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Full Length Research

Effect of Roasting on the Proximate Composition of Corn (*Zea Mays*) and Meat (Beef) Sold in Nigeria

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Abstract: The study shows the effect roasting has on corn (*Zea mays*) and meat (beef). The proximate analysis of samples was carried out using the Association of Official Analytical chemist method (AOAC, 1990). The corn and meat samples were procured from Living faith junction, Abdulrazak Street Junction, Nasarawa main market park, Angwan Power, Oversea Road junction, Opposite Tammah filling station and opposite Govt. College in Nasarawa Town. It is seen that in fresh corn samples, the moisture content is 12.50%, protein 7.00%, ash 2.20%, lipid 4.8% and carbohydrates 72.50%. While in fresh meat, the moisture content is 69.75%, protein 17.98%, ash 4.12% and fats 5.23%. The average values obtained after roasting each corn samples from each location for roasted corn; moisture content is 95.70%, protein 10.50%, ash 1.20%, lipid 2:50% and carbohydrate 71.25% and that of the roasted meat; moisture content is 65.40%, protein 19.80%, ash 1.80% and fats 2.50%. The caloric values (Kcal) of fresh corn and meat are 98.74% and 97.27% respectively. This study shows that the caloric value of fresh corn to be 98.74 and 97.27 for fresh meat, after roasting the average caloric value of the food samples were slightly reduced which shows that more calories can be gotten when the food samples are consumed fresh and less calories when consumed after roasting which is good for people undergoing weight process. From the study carried out, it can be deduced that the effect of roasting corn and meat has resulted in reduction in ash content and protein level increase. High protein levels are good for both old and young people. It is advisable to consume meat and corn in their roasted forms. In normal handling and storage of meat, the major deteriorative changes are attributed to microbial contamination and activity.
Keywords: Lipid: Protein: Proximate: Composition: Nutrition: Components: Moisture: Ash Content.

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1.0 Background of Study

There has been immense expansion in food production and also animal farming as a result of increasing demand for food applications (Bala et al., 2016; Egan & Bamfo-Agyei, 2023). The effects of various processing methods in the preparation of corn and meat for human consumption are of utmost importance (Bala et al., 2016). Roasting is the most important practice for corn and meat processing in Nigeria and is commonly carried out in open pan over fire with continuous stirring, however, such roasting process takes about 20 min or more, which may adversely affect the food constituents such as starch, lipids, protein, vitamins and other essential nutrients (Bala et al., 2016; Gebeyehu et al., 2022). Corn is the most cultivated cereal and grain crop in the world and it is used as a staple food in developing countries such as Nigeria, South Africa, Mexico and economically less privileged countries. The grains of maize are processed into intermediate products (flour and meal) which are utilized for the production of different types of ready to eat foods (Bala et al., 2016). Cooking time varies regionally and a criterion for consumer acceptance and more prominent and paramount where firewood is the main fuel source in Africa. Cooking quality (cooking time and texture) is important in determining the energy cost for preparation of meals (Shimelis & Rakshit, 2005).

Corn and meat are nutritious foods and are excellent sources of the much needed carbohydrate, animal protein in the human diet, also being rich in essential vitamins and minerals (Brody et al., 2004). Corn (*Zea mays*) is one of the world's three most important cereal crops (the other two being wheat and rice), and it is an important source of food, feed, fuel and fibers (Tenaillon & Charcosset, 2011; Ayua et al., 2023). It has the widest distribution of all the cereals, and it is primarily grown for its grain as food human consumption (Tolera et al., 1998). Corn and other cereals are the major source of calories and protein to the diets of humans and livestock, and this is largely due to their adaptability, high yields, ease of harvest and storage, as well as their processing and eating properties (Lafiandra et al., 2014). Typically, corn is composed of 8–10 % protein, 4–5 % lipid, 70–75 % starch, 1-3 % sugar, and 1–4 % ash; and supplies approximately 365 kcal/100 g of energy (USDA/ARS, 2012). Average value of meat protein is about 23%. That varies from higher to lower value according to the type of meat source. Meat fat and its fatty acid profile is a point of concern, but its moderate usage is always by doctors and nutritionists in order to live a healthy life. Animal meat like beef contains a number of bioactive substances such as creatinine, taurine, CLA, and cholesterol (Youn & Chung, 2012; Ukonu et al., 2022). One of the most important processes of corn and meat preparation is Roasting because of its ability to improve the characteristics of these food samples during the roasting process. In the food industry, roasting is an important processing method used to improve food quality, to extend the shelf life of foods and to improve the processing efficiency of subsequent treatment (Youn & Chung, 2012). Roasting is a slow method of cooking that is well suited to large cuts where the chest needs time to reach through the middle without churning the size (FAO, 2007). Roasting can be done in pans in ovens or in spits over open fires. It can be done by surrounding a food with hot coals or ashes as is done when roasting potatoes in a campfire (FAO, 2007). Meat Composition: The animal carcass consists of muscles, connective tissues, fat and bone and some 75% water in proportion. This depends on the size, species, breed and age. The amount of fat in a particular meat ranges from 15.40%-29% (FAO, 2007). The proximate composition of corn food determines the nutritional quality and composition of food. The differences in composition could include moisture, ash, carbohydrate, protein and lipid content (Osagie & Eka, 1998; Abdulkadir & Ajagba, 2022).

1.1 Proximate Composition

Proximates are used in the analysis of biological materials as a decomposition of a human consumable good into its major constituents (Parimelazhagan & Thangaraj, 2016). They are good approximations of the contents of packaged comestible goods and serve as a cost-effective and easy verification of nutritional panels. This includes moisture, ash, lipid, protein and carbohydrate contents. These food components may be of interest in the food industry for product development, quality control (QC) or regulatory purposes. Analyses used may be rapid methods for QC or more accurate but time-consuming official methods. This means that testing can be used to verify lots, but cannot be used to validate a food processing facility; Instead, a nutritional assay must be conducted on the product to qualify said producers (Parimelazhagan & Thangaraj, 2016; Olusesi & Joshua, 2022).

1.1.2 Moisture Content: The moisture (or total solids) content of foods is important to food manufacturers for a variety of reasons (Nielsen, 2010). Moisture is an important factor in food quality, preservation, and resistance to deterioration. Determination of moisture content also is necessary to calculate the content of other food constituents on a uniform basis (i.e., dry weight basis). The dry matter that remains after moisture analysis is commonly referred to as total solids (Nielsen, 2010). Water is one of the important constituents of all food materials. In general, there are three types of food products depending upon their moisture contents, firstly perishable commodities (having more than 70% moisture content in them), non-perishable commodities (having around 50–60% moisture contents) and stable food materials (with less than 15% moisture) (Lehinger et al., 1992). The more the water content of any food material the lesser are the chances of its longer shelf life as micro-organisms have greater chance to grow on them that in turn, limit their lives. Meat ranks among the perishable food material, as it contains around more than 70% of moisture in it while corn ranks among the stable food material (with less than 15% moisture). Apart from reduction in shelf life, its presence imparts a strong impact on the color, texture and flavor of food materials (Lehinger et al., 1992). During the processing conditions, such as roasting and heat treatment followed by the storage, a small percentage of the water remains within the muscle fiber which is termed as the "bound water". The three dimensional structure of muscle fiber fortified with the pressure and temperature helps the water to retain in the muscles during the processing conditions, while most of the water "lost during these circumstances is known as free water" (Lehinger et al., 1992). The water holding ability of meat and corn could be altered by the disruptions of the fibers, which resulted in the enhancement of the shelf life of food products (Lehinger et al., 1992). There are numerous methods involved in this regard containing chopping, roasting, grinding, salting, drying, thawing, breakdown of connective tissues by enzymatic or chemical means, heating application and use of chemicals or organic additives altering the acidity (pH) of the food materials are the processes that can affect the final water contents of the food products (Lehinger et al., 1992).

1.1.3 Fiber Content: Dietary fiber consists of all plant cell wall components that cannot be digested by the animal enzyme e.g; pectin, legumes, cellulose (Murray et al., 2004; Owhe-Ureghe et al., 2022). Ashes are based on their requirements. They are further classified into essential macronutrients. These include calcium, phosphorus, sodium, potassium, chlorine, magnesium and some essential nutrients which include copper, iron, molybdenum, manganese and selenium etc (Murray et al., 2004).

1.1.4 Crude Ash: Ash refers to the inorganic residue remaining after either ignition or complete oxidation of organic matter in a food sample (Harris & Marshall 2017; Abdulkadir et al., 2022). Determining the ash content of a food is part of proximate analysis for nutritional evaluation and it is an important quality attribute for some food ingredients (Harris & Marshall 2017). Ash content represents the total mineral content in foods.

Although minerals represent a small proportion of dry matter, often less than 7% of the total, they play an important role from a physicochemical, technological and nutritional point of view (Food Science, 2012). The three main types of analytical procedure used to determine the ash content in foods are based on these principles; dry ashing, wet ashing and low temperature plasma dry ashing. Ashing may also be used as a first step in preparing samples for analysis of specific minerals, by atomic absorption spectroscopy. The ash content of most fresh foods rarely is greater than 5% (Food Science, 2012). Pure oils and fats generally contain little or no ash; products such as cured bacon may contain 6% ash and dried beef may be as high as 11.6% based on weight basis (Food Science, 2012).

1.1.5 Lipids:

Lipids are usually referred to as fats and oils. Fats are materials that are solid at ambient temperature and oils are those liquid at ambient temperature (Abraham et al., 2019). Lipids [characterized as oils, greases, fats, and fatty acids (FAs)] are one of the most important components of natural foods and many synthetic compounds and emulsions. The contribution of bioactive lipids to health is determined by their compositional factors. Atty acids composition (especially levels of omega-3, omega-6, and omega-9 FAs) and other high-value minor lipid compounds (e.g., glycolipids, phospholipids, tocols, phytosterols, aroma compounds, and phenolics) have been shown to exhibit health-promoting properties and positively affect the physiological functions of our body (Abraham et al., 2019). Lipids are found in three sites in the body: The largest amount by far is in the storage deposit under the skin and around the organs. This constitutes the obvious visible fat in a piece of meat or fatty bacon. This adipose tissue is composed largely of triglycerides in proteinaceous cells with relatively little water. Small streaks of fat are visible between the bundles of muscular fibers. Intramuscular fat is the lean part of the meat. This is known as "marbing" and can amount to 4-8% of the weight of lean meat. There are small amounts of fat within the structure of fat within intramuscular or structural fats in amounts varying with the tissue (Reisor & shorland, 1990). This can be 1-3% of the weight of muscle and 5-7% the weight of the liver (Reisor & shorland, 1990). Lipids provide a significant proportion of the dietary energy although it is not an essential function. This varies from one meat source to another (Murray et al., 2004).

1.1.6 Crude Fiber: Fat-free organic substances in feeding stuffs which are insoluble in acid and alkaline media (Murray et al., 2004). Crude fiber is a measure of the quantity of indigestible cellulose, pentosans, lignin, and other components of this type in present foods. It is the residue of plant materials remaining after solvent extraction followed by digestion with dilute acid and alkali. These components have little food value but provide the bulk necessary for proper peristaltic action in the intestinal tract (Nehn et al., 2004). Crude fiber was developed in 1850 to estimate indigestible carbohydrates in animal feeds. Since an easy alternative was not available, fiber in human food was measured in crude fiber (Nehn et al., 2004).

1.1.7 Crude Protein: Proteins normally produce the body requirement for amino acids over all. Fresh green leafy vegetables have protein content ranging from 1.5-1.7%. The crude protein contains the range 15 to 30% (Osagie & Eka, 1998). The protein of typical mammalian muscle after vigor mortis but before post-mortem derogative changes contain about 19% protein., 11.5% is structural protein-actin and myosin (myofibrillar) 5.5% soluble sarcoplasmic protein in the muscle juice 2% connective tissues (collagen and elastin) encasing the structural protein and about 2.5% fat dispersed among the protein fibers. Collagen differs from most containing significant amounts of this vitamin (there are trances 10-60ug, 100kg, in muscle) under free range conditions of grazing. There is a very high intake of carotene (pro vitamin A) which is mostly converted into retinol (vitamin A) (FAO, 2007). Protein is the amount of food or the measurement of protein contents. In animals, crude protein is calculated as mineral nitrogen × 6.25 (the assumption Is that proteins of typical animal feeds contain 16% nitrogen on average). The mineral nitrogen value is obtained by kjeldahl method, or by a method giving similar results after correction, such as the Dumas method (FAO, 2007).

1.1.8 Vitamins: The body content of most vitamins is largely independent of diet (FAO, 2007). Apart from the thiamin effect on pig meat, the exception is vitamin A which is stored in the liver in amounts depending on intake, with small amount present in the kidney, these are only the tissues to contain significant amount of this vitamin (these are trances 10-60ug (100kg, in muscle) under free range conditions of grazing. There is a very high intake of carotene (pro-vitamin A) which is mostly converted into retinol (vitamin A) (FAO, 2007). The vitamin which is stored in the liver in amounts depending on the intake with small amounts present in the kidney. The composition 10-60 ug/100g, in muscles (FAO, 2007).

1.1.9 Minerals: The meat contains a wide range of mineral salt. The contents of iron, zinc, and copper vary considerably in different species, for example; molybdenum content of sheep meat increases with dietary (FAO, 2007). Meat and offal contain a wide variety of mineral salts. The content of iron, zinc and copper vary considerably in different species, liver being by far the richest source of these minerals compared with muscle tissue. High level of that mineral in the flesh and there is a complex interrelation mineral. For example, the molybdenum inhibits the accumulation of copper which is partly off-set by increased manganese (FAO, 2007). Liver copper decreases and molybdenum increases with increased amounts of molybdenum. Other inter relations between minerals include calcium and zinc (FAO, 2007).

2.0 Nutritional Value of Meat

Meat and other animal food such as milk can make a valuable contribution to the diet in developing countries. It has less importance in industrialized countries with a wide variety of food (FAO, 2007). Many diets in developing countries are based on cereals or root crops and are relatively bulky, especially where fats are in short supply and this can limit the total energy intake. This is especially true of infants after weaning and young children (FAO, 2007). The importance of metal in the diet is as a concentrated source of protein which is not only of high biological value but its amino acid composition complements that of cereal and other vegetable proteins. It is also iron, zinc, and several B vitamins and a rich source of vitamins A (FAO, 2007).

The aim of this study is to study the effect of roasting on the proximate composition of corn (Zea mays) and meat (beef) sold in Nasarawa. This research work is limited to the Northern part of the country particularly Nasarawa State. The method involves the collection of meat (beef) and corn (Zea mays) samples from Nasarawa and market respectively for further processing and analysis which involved the roasting of the meat and corn. The importance of this project study cannot be over emphasized; the writer has gone a long way to examine the effect of roasting on certain foods Corn (Zea mays) and Meat (Beef). Undoubtedly, this research study is specifically found useful in our homes and also food production industries. Food industries will find this project study useful for their various industries as this will give them an insight on how to control food processing methods in the industry.

3.0 Materials and Methods

3.1 Materials:

Samples: Fresh corn, Fresh meat, Roasted corn, Roasted meat

3.1.1 Apparatus: Oven (3D-EO-16C Electric oven), Analytical balance (Radwag AS 220), Soxhlet apparatus (Doc. Onic 6 test nantle type), Bunsen burner, Muffle furnace, Wash bottle, Crucible, Dessicator, Volumetric flask, 50ml, 100ml, 500ml, Watch glass, Round bottom flask.

3.1.2 Reagents: Boric Acid (H_3PO_4), Sulfuric acid (H_2SO_4),Hydrochloric acid (HCL), Deionized or distilled water, Sodium hydroxide (NaOH), Copper sulfate ($CuSO_4$), Double indicator.

3.2 Methods:

3.2.1 Sampling Procedures

The roasted meat and corn (Zea mays) and meat (beef) were procured from Living faith junction, Abdulrazak Street Junction, Nasarawa main market park, Angwan Power, Oversea Road junction, Opposite Tammah filling station and opposite Govt. College Nasarawa.

3.2.2 Procedure for Roasting Meat (Beef)

The meat (beef) samples collected were trimmed off all visible fat, ligament and bones. The chunks were cut into steak of about 40g and the meat samples were placed on a wire over a well regulated hot plate with temperature ranging between 140 – 165 ºF (70-75 ºC) the meat samples were then sundried, and milled for prior analysis.

3.2.3. Procedure for Roasting Corn (Zea mays)

The corn (Zea mays) were stripped, cleaned and sorted by hand before being roasted. The samples were placed on a wire over a well regulated hot plate with temperature ranging between 140 – 165 ºF (70-75 ºC) the corn samples were then sundried, and milled for prior analysis.

3.3 Moisture Content procedure for Roasted Corn and Meat

Three crucibles were washed and dried in the oven at 800C for about 30 minutes and then cooled in a desiccator and weighed (W1). The grams of the roasted food samples were taken and accurately weighed again as (W2). The sample with the container were dried in an oven at (50-600C) for about 5 hours and was quickly transferred to a desiccator to cool. The procedure was repeated for about 3 hours for each with subsequent drying to constant weight (W3).

$$\text{Moisture (\%)} = \frac{\text{Loss in weight due to drying}}{\text{Weight of samples take}} \times \frac{100}{1}$$

$$= \frac{W1-W2}{W2-W3} \times \frac{100}{1}$$

(Uzoma et al., 1998)

3.4 Ash Content Determination in Roasted Corn and Meat

Ash porcelain crucible was ignited in hot Bunsen burner flame for 20 minutes and was transferred to a desiccator to cool weighed (w1), 5g of the samples (roasted corn and meat) was also weighed into the crucible (w2) . The crucible containing the samples was heated gently on a Bunsen burner in a fume cupboard until smoking ceased and it was transferred to a muffle furnace, heated at (550C-5700C) to burn all the organic matter. The carbon cleared then burnt off as CO_2 leaving a white ash. The crucibles were taken out and immediately covered and placed in desiccators to cool and weighed (w3).

$$\text{Ash (\%)} = \frac{\text{weight of ash}}{\text{weight of sample}} \times \frac{100}{1}$$

$$= \frac{w3-w1}{w2-w1} \times \frac{100}{1}$$

(Uzoman et al., 1998)

3.5 Fat (Lipid Content Procedure of Roasted Corn and Meat)

A soxhlet extractor was fixed up a reflux condenser and a small round bottom flask. 5g of each sample (roasted corn and meat) was weighed into a feet free extraction thimble which has been previously dried in an oven weighed (w1). It was plugged lightly with a cotton wool and weighed again (w2). The thimble was placed in the extractor and solvent were added until the barrel of the extractor was left full. The condenser was replaced and placed in the heater (heating mantle or water bath). The source of the heat was adjusted so that the solvent boils gently and was left in the siphon for 6 hours. Finally, it was heated until either had siphoned over and the barrel of the extractor was empty. The condenser was detached and the thimble was removed and was dried in a fat free clean beaker, well away from any flame.

The thimble was placed in the oven at 500 C and dried to constant weight and was cooled in a desiccators and weighed w2

$$\text{Lipid (E) (w/w)} = \frac{\text{weight loss of sample (extracted) fats}}{\text{weight of sample}} \times \frac{100}{1}$$

$$\text{Lipid (F) (\%)} = \frac{\text{weight gain in flask}}{\text{Weight}} \times \frac{100}{1}$$

(Uzoman et al., 1998)

3.6 Crude Protein Content Procedure (Macro Kleidahl)

The determination of crude protein was based on the macro kjeidahl method (kjeidahl 1883). In this method, the samples were digested with concentrated sulphuric acid using copper sulfate as a catalyst to convert organic nitrogen to ammonium ions. Alkali was added and the liberated ammonia distilled into an excess of boric acid solution. The distillate was titrated with hydrochloric acid to determine the ammonia absorbed in the boric acid. The method involves three stages: Digestion, Distillation, and Titration. 0.1g of each sample was weighed into three kjeldahl flasks in duplicate 3.0g of digestion catalyst was added followed by 15 ml concentrated sulphuric acid. The mixture was heated on the electro-thermal heater at a temperature of 700C for about 45 minutes. When the color of the reacting mixture changes to a clear solution (colorless), heating is stopped. The contents of the flask were diluted with about 40 ml of distilled water and then mixed thoroughly and allowed to cool.

3.6.1 Distillation: This was carried out in the distillation unit. The digested sample was transported into a 100ml volumetric flask and made up to mark with distilled water 20 ml of the digested solution was measured into a 150 ml distillation flask which was then positioned on the electro-thermal heater and held in a retort stand. A condenser was connected to the distillation flask and into a 50ml beaker by means of Buchner funnel. 25 mls of 400C boric acid was measured into 50 mls beaker and two drops of double indicator were added into the boric acid solution. The distillation flask was heated on the electro- heater for about 10 minutes. The trapped Nitrogen passes to the boric solution to effect color changes (light blue green). The ammonia liberated into the acid solution was collected. The distillation unit was dismantled and rinsed with distilled water.

3.6.2 Titration: The distillate (boric acid-ammonia solution) was titrated with 0.1M of hydrochloric acid. The color changes to pink which marks the end point of the titration. The titer value was recorded and this was used to determine the nitrogen content from which the protein value could be calculated by multiplying with Nitrogen factor, 6.25.

% nitrogen = M1 Acid–(Nacid1.4)Weight Of Sample

Therefore,

% crude protein

= nitrogen × 6.25

= (Titer value × Atomic mass of nitrogen × normality of HCL × 4) × 6.25

= (Titer value × 14 × 0.01× 4) × 6.25

3.6.3 Crude Fibre Content Procedure: 2.0g of the samples were weighed into conical flask (w1) 100 ml of preheated H2SO4 were added and heated to boiling for 30 minutes. It was filtered using a vacuum pump, the residue was washed three times with hot distilled water and the residue was scraped back into 1 liter conical flask and 100 ml NaOH was added and heated. It was boiled slowly for 30 minutes, Filtered and washed three times with acetone, dried in a hot air oven at 1300C for one hour and was weighed using weighing balance (w2). It was ash at 5000C to 6000C in the muffle furnace, cooled in the desiccators and the ash was weighed (w3).

$$\% \text{ Fibre} = \frac{\text{Dry Wt-ash}}{\text{wt of S}} \times \frac{100}{1}$$

$$\% \text{ Fiber} = \frac{W2-W3}{w1} \times \frac{100}{1}$$

(Uzoman et al., 1998)

4.0 Results of study

This study indicated the strong nutritional composition (protein, fiber, Ash, content, moisture content, carbohydrate) of fresh corn, fresh meat, roasted corn and roasted meat including their caloric values. The effect roasting has on corn (*Zea mays)* and meat (beef) samples were determined. The proximate analysis of the samples was carried out using the Association of Official Analytical chemist method (AOAC, 1990).

Table 1: Proximate composition of corn and meat collected from living faith junction Nasarawa

Proximate Composition	Fresh Meat (Control)	Fresh Corn (Control)	Roasted Meat	Roasted Corn
Moisture	69.75%	12.50%	65.40%	10.25%
Protein	17.98%	7.00%	19.80%	10.50%
Ash	4.21%	2.20%	1.80%	1.20%

Lipid/Fats	5.33%	4.48%	2.80%	2.50%
Carbohydrates	0%	72.56%	0%	71.25%
Caloric Value (1100g)	97.27%	98.74%	97.80	95.70%

In the result above, it can be seen that there is reduced moisture in roasted meat and roasted corn by 4.35% and 2.25% respectively which indicates lesser water content in roasted samples compared to the fresh samples. Crude Protein level increased in both roasted meat and corn by 1.82% and 3.50% respectively, which means that there is higher protein level in roasted food samples than fresh samples. Ash content level in Fresh meat is reduced by 2.41% and 1.50 in roasted corn. The lipid level in meat is slightly decreased after roasting by 2.53% and 1.98% in roasted meat. Carbohydrate level in both fresh and roasted meat is 0% which means that meat doesn't contain carbohydrate while in fresh corn, the level of carbohydrate is 72.56% which reduced to 71.25% in roasted corn, this indicates that there is high level of carbohydrate in corn. The sample's caloric values are 97.27%, 98.74%, 97.80 and 95.70 for fresh meat, fresh corn, roasted meat and roasted corn respectively.

Table 2: Proximate composition of corn and meat collected from Abdulrazak street junction Nasarawa

Proximate Composition	Fresh Meat (Control)	Fresh Corn (Control)	Roasted Meat	Roasted Corn
Moisture	69.75%	12.50%	66.40%	11.30%
Protein	17.98%	7.00%	18.80%	12.70%
Ash	4.21%	2.20%	2.10%	1.62%
Lipid/Fats	5.33%	4.48%	2.30%	3.10%
Carbohydrates	0%	72.56%	0%	80.40%
Caloric Value (1100g)	97.27%	98.74%	93.12	98.12%

In the result above, it can be seen that there is reduced moisture in roasted meat and roasted corn by 33.35% and 1.20% respectively which indicates lesser water content in roasted samples compared to the fresh samples. Crude Protein level increased in both roasted meat and corn by 1.02% and 5.70% respectively, which means that there is higher protein level in roasted food samples than fresh samples. Ash content level in Fresh meat is reduced by 2.01% and 0.58% in roasted corn. The lipid level in meat is slightly decreased after roasting by 0.85% and 1.38% in roasted meat. Carbohydrate level in both fresh and roasted meat is 0% which means that meat doesn't contain carbohydrate while in fresh corn, the level of carbohydrate is 72.56% which is increased by 7.84% in roasted corn, this indicates that there is high level of carbohydrate in corn. The sample's caloric values are 97.27%, 98.74%, 93.12 and 98.12 for fresh meat, fresh corn, roasted meat and roasted corn respectively.

Table 3: Proximate composition of corn and meat collected from Nasarawa main market

Proximate Composition	Fresh Meat (Control)	Fresh Corn (Control)	Roasted Meat	Roasted Corn
Moisture	69.75%	12.50%	68.60%	10.68%
Protein	17.98%	7.00%	20.10%	11.42%
Ash	4.21%	2.20%	2.63%	1.93%
Lipid/Fats	5.33%	4.48%	2.82%	2.65%
Carbohydrates	0%	72.56%	0%	70.13%
Caloric Value (1100g)	97.27%	98.74%	96.15%	96.81%

In the result above, it can be seen that there is reduced moisture in roasted meat and roasted corn by 1.15% and 1.82% respectively which indicates lesser water content in roasted samples compared to the fresh samples. Crude Protein level increased in both roasted meat and corn by 2.12% and 4.42% respectively, which means that there is higher protein level in roasted food samples than fresh samples. Ash content level in Fresh meat is reduced by 1.58% and 0.27% in roasted corn. The lipid level in meat is slightly decreased after roasting by 2.51% and 1.83% in roasted meat. Carbohydrate level in both fresh and roasted meat is 0% which means that meat doesn't contain carbohydrate while in fresh corn, the level of carbohydrate is 72.56% which is increased by 2.43% in roasted corn, this indicates that there is high level of carbohydrate in corn. The sample's caloric values are 97.27%, 98.74%, 96.15 and 96.81 for fresh meat, fresh corn, roasted meat and roasted corn respectively.

Table 4: Proximate composition of corn and meat collected from Nasarawa main park

Proximate Composition	Fresh Meat (Control)	Fresh Corn (Control)	Roasted Meat	Roasted Corn
Moisture	69.75%	12.50%	66.26%	11.30%

Protein	17.98%	7.00%	19.60%	10.80%
Ash	4.21%	2.20%	2.47%	2.13%
Lipid/Fats	5.33%	4.48%	3.33%	2.89%
Carbohydrates	0%	72.56%	0%	71.40%
Caloric Value (1100g)	97.27%	98.74%	96.55%	98.52%

In the result above, it can be seen that there is reduced moisture in roasted meat and roasted corn by 3.55% and 1.2% respectively which indicates lesser water content in roasted samples compared to the fresh samples. Crude Protein level increased in both roasted meat and corn by 1.74% and 3.8% respectively, which means that there is higher protein level in roasted food samples than fresh samples. Ash content level in Fresh meat is reduced by 1.74% and 0.07% in roasted corn. The lipid level in meat is slightly decreased after roasting by 2.0% and 1.59% in roasted meat. Carbohydrate level in both fresh and roasted meat is 0% which means that meat doesn't contain carbohydrate while in fresh corn, the level of carbohydrate is 72.56% which is reduced by 1.16% in roasted corn, this indicates that there is high level of carbohydrate in corn. The samples caloric values are 97.27%, 98.74%, 96.55 and 98.52 for fresh meat, fresh corn, roasted meat and roasted corn respectively.

Table 5: Proximate composition of corn and meat collected from Angwan Power

Proximate Composition	Fresh Meat (Control)	Fresh Corn (Control)	Roasted Meat	Roasted Corn
Moisture	69.75%	12.50%	67.10%	10.62%
Protein	17.98%	7.00%	17.80%	11.34%
Ash	4.21%	2.20%	1.69%	1.92%
Lipid/Fats	5.33%	4.48%	2.65%	3.32%
Carbohydrates	0%	72.56%	0%	0.00%
Caloric Value (1100g)	97.27%	98.74%	95.47%	96.87%

In the result above, it can be seen that there is reduced moisture in roasted meat and roasted corn by 2.65% and 1.88% respectively which indicates lesser water content in roasted samples compared to the fresh samples. Crude Protein level increased in both roasted meat and corn by 0.18% and 4.34% respectively, which means that there is higher protein level in roasted food samples than fresh samples. Ash content level in Fresh meat is reduced by 2.52% and 0.28% in roasted corn. The lipid level in meat is slightly decreased after roasting by 2.68% and 1.16% in roasted meat. Carbohydrate level in both fresh and roasted meat is 0% which means that meat doesn't contain carbohydrate while in fresh corn, the level of carbohydrate is 72.56% which is reduced by 0.89% in roasted corn, this indicates that there is high level of carbohydrate in corn. The samples caloric values are 97.27%, 98.74%, 95.47 and 96.87 for fresh meat, fresh corn, roasted meat and roasted corn respectively

Table 6: Proximate composition of corn and meat collected from Oversea junction

Proximate Composition	Fresh Meat (Control)	Fresh Corn (Control)	Roasted Meat	Roasted Corn
Moisture	69.75%	12.50%	68.20%	11.40%
Protein	17.98%	7.00%	18.40%	11.93%
Ash	4.21%	2.20%	1.93%	1.86%
Lipid/Fats	5.33%	4.48%	1.83%	2.23%
Carbohydrates	0%	72.56%	0%	68.20%
Caloric Value (1100g)	97.27%	98.74%	93.40%	95.62%

In the result above, it can be seen that there is reduced moisture in roasted meat and roasted corn by 6.15% and 2.26% respectively which indicates lesser water content in roasted samples compared to the fresh samples. Crude Protein level increased in both roasted meat and corn by 0.42% and 4.93% respectively, which means that there is higher protein level in roasted food samples than fresh samples. Ash content level in Fresh meat is reduced by 2.28% and 0.34% in roasted corn. The lipid level in meat is slightly decreased after roasting by 2.5% and 2.25% in roasted meat. Carbohydrate level in both fresh and roasted meat is 0% which means that meat doesn't contain carbohydrate while in fresh corn, the level of carbohydrate is 72.56% which is reduced by 4.36% in roasted corn, this indicates that there is high level of carbohydrate in corn. The sample's caloric values are 97.27%, 98.74%, 93.40 and 95.62 for fresh meat, fresh corn, roasted meat and roasted corn respectively.

Table 7: Proximate composition of corn and meat collected from opposite Tammah filling station

Proximate Composition	Fresh Meat (Control)	Fresh Corn (Control)	Roasted Meat	Roasted Corn
Moisture	69.75%	12.50%	63.60%	10.24%
Protein	17.98%	7.00%	18.80%	11.32%
Ash	4.21%	2.20%	1.83%	1.94%
Lipid/Fats	5.33%	4.48%	2.33%	2.83%
Carbohydrates	0%	72.56%	0%	70.24%
Caloric Value (1100g)	97.27%	98.74%	92.20%	94.24%

In the result above, it can be seen that there is reduced moisture in roasted meat and roasted corn by 6.15% and 2.26% respectively which indicates lesser water content in roasted samples compared to the fresh samples. Crude Protein level increased in both roasted meat and corn by 2.18% and 0.82% respectively, which means that there is higher protein level in roasted food samples than fresh samples. Ash content level in Fresh meat is reduced by 3.0% and 1.65% in roasted corn. The lipid level in meat is slightly decreased after roasting by 0.26% and 2.38% in roasted meat. Carbohydrate level in both fresh and roasted meat is 0% which means that meat doesn't contain carbohydrate while in fresh corn, the level of carbohydrate is 72.56% which is reduced by 2.32% in roasted corn, this indicates that there is high level of carbohydrate in corn. The sample's caloric values are 97.27%, 98.74%, 92.20 and 94.24 for fresh meat, fresh corn, roasted meat and roasted corn respectively.

Table 8: Proximate composition of corn and meat collected from opposite Tammah filling station

Proximate Composition (%)	Fresh Meat (Control)	Fresh Corn (Control)	Roasted Meat	Roasted Corn
Moisture	69.75%	12.50%	65.90%	10.32%

Protein	17.98%	7.00%	19.64%	10.68%
Ash Content	4.21%	2.20%	1.83%	1.65%
Lipid/Fats	5.33%	4.48%	2.64%	2.58%
Carbohydrates	0%	72.56%	0%	68.36%
Caloric Value (1100g)	97.27%	98.74%	93.30%	95.20%

In the result above, it can be seen that there is reduced moisture in roasted meat and roasted corn by 3.85% and 2.18% respectively which indicates lesser water content in roasted samples compared to the fresh samples. Crude Protein level increased in both roasted meat and corn by 1.66% and 3.68% respectively, which means that there is higher protein level in roasted food samples than fresh samples. Ash content level in Fresh meat is reduced by 2.83% and 0.55% in roasted corn. The lipid level in meat is slightly decreased after roasting by 2.69% and 1.9% in roasted meat. Carbohydrate level in both fresh and roasted meat is 0% which means that meat doesn't contain carbohydrate while in fresh corn, the level of carbohydrate is 72.56% which is reduced by 4.20% in roasted corn, this indicates that there is high level of carbohydrate in corn. The sample's caloric values are 97.27%, 98.74%, 93.30 and 95.20 for fresh meat, fresh corn, roasted meat and roasted corn respectively.

4.1 Discussions of Results

This study shows that in fresh corn samples, the moisture content is 12.50%, protein 7.00%, ash 2.20%, lipid 4.8% and carbohydrates 72.50%. While in fresh meat, the moisture content is 69.75%, protein 17.98%, ash 4.12% and fats 5.23%. After the roasting process of the samples have taken place, the average samples obtained for each corn samples from each location for roasted corn; moisture content is 95.70%, protein 10.50%, ash 1.20%, lipid 2:50% and carbohydrate 71.25% while for that of the roasted meat the moisture content is 65.40%, protein 19.80%, ash 1.80% and fats 2.50%. The energy in the Kcal of fresh and roasted corn and meat were 98.74% and 97.27% respectively. Each table above shows the level of each composition in fresh meat, fresh corn which serves as control and also the level of each composition in the roasted samples which are the roasted meat, roasted corn based on the location they were collected from. Moisture Content in the food samples reduced after roasted by 4.0% on average. From the results it is seen that carbohydrate level is 0% in both fresh and roasted meat but very high in corn which means that corn is highly carbohydrate. Protein level is higher in roasted samples than in the fresh samples which means that there is high protein level roasted foods and it is best consumed in roasted form to get Higher protein level for the body. Lipids are higher in meat samples than in corn, this means that meat is fatty while corn is less fatty. The Ash content in each food is reduced after roasting, this means fresh corn and meat have higher ash content than in their roasted forms. This study shows that the caloric value of fresh corn to be 98.74 and 97.27 for fresh meat, after roasting the average caloric value of the food samples were slightly reduced which shows that more calories can be gotten when the food samples are consumed fresh and less calories when consumed after roasting which is good for people undergoing weight loss process.

5.0 Conclusions and Recommendations

This research work has provided the various nutritional components and significant roles the corn (*Zea mays)* and meat (beef) here in fulfilling and maintaining human health. It is expected that individuals should know the component nutrients of food being consumed. This study also shows that there is reduction in ash content and increase in protein level in roasted samples which shows that consumption when roasted is more proteinous. It also shows that there is higher caloric value in fresh corn and meat than in roasted corn roasted meat. In the table above, it is seen that there is an increase in the food samples protein level after roasting which indicates that there is high protein level after roasting. High protein levels are good for both old and young people. It is advisable to consume meat and cornin their roasted forms. In normal handling and storage of meat, the major deteriorative changes are attributed to microbial contamination and activity. The microorganisms which are found to contaminate and cause the spoilage of meat are bacteria, molds and yeasts These food spoilage microorganisms are introduced into meat by butchers or workmen, or through water and air in the dressing, cooling and cutting rooms or environment of slaughtering in Nigeria, especially in rural communities and townships, usually taking place under unhygienic conditions. The abattoir market, a busy dirty place where the air is strikingly polluted and contaminated with both spoilage and pathogenic bacteria, yeast and molds. From this study it is seen that roasting helps in killing or inhibiting microbes present in the food due to the heat it has been exposed to and also increases the shelf life of the foods by making it last longer than when it is fresh. It is also seen that roasting of corn and meat has resulted in loss of nutrients and also exposes food products to smoke which can be dangerous to the health. It is recommended that work should be done on the effect of the toxicity of roasted corn and meat to the body. It is advisable for people to take due advantage of this by consuming these foods in their roasted state rather than their fresh state especially due to low cost of roasting.

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