# A COMPARISON OF TWO MEAT PRESERVATION METHODS

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## ABSTRACT

**Meat samples from open flame and block ovens were compared with a view to improving on the traditional method of meat preservation in Nigeria. Mean pH values obtained for the meat products from the ovens were 6.81 and 6.83 for the open flame oven and the block oven, respectively. Moisture loss during smoking in the open flame oven was 72.9% while that of the block oven was 69.9%. Results indicated that meat products from the block were of higher acceptability in terms of colour and texture attributes. For the taste attribute of the samples, there was a higher preference for meat products from the open oven.**

**Key Words:** Smoked meat, open flame, block oven, colour, palatability.

## INTRODUCTION

In Nigeria, the supply of meat falls short of demand, consequently, most Nigerians are poorly fed and suffer from malnutrition due to lack of protein of animal origin. In the developing countries of the world, including Nigeria, the shortage of meat is not only due to scarcity of animals but also due to spoilage (Alonge, 1981). It is therefore necessary to preserve the little available meat by preventing its spoilage and contamination. The pathways by which such spoilage and deterioration can occur are diverse and include microbial, chemical and physical processes (Price and Schweigert, 1991), thus meat preservation necessarily involves the application of measures to delay or prevent certain changes which render meat un-usable as food, or which downgrade some quality aspects of it.

Common methods of meat preservation include drying, curing, smoking, thermal processing and refrigeration (chilling and freezing). Smoking is one of the most effective processes of meat preservation in Nigeria for, apart from its consequent flavour and colour attraction, it does not require high costs, and constant energy supply which is difficult to maintain in developing countries of the world.

Freshly produced smoke has such effects on meat products as aromatization, flavouring and preservation (Tilgner, 1977; Klettner, 1979; Baltes *et al*, 1981). Despite these effects, smoking of meat poses questions from public health point of view, since it can introduce, directly or indirectly, carcinogens such as polycyclic aromatic hydrocarbons (PAHs) (Alonge, 1988) and nitrosamines to the meat product (Walker, 1979). Most of these PAHs in smoked meat and fish have been epidemiologically linked with primary liver and stomach cancers in the consumers. Emerole (1980), reported that smoked meat ("Suya") contained 1,2 benzathrane and 3,4 benzoapyrene which are carcinogens at concentrations of 15.5 ug/kg and 8.5 ug/kg, respectively. This paper looks at the traditional open flame oven which has direct exposure to heat and smoke as compared to a block oven method that has a concrete block placed between the heat source and the meat chamber.

## MATERIALS AND METHODS

### Preservation Methods

*Open Flame Oven*

A drum of 58.4 cm in height was provided. A central opening measuring 17.3 cm in length and 27.9 cm wide was made at the bottom of the drum. At about 40.6 cm from the bottom, iron rods were placed across the drum on which a meat grill was placed. A metal cover with handle was provided.

### Block Oven

A drum of same height and central opening dimensions as in the open flame oven was also provided. A flat plat was constructed at the middle of the drum on which a thick concrete block (7.6 cm) was placed. Iron rods were placed across the drum at a distance of about 14.0 cm above this concrete block. A meat grill was placed on the iron rods. A metal cover with handle was also provided for the oven.

### Procedures

2 kg of fresh boneless beef cut (Sirloin butt) were cut into two groups, each group weighing 1 kg. Meat samples which were cut into 10 pieces, each piece weighing approximately 100 gm, were tagged with coded metal tags. These pieces of meat were then soaked in same concentration of 10% sodium chloride solution for 20 minutes. Thereafter, they were placed on the meat grills of the two ovens. Group A meat pieces were placed in the open flame oven and group B meat pieces in the block oven. Hardwood *(Chlorophora excelsa)* was used as fuel in the two ovens. Smoking and drying of meat was done over a period of 10 hours and 13 hours for open flame oven and block oven, respectively.

The temperatures of the meat samples in the two ovens were measured with a roast meat thermometer (Galenkamp, U.K), during the heating and smoking processes. When the meat pieces were considered dried, the weight of each piece of meat in each group was taken. They were then packed in polythene bags and kept in the refrigerator for analysis. The pH of the meat samples was measured using a standard pH meter, and the percentages of moisture losses during the heating and smoking processes were calculated.

### Colour and Palatability Assessment

The meat samples from the two ovens were subjected to colour and palatability assessment tests by an assessment panel of six, consisting of two females, and four males. Two groups of smoked meat samples from the open flame oven (Group A) and the block oven (Group B) were presented for assessment with the use of a questionnaire containing questions relating to colour, taste and texture attributes, as well as the general acceptability of the meat samples.

## RESULT AND DISCUSSION

The smoking temperatures of the meat samples from the open flame oven ranged from $189^0$ c to $196^0$ C with a mean of $192^0$ C, while the heating temperature of the block oven was between $140^0$C and $170^0$C with a mean of $155^0$C. These temperatures are in line with those obtained by Alonge (1987, 1988) who used average smoking temperatures of $170.3^0$C and $191.5^0$C respectively. Heating and smoking were done at high temperatures, because in the tropics, where there are high ambient temperatures and relatively equally high humidity levels, spoilage is likely to overtake the cure and ruin the meat except sufficient heat is applied (Alonge, 1987). The higher smoking temperature recorded in the meat samples from the open flame oven may be due to the direct smoking method. Since smoke is the source of carcinogenic polycyclic aromatic hydrocarbons ($PAH_s$) in smoke - dried meat (Potthast, 1978), and their presence and quality increase in proportion to the temperature of treatment and closeness to the source of heat (Baltes *et al*, 1981), the block oven must have prevented the deposition of these $PAH_s$ on the meat products.

The pH values recorded for the meat samples ranged from 6.60 to 7.20 with a mean of 6.81 and between 6.60 and 7.10 with a mean of 6.63 for the open flame and block oven respectively. These near acidic media apparently play no role in the preservation of this type of smoked meat. The moisture loss in open flame oven ranged from 69.5% to 76.3% (mean = 72.9%); while that of the block oven was between 60.4% and 71% (mean = 69.9%). These levels of moisture loss were high, such that the moisture content of the meat samples is low and this will prevent microbial growth. A comparison of the mean moisture loss values of the meat samples from both ovens shows no significant difference. Thus, the desired preservative

quality oven. The result of the colour and palatability assessments of the meat samples from the two ovens is presented in Table 1. Majority of the members of the panel assessed the meat samples from the open flame oven as sweet (83%), dark brown (67%), tough (50%) and of fairly satisfactory palatability (83%). In the block oven, majority of the panel members assessed the meat samples as sweet (50%), light brown (83%), soft (67%) and of satisfactory acceptability (83%). The result further shows that there is a general preference for sweet (100%) light brown (83%) and soft (83%) meat.

This shows that there is a higher preference for the meat samples from the block oven over those from the open flame oven with respect to colour and texture attributes, and also in terms of acceptability of the products. The contrary is the case for the taste attribute of the meat samples, where the preference is more for the meat products from the open flame oven. This may be due to the aromatization and the flavouring effects of the smoke (Barylko - Pikielna, (1972), which is not evident in meat samples from the block oven since they were not exposed to smoke.

TABLE 1: COLOUR AND PALATABILITY ASSESSMENT

| Index | | Group A (%) | Group B (%) | Preference (%) |
|---|---|---|---|---|
| 1. | **Taste Attribute** | | | |
| | Bitter | 17.0 | 17.0 | |
| | Sweet | 83.0 | 50.0 | 100.0 |
| | Sour | 0.0 | 33.0 | |
| 2. | Colour Attributes | | | |
| | Black | 17 | 0 | 0 |
| | Dark Brown | 67 | 17 | 17 |
| | Light Brown | 16 | 83 | 83 |
| 3. | Texture | | | |
| | Tough | 50 | 17 | 0 |
| | Moderate | 33 | 16 | 17 |
| | Soft | 17 | 67 | 83 |
| 4. | Acceptability | | | |
| | Satisfactory | 17 | 83 | 83 |
| | Fairly satisfactory | 83 | 17 | 17 |
| | Unsatisfactory | 0 | 0 | |

Group A: Meat samples from the Open Flame Oven
Group B: Meat samples from the Block Oven.

## CONCLUSION

The traditional preservation methods of meat (smoking) practised in Nigeria can be improved to produce meat of better taste, better preservation and improved degree of hygiene. This can be done via the use of the block oven method which prevents the direct application of smoke to the meat. Meat products from the block oven were found by a panel of assessors to have high acceptability.

The block oven must have also prevented the deposition of carcinogenic polycyclic aromatic hydrocarbons on meat which normally occurs during direct smoking.

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