

University Students' Preferences for and Consumption Patterns of fruits and Vegetables: Implication for Nutrition Education Interventions

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Abstract

According to the Food and Agriculture Organization (FAO), there has been a drastic reduction in the consumption of fruits and vegetables (FVs) in Ghana. However, not much empirical studies on FVs consumption pattern among university students have been undertaken. This cross-sectional study was therefore conducted to examine FVs consumption among 903 randomly sampled university students. The result revealed that although approximately 49.9% and 48.4% asserted that it is important to consume FVs because of its nutritional value and health benefits, it was not translated into their consumption practices. Out of a list of 14 fruits provided, for 8 fruits, less than 10% indicated that they consumed them at least thrice in the past one week prior to the study. Green leafy vegetables like spinach and amaranthus were preferred by less than 50% of the surveyed students. Generally, a higher proportion of the female students that were enrolled in the study consumed more vegetables than their male counterparts. The three major challenges reported by students which prevented them from eating FVs everyday were seasonal availability, cost/high prices of FVs and fear of chemical contamination. The findings suggest the need for interventions that focus on growing organic FVs on a large scale without the application of any chemicals and ensuring all-year availability. Perhaps, University Teaching Farms can take up this challenge and supply organic grown FVs at reduced prices to students at their various halls and hostels of residence in order to encourage students to consume them.

Keywords: Fruits and Vegetables; University Students; Consumption; Preferences; Barriers

Introduction

Fruits and vegetables (FVs) are often identified as the most important part of a diet in preventing age-related diseases [1]. They are universally promoted as healthy mainly because they are rich sources of vitamins, minerals, dietary fibre and phytochemicals and unlike other food sources contain less amounts of fats [1]. Generally, the pigments in FVs ensures that the bright colour, scent and flavor that they give off together with their antioxidant and anti-inflammatory actions, are behind their numerous health benefits [2]. Meals rich in these pigments induce enzymes in the liver and assist the body in eliminating potentially carcinogenic compounds [3].

People whose diets are rich in fruits and vegetables have the lowest risk of becoming obese and diabetic [4-6]. There is evidence that young adults who eat more than five servings of FVs daily, end up having a healthier heart when they grow older [6]. A study reported that young adults who ate FVs daily were less likely to have calcified plaque in their arteries decades later, had healthier hearts and this consequently reduced their risk of heart diseases [7].

Several studies conducted among adolescents and young adults revealed that there are numerous psychological outcomes including a lower incidence of depression and anxiety, greater happiness, higher life satisfaction, and greater social-emotional well-being associated with a higher consumption of FVs [6,8]. In the study of White., *et al.* (2013) [9] it was concluded that young adults who ate FVs daily had a greater emotional well-being than their counterparts who ate less or no FVs. These studies suggest that an increased intake of FVs during the early adulthood stage of life plays a beneficial role during the late adulthood stage of life [10].

The transition period from high school to a tertiary institution (university or college) usually between ages 18 and 26 has been described as being a challenging stage in adult development especially because most students find themselves in a new environment [11]. This transition period is usually associated with the need to adjust and adapt to a new academic setting which is accompanied by extra tasks coupled with stress and a lack of time that could impinge on student's lifestyle choices [12]. The stressful academic activities of university students has been described as a significant determinant and an immense contributor of poor eating behaviors, especially among the young adult population [13].

It is during this period of life that students assume the primary responsibility of purchasing food items and preparing their own meals which can lead to practicing unhealthy dietary habits such as high consumption of snack foods [14], high intake of fast food [15] and skipping of meals [16]. This stage of development has also been associated with a reduced intake of FVs [17,18]. As such, the eating habits of university students has been an important concern as a major determining factor of their health status [20].

The health and lifestyle behaviours of university students which includes their eating habits has been described as a neglected issue [16]. However, it is of great public health concern because unhealthy habits picked up at this age generally persist in older adult life and can have long-lasting implications on their health status in the future [16,19]. Stroud, *et al.* (2015) [19] asserted that contrary to popular perceptions held by people, young adults are surprisingly unhealthy. Their health status is poorer as compared with adolescents, and they also show a worse health profile than those in their late 20s and 30s [20]. However, not much attention has been paid to the health needs of young adults [21]. Moreover, Tanton, *et al.* (2015) [16] indicated that research focusing on university students' eating behaviours is limited and not conclusive. Specifically, in the case of Ghana it has been highlighted that there is dearth of literature focusing on the eating patterns of FVs, awareness of the health benefits of FVs and barriers that negatively affect the consumption of FVs among young adults such as students [22].

Generally, studies conducted in Ghana reveal that Ghanaians are not eating enough FVs daily [23,24]. A study conducted by the Food and Agriculture Organisation (FAO) revealed a drastic decline in the consumption of FVs in Ghana. According to the research, the national average consumption of FVs daily was far below the World Health Organisation's (WHO's) recommended rate. Currently, the average Ghanaian consumes 1.5% portion of fruits and 2.3% portion of vegetables daily as against the WHO requirement of 4% to 6% per day. Kegey and Boateng (2017) [24], recommended the need for further research to identify and understand the specific reasons for the low consumption of FVs especially amongst different population groups in Ghana.

In Ghana some studies have reported that the intake of FVs among adolescents and young adults is generally very low [25,26]. However, there is evidence that that a good diet in early adulthood means a healthier old age. This implies that when young adults consume healthy foods like FVs in their early years of adulthood, it may pay off later in their lives when they are older [27]. Therefore this research seeks to investigate the awareness of university students about the benefits of consuming FVs on a daily basis, their FVs eating patterns, FVs preferences and barriers to their eating of FVs as students. Again, the study seeks to assess the differences with regard to the FVs preferences, eating patterns of FVs based on the gender of students. Findings obtained from this study may guide in the planning of optimal nutrition education programmes by public health professionals for students in tertiary institutions to help reduce the prevalence of diet-related health conditions among the population of young adults. In addition, a study which considers the dietary practices of university student, with a major spotlight on their FVs intake is important since university/ college campuses may be the last setting where it is possible to comprehensively address the health needs of a large proportion of young adults.

Methods

Research Design and Sampling

This was a descriptive cross-sectional study. The study population was university students irrespective of their level/year of study in a university in Ghana. The university has four (4) colleges (Humanities and Legal studies, Education Studies, Agricultural and Natural Sciences, and Health and Allied Sciences) running the regular programme. To ensure a fair representation of the students from these four colleges of the university, 300 questionnaires each were randomly distributed to students in each of the four colleges resulting in a total sample size of 1200 of which 903 (75.2%) retrieved instruments were included in the final analysis.

Research Instrument and Data Collection

The items on the self-administered questionnaire were modified forms of items used in similar studies undertaken by [22,25,26,28]. A self-reported questionnaire was administered to all students who agreed to participate in the study by signing an informed consent form attached to the questionnaire. The first section (A) consisted of questions to assess the background characteristics of the respondents. Information obtained on the background characteristics included sex, age, level/year of study, and college of study among other variables. The second section (B) comprised questions which assessed the perceptions of students regarding the benefits of consuming fruits and vegetables. In section C, respondents were given a list of fruits and vegetables and they were required to indicate its availability on campus, their preference, and their frequency of consumption in the past one week prior to the study. With regard, to their preferences for the FVs, the respondents were asked to indicate how much they liked each of the fruits and vegetables on a four-point scale comprising of scores ranging from liked very much = 4, like = 3 dislike = 2 and to disliked very much = 1. Students were required to indicate their preference using this scale. Section D comprised questions that assessed students views on how the use of other staple foods/food stuffs are different from that FVs. In section E, respondents were asked to indicate some barriers that prevented them from eating FVs and how they process FVs before consumption.

The questionnaire was given to two registered dieticians who also had a background in public health nutrition for expert advice and comments to improve the construct and content validity of the questionnaire. The questionnaire was then pilot-tested among 20 students in a University Polytechnic and a reliability coefficient value of 0.78 was determined using Cronbach's alpha coefficient of reliability. The 20 students identified some mistakes and some ambiguities which were corrected before the final data collection. Data was collected between 11th and 25th September, 2017.

Data Analysis

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) programme (version 20.0). Descriptive statistics were presented for background information of participants, perceptions on the benefits of consuming FVs, responses of students with regard to the availability of FVs on campus, their preference, and their frequency of consumption in the past one week prior to the study. Descriptive statistics were also presented for questions assessing students views on how the use of other staple foods/food stuffs are different from that of FVs, some barriers that prevented them from eating FVs and how they process FVs before consumption. The Chi-Square test of independence was run to assess gender differences in preference for fruits and vegetables.

Ethical Considerations

Participation was voluntary and informed consent for inclusion in the study was obtained from all the students by signing an informed consent form attached to the questionnaire. Confidentiality was maintained and anonymity of responses was ensured. Students who agreed to participate in the study were given one week to complete the questionnaire and return it. The participants were given a cover letter and written information regarding the aim of the study, voluntary participation, and confidentiality of data. The students were informed by the researchers that the study was not being conducted to grade them but to obtain an idea about their perceptions on the health benefits of FVs, their consumption patterns, barriers to the consumption of FVs for research and academic purposes.

Results

Background Information of Study Participants

The background information of the students who participated in the study is presented in table 1.

Variable	Frequency	Percentage
Gender		
Male	519	57.5
Female	384	42.5
Age groups of respondents		
16-20	195	21.6
21-25	647	71.7
26-30	45	5.0
31-35	7	0.8
36-40	5	0.6
41-45	1	0.1
46-50	0	0
50 and above	3	0.3
Educational level		
Year 1	184	20.4
Year 2	367	40.6
Year 3	250	27.7
Year 4	91	10.1
Masters	7	0.8
Phd	4	0.4
College of respondents		
Humanities and legal studies	208	23.0
Health and Allied sciences	219	24.3
Educational studies	204	22.6
Agricultural and Natural sciences	272	30.1

Table 1: Background Information of Respondents.

The sample consisted of the 903 students of which the male respondents (57.5%) outnumbered their female (42.5%) counterparts. Majority (71.7%) of the respondents were in the age bracket of 21 and 25, similar to an observation made in a related study conducted among polytechnic students in Ghana, where most (70.2%) of the students who participated in the study were in the age bracket of 21 and 29 [22]. A greater proportion (40.6%) of the sample were in the second year (level 200) and most (30.1%) of the students were from the college of Agricultural and Natural sciences.

Students' responses regarding the benefits of consuming fruits and vegetables, barriers and their preparation practices before consumption

Students responses regarding the benefits of consuming FVs and how their knowledge levels has influenced their consumption practices is summarized in table 2. The results indicate that majority, 99.1% and 99.2% indicated that consuming fruits and vegetables is necessary respectively. With regard to why they agreed that eating FVs is essential, approximately 49.9% and 48.4% asserted that it is important to consume FVs because of its nutritional value and its health benefits respectively.

Item	Frequency of Respondents	Percentage of Respondents
Is the consumption of vegetables necessary		
Yes	896	99.2
No	7	0.8
Is the consumption of fruits necessary		
Yes	895	99.1
No	8	0.9
Why do you consume fruits if you do, (n=896)		
Nutritional value	447	49.9
For satisfaction	15	1.7
Health value	434	48.4
If yes to the consumption of fruits, why		
Nutritional value	451	50.4
To become satisfied	24	2.7
Health value	420	47.0
Acquisition of current knowledge on fruits and vegetables		
From experts/health professionals	340	37.7
From the media	193	21.4
From parents/guardians	156	17.3
From school	141	15.6
From friends	73	8.1
Differences in the use of fruits from other staples		
Easy to prepare compared with other staples	409	45.3
Difficult to use compared with other staples	23	2.5
Not easy to obtain	158	17.5
Easy to obtain	249	27.6
Affordable and easy to handle	50	5.5
Not easily perishable	9	1.0
Are easy to store	5	0.6
Differences in the use of vegetables from other staples		
Easy to prepare compared with other staples	416	46.1
Difficult to use compared with other staples	27	3.0
Not easy to obtain	163	18.1
Easy to obtain	217	24.0
Affordable and easy to handle	61	6.8
Not easily perishable	10	1.1
Are easy to store	9	1.0
Effect of knowledge of fruits consumption on daily intake		
Able to determine the most nutritious fruits	620	68.7
Able to store fruits well	50	5.5
Able to process fruits well	138	15.3
Able to process and store fruits well	53	5.9
Does not affect my consumption	42	4.7
Effect of knowledge of vegetables consumption on daily intake		
Able to determine the most nutritious vegetables	592	65.6
Able to store vegetables well	103	11.4
Able to process vegetables well	83	9.2
Able to process and store vegetables well	103	11.4
Does not affect my consumption	22	2.4

Table 2: Students' Responses regarding the benefits of consuming fruits and vegetables and how their knowledge levels has influenced their consumption practices.

As shown in table 2, most (37.7%) indicated that they acquired knowledge on FVs from health experts/professionals.

With respect to how their knowledge on FVs has affected their daily intake, majority 68.7% and 65.6% asserted that they are able to determine the most nutritious fruits and vegetables respectively.

A higher proportion of the students (46.1%) held the view that preparing vegetables for consumption is easier as compared with other staple foods. In addition, students reported that fruits (27.6%) were easy to obtain as compared with vegetables (24.0%).

Item	Frequency of respondents	Percentage of respondents
When do you consume fruits		
Before meals	281	31.1
After meals	410	45.4
With meals	139	15.4
As meals	20	2.2
Between meals	53	5.9
When do you consume vegetables		
Before meals	142	15.7
After meals	165	18.3
With meals	408	45.2
As meals	126	14
Between meals	62	6.9
Quantity of fruits consumed daily		
One serving	733	81.2
Two servings	90	10
Three servings	55	6.1
Four servings	20	2.2
Five servings	5	0.6
Why do you consume that quantity of vegetables		
Unaffordable/High price	351	38.9
Fear of fruits contamination because of chemicals used to cultivate them	278	30.8
Unavailable	166	18.4
Affordable	61	6.7
Affordable and available	47	5.2
Major challenge with respect to daily intake of fruits		
Seasonal availability	412	45.6
Costly	227	25.1
Fear of contamination	191	21.2
Difficult to store	55	6.1
Difficult to process	18	2.0
Quantity of vegetables consumed daily		
One serving	679	75.2
Two servings	102	11.3
Three servings	81	9.0
Four servings	32	3.5
Five servings	9	1.0
Why do you consume that quantity		
Not affordable/high prices	314	34.8
Fear of fruits contamination	305	33.8
Not readily available	154	17.0
Affordable and available	130	14.4
Major challenge with respect to daily intake of vegetables		
Costly/high prices	396	43.9
Fear of contamination/Fear of chemical residues	290	32.1
Seasonal availability	125	13.8
Difficult to store	49	5.4
Difficult to process, time require for vegetable preparation	43	4.8
Influence of appetite for vegetable consumption		
Taste	542	60.0
Texture	237	26.2
Colour	52	5.8
Aroma	39	4.3
Storage period	33	3.7
Consumption of vegetables to satisfaction		
No	574	63.6
Yes	329	36.4
If no to consumption of vegetables to satisfaction, why (n = 574)		
Unaffordable	388	67.6
Unavailable	110	19.2
Unavailable and unaffordable	76	13.2
If yes to consumption of vegetables to satisfaction, why		
Affordable and available	178	41.5
Affordable	37	8.6
Available	214	49.9
Factors that influence appetite for fruits consumption		
Taste	424	47.0
Texture	229	25.3
Storage period	144	16.0
Colour	69	7.6
Aroma	37	4.1
Consumption of fruits to satisfaction		
No	478	52.9
Yes	425	47.1
If no to consumption of fruits to satisfaction, why (n = 478)		
Unaffordable	237	49.6
Unavailable	139	29.1
Unavailable and unaffordable	102	21.3
If yes to consumption of fruits to satisfaction, why (n = 425)		
Affordable and available	167	20.8
Affordable	33	3.7
Available	225	24.9

Table 3: Students' practices of eating Fruits and Vegetables and Barriers affecting their consumption.

Regarding when students usually consume fruits, majority (45.4%) indicated that they eat fruits after meals. On the hand other, for vegetables, majority(45.2%) reported that they usually eat vegetables with their meals.

In this study, one serving of fruits or vegetables was represented by half (1/2) the quantity of a 500 ml water sachet bag, commonly used in Ghana. Majority (81.2%) indicated that they usually consumed one serving of fruits whenever they ate fruits. Regarding, their inability to consume larger portion sizes of fruits, the two main reasons cited by students were the unaffordable/high prices of fruits (38.9%) and fear of contamination of the fruits as a result of chemicals used to cultivate them by farmers (30.8%). The three major challenges reported by students which prevented them from eating fruits everyday were seasonal availability (45.6%), cost of fruits (25.1%) and fear of contamination (21.2%). The three major factors that mostly influences student's appetite for eating fruits are its taste (47.0%), texture (25.3%) and storage period (16.0%). Slightly more than half (52.9%) of the students indicated that they were unable to acquire and consume enough fruits to their satisfaction and most (49.6%) attributed this to the unaffordable /high prices of fruits.

In the case of vegetables, similar to fruits, most (75.2%) students indicated that they usually consumed one serving whenever they ate vegetables. The two major reasons given by students that prevented them consuming larger quantities of vegetables were its high prices/ unaffordable (34.8%) and fear of contamination from chemicals that are usually used to grow vegetables by farmers (33.8%) respectively. For vegetables, the three major challenges reported by students which prevented them from eating them on a daily basis were, the high prices/costly (43.9%), fear of contamination from chemical used by farmers to cultivate them (32.1%) and the seasonal availability of vegetables (13.8%). The three major factors that mostly influences student's appetite for eating vegetables are its taste (60.0%), texture (26.2%) and colour (5.8%). Similar to the responses of fruits, a higher proportion (63.6%) of the students indicated that they were unable to acquire and consume enough vegetables to their satisfaction and most (67.6%) attributed this to the unaffordable /high prices of vegetables.

Students' responses regarding the storage and processing of Fruits and Vegetables before consumption is presented in table 4. Regarding, the practice of storing fruits, a higher proportion (68.4%) of students indicated that they do not usually store fruits and majority (65.2%) further asserted that it was due to the fact that they are usually cheap when in abundance during their seasons.

Item	Frequency of respondents	Percentage of respondents
Storage of fruits		
Yes	285	31.6
No	618	68.4
If no to the storage of fruits, why, (n = 618)		
Are cheap when in abundance during their season	403	65.2
Are readily available	173	27.9
The texture and taste changes after storage	42	6.8
Storage of vegetables		
Yes	256	28.3
No	647	71.7
If no to the storage of vegetables, why (n = 647)		
Are cheap when in abundance during season	319	49.3
Are readily available	179	27.7
The texture and taste changes after storage	149	23.0
Processing of fruits before usage		
Yes	394	43.6
No	509	56.4
How do you process fruits, (n = 394)		
Into juice and add sugar	24	6.1
Into juice without adding sugar	282	71.6
Fruits salad	78	19.8
Baking purposes	10	2.5
Why processing of fruits, (n = 394)		
To make it taste better	244	61.9
To reduce contamination	111	28.2
To increase its shelf life	39	9.9
Processing of vegetables before usage		
Yes	697	77.2
No	206	22.8
How do you process vegetables, (n = 697)		
Boiling / pre-cooking/blanching	630	90.4
Frying	17	2.4
Tossing in oil/fat	50	7.2
If no to the processing of vegetables, why (n = 206)		
To avoid denaturing the nutrients/vitamins in it	169	82.0
Taste better when consumed in the fresh taste	37	18.0
Why do you process vegetables (n = 697)		
To make it taste better	373	53.5
To reduce contamination	269	38.6
To increase the shelf life	55	7.9

Table 4: Students' responses regarding the storage and processing of Fruits and Vegetables before Consumption.

With respect to the practice of storing vegetables, similar to the responses given in the case of fruits, most (71.7%) students do not usually store vegetables and use it over a period of time. Again, almost half (49.3%) of students who do not usually store vegetables attributed this practice to the fact that vegetables are cheap when in abundance in their seasons and therefore did not warrant the need to buy in bulk and store.

With respect to the practice of processing fruits before consumption, majority (56.4%) of the students indicated that they do not usually process their fruits before eating them, implying that most student consumed fruits in their raw and natural state. For students who usually process fruits before consuming them 394 (43.6%), a higher percentage (71.6%) indicated that they processed the fruits into juice without adding sugar before consuming them. Regarding why they usually processed fruits before consumption, most (61.9%) of the students stated that, it was to improve or make the taste of the fruit better than its natural state.

Unlike fruits which are rarely processed before consumption, in the case of vegetables, more than three-fourth of the students (77.2%) reported that they often processed their vegetables before consuming them. For students who processed their vegetables, a majority (90.4%) usually boiled or blanched the vegetables in small quantities of water for a short time before consuming them. Most (53.5%) of the students indicated that they processed vegetables by boiling or blanching them in order to make them taste better. For students who did not usually process their vegetables before consumption, 206 (22.8%), majority (82.0%) indicated that they wanted to avoid denaturing the nutrients in them and therefore resorted to consuming them in their unprocessed state.

Students responses on the availability, preferences and weekly consumption patterns of fruits and vegetables

Responses given by students with regard to the availability, preferences and consumption pattern of fruits and vegetables in the week before the study are presented in tables 5 and 6.

Fruits	Availability on campus		Preference		Total No. who ate/ week	Number of Times consumed per week									
	Yes		Like			1X		2X		3X		4X		≥5X	
	F	%	F	%		F	%	F	%	F	%	F	%	F	%
Banana	892	98.8	873	96.7	802 (88.8%)	187	23.3	264	32.9	193	24.1	113	14.1	45	5.6
Mangoes	794	87.9	814	90.1	348 (38.5%)	252	72.4	68	19.5	13	3.2	6	1.7	11	3.2
Pineapples	889	98.4	818	90.6	679(75.2%)	377	55.5	214	31.5	58	8.5	19	2.9	11	1.6
Pawpaw	859	95.1	787	87.2	470 (52.0%)	323	68.7	88	18.7	29	6.2	17	3.6	13	2.8
Oranges	895	99.1	875	96.9	738 (81.7%)	184	25.0	218	29.5	201	27.2	96	13.0	39	5.3
Watermelon	870	96.3	829	91.8	681 (75.4%)	243	35.7	167	24.5	147	21.6	81	11.9	43	6.3
Guava	442	48.9	426	47.2	156 (17.3%)	107	68.6	21	13.5	17	10.9	11	7.0	0	0.0
Berries	388	43.0	439	48.6	133 (14.7%)	91	68.4	27	20.3	9	6.8	6	4.5	0	0.0
Tangerine	620	68.7	692	76.6	172 (19.0%)	90	52.3	47	27.3	17	9.9	13	7.6	5	2.9
Lime/ Lemon	541	60.0	412	45.6	129 (14.3%)	72	55.8	28	21.7	19	14.7	8	6.2	2	1.6
Peach	264	29.2	435	48.2	104 (11.5%)	67	64.4	27	26.0	10	9.6	0	0.0	0	0.0
Pear	614	68.0	710	78.6	152 (16.8%)	96	63.2	25	16.4	14	9.2	11	7.2	6	4.0
Grapes	725	80.3	763	84.5	185 (20.5%)	114	61.6	41	22.2	19	10.3	8	4.3	3	1.6
Apple	855	94.7	838	92.8	363 (40.2%)	226	62.2	87	24.0	29	8.0	16	4.4	5	1.4

Table 5: Students responses on the availability, preferences and weekly consumption patterns of fruits.

Vegetables	Availability on campus		Preferences		Total No. who ate/ week	Number of Times consumed per week									
	Yes		Like			1X		2X		3X		4X		≥ 5X	
	F	%	F	%		F	%	F	%	F	%	F	%	F	%
Spinach	280	31.0	439	48.6	113 (12.5%)	86	76.1	17	15.0	6	5.3	2	1.8	2	1.8
Amaranthus	277	30.7	407	45.1	90 (9.9%)	59	65.6	22	24.4	9	10.0	0	0.0	0	0.0
Kontomire/ cocoyam leaves	853	94.5	808	89.4	510 (56.5%)	267	52.4	117	22.9	108	21.2	18	3.5	0	0.0
Cabbage	896	99.2	865	95.8	651 (72.1%)	307	47.1	218	33.5	76	11.7	41	6.3	9	1.4
Carrot	889	98.4	853	94.5	647 (71.7%)	354	54.7	175	27.0	70	10.8	32	5.0	16	2.5
Cauliflower	558	61.8	659	73.0	214 (23.7%)	126	58.9	45	21.0	26	12.1	10	4.7	7	3.3
Lettuce	640	70.9	679	75.2	269 (29.8%)	161	59.8	65	24.2	29	10.8	14	5.2	0	0.0
Tomatoes	897	99.3	885	98.0	872 (96.6%)	56	6.4	83	9.5	94	10.8	307	35.2	332	38.1
Okro	886	98.1	842	93.2	691 (76.5%)	402	58.1	179	25.9	73	10.6	37	5.4	0.0	0.0
Cucumber	881	97.6	891	98.7	617 (68.3%)	391	63.4	146	23.7	47	7.6	28	4.5	5	0.8
Garden eggs	893	98.9	880	97.5	579 (64.1%)	306	52.8	169	29.2	75	13.0	21	3.6	8	1.4
Onion	895	99.1	853	94.5	861 (85.7%)	93	10.8	110	12.8	147	17.1	198	23.0	313	36.3
Shallot	852	94.4	805	89.1	672 (74.4%)	193	28.7	164	24.4	129	19.2	125	18.6	61	9.1
Green pepper	897	99.3	741	82.1	741 (82.1%)	294	39.7	191	25.8	153	20.6	79	10.7	24	3.2
French beans	552	61.1	516	57.1	248 (27.5%)	102	41.1	57	23.0	46	18.6	36	14.5	7	2.8

Table 6: Students responses on the availability, preferences and weekly consumption of vegetables.

With respect to the availability of fruits on campus, according to the surveyed students, out of a list of 14 fruits that were given, the 7 fruits that are usually available on campus are oranges (99.1%), banana (98.8%), pineapples (98.4%), watermelon (96.3%), pawpaw (95.1%), apple (94.7%), and mangoes (87.9%) in decreasing order of students views according to their availability on campus.

Regarding preference of fruits, out of the list of 14 fruits provided, the 7 most preferred fruits in decreasing order of preference are oranges (96.9%), banana (96.7%), apple (92.8%) watermelon (91.8%), pineapple (90.6%), mangoes (90.1%) and pawpaw (87.2%).

Despite, the high percentages in the responses of students regarding the availability on campus and their preferences for some fruits, their responses did not correspond to their weekly consumption pattern. Out of the list of 14 fruits provided, for 9 fruits, less than 50% indicated that they had consumed them in the past one week prior to the study. As shown in table 5, these 9 fruits were mangoes, guava, berries, tangerine, lemon/lime, peach, pear, grapes and apple, perhaps because they are not readily available on campus as indicated by students. It was only in the case of 5 fruits (banana, oranges, watermelon, pineapple and pawpaw) that were consumed by more than 50% of the students in the previous one week before the study probably because they are readily available on campus according to students.

The results as shown in table 5 reveals that less than 50% of the students who responded to the questionnaire consumed each of the list of 14 fruits at least once in a week. Among the 7 most preferred fruits which according to the students were also readily available on campus, only 8.5%, 6.2%, 3.2%, 21.6%, 8.0%, 24.1% and 27.2% of the surveyed students indicated that they ate pineapple, pawpaw, mangoes, watermelon, apples, banana and oranges respectively at least three times in the past one week before the study.

In the case of vegetables, out of the list of 15 different kinds of vegetables provided, according to the surveyed students, the 7 vegetables that are usually available on campus are tomatoes (99.3%), sweet/green pepper (99.3%), cabbage (99.2%), onion (99.1%), garden eggs (98.9%), carrot (98.4%) and okro (98.1%).

With respect to students' preferences for vegetables, out of a list of 15 vegetables, 10 were reported to be preferred by more than 80% of the students who participated in the study. These 10 vegetables were tomatoes (98.0%), cucumber (98.7%), shallot (89.1%), garden eggs (97.5%), carrot (94.5%), cabbage (95.8%), okro (93.2%), sweet/green pepper (82.1%), kontomire (89.4%) and onion (94.5%). A little above 50% preferred vegetables like lettuce, french beans and cauliflower. Green leafy vegetables like spinach and amaranthus were preferred by less than 50% of the surveyed students.

Similar observations that were made regarding students consumption pattern of fruits were also reported for vegetables.

Comparable with fruits, although out of the list of 14 vegetables given, at least 10 were reported to be usually available by more than 90% of the students and were preferred by more than 80% of the respondents, in the case of all 15 vegetables given, less than 30% of the students consumed them at least two times in the past one week before the study. In the case of two vegetables, onion and tomatoes more than 30%, 38.1% and 36.3% of the respondents respectively indicated that they ate them at five or more times in the week prior to the study.

Gender Differences in Likeness and Dislike for FVs

Gender differences with respect to preferences for fruits and vegetables is depicted in table 7.

Fruit	Gender		P-value	Vegetable	Gender		P-value
	Male	Female			Male	Female	
Banana	3.92	3.31	0.020*	Spinach	2.28	2.32	0.610
mangoes	3.63	3.56	0.206	Amaranthus	2.17	2.24	0.206
Pineapple	3.86	3.32	0.031*	Kontomire/cocoyam leaves	3.26	3.54	0.021*
Pawpaw	3.72	3.65	0.542	Cabbage	3.51	3.57	0.623
oranges	3.84	3.79	0.316	Carrot	3.64	3.68	0.316
watermelon	3.88	3.53	0.040*	Cauliflower	3.09	3.16	0.348
Guava	2.75	2.86	0.622	Lettuce	3.36	3.42	0.622
Berries	2.61	2.72	0.573	Tomatoes	3.87	3.92	0.518
Tangarine	3.06	3.18	0.614	Okro	3.28	3.62	0.023*
Lime/Lemon	2.42	2.51	0.628	Cucumber	3.31	3.74	0.018*
peach	2.37	2.46	0.562	Gargen eggs	3.39	3.48	0.542
Pear	3.01	3.67	0.010*	Onion	3.82	3.86	0.566
Grapes	2.46	3.58	0.002*	Shallot	3.05	3.12	0.362
Apples	2.71	3.62	0.031*	Green pepper	3.32	3.81	0.013*
				French beans	3.07	3.11	0.641

Table 7: Gender Differences with respect to Preference for Fruits and Vegetables. (p value = < 0.05)

The results indicate that, female students indicated a higher preference for fruits such as apple, grapes and pear and this was statistically significant. There was a statistically significant difference ($p > 0.05$) with respect to the preference for banana, pineapple and watermelon for male students as compared with their female counterparts.

With regard to differences in preference for vegetables, more females preferred vegetables like kontomire/cocoyam leaves, okro, cucumber and green/sweet pepper than their male counterparts and the difference between the males and females was statistically significant.

Gender differences with regard to consuming FVs at least once in a week is summarized in table 8.

Fruit	Total who ate fruit/ week	Gender		Vegetables	Total who ate vegetables/ week	Gender	
		Male n (%)	Female n (%)			Male n (%)	Female n (%)
Banana	802	462 (57.6)	340 (38.0)	Spinach	113	42 (37.2)	71 (62.8)
Mangoes	348	192 (55.2)	156 (44.8)	Amaranthus	90	26 (28.9)	64 (71.1)
Pineapple	679	382 (56.3)	297 (43.7)	Cocoyam leaves**	510	247 (48.4)	263 (51.6)
Pawpaw	470	241 (51.3)	229 (48.7)	Cabbage	651	293 (45.0)	358 (55.0)
Oranges	738	449 (60.8)	289 (39.2)	Carrot	647	281 (43.4)	366 (56.6)
watermelon	681	443 (65.1)	238 (34.9)	Cauliflower	214	89 (41.6)	125 (58.4)
Guava	156	59 (37.8)	97 (62.2)	Lettuce	274	103 (37.6)	171 (62.4)
Berries	133	51 (38.3)	82 (61.7)	Tomatoes	872	490 (56.2)	382 (43.8)
Tangerine	172	79 (46.0)	93 (54.0)	Okro	691	332 (48.0)	359 (52.0)
Lime/Lemon	129	42 (32.6)	87 (67.4)	Cucumber	617	256 (41.5)	361 (58.5)
peach	104	34 (32.7)	70 (67.3)	Gargen eggs	579	238 (41.1)	341 (58.9)
Pear	152	53 (34.9)	99 (65.1)	Onion	861	481 (55.9)	380 (44.1)
Grapes	185	53 (28.6)	132 (71.4)	Shallot	672	320 (47.6)	352 (52.3)
Apples	363	138 (38.0)	225 (62.0)	Green pepper	741	373 (50.3)	368 (49.7)
				French beans	248	93 (37.5)	155 (62.5)

Table 8: Gender Differences with respect to Consumption of Fruits and Vegetables per Week

** local name for cocoyam leaves is kontomire

For the consumption of fruits, generally the results showed that whereas a greater proportion of the respondents who ate banana, mangoes, pineapple, pawpaw, oranges and watermelon were males, a higher proportion of students who consumed guava, berries, tangerine, lime/lemon, pear, grapes and apples were females. It appeared that male students usually consumed more of the fruits that were reported by students to be readily available as compared with their female counterparts. On the other hand, the results indicated that female students rather consumed fruits that were not easily obtainable without much difficulty on campus than male students.

With regard to vegetables, generally a higher proportion of females consumed more vegetables than their males counterparts. It is only in the case of three vegetables, tomatoes, onion and green pepper that a higher percentage of males consumed them as compared with females. Even in the case of these three vegetables, 382, 380 and 368 females out of a total number of 384 female participants consumed them in the past week before the study. These numbers represents approximately 99.5%, 98.9% and 95.8% of the female participants who ate tomatoes, onions and green pepper respectively in the previous week before the study.

Discussion

In this study, approximately equal proportions of the students 49.9% and 48.4% indicated that it is essential to consume FVs because of their nutritional value and health benefits to the body. The respondents in this study demonstrated adequate knowledge about the benefits of consuming FVs, which is vital in the Ministry of Health's (MoH) campaign of promoting the adoption of healthy lifestyle practices in order to eliminate and prevent potential diseases that have an impact on the health and general well-being of Ghanaians [29]. One of MoH's standardized messages that has been drafted and used in health advocacy under the Regenerative Health and Nutrition Program is "fruits and vegetables is medicine" [30]. Our finding regarding student's knowledge on the benefits of consuming FVs agrees with another previous study in Ghana in which most students (56.4%) consumed FVs due to their health benefits [22].

Our findings revealed that the three main determining factors/barriers that influences the consumption of FVs on a daily basis by students are seasonal availability, cost/high prices of FVs and fear of contamination as a result of chemicals used to cultivate them by farmers. Our findings corroborates with that of Perera and Madhujith (2012) [31] in which unavailability of FVs in students' places of residence, high prices of FVs and fear of pesticides and other chemicals used to grow FVs were identified as barriers to consuming FVs.

This observation is, however, inconsistent with Kpodo., *et al.*'s, (2015) [22] finding that whereas factors such as availability, convenience and attractiveness predominantly influenced choice of fruits by students, factors such as long storage life and cost appeared to be the least important determinants of consumption of fruits. In support of our findings, it has been reported that in some settings, consumers have reduced their usual intake of FVs as a result of fears about pesticide residues, thus opposing the positive health benefits ascribed to the consumption of higher portion sizes of FVs [32]. In Ghana, a common practice of farmers is the application of pesticides on crops in order to prevent low productivity in the agricultural sector because of the potential damages caused by pests [33]. In Ghana, past studies have revealed that FVs are contaminated with insecticide and pesticide residues [34,35]. Perhaps, students are aware of such reports on pesticide and insecticide contamination of FVs and therefore have become cautious about consuming them.

In this study it was revealed that although more than 80% of the surveyed students indicated that fruits such as banana, oranges, pineapple, watermelon, apple, pawpaw and mangoes were available and they preferred these fruits, less than 80% of the students ate these fruits, with the exception of banana and oranges, in the past week before the study. Similar observations were made in another study that was conducted in a polytechnic in Ghana where fruits such as banana, orange and watermelon were consumed by 20.6%, 16.4% and 15.7% of students [22]. Layade and Adeoye, (2014) [36] indicated that in Africa where technologies needed to extend the harvest session, and facilitate storage are limited, most FVs are not available all year round. Consequently, the availability and accessibility to most FVs is largely dependent on their seasons of abundance and as such it is expected that not a wide variety of FVs will be available throughout the year. This assertion is supported by findings in a related study in which factors such as the availability, accessibility and seasonality of FVs was found to influence their consumption [37].

Similar to the results in this present study where tomatoes and onions were the only two vegetables that were consumed by most students more than five times in a week, the study of Kpodo., *et al.* (2015) [22] also reported that these two vegetables appeared to be marginally the top two commonly patronized vegetables by students in tertiary institutions. This is not surprising as most students in Ghana usually prepare tomato sauce/stew using these two food ingredients as reported by Kpodo., *et al.* 2015 [22]. Comparable to the finding that less than 30% of the respondents consumed vegetables such as french beans and lettuce at least once in a week, Kpodo., *et al.* (2015) [22] also indicated that lettuce and french beans were least purchased and consumed by students. Findings from our study generally indicated that green leafy vegetables are less frequently consumed by students supported by a similar observation made by Sharma, Thomas and Shrivastav (2016) [38] in a study among students in University of Delhi. In another related study undertaken in a tertiary institution in Ghana, an observation made was that only 17.9% of the students consumed green leafy vegetables on a daily basis [25]. Clearly, this finding suggests that intake of green leafy vegetables is generally a rare practice among tertiary students.

Regarding fruits preferences among students, fruits such as banana, oranges, watermelon, pineapple and mangoes were preferred by more than 80% of the study participants compared with fruits such as berries, lemon and lime and guava preferred by less than 50% of the surveyed students. Our findings are comparable to the findings of Kpodo., *et al.* (2015) [22] in which students' preference for banana and watermelon were very high relative to other fruits such as guava, blackberries and lemon. Similarly, our findings corroborates with that of Layade and Adeoye (2014) [36], in a study among students in a tertiary institution in Nigeria in which the most preferred fruit by students was banana.

Regarding preference for vegetables, more than 80% of the students preferred vegetables such tomatoes, cucumber, garden eggs, carrot, cabbage, okro, sweet/green pepper and onion as compared with green leafy vegetables like lettuce, spinach and amaranthus. These findings of the present study corroborate the observations of a related study in Ghana, in which the top three most liked vegetables were carrots, tomato and onion whereas, the least preferred ones were green leafy vegetables such as bokoboko (*Talinum triangulare*) and aleefu (*Amaranthus cruentus*) [22].

One can infer from the results of this study that FVs that were frequently consumed were usually available to students as reported in similar studies that factors that have been found to determine FVs intake and preferences include its availability/accessibility in the immediate environment of people such as the home and school [36,39,40]. For example, in the study of Layade and Adeoye (2014) [36] among tertiary students, it was found that availability of fruits on the premises of the institution determined fruit consumption among students.

With regard to the frequency of consuming fruits on a weekly basis, most of the surveyed students consumed fruits either once or twice per week. It is only in the case of three fruits-banana, orange and watermelon, that were consumed three times by more than 20%, but less than 30% of the respondents in the previous week before the study. The findings in this current study shows that to a large extent university students, who are young adults do not consume fruits on a daily basis consistent with findings of previous studies conducted among university students [41,42]. For example in the study of Abdel-Megeid., *et al.* (2011) [42], it was revealed that only 30.6% of the students usually consumed fruits once or twice in a week.

With respect to gender and fruits preferences, in the current study male students indicated a higher preference for orange, banana and pineapple than their female counterparts similar to the results of Kpodo., *et al.* (2015) [22]. However, in the case of fruits which were not readily available on campus such as apple, berries and grapes, female students reported a higher preference for them than their male counterparts corroborating with the results of Gonzales., *et al.* (2016) [43]. Regarding differences in preference for FVs, more females than males were likely to indicate preference for cucumber, green pepper, lettuce, grapes and berries than their male counterparts supporting the findings of Kpodo., *et al.* (2015) [22].

Gender differences with regard to preferences for and consumption of FVs is widely documented although not well understood [39]. In this study, the results revealed that female students were more likely to consume more fruits and vegetables than their male counterparts confirming the results of other related studies [37,44,45]. For example, in the study of Poscia., *et al.* (2017) [44] whereas 26.3% of females reported that they consumed at least one portion of fruit every day, for male respondents, only 15.8% gave such reports about their fruit intake. Similarly in the study of El Ansari., *et al.* (2015) [45], a higher proportion of female students (58.6%) compared with their male counterparts (35.6%) consumed fruits on a daily basis and adhered to guidelines given on fruit intake. Likewise, Menozzi., *et al.* (2015) [39] also indicated that females have a more positive attitude towards vegetables consumption than males.

In the case of vegetables intake, apart from tomatoes and onions which were consumed for 5 or more times in a week by 38.1% and 36.3% of the students respectively, for most of the vegetables, students consumed them either once or twice on a weekly basis indicating a low intake of a wide variety of vegetables by students on a daily basis as reported in another related study [46]. For example in the study of Gan., *et al.* (2011) [46], only 19% of university students consumed vegetables more than three times a week.

Generally, a higher proportion of the female students that were enrolled in the study consumed more vegetables than their male counterparts in agreement with the findings of previous studies [25,45,46]. For instance, in the study of Adinku (2014) [25] which was conducted in a tertiary institution in Ghana, an observation made was that consumption of vegetables among females was higher than males. In the study of Adinku (2014) [25], a significant number of female students consumed vegetables three times daily than their male counterparts. Likewise, in the study of El Ansari., *et al.* (2015) [45], a greater proportion of female students (32.3%) compared with their male counterparts (19.8%) consumed vegetables on a daily basis and adhered to guidelines given on vegetable intake.

Arganini., *et al.* (2012) [47] emphasized that females are more concerned about health issues, have stronger beliefs in the importance of consuming healthy foods, have a higher tendency to make healthier food choices and exhibit greater commitment in looking after their appearance than males. Gonzales., *et al.* (2016) [43] also asserted that females were more conscious of the health benefits of eating fruits and had the perception that fruits make them slim and gives beautiful hair, skin and body. As such females are more likely to translate their perceptions into action by consuming healthy foods such as FVs, which may be a potential explanation for the differences in dietary habits in the present study.

The fruits that were consumed by more than two-thirds (> 75%) of the students were banana, oranges, watermelon and pineapple. In a similar study conducted among undergraduate students in a university in Sri Lanka, it was observed that the most frequently consumed fruits by the students included banana, orange and pineapple [31] perhaps because they are usually available all year-round.

Conclusion

The findings in this study revealed that most students do not consume FVs on a daily basis, and is indicative of the dire need to promote nutritional education campaigns among university students sensitizing them about the importance of FVs in their diet to promote healthier lives.

The results highlight the importance of monitoring dietary and health-related practices among students in universities and colleges settings. The development of effective strategies and educational programmes are important to address the specific nutritional needs of today's student. The three main barriers that prevented students from adopting the dietary habits of consuming FVs on a daily basis were seasonal availability, cost/high prices of FVs and fear of contamination. Therefore, these findings underline the urgent need to make a deliberate effort to ensure that students have access to organic grown FVs in their places of residence and be assured that they are consuming FVs that have not been applied with chemicals. This will go a long way to encourage students to purchase FVs without being skeptical but rather with much convenience and consume them regularly.

Recommendations

Interventions to encourage daily consumption of FVs should target availability on university campuses within the easy reach of students probably in their halls and hostels of residence. Maybe, the University Teaching Farms can assume the role of taking up the responsibility of growing organic FVs and making it available to students at affordable prices rather than allowing sellers to buy from them and then sell to students at increased prices.

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Author's Contribution

CN: Conceived the idea for this study, interpreted the data, wrote the first draft of the manuscript and finalized the manuscript for submission. DA: reviewed relevant literature for the study, collected the data and analysed the data. The authors together designed the study and contributed to writing and critically reviewing the manuscript before submission for publication.

Conflict of Interest

There are no financial interests or any conflict of interest existing.

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