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Macro-nutrient composition of vegetarian meals consumed by undergraduate students of Babcock University

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Abstract
Macronutrient composition of meals consumed by young people had been a major concern of nutritionist across the globe, as this has a direct impact on their growth process. However, it becomes more pertinent for young people who are vegetarians which imply that they may have challenges accessing those macronutrients such as protein which are predominantly available in animal products. The study investigated the macronutrient composition of vegetarian meals served undergraduates of Babcock University. The study carried at Babcock University, Ilishan Remo Ogun State, Nigeria utilized a sample of 210 students. Samples of each cooked food served to the students were collected for each meal served during the whole week. Samples were analyzed chemically according to the official methods of analysis described by the Association of Official Analytical Chemist (AOAC, 2005). All analyses were carried out in duplicate. The proximate analyses results of the samples were analyzed statistically by means of SPSS version 16.0 to calculate the mean and standard deviation. ANOVA was used to determine significant differences between variables and Duncan test was used to separate the means. While significant differences were observed in terms of protein between bread, cornflakes, granular and rice and coleslaw. Beans, Oat, Custard, Eba, Fried Yam, Indomie, Jollof Rice, Jollof Spaghetti/Beans, Pap, Pottage, Rice and Beans and Yam were not significantly different. The highest Energy was found in Cornflakes (1567.89±94.35kcal), highest Protein in Rice and Coleslaw (65.36±1.98% and 20.64±2.91mg respectively). The macronutrients intake of the undergraduates was below RDI. When separated by sex, only female undergraduates met 100% and above of their RDI for protein. This low intake of macronutrients by the respondents can be attributed to meals skipping which was found among respondents in this study.

Keywords: Macronutrient composition, vegetarian meals, undergraduate students, proximate analysis, Babcock University

Introduction
A healthy vegetarian diet consists primarily of plant-based foods, such as fruits, vegetables, whole grains, legumes, nuts and seeds. Because the emphasis is on non-meat food sources, a vegetarian diet generally contains less fat and cholesterol, and typically includes more fiber. People who follow vegetarian diets can get all the nutrients they need. However, they must be careful to eat a wide variety of foods to meet their nutritional needs.

About 70% of protein comes from animal sources. The major sources of protein are water-packed tuna (which is 80% protein energy), poultry, fish, meat, milk, milk products, beans and nuts (Wardlaw *et al.*, 2004) [8]. Many plant foods in proportion to the amount of energy they supply provide not only much protein but also ample magnesium and dietary fibre along with other benefits. Although the protein is somewhat less efficiently used by the body than animal proteins, this drop is not significant enough to influence diet planning when a variety of foods is used. The vegetable proteins we eat also contain no cholesterol and little saturated fat, unless added during processing. Regular use of plant protein makes a valuable addition to a diet because these supply a variety of other nutrients (Wardlaw *et al.*, 2004) [8]

Protein deficiency usually accompanies a deficiency of dietary energy and other nutrient resulting from in-sufficient food intake. People who consumed too little protein and food energy can go to develop protein energy malnutrition (PEM). If the nutrient deficiency is quite severe for energy, a deficiency disease called marasmus can result. When an already existing disease is combined with an inadequate intake, a form of malnutrition called kwashiorkor develops. Though both are seen primarily in children, but can also develop in adults (Onis *et al.*, 1993) [7]. Protein energy malnutrition affects virtually every organ system (Demling 2005) [3]. Patients with protein energy malnutrition may also have deficiencies of vitamins, essential fatty acids and trace elements, all of which contribute to their dermatitis. Therefore, protein energy malnutrition also involves an inadequate intake of many essential nutrients (World Health Organization WHO, 2000).

Materials and Methods
Study Location
Babcock University is an Institution of Higher owned by the Seventh – Day Adventist Church. Though owned by a church denomination, Babcock University is a private institution attended by young adults from different religious affiliations. About 90% of the student population are resident on campus and are served with lacto-ovo vegetarian diet as a way of

encouraging healthy living and reducing the risk of meat and fish related diseases.

Sample and sampling technique

The Study population comprised male and female students of Babcock University. According to the University records of 2009/2010 session, Babcock University had a student population of six thousand one hundred and ninety eight students (6, 198) out of which five thousand five hundred and seventy four (5, 574) were boarders.

The sample size for the study was calculated using (Araoye, 2003)

$$N = \frac{Z^2pq}{d^2}$$

Where N = sample size

Z^2 = level of confidence or the probability that the true percentage is within chosen value d. = 1.96

P = proportion or estimate of percentage of sampling frame.

q = 1-p

d = level of precision (5%) required of results.

Hence, 210 student sample size at 5% level of precision was obtained. This study therefore used 210 boarding students as respondents for this study.

Two hundred and ten (210) healthy students were randomly selected for the study but Two hundred and six (206) questionnaires with matching food intake were analyzed.

Collection and Preparation of Samples

Representative samples of each cooked food served to the students were collected on each meal for the whole week. The samples (500g each) were kept in sealed food containers. The whole 500g sample was homogenized using a Kenwood electric blender, coded and then stored in a freezer before analysis.

Proximate Analysis

Samples were analyzed chemically according to the official methods of analysis described by the Association of Official Analytical Chemist (AOAC, 2005). All analysis was carried out in duplicate.

Dry Matter and Moisture Determination (AOAC Official Method 967.08)

Apparatus: Oven, crucibles, desiccators and balance.

Reagents: Silica gel, grease.

Determination: 2g of food sample was put in a weighed crucible and dried in an oven at 100°C for 24 hour. The crucible was then placed in a dessicator, cooled for 10min and weighed.

$$\% \text{ Dry Matter (\% DM)} = \frac{W_3 - Wo}{W_1 - Wo} \times \frac{100}{1}$$

$$\% \text{ Moisture} = \frac{W_1 - W_3}{W_1 - Wo} \times \frac{100}{1}$$

OR

% Moisture = 100 – % DM.

If, weight of empty crucible is Wo,

Weight of crucible plus sample is W_1,

Weight of crucible plus oven-dried sample W_3

Crude Protein Determination (AOAC Official Method 988.05)

The crude protein was determined by the routine semi-micro Kjeldahl, procedure/technique. This consists of three steps namely Digestion, Distillation and Titration.

Apparatus: Analytical Balance, Digestion tubes, Digestion Block Heaters, 50ml Burette, 5ml Pipette, 10ml Pipette, 10ml Measuring Cylinder, 100ml Beakers, Fume Cupboard.

Reagents: Con$C.H_2SO_4$, 0.01NHCL, 40% (W/V) NaOH, 2% Boric Acid Solution, Methyl Red – Bromocresol green mixed indicator, Kjeldahl Catalyst tablet.

Crude Fat or Ether Extracts Determination (AOAC Official Method 2003.06)

Apparatus: Soxhlet apparatus and accessories, oven, desiccators and analytical balance.

Reagents: Petroleum spirit or Ether (40° – 60°C b.pt).

The percentage fat/oil was obtained by the formula:

$$\% \text{ Weight} = \frac{W_1 - Wo}{\text{Wt. of Sample}} \times \frac{100}{1}$$

Fibre Determination (AOAC 958.06)

Apparatus: Heating mantle, crucibles, furnace, sieve cloth, fiber flask, funnel, analytical weighing balance, a dessicator.

Reagents: 0.255N H_2SO_4, 0.313N NaOH and Acetone.

The percentage fibre was obtained by the formula:

$$\% \text{ Fibre} = \frac{W1 - W_2}{\text{Wt. of sample}} \times 100$$

Determination of Ash (AOAC OFFICIAL METHOD 942.05)

Apparatus: Porcelain Crucibles, a Desiccator, Analytical Balances and a Furnace.

The percentage ash was calculated from the formula

$$\text{Ash content} = \frac{\text{wt. of ash}}{\text{Original wt.}} \times \frac{100}{1}$$

Carbohydrate Determination (Nitrogen Free Extract (NFE))

The carbohydrate content was determined by subtracting SUM of (Moisture % + % Crude Protein + % Fat + % Crude Fibre + % Ash) from 100 i.e.

(100 – (% M + % CP + % EE + % CF + % Ash) (Wardlaw *et al.*, 2004) [8].

Energy Determination

The energy content of the foods was determined by simple multiple calculation of the protein, fat and carbohydrate as follows;

4x Protein +9x Fat +4x carbohydrate = Energy Content (Wardlaw *et al*, 2004) [8].

Therefore the Energy content of each sample is

Energy Content = 4x Protein +9x Fat +4x carbohydrate

The Proximate and Mineral Analysis

The proximate and mineral analyses results of the samples were analyzed statistically by means of SPSS version 16.0 to calculate the mean and standard deviation.

Association between Variables

ANOVA was used to determine significant differences between variables and Duncan test was used to separate the means.

Feeding Pattern and Menu of the Respondents

Table 1 is a copy of Babcock University Student menu for 2009/2010 second semester. The menu gives repeated allowance of various foods which is aimed at ensuring adequacy of nutrient over period of a week. Hot cereals like oat, pap, custard, are served with moinmoin or akara three times a week for breakfast while cornflakes, granola and bread with margarine or peanut butter are served four times in a week. All breakfast meals are served with milk. The lunch meals include solids and semi solid foods which are mainly starchy roots and tubers. There are fatty and proteinous food coupled with fruit and vegetables. The supper meals include legumes, fruits and vegetables all spread to ensure variety and balance of the meals. Fruits and vegetable is served mostly twice in a day. Generally, the meals are heavy and are planned in such a manner that the vegetarian meal would sustain the students without outcome of malnutrition.

Macronutrient Composition of Foods

Table 2, shows the mean and standard deviation of foods served for breakfast. The foods were mainly cereal, accounting for the high carbohydrate content of the foods. However, the meal is balanced up with protein giving food like milk (22.46±0.03%), akara (17.29±0.11%) and moinmoin (15.73±0.09%). The use of margarine and peanut butter guaranteed a good supply of fat having 83.88±0.02% and 41.67±0.02% respectively. The energy supply of margarine (760.56±0.00kcal), Peanut (560.39±0.00kcal), Sugar (399±1.42kcal) and Granola (377.9±0.00kcal) keeps the body prepared for the day's activity. Protein was highest in Peanut butter (39.92±0.07%) and Lowest in Margarine (0.13±0.00%) with the exception sugar. Fat was lowest in conflakes (1.26±0.02%) and highest in margarine (83.88±0.02%). Carbohydrate was highest in Sugar (99.75±0.02%) and lowest in margarine (1.28±0.03%). Energy was lowest in custard (120.85±2.12kcal)

Table 2: Macronutrient content of breakfast foods

Food	% Moisture	% Crude Protein	% Fat	% Fibre	% Ash	% Carbohydrate	Energy (kcal)
Custard	73.52±0.39	2.43±0.06	4.81±0.04	0.23±0.03	2.05±0.03	16.97±0.54	120.85±2.12
Oat	61.85±0.02	5.15±0.03	1.94±0.03	0.87±0.02	2.49±0.03	27.70±0.07	148.86±0.00
Boiled Egg	31.5±0.01	11.85±0.00	9.82±0.01	0.13±0.01	1.58±0.02	45.12±0.01	316.26±0.00
Cornflakes	7.66±0.02	9.28±0.02	1.26±0.02	0.94±0.02	1.37±1.39	79.49±1.39	366.42±0.00
Akara	36.30±0.03	17.29±0.11	5.15±0.04	2.90±0.01	1.87±0.01	36.49±0.02	261.47±0.00
Chocolate Drink	67.35±0.01	10.74±0.08	2.87±0.02	0.00±0.00	2.35±0.02	16.69±0.02	135.55±0.00
Milk	57.97±0.01	22.46±0.03	13.27±0.02	0.00±0.00	1.45±0.04	4.85±0.06	288.67±0.00
Bread	36.26±0.02	9.42±0.08	19.74±0.03	0.37±0.02	1.45±0.03	32.76±0.03	346.38±0.02
Magarine	13.26±0.04	0.13±0.00	83.88±0.02	0.00±0.00	1.45±0.03	1.28±0.03	760.56±0.00
Moinmoin	38.88±0.02	15.73±0.09	11.88±0.02	0.75±0.02	1.66±0.02	31.10±0.02	294.24±0.00
Granola	9.85±0.02	8.92±0.78	6.66±0.02	0.22±0.02	3.78±0.02	70.57±0.02	377.9±0.00
Sugar	0.25±0.02	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	99.75±0.02	399±1.42
Pap	42.90±0.16	2.23±0.01	8.60±0.01	0.93±0.02	1.06±0.01	44.29±0.19	263.44±0.00
Peanut Butter	3.27±0.02	39.92±0.07	41.67±0.02	2.12±0.01	6.60±0.01	6.42±0.03	560.39±0.00

Table 3, reflects the mean and standard deviation of lunch foods. Gbadun stew had the highest protein (23.33±0.06%) while semovita contain relatively low protein (1.80±0.00%). Sugar and caprisonne contained less than 1% of protein. Okazi soup had the highest percentage of fat (28.34±0.02%) while Eba had the lowest (0.38±0.01%). Semovita and jollof rice had high amount of carbohydrate which are 48.74±0.03% and 29.21±0.03% respectively. Tofu had a high level of energy (300.18±0.00kcal) with 10.72±0.10% of protein, 57.80±0.16% carbohydrate and 2.90±0.02% fat. The two major drink for lunch were caprisonne and zobo drink. Zobo had 28.35±0.05kcal of energy, 3.57±0.13% of carbohydrate, 0.75±0.02% of fat and 1.83±0.09% of protein, while Caprisonne had 39.13±0.02kcal of energy, 8.64±0.06% of carbohydrate, 0.25±0.02% of fat and 0.58±0.00% of protein.

Table 3: Macronutrient content of lunch foods

Food	% Moisture	% Crude Protein	% Fat	% Fibre	% Ash	% Carbohydrate	Energy (kcal)
White Rice	70.27±0.02	5.76±0.00	7.56±0.35	1.23±0.00	1.85±0.01	13.33±0.05	144.4±0.00
Zobo	91.84±0.02	1.83±0.09	0.75±0.02	0.00±0.00	2.01±0.04	3.57±0.13	28.35±0.05
Eba	67.94±0.03	4.84±0.08	0.38±0.01	1.58±0.02	1.97±0.01	23.29±0.06	115.94±0.00
Asepo Okro	43.90±0.01	9.37±0.00	7.23±0.02	3.57±0.03	2.17±0.01	33.76±0.05	237.59±0.00
Jollof Rice	55.88±0.02	7.76±0.00	3.90±0.01	0.77±0.01	2.48±0.02	29.21±0.03	182.98±0.00
Caprisone	89.75±0.02	0.58±0.00	0.25±0.02	0.00±0.00	0.78±0.02	8.64±0.06	39.13±0.02
Stew	11.21±0.04	19.73±0.08	24.86±0.01	1.28±0.02	11.25±0.02	31.67±0.01	429.35±0.00
Gbadun Stew	0.00±0.02	23.33±0.06	26.80±0.06	1.55±0.04	13.17±0.02	25.15±0.15	435.12±0.00
Coleslaw	34.65±0.03	7.34±0.06	6.51±0.02	4.56±0.02	2.24±0.01	44.70±0.02	266.75±0.01
Semovita	46.78±0.02	1.80±0.00	0.34±0.02	0.22±0.01	2.12±0.01	48.74±0.03	205.22±0.00
Okazi	43.64±0.03	18.32±0.08	28.34±0.02	3.27±0.01	6.85±0.02	0.42±0.01	326.66±0.00

Egusi with Ugu Soup	59.24±0.01	16.59±0.00	13.39±0.03	1.74±0.03	1.97±0.02	7.07±0.04	215.15±0.00
Beans	53.26±0.02	11.78±0.00	9.32±0.01	1.55±0.01	2.13±0.01	21.96±0.00	218.84±0.01
Pottage Beans	60.71±0.02	12.05±0.01	6.94±0.03	1.43±0.01	2.55±0.02	19.32±0.07	175.94±0.00
Tofu	25.36±0.01	10.72±0.10	2.90±0.02	1.65±0.03	1.57±0.02	57.80±0.16	300.18±0.00
Fried Rice	54.68±0.00	13.32±0.08	10.06±0.01	0.32±0.01	4.28±0.02	17.34±0.9	213.18±0.00
Pottage Yam	69.90±0.10	7.40±0.08	2.06±0.03	1.55±0.01	2.67±0.02	16.42±0.09	113.82±0.00

Table 4, shows the list of supper foods with the mean and standard deviation. The results showed highest protein content in egg stew (18.93±0.02), highest fat content in Garden Egg Stew (21.31±0.04%), highest carbohydrate in Steamed Vegetable (47.62±0.07%) and highest energy content in egg stew (355.77±0.08kcal). The lowest protein and energy content was in boiled Irish potato 1.26±0.01% and 78.53±0.00kcal respectively. Lowest fat content was in Indomie (1.31±0.04%) and lowest carbohydrate content in fried Irish potato (4.58±0.04%). The food rich in fibre was fried Irish potato (2.90±0.01%). Highest ash contents were in Jollof spaghetti (3.30±0.01%), egg stew (2.8±0.01%) and fried irish potato (2.64±0.00%).

Table 4: macronutrient content of supper foods

Food	% Moisture	% Crude Protein	% Fat	% Fibre	% Ash	% Carbohydrate	Energy (kcal)
Fried Irish Potato	61.81±0.02	3.72±0.01	14.35±0.03	2.90±0.01	2.64±0.00	4.58±0.04	202.35±0.00
Spaghetti	72.33±0.02	6.28±0.00	8.31±0.04	1.27±0.01	2.04±0.01	9.77±0.09	138.99±0.00
Egg Stew	26.77±0.03	18.93±0.02	15.41±0.01	0.75±0.00	2.80±0.01	35.34±0.02	355.77±0.08
Jollof Spaghetti	70.15±0.02	8.33±0.02	4.54±0.02	1.15±0.01	3.30±0.01	12.53±0.06	124.30±0.00
Steamed Vegetable	28.93±0.02	15.39±0.11	4.92±0.01	1.48±0.02	1.66±0.02	47.62±0.07	296.32±0.00
Indomie	69.26±0.02	2.10±0.05	1.31±0.04	0.00±0.00	0.22±0.01	27.11±0.09	128.63±0.00
Boiled Yam	51.30±0.02	4.59±0.00	0.42±0.01	1.47±0.01	1.86±0.02	40.36±0.03	183.58±0.00
Strongoff	46.37±0.02	7.12±0.08	14.65±0.03	0.17±0.02	1.14±0.02	30.55±0.01	282.53±0.00
Fried Yam	43.26±0.01	11.64±0.08	8.25±0.2	0.88±0.02	0.95±0.02	35.02±0.00	260.89±0.00
Eko	67.28±0.02	6.30±0.02	1.48±0.02	1.30±0.01	2.06±0.01	21.06±0.06	124.84±0.00
Boiled Irish Potato	79.55±0.01	1.26±0.01	1.45±0.02	1.03±0.03	1.60±0.02	15.11±0.16	78.53±0.00
Garden Egg Stew	33.88±0.02	17.68±0.09	21.31±0.04	1.80±0.01	9.25±0.01	16.08±0.14	326.83±0.00

In table 5, the macronutrient intake of respondents based on number of meals taken per day was established. The RDI range was for male and female and only protein and Energy intake of 3 meals were within the RDI. All other intake both for 2 and 3 meals were below the RDI.

T**able 5:** Macronutrient consumption based on number of meals

Macronutrient	Number of meals/day	Mean	RDI
Energy	Twice Thrice	1667.39kcal 2500.50kcal	2200-2900kcal
Protein	Twice Thrice	34.67g 46.18g	46-58g

Table 6, shows the daily total macronutrients intake. The meal analysis for a day gave the account of expected intake from the menu. The daily protein was not significantly different. The energy intake of Monday and Saturday were not significantly different. The highest intake of Energy and Protein was on Monday while the lowest Energy intake was on Friday and the lowest Protein intake was on Thursday.

T**able 6:** Macronutrient composition of meals per day

Days	Energy	Protein
Sunday	2016.84_{b}±67.90	38.99_{a}±4.52
Monday	2602.55_{a}±144.13	48.35_{a}±7.44
Tuesday	2191.40_{a}±30.97	41.80_{a}±5.21
Wednesday	2118.25_{b}±220.34	35.80_{a}±9.63
Thursday	2018.45_{b}±57.77	32.39_{a}±3.62
Friday	2010.61_{b}±212.41	36.27_{a}±8.04
Saturday	2562.49_{a}±214.16	45.89_{a}±6.20

Note: Mean along the same column with different subscripts are not significantly different at P>0.05

In Table 7, the dishes were compared in terms of macronutrients. Bread, Cornflakes, Granular, Rice and Coleslaw were not significantly different but were different from Cereal, Custard, Eba/Semo, Fried Yam, Pap, Pottage, Rice and Beans which were also different from Beans, Indomie, Jollof Rice, Jollof Spaghetti, Beans and Yam in Energy. While significant differences were observed in terms of protein between bread, conflakes, granular and rice and coleslaw. Beans, Oat, Custard, Eba, Fried Yam, Indomie, Jollof Rice, Jollof Spaghetti/Beans, Pap, Pottage, Rice and Beans and Yam were not significantly different. The highest

Energy was found in Cornflakes (1567.89±94.35kcal), highest Protein in Rice and Coleslaw (65.36±1.98% and 20.64±2.91mg respectively). All breakfast foods are served with milk.

Table 7: Macronutrient content of dishes

Dishes	Energy	Protein
Beans+bread	741.26_{bc}±110.63	35.19_{bc}±4.72
Bread+chocolate+peanut butter	1619.70_{a}±42.33	46.62_{a}±5.34
Oat+moimoi+sugar	1071.68_{b}±73.68	27.66_{bc}±2.76
Cornflakes+bread+margarine	1567.69_{a}±94.35	41.01_{a}±9.72
Custard+akara+sugar	1016.77_{b}±14.01	21.98_{bc}±1.36
Eba + Soup	1082.43_{b}±69.89	46.65_{bc}±3.40
Fried Yam + egg stew	1056.05_{b}±7.59	58.14_{bc}±1.44
Granular+bread+margarine	1815.12_{a}±95.75	49.47_{a}±11.96
Indomie+boiled egg	771.44_{bc}±23.55	18.08_{bc}±3.52
Jollof Rice+coleslaw	949.49_{bc}±56.79	34.10_{cb}±2.34
Jollof Spaghetti/Beans	813.42_{bc}±29.64	38.47_{bc}±1.87
Pap+akara+sugar	1057.67_{b}±87.68	26.30_{bc}±4.12
Pottage+steamed vegetable	627.3_{b}±28.30	30.47_{bc}±8.44
Rice & Beans+stew	1090.06_{b}±20.71	48.25_{bc}±0.26
Rice & Coleslaw	1478.99_{a}±31.5	65.36_{b}±1.98
Yam+garden egg stew	857.99_{bc}±51.25	38.68_{bc}±1.03

Note: Mean along the same column with different subscripts are not significantly different at P>0.05

Discussion

The study population was mostly Christians from monogamous family with a mean age of 21-25 years of age which is the age group for most university undergraduates. Most of the respondents were Yoruba given that Babcock University is located in the southwest, a Yoruba speaking geopolitical zone of Nigeria. The parents of the respondents were mainly from the literate class with post graduate education and high income earning who could afford the cost of a private university education.

All meals served were cooked dishes that could encourage student's participation. FAO (2005) recommends variety of food and a selection of different meals over the course of the week. To this end dishes served include legumes (cowpea, soyabeans), cereal (maize or rice), tubers (yam), soups (made up of leafy vegetables) and fruits. The food combination is such that should improve the macronutrient intake from the dishes. These cooked vegetables are popular staples in Nigeria (Maziya- Dixon *et al*., 2004). Breakfast meals supply higher quantity of energy than lunch and dinner meal as a result of the sugar intake in the menu. The implication is that it is preferable for those who choose two meals, to include breakfast in their choice for rich energy supply for the day's activities. However, it does not matter the combinations of 2-meal the individual choices, the protein content is fairly the same has all dishes composed of legumes such as beans and "Tofu" from soybeans.

The macronutrients intake of the undergraduates was below RDI. When separated by sex, only female undergraduates met 100% and above of their RDI for protein. This low intake of macronutrients by the respondents can be attributed to meals skipping which was found among respondents in this study. Meal skipping is a common character of young adults (O'Connor *et a*l., 1987). The mean macronutrient intake of female students that consumed 3-meals in a day was adequate for protein and energy. However other macronutrients were low.

Conclusion

From this study, the proximate and macronutrient analysis results of the vegetarian meals showed great reliability giving similar results as in food composition tables when compared. Male and female respondent's consumption of meals covered high percentage of RDI of protein and energy. Peanut butter and gbadu stew were foods with the highest protein content in the diet of the young adults, while energy was high in margarine and peanut butter.

References

1. AOAC. Official methods of analysis. Association of Official Analytical Chemists. (18th ed) Washington DC, USA. 2005.
2. Araoye NA. Research Methodology with Statistics for Health and Social Sciences, Ilorin, Nigeria: Mathadex Publishers. 2003, 117-118.
3. Demling RH. The incidence and impact of pre-existing protein energy malnutrition on outcome in the elderly burn patient population. J Burn Care Rehabil. 2005; 26(1):94-100.
4. FAO. A manual for teachers, parents and communities, Food and Agriculture Organization of the United Nations, Rome. 2005. ISBN 92 -5-105 408 -8
5. Maziya-Dixon B, Akinyele IO, Oguntona EB, Nokoe S, Sanusi RA, Harris E. Nigerian food consumption and Nutrition survey 2001 – 2003, Summary, Ibadan, Nigeria: International Institute of Tropical Agriculture (IITA). 2004.
6. O'Connor MA, Touyz SW, Dunn SM, Beumont PJ. Vegetarianism in anorexia nervosa? A review of 116 consecutive cases. Medical Journal of Australia. 1987; 147(11-12):540-2. PMID 3696039.
7. Onis M de, Monteiro C, Clugton G. The worldwide magnitude of protein-energy malnutrition: an overview from the WHO Global Database on child Growth. Bulletin of the World Health Organization. 1993, 71(6).
8. Wardlaw, Gordon M, Hampl Jeffrey S, DiSilvestro, Robert A. Perspectives in Nutrition (6th ed.), New York: McGraw – Hill Inc. 2004.
9. World Watch Institute (WWI). United States Leads World Meat Stampede. 1998. https://www.worldwatch.org/press/news/1998/07/02 downloaded 26/03/2009.