

# Nutrition-related cancer prevention knowledge of undergraduate students at the University of Ibadan, Nigeria

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**Objective:** This study assessed the nutrition-related cancer prevention knowledge and dietary pattern of undergraduate students.

**Design:** A cross-sectional study design was employed.

**Setting:** The University of Ibadan campus, Ibadan, Oyo state, Nigeria.

**Participants:** A systematic random sampling of 367 undergraduate students was done. Method: A pretested self-administered questionnaire assessed the nutrition-related cancer prevention knowledge of the participants based on WCRF/AICR guidelines. A food frequency questionnaire was used to evaluate the dietary pattern. Weight, height, waist and hip circumferences, body mass index and waist:hip ratio were measured and computed based on standard procedures.

**Results:** Less than half (49%) had good nutrition-related knowledge of cancer prevention. About 30.0–40.0% frequently consumed legumes/nuts, vegetables and fruits respectively. About 75.0% frequently consumed processed cereals and grains (white rice, white bread and noodles). Above 20.0% were overweight, while 3.8% were obese. Less than 75.0% had low risk of abdominal obesity while 25.5% had high risk of abdominal obesity. Nutrition knowledge of cancer prevention was associated with the frequency of consumption of processed cereals and grains ( $\chi^2 = 13.724; p = 0.000$ ), legumes/nuts ( $\chi^2 = 17.268; p = 0.000$ ), meat ( $\chi^2 = 22.972; p = 0.000$ ), fish ( $\chi^2 = 23.017; p = 0.000$ ), pastry snacks ( $\chi^2 = 36.159; p = 0.000$ ) and sugary drinks ( $\chi^2 = 6.432; p = 0.011$ ). There was no significant difference in knowledge of cancer prevention and the frequency of consumption of roots and tubers, milk, vegetables, and fruits. A higher risk of abdominal obesity was associated with infrequent consumption of legumes/nuts ( $\chi^2 = 7.001, p = 0.008$ ) in the males, and with vegetables ( $\chi^2 = 6.771, p = 0.009$ ) and fruits ( $\chi^2 = 4.205, p = 0.040$ ) intakes in the females.

**Conclusion:** Nutrition-related knowledge of cancer prevention was low, and the respondents also had a poor dietary pattern. The high risk of abdominal obesity may be a pointer to the larger young adult population, emphasising a need for targeted intervention.

**Keywords:** adolescents and young adult health, cancer prevention, nutrition knowledge

## Introduction

Cancer is one of the leading causes of morbidity and mortality worldwide; moreover, it is expected to move higher up the projection ladder by 2030.<sup>1</sup> The newest database for the International Agency for Research on Cancer, GLOBOCAN, revealed that new cases of cancer globally increased from 12.7 million in 2008 to 14.1 million in 2012 and cancer deaths increased from 7.6 million to 8.2 million.<sup>2</sup> The number of new cases is expected to rise by about 70% over the next two decades.<sup>3</sup>

Globally, the commonly diagnosed cancers were lungs, breast, colorectal, cervical, prostate and liver cancers.<sup>4</sup> In the same report, more than 60% of the world's new cancer cases occur in Africa, Asia, and Central and South America; these regions account for 70% of the global cancer deaths. In Nigeria, 102,100 new cancer cases were recorded in 2012, with 71,600 cancer deaths. Nigeria contributed 8.3% to the estimated 847,000 new cancer cases that occurred in Africa in 2012.<sup>5</sup> The most common cancers in males were prostate and liver cancer while breast and cervical cancer were the commonest cancers in Nigerian women.<sup>5</sup> In a population-based cancer registry in Ibadan, Nigeria

about 33,933 cancer cases were reported between 2009 and 2010, of which 66.4% were females and 33.6% were males. The common types of cancers recorded were breast and cervical cancers among females and prostate cancer among males.<sup>6,7</sup>

The burden of cancer is increasing in economically developing countries as a result of population ageing and growth as well as, increasingly, an adoption of cancer-associated lifestyle choices including smoking, physical inactivity, and 'Westernised' diets, which includes consumption of calorie-dense food.<sup>8</sup> Smoking, unhealthy diet, physical inactivity, excess body weight and associated factors are the most important preventable causes of cancers.<sup>9,10</sup> Diet and nutrition contribute appreciably to the burden of chronic and preventable diseases; specifically, healthy diets, such as high consumption of fruits and vegetables and lower fat intake, are associated with reduced risk for obesity, cardiovascular disease, diabetes, and many cancers.<sup>11,12</sup> Dietary factors such as obesity and alcohol consumption have been shown to increase the risk of breast cancer and colon cancer.<sup>10</sup> Obesity increases breast cancer risk in women, especially postmenopausal women, by around 50%.<sup>13</sup> Foods associated with decreased cancer risk include fruits, vegetables, and

unprocessed whole grains. Foods associated with an increased cancer risk include red and processed meats, salt, alcohol, foods contaminated with mycotoxins such as aflatoxins, and arsenic-contaminated water.<sup>12</sup>

Previous studies have revealed that university students have unhealthy eating habits, they eat more fast foods that are usually high in fat, sugar, and salt, and there is a high rate of meal skipping, a low frequency of fruit and vegetable consumption and poor physical activity level.<sup>14–16</sup> Nigerian undergraduates have been observed to adopt unhealthy practices known to be linked with increased cancer risk, such as low fruit and vegetable consumption, high consumption of energy-dense, nutrient poor foods, foods high in sugars, fats and salt, as well as a low level of physical activity.<sup>17–19</sup> Similar documentation was recently reported among South African students.<sup>20</sup> A substantial proportion of the worldwide burden of cancer could be prevented through the application of existing cancer control and by implementing a programme for tobacco control, a healthier dietary intake, promoting physical activity as well as vaccination, and early detection and treatment.<sup>4</sup>

A study identified limited awareness of cancer prevention as one of the factors causing higher cancer rates in Africa.<sup>8</sup> The knowledge and understanding of cancer risk factors and outcome of the disease have been identified to influence an individual's decisions to adopt preventive measures.<sup>20</sup> It has also been suggested that higher awareness and knowledge levels are associated with possible attitudes that will ultimately influence individual behaviour in relation to the disease.<sup>21</sup> Unhealthy dietary habits that develop early in life and persist into adulthood may increase the risk of some cancer types,<sup>22</sup> but additional research is needed to understand better the degree to which childhood dietary patterns relate to subsequent cancer risk later in life.<sup>12</sup>

The university and college represent an opportunity for health and nutritional education for a large number of young adults.<sup>23</sup> When university students make positive changes in exercise and dietary habits, and when these changes persist into the adult years, the risk of chronic diseases may be reduced.<sup>15</sup> There is a paucity of published data on nutrition-related cancer prevention knowledge among university students in Nigeria. This study, therefore, aimed at providing baseline data on the nutrition-related knowledge of cancer prevention amongst undergraduates and investigated the relationship with the dietary pattern as well as the risk of abdominal obesity.

## Methodology

### Study design

This was a cross sectional descriptive study.

### Study setting and population

The study was conducted on the campus of the University of Ibadan, Nigeria, amongst undergraduate students between June and November 2013.

### Study technique

A minimum sample size was calculated as follows for cross-sectional study with formulae:<sup>24</sup>

$$N = \frac{Z_{\alpha/2}^2 P Q}{d^2}$$

where  $N$  = Minimum sample size,  $Z = 1.96$  at 5% level of type 1 error,  $D$  = desired precision (0.05),  $P$  = prevalence = 50% (assumed),  $Q = 1 - P$  inclusion criteria: consenting students, undergraduate.

Sampling procedure: The students were visited in the evening at their hostels to seek their consent to participate in the study. There are a total of nine (10) undergraduate hostels on the university campus, three female hostels and six males (respondents were also recruited from the student hostel at the UCH campus). To ensure a total number of 405 respondents ( $405/10 = 40.5$ ), 41 respondents were recruited from each hostel. Random numbers were computer generated from a sampling frame of 41 with the Excel<sup>®</sup> (Microsoft Corp, Redmond, WA, USA) random number generator. Each hostel room number that tallies with the next generated random numbers was approached and recruited provided the student gave consent; one student per room was recruited. If the student(s) did not consent the next room number corresponding to the generated random number was approached until a total of 41 respondents were interviewed in that hostel. With the assistance of male and female research assistants, both male and female accommodation blocks were visited.

In total, 367 undergraduate students from the University of Ibadan were selected by systematic random sampling from the various halls of residence on campus. A semi-structured, self-administered questionnaire was used to collect information on socio-demography, nutrition knowledge concerning cancer prevention, modified food frequency questionnaire (FFQ) and anthropometric measurements. The nutrition knowledge section assessed respondents' nutrition-related knowledge of cancer prevention based on recommended guidelines from the literature.<sup>10</sup> The modified FFQ assessed the dietary pattern. The modified FFQ was a compilation of commonly consumed foods in south-western Nigeria based on the West African Food Composition table.<sup>25</sup> The modified FFQ used contains originally eight food groups: cereals and grains; roots and tubers; legumes/nuts; meat, fish and poultry and products; vegetables; fruits; snacks; and alcohol. Anthropometric measurements were taken according to standardised techniques by two trained research assistants. The research assistants were trained and re-trained by the supervisor of the project, an experienced physician, before and midway into the data collection. Height was measured to the nearest 0.1 cm with a stadiometer. With the Omron<sup>®</sup> body composition (model BF511) digital scale (Omron Healthcare Inc, Lake Forest, IL, USA), each respondent's weight, body fat, visceral fat and skeletal muscle mass was measured. The weight was measured to the nearest 0.1 kg. Body mass index was calculated from weight (kg)/height (m<sup>2</sup>). Waist and hip circumference were also measured to the nearest 0.1 cm using a non-stretching measuring tape. The waist:hip ratio was calculated from waist circumference/hip circumference measurements. The questionnaire was pretested and demonstrated good internal consistency and reliability with a Cronbach's alpha correlation value of 0.908.

### Data analysis

The data obtained were coded, entered and analysed using the Statistical Package for the Social Sciences (SPSS<sup>®</sup>) version 17.0 (SPSS Inc, Chicago, USA). Twenty questions were used to assess the respondent's nutrition-related knowledge of cancer prevention. Categorical responses (correct/incorrect/not sure) were used, whereby a score of '1' was given for a correct response, while '0' was given for incorrect or 'not sure' responses. Nutrition

**Table 1:** Demographic characteristics of the undergraduate students (n = 367)

Variables	Frequency	Percentage (%)
Sex		
Male	236	64.3
Female	131	35.7
Age (years)		
< 20	60	16.3
20–24	237	64.6
25–29	58	15.8
≥ 30	12	3.3
Mean age: 21.9 ± 2.7		
Year/level of study		
First year (100L)	68	18.5
Second year (200L)	116	31.6
Third year (300L)	84	22.9
Fourth year (400L)	76	20.7
Fifth year (500L)	23	6.3
Ethnicity		
Yoruba	217	59.1
Igbo	88	24.0
Hausa	35	9.5
Others	27	7.4

knowledge scores were calculated and reported as mean ± 2 SD. Knowledge scores less than the mean score were classified as poor while scores at the mean and above were classified as good. The frequency of consumption of food groups was categorised as frequent (more than thrice weekly) and infrequent (less than thrice weekly) consumers. Descriptive and inferential analyses were done. Categorical variables were analysed with the  $\chi^2$ , continuous variables with the t-test. The level of significance was set at  $p < 0.05$ .

### Ethical consideration

The study was approved by the University of Ibadan/University College Hospital (UI/UCH) ethical review board.

### Results

A total of 367 undergraduate students participated in the study (with a response rate of about 90.6%); 64.3% were male; the mean age (in years) was 21.9 ± 2.7. The majority (31.6% and 22.9%) were in the second year (200 level) and third year (300 level) of study while 20.7% and 6.3% were in the fourth year (400 level) and fifth year (500 level), respectively. The majority (59.1%) of the respondents belonged to the Yoruba ethnic group (Table 1).

The mean weight (kg), height (cm), body mass index (kg/m<sup>2</sup>), and waist circumference (cm) of the male respondents were 60.7 ± 9.3, 167.1 ± 7.4, 21.8 ± 2.9 and 75.5 ± 5.9 respectively. Those of the females were 56.9 ± 9.5, 161.4 ± 7.6, 21.7 ± 3.2 and 74.6 ± 7.6 respectively. The mean waist/hip ratio was 0.83 ± 0.04 and 0.82 ± 0.07 for the males and females respectively. Based on body mass index, 12.5% were underweight, 61.9% were normal, 21.8% were overweight, and 3.8% were obese. Using waist:hip ratio, 74.5% had low risk of abdominal obesity while 25.5% had high risk of abdominal obesity (see Table 2).

**Table 2:** Anthropometric characteristics of the respondents

Variables	Mean	SD	Min	Max
Age (years)				
Male	21.8	2.8	17.0	39.0
Female	22.1	2.6	17.0	31.0
Weight (kg)				
Male	60.7	9.3	39.9	86.2
Female	56.9	9.5	41.1	82.5
Height (cm)				
Male	167.1	7.4	143.0	180.1
Female	161.4	7.6	137.0	181.0
BMI (kg/m <sup>2</sup> )				
Male	21.8	2.9	17.7	27.8
Female	21.7	3.2	17.7	27.8
Waist circumference (cm)				
Male	75.5	5.9	64.0	89.3
Female	74.6	8.7	71.5	89.0
Hip circumference (cm)				
Male	91.6	6.3	74.0	109.8
Female	91.4	7.8	81.5	109.8
Waist to hip ratio				
Male	0.83	0.04	0.72	0.99
Female	0.82	0.07	0.82	0.91
Frequency (n) Percentage (%)				
Body mass index category:				
Underweight	46 (12.5)			
Normal	227 (61.9)			
Overweight	80 (21.8)			
Obese	14 (3.8)			
Waist:hip ratio; risk of abdominal obesity* (n = 353)				
Low risk	263 (74.5)			
High risk	90 (25.5)			

\*Not all the respondents consented to waist and hip circumference measurements.

Overall less than half (49%) of the respondents had good nutrition-related knowledge on cancer prevention while 51% had poor knowledge. In 15 of the 20 knowledge questions, more than 60.0% of the respondents gave correct responses. Above 60.0% agreed that limiting the intake of energy-dense foods protects against cancer; 70.3% agreed that fruits and vegetables should ideally amount to half the plate of an adult. Only 58.3% of the students agreed that reducing alcohol intake is protective against cancer development while 64.6% agreed that avoiding smoking of tobacco or contact with smokers is protective against cancer development. The mean knowledge score was 13.0 ± 3.0 (the minimum score = 4, maximum score = 20). There was significant difference between knowledge of males compared with females,  $\chi^2 = 45.577$ ,  $df = 19$ ,  $p = 0.000^*$  (Table 3).

The consumption pattern from food groups indicated that roots/tubers, processed cereals and grains and meat were frequently consumed, by 77.0, 75.5 and 72.5% of the respondents respectively, while fruits and vegetables were frequently consumed by 42.8% and 36.5% of the respondents respectively.

**Table 3:** Distribution of nutrition-related knowledge of cancer prevention of respondents by gender

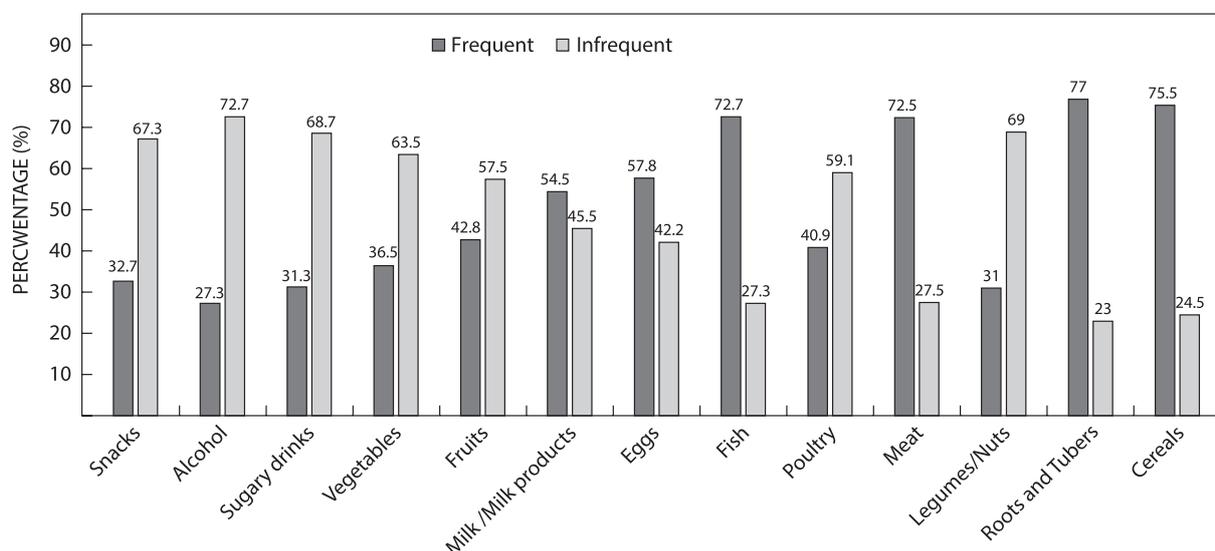
Serial no.	Nutrition-related knowledge of cancer prevention	Male		Female		Total	
		Correct response		Correct response		Correct response	
		n	%	n	%	n	%
1	Maintaining a healthy weight throughout life is protective against cancers?	186	50.7	111	30.2	297*	80.9
2	Increase in waistline circumference as one grows older can promote cancers?	112	30.5	76	20.7	188	51.2
3	Brisk walking for at least 30 minutes daily can reduce the risk of cancers?	184	50.1	103	28.1	287	78.2
4	Limiting sedentary habits, e.g. sitting long hours at the computer or TV can prevent cancers?	106	28.9	50	13.6	156	42.5
5	Limiting the intake of energy-dense foods protects against cancer?	135	36.8	100	27.2	235	64.0
6	By avoiding sugary drinks, one can reduce the chance of cancer developing?	180	49.0	110	30.0	290	79.0
7	Eating more fibre-rich grains, cereals and tubers is protective against cancer?	169	46.0	95	25.9	264	71.9
8	Intake of refined starchy foods (rice, noodles, spaghetti) is important to prevent cancers?	158	43.1	73	19.9	231	62.9
9	It is important to avoid eating a variety of fruits and vegetables daily	160	43.6	98	26.7	258	70.3
10	A variety of starchy roots and tubers are to be consumed daily?	94	25.6	56	15.3	150	40.8
11	Vegetables and fruits should ideally amount to about half the plate of an adult?	185	50.4	109	29.7	294	80.1
12	Foods of plant origin are least protective against cancers	123	33.5	42	11.4	165	44.9
13	Avoiding excessive intake of meat and red meat is not protective against cancers	139	37.9	48	13.1	187	50.9
14	Fish is better consumed compared with red meat for cancer prevention	184	50.1	102	27.8	286	77.9
15	Reducing alcohol intake is protective against cancer development	158	43.1	56	15.3	214	58.3
16	Avoiding of smoking of tobacco or contact with smokers is protective against cancer development	158	43.1	79	21.5	237	64.6
17	Eating foods fresh is important to protect against cancer development	193	52.6	113	30.8	306	83.3
18	Avoiding stale, mouldy foods protects against cancers	176	48.0	100	27.2	276	75.2
19	Avoiding of salty foods or lots of salt intake can protect against cancers	173	47.1	111	30.2	284	77.4
20	Exclusive breastfeeding for up to 6 months may protect mothers against breast cancer?	156	42.5	85	23.2	241	65.6

\*Total correct responses are expressed as percentage of overall sample collected,  $n = 367$ . The correct responses based on gender add up to the total correct responses.

About 31.0% frequently consumed sugary drinks and legumes/nuts respectively, while 27.3% consumed alcohol frequently (Figure 1).

Table 4 reveals the relationship between nutrition knowledge on cancer prevention and the dietary pattern of consumption by the respondents from food groups. Significant associations were found between knowledge of cancer prevention and consumption pattern of processed cereals/grains (polished

rice, white bread, noodles and spaghetti etc.) ( $\chi^2 = 13.724$ ,  $p = 0.000$ ), legumes/nut (beans, groundnut, melon) ( $\chi^2 = 17.268$ ,  $p = 0.000$ ), meat (beef) ( $\chi^2 = 22.972$ ,  $p = 0.000$ ), fish ( $\chi^2 = 23.017$ ,  $p = 0.000$ ), alcohol ( $\chi^2 = 19.534$ ,  $p = 0.001$ ), sugary drinks ( $\chi^2 = 6.067$ ,  $p = 0.014$ ) and snacks ( $\chi^2 = 36.159$ ,  $p = 0.000$ ). There was no significant association between nutrition knowledge on cancer prevention and vegetable and fruit consumption (Table 4).



**Figure 1:** Pattern of consumption from food groups by respondents (expressed in percentages).

**Table 4:** Relationship between dietary consumption pattern and nutrition knowledge of cancer prevention (n = 367)

Food groups		Knowledge of cancer prevention		Total	$\chi^2$	p-value
		Poor	Good			
Dietary consumption pattern						
Pro-processed cereals/ grains	Infrequently	69	35	104	13.724	0.000*
	Frequently	137	126	263		
Roots and tubers	Infrequently	32	41	73	0.159	0.690
	Frequently	132	162	294		
Legumes/ nuts	Infrequently	172	101	273	17.268	0.000*
	Frequently	36	58	94		
Vegetables	Infrequently	126	96	222	0.075	0.785
	Frequently	82	63	145		
Fruits	Infrequently	125	101	226	0.316	0.574
	Frequently	81	60	141		
Meat	Infrequently	48	67	115	22.972	0.000*
	Frequently	156	96	252		
Fish	Infrequently	48	63	111	23.017	0.000*
	Frequently	156	100	256		
Eggs/ poultry	Infrequently	98	66	164	13.720	0.008*
	Frequently	103	100	203		
Milk/milk products	Infrequently	94	74	168	6.678	0.154
	Frequently	120	79	199		
Snacks	Infrequently	121	133	254	36.159	0.000*
	Frequently	76	37	113		
Sugary drinks	Infrequently	144	108	252	6.067	0.014*
	Frequently	53	62	115		
Alcohol	Infrequently	148	126	274	19.534	0.001*
	Frequently	56	37	93		

\*Significant difference at  $p < 0.05$ .

The relationship between the dietary consumption pattern of food groups and the waist:hip ratio is shown in Table 5. Infrequent consumption of legumes was significantly associated with high risk of abdominal obesity in the male respondents ( $F = 7.001$ ,  $p = 0.008$ ) while infrequent consumption of fruits and vegetables was significantly associated with high risk of abdominal obesity in the female respondents ( $F = 6.771$ ,  $p = 0.009$ , and  $\chi^2 = 4.205$ ,  $p = 0.040$  respectively).

## Discussion

The study investigated the nutrition-related knowledge of cancer prevention among undergraduate students at the University of Ibadan, Nigeria. The rationale for the study is the need to have information on the knowledge of cancer prevention amongst adolescents in Nigeria. Proper nutrition knowledge imparted early in life encourages the practice of a healthy lifestyle that can invariably reduce the risk of nutrition-related cancers later in life. Despite more than 60% of the respondents giving correct responses in 15 of the 20 knowledge questions, overall less than half (49%) the cohort of undergraduate students studied had good nutrition-related knowledge of cancer prevention. The respondents also had poor consumption pattern as regards cancer prevention. The unfavourable consumption

pattern reported may have contributed to the high risk of abdominal obesity observed.

The majority (70–80%) correctly responded that: maintaining a healthy weight throughout life is protective against cancers, being physically active, avoiding sugary drinks, eating higher fibre diets, vegetables, and fruits, consuming fish compared with red meat, avoiding salty foods and rotten or mouldy food can be protective against cancers. This current finding is in contrast to a Sudanese study, where only 8.8% of the respondents thought that consumption of fruits and vegetables is protective against cancers.<sup>26</sup> Similarly, the current findings agree with the same Sudanese report where more males (46%) compared with females (25.9%) correctly answered that eating higher fibre diets is protective against cancers. About 45.0% of the respondents correctly indicated that limiting sedentary activities, and consuming a variety of starchy roots and tubers and foods of plant origin are least protective against cancers. The average to low level of cancer prevention knowledge reported in the current study is similar to Al-naggar and Chen's report, where low knowledge levels of cancer prevention were reported among university students in Malaysia.<sup>27</sup>

Also, from the current study, the significant gender difference in knowledge on cancer prevention is similar to the report by Loo *et al.* among Malaysian students, where the female students had higher nutrition knowledge than male students suggesting that females were more concerned about their nutrition and health than males.<sup>21</sup> The general knowledge on cancer prevention was low, similar to a report from an older population study in Cairo where a poor level of knowledge and inadequate practices regarding dietary cancer prevention was reported despite good attitudes.<sup>28</sup>

In the current study, the most frequently consumed foods are processed cereals and grains (such as white rice, noodles, spaghetti, white bread), roots and tubers, meat and fish, while vegetables, fruits and legumes/nuts were less frequently consumed, in contrast to the public health recommendations and previous study.<sup>10,12</sup> This is contrary to a previous study among Turkish adolescents who have lower meat eating habits and eat more fruits and vegetables.<sup>29</sup> However, the current finding of low vegetable and fruit intake was similarly reported, in that low nutrition knowledge levels were associated with daily vegetable and fruit consumptions among adolescents.<sup>12</sup> Also, the high consumption pattern of foods low in dietary fibre and red meat may be reflective of why more respondents than expected could not respond correctly that (i) intake of refined starchy foods (rice, noodles, spaghetti) is important to prevent cancers, (ii) eating a variety of starchy roots and tuber foods is important to prevent cancers, (iii) foods of plant origin are least protective against cancers, and (iv) avoiding excessive intake of meat and alcohol can be protective against cancers.

Also, in the current study, significant associations of gender with consumption from certain food groups and increased risk of abdominal obesity were noted. Most of the significant associations were with the dietary pattern of the female respondents who also had a high risk of abdominal obesity. Infrequent consumption of legumes is significantly associated with a high risk of abdominal obesity in the male respondents while infrequent consumption of vegetables and fruits was significantly associated with a high risk of abdominal obesity in the female respondents. Physiologically, females have a higher predisposition to accumulating fat and obesity has been linked to female cancers like those of the breast,

**Table 5:** Relationship between dietary consumption pattern and waist:hip ratio of respondents based on gender

Dietary consumption pattern	Waist:hip ratio for males		Total	$\chi^2$	p-value	Waist:hip ratio for females		Total	$\chi^2$	p-value
	Pattern	Low risk of abdominal obesity				High risk of abdominal obesity	Low risk of abdominal obesity			
Processed cereals/grains										
Infrequently	0	30	30	0.990	0.320	6	24	30	1.892	0.169
Frequently	6	181	187			29	58	87		
Roots and tubers										
Infrequently	0	33	33	0.596	0.383	6	14	20	0.102	0.750
Frequently	6	167	173			29	57	86		
Legumes and nuts										
Infrequently	1	144	145	7.001	0.008* (Fisher's)	22	49	71	1.923	0.165
Frequently	5	67	72			12	14	26		
Vegetables										
Infrequently	21	36	57	0.715	0.356	0	113	113	6.771	0.009* (Fisher's)
Frequently	13	32	45			6	97	103		
Fruits										
Infrequently	1	117	118	3.390	0.066	24	34	58	4.205	0.040*
Frequently	5	97	102			10	35	45		
Sugary drinks										
Infrequently	18	55	73	0.043	0.836	3	138	141	0.043	0.836
Frequently	13	25	38			2	76	78		
Alcohol										
Infrequently	116	38	154	7.668	0.105	59	19	78	0.216	0.975
Frequently	52	8	60			26	9	35		

Notes: Total do not add up to 367. Result analysed only for respondents who had the waist and hip circumference measured.

cervix, and ovary.<sup>10</sup> Also, a strong and clear relationship has been reported between waist circumference and risk of colon cancers.<sup>30</sup> The incidental finding of high risk of abdominal obesity in the cohort studied calls for urgent intervention and to educate female students in particular about unhealthy eating patterns and the risk of obesity. The smoking of cigarettes was not assessed in this study because none of the respondents claimed to smoke in the pilot survey, a limitation that did not rule out the fact that the students are exposed to other habits like chewing marijuana and cooking legumes with marijuana that this study was not designed to capture. The non-smoking state may not be because respondents were fully aware of the hazardous health implications, and rather may be due to religious reasons. A strength of this study is that it is the first in this environment that reports knowledge of recommended guidelines on cancer prevention.<sup>10</sup> It also provides valuable information for the formulation of relevant cancer prevention strategies and interventions, especially within the scope of nutrition education among adolescents and undergraduate students.

## Conclusion

Nutrition-related knowledge of cancer prevention was low and was reflected in the poor dietary pattern of the respondents. The associated high risk of abdominal obesity may be a pointer to the larger young adult population, emphasising a need for targeted intervention.

## Authorship

OFF designed the study, supervised the project and wrote the manuscript, AMF analysed the data and wrote a draft of the manuscript, SC collected the data and wrote part of the draft manuscript.

*Conflict of interest* – None

## Supplementary material

Supplementary material for this article can be accessed here <http://dx.doi.org/10.1080/16070658.2016.1217648>.

## References

1. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Med.* 2015;3(11):2011–30.
2. The International Agency for Research on Cancer (IARC). World cancer statistics. World Health Organization Press release. 2013;223:1–3.
3. World Health Organization Media Centre. Cancer: key facts. 2015. Fact sheet No 297. Available from: <http://www.who.int/mediacentre/factsheets/fs297/en>
4. Jemal A, Bray F, Center MM. Global cancer statistics CA Cancer J Clin [Internet]. 2011;61(2):[69–90 pp.] Available from: <http://www.ncbi.nlm.nih.gov/pubmed.21296855>, <http://dx.doi.org/10.3322/caac.v61:2>
5. Nigerian National System of Cancer Registries (NSCR). In brief.cancer incidence in Nigeria: globocan 2012. 2014;4(1):1–10.
6. Adebamowo CA, Ajayi OO. Breast cancer in Nigeria. *West Afr J Med.* 2000;19(3):179–91.

7. Jedy-Agba E, Curado MP, Ogunbiyi O, Oga E, Fabowale T, Igbinoba F, et al. Cancer incidence in Nigeria: A report from population-based cancer registries. *Cancer Epidemiol* [Internet]. 2012;36(5):[e271–78 pp.] Available from: <http://www.sciencedirect.com/science/article/pii/S1877782112000604> <http://dx.doi.org/10.1016/j.canep.2012.04.007>
8. American Cancer Society. *Cancer in Africa*. Atlanta, GA: American Cancer Society; 2011. 1–20 pp.
9. WHO/FAO. Diet, nutrition and the prevention of chronic diseases: [Internet]. Report of a Joint WHO/FAO Expert Consultation. 2003;[1–3 pp.] Available from: <http://dro.deakin.edu.au/view/DU:30010488>
10. WCRF/AICR. Food, nutrition, physical activity, and the prevention of cancer: A global perspective. Author, Washington, DC; 2007. 1–392 p.
11. Byers T, Nestle M, McTiernan A, et al. American cancer society guidelines on nutrition and physical activity for cancer prevention: reducing the risk of cancer with healthy food choices and physical activity. *CA Cancer J Clin* [Internet]. 2002 [cited 2016 Feb 25];52(2):[92–119 pp.] Available from: <http://www.ncbi.nlm.nih.gov/pubmed/11929008> <http://dx.doi.org/10.3322/canjclin.52.2.92>
12. Holman DM, White MC. Dietary behaviours related to cancer prevention among pre-adolescents and adolescents: the gap between recommendations and reality. *Nutr J* [Internet]. BioMed Central. 2011 [cited 2016 Feb 25];10(60);[1–8 pp.] Available from: <http://www.nutritionj.com/content/10/1/60> doi:10.1186/1475-2891-10-60.
13. Key TJ, Schatzkin A, Willett WC, et al. Diet, nutrition and the prevention of cancer. *Public Health Nutr*. 2004;7(1A):187–200. doi:10.1079/PHN2003588.
14. Abolfotouh MA, Bassiouni FA, Mounir GM, et al. Health-related lifestyles and risk behaviours among students living in Alexandria University hostels. *East Mediterr Heal J*. 2007;13(2):376–91.
15. Ganasegeran K, Al-Dubai SA, Qureshi AM, et al. Social and psychological factors affecting eating habits among university students in a Malaysian medical school: a cross-sectional study. *Nutr J* [Internet]. 2012;11(1):1–7 pp.] Available from: <http://www.nutritionj.com/content/11/1/48>
16. Al-Naggar RA, Bobryshev YV, Mohd Noor NAB. Lifestyle practice among Malaysian university students. *Asian Pacific J Cancer Prev*. 2013;14(3):1895–1903. doi:10.7314/APJCP.2013.14.3.1895.
17. Olusanya J, Omotayo OA. Prevalence of obesity among undergraduate students of Tai Solarin University of Education, Ijagun, Ijebu-Ode. *Pakistan J Nutr* [Internet]. 2011 [cited 2016 Feb 25];10(10):[940–46pp.] Available from: [http://www.pjbs.org/pjnonline/10\(10\).htm](http://www.pjbs.org/pjnonline/10(10).htm)
18. Arulogun OS, Owolabi MO. Fast food consumption pattern among undergraduates of the University of Ibadan, Nigeria: implications for nutrition education. *J Agric Food Technol* [Internet]. 2011 [cited 2016 Feb 25];1(6):[89–93pp.] Available from <http://textroad.com/JAFT-June%202011.html>
19. Afolabi WAO, Towobola SK, Oguntona CRB, et al. Pattern of fast foods consumption and contribution to nutrient intake of Nigerian University Students. *Int J Educ Res* [Internet]. 2013 [cited 2016 Feb 25];1(5):[1–10 pp.] Available from: <https://timedotcom.files.wordpress.com/2014/12/03.pdf>
20. Gresses A, Steenkamp L, Pietersen J. Eating, drinking and physical activity in Faculty of Health Science students compared to other students at a South African university. *S Afr J Clin Nutr*. 2015;28(4):154–59.
21. Lin Loo J, Yee Woo W, Wah Chin M, et al. Cancer awareness of a sample of Malaysian undergraduate students. *Am J Cancer Prev* [Internet]. 2013 [cited 2016 Feb 23];1(1):[9–13 pp.] Available from: <http://pubs.sciepub.com/ajcp/1/1/3/>, <http://dx.doi.org/10.12691/ajcp-1-1-3>
22. Power E, Simon A, Juszczak D, et al. Assessing awareness of colorectal cancer symptoms: Measure development and results from a population survey in the UK. *BMC Cancer* [Internet]. BioMed Central; 2011;11:[about 366 p.] Available from: <http://www.biomedcentral.com/1471-2407/11/366>
23. Moy FM, Johari S, Ismail Y, et al. Breakfast skipping and its associated factors among undergraduates in a public university in Kuala Lumpur. *Malays J Nutr* [Internet]. 2009 [cited 2016 Feb 23];15(2):[165–74 pp.] Available from: [http://nutriweb.org.my/publications/mjn0015\\_2/default.php](http://nutriweb.org.my/publications/mjn0015_2/default.php)
24. Charan J, Biswas T. How to calculate sample size for different study designs in medical research?. *Indian J Psychol Med* [Internet]. 2013;35(2):[121–26 pp.] Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3775042/> <http://dx.doi.org/10.4103/0253-7176.116232>
25. Stadlmayr B, Charrondiere UR, Enujiugha VN, et al. Food groups In: West African food composition table [Table de composition des aliments d'Afrique de l'Ouest]. Rome: FAO; 2012:1–87. ISBN 978-92-5-007207-4.
26. Bovell-Benjamin A, Elmubarak E. Diet-nutrition-related cancer prevention knowledge and beliefs of Sudanese in Khartoum: A descriptive study. *Open J Prev Med* [Internet]. 2013;03(03):[320–28 pp.] Available from: <http://dx.doi.org/10.4236/ojpm.2013.33043> <http://dx.doi.org/10.4236/ojpm.2013.33043>
27. Al-naggar RA, Chen R. Nutrition and cancer prevention: knowledge, attitudes and practices among young Malaysians. *Asian Pacific J Cancer Prev* [Internet]. 2011 [cited 2016 Feb 21];12(3):[691–694 pp.] Available from: <http://www.ncbi.nlm.nih.gov/pubmed/21627365>
28. El-maksoud MMA, El-mohsen ASA. Dietary behavior related to cancer prevention in a low income community. *J Nurs Educ Pract* [Internet]. 2015;35(3):[81–9 pp.] Available from: [www.sciedu.ca/DOI:10.5430/jnep.v5n3p81](http://www.sciedu.ca/DOI:10.5430/jnep.v5n3p81)
29. Can HO, Ceber E, Sogukpinar N, et al. Eating habits, knowledge about cancer prevention and the HPLP scale in Turkish adolescents. *Asian Pacific J Cancer Prev*. 2008;9:569–74
30. Willet W, Hu F. Anthropometric measures and body composition. In: Willet W, editor. *Nutritional epidemiology*. 3rd ed. Oxford University Press; 2013:244–72.