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EFFECT OF PROCESSING AND PRESERVATION METHOD ON THE ORGANOLEPTIC AND SHELF LIFE OF MEAT PRODUCTS

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Target Audience: Food scientists, policy makers and household consumers

ABSTRACT

Two meat products (Beef and Mutton) were subjected to four processing methods-frying, boiling, roasting and oven-drying to investigate the effects of processing and preservation methods on the organoleptic and shelf-life of meat products. The results obtained revealed fried Mutton to have the highest rating scores (better taste) of 91% while boiled beef had the lowest rating of 42%. Preserving the meat at room temperature (25°C average) had a significant ($P<0.01$) effect on the taste and microbial load of the meat products. Processing methods however, had no significant effect on the microbial count of products. Boiled meat (at 100°C for 30 minutes) had the shortest shelf, while fried meat (at 180°C for 10 minutes) stored at refrigerated temperature (4°C) had the highest shelf life of 14 days. Oven-dried meat (200°C for 24 hours) and roasted meat (on open hot coal for 12 hours) had shelf life of 7 days each at 4°C. Lower shelf-life was recorded for meat stored at 25°C for all the processing methods.

Keywords: Meat products, processing, preservation, qualities.

DESCRIPTION OF PROBLEM

There has been a persistent advocacy over the years on the need to increase the animal protein intake of an average African. Protein as a food component is important in the building and maintenance of tissue cells and other functions. Proteins from animal sources are said to have high biological value compared to those of plant sources (2). Animal protein could be sourced from many different animal products and by-products such as eggs; poultry meat, pork, beef, mutton, fish, milk, and milk-products.

No food will keep indefinitely in its natural form. All natural foods are alive and like all other living materials are subject to processes of

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deterioration and decay. These gradual changes according to (3) in fresh food are due partly to chemical changes in the living protoplasm of the food itself. It is usually catalysed by the cell enzymes and partly due to changes caused by minute organisms (microbes) which gets into the food from outside (External source). Hence, milk go sour, meat and fish go putrid and fat goes rancid. Meat is a fresh, very perishable product and conditions that favours the growth of organisms which exists in meat will surely reduce the shelf-life and keeping quality of the product. To rescue the undesirable situation, some processing has to be carried out to extend the shelf-life of meat.

Meat is processed to appraise its tenderness and palatability and enhance acceptance by consumers. Meat processing is one of the biggest industries in the developed countries, however, this has not been given much emphasis in the developing countries like Nigeria. It is of interest to note that, even though, Nigeria has great potential for sourcing meat requirements by her citizens because of large concentration and population of livestock, much of the meat consumed is processed locally at the hold level. These processing methods include frying, cooking, smoking, sundrying and salting among others.

This study aimed at assessing the organoleptic and microbial characteristics of processed meat products preserved at room temperature (25°C) and refrigerator temperature (4°C), was designed to provide information on the effect of processing and preservation methods on the taste and shelf life of meat products.

MATERIALS AND METHODS

Sample collection and processing

Two meat products (Beef and Mutton) of 4kg each were purchased from Yelwa market and subjected to four different processing methods each at controlled temperature. Frying at 180°C for 10 minutes, Boiling at 100°C for 30 minutes, oven-drying at 200°C for 24 hours and Roasting was done on open coal flame for 12 hours. Each of the processed meat was divided into 2 equal parts and preserved under room temperature (25°C) and refrigerator temperature (4°C).

Organoleptic test

Organoleptic test of the processed meat samples was conducted. Men panel of judges were used in assessing the products. Qualities evaluated included flavour, taste and appearance/colour. Hedonic preference test was used in testing for a significant difference in each of the parameter mentioned above.

Microbial analysis

After each of the organoleptic test, microbial analysis was conducted on

the meat sample and the total microbial load of the samples were determined. Plate count agar (oxoid) was prepared according to manufacturer's instruction and sterilized. This was then dispensed into sterile petridishes. 1 gramme of each of the processed meat was weighed by the use of a Gallenhamp mettler into a sterile mortal containing 3ml sterile 0.1% phosphate buffered peptone and mashed with pestle for 15-20 minutes. The oven dried samples were first rehydrated before mashing. After mashing, 7mls of 0.1% phosphate buffered peptone water was then added to give a final volume of 1ml to 10mls of fluid. This was shaken thoroughly to obtain a homogeneous solution. Serial dilution was then carried out 10^{-5} dilution.

Enumeration of micro-organisms was caried out using the surface plating technique. 0.1ml of the dilution of each sample was innoculated on the plate count agar using a sterile pipette. The inoculated plates were then incubated at 37°C for 24 hours. At the end of the incubation period, total aerobic plate count was carried out with the aid of Gallenhamp colony counter. Average plates with 40-400 colonies were counted and recorded as the number of colony forming unit (cfu) per gram of meat.

Total microbial count (TMC) = N/V x R

Where N= number of colonies,
V= value of the particular dilution plated out in MC
R= Dilution factor.

Experimental design

This experiment which was completely randomized design examined the effects of four processing methods frying, boiling, roasting and oven drying on two meat products (Beef and Mutton).

RESULTS

Table 1 shows the effects of processing and preservation temperature on the organoleptic tests of the meat products. Frying, boiling, roasting and oven-drying had 87, 42, 72 and 73% for beef and 91, 43, 72 and 72% for Mutton respectively. Results of the statistical analysis (ANOVA) showed that meat stored at room temperature (25°C) were significantly ($P<0.01$) different in terms of organoleptic taste from beef and mutton under refridgerated temperature (4°C).

The total microbial count (cfu/g) on processed meat products preserved at 4°C and 25°C are shown in Table 2. Results indicated that boiled beef stored at 25°C had the highest microbial load of 3.86×10^7 and fried Mutton stored at 4°C had the lowest count of 1.68×10^7 cfu/g at the end of the one.

Table 1: Effect of processing and preservation temperature on the organoleptic taste of meat products.

	Frying	Boiling	Roasting	Oven-Drying	25°C	4°C
Beef	87%	42%	72%	73%	**	NS
Mutton	91%	43%	72%	72%	**	NS

** = Highly significant ($P<0.01$)
NS = Not significant.

week storage period. Mean count of microorganisms on the meat showed that boiled beef had the highest count of 2.28×10^7 and fried Mutton count had the lowest of 9.87×10^6 cfu/g. The overall result indicated that fried meat had the least number of microbes. Roasted and oven dried meat were relatively low in their microbial counts when compared with boiled meat.

Table 2: Total and Average microbial load [CFU/g] of processed meat products preserved at 4°C and 25°C.

		BEEF		MUTTON	
Days in storage		4°C	25°C	4°C	25°C
1st Day	A*	4.16×10^3	4.09×10^3	4.03×10^3	4.05×10^3
	B	4.28×10^3	4.29×10^3	4.31×10^3	4.36×10^3
	C	4.02×10^3	4.04×1.0^3	4.02×10^3	4.08×10^3
	D	4.07×10^3	4.10×10^3	4.01×10^3	4.09×10^3
3rd Day	A	1.30×10^7	1.97×10^7	1.27×10^7	1.83×10^7
	B	1.53×10^7	1.97×10^7	1.47×10^7	1.89×10^7
	C	1.27×10^7	1.35×10^7	1.30×10^7	1.31×10^7
	D	1.32×10^7	1.40×10^7	1.29×10^7	1.33×10^7
5th Day	A	1.73×10^7	2.53×10^7	1.68×10^7	2.67×10^7
	B	1.97×10^7	3.86×10^7	1.92×10^7	3.81×10^7
	C	1.96×10^7	2.29×10^7	1.69×10^7	3.2×10^7
	D	1.81×10^7	2.35×10^7	1.86×10^7	3.33×10^7
Average	A	1.02×10^7	1.49×10^7	9.87×10^7	1.50×10^7
	B	1.67×10^7	2.28×10^7	1.13×10^7	2.23×10^7
	C	1.00×10^7	1.55×10^7	9.97×10^7	1.84×10^7
	D	1.04×10^7	1.58×10^7	1.05×10^7	1.89×10^7

*A= Frying, B=Boling, C=Roasting, D=Oven-drying.

Table 3 shows the statistical result of the effect of time and temperature of preservation on preservation and processing method on the microbial load

of the meat products. Time and temperature of processing meat both had significant ($P<0.01$) effect on the bacterial load not the method of processing the meat.

The shelf-life of processed meat products preserved under the two temperatures are contained in Table 4. Fried meat had a shelf-life of more than seven days at room temperatures while it stayed for fourteen days at refrigerated temperature. Roasted and oven dried meats had relatively the same shelf-life of three days at room temperature and seven days at refrigerated temperature.

Table 3. Shelf-life (days) of processed meat products preserved at 4°C and 25°C.

	BEEF		MUTTON	
	4°C	25°C	4°C	25°C
Frying	14	7	14	7
Boiling	7	2	7	2
Roasting	7	3	7	3
Oven-drying	7	3	7	3

DISCUSSION

Meat used for the purpose of this experiment was purchased at once from a single source. Variations in the results of the organoleptic test could only be due to treatment effect on the meat. The organoleptic tests showed that, the taste of the meat (which invariably determine consumers acceptability) is a function of processing, preservation and the type of meat. This agrees with the findings of (6) who reported that people showed concern on the wholesomeness and flavour of food they eat than its kind. Different processing methods produced different flavour. Frying process enhances the flavour of meat than processing by boiling. This may be due to interactive effect of the oil use in frying which may have added additional flavour and aroma on the meat. Organoleptic assessment showed lower values for both roasting and oven drying may be as a result of lower moisture value due to dryness as well as concentration effects of the additives such as salt. This work agrees with the findings of (4), that frying commands stability and acceptance in meat than any other processing methods.

The temperature at which the meat was stored over time also had significant effect on the taste of the meat. This agrees with the result of (5) who identified that freezing temperatures control the quality of food stuffs.

Meat stored at room temperature showed a rapid decline in taste than that kept under refrigerated temperature. This may be due to the rapid increase in the number of microorganisms inhabiting the meat as a result of favourable environmental condition for their growth and multiplication outside the refrigerated temperature.

This corroborate the findings of (1) who stated that the quality of meat is affected by the quality of the microbial growth causing chemical changes resulting in the meat being unacceptable to the consumer due to slime, souring or putrid odours.

The result of the statistical analysis however showed that processing played no significant role in the amount of microorganisms found on the meat. However, some slight variations in microbial number were observed which are not statistically significant.

The shelf life of the meat depends significantly on the temperature of preservation. Processing plays a contributing role however on the stability of the meat products with frying having the longest shelf life of more than seven days under room temperature and boiling had the least of only two days under the same condition. All the meats processed differently stayed longer under refrigerated temperature.

Pace (1975) reported that different temperatures have varying effects on the growth of bacteria on foodstuffs which corroborate the findings of this studies.

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