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COMPARATIVE STUDIES AND PROXIMATE ANALYSIS OF BROWN BEANS AS A PLANT-BASED MEAT ALTERNATIVE

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ABSTRACT:

Overconsumption of meat poses significant health, environmental, and ethical challenges. The World Health Organization (WHO) and several national dietary advice bodies around the world have recently recommended a reduction in the consumption of red meats, based on consistent evidence that links highly processed meat with colorectal cancer in particular. Beans are a nutrient-dense food as they are a rich source of bioactive compounds, including polysaccharides, oligosaccharides, proteins, polyphenols, phytochemicals, and several vitamins and minerals. This research work aims to assess and use brown beans as a plant-based meat alternative by comparative study. From the result of the study, brown beans was found to have higher percentage ash (4.05%), crude fiber(13.10), and carbohydrate contents (56.37%) than beef meat ash (0.96%), crude fiber (0.00%), and carbohydrate (1.04%), while beef meat has higher percentage of moisture(67.84) content, crude fat (6.09)and crude protein (22.09) than brown beans according to world health organization (WHO)

standard, The high ash content of beans facilitates a balanced diet and general well-being. The high crude fiber content in brown beans offers numerous health benefits due to the essential role that fiber plays in maintaining digestive health and overall well-being. Brown beans can serve as an alternative meat when mixed with a vegetable that contains high fat content like olive and corn offering a wide array of health, environmental, and ethical, culinary, and economic benefits.

KKEYWORDS: *Brown Beans*, *Meat*, *Composition*, *Proximate Analysis*.

INTRODUCTION:

Brown beans, like many legumes, can serve as a nutritious and sustainable alternative in a variety of diets, making them a great plant-based protein source. They are high in dietary fiber, a good source of essential vitamins and minerals, low in fat, and free from cholesterol, thereby making them a heart-healthy choice. They are generally inexpensive and widely available, making them an accessible protein source for people around the world.

Plant dependent meat alternative involve analogues based on textured vegetable protein (TVP), it is a dry immense product that is derived from soy concentrates (Malav et al., 2015). Analogue is a substance that is similar in structure with each other but slightly different in make-up. Meat analogue or mimic meat in this study is a foodstuff that seems to be similar in structure to meat but differ significantly in composition. Meat like substance made from plant sources is simply called meat analogue. Plant-based meat, vegetarian meat, meat substitute, mimic meat, meat replacement, synthetic meat, or amalgam meat are some of the most commonly used names. Mock meat almost has the same aesthetic attributes (like consistency, taste, physical appearance) or chemical-based traits of special meat kinds. Due to the worldwide demand for sustainable meals as a consequence of the involvement of animal foods as well as other environmental effects, industries have expanded their focus on developing meat replacements. The faux meat market is dependent on group of consumers interested in mostly weight and health maintenance (meat reducers). Many health-related benefits of eating meat analogues reduced consumption of meat which help in decreasing cholesterol levels and hence prevents heart-related issues, daily consumption of original meat is also associated with colorectal cancers (Ahmad *et al.,* 2022). Plant based meat is currently gaining huge interest amongst researchers due to high consumer demand because of health problems associated with daily consumption of meat or due to obligations of consuming a vegetarian diet in

particular religious' sections. The literature about meat-based alternatives is summarized to provide a handful of information to researchers for restructuring plant meat.

The legume family, Fabaceae (Leguminosae), is made up of three subgroups that include oilseed legumes, fresh legumes, and pulses. Legume refers to plants that have their seeds enclosed in a pod. Soybeans and peanuts are considered oilseed legumes, while fresh legumes include beans and peas. Pulses are the dried seeds of legumes and include chickpeas, dried peas, lentils, and dry common beans (Rebello et al., 2014). The terms "seeds", "dried beans", and "pulses" refer to the edible portion of the legume and are therefore often used interchangeably. Dry beans are a staple in the diets of many cultures in both industrialized and developing countries, comprising a significant portion of daily caloric intake.

Beans are yet nutrient-dense food as they are a rich source of bioactive compounds including polysaccharides, oligosaccharides, protein, polyphenols/phytochemicals, and several vitamins and minerals. Pulses are mainly comprised of carbohydrate, making up over half of the total weight, between 55 and 65%. As the main form of carbohydrate, starch content in pulses includes a high amount of resistant starch (RS), as reflected in 30 to 40% amylose content and insusceptibility to digestion. In contrast, amylose makes up 15 to 30% of grain products such as cereal, allowing for elevated digestibility and blood glucose response rate. Resistant starch moves through the digestive tract to the large intestine, lending itself to microbial fermentation processes and the production of beneficial short-chain fatty acids (SCFAs) (González *et al.,* 2019).

Scientific research linking health, nutrition, and longevity to the affordable and widely available dry bean continues to emerge. Beans are inexpensive sources of high-quality protein. Today, however, beans are also in the news because of their potential to lower cholesterol, reduce the risks of heart disease, relieve constipation, improve gastrointestinal integrity, and stabilize blood sugar. An Ancient Food Because they are easy to plant, grow, and store, beans are among the oldest cultivated and most widely used foods in the world. They are also relatively inexpensive to produce, are portable, and have a long storage life (Peraro *et al.,* 2016). Their low cost and high nutritional value have contributed to their global popularity. Historically, beans have served as a food staple for at least 10,000 years, and some food historians double that figure.

There has been an increase in the global consumption of meat. The consumption of different types of meat and meat products has substantial effects on people's health, and livestock production can have major negative effects on the environment. Meat is a good source of

energy and some essential nutrients including protein and micronutrients such as iron, zinc, and vitamin B_{12} although it is possible to obtain a sufficient intake of these nutrients without eating meat if a wide variety of other foods is available and consumed.

Meat production is one of the most important ways in which humanity affects the environment: We cut down forests to create pasture as well as arable land to meet the demand for animal feed (N. Ramankutty, and J. A. Foley 1992), Livestock production is a major source of greenhouse gases (GHGs) and other pollutants, in some areas makes major demands on scarce water resources (M. M. Mekonnen, A. Y. Hoekstra, (2012), and can exacerbate soil erosion.

Plate 1 : Brown Beans

Plate 1 : Beef Meat

MATERIALS AND METHODS:

Conical flask, beaker, test tubes, sample of brown beans, beef meat, distilled water, funnel, weighing balance, motor and pistil, ovum drier and so on.

Sample Collection

The sample of brown beans and beef meat was purchased from Jalingo main market Taraba state and taken to the laboratory (in polyethylene bags). The seeds were handpicked to remove damaged seeds, dirt and stones. The sample was ground into fine powder using an electric blender to ensure homogeneity and kept in an airtight container for further analysis. All the reagents used in this study were of analytical grade.

Proximate analysis of brown Beans and Beef Meat

Meat sample was separately communized into fine fiber fragments in a meat homogenizer after which it was packaged in cellophane bags, labeled and stored in a frostless freezer at about -10^{o}C. Proximate analysis was carried out using method proposed by (AOAC,2000).

Parameters investigated on dry matter basis included crude protein (CP),ash, crude fiber(CF), crude protein, moisture and Carbohydrate content. Each analysis was replicated three times.The carbohydrate was calculated by subtracting the sum (g/100 g dry matter) of Crude protein, Crude fat, Ash and Crude fiber from 100 g. The dry matter (DM) content was determined by heating evaporating dishes to a constant weight using an oven. 2 g of the powdered samples were added into the dishes and reweighed. The dishes and its content were placed in an oven at 150°C and dried to constant weight. The ash content was determined by incinerating 2 g sample in a furnace at 450°C until fully burnt to obtain ash of constant weight. Nitrogen was determined by micro-Kjeldahl method as described by Pearson (1976) and the crude protein content was calculated as N % × 6.25.

Determination of Total Ash Content

An empty crucible was weighed (w1), 2 g of dried (moisture free) sample was placed into the crucible and weighed (w2). The sample was placed in the furnace and ashing and crucible was weighed (w3) after ashing.

% ash = w3 – w 1 / w2 –w1 x 100

Determination of Crude Fiber:

Sample (3 g) was boiled with 200cm3 of H2SO4 for 30 mins, filtered and washed with boiling water. The residue was boiled with 200 cm3 NaOH solution for 30 min, filtered again, and washed with hot water and ethanol. The residue was transferred to a crucible (pre-weighed w1), dried and weighed (w2). Sample was ashed and weighed again (w3).

% crude fibre = (w 2-w1) -(w3-w1) / weight of sample (2 g) x 100

Determination of Carbohydrate Content

The percentage of available carbohydrate content was calculated by difference as follows Carbohydrate = 100 - (Moisture + Ash + Crude Fat + Crude Fiber + crude protein)

Moisture content analysis;

The procedure described by Abbey and Ibeh (1998) was used to determine the water absorption capacity of the brown beans. Five gram of the flour (ground sample) was weighed into centrifuge tube and 10ml of distilled water was added. The tube containing sample and distilled water was allowed to stand at room temperature for 30 minutes after turning with stirrer and centrifuged at 5000rpm for 10minutes. The volume of the supernatant was measured using 10ml graduated cylinder. The density value 1000 kg/m3 was assumed and mean water absorption capacity obtained.

Determination ofCrude Protein

Dried sample (0.15g) was digested in Kjeldahl flask with catalyst and concentrated H2SO4 (2 cm3) to a clear liquid. About 15 ml of 40% NaOH was added and ammonia steam was distilled into 10ml 2% boric acid solution with 5 drops of methyl red indicator which was then titrated with 0.01N HCl. Percentage nitrogen = titre value (ml) x0.00056 x 6.25/sample weight (g) x 100.

RESULTS:

Table 1: Proximate analysis of brown beans and Beef Meat

Parameters	%Brown Beans	%Beef Meat
Ash	4.05	0.96
Moisture	4.80 ± 0.31	67.84
Crude Protein	17.43 ± 0.09	22.09
Crude Fat	4.20 ± 0.65	6.09
Crude fiber	13.10 ± 0.07	-
Carbohydrate	56.37 ± 0.72	1.04

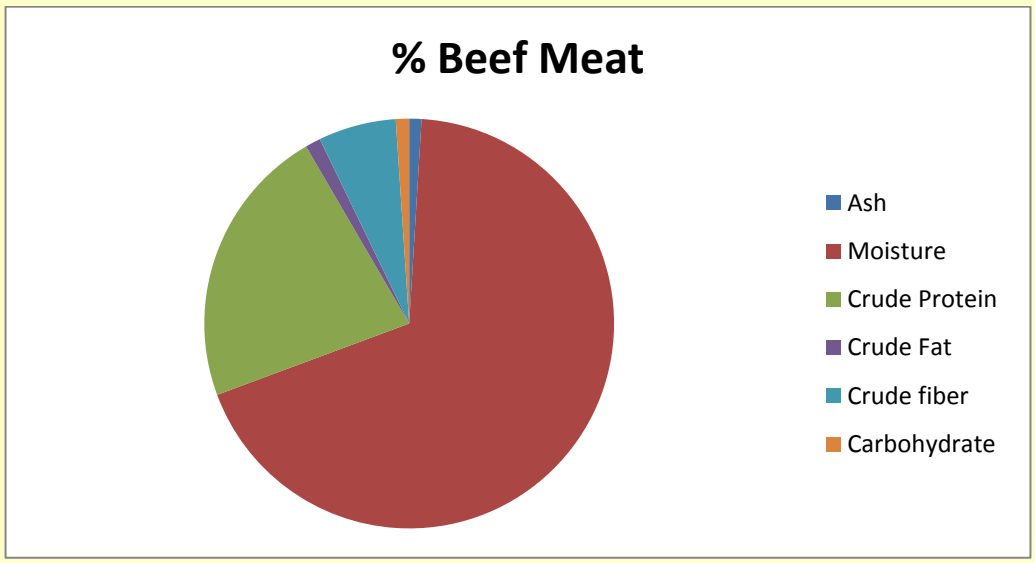

Figure 1: Result of proximate analysis of Beef Meat

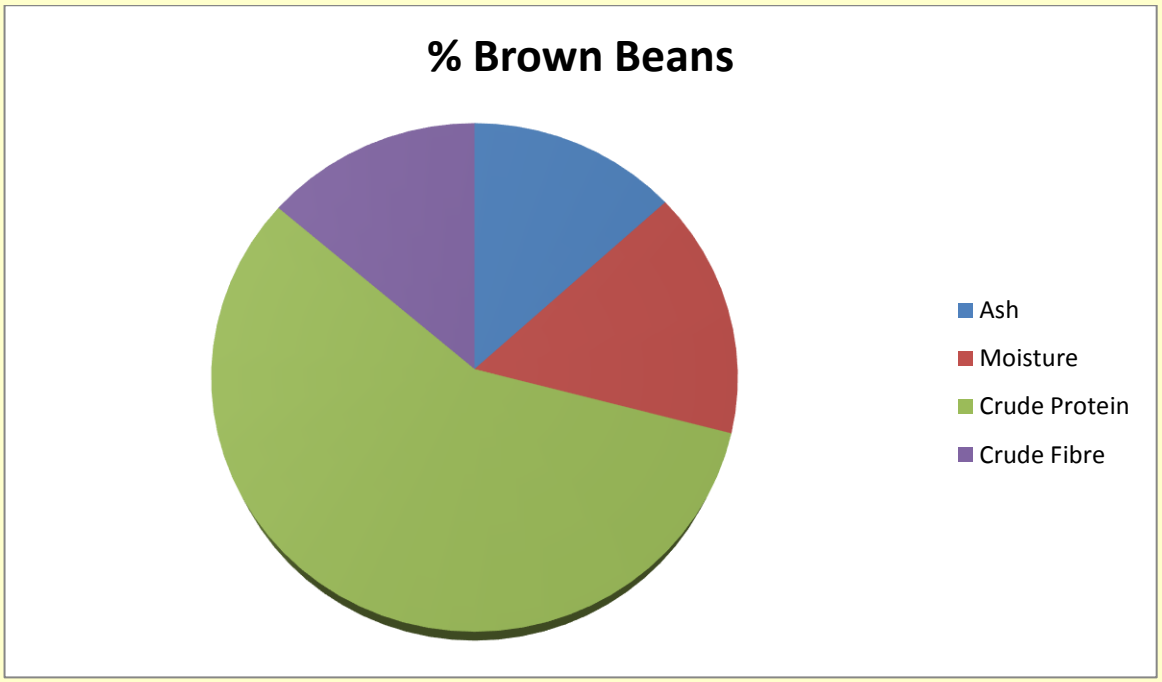

Figure 2: Result of proximate analysis of Brown Beans

DISCUSSION:

From the result of the study, brown beans was found to have higher percentage ash (4.05%), crude fiber(13.10), and carbohydrate contents (56.37%) than beef meat ash (0.96%), crude fiber (0.00%), and carbohydrate (1.04%), while beef meat has higher percentage of moisture content, crude fat and crude protein than brown beans, The high ash content of beans facilitates a balanced diet and general well-being by providing vital minerals for immune system support, bone health, muscle function, nerve transmission, cognitive function, mood control, and energy levels. The high crude fiber content in brown beans offers numerous health benefits due to the essential role that fiber plays in maintaining digestive health and overall well-being. Incorporating beans with high carbohydrate content into your diet can provide sustained energy, support metabolic health, and contribute to overall nutritional well-being. Maintaining an optimal level of moisture in beef meat is crucial for ensuring quality, flavor, and a positive eating experience. It enhances the culinary properties and nutritional benefits of the meat. The crude fat in beef meat provides a balance of flavor, texture, and nutritional benefits. It is essential for maintaining the quality of the meat and contributing to a well-rounded, nutritious diet. Crude fat in beef meat, which includes essential fats and lipids, offers several important benefits, both nutritionally and in terms of culinary qualities. The high crude protein content in beef meat offers numerous health benefits, as proteins are essential macronutrients vital for various bodily functions.

CONCLUSION:

In conclusion, brown beans can serve as an alternative meat when mixed with a vegetable that contains high fat content, offering a wide array of health, environmental, and ethical, culinary, and economic benefits. Incorporating them into your diet can lead to improved health outcomes, a reduced environmental footprint, and a more sustainable and ethical food system. The proximate composition of the beef obtained from the Kano abattoir was found to be similar to several reports by some researchers. The mean protein content for beef reported in this study (22.90%) was comparable to those observed by Datti et al. (2020).

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