

Fruit and Vegetable Consumption among Medical Students in an Egyptian University: Knowledge, Practice, and Attitude towards Accessible Healthy Food

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Received : July 2017 Accepted : October 2017

Abstract

Background: Diet rich in fruits and vegetables is associated with a decreased risk for many chronic diseases. Several studies have shown low fruit and vegetable consumption among university students. The burden of disease associated with inadequate nutrition negatively affects their health. **Objectives:** Assessment of fruit and vegetable (F&V) consumption among medical students, knowledge of daily requirements, perceptions of benefits, barriers and motives for (F&V) consumption and identify their acceptance of accessible healthy food. **Methods:** A self-administered questionnaire adapted from Food Attitudes and Behaviors Survey (FAB) was completed by 473 students. Scores were calculated for knowledge, benefits, barriers and motives. Food events were done in between teaching sessions and in the faculty campus where healthy stuffs were provided. Students' acceptance of healthy food was assessed by those who got food items during events and those who expressed willingness to try food stuffs in future events. **Results:** Knowledge of the recommended five daily servings for F&V was recalled by 8.2% of students, 110 (23.26%) consumed 5 servings of F&V daily. Mean knowledge score percent was 28.11 ± 26.69 and higher among males ($P < 0.01$). Mean benefit score percent was 83.9 ± 11.7 , for barriers 61.75 ± 16.55 and for motivation 59.79 ± 19.83 . Males as well as smokers had higher mean barrier score ($P < 0.01$). Healthy food items were tried by 35.7% of students. Fresh orange juice, green salad and banana were the most requested items. Almost 44% expressed willingness to try healthy food in future events. **Conclusion and recommendation:** Medical students have infrequent F&V consumption; however, they have motives to consume them. A high frequency of students accepts presence of healthy food environment. Wider access is recommended.

Key words: Fruits and vegetables, consumption, knowledge, motives, barriers, healthy food

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Introduction

A diet high in fruits and vegetables (F&V) is associated with a broad spectrum of health benefits and a decreased risk of many chronic diseases and some cancers. It also helps in weight management ⁽¹⁾. Young adults at the age between 18 and 24 years are in a stage of life in which they make their own dietary choices and are continuously challenged to make healthy

ones ². Health hazards of inadequate (F&V) consumption can be observed at such young age and affects health negatively. Low fruit and vegetables consumption was significantly associated with dyslipidaemia among university students in Fayoum ³. Moreover, Egypt Demographic and Health Survey in 2014 reported that overweight and obesity were prevalent among 42.3% of girls and 30.1% of boys aged 15-19 years ⁴.

The problem of unhealthy eating behavior among youth is of importance as it influences their risk of many chronic diseases later on.

The average estimated needs/day varies according to age, gender and level of physical activity for adults aged 18-30 years that range between 1800-3200 Kcal/day⁵.

The recommended daily intake of fruits and vegetables based on an average 2000 kcal diet is two cup equivalents of fruits and two and a half cup equivalents of vegetables. One cup equals approximately one medium apple, eight strawberries, 12 baby carrots, or one large tomato as examples. Recommended intake is often expressed as five servings of fruits and vegetables daily^{1,6}.

An assessment of F&V intake in 9 countries in the Eastern Mediterranean region revealed that 70% of the adult population (15 – 65 years) consume less than the recommended five servings per day.¹

Fruit and vegetable consumption studied among adolescents in eleven countries in the Eastern Mediterranean Region showed that only 19.4 % reported consuming F&V ≥ 5 times/d⁷.

A population based survey (STEPS) conducted in Egypt on 5300 adults aged 15-65 years, revealed that 95.6% of adults aged 25-64 years eat less than 5 servings of fruits and or vegetables/day⁸.

Fruit and vegetable consumption has been invariably reported to be low among adolescents and young adults. A fairly low frequency of adequate consumption of F&V (21.7%) was found among adolescents in Sohag, Upper Egypt⁽⁹⁾. In Mansoura, Lower Egypt, a study of the dietary habits of 927 secondary school students showed that 29% consume fruits and 78.2% consume raw vegetables on a daily basis however the number of daily servings was not specified¹⁰. Among a sample of 2875 Egyptian university

students assessing their healthy nutrition and physical activity guidelines, fresh fruits were consumed on daily basis by 31.4% of participants, while 40.2% consume salads and raw vegetables daily.¹¹ Studies involving young adults from a number of developing countries have shown similarly low F&V consumption (23% in Brazil, 26.5% in Malaysia and 37% in Nigeria)^{12, 13, 14}.

F&V consumption remains low among university students. In a Saudi Arabian University F&V consumption was 22%¹⁵. Another study found that F&V consumption of at least 5 daily servings was 34.7% with a significantly higher consumption among females¹⁶.

Many factors affect students F&V eating habits. Correct knowledge of F&V recommended daily intake doesn't always guarantee adherence to it. A recent Saudi Arabian study showed that despite the fact that 72.2% of University students had correct information about the daily F&V WHO recommendations; only 3.27% actually consumed 5 servings or more daily¹⁷.

An ecological framework previously described by Story et al, 2008 reveals that not only knowledge but also the environmental context influence food choices and eating behavior. These include the social environment (as family, friends and peers), the physical environments (as schools, work sites and restaurants) and the macro-level environments as food marketing¹⁸. A similar group of factors including living with the family, planning daily menu by themselves, fitness consciousness and regular exercise were found to encourage more F&V consumption among university students¹⁷. An Egyptian study found that those from higher social class were twice as likely to consume vegetables and nearly 4 times as likely to consume fruits daily compared to low social class¹⁰. The presence of a healthy food environment in campus could

enhance better food choices among students². Environmental strategies are one component in the ecological framework described by Story et al, 2008¹⁸ which can alone or combined with other interventions influence students eating behavior. Environmental influences include food availability, price, promotion, social norms and role models^(19, 20). This study investigated the following research questions: Do medical students know the recommended daily requirements of F&V, what is their actual consumption, what motivates them to consume F&V and what are their perceived benefits and barriers. Will students accept the presence of a healthy food environment and what are their preferred food choices?

The aim of the current study is to determine students' nutritional knowledge regarding the recommended daily requirements of fruit and vegetable, to assess the current fruit and vegetable consumption among medical students, to identify motives, perceived benefits, and perceived barriers in fruit and vegetable consumption and to assess students' acceptance of presence of a healthy food environment and their preferred food choices.

Method

Study design and setting: This cross sectional study involved 473 medical students at the Faculty of medicine Ain Shams University during the academic year 2012-2103.

Sample size: Calculations were based on a prevalence of 21.7% for adequate fruit and vegetable consumption among 300 adolescents in Egypt⁹ with 95% confidence level and 80% power, the estimated required sample size was 483 using NCSS PASS 11 statistical package.

A total of 550 questionnaires (to compensate for non-response and incomplete responses) were distributed, 508 questionnaires were returned of which

35 questionnaires were excluded due to largely missing data resulting in a final sample of 473.

Tool: A self-administered questionnaire adapted from FAB survey, 2009⁶ was distributed to students during Healthy food events. The department of Community, Environmental and Occupational medicine at Ain Shams University has initiated "Healthy food events" in attempt to promote healthy eating choices among medical students and to identify their acceptance of a healthy food environment. Access to Healthy food was provided physically and economically (low price) in between teaching sessions for 4th year medical students on Wednesdays each week during the first semester of the academic year 2012-2013 mounting up to 13 events. Two other healthy food events were organized in the faculty campus to extend access to students from all other grades based on their availability. The initiative was based on providing a selected list of food items including whole fresh vegetables and fruits, salads, sandwiches and fresh fruit juices. Acceptance of a healthy food environment was indicated by student's response to the following questions: (1) Have you ever tried getting food from the healthy food days? (2) Are you willing to try healthy food stuffs or to participate in organizing healthy food days in future events?

Questionnaire description and validation: The questionnaire included sections on: participant's demographic characteristics, nutritional knowledge, attitude towards eating F&V that asked about benefits, barriers and motives, consumption of F&V and lastly a section about participation in the healthy food events.

Examples of how much counts as 1 cup or 1 serving of F&V was included in the questionnaire section adapted from FAB survey, 2009⁶. It was meant to guide students recall correctly their average daily consumption of F&V.

Questionnaire forms were kept in English language to ensure validity of the adapted questions. The researchers established face and content validity before conducting the study by reviewing the questionnaire items with faculty. Two questions that asked about self rating of health status were omitted because of non specific responses.

Study population: It included a convenient sample of medical students in the 4th grade during attending the community medicine round as well as medical students from other educational grades. The later were enrolled in the study based on their availability during the healthy food events organized outdoors in the faculty venue.

Scoring of variables: Scores were created for the following aspects: Knowledge, Benefits, Motivation and Barriers.

Knowledge (4 questions: average calorie needs for an adult, recommended daily servings of fruits& vegetables, recommended daily number of cups of fruits and recommended daily number of cups of vegetables).

For nutrition knowledge questions, answers to questions were graded one for correct answer and Zero for the incorrect with a total score of 4.

Correct answers for knowledge sections were set as follows: Recommended average calorie needs for an adult= 1800-3200 kcal/day⁵. Recommended number of daily servings of fruits and vegetables= 5. Recommended fruit intake daily = 2-3 cups of fruits/day. Recommended vegetable intake daily = 2-3 cups of vegetables/day

For the sections of perceived benefits, barriers and motivation a likert scale of 5 categories was used where 5 = strongly agree and 1 = strongly disagree). Benefits: (5 statements for fruits and 6 for vegetables with a total score of 55), motivation for consumption: (8 statements with a total score of 40), Barriers: (5 statements for fruits and 5 for vegetables with a total score of 50).

A summation of scores of all questions in each section was done for each student then divided by the total number of students. All scores were then multiplied by 100 and presented as percentages.

Data management and Statistical analysis: Data were statistically described in terms of mean \pm standard deviation, or frequencies (number of cases) and percentages when appropriate. Analysis was done using independent sample t-test for comparison of means. Chi squared test and Odds ratio for testing the association between categorical variables. Significance level was selected at $p \leq 0.05$. Statistical analysis was done using SPSS version 22 for Microsoft Windows. During analysis, any student other than being a 4th grade student was grouped in a separate category "other educational grades" as the aim was not to compare F&V consumption and attitude in each educational grade, but rather to explore whether a 4th grade student; being exposed to recurrent healthy food days with easier accessibility; would have different responses.

Ethical consideration: The study didn't include any additional procedures rather than the daily living activities. Verbal informed consent was witnessed and formally recorded. All questionnaire forms were anonymous.

Results

The sample included 473 students of whom 263 (55.60%) were females. Their mean age was 20.47 ± 1.35 years. There were 59 (12.47%) current smokers. Based on self-reported height and weight, 35.5% were categorized as overweight or obese (BMI ≥ 25). Mean age of 4th year students was 20.61 ± 0.73 while mean age of students from other grades was 20.24 ± 1.95 ($p = 0.014$). Detailed characteristics of the sample is in (table 1)

The least known knowledge in nutrition was the recommended number of daily servings of fruits and vegetables as only 39

students (8.25%) knew the correct answer (table 2).

When asked about the actual daily intake of F&V, nearly one quarter of students (24.5% and 23.2%) met the recommended daily amounts for fruit and vegetable respectively. Almost 10% of students do not consume either item daily (table 3).

Groups and types of fruits and vegetables in each group were listed for students to choose the ones they mostly consume. The preferred vegetables being consumed by students based on their recall were: Non starchy vegetables: 366 (85.71%), Leafy: 344 (80.56%), Starchy: 325 (76.11%). Most preferred fruits consumed were: Fresh fruits: 383 (89.49%) and Fruit juices: 321 (75%). then dried fruits: 212 (49.53%) and canned: 202 (47.2%).

Most students identified "being tasteless" (60.68%) and "Quick spoilage" (58.35%) as the main barriers to eating vegetables; while the main barriers to eating fruits were being chemically polluted (50.95%), quick spoilage (49.26%) and being expensive (42.71%). Concerning motives, the first five statements mostly agreed by students indicate intrinsic motivation; Good for health (55.81%), To improve physical health (53.91%), To feel better about myself (51.37%), A choice I really want to make (46.93%) and to feel in control of myself (46.72%) (Table 4).

The mean score percentages calculated for knowledge, benefits, motives and barriers towards consuming F&V revealed the following : Benefits were given the highest score percent being 83.94% (± 11.68), followed by barriers 61.75% (± 16.55) , motives 59.79% (± 19.83) and least mean score percent was for nutrition knowledge being 28.11% (± 26.69).

Students were categorized as those with adequate daily intake of F&V and those without and were compared in respect to their mean knowledge, benefits, motives and barrier scores (Table 5). No association was found between the

knowledge; motives, benefit and barrier scores of students and their adequate consumption for fruits and vegetables.

Knowledge and perceived barriers scores for fruit and vegetables consumption were significantly higher among males than females ($p < 0.05$). Students reporting good health status had significantly higher knowledge scores. Barriers score was significantly higher among smokers. Students currently on diet regimen have higher motivation score (Table 6a). Students who knew about healthy food events have shown a higher knowledge and benefit score and a lower barrier score $p < 0.05$ (Table 6b).

Students' personal characters such as educational grade, gender, body mass index, smoking and eating outdoors showed no association with F&V consumption. , knowledge about healthy food events was not associated with F&V consumption reported by students. Students with adequate F&V consumption were not significantly different from those with inadequate consumption regarding ever participating in healthy food events or willingness to participate in the future (Table 7).

Most students (64.48%) were aware of the healthy food events organized by Community Medicine Department. The majority of them knew about it from friends (47.5%), faculty staff (33%) or posters (19.5%). One hundred sixty nine students (35.73%) ever tried buying healthy food at these events and 206 (43.55%) are willing to try healthy food in future events while 207 (43.76%) expressed willingness to actively participate in organizing similar events in the future (Figure a)

Students eating habits largely influenced whether or not they bought healthy foods. Table (8) shows that, eating outdoors and being currently on a diet regimen was significantly associated with ever buying healthy foods during the events.

Willingness to try healthy foods in future events was only significantly associated with being a 4th grade student. Willing to actively adopt the initiative of healthy food events was significantly associated with female gender, eating outdoors and being on a diet.

Students were asked to list their preferred food choices to be available in healthy food events. Regarding fruit categories, fruit salad cups (42.9%) and whole fruit; mainly banana (44.8%) and apples (40%) were the most frequently requested items by students. From the fresh vegetables, green salad plates (56%), cherry tomato cups (38.7%) and sliced carrots (31.5%) were the most frequently requested items. Whole-grain bread sandwiches as tuna sandwiches (43.3%), cottage cheese sandwiches (31%) were the most desirable items in sandwiches.

Fresh orange juice was the most preferred type of juice listed by (60.8 %) of students.

Discussion

In this study we have assessed medical students' consumption of F&V and response towards an initiative providing accessible healthy food items. The study revealed that consumption of F&V tends to be low among students (23.3%) and a low frequency of participants was not eating F&V at all.

Few studies have explored students' F&V consumption based on recommended daily intake, while others only reported whether or not student consume any amount of F&V on daily basis. In either case, most studies have generally shown low F&V consumption ranging between 10% and 37%^{9, 12, 15, 14, 13, 21, 22}.

Similar to the findings of the present study, a cross sectional survey among undergraduates in 11 faculties at Assuit University showed that 21.2% and 22.8% consume fruits and vegetables respectively several times daily although the number of daily servings was not specified²³.

Similar results were found in countries in the region. A Saudi Arabians study reported that 40.5% consume fresh fruits only twice a week and 48% consume vegetables once weekly, and 85.5 % ate less than 3 servings on these days²⁴.

Few studies found a high F&V consumption among students. One Saudi Arabian study reported that more than 50% of a sample of University students consumed at least 3 servings of vegetables and at least 2 servings of fruits/day. However more than one third of them were studying at the department of nutrition whose vegetable consumption was significantly higher than students of the non-nutrition departments²⁰. Compared to the current study, a recent survey among 2875 undergraduate students in Assuit University showed higher consumption rates of fruits 31.4% and raw vegetables 40.2%¹¹.

Gender was not consistently associated with F&V consumption across previous studies. The current study shows no association between gender and adequate consumption of F&V in agreement with other studies^{12, 17}.

In contrast, some studies in Greece, Saudi Arabia and in the US revealed that females had more regular F&V consumption^{16, 25, 26}. A Turkish study showed that females had better attitude and motivation to eat adequate amounts of F&V²⁷. An Egyptian study reported significantly higher vegetables consumption among male university students, but no gender difference regarding fruit consumption²³.

In the present study, students' knowledge did not seem to affect their F&V consumption. While male students had significantly higher knowledge score, it didn't positively influence their consumption. On the contrary, two studies detected an association between knowledge and consumption^{17, 21}.

However, F&V consumption is not only determined by an individual's knowledge.

Previous studies reported that perceived barriers significantly affected adolescents' fruit and vegetable intake^{29, 30}. In the present study a slightly higher perceived benefit score and lower barrier score was observed among the group who has been adherent to adequate F&V intake, yet the difference was not statistically significant. The recommended F&V daily intake was the least known issue to students with only 8.2% giving the correct answer. A comparable frequency was reported from other groups of undergraduate students⁽²¹⁾. This low level of knowledge of recommended F&V requirements may be attributed to the lack of nutritional education in school years in Egypt as previously reported⁽³⁰⁾. Besides, adequate F&V consumption seems not to be the norm among Egyptian population⁽⁸⁾. Despite the low level of knowledge of student in the current study, healthy food events may have slightly influenced the level of knowledge of students who have heard of it.

In the present study, the barrier score is higher among males and among smokers. A significantly higher benefit score and a significantly lower barrier score were found among 4th grade students compared to students of other educational grades collectively although the mean age was comparable. This may be attributed to the fact that 4th grade students were studying at the community medicine department. Thus, 4th grade students' attitude may have been influenced by exposure to reinforced stimulating environment where multiple healthy food events took place³¹.

The most frequently reported barriers for eating vegetables among medical students in the present study were the concern about pesticide or chemical pollution. These concerns were the least important in a Sri Lankan study at medical and other scientific schools²¹. The high cost of fruits was identified as one of the barriers to their

consumption in accordance with other studies^{21, 24}.

More than half of the students have rated health aspects as the most important motives for F&V consumption which was a similar opinion of other university student^{22, 24}. Statements reflecting internal motives to eat healthy featured more prominently in students' responses compared to statements that reflect external motives; as pressure from others or seeking others approval of them.

The healthy food initiative carried out by Community medicine department at the faculty of medicine has provided some forms of physical and economic access to healthy foods to students. A high frequency of students has benefited from the health events or is willing to share in future events, which reflects acceptance of such environmental changes. A previous study emphasized the presence of a healthy food environment and its role in healthier food choices by students^{2, 32}.

Willingness to try healthy food in future events was shown to be higher among 4th grade students This may be associated with the fact that 4th grade students attend 2 months at the Department of Community medicine; hence they are more frequently exposed and have easier and greater accessibility to healthy food during the successive healthy food events. Females and students who were dieting were enthusiastic about actively taking part in the healthy food events which may be a step towards expanding this initiative.

The habit of eating outdoor is common among adolescence in general⁽⁹⁾. The current study showed that eating outdoors is frequent among medical students, this poses an opportunity to offer healthy food items at students cafeteria instead of fast food stuffs. According to a number of previous studies, college students have expressed a need for accessible quality healthy foods at a reasonable or subsidized price at university campus^{21, 33, 34}.

Conclusion: The present study revealed low consumption of F&V among students irrespective of their knowledge or attitude scores regarding F&V. On the other hand, it showed that high frequencies of students are willing to purchase healthy food if it is made available and accessible to them. Students' knowledge and perceptions of benefits and barriers of F&V intake seem to have been positively influenced by the healthy environment in the form of healthy food events conducted by the department of Community medicine.

Recommendations: The infrequent F&V consumption highlights the need for effective interventions and approaches to encourage students increase their daily intake as per recommendations. Making an outlet for healthy eating inside the campus supported by the faculty administration and with participation of students can be an influencing factor. Greater access to F&V and nutrition education messages can motivate students adopt healthier life long eating habits.

Acknowledgments

We express our gratitude to the members of the department of Community, Environmental and Occupational medicine for volunteering their time and effort to organize healthy food events. We extend our thanks to the students who have participated in this study.

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Table (1) Socio demographic characteristics of the studied sample of students (N=473)

Character	Mean	Standard deviation	Minimum	Maximum
Age in years	20.47	1.35	17	27
	Number	Percent		
Gender				
Male	210	44.40		
Female	263	55.60		
Grade				
4 th year	291	61.52		
Other educational years	182	38.48		
Smoking				
Non Smoker	414	87.53		
Smoker	59	12.47		
Eating outdoors				
Yes	353	74.63		
No	120	25.37		
	Mean	Standard deviation	Minimum	Maximum
Weight in kg	69.3	14.74	28	130
Height in cm	169.02	10.39	130	204
	Number	Percent		
Body Mass Index (BMI)*				
Underweight	22	4.74		
Normal	283	59.75		
Overweight	128	26.98		
Obese	40	8.54		
Currently on a Diet regimen				
Yes	318	67.23		
No	155	32.77		

*BMI was calculated based on students' self-reported weight and height

Table (2) Nutritional Knowledge of students regarding fruits and vegetables daily requirements

Item	Number	Percent
Daily Caloric intake		
Incorrect	275	58.14
Correct	198	41.86
Daily F&V servings		
Incorrect	434	91.75
Correct	39	8.25
Daily fruit cups		
Incorrect	323	68.29
Correct	150	31.71
Daily vegetable cups		
Incorrect	342	72.30
Correct	131	27.70
Total	473	100.00

Table (3): Fruit and vegetable daily intake among students

Daily Intake*	Vegetables		Fruits	
	Number	Percent	Number	Percent
Not consumed	46	9.73	45	9.51
Inadequate	249	52.64	274	57.93
Adequate	116	24.52	110	23.26
Exceeding adequate amounts	62	13.11	44	9.30

*Inadequate (< 2 cups daily), adequate (2 – 3 cups/day), excess (> 3 cups day)

Table (4): Students 'agreement* to statements assessing the benefits, barriers and motives to fruit and vegetable consumption

Benefits of vegetable consumption	N= 473 N	Percent
Vegetables help prevent diseases	408	86.26
Vegetables are a substitute for unhealthy food	384	81.18
Vegetables are always available	365	77.17
Vegetables make one feel better	360	76.11
Vegetables help maintain weight	354	74.84
Benefits of fruit consumption	N	Percent
Fruits make diet more varied	403	85.20
Fruits help prevent disease	394	83.30
Fruits make one feel better	385	81.40
Fruits always available	365	77.17
Fruits are a substitute for unhealthy food	349	73.78
Fruits help maintain weight	333	70.40
Barriers to vegetables consumption	N	Percent
Vegetables tasteless	287	60.68
Vegetables spoil quickly	276	58.35
Vegetables take time to buy	248	52.43
Vegetables chemically polluted	235	49.68
Vegetables expensive	123	26
Barriers to fruit consumption	N	Percent
Fruits chemically polluted	241	50.95
Fruits spoil quickly	233	49.26
Fruits expensive	202	42.71
Fruits takes time to buy	200	42.28
Fruits Tasteless	142	30.02
Motives for fruit and vegetable consumption	N	Percent
- Intrinsic motives:		
Good thing for my health	264	55.81
To improve my physical health	255	53.91
Feel better about myself	243	51.37
Choice I really want to make	222	46.93
To feel in control of myself	221	46.72
- Extrinsic motives:		
To set a good example	133	28.12
Pressure from others	107	22.62
Want others to approve of me	102	21.56

*Agreement was considered for students who answered "Agree" and "Strongly agree" in the Likert scale

Table (5): Relation between consumption of fruits and vegetables and other scores (knowledge, motivation, perceived benefits and barriers)

	Adherence to the recommended intake*				P value [†]
	Adherent N= 110		Non Adherent N = 363		
Knowledge score percent (Mean ± SD)	28.40	26.94	28.0	26.63	0.902
Motivation score percent (Mean ± SD)	58.65	18.65	60.13	20.00	0.534
Perceived Benefits score percent (Mean ± SD)	85.17	11.44	83.56	11.79	0.247
Perceived Barriers score percent (Mean ± SD)	59.13	18.29	62.54	15.97	0.079

*Recommended intake of at least 2.5 cups of vegetables and 2 cups of fruits equivalent to 5 servings of fruits and vegetables daily

[†]Independent samples t test was used

Table (6a): Factors affecting students' knowledge and attitude scores (motivation, barriers and benefits)

Variables	Knowledge			Motivation			Benefits			Barriers		
	Mean%	SD	P value	Mean%	SD	P value	Mean%	SD	P value	Mean%	SD	P value
Grade												
4 th year	29.73	27.22	0.108	61.07	19.72	0.081	85.24	10.9	0.003*	60.12	16.19	0.011*
Other educational years	25.52	25.67		57.74	19.83		81.85	12.54		64.36	16.75	
Gender												
Male	31.79	25.89	0.009*	60.32	19.86	0.615	83.09	11.42	0.194	63.82	16.82	0.016*
Female	25.17	26.99		59.36	19.78		84.61	11.84		60.1	16.12	
Smoking												
No	27.95	26.78	0.759	60.19	19.52	0.275	84.29	11.45	0.131	60.94	16.48	0.009*
Yes	29.24	26.20		56.97	21.67		81.44	12.91		67.46	15.81	
Eating outdoors												
Yes	26.70	25.99	0.064	59.2	19.66	0.303	83.72	12.12	0.513	62.20	16.91	0.327
No	32.26	28.37		61.52	20.21		84.57	10.25		60.43	15.31	
Overweight/ obese												
No	27.82	27.09	0.781	59.64	19.17	0.839	84.24	11.17	0.508	60.91	16.88	0.184
Yes	28.64	26.01		60.05	20.96		83.38	12.53		63.28	15.78	
On Diet regimen												
No	28.29	25.17	0.928	56.22	19.46	0.008*	82.85	12.32	0.169	60.63	17.09	0.331
Yes	28.02	27.43		61.53	19.76		84.46	11.32		62.30	16.23	

Independent t test was used

*Statistical significance level $P < 0.05$

Table (6b): Factors affecting students' knowledge and attitude scores (motivation, barriers and benefits)

Variables	Knowledge			Motivation			Benefits			Barriers		
	Mean%	SD	P value	Mean%	SD	P value	Mean%	SD	P value	Mean%	SD	P value
Knew of healthy food day												
No	23.64	26.02	0.008*	54.91	21.4	0.001*	82.57	12.63	0.067	65.16	16.24	0.001*
Yes	30.56	26.72		62.46	18.4		84.69	11.08		59.88	16.44	
Ever tried buying												
No	28.13	26.97	0.992	58.43	20.67	0.049	83.54	11.52	0.339	61.14	16.88	0.320
Yes	28.11	26.29		62.23	18.07		84.67	11.94		62.84	15.91	
Willing to buy												
No	27.86	26.86	0.838	58.66	20.09	0.182	82.66	12.66	0.019	63.83	15.9	0.002*
Yes	28.42	26.51		61.26	19.43		85.60	10.07		59.05	17.01	
Willing to participate												
No	27.02	26.26	0.337	56.64	19.43	< 0.001*	82.19	12.48	0.001*	63.37	16.34	0.020*
Yes	29.51	27.22		63.82	19.66		86.17	10.17		59.67	16.68	

Independent t test was used

*Statistical significance level $P < 0.05$

Table (7) Factors that may be associated with students' consumption of F&V (practice)

	Adherence to the recommended intake of F&V* (Practice)					OR (95% CI)
	Adherent N= 110		Non Adherent N=363		P value [†]	
	Number	Row %	Number	Row %		
Grade						
4th grade	64	21.99	227	78.01	0.441	0.834 (0.54-1.28)
Other education grades	46	25.27	136	74.73		
Gender					0.074	1.476(0.96-2.26)
Male	57	27.14	153	72.86		
Female	53	20.15	210	79.85		
Smoking					0.571	0.823 (0.42-1.614)
No	98	23.67	316	76.33		
Yes	12	20.34	47	79.66		
Eating outdoors					0.502	0.842 (0.50-1.39)
Yes	84	23.80	269	76.20		
No	26	21.67	94	78.33		
Overweight/ obese					0.304	0.788 (0.5- 1.24)
No	76	24.92	229	75.08		
Yes	34	20.24	134	79.76		
On Diet regimen					0.251	0.77 (0.49-1.20)
No	40	25.81	115	74.19		
Yes	70	22.01	248	77.99		
Knew of healthy food day					0.344	1.247 (0.78-1.97)
No	36	21.43	132	78.57		
Yes	74	24.26	231	75.74		
Ever tried buying healthy food					0.321	1.245 (0.80-1.92)
No	70	22.77	234	77.23		
Yes	40	24.12	129	75.88		
Willing to buy in coming events					0.751	0.933 (0.60 – 1.43)
No	64	23.97	203	76.03		
Yes	46	22.33	160	77.67		
Willing to participate					0.313	0.8(0.518-1.235)
No	67	25.19	199	74.81		
Yes	43	20.77	164	79.23		

OR (95% CI): Odds Ratio (95% Confidence interval)

*Recommended intake of at least 2.5 cups of vegetables and 2 cups of fruits equivalent to 5 servings of fruits and vegetables daily.

[†]Chi squared test was used

Table (8): Association between demographic characters and students' participation in healthy food events

	Ever tried buying healthy food N=169				Willing to buy in coming events N=206				Willing to participate N=207			
	N	Row %	P value	OR	N	Row %	P value	OR	N	Row %	P value	OR
Grade												
Other than 4 th grade	64	35.16	0.072	1.095(0.74-1.60)	71	39.01	0.032*	1.268(0.87-1.84)	83	45.60	0.060	0.911(0.62-1.32)
4 th grade	105	36.08			135	46.39			124	42.61		
Gender												
Female	91	34.60	0.059	1.187(0.81-1.72)	113	42.97	0.069	0.947 (0.65-1.36)	125	47.53	0.014*	0.711(0.49-1.02)
Male	78	37.14			93	44.29			82	39.05		
Smoking												
No	141	34.06	0.013*	1.632(0.94-2.82)	184	44.44	0.069	0.758(0.43-1.33)	181	43.72	0.111	1.076(0.62-1.86)
Yes	28	47.46			22	37.29			26	44.07		
Eating outdoors												
Yes	135	38.24	0.019*	0.643(0.41-1)	153	43.34	0.082	1.031(0.67-1.56)	160	45.33	0.043*	.738(0.48-1.12)
No	34	28.33			53	44.17			47	39.17		
Overweight/obese												
No	107	35.08	0.077	1.113(0.77-1.66)	133	43.61	0.073	0.952 (0.65-1.39)	133	43.61	0.071	1.033(0.70-1.50)
Yes	62	36.90			73	43.45			74	44.05		
On Diet regimen												
No	50	32.26	0.040*	1.175(0.79-1.74)	63	40.65	0.056	1.163(0.78-1.71)	63	40.65	0.046*	1.24(0.84-0.829)
Yes	119	37.42			143	44.97			144	45.28		

OR: Odds Ratio, Chi squared test was used

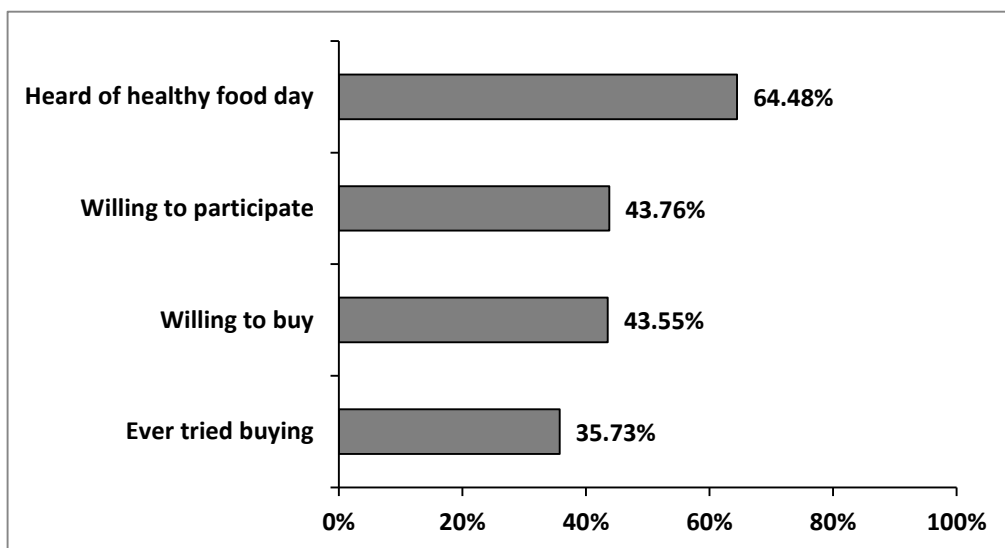


Figure (a): Participation in the healthy food day events