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Organoleptic Assessment and Proximate Composition of Red Meat Varieties Subjected to Moist Cooking Methods

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Abstract

This research study was carried out on how different cooking methods affect the organoleptic and proximate composition of three different red meat subjected to three moist cooking methods. The three red meat were beef, lamb and chevon (goat meat) and the three moist cooking methods used were braising, steaming and stewing. A 9-point hedonic scale rating as contained in sensory evaluation form/sheet were administered to the taste panelists to gather data. Moreso, Association of Official Analytical Chemists method was used to evaluate the proximate characteristics of various cooked meat samples. The data gathered from the taste panelists was also analysed using Analysis Of Variance (ANOVA), simple mean and standard deviation. The proximate composition or characteristics of different samples indicated a significant difference ($p<0.05$) and based on the analysis of data the results showed that braising method is the most suitable for goat meat and also stewing method is the most suitable for beef mean plotted graph, it was evident that braising method is best for goat meat and lamb should be best subjected to all cooking methods due to variation in the mean plotted graph.

Keywords: Organoleptic, tenderness, palatability and edibility

INTRODUCTION

Meats are the flesh of animal which are suitable for use as food. Meat consist muscular and fatty tissues. The unit of fatty tissue varies with the part of meat, the animal, the species, and feed. The demand and consumption of red meats especially that of cattle (Beef) has been increasing considerably, probably because of their nutritional benefits over other types of red meats and easy preparation and fewer religion restrictions (Chumngeon & Tan, 2015).

Red meat are darkly pigmented; they are flesh of animals such as cattle (beef), pig (pork, bacon, ham), goat (chevon), sheep (lamb, mutton). Red meat contains more narrow muscle fibres.

White meats are lightly pigmented; they are flesh of animals such as turkeys, chicken, duck, geese, and guinea fowl. White meat contains broad fibres and they are loose in texture than red meat and contain less fat and connective tissues; the cooking and sample preparation of white meat influence consumer purchase decisions (Kirmaci & Sigh, 2012).

Meats are mainly composed of specialized striped muscle cells which form fibres and held together by connective tissue into bundles (Aguirrezabal, 2010). The bundles are joined to the bones by tendons. Each fibres is made up of cells containing the protein myosin which is 55% and actin 25% and watery solution of minerals, salt, vitamins, and extractives. This extractive gives the flavours to meat. Quality of meat deteriorates due to microbial growth and rancidity of lipids in the course of storage (Aguirrezabal 2010), and this makes it advisable to purchase fresh meats for quality, pleasant and edible tastes.

Most meats are mainly composed of 75% water, 20% protein, and 5% fat, all vitamins in B complex, iron, potassium, phosphorus. All muscle tissues are rich in essential amino acids and also an excellent source of Vitamin. B12, B6, zinc, niacin, chlorine, riboflavin and iron. Several meats are also high in Vit. K. (Pearson, 2008).

Meats are cooked using different types of cooking methods which are categorized into two (2) forms; that is, dry and moist cooking methods.

Dry cooking methods are used for cuts of meats that are tender. Examples include roasting, broiling, grilling, barbequing and stir frying and others while moist cooking methods are braising, steaming, boiling, stewing and others, which are used for parts of animals that are either low in fat or tough in muscle. It is necessary to note that meat that are meant to be cooked

with this method will be less tender cuts, therefore needs to be cooked longer to tenderize them. Cooking makes meat palatable, nutritious and safe. The type of moist method of cooking it undergoes will determine the taste and appetizing look of the meat.

Quality protein is relevant for maintaining muscle mass, especially in older adults. Insufficient protein consumption may increase and worsen age-related muscle wasting. This increases the risk of sarcopenia, an health condition related with very low muscle mass. Meat quality (flavour) is also influenced by the nutrition of the animals before slaughter (Melton, 2010) grazing increased the intensity of flavours on red meats. (Fischer et al, 2010).

Meat includes beef, lamb, chevon, pork and chicken, rabbit, mutton among others. Meat consists majourly the carcass and the offals: sweetbreads (thymus and pancreas), kidney, heart, tongue, liver and tripe (stomach)

Meat products includes meat dishes, snacks containing meat and other food product with. Bastick & Walker (2012). According to Horcada, (2012); Beriain et al, (2009). Meat flavour differs and this influences consumer preferences for various processed meat.

Meat consumption is a simple way to control iron deficiency anamia.

Lamb may foster the growth and maintenance of healthy muscle mass and improve muscle function, stamina, and exercise performance. As a rich source of highly available iron, lamb may help prevent anamia.

Lamb not only helps preserve muscle mass but may also be important for muscle function (Aguirrezabal.,et al. 2010).

Goat meat is the meat of the domestic goat (*Capra aegagrushircus*). Goat meat from adults is often called chevon and cabrito, capretto or kid when it is from young animals (Thompson et el, 2014).

Beef is a source of high-quality protein and nutrients (Bastick and Walker, 2010).

MATERIALS AND METHODS

Study area

Ilaro was founded in the 18th century by Aro who migrated from Oyo town to settle down in Igbo Aje, a little hill situated at the centre of the town from where he and his warriors can see the enemies on attack from a long distance.

Ilaro, Ogun state is a town in Ogun state, Nigeria Ilaro town houses about 57,850 people. Ilaro is the headquarter of yewa south local government, now known as Yewa land which replace the egbado division of the former western state and later became a part of the Ogun state of Nigeria.

The Federal Polytechnic, Ilaro was established by Decree No. 33 of July 25, 1979. The Polytechnic opened to students on November 15, 1979 on a temporary site provided by its host community, the ancient town of Ilaro, Ogun state. The polytechnic commenced academic activities on its permanent site along Ilaro/Oja-Odan Road, about three kilometers from Ilaro Township with 175 students in the School of Applied science, Engineering and Management Studies. However, a fourth School, School of Environmental Studies, was established in 1990 by Prince Dr. Olateru Olagbegi, the second rector, The fifth School, School Communication and Information Technology was founded by Arc, Dr Olusegun Aluko in 2016.

Materials

The materials to be use for this research includes chef knife, cutting board, cooking pot, stirring spoon, cooking gas, napkins or paper towels, bucket, casserole dishes, tasting spoon and cup.

Ingredient: Flour, Onion, Pepper, Meat, Salt, Vegetable oil, Thyme, broth, tomato paste, maggi.

Source of materials

Materials for this study were sourced domestically and some were sourced from Sayedero, the major local market in Ilaro, Ogun state.

Method

The methods of moist cooking that was use for this research study the methods on the preparation of red types of meat which include braising, stewing, steaming methods.

Braising Cooking Method of Red Meat

Recipe:	Items	Quantity
	Meat	250g
	Onion	1 bulb
	Pepper	½ tbs
	Maggi	I cube
	Salt	½ tsp
	Veg oil	2 tbs
	Thyme	1 tsp
	Broth	1 medium cup

Preparation method

I trimmed the excess fat from the meat and heated about 2tbs oil in a cooking pot after which the meat was seasoned with salt and pepper. I added the meat to the hot oil, and allowed to brown on all sides and then removed the browned meat from the pan and poured off the fat and returned the meat to the pan.

I combined the broth and seasoning, as needed, and then poured around the meat. I added about 1 tsp of thyme, covered the dish pan and cooked under low heat on top of gas stove for an hour until properly tenderized

FLOW CHART SHOWING THE BRAISING METHOD OF COOKING MEAT

Washing of meat

Trimming of fat

Seasoning and adding of meat to the hot oil

Combining of liquid and seasoning

Poring of liquid to the meat

Cover to cook

Ready to serve

Steaming Cooking Method of Meat

Recipe:	Items	Quantity
	Meat	250g
	Maggi	1 cube
	Salt	½ tsp
	Onion	1 bulb
	Water	25ml

Preparation method

I washed the meat well and trimmed the fat from it after which I blot the meat dry with napkin to enhance the browning process. I cut the meat into shapes, added the seasonings (magi and salt) and then turned the meats into pot with addition of little water after which I allowed to cook for an hour till it became tender.

FLOW CHART SHOWING THE STEAMING METHOD OF COOKING MEAT

Washing of meat

Trimming of fat from the meat

Cutting of meat into shapes

Seasoning of the meat

Bring to boil

Ready to serve

Stewing Cooking Method Of Meat

Recipe	Items	Quantity
	Meat	250g
	Onion	1 bulb
	Veg. Oil	little
	Tomato paste	½ paste
	Pepper	1 tbs
	Flour	½ tbs
	Broth	little
	Maggi	1 cube
	Salt	5mg

Preparation method

The meat was washed and cut into shape, while the onion was peeled, washed and diced. I heated the vegetable oil in a medium pot on the cooking gas, added the diced onions and allowed to cook for about 5 minutes. I added some tomato paste, pepper and 2.5g of flour and then poured in the browned meat.

I mixed the beef broth, with seasoning in a separate bowl, added the liquid to the meat in the pot/Dutch and brought to boil

FLOW CHART OF STEWING COOKING METHOD OF MEAT

Washing and cutting of meat

Seasoning of the meat

Dicing of onions

Pawning of meat in a hot oil

Mixing of liquid with seasoning

Mixing of liquid with the meat

Bring to boil

Ready to serve

Research Population

For this study the academic staff of School of Pure and Applied Science, Federal Polytechnic Ilaro Ogun State were used as the taste panelists.

Sample and Sampling Techniques

The sample size for this study was determined using Taro Yammer Formula i.e.

$$n = \frac{N}{1+N\,(e)^2}$$

where,

1= constant

n = number of sample size

N = total number of people (panelist) that contribute the population i.e. 27

e = exponential is the level of significant i.e. 95% = 0.05, now this can be calculate thus:

$$= \frac{N}{1+N\,(e)^2}$$

$$= \frac{27}{1+27\,(0.05)^2}$$

$$= \frac{27}{1+27(0.0025)}$$

$$= \frac{27}{1+0.0675}$$

$$= \frac{27}{1.0675} = 25.29274$$

$$= 25 \text{ sample size}$$

Therefore, the target sample size for this study is 25

Instrument for Data Collection

The research instrument that was used for this study is sensory evaluation sheet, which was administered to the taste panelists. The taste panelists were asked to evaluate the sensory attributes of the different red meat prepared by moist heat/cooking methods. The attributes include appearance, colour, taste, aroma, flavour and overall acceptability with 9-point hedonic rating scale.

The source of data that was used for this research are primary and secondary. Secondary source of data are journals, newspapers, textbooks, notebooks while the primary source of data is sensory evaluation sheet.

Data Analysis

The information collected was analyzed using one-way analysis of variance ANOVA using the statistical package for social science SPSS version 20.0. Analysis of variance was employed in order to determine the significance difference in means, and least significant difference (LSD) analysis ($p<0.05$) to separate means. Proximate composition of samples was determined using Association of Analytical Chemists methods (AOAC, 2000) for crude protein (974.24), fat (65.17), ash, moisture-content and crude fibre (992.16)

RESULTS AND DISCUSSION

The table 1 shows the description statistics of the red meat types subjected to three different moist cooking methods. The last of panelist that was use for the research study. The score ranges from 9-1, sample A, A^0, A^{02}, C, C^0, C^{02}, and B approximately 8 with corresponding standard deviation $\pm$ 1.128, $\pm$ 1.320, $\pm$ 1.190, $\pm$ 0.0926 implies that an average, the analyzed three types of red meat subjected to moist cooking methods taking appearance into consideration were "liked very much" by the panelist while mean of sample B^0 and B^{02} is approximately to 7 was found to be "like moderately" mean response on "colour" also indicates that all the sample has approximately mean of 8 which was found to be "liked very much" except sample C^0 that was found to be like moderately with approximately corresponding means of 7.

However, the "texture" of the red meat with three different moist method of cooking were also analyzed, the result indicates that sample A, A^{02}, B, C, C^0, C^{02} were found that the approximately mean is 8 which sensed to be "like very much" while sample A, B, and B^0 are "like moderately" with the approximately mean of 7.

Taking the "taste" which also have the same result with "flavour", sample A, A^{02}, C, C^0 and C^{02} were found that the approximately mean is 8 which sensed to be "liked very much" while the sample A^0, C^{02}, B and B^0 are like moderately with the approximately mean of 7.

Mean response of the "flavour", the analysis reveal that sample A^{02}, C, C^0, C^{02}, B and B^0, have the approximately means of 8 while sample A, A^0 and A^{02} were found to have an approximately mean of 7 which sensed to be "like moderately".

Also, the result of the analysis above based on the overall acceptability depict that all the samples of red meat with their corresponding method of moist cooking methods found to be "like very much".

Discussion

From the result obtained, it was observed that there was just little different with the samples. The Appearance samples ranges between 7.40-7.96, the colour of the samples ranges between 7.60 -7.68, Texture is between 7.32 – 7.68, Taste ranges between 7.48-7.64, Flavour is between 7.32-7.44 and overall acceptability ranges from 7.90 – 8.12. With sample having the highest value in all the sensory quality. Sample A, A^{02}, C, C^{02}, having highest value of similar appearance (7.84, 7.84, 7.88, 7.96) while sample A^{02} and C^{02} have the same value of appearance (7.84) while sample B had lowest value of appearance (7.40-7.56) in terms of both the appearance of meal shows an impact of appetite stimulation (Man et al, 2017).

Also, the texture of the samples shows that sample (has the highest value (7.80) while sample A has the lowest value. The taste shows that sample has the highest value (7.84) while sample A^0 has the lowest value. The flavour shows that sample C has the highest value followed by sample B while sample C^{02} has the lowest value, colour also shows that sample C has the highest while sample C^0 has the lowest, sample C^{02} and sample B has the same value of colour and the overall acceptability of sample C is also the highest of all followed by sample A while sample A^0 has the lowest.

It was observed that there is not much significance different between the samples except for sample A which is the most subjected to moist cooking methods in terms of appearance, colour, texture, taste, flavour and overall acceptability. And also sample A is subjected to moist method of cooking in terms of appearance and overall acceptability.

Table 1 Results of organoleptic assessments of meat samples

Samples	Appear	Colour	Texture	Taste	Flavour	Overall Acceptability
A	7.96±1.05	7.68±0.85	7.32±1.10	7.64±1.19	7.44±0.24	8.12±0.13
A^0	7.52±1.19	7.64±0.95	7.56±1.04	7.16±0.25	7.40±0.21	7.72±0.18
A^{02}	7.84±0.80	7.64±1.07	7.68±1.06	7.56±0.18	7.56±0.20	8.00±0.14
B	7.560±1.32	7.56±1.38	7.36±0.99	7.36±0.88	7.60±0.27	7.88±0.22
B^0	7.40±1.04	7.64±1.15	7.48±1.29	7.52±0.15	7.56±0.23	7.96±0.21
B^{02}	7.40±1.55	7.60±1.00	7.68±1.06	7.48±0.32	7.32±0.34	7.84±0.22
C	7.88±0.88	7.72±1.32	7.80±1.08	7.84±0.24	7.76±0.26	8.08±0.16
C^0	7.80±1.04	7.40±1.32	7.68±1.10	7.52±0.23	7.52±0.33	7.96±0.22
C^{02}	7.84±1.28	7.56±1.38	7.52±1.22	7.60±0.21	7.48±0.22	7.60±0.27

Values are the means of duplicate determinations ± standard deviation

Sample A: Braised Beef
A^0: Steamed Beef
A^{02}: Stewed Beef
Sample B: Braised Lamb
B^0: Steamed Lamb
B^{02}: Stewed Lamb
Sample C: Braised Goat Meat
C^0: Steamed Goat Meat
C^{02}: Stewed Goat meat

Proximate composition

From table 2, the Crude protein of moist cooked meat samples ranged from 28.80% to 28.22%; the highest crude protein content was obtained in braised beef (28.80%) and the lowest crude protein content was obtained in stewed lamb. The crude protein content was also relatively high in steamed beef 28.71%, stewed beef 28.64% and braised beef 28.64%, however there was a slightly significant ($p<0.05$) difference among the samples in regards to the crude protein content and this is in conformity with the reports and findings of Elizabeth and Benson (2013) that cooking methods impacts slightly on the crude protein content of meats. The fat content across various samples of moist cooked meat ranged from 4.65% in braised beef to 4.09% obtained in stewed goat meat. The highest to lowest fat content obtained from all samples of meats cooked by moist heat methods showed a little significant ($p<0.05$) relatively high fat content was obtained in braised beef 4.65%, steamed beef 4.86% and braised lamb 4.72% this is in tandem with Omotola and Ewatomi (2012).

Findings or reports that appropriate cooking method helps in reducing fat in meat and that certain cooking

method may encourage concentration of fat in meat. The ash content percentage values ranged from 0.97% in braised beef which was the highest percentage to 0.81% in stewed lamb which was the lowest percentage value thus showing a slight significant difference ($p<0.05$) in Ash Content across the various sample.

Donald (2013) reported that moist cooking methods does not encourage increased ash content.

Moisture Content obtained across the meat samples ranged from 20.13% in stewed goat meat (the highest percentage to 16.03% in steamed beef (the lowest percentage). There was significant difference ($P<0.05$) in the percentage values or scores obtained across various moist cooked meat samples.

Peterson (2014) reported that steaming method of cooking allows little or no significant amount of moisture or liquid in food cooked. Crude Fibre of the samples ranged from 1.32% in steamed beef which had the highest percentage to 1.20% in stewed lamb with the lowest percentage. There was little significant difference ($P<0.05$) in the scores or values obtained in various samples of meat prepared by the moist cooking methods.

Table 2: Proximate composition of meat samples cooked by moist heat methods (i.e. braising, steaming and stewing methods)

Samples	Crude Protein %	Fat %	Ash %	Moisture Content %	Crude Fibre %
A	28.80^{a}	4.65^{a}	0.97^{a}	19.94^{b}	1.28^{b}
A^{0}	28.71^{b}	4.86^{b}	0.91^{b}	16.03^{b}	1.32^{a}
A^{02}	28.64^{c}	4.48^{c}	0.82^{c}	20.09^{b}	1.27^{b}
B	28.28^{b}	4.58^{b}	0.89^{b}	19.28^{b}	1.26^{a}
B^{0}	28.24^{a}	4.72^{b}	0.84^{b}	16.12^{a}	1.30^{b}
B^{02}	28.22^{c}	4.10^{c}	0.81^{c}	20.02^{a}	1.20^{ab}
C	28.64^{a}	4.44^{a}	0.93^{a}	19.81^{c}	1.27^{c}
C^{0}	28.34^{b}	4.43^{b}	0.88^{c}	16.07^{c}	1.31^{c}
C^{02}	28.23^{b}	4.09^{b}	0.91^{c}	20.13^{c}	1.24^{a}

Means with different letters across the columns are significantly ($P<0.05$) different.

CONCLUSION

Meats are associated with toughness as they grow in age. However, the findings of this research study as clearly seen above is concluded that two types of the red meat used, Goat meat and beef. braising is more suitable for goat meat, steamed goat meat also has a higher results which means goat meat can be cooking with steaming methods of cooking and the stewing is more suitable for beef while lamb has the lowest value which does not has good and acceptable results. Lamb can be cooked with any type of the moist cooking method used in this research, but it is not best subjected to any of the results.

Based on the finding and conclusion of the research work, the following recommendations will go a long way in the food industries. The recommendations are stated below.

i. Apart from the common frying and grilling methods, meat should also be braised in order to create a different taste.
ii. Moist cooking method makes goat meat more suitable with good taste and should also be served in food outlets globally.
iii. Goat meat is suitable to all types of moist cooking methods most especially braising

method and therefore should be prepared by this method in all food outlets.

iv. Meat consumers and food industries should prepare meat with moist cooking method using stewing for beef, braising for goat meat and steaming for lamb.

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