



**Nutritional Composition and Microbial Load of Skewed Meat (*Tsire*) in Dutse Metropolis, Jigawa State, Nigeria**

<sup>1</sup>Umar, A.M., <sup>1</sup>Bashir, M.K., <sup>2</sup>Muhammad, Y., <sup>3</sup>Madigawa, I.L. and <sup>1</sup>Bature. N.

<sup>1</sup>Department of Animal Science, Federal University, Dutse.

<sup>2</sup>Department of Animal Health and Production, Binyaminu Usman Polytechnic Hadejia, Jigawa State.

<sup>3</sup>Department of Animal Health and Production, Audu Bako College of Agriculture, Thomas, Danbatta, Kano State.

**Abstract**

*The study was conducted to determine the nutritional composition and microbial load of Skewed meat retailed at some designated locations in Dutse Metropolis, Jigawa State. The locally prepared samples were obtained from five locations viz, A, B, C, D and E and the experiment was laid in a Randomized Complete Block Design. Data generated were subjected to Analysis of Variance (ANOVA) and Duncan's Multiple Range Tests ( $p < 0.05$ ) was used to separate the differences between means. SAS software (version 20.0) was employed for all the analysis. The values obtained from the Nutritional Composition revealed significant ( $p < 0.05$ ) differences in all the parameters evaluated across the locations. Location D had the highest values of dry matter (70.40), crude protein (31.00), ether extract (36.00) and crude fibre (32.00), while least value of ash (6.00) was recorded in location B. Microbial load of Skewed Meat revealed significant ( $p < 0.05$ ) differences in bacterial (Cfu/g) and fungal (Cfu/g) load across the locations. Highest ( $1.92 \times 10^4$ ) bacterial (Cfu/g) count was obtained from D while C recorded the least bacterial count ( $1.16 \times 10^4$ ). Location D also recorded the highest count ( $4.27 \times 10^3$ ) of fungal while B recorded the least fungal ( $1.77 \times 10^3$ ). The results showed that the environment where skewed meat was prepared together with the meat processors and equipment could be sources of microbial contamination. There should be education of skewed meat processors in Dutse Metropolis on the hazards associated with unhygienic practices during skewed meat preparations.*

**Keywords:** Bacterial, Fungal, Composition, Skewed, Meat.

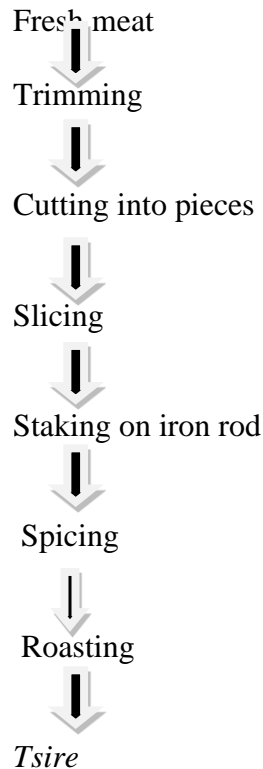
**Introduction**

Meat is defined as the edible part of the skeletal muscle of an animal that is healthy at the time of slaughter (Olaoye and Onilude, 2010). Meat is composed chemically of protein, lipid, carbohydrate, water and many other minor components such as vitamins, enzymes, pigments and flavor compounds (Olaoye *et al.*, 2010; Calkins and Hodgen, 2007). Meat as a source of animal protein is consumed heavily in Nigeria and is also recommended by nutritionists as a major source of protein for growing children, convalescent, expectant mothers and aged. Meat is a nutritious, protein-rich food which is highly perishable and has a short shelf-life unless preservation methods are used (Koffi-

Nevry *et al.*, 2011). Shelf life and maintenance of the meat quality are influenced by a number of inter-related factors including holding temperature, which can result in detrimental changes in the quality attributes of meat (Olaoye *et al.*, 2010). Meat is the most perishable of all food and which is as a result of their chemical composition. Meat contains an abundance of all nutrients required for the growth of bacteria, yeasts and molds and an adequate quantity of these constituents exist in fresh meat. Currently, little attention has been given to the awareness of meat and its consumption among many consumers of the product in many developing countries, such as Nigeria (Abubakar *et al.*, 2014).

The preparation processes of *tsire* involve defatting and slicing the meat on a slab or table, after which it is staked into sticks, spiced and roasted for about twenty (20) minutes,

thereafter, the products is spiced again and briefly reheated for about two (2) minutes. It is then displayed for marketing on table tops or trays where it can be street-vended (Edema *et al.*, 2008).



**Figure 1: Procedure for *Tsire* Preparation** (Abubakar *et al.*, 2014)

Skewed meat is prepared basically from boneless meat of animals (Abdullahi *et al.*, 2004). Muscles of almost any kind can be dried to increase its keeping quality. When meat is dried or roasted, there is loss of moisture. This reduces the water activity of the food thereby preventing some bacteria from forming spoilage association. In Skewed meat preparation, use of lean meat is necessary since fat becomes rancid during the drying process. Skewed meat preparation in Nigeria lacks proper hygienic control and the risk of food borne infections is very high (Odusole and Akinyanju, 2003). Edema *et al.* (2008) noticed sporadic cases of gastroenteritis and symptoms of infection after consumption of Skewed meat which

indicated that the product may constitute a food safety risk.

Microbiological quality assessment of Skewed meat is very critical even though epidemiological evidence on outbreaks of Skewed meat borne diseases is scarce, there are indications that Skewed meat could be contaminated to unsafe level at the point of consumption with air flora and other microorganisms from handlers, equipment, utensils like trays, spoons and knives (WHO, 1997). The aim of this research was to evaluate the nutritional composition and microbial load of Skewed meat sold in Dutse Metropolis, Jigawa State.

## Materials and Methods

### Study Area

The study was conducted in Dutse Metropolis, Jigawa State (Figure 1). Dutse is a city located in the North- Western part of Nigeria and is the capital city of Jigawa State with an estimated population of 153,000 (NPC, 2006). It is located on the geographical coordinates latitude  $11^{\circ}42'04''\text{N}$  and longitude  $9^{\circ}20'31''\text{E}/11.70111^{\circ}\text{N}$  and  $9.34194^{\circ}\text{E}$ , with a mean annual rainfall of 958.5mm and maximum and minimum



Figure 1: Map of Jigawa State

### Data Collection

Forty samples of Skewed Meat were purchased from five (5) different vendors in Dutse Metropolis. These places were Hakimi Street, Dutse Abattoir, Sabuwar Kasuwa, Yalwawa and Zai Junction. The Skewed Meat samples were put in a sterilized container at room temperature and immediately taken to the Biochemistry Laboratory and Animal Science Laboratory, Federal University Dutse, Jigawa State for microbial and nutritional analysis, respectively. The experiment was conducted from 20<sup>th</sup> November, 2021 to 20<sup>th</sup> January, 2022.

### Laboratory Analysis

#### Nutritional Analysis

The meat samples were analyzed in triplicate for proximate composition: Lipid content by the Bligh and Dyer (1959) method, moisture content by the AOAC (1984) method, total

temperature of 40 and  $11^{\circ}\text{C}$ , respectively (JARDA, 2009). Over 80% of the populations are engaged in subsistence farming and animal husbandry practice. The environment is conducive to different species of livestock production, such as cattle, sheep, goats, rabbits, donkeys and poultry (JARDA, 2012). However, some crops are also grown in the area; these crops are millet, rice, corn, sesame, cowpea, watermelon, groundnut and soybeans (Umar and Abdullahi, 2017).

crude protein by the Kjeldahl method (AOAC, 1990) and ash content by the AOAC (1984) method.

### Microbial Analysis

One gram (1.0 g) of each sample was weighed and aseptically taken into a sterile jar containing 9 mL sterile peptone water, which was homogenized with sterile blender (Retsch, GM 200, Australia) at 3,000 rpm for 10 minutes. A 1 mL aliquot of homogenate was transferred to a test tube containing 9 mL sterile distilled water to make  $10^{-2}$  dilution and centrifuged with vortex mixer (Digosystem, VM-1000, Taiwan) at 2,000 rpm for 5 minutes. Serial dilutions up to  $10^{-5}$  were prepared for the bacteriological analysis. Test tubes were labeled with respect to their dilution (APHA, 1992).

The bacteriological quality and safety of meat samples were assessed on the basis of Total Bacterial Count (TBC) and Total Fungal Count (TFC) using Nutrient Agar and Potato

Dextrose Agar, respectively. All culture media were prepared in accordance with the manufacturer's specification. Aliquots (0.1 mL) of each dilution were transferred in replicate into corresponding differential and selective media (in duplicates), and were spread uniformly using a hockey stick. Diluted samples were spread on to those plates and incubated at 37 °C for 24 hours

and at 25 °C for 5 days for bacterial count and detection of fungi, respectively.

At the end of the incubation period, colonies (30-300) that appeared on each plate for the different dilution were counted and recorded using the illuminated colony counter (Gallenkamp, England). The counts for each plate were expressed as colony forming unit (cfu/g) of the suspension

$$\text{Colony forming unit/g} = \frac{\text{Number of colony counted} \times \text{Reciprocal of dilution factor}}{\text{Volume of sample inoculated}}$$

### Experimental Design and Statistical Analysis

The experiment was laid in a randomized complete block design, statistical significance of the data among the samples was determined by analysis of variance (ANOVA) and Duncan's Multiple Range Test ( $p < 0.05$ ) to determine the difference between means. SAS statistics (version 20.0) software was employed.

### Results and Discussions

Table 1 shows the nutritional Composition of Skewed meat sold at different locations in Dutse Metropolis Jigawa State. The values obtained revealed significant ( $p < 0.05$ ) differences in all the parameters evaluated across the locations. Location D had the highest value of dry matter (70.40), crude protein (31.00) and ether extract (36.00), while locations C has the least values of dry matter (49.20) and ether extract (11.00). Fat content was significantly higher in locations D (36.00) and B (30.00) and the difference in fat contents might be due to the amount of fat contained in the type/source of spices used. Protein sources with higher fat contents such as in the full fat state will introduce higher fat levels. The fat content of the foods may constitute saturated, trans, monounsaturated and polyunsaturated fats (Mckinley, 2014). High fat content in spice is however

undesirable as this may pose problems of rancidity, leading to off-flavours and hence a reduction in its shelf life. In addition, a protein source with high fat content may be low in crude protein content (Serap *et al.*, 2010).

Proteins are required for body building, renewal of body cells and a host of other physiologic functions. Skewed meat with high protein content is therefore most desirable. Significant protein values were observed in some of the samples. This may be due to higher inclusion amounts of the protein source which incidentally may also double as the fat source in the spice. However, the protein content of the skewed meat spices from the different sampling points were observed to be higher than the 5.9% protein value for skewed meat spices obtained at Rumuokoro area (RS1) of Port Harcourt (Ngozi *et al.*, 2017). The high difference in values with reports of Ngozi *et al.* (2017) may be due to the use of a different source of protein, presumably one with higher protein contents than was employed in Port Harcourt.

Ash constitutes the inorganic component of food and this provides an estimate of the mineral constituents of the food. The ash content is often regarded as an index of mineral content in biological mass.

Differences in ash values may probably be due to differences in the origin and variety of samples. In addition, the storage of food samples may possibly affect the ash contents

as improperly stored samples are prone to microbial attacks and contamination with foreign particles which might contribute to a higher ash value (Armand *et al.*, 2012).

**Table 1: Nutritional Composition of Skewed Meat Sold in Dutse Metropolis Jigawa State**

| Parameters (%) | Locations          |                    |                    |                    |                    |
|----------------|--------------------|--------------------|--------------------|--------------------|--------------------|
|                | A                  | B                  | C                  | D                  | E                  |
| DM             | 65.50 <sup>b</sup> | 70.00 <sup>a</sup> | 52.00 <sup>c</sup> | 70.40 <sup>a</sup> | 49.20 <sup>d</sup> |
| CP             | 23.20 <sup>d</sup> | 22.00 <sup>d</sup> | 29.00 <sup>b</sup> | 31.00 <sup>a</sup> | 26.00 <sup>c</sup> |
| EE             | 27.00 <sup>c</sup> | 30.00 <sup>b</sup> | 12.00 <sup>d</sup> | 36.00 <sup>a</sup> | 11.00 <sup>d</sup> |
| ASH            | 9.00 <sup>b</sup>  | 6.00 <sup>c</sup>  | 15.00 <sup>a</sup> | 8.00 <sup>b</sup>  | 8.00 <sup>b</sup>  |

Means along the same row having different superscripts (p<0.05) differ. DM=Dry Matter, EE=Ether Extract, CP=Crude Protein, EMS = Error Mean of Square

Table 2 Shows the Microbial load of Skewed Meat Sold in Dutse Metropolis Jigawa State. There were significant (p<0.05) differences in bacterial (Cfu/g) and fungal (Cfu/g) load across the locations. Highest bacterial ( $1.92 \times 10^4$  Cfu/g) and fungal ( $4.27 \times 10^3$ ) counts were reported in location D while locations C ( $1.16 \times 10^4$ ) and B ( $1.77 \times 10^3$ ) recorded the least values of bacterial and fungal counts, respectively.

The possible sources of contamination are through slaughtering of sick animals, washing the meat with contaminated water, handling by butchers, contamination by flies, processing close to sewage or refuse dumps, addition of contaminated spices, transportation and use of contaminated equipment such as knives and other utensils (Enem and Onyekwodiri, 2015)

The microbial loads of skewed meat samples reported from Federal Polytechnic Nekede Owerri, Imo State Nigeria showed total viable bacterial counts ranged from  $4.0 \times 10^3$  cfu/g to  $8.4 \times 10^4$  cfu/g and no coliform count recorded (Edema *et al.*, 2008).

Total fungal counts of  $1.0 \times 10^3$  cfu/g and total viable counts of  $1.9 \times 10^3$  cfu/g of

skewed meat sold in Enugu metropolis were recorded by Nwakanma *et al.*, (2015). The microbial load obtained in the current study ( $1.77 \times 10^3$  cfu/g) could be compared to what had been reported locally:  $2.88 \times 10^2$  –  $9.49 \times 10^3$  (cfu/g) by Abubakar *et al.* (2014) for *Dambun-Nama*,  $7.00 \times 10^2$  –  $1.71 \times 10^4$  cfu /g by Uzeh *et al.* (2006) for *tsire suya*,  $3.30 \times 10^4$  cfu /g for processed ready to eat beef by Ologhobo *et al.* (2010),  $7.00 \times 10^3$  -  $2.22 \times 10^5$  cfu/g for ready to eat *suya* by Edema, *et al.* (2008),  $3.70 \times 10^5$  –  $2.40 \times 10^6$  cfu/g by Inyang *et al.* (2005),  $7.40 \times 10^4$  cfu/g by Chukwu and Imodiboh, (2009) and  $8.00 \times 10^5$  cfu/g by Shamsuddeen and Oyeyi, (2008), all these fell within the safe limits of  $10^7$  cfu/g specified for meat products by the ICMSF (1998). On the contrary Salihu *et al.* (2010) obtained total mesophilic aerobic bacteria count of  $4.50 \times 10^9$  cfu/ g on traditionally prepared *Dambun-Nama* sold in Sokoto and concluded that the product (*Dambun-Nama*) was unsafe and may constitute a food safety risk to the numerous ever-increasing consumers.

## Conclusion



It is concluded that location D had the highest values of dry matter, crude protein and ether extract.

### Recommendations

✓ Skewed Meat produced at locations C and B were recommended because they had the least values of bacterial and fungal counts.

✓ There should be education of skewed meat processors in Dutse Metropolis on the hazards associated with unhygienic practices during skewed meat preparations.

✓ Consumers should purchase skewed meat from certified sellers and to make sure it is properly packed with hygienic materials to avoid any form of contamination.

**Table 2: Microbial Load of Skewed Meat Sold in Dutse Metropolis Jigawa State**

| Parameters            | Locations         |                   |                   |                   |                   |          |
|-----------------------|-------------------|-------------------|-------------------|-------------------|-------------------|----------|
|                       | A                 | B                 | C                 | D                 | E                 | EMS      |
| TBC ( $\times 10^4$ ) | 1.73 <sup>b</sup> | 1.47 <sup>c</sup> | 1.16 <sup>e</sup> | 1.92 <sup>a</sup> | 1.23 <sup>d</sup> | 0.000813 |
| TFC ( $\times 10^3$ ) | 2.07 <sup>d</sup> | 1.77 <sup>e</sup> | 3.10 <sup>b</sup> | 4.27 <sup>a</sup> | 2.37 <sup>c</sup> | 0.020667 |

Means along the same row having different superscripts (p<0.05) differ. TBC = Total Bacteria Count, TFC= Total Fungal Count, EMS = Error Mean of Square

### References

Abdullahi I.O., Umoh V.J. and Galadima M. (2004). Hazards Associated with *Kilshi* Preparation in Zaria, Nigeria. *Nigera Journal of Microbiology* 18 (1-2): 338-345.

Abubakar, M. M., Bube, M. M., Adegbola, T. A. and Oyawoye, E. O. (2014). Assessment of Four Meat Products (*Kilishi*, *Tsire*, *Damb* uand *Balangu*) in Bauchi Metropolis. *ACT-Biotechnology Research Communications*, 1:140-148.

AOAC (1984). Association of Official Analytical Chemists, Methods of Analysis 14<sup>th</sup> Edition Washington D.C.

AOAC (1990). Association of Official Analytical Chemists, Methods of Analysis 15<sup>th</sup> Edition Washington D.C.

APHA (1992). American Public Health Association, Compendium of

Methods for Microbiological Examination of Foods 3<sup>rd</sup> Edition, 1992.

Armand Y.N., Nicolas. S.F., Harquin. S., Joel, M. and Didier, M.F.M. (2012). Proximate composition, mineral and vitamin content of some wild plants used as spices in Cameroon. *Food and Nutrition Sciences*, (3), 423-432.

Bligh, E.G. and Dyer, W.J. (1959). Arapid method of total lipid extraction and purification. *Can. J. Biochem. Physiol.* 37, 911–917.

Calkins, C. R. and Hodgen, J. M. (2007). A fresh look at meat flavor. *Meat Sci.* 77(1): 63-80

Chukwu, O. and Imodiboh, L. I. (2009). Influence of Storage Conditions on Shelf-Life of Dried Beef Product (*Kilishi*). *World Journal of Agricultural Science*, 5:34-39.

Edema, M.O., Osho, AT. and Diala, C.I. (2008). Evaluation of microbial

- hazard associated with processing of suya (a grilled meat product). *Scientific Research and Essay*, 3(12): 621-626.
- Enem, S.I. and Onyekwodiri, E.O. (2015). Evaluation of Bacterial Contamination of *Suya* at Nsukka, Enugu State, Nigeria. *Animal Production Research Advances*, 5(1):4665-4671.
- ICMSF (1998). International Commission of Microbiological Standards for Foods. Micro-Organisms in Foods 2. Sampling for Microbial Analysis. Principles and Specific Applications. University of Toronto Press, Toronto.
- Inyang, C.U., Igyor, M.A. and Uma, E.N. (2005). Bacterial Quality of a Smoked Meat Product (*suya*), *Nigerian Food Journal*, 23:239-242.
- JARDA. (2009). Jigawa State Agricultural and Rural Development Authority. Agricultural Extension Manual on Crops. Pp.27-32
- JARDA. (2012). Jigawa State Agricultural and Rural Development Authority. Agricultural Extension on Crops.
- Koffi-Nevry, R., Koussemon, M. and Coulibaly, S. O. (2011). Bacteriological Quality of Beef Offered for Retail Sale in Cote D'ivoire. *American Journal of Food Technology*. 6(9):835-842.
- McKinley Health Center, University of Illinois at Urbanachampaign. Macronutrients: the importance of Carbohydrate, Protein and Fat", Retrieved 20 September 2014
- Ngozi, N., Akwasiam, B., Iheanyi, O. O. (2017). proximate and mineral composition of suya spices sold in Port Harcourt, Nigeria, *Scientific and Academic Publishing, Food and Public Health*, 7(2): 35-39.
- NPC (2006). National Population Commission Census, Nigerian Population Census, Abuja Nigeria
- Nwakanma, C., Unachukwu, M. N. And Momoh, O.R. (2015). Bacteriological examination of suya meat sold in Enugu Metropolis. *World Journal of Pharmaceutical Research*, 4(12): 61-70.
- Odusole, K.A. and Akinyanju, O.O. (2003). Red Suya Syndrome-Acute Intravascular Administration and Control. *Consumer Safety Bulletin*.2(2): 20-24.
- Olaoye, O.A. and Onilude, A.A. (2010). Investigation on the Potential Use of Biological Agents in the Extension of Fresh Beef in Nigeria. *World Journal of Microbiology and Biotechnology* 26: 1445–1454.
- Olaoye, O.A., Onilude, A.A. and Idowu, O.A. (2010). Microbiological Profile of Goat Meat Inoculated with Lactic Acid Bacteria Cultures and Stored at 30°C for 7 days. *Food and Bioprocess Technology*.
- Ologhobo, A.D., Omojola, A. B., Ofongo, S. T., Moiforay, S. and Jibir, M. (2010). Safety of Street Vended Meat Products - Chicken and Beef *Suya*. *African Journal of Biotechnology*,9:4091-4095.
- Salihu, M.D., Junaidu, A.U., Magaji, A.A., Aliyu, R. M. Y., Shittu, A. and Ibrahim, M.A. (2010). Bacteriological Quantity of Traditionally Prepared Fried Ground Beef (*Dambun-Nama*) in Sokoto, Nigeria. *Advance Journal of Food Science and Technology*, 2:145-147.
- Serap, G., Yesim, O., Mucella, S. and Faith, O. (2010). Proximate analysis. Fatty acid profiles and mineral contents of meats: A comparative study. *Journal of Muscle Foods*. 21:210–223.

- 
- Shamsuddeen, U. and T.I. Oyeyi (2008). Survey on the Possible Microbiological Hazards and Critical Control Points during the Production of *Tsire* at Fagge L.G.A., Kano, Nigeria. *International Journal of Pure and Applied Science*,2:6-10.
- Umar, A.M. and Abdullahi, H.I. (2017). Chemical Composition of *Balangu* offered for sale at Hadejia Local Government Area of Jigawa State. *Semi-Arid Journal of Academic Research and Development*. 1(1):64-69.
- Uzeh, R.E., Ohenhen, R.E. and Adeniji, O.O. (2006). Microbial Contamination of *Tsire-Suya*-a Nigerian Meat Product. *Pakistan Journal of Nutrition*. 5(5):458-460.
- WHO (1997). World Health Organisation Statistics Quarterly. Food Safety and Foodborne Diseases. 50(1/2).