Available Online at ESci Journals

Journal of Food Chemistry and Nutrition

ISSN: 2307-4124 (Online), 2308-7943 (Print)

http://www.escijournals.net/JFCN

NUTRIENT COMPOSITION OF SOME FOODS FROM A NIGERIAN EATERY

Israel O. Otemuyiwa*, Steve R. A. Adewusi

Department of Chemistry, Obafemi Awolowo University, Ile-Ife, Nigeria.

A B S T R A C T

This study investigated the nutrient composition of some foods prepared from an eatery in Nigerian. The samples were analyzed for moisture, ash, fibre, protein, fat and carbohydrate using AOAC methods, amino acid profile was determined using amino acid analyzer and available lysine by FDNB spectrophotometric method. The percentages for moisture, ash, fiber, protein, fat and energy ranged from 14 to 40, 1.3 to 3.8, 0.1to 1.6, 6.2 to 23, 12 to 20 % and 1328 to 2048 kJ, correspondingly. On the other hand, iron, zinc and copper ranged from 3.0 to 11.0, 5.7 to 35 and 0.2 to 1.6 mg / 100 g, while lysine, isoleucine, leucine, threonine and valine ranged from 1.9 to 6.5, 2.2 to 4.2, 3.3 to 6 9, 1.0 to 3.5 and 2.2 to 5.6 g / 100 g protein, respectively. Protein Digestibility-Corrected Amino Acid Scores (PDCAAS) is above 50 % for all meals. Conventional fast foods are high in fat and sodium; low in calcium and fibre but adequate in iron, zinc, copper. In contrast, ethnic diets are adequate in fibre, magnesium, calcium and potassium but low in protein. The study concluded that fast foods, though deficient in some nutrients could not be totally regarded as unwholesome.

Keywords: Fast food, nutrient, Energy density, Food processing, Eateries.

INTRODUCTION

Nutrition is coming to fore as a major modifiable determinant of chronic disease, with scientific evidence which increasingly supporting the view that alterations in diet have strong effects, both positive and negative, on health throughout life. Most importantly, dietary adjustments may not only influence present health but may determine whether or not an individual will develop such disease such as cancer, cardiovascular disease and diabetes much later in life (Froidmont-Görtz, 2007).

Nowadays fast food is a multibillion naira industry which has continued to grow at a rapid pace to the 21st century in many countries as eating in fast food restaurants is becoming more and more widely spread all over the world. It is very comfortable for people because fast food outlets often provide takeaway or takeout food in addition to a sit-down service thereby offering alternative to home cooked foods. In the developed countries where fast food consumption is habitual, a lot of research efforts have identified some factors that may lead to excessive weight gain such as massive serving size, high energy density, palatability (appealing to primordial taste preferences for fats, sugar and salt), high content of saturated and trans fatty acids and low content of fiber (Ebeling *et al.,* 2002; Bowman *et al*., 2004; Sand *et al.,* 2007). The concept of fast food in the developed countries may not be the same as in Nigeria, for instance apart from conventional fast foods, the eateries incorporated ethnic diets (diets of the people where the eatery is located) into their menus. Since the ingredients and mode of preparation of the foods may not be the same as done in developed nation, the contribution of fast food to nutrient intake among Nigerians cannot be estimated from food composition tables computed for food prepared by other nations. Therefore, there is the need to carry out nutrient analysis of foods prepared by eateries in Nigeria.

In Nigeria, there is the association of fast food and confectionary operators of Nigeria (AFFCON) but the eateries were not mandated to display the nutrition labels (if any), and information is limited on the nutritional qualities of foods from eateries hence, the objective of this study is to carry out nutrient analysis of some food prepared by a Nigerian eatery.

MATERIAL AND METHODS

Food Samples: Ten cooked food samples were collected in food flask (warmer) as consumed from five outlets of a

* Corresponding Author:

Email ID: Otemuyisegun@oauife.edu.ng

popular eatery located in Lagos, Nigeria. The meals were weighed, dried in the oven (Gallenkamp Oven Model SA 9059 B) at 50° C, ground into powder and then sieved with No 72 mesh size (Griffin and George Ltd., London). The samples were stored in plastic containers with screw cap and kept in the freezer until use.

Proximate composition: The moisture, ash, fibre, protein, fat content was determined by the method of official Analytical Chemists (AOAC (2000), carbohydrate content was determined by difference.

Energy value was estimated by Atwater principle of calculation based on 17 kJ / g carbohydrate, 17 kJ / g protein and 37 kJ / g fat (James, 1986).

Minerals were determined after wet digestion with nitric acid and perchloric acid mixture (HNO_3 / $HClO_4$; 4:1, v / v) using the Alpha 4 Model Atomic Absorption Spectrophotometer (Fisons Chem-Tech Analytical, UK) while sodium and potassium were determined with the Flame Absorption Photometer (Corning Ltd, England).

Determination of Amino Acid Profile: The amino acid profile of the samples was determined by the AOAC (2000) method number 999.13 using a Sequential Multi-Sample Amino Acid Analyzer (TSM) (Technicon Instruments Corporation, New York) with norleucine as an internal standard.

Protein Digestibility Studies: *In vitro* digestion of protein was carried out by the method of Miller *et al.,* (1981). The sample (250 mg) in 100 mL beaker was suspended in 15 mL of 0.1 M hydrochloric acid containing 1.5 mg pepsin and incubated at 37 ° C in a shaking water bath for 2 h; the suspension was neutralized with 0.5 M sodium hydroxide solution to pH 7.0. The suspension was treated with 4.0 mg pancreatin in 7.5 mL of 0.2 M sodium phosphate buffer (pH 8.0) containing sodium azide and incubated for another 2 hours, the resultant solution was filtered and the filtrate was kept in the freezer overnight for protein to precipitate. The precipitated protein was collected, dried and taken for the determination of digestible protein using kjeldahl Method (AOAC, 2000). Protein Digestibility and Protein Digestibility-Corrected Amino Acid Scores (PDCAAS) was calculated for the essential amino acid using the method of W.H.O (2002).

Determination of Available Lysine: Available lysine was determined as reported by Ramirez-Jimenez *et al.* (2004). The samples were reacted with 1-fluoro-2-4-dinitrobenzene (FDNB) solution prepared in ethanol, shaken mechanically for 3 hours at room temperature; ethanol was evaporated by immersing in water bath at 95° C. The FDNB modified protein was hydrolyzed with 8.1 M hydrochloric acid at 110° C for 24 hours, filtered and extracted three times with 2.0 ml diethyl ether. The aqueous layer was diluted and the absorbance measured at 415 nm. N-ε-2, 4- DNP-L-lysine HCl (Sigma Chemical Co) was used as a standard.

Statistical Analysis: Analysis was carried out in triplicate on the samples obtained from each outlet and the result presented as mean and standard deviation of all determinations. Analysis of variance was used to assess and compare results. Statistical analysis was carried out by the use of Microsoft Excel Statistical Packages (Microsoft Corporations, USA) and Graph-Pad Instat-3 Packages (Graph Pad software Inc, USA).

RESULTS AND DISCUSSION

The samples analyzed and mode of preparation is presented in Table 1 while the result of proximate and mineral content is presented in Table 2. The percentage moisture content ranged from 14 to 40 %, fried and baked foods have lower moisture than ethnic diets. Low moisture content foods are often characterized by high energy density and nutrients per gram of food; this is because there is less dilution of the nutrients. Moisture content is a measure of bio-degradability of food due the action of micro-organisms afforded by water activity (Mariam, 2005).

The ash, which is a measure of mineral content ranged from1.3 to 3.8 % and was significantly higher ($p < 0.05$) in ethnic diets than fried and baked foods. The range of ash reported compared favourably with 0.2 to 2.1 % ash reported for snack food (Tee *et al*., 1989).

The values reported for fiber (0.1 to 1.6 %) was lower than the range of 14 to 32 g / 100 g reported for ready-to-eat food (Mardukorsin *et al*., 2009). Conventional fast foods are made from highly refined and processed grains hence, the low fiber content. The gem and bran which are known to contain high fiber has been completely removed. Pereira *et al*. (2005) found association between increase intake of fiber and lowering of blood lipids especially cholesterol, improving glycemic index and increasing hyper-insulemnia. Fiber intake has been found to increase the process of digestion and bowel movement. While inadequate intake was reported to predispose consumers to cancer of colon, constipation, irritable bowel syndrome, overweight and obesity, coronary heart disease and diabetes (Wu *et al.,* 2003).

Only cowpea meal has low carbohydrate content because it is leguminous. Polysaccharides are characterised by slower rates of digestion and absorption, a greater satiating ability and effective feedback control of oxidation (Atkins and Davies, 2000). The calculated energy density of the meal (kJ/g) showed that fast foods are energy dense foods (≥ 16.8 kJ/g) whereas the energy density of ethnic diets falls within medium density range but none within low energy density range. This is in agreement with the findings of Bowman *et al*. (2004) that fast foods are high energy density food which has been reported to promote occurrence of overweight and obesity among children.

Protein content of the meals ranged from 6.2 to 23 % with the highest value reported for cowpea meal. The least protein content was reported for *eba* (a cassava meal), this result is consistent with the observation that cassava has low protein and amino acid composition (Nassar and Sousa, 2007). However, a marked increase in the protein quality of *eba* composite meal was observed when vegetable soup and meat are added, it is well known that a combination of two protein sources often give better nutritive value because of the complementation of their protein content. Minerals are known to play vital roles in the maintenance of human health (Uauy *et al.,* 1998). The result of iron content (Table 2) indicated that fast food flour products (meat pie, doughnut and hot dog) recorded significantly higher value ($p < 0.05$) than ethnic diets; this could result from fortification of wheat flour, and could be an advantage especially in Nigeria where iron deficiency anaemia is endemic. However, bioavailability in these foods could be low as it is affected by dietary factors which could increase (presence of meat or fish or organic acids such as ascorbic acid, citric acid, lactic acid) or inhibit (phytate, calcium, tannins, fibre) its availability as well as iron status of individual (Fairweather – Tait, 1999).

The zinc and copper were also significantly ($p < 0.05$) higher in wheat flour products (meat pie, hot dog doughnut). Zinc is an important trace element whose function is associated with growth, normal embryogenesis, foetal growth and colostrum production during lactation. Studies in human and animals have shown that zinc is essential for normal and functional maturation of immune system. It also promotes the transport of lipid from the small intestine to the blood. In living tissue, zinc has been found to be essential for the mechanism of taste and smell. It is needed for the synthesis of nucleic acid and protein (Sanstead, 1981; Prasad, 1983). Copper has been known to be associated with lipid metabolism and deficiency of copper can significantly increase the plasma cholesterol concentration.

Table 1. Sample Description and Mode of Preparation.

Sample	**Description and Method of Preparation**
Conventional Fast Foods	
Jollof rice:	Rice cooked (or baked) with ground tomatoes, peppers, sometimes with meat and other spices
Fried rice:	Rice cooked in vegetable oils, liver chop, meat, carrot, green beans and spices are added to taste
Meat pie	Snack made from wheat flour dough containing pastry of seasoned meat, potatoes & vegetables
Doughnut:	Snack made from wheat flour dough mixed into a circular ball fried in deep frying oven and then robbed with sugar or honey
Hotdog	Snack made from wheat flour dough stuffed with cheese, potato, onion, tomato and cooked sausage made from meat slurry and cooked on a hot grill
Beef roll	Snack made from wheat flour dough containing cooked sausage is rolled up in a pastry and baked in the oven
Ethnic diets	
Eba	Prepared from gari (peeled, grated cassava tuber, fermented, partially dehydrated and baked or fried) mixed with hot water to thick paste served with vegetable soup and fish
Amala	Prepared by mixing dried yam flour powder in boiled water into a thick paste, served with vegetable soup and fish
Pounded yam	Prepared by pounding boiled yam in a mortal with pestle to smooth paste served with vegetable soup and fish
Cowpea(Mashed Beans)	Prepared by cooking cowpea (*Vigna unguiculata L. Walp*), pepper, palm oil and other ingredients are added to the broth and mashed to paste.

Table 2. Macronutrient and mineral content of Eatery food (% dry weight basis).

Samples	Fried rice	Jollo rice	Meat pie	Beef roll	Doughnut	Hot dog	*Amala*	*Eba*	Pounded yam	Cowpea	RDA*
Moisture	24 ± 0.1^{b}	19 ± 0.2^{c}	14± 0.1^{c}	16 ± 0.2^{c}	15 ± 3.1^{c}	15 ± 1.9^{c}	35± 2.8^{a}	38± 4.0^{a}	36± 5.0^{a}	40 ± 2.8^{a}	-
Ash	1.3 ± 0.0^{d}	1.6 ± 0.2^{d}	2.0 ± 0.3^{d}	2.6 ± 0.1^{cd}	1.5 ± 0.2^{d}	3.0 ± 0.6^{c}	3.3 ± 0.8^{bc}	3.2 ± 0.2^{bc}	2.3 ± 0.4^{d}	3.8 ± 1.6^{a}	20
Fibre	0.4 ± 0.1^{c}	0.3 ± 0.2^{cd}	0.4 ± 0.3^{c}	0.1 ± 0.0^{d}	0.5 ± 0.1^{bc}	0.2 ± 0.1^{d}	1.6 ± 0.5^{a}	0.8 ± 0.4^{b}	1.2 ± 0.1^{a}	0.4 ± 0.1^{c}	
Fat	12 ± 0.2^{c}	15 ± 1.8^{b}	13 ± 0.4^{c}	14 ± 3.0^{bc}	15 ± 0.3^{b}	14 ± 0.8^{bc}	13 ± 0.2^{c}	12 ± 0.4^{c}	12 ± 0.2c	20 ± 2.0^{a}	65
Protein	10 ± 0.2$^{b c}$	12 ± 0.4^{b}	10 ± 0.2$^{b c}$	12 ± 0.5^{b}	8.0 ± 0.1^{c}	9.0 ± 0.4$^{b c}$	6.2 ± 1.2^{d}	8.5 ± 2.0^{c}	8.2 ± 0.9 c	23 ± 3.2^{a}	50
Carbohydrate	52.0 ± 3.0^{b}	52.4 ± 1.0^{b}	60.6 ± 2.4^{a}	55.3 ± 0.9^{ab}	60.0 ± 1.2^{a}	58.8 ± 2.0^{a}	40.9 ± 0.8^{c}	37.5 ± 3.2^{c}	40.3 ± 2.2^{c}	12.8 ± 0.2^{d}	-
Energy (kJ)	2048 ± 20^{a}	2010 ± 10^{b}	1678 ± 8.0^{g}	1662 ± 10^{h}	1900 ± 6.2^{i}	1663± 14^{j}	1908 ± 7.0^{f}	2600± 22^{d}	2086± 10^{c}	1828±13^{e}	2200
Energy density	17±1.1^{a}	16±0.1^{a}	17±2.0^{a}	17±0.3^{a}	17±0.4^{a}	17 ± 0.9^{a}	15±0.1^{b}	15±0.2^{b}	15±0.4^{b}	16±0.6^{a}	`-
					Minerals						
Iron	3.0 ± 0.2^{c}	4.0 ± 0.8^{c}	9.0 ± 1.1^{a}	9.0 ± 3.1^{a}	11 ± 2.1^{a}	7.0 ± 1.1^{b}	3.2 ± 1.8^{c}	7.1 ± 0.5^{b}	5.4 ± 1.5^{c}	5.6 ± 0.7^{c}	10.8
Zinc	6.2 ± 0.7^{c}	6.4 ± 1.1^{c}	31 ± 3.2^{a}	35 ± 2.9^{a}	20 ± 2.3^{b}	17 ± 1.8^{b}	6.0 ± 0.3^{c}	7.0 ± 1.2^{c}	5.7 ± 2.2^{c}	11 ± 1.8^{c}	15.0
Copper	0.20 ± 0.0^{c}	0.8 ± 0.2^{b}	0.70 ± 0.0^{c}	0.5 ± 0.1^{c}	2.4 ± 0.8^{a}	0.95 ± 0.2^{b}	1.3 ± 0.5^{b}	1.6 ± 0.4^{ab}	1.1 ± 0.2^{b}	1.3 ± 0.3^{b}	3.0
Calcium	74 ± 2.7^{c}	108 ± 17^{ab}	49 ± 2.9^{d}	81 ± 7.5^{bc}	76 ± 18^{c}	64 ± 10^{c}	84 ± 10^{b}	133 ± 7.7^{a}	75 ± 10^{c}	136 ± 9^{a}	800
Magnesium	85 ± 5^{b}	63 ± 6^{b}	89 ± 9^{b}	88 ± 4.8^{b}	145 ± 24^{a}	77 ± 12^{b}	95 ± 21^{b}	141 ± 18^{a}	95 ± 13^{b}	120 ± 10^{a}	400
Potassium	130 ± 12^{f}	202 ± 9^{e}	24 ± 17^{g}	268 ± 66^{b}	638 ± 30^{b}	465 ± 10^{c}	490 ± 5.0^{c}	618 ± 30^{b}	301 ± 10^{d}	915 ± 23^{a}	
Sodium	255 ± 18^{e}	350 ± 11^{d}	1062 ±18a	780 ± 30^{c}	875 ± 40^{b}	628 ± 15^{d}	238 ± 30^{e}	500 ± 10^{c}	503 ± 14^{c}	511 ± 33^{c}	
Na/K ratio	1.45	1.34	4.12	1.35	1.37	2.90	0.92	0.68	1.31	0.72	0.6*
K/(Ca+Mg)	1.27	1.10	0.57	0.30	0.40	0.63	0.84	0.76	0.97	0.72	2.2*
Ca/Mg ratio	0.53	0.34	1.84	1.20	1.25	1.08	0.39	0.48	0.41	0.33	1.0*

Mean ± SD of triplicate analysis

Values with the same superscripts within the column are not significantly different ($p < 0.05$)

*RDA- recommended dietary allowances

Calcium and potassium were higher in ethnic diets especially in cowpea meal. Calcium is essential for bone development and prevention of osteoporosis and may also reduce the absorption of dietary fat thereby lowering serum total cholesterol and low- density lipoprotein cholesterol concentration (Vaskonen, 2003) while potassium is involved in both electrical and cellular function in the body; therefore it is classified as an electrolyte. It has various roles in the metabolism, for instance it is essential for the regulation of acid - base balance and water balance in the blood and body tissues. Total body potassium is reported to be an index of the body's cell mass (He *et al.,* 2003). An adequate intake of potassium has been found to prevent high blood pressure and reduce the risk of stroke (whelton *et al.,* 1997; Ascherio *et al.,* 1998).

Sodium ranged from 238 to 1062 mg / 100 g, the highest value was reported for meat pie. Sodium content of snack food reported by Tee *et al*. (1989) ranged from 3 to 595 mg/100 g. High dietary sodium intake has been implicated for the development of high blood pressure and stiffening of the arterial walls and therefore, a risk factor for Coronary Heart Disease, which is a major cause of death in Europe (Franco *et al.*, 2004) oedemia or water retention (Anderson *et al.*, 2007). The standard sodium-potassium ratio that favoured non-enhancement of high pressure disease is given as 0.60 all diets exceeded this ratio, also calcium: magnesium ratio in fast food is higher than the recommended ratio of 1.0 and the milliequivalent ratio of (K/(Ca+Mg) was less than 2.2, this implies that both calcium and magnesium in the diets would need adjustment for good health.

The amino acid profile (g / 100 g protein) presented in Table 3, indicated that the most concentrated amino acids in all the samples were glutamic acid, aspartic acid and arginine. High glutamic acid content has been reported in snack foods (Adeyeye *et al.,* 2006). Essential amino acids, Lysine, isoleucine, leucine, threonine and valine ranged from 1.9 to 6.5 g, 2.2 to 4.2 g, 3.3 to 6 9 g. 1.0 to 3.5 g and 2.2 to 5.6 g, respectively. Sulphur (cysteine and methionine) and aromatic (tyrosine and phenylalanine) amino acids ranged from 1.4 to 3.9 and 3.9 to 8.6 g / 100 g protein respectively. The non-essential amino acids; serine, alanine, glycine, arginine, asparagines, glutamic acid and proline ranged from 0.6 to 4.1, 3.1 to 6.3, 2.3 to 4.5, 4.0 to 6.2, 3.2 to 10.1, 7.9 to 13.8 and 1.0 to 3.6 g / 100 g protein, respectively.

Protein Digestibility (Table 4) for *eba* and rice was 0.72 and 0.88. The digestibility-corrected amino acid per serving of the meals, indicated that isoleucine, leucine, lysine, valine, ranged from 206 to 2218 mg, 346 to 4386 mg, 189 to 3743 mg, 520 to 2974 mg, respectively, while methionine /cystine ranged from 173 to 2186 mg. Protein Digestibility--Corrected Amino Acid Score (PDCAAS) which measures quality of the meals revealed that in all meals, the digestibility-corrected amino acid scores were greater than 50 % except *amala* which reported less than 50 % for isoleucine. The limiting amino acid in rice was lysine, threonine in doughnut while all other samples were limiting in sulphur amino acids (methionine + cysteine). This observation is consistent with the findings of Meredith and Caster (1984). There is the need to balance foods that are limiting in sulphur containing amino acids with the complementary meals because cystine has positive effect on mineral absorption especially zinc (Hurrell *et al*., 1996).

Isoleucine is needed for the production of haemoglobin and to regulate the blood sugar level in the body. It is responsible for muscle recovery after exercise. Deficiency of isoleucine can lead to symptoms similar to those of hypoglycemia. Methionine is needed for the synthesis of choline which forms lecithin and other phospholipids in the body when diet is low in protein for instance in kwashiorkor or alcoholism, insufficient choline may be formed, this may cause accumulation of fat in the liver (Bimgham, 1977).

The available lysine (Table 5) ranged from 1.50 to 5.50 g, The high lysine content of meat pie, beef roll and hotdog could be as a result of meat sausage added, which was not present in doughnut, hence the observed low lysine despite of the same wheat flour (cereal) source.

Table 3. Amino Acid Profile of some food from Eatery (g/100g protein).

Sample	Rice	Doughnut	Meat pie	Amala	Eba	Pounded Yam	Cowpea	Reference egg*	WHO Pattern
				Essential Amino Acids					
Lys	3.2(0.45)	2.9 (0.41)	6.5 (0.89)	3.3 (0.47)	1.9 (0.27)	2.7 (0.39)	5.7(0.81)	7.0	5.5
Ile	3.6 (0.67)	3.2 (0.58)	4.2(0.77)	3.5(0.64)	2.2(0.39)	3.0(0.55)	3.5(0.64)	5.4	4.0
Leu	6.2 (0.71)	5.3 (0.62)	6.1 (0.70)	4.0 (0.46)	3.3 (0.37)	4.9 (0.56)	6.9 (0.80)	8.6	7.0
Cys*	1.5	1.5	0.8	0.7	0.6	1.2	1.0	5.7	3.5
Met*	2.5 (0.68)	1.2 (0.46)	3.0 (0.66)	1.0 (0.30)	0.8 (0.25)	0.80(0.34)	1.4(0.42)		
Tyr**	3.6	2.7	3.9	1.1	1.5	3.1	3.2	9.3	6.0
Phe**	4.9(0.92)	3.9(0.71)	4.4(0.88)	4.2(0.57)	2.3(0.41)	3.7(0.73)	4.8(0.80)		
Thre	3.5(0.74)	2.2(0.48)	2.9(0.60)	2.3(0.48)	1.0(0.21)	2.6(0.55)	2.9(0.62)	4.7	4.0
Val	4.2(0.63)	3.0(0.45)	4.7(0.70)	2.2(0.32)	5.6(0.84)	3.8(0.58)	4.5(0.68)	6.6	5.0
His	3.2	1.8	2.3	2.6	1.0	3.0	3.1		
				Non-essential Amino Acids					
Ser	2.9	4.1	3.5	0.6	0.9	3.0	3.4		
Ala	4.9	3.1	2.9	6.3	3.5	4.4	3.6		
Gly	4.5	2.9	3.3	4.4	2.3	3.1	3.5		
Arg	5.3	4.1	5.0	8.9	5.2	4.0	6.2		
Asp	8.6	5.0	9.3	4.7	3.2	5.7	10.1		
Glu	11.2	9.4	12.4	10.1	7.9	9.1	13.8		
Pro	2.7	3.6	3.0	3.2	1.0	2.8	3.2		

Value in parenthesis represents amino acid score; * score for Cys/Met. and ** score for Phe/Tyr
Amino acid scores was compared to egg as reference amino acid according to FAO, 1991.

Table 4. Protein Digestibility- Corrected Amino Acid of some foods from Eatery (g per serving DM basis).

Parameter	Jollof rice	Fried rice	Meat pie	Doughnut	*Amala*	*Eba*	*Pounded Yam*	*Cowpea*	RDA[1]
Digestibility	0.88	0.88	0.86	0.84	0.74	0.72	0.74	0.78	
DM[2]	239±10	362±13	116 ± 5.0	60 ± 4.2	124± 8.0	148± 13	158±10	180±15	
DCP[3]	46	58	11.6	5.3	36	33	35	41	77
Digestibility-corrected Amino acid (mg / serving)									
Ileu	1900	1928	469	206	681	748	923	2218	1400
Leu	3518	3564	678	346	1299	1469	2159	4386	2730
Lys	3365	3412	696	189	1499	1292	1422	3743	2100
Met / Cys	2157	2186	422	173	922	844	934	1837	1050
Phe / Tyr	4355	4420	921	431	1603	1699	2099	5085	1750
Thr	2035	2061	319	145	967	806	980	2051	1050
Val	2552	2582	520	522	1151	1304	1199	2974	1820
Digestibility-corrected Amino acid score of the meals as percentages									
Ileu	65	61	77	58	44	55	61	64	
Leu	75	71	71	62	52	67	89	79	
Lys	88	84	89	42	76	73	72	83	
Met/Cys	70	66	66	47	56	59	58	50	
Phe/Tyr	86	88	89	71	60	72	79	85	
Thr	80	75	61	47	72	68	74	68	
Val	71	67	70	46	61	78	65	70	

[1]Recommended Daily Allowance- Calculated based on protein requirement of 1.1 g / kg body weight of a 70 kg moderately active adult and amino acid requirement of age ≥ 18 years

[2] DM = Dry matter

[3] DCP = Digestibility- Corrected Protein

Cereals are known to be limiting in lysine. However, percentage availability of lysine ranged from 66 to 85 % indicating that though the lysine content may be low compare to other foods as the lysine is readily available. Schneider and Fennema (1989) observed that available lysine content of dried whey protein concentrate decreased most at high water activity and temperature. Fernandez-Artigas *et al*. (1999) reported lysine loss of toasted flour between 14 to 29 % and 53 % decrease in roller-dried rice-corn-soy product.

Table 5: Available Lysine content of some foods from eatery (g/100 g protein).

Sample	Total Lysine	Available Lysine	% availability
Jollof rice	3.20	2.72 ± 0.06	85
Fried rice	3.20	2.70 ± 0.01	84
Meat pie	6.5	5.50 ± 0.02	85
Beef roll	6.5	4.40 ± 0.04	68
Doughnut	2.9	2.33 ± 0.01	80
Hot dog	6.5	4.31 ± 0.02	66
Eba	1.9	1.50 ± 0.01	79
Amala	3.3	2.30 ± 0.01	68
Pounded yam	2.7	1.90 ± 0.06	70
Cowpea	5.7	4.20 ± 0.1	73

CONCLUSION

The findings of this study revealed that conventional fast are high in sodium, fat and energy density, low in fibre and calcium but possess some inherent nutritional qualities that could enhance proper growth and development in Nigerian context.

On the other hand, ethnic diets seem nutritionally better but low in protein; this is of great health concern if the consumption of the foods were not complemented. The study, apart from providing an insight into nutrient content of foods from eatery, it also shed light on the fact that fast foods could not be totally regarded as unwholesome in terms of nutrient content however, adequacy of intake must also take into account of both the portion size and frequency of consumption in the daily diet.

ACKNOWLEDGEMENT

The study is self-financed, however we are grateful to Mr Mr Aderanti E.O (Principal Technologist, Department of Chemistry and Mr Adeagbo both of Obafemi Awolowo University, Ile-Ife, Nigeria, for their assistance.

REFERENCES

Adeyeye, E.I., O.T. Orisakaye and M.A. Oyarekun. 2006. Composition, Mineral Safety Index, Calcium, Zinc and Phytate inter-relationship in four Fast Foods consumed in Nigeria. Pak. J. of Nutr. 5: 1-7.

AOAC. 2000. Official methods of analysis of the Association of Official Analytical Chemists 17th Edition AOAC International, Gaithersburg MD.

Ascherio A, E.B. Rimm, M.A. Herman, E.L. Giovannucci, I. Kawachi, M.J. Stampfer and W.C. Willett. 1998. Intake of Potassium, magnesium, and fibre and risk of stroke among US men, Circulation 98: 1198 – 204.

Atkin, L.M. and P.S. Davies. 2000. Diet Composition and Body Composition in Preschool Children. Am. J. of Clin. Nutr. 72: 15 – 21.

Bowman, S.A., S.L. Gortmaker,C.B. Ebbeling, M.A. Pereira and D.S. Ludwig. 2004. Effect of Fast Food Consumption on Energy Intake and Diet Quality among Children in a National Household Survey. Paediatrics. 113: 111 – 120.

Bingham, S. 1977. Dictionary of Nutrition. Banne and Jenkins Limited London UK. 69-70.

Ebeling, C.B., D.B. Pawlak and D.S. Ludwig. 2002. Childhood Obesity, Public Health Crisis; Common Sense Cure Lancet. 360: 473–482.

FAO/WHO. 1991. Protein Quality Evaluation; Report of the Joint FAO / WHO Expert consultation.FAO Food and Nutrition Paper 51 Bethseda Md., USA26-42.

Fairweather-Tait S.J. 1999. The importance of trace metal speciation in nutrition sciences. Fresnius. J. Anal Chem. 363: 536-40.

Fernandez-Artigas, P., B. Garcıa-Villanova and E. Guerra-Hernandez. 1999. Blockage of Available Lysine at different stages of Infant Cereal Production. J. Sci Food and Agric.79: 1–4.

Froidmont-Gortz, P. 2007. Emerging technologies and perspectives for nutrition research in framework programme 7 (FP.7); In Proceedings of International Symposium on Functional Food in Europe. International Development in Science and Health Claims Malta 9-11 May.

He, Q., M. Heo, S. Heska, J. Wang, R.N. Pierson, J. Albu, Z. Wang and D. Gallagher. 2003. Total Body Potassium differs by Sex and Race across the Adult Age Span. Am. J of Clin Nutr. 78: 72–77.

Hurrell, R.F., Davidson, L., Sandstrom, B., Marcel, J. and Annette, A.(1996). Zinc Absorption in Adult Humans. The effect of protein sources added to lipid test meal. British J. Nutr, 75, (1); 602–613.

James, C.S. 1996. Analytical Chemistry of Foods. Mackie Academic and Professionals Ltd Glassgow, 135.

Mariam, S. 2005. Nutritive value of three potential complementary food based cereals and legumes. Afr. J. Food Agric. Nutri. Devt. 5: 1-15.

Meredith, F.I. and W.D. Caster. 1984. Amino Acid Content in Selected Cereals. J. Food Sci. 49: 1624-1625.

Mardukosin, C.H. and G.I. Adoga. 2009. Some Nutrient Composition of Ready-to-eat Foods consumed by Pregnant and Lactating Women in Bassa LGA of Plateau State, Nigeria. Pak. J. Nutr. 8: 1889-1893.

Miller D.D, B.R. Schriker, R.R. Rasmussen and D. Van-campen. 1981. An in-vitro method of estimation of iron availability from meals. Am. J. Clin. Nutr. 34: 2257- 78.

Nassar, N.M.A. and M.V. Sousa. 2007. Amino acid profile in cassava and its interspecific hybrid Genetics. Mol. Res. 6: 292-297.

Pereira, M.A., A.I. Kartashov, C.B. Ebbeling, L. Van Horn, M.L. Slattery, D.R. Jacobs and D.S. Ludwig. 2005. Fast food increases the risk of Obesity and Diabetes. Lancet. 365: 36–42.

Prasad, A.S. 1983. Clinical, Biochemical and Nutritional Spectrum of Zinc Deficiency in Human Subject: An Update. Nutri. Rev. 41: 197–207.

Ramırez-Jimenez, A., B. Garcıa-Villanova and E. Guerra-Hernandez. 2004. Effect of Storage Conditions and inclusion of milk on Available Lysine in Infant Cereals. Food Chem. 85: 239–244.

Sand, B., B.L. Jansen, I.D. Carol, C. Henry, S. Sanbir and R.S. Ashwine. 2007. The Prevalence and Nutrition Implication of Fast Food Consumption among haemodialysis patience. J. Renal Nutr. 17: 264–269.

Sandstead, H.H. 1981. Method of Determining Nutrient

Requirements in Pregnancy 1. Am. J Clin Nutr. 34: 697–704.

Schneider, U.Z. and O. Fennema.1989. Stability of Lysine, Methionine and Tryptophan in dried Whey Concentrate during storage. J. Diary Sci. 72: 1740-1747.

Tee, E.S., S.S. Mizura. A. Anuar, R. Kuladevan, S.E. Young, S.C. Khor and S.K. Chin. 1989. Nutrient Composition of Selected Cooked and Processed Snack Food. Pertanika. 12: 15-25.

Uauy, R., M. Olivares and M. Gonzalez. 1998. Essentiality of Copper in Humans. Am. J. Clin. Nutr. 67 (suppl): 952S–959S.

Vaskonen, M.D. 2003. Dietary minerals and modifications of cardiovascular risk factors. J. Nutr. Biochem.14; 492-506.

Whelton P.K., J. He, J.A. Cutler, F.L. Brancati, L.J. Appel, D. Follmann, M.J. Klag. 1997. Effect of oral potassium on blood pressure, Meta-analysis of randomnized control clinical trials. J. Am. Med. Assoc. 277: 1624- 32.

WHO. 2002. Protein and Amino acid requirement in human Nutrition. Technical Report Series 935 Report of a Joint WHO/FAO/UNU expert consultation Geneva Switzerland.

Wu, H., K.M. Dywer, Z. Fan, S. Anne, J. Fan and J.H. Dywer. 2003. Dietary Fiber and progression of Arteriosclerosis: The Los Angeles Atherosclerosis Study. Am. J. Clin. Nutr. 78: 1085–1091.