EFFECT OF THERMAL PROCESSING METHODS ON THE EATING QUALITIES AND ACCEPTABILITY OF DIFFERENT MEAT TYPES

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ABSTRACT

This study was carried out to evaluate the eating qualities of six different meat types namely: beef, chevon, pork, rabbit, turkey and chicken cooked with three methods. The three cooking methods employed were frying, boiling and roasting. Fresh meat cuts (250g) of 5 meat types were purchased from Ayetoro market in Yewa North Local Government areas of Ogun State, while live rabbits were bought and slaughtered and 250g of meat harvested and used for this study. The 250g of each meat type was divided into 50g and subjected to cooking using frying, boiling and roasting for 20 minutes. The meat samples were served to a semi-trained 10-member taste panel that adjudged the test on the meats for flavour, tenderness, juiciness, texture and overall acceptability using 9-point hedonic scale on which 1= disliked extremely and 9= liked extremely. The results showed that frying increased ($p<0.05$) the juiciness and texture of rabbit, turkey, chicken and pork meats as well as the overall acceptability of the same meat types. Boiling increased the flavour of beef and chevon and tenderness of rabbit, turkey, pork and chicken as well as the texture of beef, chevon, pork and rabbit, but enhanced the overall acceptability of beef and chevon. Roasting improved the flavour of beef and chevon, tenderized pork and rabbit meat as well as increased the juiciness of beef and chevon, texture of beef, chevon and rabbit meats; it increased the consumer's acceptability of beef, chevon and rabbit meats. It was concluded that each meat type should be cooked based on the method that impacts palatability quality which the consumer desired. It was suggested that pork, rabbit, turkey and chicken meats be fried as it enhanced most of the palatability qualities of these meat types, beef and chevon meat be boiled or roasted for higher acceptability.

Keywords: Acceptability, eating qualities, hedonic scale, meat types, thermal processing

INTRODUCTION

Meats are the most important sources of protein and include the flesh or entire musculature and organs of any animal used for food (USDA, 2006). It is made up essentially of water, fat, mineral and vitamins apart from protein and needs to be processed before consumption (Lawrie, 2006). The indispensable processing of meat prior to

consumption is cooking which influence it eating qualities (Aduku and Olukosi, 1990). It had been reported (Ikeme, 1990; Qiofen and Da-Wen 2005) that different methods of cooking have different effects on the doneness of meat vis-à-vis its desirability and acceptability. Method of cooking meat included roasting which is accomplished by placing pieces of meat in a shallow pan and inserting them in an oven temperature between 150-175°C for 45mins or in an open burning charcoal in which case, the meat has to be turned at regular intervals (Apata, 2009). Cooking by grilling it achieved by placing meat on wire mesh 8-12cm from the source of heat, the meat is turned when one side is brown and takes about 15 minutes to cook. Frying is done in heated fat or oil within temperature range of 160-200°C with regular turning, while cooking by boiling is carried out by placing meat in water for a relatively longer time using a simmering temperature of 95-100°C (Miller *et al*., 2001; Hannula and Puolamme, 2004; Apata *et al*., 2005; Apata and Akinfemi, 2010). Consumers attitude to meat involves preference depending on the criteria they consider as important. Such criteria may include the species of animal, age of animal at slaughter and especially the eating qualities or factors of meat like flavour, tenderness, juiciness, colour, texture and overall acceptability (Joseph *et al.,* 1995). Since eating, palatability qualities or factors are excellent guide to nutrition, cooking has been used to improve them which also depends on the appropriateness of the cooking techniques or method employed (Larson *et al.,* 1992). Aduku

and Olukosi (2000) reported that when meat is cooked its palatability qualities or factors are improved therefore, a suitable method of cooking is necessary in order to release the irresistible, palatable and nutritious factors in meats. This study was conducted to assess the eating and acceptability attributes of some meat types cooked with different methods.

MATERIALS AND METHODS
Meat samples
Fresh cuts (250g) of beef, chevon, pork, chicken and turkey meat were purchased from Lafenwa market at Abeokuta, while live rabbits were purchased from Olabisi Onabanjo University Teaching and |Research Farm, Rabbits Unit, slaughtered and the meat used for this study because rabbit meat was not available in the market.

Cooking methods
The lean meat (250g) cuts of different meat types were divided into 50g and randomly subjected to three cooking methods: Frying (160-200C) Boiling (95-100C) and Roasting (150-175C). The meats were cooked for 20 minutes to the internal doneness of 72C (Apata, 2011)

Organoleptic evaluation of meats
The cooked meat sample were evaluated for palatability using a 10-member taste panel to adjudge the test for flavour, tenderness, juiciness, texture and overall acceptability of the meats on a 9-point hedonic scale on which 1= extremely dislike and 9= extremely like. Panelists were semi-

trained by instructing them how to fill the questionnaire form and to use water and biscuit provided between meat samples and were provided an unsalted biscuit and water for use between meat samples according to the procedures of American Meat Science Association (AMSA, 2015).

Experimental design and statistical analysis

The experimental design used for this study was completely randomized design (CRD). Data collected were subjected to statistical analysis of variance (ANOVA) using statistical analysis system (SAS, 2002) instrument and the means

were separated by Duncan multiple range test of the same system.

RESULTS

Table 1 presents the flavour results of different meats types. Rabbit, turkey and chicken meats had higher ($p<0.05$) when fried followed by pork and least ($p<0.05$) least in beef and chevon while, beef, chevon and pork elicited higher ($p<0.05$) higher flavor under boiling cooking method. But rabbit, turkey and chicken had lower flavor ($p<0.05$) whereas beef and chevon had higher ($p<0.05$) flavor follow by rabbit meat, while pork, turkey and chicken meat had least flavor under roasting cooking method.

Table 1: Effect of cooking methods on flavour scores of some meat types

Treatment	Meat Types						
	Beef	Chevon	Pork	Rabbit	Turkey	Chicken	SEM
Frying	5.15^c	5.21^c	6.40^b	7.52^a	7.50^a	7.43^a	0.82
Boiling	7.52^a	7.32^a	7.22^a	6.13^b	6.24^b	6.19^b	0.85
Roasting	7.40^a	7.34^a	5.26^c	6.30^b	5.24^c	5.25^c	0.85

Means on the same row with different superscripts are statistically significant ($p<0.05$)

Beef and chevon were adjudged the most tender than pork, rabbit, turkey and chicken meats when fried, but rabbit, turkey and chicken meats were scored higher ($p<0.05$) for tenderness followed by pork and chevon and least ($p<0.05$) in beef when boiled (Table 2). Roasting impacted higher ($p<0.05$) tenderness values on pork and rabbit meats than in turkey, chicken and beef.

Table 2: Cooking methods and the influence on tenderness scores of some meat types

Treatment	Meat Types						
	Beef	Chevon	Pork	Rabbit	Turkey	Chicken	SEM
Frying	7.79^a	7.58^a	6.46^b	6.30^b	6.38^b	6.27^b	0.70
Boiling	4.48^d	5.88^c	6.17^b	7.61^a	7.54^a	7.65^a	0.72
Roasting	5.07^c	6.10^b	7.28^a	7.40^a	6.09^b	6.09^b	0.74

Means on the same row with different superscripts are statistically ($p<0.05$)

Meats from rabbit, turkey and chicken were rated higher ($p<0.05$) in juiceness than meats from pork, chevon and beef when fried, but meats from pork, rabbit, turkey and chicken were scored higher ($p<0.05$) for juiceness than chevon and beef when boiled, whereas beef, chevon and rabbit meats were rated higher ($p<0.05$) for juiceness than pork, turkey and chicken when roasted (Table 3).

Table 3: Juiciness scores of some meat types as affected by cooking method

			Meat Types				
Treatment	Beef	Chevon	Pork	Rabbit	Turkey	Chicken	SEM
Frying	4.23^d	5.25^c	6.33^b	7.35^a	7.65^a	7.73^a	0.65
Boiling	4.33^c	5.45^b	7.46^a	7.59^a	7.78^a	7.65^a	0.62
Roasting	7.43^a	7.30^a	6.20^b	7.15^a	6.21^b	6.28^b	0.67

Means on the same row with different superscript are statistically significant ($p<0.05$)

The results of cooking methods on texture scores (Table 4) of meat types tested in this study showed that beef and chevon had the least ($p<0.05$) fine texture, while pork, rabbit, turkey and chicken meats elicited higher ($p<0.05$) textural scores when fried, but beef, chevon, pork and rabbit

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meats had higher ($p<0.05$) textural scores than turkey and chicken meats when boiled. Beef, chevon and rabbit meats had higher ($p<0.05$) scores for texture than pork, turkey and chicken with lower ($p<0.05$) scores when the meats sample were roasted

Table 4: Effective of cooking method on Textural scores of some meat type

			Meat Type				
Treatment	Beef	Chevon	Pork	Rabbit	Turkey	Chicken	SEM
Frying	6.30^b	6.00^b	7.39	7.33^a	7.42^a	7.34^a	0.89
Boiling	7.81^a	7.88^a	7.63	7.72^a	6.60^b	6.62^b	0.83
Roasting	7.69^a	7.87^a	6.52	7.67^a	5.43^c	5.45^c	0.85

Means on the same row with different superscript are statistically significant ($p<0.05$).

The result on Table 5 showed that meat types acceptability scores. Pork, rabbit, turkey and chicken meat samples were more ($p<0.05$) accepted than beef and chevon under frying method, wkile turkey and chicken were least ($p<0.05$) accepted than rabbit and turkey but beef

and chevon were highly ($p<0.05$) accepted than any of the meat types when boiled, whereas beef, chevon and rabbit meats where accepted more ($p<0.05$) than pork ,turkey and chicken when they were roasted.

Table 5: Effect of cooking methods on overall acceptability scores of some meat type

			Meat Type				
Treatment	Beef	Chevon	Pork	Rabbit	Turkey	Chicken	SEM
Frying	5.90^b	5.00^b	7.39^a	7.33^a	7.42^a	7.00^a	0.89
Boiling	7.71^a	7.38^a	6.83^b	6.82^b	5.72^c	5.74^c	0.83
Roasting	7.69^a	7.87^a	6.32^b	7.69^a	6.63^b	6.65^b	0.85

Means on the same row with different superscript are statistically significant ($p<0.05$).

DISCUSSION

Chicken, turkey and rabbit meats had higher (P<0.05) scores (7.73), (7.65), (7.35) respectively followed by pork meat (6.33), then chevon while beef had lower (P<0.05) score (4.25) for flavour when the meats were fried as shown on Table 1, but when boiled, beef, chevon and pork were rated higher (P<0.05) for flavour while rabbit, turkey and chicken meats were rated lower (P<0.05), while beef and chevon had higher (P<0.05) flavour when fried, turkey and chicken had least (P<0.05) flavour scores. It was observed in these results that consumers enjoyed beef and chevon flavour when boiled or roasted than been fried, but would like to consume rabbit, turkey and chicken when the meats are fried for high flavour, pork is however preferred for high flavour when boiled. These results agreed with the report of Apata and Okubanjo (2010), Apata and Akinfemi (2010). Table 2 shows that beef and chevon were more (P<0.05) tender than other meat types when subjected to frying while rabbit, turkey and chicken meats were tenderer (P<0.05) when boiled compared with beef and chevon, while pork meat was intermediate, however pork and rabbit meats were more (P<0.05) tender when roasted, while beef had least (P<0.05) tenderness score. The variations observed in the tenderness of different meat types under different cooking methods might be due to differences in muscle fiber size as well as the reaction of connective tissues and collagen holding the muscles within the muscles to the temperature at which they were cooked. Higher

temperature would break the fibres, tissues and collagen easily and render the meat more tendered than meat types that were exposed to lower temperature. Also, meat type with lower fibre, connective and collagen size would tend to break easily and become tender when heated. These results were in agreement with (Miller *et al*, 2001) who reported that there were thresholds for establishing the value of meat tenderness under cooking condition as well as (Haunula and Puolamme, 2004) who reported similar effect of temperature on cooked meat.

Rabbit, turkey and chicken meats were juicier when boiled and fried (Table 3), but beef, chevon and pork were juicier when roasted than other meat types in this study while pork, turkey and chicken had the same (P>0.05) juiciness scores irrespective of the cooking method used. Juiciness of any meat type depends largely on the method of cooking employed. This is because losses would have occurred during cooking as a result of the meat juices that are leaked into the formed broth which added to the flavour of cooked meat. These results were in agreement with the findings of both Aduku and Olukosi (2000) and Da-Wen (2005). Pork, rabbit, turkey and chicken meats were fine textured when they were fried while, the texture of beef and chevon was rough (Table 4). It was also observed that the beef, chevon, pork and rabbit meat were fine in texture when boiled than those of turkey and chicken, whereas beef, chevon and rabbit meats were fine in texture when roasted, while those of pork, turkey and chicken were

coarsely textured. This could be as a result of different anatomical structure of fibres in each meat type coupled with the degree of temperature at which the meats were subjected during cooking (Larson *et al;* 1992, USDA, 2006; Lawrie, 2006). Table 5 depicted the results of cooking methods and overall acceptability of different meat types tested in this study. Pork, rabbit, turkey and chicken meats were accepted the same when fried, while beef and chevon acceptability were lower (P<0.05) than other meat types, however beef and chevon meats were more acceptable (P<0.05) to the taste panelists than pork and rabbit. Turkey and chicken meats were accepted least (P<0.05) when they were boiled, but beef, chevon and rabbit meats were highly (P<0.05) accepted than pork, turkey and chicken meats when roasted. Joseph et al; (1995), Apata *et al;* (2005) and (AMSA, 2015) reported that overall acceptability is a function of the ratings of the palatability traits which measure the level of appeal of a particular meat or meat products to consumers. These results showed that each of the cooking methods impacted a unique palatability trait to each type of meat with different appeal to the consumers.

CONCLUSION

The cooking methods tested in this study- frying, boiling and roasting had significant effects on the eating attributes (flavour, tenderness, juiciness, texture and overall acceptability) of the meat types evaluated. However, consumers preferred fried pork, rabbit, turkey and chicken, but relished boiled beef and chevon meats whereas they enjoyed eating roasted beef, chevon and rabbit meats than other meat types cooked with roasting. It was suggested that each meat type should be cooked based on the method that impacts more desirable eating traits to the particular meat to be consumed. But based on the results of this study, frying was found to enhance most of the palatability trait of pork, rabbit, turkey and chicken meat while boiling and roasting were better applied to beef and chevon meats.

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