

Nutrition Knowledge, Attitude, Body Composition, and Dietary Patterns of Female Undergraduate Students in Owerri Metropolis

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ABSTRACT

Background: Nutrition knowledge is necessary for promoting healthy dietary habits which is vital for the maintenance of optimum nutritional status.

Objective: This study aimed at assessing the nutrition knowledge, attitude, body composition and dietary habits of female undergraduate students from selected tertiary institutions in Owerri metropolis.

Materials and methods: The study was a cross sectional survey comprising of 250 female undergraduate students from selected tertiary institutions in Owerri metropolis. A multi-stage sampling technique was adopted in the selection of respondents from five tertiary Institutions in Owerri Metropolis. A well-structured and validated questionnaire was administered to collect information on socio-economic characteristics, nutrition knowledge, nutrition attitude and dietary habits. Height was measured using a stadiometer while weight and body composition were assessed using bioelectrical impedance analyzer (Omron- HBF-511B-E). Data was analyzed using descriptive statistics and Pearson's bivariate correlation using IBM SPSS Statistics version 21.0.

Results: Approximately 70.8% of the respondents had good nutrition knowledge while 51.6% had poor nutrition attitude. Most of the respondents (82.4%) had normal body water, 63.6% had high muscle fat and 42.8% were obese due to high body fat. Majority (72.4%) of the respondents eat twice daily, 46.8% skip meals due to lectures and 33.6% consume fruits daily. There were no significant correlations observed between nutrition knowledge and body composition. Body mass index had marked negative correlation with skeletal muscle mass ($p=0.00$) while BMI had a significant ($p=0.0$) positive correlation with body fat.

Conclusion: This study shows that majority of the respondents had good nutrition knowledge however, more than half of the respondents still have poor nutrition attitude and the rate of obesity among the respondents was very high.

Key Words: Nutrition, knowledge, attitude, body composition

INTRODUCTION

The need for good nutritional practices as an important lifestyle factor in the maintenance of health has gained attention recently. The level of nutrition knowledge of an individual can impact positively or negatively on their nutritional attitude and nutritional status (1). Past studies have demonstrated that enhancing nutritional knowledge and attitude of individuals will result in a society that is more nutrition conscious thereby, promoting a healthier society (2). Nutritional knowledge is necessary for promoting healthier eating habits, and consequently, maintaining an appropriate body weight, thereby, preventing overweight and obesity (3,4).

Body composition is referred to as the proportion of lean body mass to fat in the body and it is estimated by grouping the body into compartments of tissues that are similar in nature such as fat mass and fat-free mass (5). Body composition can be analyzed using methods such as isotope dilution, neutron activation, anthropometry, densitometry, and bioelectric impedance analysis. Several factors such as age, gender, genetics, and muscle mass influence the body composition of an individual (6). It has

been demonstrated that the body composition of female undergraduate students is transmitted into a long-term effect on them (7) as obese children and adolescents have higher risk of developing metabolic diseases such as diabetes mellitus, cardiovascular diseases and hypertension during adulthood (8). High rate of fat accumulation in undergraduate students have been linked to lifestyle factors such as poor dietary choices and physical inactivity (9).

Dietary practices can be referred to as an individual's food preferences or food-related behaviors by which an individual or group selects, prepares, or consumes food, directly or indirectly as a part of cultural, social and religious practices (10). Current shifts in diets have been observed where more energy-dense carbonated drinks as well as refined grain products containing high fat and sugar are becoming increasingly consumed with less intake of whole grain and their products, fruits, and vegetables (11). However, a good dietary habit combined with physical activity helps to promote healthy weight and improve immune system functions (12).

University life is a challenging period especially for students who leave their familiar surroundings and move into a new environment which may affect their personality and behavior especially their food choices which subsequently influences their nutritional status (1, 13). Lack of a central feeding facility for students in university campuses forces them to take responsibility of their feeding which could lead to consumption of processed foods which are high in sugar, fats and salts (14). Other factors that have been identified to influence the food preferences of undergraduate students in Nigeria include level of nutrition knowledge, nutrition behaviors, lack of time due to constant study pressure, cost of food, availability of food and lack of finance (2,15).

Past studies suggest that poor nutrition knowledge and poor dietary practices predisposes undergraduate students to overweight and obesity which is a risk factor associated with lifestyle related chronic diseases such as diabetes mellitus and cardiovascular diseases (2, 13,17,). Most studies on the evaluation of nutritional status of undergraduate students have been based on estimating the body mass index of the individuals. An important advantage of bioelectric impedance analysis over body mass index in the assessment of nutritional status is that body mass index does not distinguish between weight changes due to water, lean mass or fat mass. This study was therefore aimed at assessing the nutrition knowledge, attitude, body composition and dietary pattern of female undergraduate students in Owerri metropolis.

MATERIALS AND METHODS

Study area

Owerri is the capital of Imo State in Nigeria (18). Owerri metropolis consists of three Local Government Areas including Owerri Municipal, Owerri North and Owerri West; Owerri is bordered by the Otamiri River to the east and the Nworie River to the south (18). The study was carried out in five tertiary institutions out of the seven tertiary institutions located in Owerri metropolis. These include, Federal university of technology Owerri, Imo State University Owerri, Alvan Ikeoku Federal College of Education Owerri, Imo State Polytechnic Umuagwo and Federal Polytechnic Nekede. Other tertiary Institutions in Owerri include Claretian University of Nigeria, Nekede and the national open university of Nigeria, Owerri.

Federal University of technology Owerri is located in Owerri West LGA, Imo State. It is the first federal university of technology in the Southeastern part of Nigeria and was established in 1980. It is bounded by Ihiagwa, Eziobodo, Umuchima and Obinze communities (19). Imo State University Owerri, is owned by the Imo state government. It was

established in 1981. The main building of Imo State University is located in Owerri Municipal (20). Alvan Ikoku federal college of education was established in 1963 as the advanced teachers training college. It awards the national certificate in education and the professional diploma in education. It awards a Bachelor of education in affiliation with University of Nigeria Nssuka (21).

Federal polytechnic Nekede is a federal government owned higher Institution located in Nekede, Owerri west LGA in Imo State. It was established on a temporary site at the premises of Government technical college in 1978 as college of technology Owerri before it moved to its permanent site in Nekede (22). The Polytechnic was changed to a federal government Institution and was renamed Federal Polytechnic Nekede in 1993. Imo State Polytechnic Umuagwo is a higher education institute located in Umuagwo, Owerri West LGA, Imo State, Nigeria. It was established in 1978 as the Michael Okpara College of Agriculture, Umuagwo and was upgraded to a Polytechnic status and was renamed the Imo State Polytechnic, Umuagwo in 2007. The institution is certified to award National Diploma and Higher National Diploma qualifications

Survey design

This study adopted a cross-sectional design.

Population of study

This study involved female undergraduate students attending tertiary institutions in Owerri metropolis.

Sample selection

A multi-stage sampling technique was employed in the selection of 250 respondents in this study. The first stage involved the selection of five tertiary Institutions from the seven tertiary Institutions in Owerri metropolis by balloting. The selected Institutions includes Federal university of technology Owerri, Imo State University Owerri, Alvan Ikeoku Federal College of Education Owerri, Imo State Polytechnic Umuagwo and Federal Polytechnic Nekede. The second stage comprised of the selection of five departments from each of the selected tertiary Institutions in Owerri metropolis by balloting. The final stage involved the selection of ten students from each selected department. The respondents were selected by randomly choosing from the students' files from the selected departments in each tertiary Institution.

Ethical considerations

Ethical clearance for this study was obtained from the Research Ethics Committee of the public health department of the Imo State Ministry of Health, Owerri. The respondents who participated in the

study were required to sign the informed consent form before they were recruited into the study.

Sample size determination

This was determined using the formula

$$n = \frac{Z^2 Pq}{e^2}$$

Where: n = sample size; Z = desired confidence level which is 1.96; e = acceptable margin of sampling error which is 0.05; P = prevalence rate of obesity in female which is 20% = 0.2 (23); q = 1 - P which (1 - 0.2)

$$n = \frac{(1.96^2) (0.2) (1 - 0.2)}{0.05^2}$$

Therefore n = 245.7. The sample size was made up to 250

Data collection

A well-structured and validated questionnaire was used to elicit information on socio economic characteristics, nutrition knowledge, nutritional attitude, dietary practices, and 24 hours diet recall. The height of each respondent was assessed using stadiometer as described by (24) where the subjects were asked to stand erect on bare feet against a wooden stadiometer with their feet parallel, their buttocks and back touching the instrument and their hands were hanging freely by the sides and the readings were taken to the nearest 0.1cm. The assessment of weight, total body water, body fat and skeletal muscle mass of each respondent was carried out using a bioelectrical impedance analyzer (model Omron- HBF-511B-E). For assessment of weight, the respondents were asked to step onto the device after the device has been turned on and "0.0kg" appears on the device's display. The device automatically displays the respondent's weight when it completes the measurement. For assessment of total body water, body fat and skeletal muscle mass, the respondents were asked to stand bare footed on the footplate of the device, with their knees and back straight and looking straight ahead. The arms were horizontally raised, and the elbows were extended straight. The arms were extended at 90 degrees angle to the body and the palms were pressed firmly on the handgrip electrodes. Age, gender, and height information were entered into the device, and the appropriate button (body fat, skeletal muscle mass etc.) was selected to view the measurement result on the device's display.

The nutrition knowledge of the respondents was assessed on various aspects of nutrition which include nutrients, food hygiene, nutrition and health and the knowledge of different food groups using 15 multiple choice questions. The nutrition attitude questions assessed the beliefs and reactions of the respondents about diet and good nutritional practices. The food frequency questionnaire was

used to assess the frequency of food consumption of various foods under six food groups, which include roots and tubers, cereals, legumes, fruits, vegetables, milk and milk products, fish groups, meat and fats and oil group. The frequency of food intake was categorized as daily, weekly, monthly, and occasionally. For the assessment of 24 hours diet recall, the respondents were asked to recall all the foods and beverages consumed within the previous 24 hours. The recall included main meals, snacks and beverages consumed.

Data and statistical analysis

Body mass index (BMI) was estimated and classified according to WHO (25) standard as <18.5 is classified as underweight, 18.5- 25 is normal, 25.1-29.9 is overweight while ≥ 30 was classified as obese. The total body water (TBW) was classified according to standard (26) as TBW for females <45% is poor, 45-65% is good. The body fat (BF) was graded as described by (26). Seventeen-year-old females who had <15.4% body fat were classified as low, 15.5-34.7% as normal, 34.8-37.3% as high while $\geq 37.4\%$ as very high body fat. Females between 18-39 years were classified as <21% is low, 21-32.9% is normal, 33.0-38.9% is high while $\geq 39\%$ body fat was very high/obese. The skeletal muscle mass was classified according to (26) for women 18-39 years as <24.3% is low, 24.3-30.3% is normal, 30.4-35.3% is high while $\geq 35.4\%$ is very high.

The nutrition knowledge of the respondents was evaluated by awarding one score to each correct answer and zero to each wrong answer. The highest obtainable score was fifteen and the lowest was zero. The scores were graded into three categories whereby scores ≤ 5 was graded as poor nutrition knowledge, 6-10 was moderate knowledge while 11-15 were good nutrition knowledge. The 4-point Likert scale was used to indicate how much the respondents agreed or disagreed to each given statement. One point for strongly disagree and 4 points for strongly agree (27). There were five negative questions for which reverse scoring was done. That is, one point was awarded for strongly agree while 4 points for strongly disagree. The highest attainable score was 60 while the lowest was 15. The scores were classified into three categories as ≤ 20 was poor nutrition attitude, 21-40 was graded as moderate attitude while scores from 41-60 was graded as having good nutrition attitude. The frequency of food consumption of the subjects was classified as follows daily, 3-5 times weekly, 1-2 times weekly and occasionally.

The IBM SPSS Statistics (version 21.0) was used to analyze the data. Data was analyzed using descriptive statistics and Pearson's bivariate correlations. Significance level was set at $p < 0.05$.

RESULTS

Socio- economic characteristics of the respondents

Table 1 shows the Socio-economic characteristic of the respondents. More than half (65.6%) of the respondents were within the age range of 20-25

years, 93.6% were single while majority of the respondents (97.6%) were Christians. Approximately half of the respondents (52.8%) received below twenty thousand naira (₦) as monthly stipend and majority of the respondents (85.2%) were Igbo's.

Table 1: Socio-economic characteristics of the respondents

Variable	FreQUENCY	Percentage
Age (in years)		
≤20	75	30.0
20-25	164	65.6
25-30	11	4.4
Marital status		
Single	234	93.6
Married	1	6.4
Religion		
Christain	244	97.6
Islam	5	2.0
Traditional	1	4
Monthly income (in naira)		
≤20000	132	52.8
20000-50000	102	40.8
50000-100000	7	2.8
No response	9	3.6
Ethnicity		
Yoruba	20	8.0
Igbo	213	85.2
Hausa	16	6.4
Others	1	4
Total	250	100.0

Nutrition knowledge, attitude, and body composition of the respondents

Table 2 shows the nutrition knowledge, attitude, and body composition of the respondents. Majority (70%) of the respondents had good nutrition

knowledge however up to 52% of the respondents still had poor nutritional attitude. More than half (65.6%) of the respondents had normal BMI, 63.6% had high skeletal muscle mass, 42.8% had very high (obese) body fat while 96.0% had good body water.

Table 2: Nutrition knowledge, attitude, and body composition of the respondents

Variable	Frequency	Percentage
Nutrition Knowledge		
Good	175	70
Moderate	65	26
Poor	10	4
Nutrition attitude		
Good	75	30
Moderate	45	18
Poor	130	52
Body mass index		
Under weight	9	3.6
Normal	164	65.6
Overweight	77	30.8
Body fat		
Low fat	17	6.8
Normal fat	50	20.0
High fat	76	30.4
Very high fat/obese	107	42.8
Skeletal muscle mass		
Low	3	1.2
Normal	58	23.2
High	159	63.6
Very high	30	12.0
Total body water		
Poor	10	4.0
Good	240	96.0
Total	250	100.0

Dietary practices of the respondents

Information on dietary practices of the respondents is presented in Table 3. Most (72.4%) of the respondents eat twice daily, 84% skip meals, while 46.8% attributed their reason for skipping meals to lateness to lectures. More than half (61.2%) of the respondents take snacks, 53.2% consume alcohol

and 12.0% had history of smoking. Few (29.6%) of the respondents take nutrient supplements, 26% have food restrictions, 14.4% gave their reason for food restriction to health matters while 59.6% of the respondents do not exercise.

Table 3: dietary practices of the respondents

Variable	Frequency	Percentage
Frequency of meal intake		
Once daily	18	7.2
Twice daily	181	72.4
Three times daily	48	19.2
Four times daily	3	1.2
Skipping of meal		
Yes	210	84.0
No	40	16.0
Reasons for skipping meal		
Lectures	117	46.8
Weight management	41	16.4
Lack of time	31	12.4
Finance	24	9.6
Others	37	14.8
Snack intake		
Yes	153	61.2
No	97	38.8
Frequency of snack intake		
Daily	68	27.2
Weekly	29	11.6
Occasionally	153	61.2
Alcohol consumption		
Yes	133	53.2
No	117	46.8
History of smoking		
Yes	30	12.0
No	220	88.0
Supplement intake		
Yes	76	30.4
No	174	69.6
Food restriction		
Yes	65	26.0
No	185	74.0
Reasons for food restriction		
Recession	17	6.8
Health	36	14.4
Culture	17	6.8
Others	180	72.0
Exercise		
Yes	101	40.4
No	149	59.6
Total	250	100.0

24 Hour Dietary Recall of the subjects

Table 4 shows the 24 hours dietary recall of the respondents. For breakfast, 36% of the respondents recalled rice and beans while 40.0% recalled yam/potato chips/agidi (fried, boiled or jollof) for midmorning snack. Approximately 35.2% recalled

ukwa, beans and rice (jollof/stew) for lunch while 23.6% did not take mid lunch snack. Approximately 32.8% of the respondents recalled plantain/potato/noodles for dinner while 40% had bread and akara/eggs as bed time snacks.

Table 4: 24 Hour dietary recall of the respondents

Variable	Frequency	Percentage
Breakfast		
Rice (fried, jollof, coconut) and beans	90	36.0
Bread and tea/akara/egg	54	21.6
Garri/fufu and soup (egusi, oha, okra)	16	6.4
Breakfast cereals, noodles/spaghetti	55	22
Plantain/potato/yam	1	0.4
Meat pie/biscuit/sausage roll	18	7.2
Skipped breakfast	16	6.4
Mid-morning snacks		
Yam/potato chips/agidi	100	40.0
Pawpaw/avocado pear/apple/banana	28	11.2
Chin-chin/meat pie/biscuit	72	28.8
Skipped mid-morning snacks	50	20.0
Lunch		
Ukwa, beans and rice (jollof/stew)	88	35.2
Garri/fufu and soup (oha, okra etc)	64	25.6
Noodles/spaghetti/ Plantain/potato/yam	63	25.2
Chin-chin/meat pie/biscuit/groundnut	14	5.6
Banana/pineapple/watermelon	12	4.8
Skipped lunch	9	3.6
Mid lunch snack		
Breakfast cereals	47	18.8
Meat/fish (pepper soup, fried etc)	55	22.0
Abacha/ugba	54	21.6
Orange/apple/cucumber	6	2.4
Chin-chin/meat pie and soft drinks	29	11.6
Skipped mid lunch snacks	59	23.6
Dinner		
Garri and soup (vegetable, okra, etc)	40	16.0
Plantain/potato/noodles	82	32.8
Moimoi, ukwa	65	26.0
Fruit salad/chin-chin, meat pie, biscuit	53	21.2
Skipped dinner	10	4.0
Bed time snack		
Bread and akara/eggs	100	40
Fruit salad/chin-chin, meat pie, biscuit	71	28.4
Skipped bed time snacks	79	31.6
Total	250	100.0

Frequency of food consumption of the respondents

Table 5 shows the frequency of food consumption of the respondents from the food groups. Approximately 35.2% and 36.4% of the respondents

consume roots and tubers and legumes respectively up to 1-2 times weekly while 38.4%, 58.0%, 56% and 50% had daily consumption of cereals, fruits and vegetables, milk and milk products, meat fish and their products and fats and oils respectively.

Table 4: frequency of food consumption

Variable	Frequency	Percentage
Roots and tubers		
Daily	37	14.8
3-5 times weekly	65	26.0
1-2 times weekly	88	35.2
Occasionally	60	24.0
Legumes		
Daily	61	24.4
3-5 times weekly	36	14.4
1-2 times weekly	91	36.4
Occasionally	62	22.0
Cereals		
Daily	125	50.0
3-5 times weekly	26	10.4
1-2 times weekly	64	25.6
Occasionally	35	14.0
Fruit and Vegetables		
Daily	96	38.4
3-5 times weekly	26	10.4
1-2 times weekly	76	30.4
Occasionally	52	20.8
Milk and milk products		
Daily	145	58.0
3-5 times weekly	20	8.0
1-2 times weekly	43	17.2
Occasionally	42	16.8
Meat, fish and their products		
Daily	140	56.0
3-5 times weekly	20	8.0
1-2 times weekly	55	22.0
Occasionally	35	14.0
Fats and oil		
Daily	125	50.0
3-5 times weekly	14	5.6
1-2 times weekly	64	25.6
Occasionally	47	18.8
Total	250	100.0

Relationship between nutrition knowledge, nutrition attitude and body composition of the respondents

There were no significant correlations observed between nutrition knowledge as well as nutrition attitude and the body composition parameters assessed in this study. BMI had marked negative correlation with skeletal muscle mass ($p=0.00$) and total body water ($p=0.00$) respectively while BMI

had a significant positive correlation with body fat. Skeletal muscle mass had marked negative correlation with body fat ($p=0.00$) while skeletal muscle mass had a significant positive correlation with total body water. The body fat percentage was observed to have a significant ($p=0.00$) positive correlation with total body water.

Table 6: Relationship between nutrition knowledge, nutrition attitude, body mass index and body composition of the respondents

	Nutrition knowledge	Nutrition attitude	BMI	Muscle mass	Body fat	Body water
Nutrition knowledge	1					
Nutrition attitude	-.006(p = 0.92)	1				
BMI	-.114(p = 0.07)	-0.014(p = 0.82)	1			
Skeletal muscle mass	0.11(p = 0.08)	-0.129(p = 0.06)	-0.52 ^b (p = 0.0)	1		
Body fat	-.04(p = 0.45)	0.048(p = 0.43)	0.63 ^b (p = 0.0)	-0.59 ^b (p = 0.0)	1	
Total body water	0.06(p = 0.30)	-0.05(p = 0.41)	-0.27 ^b (p = 0.0)	0.38 ^b (p = 0.0)	-0.46 ^b (p = 0.0)	1

^a. correlation is significant at 0.05 level

^b. correlation is significant at 0.01 level

DISCUSSIONS

This study evaluated the nutritional knowledge, attitude, body composition and dietary practices of female undergraduate students in Owerri metropolis. A high proportion of the respondents who were younger than 25 years could be attributed to the encouragement of early childhood education in Nigeria which led to their early university education (28). This agrees with the study by Ikujenlola and Adekoya (29) who reported that 98% of undergraduates were younger than 25 years. Most students reported to be single in this study could be linked to the relatively young age of the respondents and education instead of marriage might be a current priority for most of them (30). This is in line with Omage and Omuenu (31) who observed that 98.5% of undergraduate students were single. The poor monthly stipend received by more than half of the respondents is related to the observations of (29) who reported more than half of undergraduate students received below ₦20,000 as monthly allowance. The high proportion of the respondents who were Igbos and Christians could be associated with the geographical location in which the research was carried out as the major ethnic group in Owerri Metropolis is Igbo while the major religion that is practiced in Owerri is Christianity (32).

The majority of the respondents who had at least a moderate level of nutrition knowledge could be associated to schools being an avenue through which

students gain nutrition knowledge (13). This agrees with a previous study by Barzegari *et al.*, (1) who reported that 87% of female undergraduate students had moderate nutrition knowledge. The negative attitude toward nutrition observed in more than half of the respondents even though majority of the students had good knowledge of nutrition could be linked to other factors that influence the food choice of university students. Inghram (33) suggested that although increasing knowledge is an effective method to improve nutrition behaviors, it is not always the only attribute that will change nutrition behavior. Kabir (34) reported that factors such as cooking skills, food taboos, social norms, food cost, access to cooking facilities, frequency of examination and campus culture also influence the nutrition attitude of undergraduate students. There is therefore a need for nutrition education programs targeted at improving the nutritional attitude of female undergraduate students in a bid to promote good dietary practices among female undergraduate students. The level of poor nutrition attitude observed in this study agrees with Elhassan (3) who reported that 53.7% of students in Ahfad university for women had poor nutrition attitude while Kinyua (35) observed that 40% of female undergraduate students within Nairobi Metropolis had poor nutrition attitude.

The considerable proportion of the respondents who were either underweight (3.6%) or overweight

(30.8%) as shown by the BMI estimates, indicates an imbalance in nutrient intake which can be attributed to poor dietary practices of the respondents. The underweight respondents are likely to be at a higher risk of not meeting the demands of their physiological state while the overweight students have a high chance of having diseases associated with obesity. The marked positive correlation observed between BMI and percentage body fat implies that BMI could be used to estimate level of fat in the body as the higher an individual's BMI, the higher the percentage body fat of the individual. The BMI of the respondents is like the report of Adepoju and Gabriel (36) who also observed underweight and overweight among female undergraduate students in Federal Polytechnic Ilaro. The high level of skeletal muscle mass observed in the respondents implies that they have good muscle function. In addition, skeletal muscle mass was observed to have a marked negative correlation with BMI in this study. This shows that the BMI of the individuals will decrease with increasing levels skeletal muscle mass.

Interestingly, this study observed that the high prevalence of normal weight among the respondents according to BMI classification conflicts with high levels of body fat percentage in the respondents. Mialich *et al* (37) also observed that although 70% of university students had normal weight according to BMI classification, 70.8% of them had high levels of body fat. In another study Mitiniyanzi (38) reported that 40.1% of female students with normal BMI had high body fat in Chinese University. Previous studies have reported that higher body fat is linked to an increased risk of having cardiovascular diseases irrespective of the BMI classification of the respondents as BMI often led to the underestimation of the individuals with risk of cardiovascular diseases. Majority of the respondents had good total body water which indicates sufficient hydration among the respondents. The total body water observed in this study agrees with the report of Wang *et al.*, (39) who reported that 80% of females had normal total body water.

This study observed that majority of the respondents eat below the recommended five to six times in a day including snacks (40). This is in line with a study by Achinihu (14) on the eating pattern of undergraduate students in private universities in southern Nigeria which showed that majority of university students eat twice daily. A large proportion of the

respondents skip at least one meal especially breakfast which agrees with Khan and Lipke (41) who reported that students skipped breakfast and often missed dinner. Omege and Omuenu (31) also reported that more than half of undergraduate students in a private university in southern Nigeria skip breakfast. Skipping meals affects the students learning process thereby making them unable to concentrate for a long time and also influences their immune health (15). The 24 hours diet recall of the respondents revealed that foods from milk and milk products, meat, fish and their products, fats and oil and cereals food groups are the common foods consumed by the respondents while the rate of daily consumption of foods from the root and tubers, legumes and fruit and vegetable food groups were very low. This agrees with a study at Babcock University that reported low daily intake of fruits (17.0%) and vegetables (14.9%) by undergraduate students (42).

CONCLUSION

This study revealed that although majority of the respondents had moderate nutrition knowledge more than half still had poor nutrition attitude. The BMI estimates of the respondents indicated that none of the respondents was obese while the body fat assessment revealed that up to 42% of the respondents were obese which shows the underestimation of the respondents with risk of diet related chronic non-communicable diseases using BMI classification. Furthermore, the respondents had low rate of daily consumption of fruits and vegetables and adopted poor dietary patterns. Therefore, there is need to strengthen nutrition education programs targeted at promoting healthy nutrition attitude at the university level to improve the dietary practices and nutritional status of female undergraduate students.

Ethical considerations

Ethical clearance for this study was obtained from the Research Ethics Committee of the public health department of the Imo State Ministry of Health, Owerri.

Conflict of interests

No conflict of interest is declared.

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REFERENCES

1. Ozgen L. Nutritional Knowledge, Attitudes and Practices among University Students in Turkey and the US. *Anthropologist* 2016; 26(3): 158-166
2. Amosu AM, Kukoyi OB. Knowledge and Attitude of Nigerian Undergraduates on Healthy Diet: Outcome of a Nutrition Education and Mobile Phone Communication Intervention. *Texila International Journal of Public Health* 2020; 8(2):1-9
3. Elhassan MR, Gamal HE, Mohammed GS. Nutrition Knowledge, Attitude and Practices among Students of Ahfad University for Women. *Indian Journal of Science and Research*, 2013;4(1), 25-34.
4. Elejo A, Charles U, Anyebe J. Physical Activity Level and Dietary Pattern of Undergraduate Students of Kogi State University, Anyigba Kogi State. *Archives of Current Research International*, 2019; 17(3):1-8. DOI: 10.9734/acri/2019/v17i330114.
5. Howe AS, Black KE, Wong JE, Parnell WR, Skidmore PML. Dieting status influences associations between dietary patterns and body composition in adolescents: a cross-sectional study. *Nutrition Journal* 2013; 12 (1): 51-63
6. Kapoor N, Lotfaliany M, Sathish T, Thankappan KR, Thomas N, Furler J, Oldenburg B, Tapp RJ. Prevalence of normal weight obesity and its associated cardio-metabolic risk factors – Results from the baseline data of the Kerala Diabetes Prevention Program (KDPP). *Plos ONE* 2020; 15(8):1-11
7. Mushengezi B, Chillo P. Association between body fat composition and blood pressure level among secondary school adolescents in Dar es Salaam, Tanzania. *Pan African Medical Journal* 2014; 19:327-338.
8. Wang L, Zhou B, Zhao Z, Yang L, Zhang M, Jiang Y, Li Y, Zhou M, Wang L, Huang Z. Body-mass index and obesity in urban and rural China: Findings from consecutive nationally representative surveys during 2004–18. *Lancet* 2021; 398:53–63
9. Cohen DA. Energy balance in adolescent girls: the trial of activity for adolescent girls cohort. *Obesity* 2014; 22.3:772-780
10. Yalawdeg M, Birhane M, Adissu Y. Dietary Practices and Their Determinants among Pregnant Women in Gedeo Zone, Southern Ethiopia: A Community-Based Cross-Sectional Study. *Nutrition and Dietary Supplements* 2020; 12 267–275
11. Kabir A, Miah S, Islam A. Factors influencing eating behavior and dietary intake among resident students in a public university in Bangladesh: A qualitative study. *PLoS ONE* 2018; 13(6): 1-9
12. Swift DL, Johannsen NM, Lavie CJ, Earnest CP, Church TS. The Role of Exercise and Physical Activity in Weight Loss and Maintenance. *Progress in Cardiovascular Diseases*, 2014; 56 (4): 441-447.
13. Barzegari A, Ebrahimi M, Azizi M, Ranjbar K. A Study of Nutrition Knowledge, Attitudes and Food Habits of College Students. *World Applied Sciences Journal*, 2011; 15(7):1012-1017
14. Achinihu G. Nutritional status of university students in south-eastern states of Nigeria. *Journal of Research in National Development*, 2009; 7(2):1-13
15. Yahia N, Brown CA, Rapley M, Chung M. Level of nutrition knowledge and its association with fat consumption among college students. *BMC Public Health*, 2016; 16:1-9
16. Wangeri T, Kimani E, Mutweleli S. Transitional challenges facing University first year students in Kenya public universities: A case study of Kenyatta University. *Interdisciplinary Review of Economics and Management*, 2012; 2:11-12
17. Malinauskas BM, Raedeke TD, Aeby VG, Smith JL, Dallas MB. Dieting practices, weight perceptions, and body composition: A comparison of normal weight, overweight, and obese college females. *Nutrition Journal*, 2006; 5(11):1-8
18. Acholonu AW. Water quality studies of Nworie River in Owerri, Nigeria
19. Federal University of technology Owerri About us- Federal University of technology Owerri. Available from <https://futo.edu.ng/about-us/>
20. University compass. About Imo State University IMSU. Available from: <https://universitycompass.com/africa/Nigeria/imo-state-university.php>
21. Alvan Ikoku Federal College of Education Owerri. History of Alvan Ikoku Federal College of Education. Available from: <https://alvanikoku.edu.ng/history/>
22. Federal Polytechnic Nekede Owerri. History of the Federal Polytechnic Nekede Owerri. Available from <https://fpno.edu.ng/history/.php>
23. Akintunde AA, Akinwusi PO, Adebayo RA, Ogunyemi A, Opadijo OG. Burden of obesity in essential hypertension: Pattern and prevalence. *Nigerian Journal of Clinical Practice*, 2010; 13(4)399-402
24. World Health Organization. Country profile indicators interpretation guide. Geneva 2010. Available from: http://www.who.int/nlis_interpretation_guide.pdf
25. World Health Organization. Obesity and Overweight. Geneva 2006. Available from:

- <http://www.who.int/mediacentre/factsheets/fs311/en/index.html>
26. Omron Instruction manual. Full body sensor body composition monitor and scale model HBF-514. China:Omron Healthcare 2008.
 27. Boone H, Boone D. Analyzing Likert Data. *Journal of Extension*. 2012; 50 (2):1-7
 28. Akinrotimi AA, Olowe PK. Challenges in the implementation of early childhood education in Nigeria: The way forward. *Journal of Education and Practice*, 2016; 7(7):1-6
 29. Ikujenlola AV, Adekoya TS. Nutritional status and feeding habits of females in public and private and Private Universities in Osun State, Southwestern Nigeria. *Heliyon*, 2020; 6:1-9
 30. Johansen A, Rasmussen S, Madsen M. Health behaviour among adolescents in Denmark: Influence of School Class and Individual Risk Factors *Scandinavian Journal of Public Health*, 2006; 34: 32-40
 31. Omage K, Omuenu VO. Assessment of dietary pattern and nutritional status of undergraduate students in a private university in southern Nigeria. *Food Science and Nutrition*, 2018; 6(7):1890-1897
 32. Nwadike G. Understanding the guber imbroglio in Imo State. *PMNews Nigeria* 2019, January 21. Available from: <https://pmnews Nigeria.com/2019/01/21/understanding-the-guber-imbroglio-in-imo-state/>
 33. Inghram V. Nutritional knowledge and behaviours of undergraduate students. [Bachelor of Science Thesis, University of Mississippi, 2019]. Available from https://engrave.olemiss.edu/hon_thesis/1238
 34. Kabir A, Miah S, Islam A. Factors influencing eating behavior and dietary intake among resident students in a public university in Bangladesh: A qualitative study. *PLoS ONE*, 2018; 13(6):1-17
 35. Kinyua LW. Association of nutrition knowledge and attitude with dietary practices and nutritional status of female undergraduate students attending university colleges within Nairobi.[Masters Dissertation, University of Nairobi, 2013].
 36. Adepoju AB, Gabriel E. Nutritional status, knowledge and food habit of female students residing in the Federal Polytechnic Ilaro hostel. *Book of Proceedings of 4th National Development Conference of the School of Pure and Applied Science, The Federal Polytechnic Ilaro, Ogun State* 2019:62-72
 37. Mialich MS, Covolo N, Vettori JC, Jordao AA. Relationship between body composition and level of physical activity among university students *Revista Chilena de Nutrición*, 2014; 41(1):46-53
 38. Maitiniyazi G, Chen Y, Qiu Y, Xie Z, He J, Xia S. Characteristics of Body Composition and Lifestyle in Chinese University Students with Normal-Weight Obesity: A Cross-Sectional Study. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy* 2021; 4:3427–3436
 39. Wang ZM, Pierson RN, Heymsfield SB. The five-level model: a new approach to organizing body-composition research. *American Journal Clinical Nutrition*, 2009; 56: 19-28.
 40. World Health Organization (WHO) and Food and Agricultural Organization (FAO). Vitamin and mineral requirements in human nutrition Available from <https://www.who.int/nutrition/publications/micronutrients/9241546123/en/>
 41. Khan WA, Lipke LK. Snacking and its contribution to food and nutrient intake of college students. *Journal of the American Dietetic Association*, 2009; 81:583-587.
 42. Ani IF, Eboka YI, Adeoye BK, Ngozi EO, Ajuzie NC. Eating habits and nutritional status of a Nigerian private university students. *Journal of Humanities, Social Sciences and Creative Arts*, 2018; 13:31-40