knowledge; whereas, most of them had positive attitude about taking good food (63.8%). Students with poor knowledge compared to good knowledge when adjusted with attitude were less likely to take vegetables and fruits, even though it is not statistically significant.

Conclusion: This data showed no association between nutrition knowledge and, attitudes, with intake of vegetables, fruits and dairy products among students at the Asian University for Women (AUW). The study recommends that basic nutrition knowledge on micro nutrients can be provided to AUW students.

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Introduction

According to the World Health Organization's (WHO) report, unhealthy diet is one of the key risks to health across the globe (WHO, 2016). A healthy diet can actually help prevent several diseases including all kinds of malnutrition, few cancers, impairment of mental development and heart diseases (WHO, 2016). However, with the arrival of more processed foods and changing life styles, food intakes have also been transformed to eating more unhealthy foods (WHO, 2016). This was not realized until the 1990's when diseases like hypertension, diabetes, and obesity became global health issues (Popkin, 2012). WHO's statistics shows that among the 56.5 million recorded deaths, almost 60% of the diseases are due to issues related to diet and nutrition, and by 2020, non communicable diseases is predicted to increase up to 57% (WHO, 2016). Many researches have been done to understand the factors that determines one's food intake. Studies done among university students show that several factors in adulthood can influence one's food intake. For example, Nani in her research reported that educational life exposes university students to different experiences, where they not only develop a sense of individual freedom but also start creating one's identity, which has an important influence on their diet pattern (Nani, 2016). Moreover, studies show that many students in their university life do not have a healthy eating habit, for example, they would either not eat their meals regularly or eat more fast food (Nani, 2016). Such dietary behaviors, where college students eat more sugar and fats instead of eating more fruits and vegetables, have a negative impact on the food intakes of students in the long term (Nani, 2016).

Worsley in his article on "nutrition knowledge and food consumption" mentions that food intake can be influenced by many factors, and nutrition knowledge is a key determinant

(Worsley 2002). Spronk also writes that very few studies have been done to explore the effects of nutrition knowledge on people's food intakes (Spronk, 2014). According to the National Health Service of UK, one way to maintain a good health is to have a balanced diet, which they have defined as a diet that constitutes different foods and drinks that are needed by the body in a specific amount to retain a "healthy body weight" ("Eating a balanced diet", 2016). Balanced diet has been promoted in colleges through various initiatives, and many studies have been done on such interventions too (Nani, 2016). At the Asian University for Women, nutrition education is also being promoted in the form of a food pictorial that has been created by public health students and is displayed in the health center and on the desktops of some of the computers in the computer lab. Moreover, the menu at AUW dining hall also provides variety of foods including protein, carbohydrates, and fruits; thus, covering almost all the food groups that are present in an ideal food pictorial. Questions remain, whether such nutrition education in campus has an effect on the healthy food intake of AUW students.

Objectives

General: This study aims to contribute in achieving healthy food intake among students at Asian University for Women (AUW) for better health outcomes.

Specific:

1. To assess student's knowledge about nutrition and attitudes towards healthy diet using standard survey questionnaire,
2. To understand student's food intake practices, especially vegetables, fruits and dairy

products using a 3 day food recall

3. To determine the association between nutrition knowledge, attitudes with food intake of students at AUW

Methodology

Study Design and study population:

A cross sectional study was conducted, from November to December 2016, at the Asian University for Women, Chittagong, where students from different religious, nationality and ethnic background from around the world reside in the campus dormitories. Students of our different levels of undergraduate courses were recruited in the study.

Sample size and sampling:

Sample size was estimated to be 200 participants to take 50 from each of the four undergraduate levels. But finally, 102 participants were recruited in the study, taking twenty five students from each batch, from UG1 to UG4, having additional two from UG1. Multiple attempts were made to recruit the selected student through email reminders and personal visit to their respective dorm rooms. Stratified randomization was used to ensure equal participation and representation from each batch and simple randomization method was used to ensure that students from each batch are randomly selected.

The survey questionnaire was distributed to the participants by going door to door to all the rooms on campus. Before entering the room, the names of all students, which are already written on the door by the residential life department of AUW, were separately assigned a numerical numbers on small pieces of paper and folded fourth, and the names were randomly picked up before entering the rooms. In a room where there were 3 students, one student was

randomly selected for participation in the study, whereas the room where 5 students were residing, two among them was randomly selected.

Questionnaire Development

WHO's standard 'Nutrition knowledge, attitude and practice (KAP) model' questionnaire was used with some modifications to fit the context. In total, 13 modules have been used by WHO to assess nutrition knowledge, attitudes and practices of people in a community; however, for this study four modules were used because of their relevance to the context, length, availability of resources this study. Modules like under nutrition, and infant feeding were eliminated due to their irrelevance to this study. Similarly, modules like overweight and obesity, and food safety were not used because of their contribution to the length of the questionnaire, which is one of the limitations of this study. For this study the following modules were used in the questionnaire with some modifications:

- Iron-deficiency anemia
- Vitamin A deficiency
- Iodine Deficiency
- Food Based Dietary guidelines

For each module, there were separate questions to assess the knowledge, attitudes and practices regarding that particular topic. The type of questions regarding nutrition knowledge, attitude and practice was chosen based on the guidelines given by WHO, which basically has categorized the questions into core, optional and specific questions. The core questions are the ones which should always be asked when doing a KAP survey; the optional ones can be included as a measurement of KAP's specific information, and specific questions address the "very special aspects of KAP" (Marias *et al.* 2014). All the core and many of the specific

questions for each module regarding knowledge, attitudes and practice were included in this study's questionnaire and questions based on their relevance and importance from the optional question portion were selected accordingly. The questionnaire went through multiple revisions by the thesis adviser and for validity a small pre-testing was done on six students, whose comments were taken into consideration and the questionnaire was adapted accordingly. For example, simple vocabulary was used for the participant's convenience.

In the dietary guidelines section, the food pictorial created by former AUW graduates was used, since the students at AUW belong to different nationalities, and using one country's food pictorial in this context was not feasible. AUW food pictorial has been displayed in few places in the campus, which is why it was used, with the assumption that students might have got an understanding of the diverse food one is required to eat and maintain. It will also help us understand if the pictorial has an effect on AUW student's eating behavior or whether it needs to be modified or simplified in the future, to make it more effective in conveying the message.

An additional 3 day food recall sheet was attached with the survey questionnaire to gain a more realistic or practical view of the AUW student's actual food intakes, and thus make the study more relevant to the context.

Data Collection

The data was collected through survey questionnaire and 3 day food recall. A brief introduction of the research and the researcher was given to each participant, and the survey questionnaire was explained to them to ensure that any clarification is provided on the spot if needed. The participants were given three days because of the 3 day food recall, and the data were collected by going back to their respective rooms.

Measurements

Nutrition knowledge has been defined by the UN's Food and Agriculture Organization (FAO) as "an individual's understanding of nutrition, including the intellectual ability to remember and recall food-and nutrition related terminologies, specific pieces of information and facts" (Marias *et al.*, 2014).

Attitude has been defined by FAO as one's "emotional, motivational, perceptive and cognitive beliefs that positively or negatively influence the behavior or practice of an individual" (Marias *et al.*, 2014).

Food intake, in this research, has been defined as the frequency of intake of vegetables, fruits and dairy products. Because all the students at AUW eat from the dining hall, which has a fixed menu, each of the above food groups was divided further into two groups. For example, for fruits, the two groups would be: 1) took fruits everyday in the 3 day food recall, 2) didn't take fruits everyday in the 3 day food recall.

In this research, there were 16 questions in total to assess nutrition knowledge: 9 multiple response and 7 single response questions; 4 questions assessed knowledge level on dietary guidelines, 5 questions assessed knowledge of iron deficiency anemia, 4 assessed knowledge on vitamin A deficiency, and 3 assessed iodine deficiency anemia. Because the 16 questions were presenting extreme frequency distribution, the 9 multiple response questions were treated as separate questions during the analysis. Therefore, in total, we had 7 questions to assess knowledge on dietary guidelines, 15 to assess iron deficiency anemia, 12 questions to assess vitamin A deficiency, and 5 questions to assess iodine deficiency. All the questions for each module was then categorized into 3 categories: good ($\geq 70\%$), moderate ($\geq 50\%$) and poor ($<50\%$) knowledge, using the threshold suggested by Kigaru *et al* in their article (Kigaru

et al. 2015). Similarly, there were 11 questions to assess attitude of AUW student's towards nutrition related health conditions. Questions assessing attitude were also divided into three categories: positive, neutral/you are not sure, and negative. An attitude was considered positive if the student, for example, likes the taste of a food, and thinks she might be lacking the micronutrient and that a deficiency of that certain micronutrient is serious. If a student likes the taste of a micronutrient containing food, it is more likely they will consume it more and hence will not be deficient in the micronutrient. Similarly, if students think they are likely to be deficient in a micronutrient, it implies that they will prefer intake of that micronutrient, which as a result will not make them deficient in micronutrient. If students think that health related micronutrient deficiency is serious, they are more likely to go for treatments or prevention than the ones who think that a diet related health condition is not serious. Although these cut offs have been set based on qualitative data, the intake in terms of quantity is a different discourse, which this paper does not address.

The food intake was measured as frequency of student's intake of particular foods: vegetables, fruits and dairy products. The reason for choosing only these food groups was because the questionnaire was assessing the participant's knowledge on micronutrient related health conditions. The four modules used assessed dietary guidelines and the rest three were on micronutrient deficiency health related issues and foods containing the micronutrient. A general graph of food intake was obtained to relate it with their overall knowledge, and only vegetables, fruits and dairy was used to specifically analyze the association and relationship. This was done to ensure that significant evidence is obtained to see the association, as Worsley mentions it as "law of specificity" (Worsley 2002), which means asking questions that really measure the outcome. For example, when knowledge related to micronutrient is

measured, the result cannot be used to test someone's protein intake, which is a macronutrient.

Statistical Analysis

Pearson Chi square test was used to test the association between nutrition knowledge, attitude and the frequency of vegetable, fruits and dairy products intake. This chi-square test was run separately to test association of knowledge with the 3 food groups and to test attitude score with the 3 food groups. The null hypothesis was that there is no association between nutrition knowledge, attitudes and food intake, the alternative hypothesis was: there is an association between nutrition knowledge, attitude and food intake. The null hypothesis would be rejected if p-value obtained was <0.05 , while it was accepted if the obtained p-value was >0.05 . To test the relationship and make a prediction whether one's knowledge score and attitude can be used to predict one's food intake, logistic regression was used because we had two categorical outcome variables. The independent variables in this study were nutrition knowledge and attitudes, and the dependent variable was intake of fruit, vegetable and dairy product categorized as either took all three days or not. The regression test initially was run separately for knowledge score and for each food item, for example, vegetable, and the unadjusted OR ratio was recorded. Then, attitude was added to independent variables, and the adjusted OR ratio was recorded.

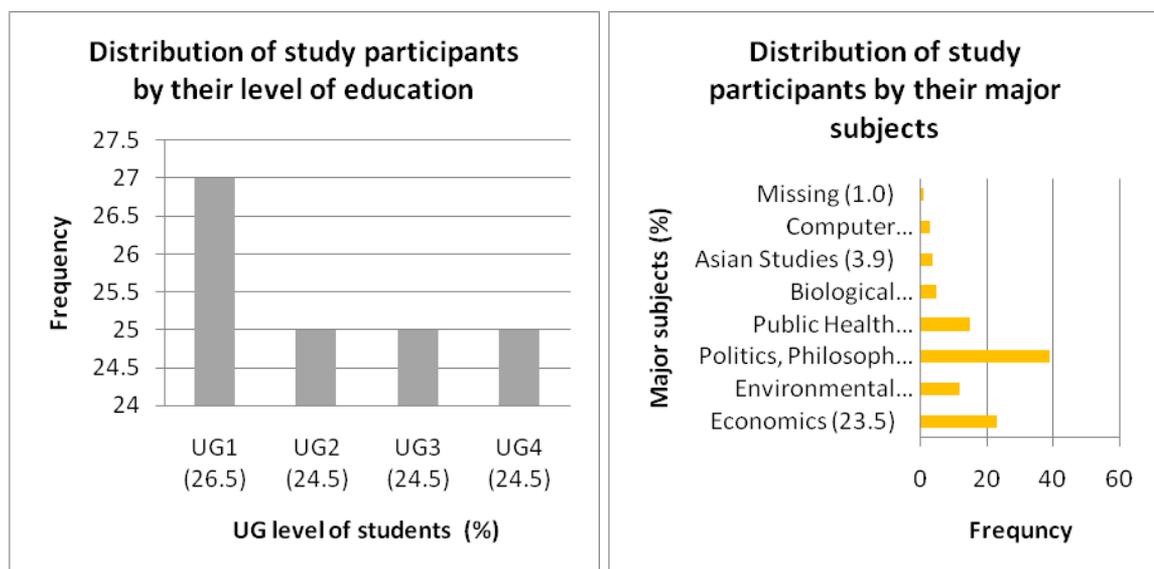
Institutional Review Board Approval

The study was approved by the Institutional Review Board of the Asian University for Women. Written consent was taken from each participant's.

Result

Figure 1

Most of the students belong to Undergraduate level 1 while an equal number of students are in the other three UG levels and majority of the participants belong to PPE major, while only 2.9% belong to computer sciences (Figure 1 and 2)



Less than 50% of the students have good knowledge of diet related health issues, while >50% have positive attitude toward diet related health conditions. (Figure 3 and 4)

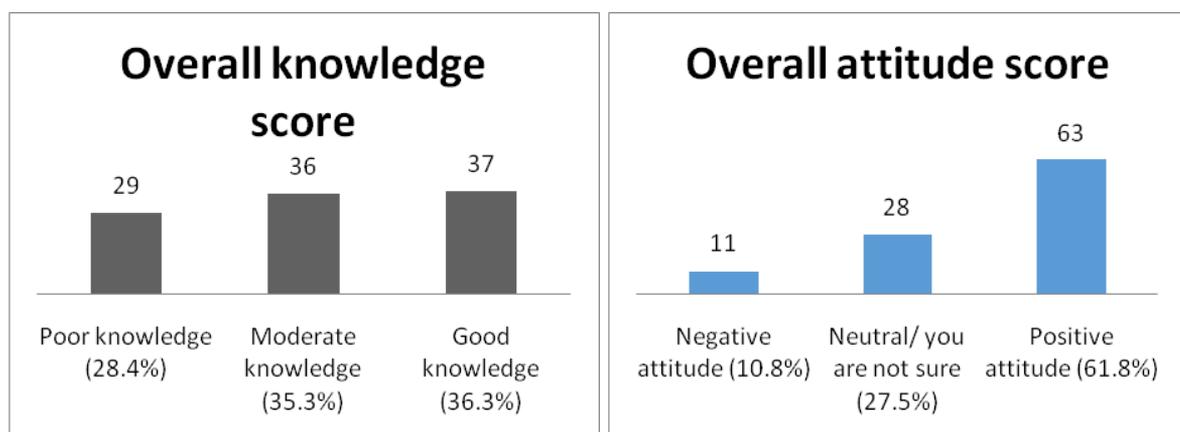
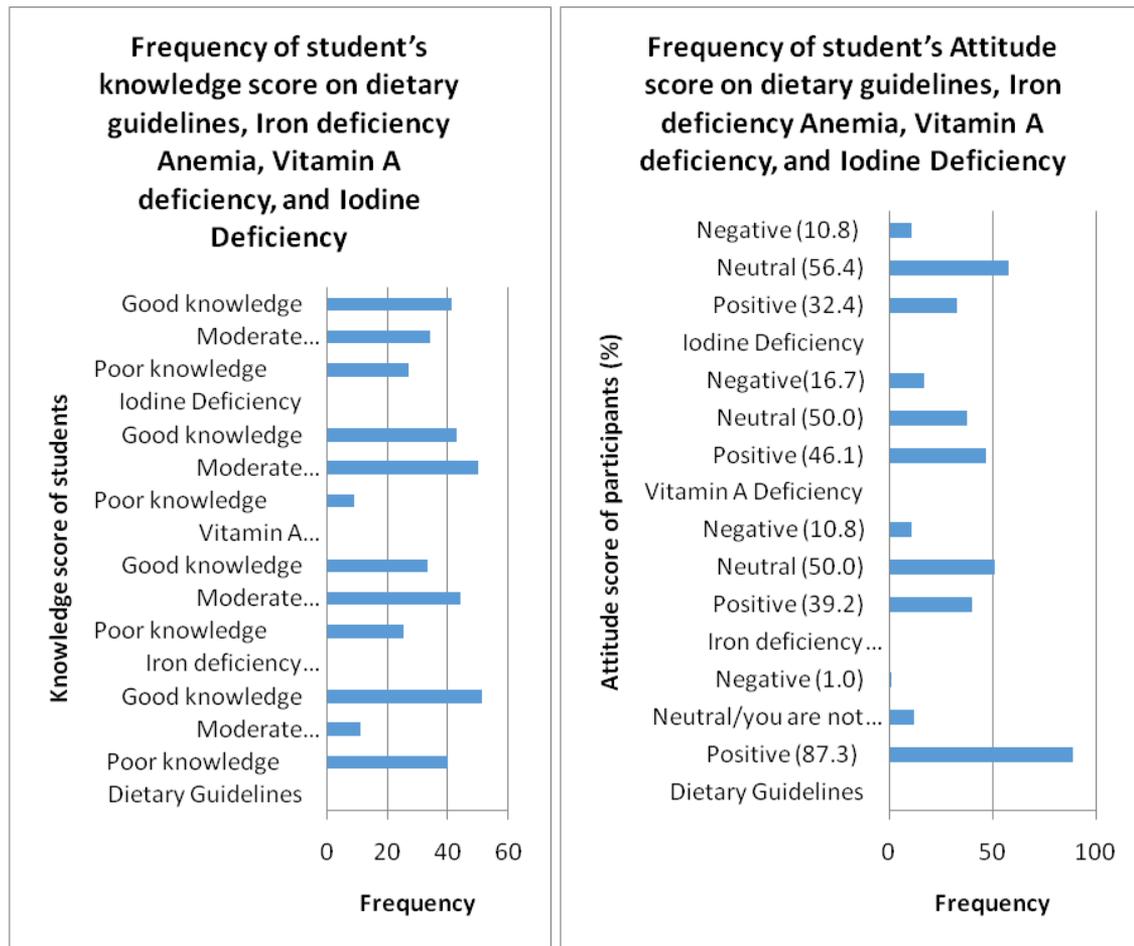
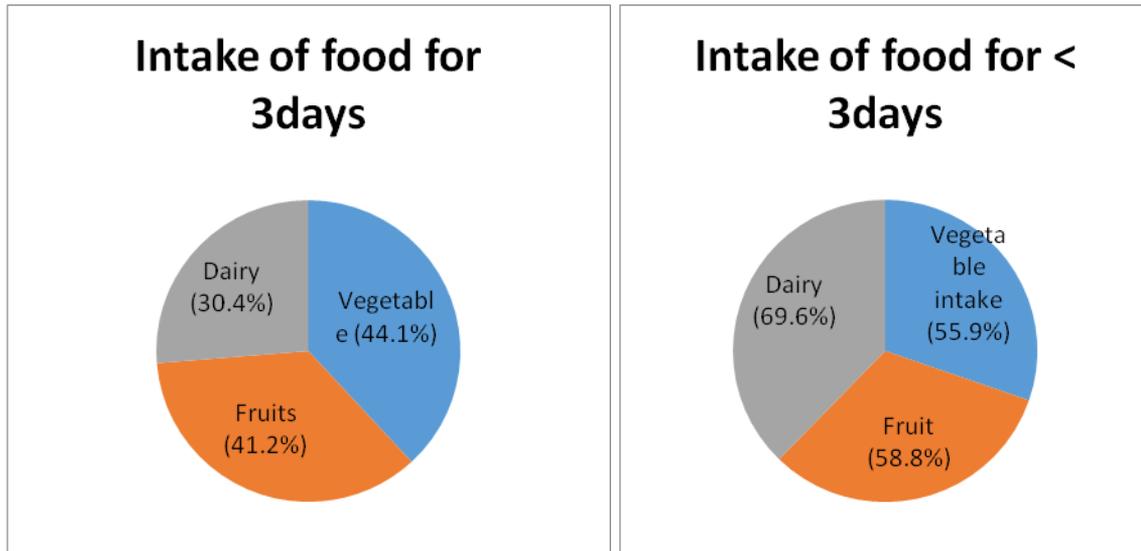


Figure 5 and 6:



Overall, majority of the participants have good knowledge of dietary guidelines and iodine deficiency, while majority of them have a moderate knowledge of iron and vitamin A deficiency. 87.3% of the participants have a positive attitude towards dietary guidelines, while less than 50% of them, that is 32%, 39% and 46%, have a positive attitude towards iron and vitamin A deficiency

Figure 7 and 8: Frequency of student's food intake from vegetable, fruits and dairy products in 3 days food recall.



Less than 50%, that is 44.1% of the students take vegetable every day, while 55.9% of them don't take it every day. The percentage of student's regular intake of fruits and dairy products is also low as compared to the ones who do not take it every day.

Table 1: Association between student's nutrition knowledge level and their vegetable intake in 3 days food recall ($\alpha \leq 0.05$)

	Poor knowledge N (%)	Moderate knowledge N (%)	Good knowledge N (%)	P-value
Didn't take vegetable everyday in 3 days	15 (51.7)	22 (61.1)	20 (54.1)	0.72
Took vegetable everyday in 3 days	14 (48.3)	14 (38.9)	17 (45.9)	

There is no statistically significant association between student's nutrition knowledge and vegetable intake. 48.3% of Student's with poor knowledge took vegetable every day, while 45.9% of the student's with good knowledge score also took vegetable everyday in the three days food recall.

Table 2: Association between student's nutrition knowledge level and their fruit intake frequency in 3days food recall ($\alpha \leq 0.05$)

	Poor knowledge N (%)	Moderate knowledge N (%)	Good knowledge N (%)	P-value
Didn't take fruit everyday in 3 days	16 (55.2)	22(61.1)	22 (59.5)	0.88
Took fruit everyday in 3 days	13 (44.8)	14 (38.9)	15 (40.5)	

No significant association has been found between student's nutrition knowledge and fruits intake. Most of them (59.5%) have good knowledge score yet they do not take fruits every day.

Table 3: Association between student's nutrition knowledge level and their dairy products intake frequency in 3days food recall ($\alpha \leq 0.05$)

	Poor knowledge N (%)	Moderate knowledge N (%)	Good knowledge N (%)	P-value
Didn't take dairy products everyday in 3	21 (72.4)	24 (66.7)	26 (70.3)	0.87

days				
Took dairy products everyday in 3 days	8 (77.6)	12 (33.3)	11 (29.7)	

There is also no significant association between student's nutrition knowledge and dairy products intake. Majority of them (70.3%) with good knowledge do not take dairy products every day, while 77.6% of them with poor knowledge do take dairy products every day.

Table 4: Association between student's attitude score and their vegetable intake in 3days food recall ($\alpha \leq 0.05$)

	Negative N (%)	Neutral N (%)	Positive N (%)	P-value
Didn't take vegetable everyday in 3 days	15 (51.7)	22 (61.1)	20 (54.1)	0.72
Took vegetable everyday in 3 days	14 (48.3)	14 (38.9)	17 (45.9)	

Most of the students (54.1%) with good knowledge didn't take vegetable every day, while student's event with negative attitude, 48% of them too vegetable every day in three days food recall

Table 5: Association between student's attitude score and their fruits intake in 3days food recall ($\alpha \leq 0.05$)

	Negative N (%)	Neutral N (%)	Positive N (%)	P-value

Didn't take fruit everyday in 3 days	16 (55.2)	22(61.1)	22 (59.5)	0.88
Took fruit everyday in 3 days	13 (44.8)	14 (38.9)	15 (40.5)	

Table 6: Association between student's attitude score and their dairy products intake in 3days food recall ($\alpha \leq 0.05$)

	Negative N (%)	Neutral N (%)	Positive N (%)	P-value
Didn't take dairy products everyday in 3 days	21 (72.4)	24 (66.7)	26 (70.3)	0.87
Took dairy products everyday in 3 days	8 (77.6)	12 (33.3)	11 (29.7)	

Table 7: Logistic regression analysis of student's nutrition knowledge, attitudes and their vegetables intake (95% confidence interval, $\alpha < 0.05$)

Variables		Unadjusted OR ratio	95% Confidence interval	Adjusted OR ratio	95% Confidence interval
Knowledge	Good (Ref)				
	Poor	1.0	0.415-2.908	1.100	0.407-2.977
	Moderate	0.7	0.295-1.900	0.697	0.270-1.797

Attitudes	Positive (Ref)				
	Negative	0.4	0.107-1.812	0.405	0.097-1.694
	Neutral	1.0	0.416-2.481	1.015	0.410-2.514

The result showed no significant relationship between student's nutrition knowledge and their vegetable intake. However, it does tell us that student's with poor knowledge, as compared to students with good knowledge are 1.1 times more likely to not take vegetables everyday even after adjusting it with their attitude score

Table 8: Logistic regression analysis of student's nutrition knowledge, attitudes and their fruit intake (95% confidence interval, alpha < 0.05)

Variables		Unadjusted OR ratio	95% Confidence interval	Adjusted OR ratio	95% Confidence interval
Knowledge	Good (Ref)				
	Poor	1.192	0.446-3.185	1.43	0.514-3.983
	Moderate	0.933	0.365-2.384	1.00	0.381-2.647
Attitudes	Positive (Ref)				
	Negative	0.50	0.157-2.217	0.562	0.147-2.147
	Neutral	0.344*	0.128-0.924	0.327*	0.120-0.893

*p<0.05

When adjusted with attitude, students with poor knowledge are 1.4 times more likely to not take fruits every day either. It also shows that student's neutral attitude significantly (0.02) explains why they don't take fruits every day.

Table 9: Logistic regression analysis of student's nutrition knowledge, attitudes and their intake of dairy products (95% confidence interval, $\alpha < 0.05$)

Variables		Unadjusted OR ratio	95% Confidence interval	Adjusted OR ratio	95% Confidence interval
Knowledge	Good (Ref)				
	Poor	0.900	0.307-2.644	0.897	0.300-2.678
	Moderate	1.182	0.440-3.176	1.12	0.413-3.053
Attitudes	Positive (Ref)				
	Negative	0.478	0.094-2.418	0.49	0.097-2.525
	Neutral	1.018	0.392-2.644	1.02	0.391-2.700

This table shows a different result; student's having moderate nutrition knowledge are 1.1 times more likely to not take dairy products every day, when compared with students who have poor knowledge. The same trend can be seen even after adjusting nutrition knowledge with their attitude score; students with neutral attitude are more likely to not take dairy products everyday as compared to the students who show poor attitude.

Discussion

This study showed that there isn't a huge difference in student nutrition knowledge score. About 28% students had poor knowledge of the diet related health issues, while 35.3 %

had moderate and 36.3% had good knowledge score. When looked at the attitude score, more than 50 % of the students show positive attitude towards taking healthy food. When both of these independent variables are compared to the overall consumption of fruits, vegetables, and dairy products intake, it was seen that many of them did not take these food items everyday in the food recall. This could be explained by analyzing the student's nutrition knowledge score. The less knowledge score implies that most of them are not aware of diet related health conditions, like Vitamin A and Iron deficiency Anemia, because of which they may not take the foods that contain the required micronutrients, even if provided in limited option, from the dining hall. On the other hand, when looked at the overall attitude score, many of participants, more than 50%, exhibit a positive attitude, which generally implies that the participants will also take fruits, vegetables and dairy products on a daily basis in these three day food recall. But, that is not the case in this data. Because attitude has been related to one's motivation too, one can say that the less variety in the food might have contributed to their less intake of, let's say vegetable which contains iron. Students can show a positive attitude towards iron deficiency anemia, and iron can be found in many food items. If dining provides only spinach, and many students' don't like it, that would partially explain why, despite a positive attitude, student's didn't take vegetable on a daily basis. Another explanation could be the fixed menu. For example, if the students take the survey from Friday-Sunday, and during this survey time the dining hall doesn't provide fish in its menu, they would not write it, and the data would apparently show that they are not taking enough fish, which is a source of vitamin A.

Another possible reason for seeing a more positive attitude but low intake of vegetables, fruits and dairy products could be because of the type of questions that were

asked related to one's attitude. The questions included the taste of specific food and the nutrient it contains, their perceived danger of that specific nutrient deficiency and whether they think the deficiency is serious or not. Only one food example was given to them when asked about the taste, which covers all types of food containing that nutrient into one, let's say vitamin A. Vitamin A is found in many foods, not just carrot's which was given in the example. Now, some people may like the taste of carrots and other may not, this doesn't mean that the people who don't eat carrots are more likely to not likely to get enough vitamin A, of course they might get it, but from different food sources such as, liver, which was not asked in the questionnaire.

When chi square test was run to check for association, the data showed that there is no association between participant's nutrition knowledge and attitude with their intake of vegetables, fruits and dairy products. Therefore, the null hypothesis was accepted. Although the null hypothesis was accepted, it still doesn't mean that the null hypothesis is true, it just means that we accepted the null hypothesis. This result also aligns with other studies where they also didn't find any association between nutrition knowledge and food intake of people. The insignificant result is also an indication that determinants, other than one's nutrition knowledge and attitudes, were not included in the study. Few examples of other determinants could be an individual's ability to afford and access the food of their choice.

In many researches, nutrition knowledge has been regarded as one of the main determinants of people's dietary practices. Dallongeville *et al* write that people's food habit, apart from food availability and socio economic status, can be determined by their nutrition knowledge (Dallongeville *et al.*, 2000). Similarly, Pirouznia, in her article on food behavior among adolescent male and female in the US, mentions that along with peer influence and

media, nutrition knowledge also influences adolescents' food behavior (Pirouznia, 2001). Although nutrition knowledge seems to be general indicator of people's food intake and implies that when people have a sound nutrition knowledge they will also choose to eat healthy food, which means eating foods of different types, for example grain, vegetables, fruits and dairy. However, many studies show that one's nutrition knowledge is not "sufficient" to change people's eating behavior (Worsley, 2002, Dallongeville et al., 2000). Researchers have also found a positive but weak association between nutrition knowledge and their food intake (Dallongeville et al., 2000). Because of the statically insignificant association results, Wardle says that researchers have started wondering whether one's nutrition knowledge is even relevant to their food intake (Wardle, 2000). Nayga's research also shows that gender doesn't have an effect on food behavior either; the result shows that it is just because of the difference in their nutrition knowledge (Nayga, 2001). All such studies could partly explain why this data also didn't show any significant association between nutrition knowledge, and attitude with food intake.

Besides, in a context like that of AUW where all students eat from the same dining hall and the same food, this study is either not feasible or could have been modified more to fit the context. For example, because students usually spend more time with their studies or other activities of their interest, and might have spent less time filling the food recall, because of which they might have missed writing all the types of food they eat. Another reason for not getting a significant result could be because, although students have seen the AUW's dietary guideline, they were not asked if they follow it and the assumption that they have seen the image and believe that it is important is not a robust proof to show if they also follow it. It can only be accurately measured if the environment was such where the students have the

option to choose their food. For example, if they all had to eat from a restaurant or had to cook for themselves in their dorms, it would give a different picture because then considering the factors, such as time, accessibility and motivation, a different result could be obtained.

Recommendations

A more feasible way to properly measure the association between knowledge, attitude and food intake would be to make the questions more valid and specific. For example, this research could have taken just one diet health related issue, for instance Vitamin A deficiency, and had a list of questions to measure knowledge and attitudes just related to that micronutrient, and checked through a food recall just the foods that contain that specific nutrient. Such a method would assess one's specific knowledge, attitudes, and the intake of that particular food, which would then be specific and valid enough for the research. Moreover, the reliability can be improved by doing this study with a large sample size.

This research calls for an improved nutrition knowledge to be disseminated to AUW students. For example, a big chart in the dining hall could be pasted, where basic knowledge on micronutrients is mentioned; which includes foods that contain them, the health benefits of taking them and disadvantages of not taking them. It would act as a constant reminder to students and encourage them to eat healthy food.

Limitations

The sample size was small, which could have contributed to getting statistically insignificant result. Besides, the main food was taken from dining, where the food options are limited; although, there were options for students to fruits and dairy from outside sources. Also, poor

response rates could have added chances of selection bias.

Conclusion

This study showed that only half of the students had good knowledge about Iron deficiency anemia, iodine deficiency and vitamin A deficiency; whereas, more than 50% of them had positive attitude towards food and food related health issues. It was found that there was no association between nutrition knowledge, attitude and food intake in AUW students. Their food intake was poor as many of them didn't take vegetable, dairy and fruits every day, despite many having a positive attitude even if few had good knowledge. Therefore, few suggestions are provided. First this study could be done with a large sample size to increase its reliability. Second, basic knowledge on micro nutrients need to be provided to students. It can be done by the help of AUW's health center in collaboration with AUW's public health department. This basic knowledge includes health benefits of taking and risks of not taking the nutrients and a list of accessible and affordable foods that contain them. This knowledge can be displayed on a big chart, visible enough to gain student's attention, and pasted on the notice board in the dining hall. Besides, nutrition can be made one of the core courses in AUW, so that students understand that there are many diseases that are just related to one's diet and could be prevented through a healthy diet. Such an initiative could help students achieve a more healthy diet.

References:

1. Dallongeville, J., Marécaux, N., Cottel, D., Bingham, A., & Amouyel, P. (2001). Association between nutrition knowledge and nutritional intake in middle-aged men from Northern France. *Public Health Nutrition*, 4(01), 27-33.
2. "Definition of Key Terms." *World Health Organization*. WHO, n.d. Web. <<http://www.who.int/hiv/pub/guidelines/arv2013/intro/keyterms/en/>>.
3. "Eating a Balanced Diet." *National Health Service Choices*. Gov.UK, n.d. Web. <<http://www.nhs.uk/Livewell/Goodfood/Pages/Healthyeating.aspx#>>.
4. "Healthy Diet." *World Health Organization*. WHO 2016, 2015. Web. 27 Mar. 2016. <<http://www.who.int/mediacentre/factsheets/fs394/en/>>.
5. Kigaru, D. M. D., Loechl, C., Moleah, T., Macharia-Mutie, C. W., & Ndungu, Z. W. (2015). Nutrition knowledge, attitude and practices among urban primary school children in Nairobi City, Kenya: a KAP study. *BMC Nutrition*, 1(1), 44.
6. Marias, Y. F., & Glasauer, P. (2014). *Guidelines for assessing nutrition-related knowledge, attitudes and practices*. Food and Agriculture Organization of the United Nations (FAO).
7. Nani, M. O. (2016). *RELATIONSHIP BETWEEN NUTRITION KNOWLEDGE AND FOOD INTAKE OF COLLEGE STUDENTS* (Doctoral dissertation, Kent State University).
8. Nayga Jr, R. M. (2000). Nutrition knowledge, gender, and food label use. *The Journal of Consumer Affairs*, 97-112.
9. Pirouznia, M. (2001). The association between nutrition knowledge and eating

behavior in male and female adolescents in the US. *International journal of food sciences and nutrition*, 52(2), 127-132.

10. Spronk, I., Kullen, C., Burdon, C., & O'Connor, H. (2014). Relationship between nutrition knowledge and dietary intake. *British Journal of Nutrition*, 111(10), 1713-1726.
11. "The Global Burden of Chronic." World Health Organization. WHO, n.d. Web. 29 Mar. 2016. <http://www.who.int/nutrition/topics/2_background/en/>.
12. Wardle, J., Parmenter, K., & Waller, J. (2000). Nutrition knowledge and food intake. *Appetite*, 34(3), 269-275.
13. Worsley, A. (2002). Nutrition knowledge and food consumption: can nutrition knowledge change food behavior?. *Asia Pacific journal of clinical nutrition*, 11(s3).

Appendix**Participant Consent Form**

Study title: Association between nutrition knowledge and attitudes with intake of vegetables, fruits and dairy products among students at the Asian University for Women (AUW),

Chittagong

Lead investigator: Shafia Mirza

Declaration by participant:

I have read, or have had read to me, and I understand the Participant Information Sheet. I have had the opportunity to ask questions and I am satisfied with the answers I have received.

I freely agree to participate in this study and understand that I can terminate my participation at any point during the study without any adverse consequences. I reserve the right to refuse to answer any question I do not want to answer.

I have been given a copy of the Participant Information Sheet and Consent Form to keep.

Participant's name:

Signature:

Date:

Declaration by member of research team:

I have given a verbal explanation of the research project to the participant, and have answered the participant's questions about it.

I believe that the participant understands the study and has given informed consent to participate.

Researcher's name: Shafia Mirza

Signature: Shafia Mirza

Date:

Questionnaire

Association between nutrition knowledge and attitudes with intake of vegetables, fruits and dairy products among students at the Asian University for Women (AUW), Chittagong

❖ UG level: _____ Date: _____ Case# _____

❖ Major and Minor (or intended major): _____

Food-based dietary guidelines

I am going to ask you some questions about food-based dietary guidelines. Please let me know if you need me to clarify any of my questions. Feel free to ask any question you may have..

Please look at this image carefully and answer the following questions

AUW FUTURE LEADERS NEED HEALTHY EATING HABITS!!!



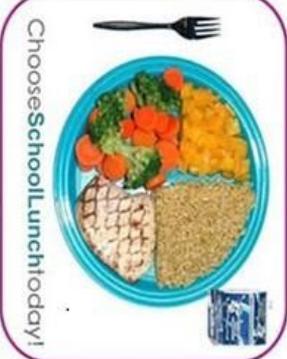
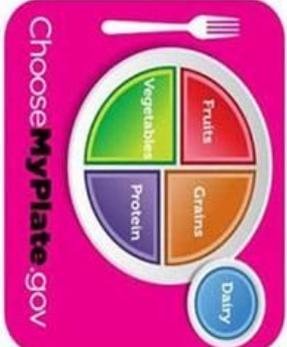
*Eat Healthy!
Feel Healthy!
Be Healthy!*



Eat Fresh & BE Fresh
Store and Dispose Food SAFELY and PROTECT yourself from FOOD POISONING!
Reduce the Salty Junk Food that you consume, Live Longer!
Eat Breakfast Daily: to Maintain a Healthy Weight!
Eat Fruits: No Sugar-added & Zero Fiber Juices and Reduce 20% of Heart Diseases!
Add more Vegetables to your Daily Diet – Sustain Proper Maintenance of YOUR body!



then you are eating healthy!



good health

Questions	Responses	Coding
1. Have you ever seen this image?	A. Yes B. No (<i>Go to question 3</i>) C. Don't know	A=1 B=0 C=2
2. <i>If yes</i> , Could you tell me what it is?	A. Eat Healthy, Feel Healthy Be healthy chart B. Don't know	A=0 B=1
3. Why do you think this <i>Eat Healthy, Feel Healthy Be healthy</i> chart exists?	A. To encourage people to eat foods from different food groups/have a diversified diet B. Don't know	A=0 B=2
4. Can you list two foods suggested in each food group in the ChooseMyPlate.gov picture?	A. Fruits: _____, _____ B. Vegetables: _____, _____ C. Grains: _____, _____ D. Protein: _____, _____ E. Don't know	Yes=1 No=0
5. How important is it to follow the <i>Eat Healthy, Feel Healthy Be healthy</i> dietary guidelines?	A. Important B. Not important (<i>go to question 7</i>) C. You're not sure	A=1 B=0 C=2

6. Can you tell me the reasons why the <i>Eat Healthy, Feel Healthy Be healthy</i> dietary guidelines <u>is important</u> ?	<hr/> <hr/>	
7. Can you tell me the reasons why the <i>Eat Healthy, Feel Healthy Be healthy</i> dietary guidelines <u>is not important</u> ?	<hr/> <hr/>	
<p>Iron-deficiency anemia</p> <p>I am going to ask you some questions about anaemia and iron-rich foods. Please let me know if you need me to clarify any of my questions. Feel free to ask any question you may have.</p>		
8. Have you heard about iron-deficiency anemia?	<p>A. Yes</p> <p>B. No (Go to question 10)</p> <p>C. Don't know/no answer</p>	<p>A=1</p> <p>B=0</p> <p>C=2</p>
9. Can you tell me how you can recognize someone who has anemia? (Multiple options are possible)	<p>A. Less energy/weakness</p> <p>B. Paleness/pallor</p> <p>C. Spoon nails/bent nails (koilonychias)</p> <p>D. More likely to become sick (less immunity to infections)</p> <p>E. Don't know</p>	<p>Yes=1</p> <p>No=0</p>

<p>10. What causes anemia?</p> <p>(Multiple options are possible)</p>	<p>A. Lack of iron in the diet/eat too little, not much</p> <p>B. Sickness/infection (malaria, hookworm infection, other infection such as HIV/AIDS)</p> <p>C. Heavy bleeding during menstruation</p> <p>D. Don't know</p>	<p>Yes=1</p> <p>No=0</p>
<p>11. How can anemia be prevented?</p> <p>(Multiple options are possible)</p>	<p>A. Eat iron-rich foods</p> <p>B. Eat vitamin-C-rich foods during or right after meals</p> <p>C. Take iron supplements if prescribed</p> <p>D. Treat other causes of anemia (diseases and infections) – seek health-care assistance</p> <p>E. Don't know</p>	<p>Yes=1</p> <p>No=0</p>
<p>12. Which of the foods do you think is rich in iron?</p> <p>(Multiple responses possible)</p>	<p>A. Organ meat:</p> <p>i. Liver</p> <p>ii. Kidney</p> <p>iii. Heart</p> <p>B. Flesh meat:</p> <p>i. Beef</p> <p>ii. Pork</p>	<p>Yes=1</p> <p>No=0</p>

	<p>iii.Lamb</p> <p>C. Fish and seafood:</p> <p>i. Fish</p> <p>ii. Prawn</p> <p>iii.Shrimps</p> <p>D. Don't know</p>	
13. How likely do you think you are to be Iron deficient/anaemic?	<p>A. Not likely</p> <p>B. You are not sure</p> <p>C. Likely</p>	<p>A=0</p> <p>B=1</p> <p>C=2</p>
14. Can you tell me the reason why it is not likely?	<p>_____</p> <p>_____</p>	
15. How serious do you think Iron deficiency is?	<p>A. Not serious</p> <p>B. you are not sure</p> <p>C. serious</p>	<p>A=0</p> <p>B=1</p> <p>C=2</p>
16. Can you tell me the reason why it is <u>not serious</u> ?	<p>_____</p> <p>_____</p>	
17. How much do you like the taste of [iron-rich food item or meal]?	<p>A. Dislike</p> <p>B. You're not sure</p>	<p>A=0</p> <p>B=1</p>

	C. Like	C=2
Vitamin A deficiency		
I am going to ask you some questions about vitamin A and food rich in vitamin A. Please let me know if you need me to clarify any of my questions. Feel free to ask any question you may have.		
18. Have you heard about vitamin A deficiency or lack of vitamin A?	A. Yes B. No C. Don't know/no answer	A=1 B=0 C=2
19. Can you tell me how you can recognize someone who lacks vitamin A in his/her body? (Multiple options are possible)	A. Weakness/feels less energy B. Be more likely to become sick(less immunity) C. Eye problems: night blindness, dry eyes, blindness D. Don't know	Yes=1 No=0
20. How can one prevent deficiency of vitamin A in the body? (Multiple options are possible)	A. Eat vitamin-A-rich foods B. Eat foods fortified with vitamin A C. Give vitamin A supplements D. Don't know	Yes=1 No=0
21. Can you tell me which of these foods are rich in vitamin A?	A. Animal-source foods: i. Liver ii. Kidney	Yes=1 No=0

iii. Heart

iv. Egg yolks

v. Milk

vi. Cheese

vii. Yogurt

B. Orange-colored vegetables:

i. Orange sweet potato

ii. Carrot

iii. Pumpkin

iv. Green vegetables

i. Spinach

ii. Ladyfinger (okra)

iii. cabbage

C. Fruits

i. Ripe mango

ii. Ripe papaya

iii. Apricot

iv. Dried peach

E. Don't know

22. How much do you like the taste of [Carrots]? Do you dislike it, you neither like it nor dislike it (neutral) or do you like it?	A. Dislike B. Neutral C. Like	A=0 B=1 C=2
23. How likely do you think you are to lack vitamin A in your body?	A. Not likely B. Your are not sure C. Likely	A=0 B=1 C=2
24. Can you tell me the reason why it is <u>not likely</u> ?	_____ _____	
25. How serious do you think a lack of Vitamin A is?	A. Not serious B. Your are not sure C. Serious	A=0 B=1 C=2
26. Can you tell me the reason why it is <u>not serious</u> ?	_____ _____	
<p>Iodine deficiency</p> <p>I am going to ask you some questions about iodine deficiency. Please let me know if you need me to clarify any of my questions. Feel free to ask any question you may have.</p>		
27. Have you heard about iodine deficiency?	A. Yes B. No	A=0 B=1

	C. Don't know/no answer	C=2
28. Can you describe the signs of a lack of iodine in the body? (multiple options are possible)	A. Apathy (lack of motivation and excitement) B. Having difficulty working or studying C. Goiter D. Don't know	Yes= 1 No =0
29. How can iodine deficiency be prevented?	A. Eat/prepare foods with iodized salt B. Don't know	A=0 B=2
30. How likely do you think you are to lack Iodine?	A. Not likely B. Your are not sure C. Likely	A=0 B=1 C=2
31. Can you tell me the reason why it is <u>not likely</u> ?	_____ _____	
32. How serious do you think a lack of iodine in the body is?	A. Not serious B. You are not sure C. Serious	A=0 B=1 C=2
33. Can you tell me the reason why it is not serious?	_____ _____	

34. Do you use salt while cooking your meal?	A. Yes B. No C. Don't know/no answer	A=1 B=0 C=2
35. <i>If Yes:</i> What kind of salt did you use?	A. Iodized B. Not iodized C. Don't know/no answer	A=0 B=1 C=2

3 days food recall

Case# _____

Dear participant,

Please take few minutes to mention the list of foods you took during the mentioned times and the days, including food bought from supermarkets/shops. Thank you.

#	Time	Please write what food did you eat?		
		Day 1 (Friday)	Day 2 (Saturday)	Day 3 (Sunday)
1	For breakfast			
2	Between breakfast and lunch			
3	For Lunch			
4	Between lunch and evening tea time			
5	Evening (3:00pm-6:30pm)			
6	Dinner			
7	After dinner before sleeping			

Thank you for your participation.

