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**Research Journal of Food Science and Nutrition**
Volume 7(5), pages 141-147, December 2022
Article Number: 522403AA2
ISSN: 2536-7080
https://doi.org/10.31248/RJFSN2022.153
https://integrityresjournals.org/journal/RJFSN

*Full Length Research*

# Comparative evaluation of the sensory properties of fish and beef *Kilishi* (roasted) as food snacks

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Received 14th October 2022; Accepted 16th November 2022

**ABSTRACT:** The organoleptic evaluation of *kilishi* produced from beef and fish was carried out to test the acceptability of fish kilishi as a possible replacement beef with fish in *kilishi* production, due to high cost of beef meat in relation fish. There was significant difference ($p<0.05$) in the prices of beef and fish meat of 50%. The same weight of beef and fish samples was processed separately with the same quantity and quality of ingredients, to obtain a beef and fish *kilishi* product of 10% moisture content. The sensory evaluation of the produced *Kilishi* was carried out using 9-point hedonic scale with thirty trained panellists. The data generated were subjected to ANOVA test at 0.05 significant level, using SPSS version 20. The mean result score by the panellists for fish *kilishi* based on colour, taste, aroma, texture and overall acceptability were 6.83±1.21, 6.40±1.48, 6.57±1.38, 6.93±1.26 and 7.37±0.99, respectively. While that of beef *Kilishi* were 7.50±0.90, 7.33±1.09, 7.23±1.10, 7.10±1.16 and 7.77±0.94, respectively. The beef *kilishi* had a general acceptability score of 7.77±0.94 which reads 'like moderately' while that of fish *kilishi* has a general acceptability score of 7.37±0.99 which reads 'liked moderately'. This study shows that fish *kilishi* can serve as suitable alternative to beef *kilishi* as a cheap snack that can provide cheap source of animal protein there by improve the quality of people's health.

**Keywords:** Beef, fish, general acceptability, *Kilishi,* kiln, organoleptic properties, processing.

## INTRODUCTION

The *kilishi* is a version of jerky roasted filleted meat of cow (beef), goat (chevon) and sheep (mutton) that originated from the Hausa land of the Northern States of Nigeria and specifically the Niger State. It is a dried form of meat (suya), made from cow, sheep and goat. *Kilishi* delicacy had been processed using traditional methods and have been largely produced from beef over the years (Igene *et al.,* 1990; Abdullahi *et al*., 2016; Iheagwara and Okonkwo, 2016).

Fish has been found to be highly appreciated by consumers as a result of its varied uses and unique taste (Muhammadi, 2020). In Nigeria, fish constitutes an important component of the daily diet of the people and provide the needed protein for healthy living. It is acceptability cut across all the economic and social strata of the society. Food and Agricultural Organization (2010) stated that fish makes up to 60% of the world's animal protein supply, and that 60% of the developing countries, obtain more than 30% of their animal protein from fish. Fishes are generally known to be safe (containing vital minerals and Omega-3 oil), nutritious and beneficial because it has high biological values in terms of high protein in the body, the presence of essential amino acids and ability to lower cholesterol level (Rickett, 2018).

After death, fish tend to deteriorate very fast due to the physical, chemical and microbial activities (Aliya, 2012; Guillén and Errecalde, 2002; Olagbemide, 2015; Okeke *et al*., 2020). Therefore, it is highly imperative that fish when captured, should be immediately processed and stored without delay, hence deterioration will set in (Mosarrat *et al.,* 2016). Therefore, in order to achieve good quality fish products, that ensure value addition, product diversification and reduction in post-harvest fish losses, it has become necessary for alternative application of fish in

food production, hence the need for the sensory evaluation of catfish – *Clarias gariepinus* in *kilishi* production. There is also limited information on physical cum chemical nutritional properties and methods of processing beef *kilishi* and much more on fish *kilishi*.

The diets of poor and low-income earners lack enough animal protein therefore the availability of fish *kilishi* to the populace, could solve the problem of protein deficiency in poor countries (Ogunsola and Omojola, 2008). This is consequence of the exorbitant high cost of beef *kilishi* in the market. It therefore became imperative to produce *klishi* using alternative source of animal protein (fish). This is encouraged because fish has an edge over beef as it is cheaper and relatively more abundant, breed faster and matures faster when compared to livestock like cattle (Apata *et al*., 2013). In addition, fish is found to be a nutritious and palatable food stuff, specifically demanded for its protein, which is of a higher quality when compared with protein sources from livestock (meat and egg) (Ojutiku *et al*., 2009; Ikutegbe and Sikoki,2012). Adopting fish for *kilishi* production, would result to quality improvement (value addition) and make it available at cheaper price and within the reach of consumers (Olusola *et al.,* 2012). This study is aimed at providing an alternative to beef *kilishi* snack to consumers and in addition, open another fish processing value chain enterprise to fish processors as a result of increase in fish production in Nigeria, from 0.45 million metric tonnes to 2.40 million metric tonnes per annum (Okeke *et al*., 2016).

## MATERIALS AND METHOD

### Sample collection

The species of fish used was 8.00 kg of *Clarias gariepinus* (Catfish) which was procured from a reputable fish farm in Awka, Anambra state, which was convey using a 50 litre plastic container, while the beef sample which weighed 8.00 kg was purchased from a meat market located at Ugwuoba, Enugu state, Nigeria, at the cost of two thousand, five hundred naira (₦2,500.00) or $4.55 per kilogram. The beef was convey in a sterilized polyethene bag to the processing laboratory. A total of eight fish samples with an average weight of 1.00 kg, were purchased at the cost of ₦1,250.00 or $2.75 per kilogram were selected. The weights were measured, using a sensitive electronic weighing balance. The ingredients (spices) used for slurry formulation were ordered and bought from Jos market in Plateau State of Northern Nigeria. The principal ingredient is the defatted groundnut cake which was bought from groundnut millers. Other ingredients used include table salt (sodium chloride), seasoning cube and curry powder. While natural spices used include ginger, gloves, black pepper, red pepper, alligator pepper, onion, garlic and sugar. All of which were processed by drying and grounding as the case maybe.

### Preparation of slurry

The slurry was prepared according to the method of Ogunsola and Omojola (2008) using ginger, cloves, black pepper, red pepper, alligator pepper, onion, garlic, curry, salt, cube seasoning, sugar, turmeric, groundnut cake, and water according to the various compositions in grams as shown in Table 1. The ingredients were measured dried using a sensitive weighing scale and mixed in a round bowl of 10 litre capacity. The formulation was thick due to high proportion of principal ingredients (defatted groundnut) that was used and was the same for fish and beef *kilishi*

### Preparation of samples

#### *Dressing*

The fish and beef samples were washed thoroughly with saline water. The scales, bones, fins, heads and tail of the fish was degutted and every organs and unwanted parts were removed to enhance filleting by using a sharp knife to cut ventrally.

#### *Filleting*

The beef and fish samples were filleted by removing every bone in their muscles with the aid of a sharp knife cutting ventrally. The fillets were placed on top of a sieve to allowed water to drip for 10 minutes, so as to reduce the moisture content.

### First drying

The freshly prepared fillets were introduced to sun drying rafts by carefully spreading it out one by one on a rack to reduce its moisture content by evaporation for forty-five minutes. A mosquito net of 1.2 mm mesh was spread over the raft to keep off houseflies from perching on the samples. This was done to further reduce the moisture content, thereby enhance proper absorption of slurry during infusion.

#### *Infusion of partially dried fillets into slurry*

The partially dried fillets of both samples, were then infused in the prepared formulated slurry containing spices and were thoroughly mixed for 10 minutes to ensure absorption of the slurry.

#### *Second drying*

The infused fillets were then placed in a smoking kiln to undergo second drying at a temperature 70°C for 30

**Table 1.** Composition of ingredients used for slurry (1000g)

| Ingredients | Other names | Composition (Grams) |
|---|---|---|
| Ginger | Zingiber officinale | 38 |
| Cloves | Eugenice caryophylceta | 26 |
| Black pepper | guineense | 34 |
| Red pepper | frutescens | 19 |
| Alligator pepper | *Afromomum meleginata* | 21 |
| Onion | *Allium cepa* | 84 |
| Garlic | *Allium sativum* | 1 |
| African nutmeg | *Monodor myristica* | 4 |
| Curry | *Fagara xanthoxyloides* | 7 |
| Salt | *Sodium chloride* | 7 |
| cube seasoning | *Monosodium glutamate* | 58 |
| Sugar | Sucrose | 35 |
| Groundnut cake | *Arachis hypogea* | 285 |
| Water | | 362 |
| Turmeric | *Curcuma longa* | 19 |
| Total | | 1000 |

**Source:** Ogunsola and Omojola (2008).

minutes to further reduce the moisture content. This was done under controlled heating to ensure a permanent absorption of the slurry onto the fillet.

### *Roasting*

After drying, the dried fillets were roasted for 60 minutes in a smoking kiln in a mild and steady heat, to ensure blending of ingredients into the dried fish and beef fillets and to enhance taste of the final products. Care must be taking not to char the final product, there by introducing bitter taste, dark colour and offensive aroma. The product obtained after roasting give the final fish and beef *kilishi* samples with moisture content of 10% as shown in the flow chart (Figure 1). This sensory evaluation assessment was done three consecutive times to generate the mean scores values of the organoleptic properties of fish and beef *kilishi.*

### *Packaging of products*

The fish products were packaged in separate clean air tight containers and were labelled according to their respective samples (FK and BK which represented Fish *kilishi* and beef *kilishi* respectively) and it was served for organoleptic assessment. The fish and beef *kilishi* were stored at room temperature of between 21 to 30°C and were not allowed to come in contact with moisture through-out the experimental period.

### Sensory evaluation

The overall acceptability and sensory evaluation of beef and fish *kilishi* were carried out by 30 trained panellists consisting of equal number of males and females who have not taken alcohol for a period of at least two months based on their responses to the questionnaire served to them prior to their selection and also, not conversant with the taste of *kilishi*. The study was also conducted within

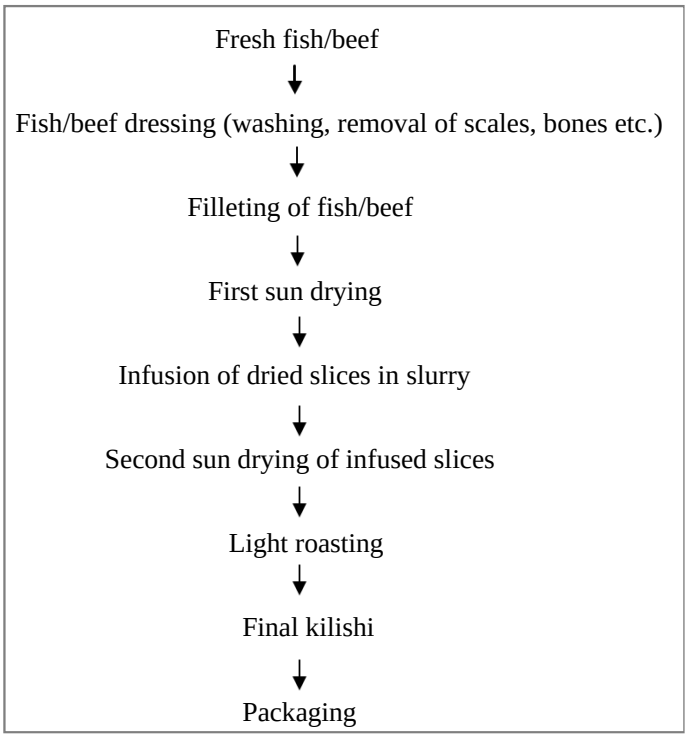


**Figure 1.** Flow chart of fish/beef *kilishi* processing.

**Table 2.** 9-point Hedonic scale.

| Rating Acceptability | Score |
|---|---|
| Like extremely | 9 |
| Like very much | 8 |
| Like moderately | 7 |
| Like slightly | 6 |
| Neither like nor dislike | 5 |
| Dislike slightly | 4 |
| Dislike moderately | 3 |
| Dislike very much | 2 |
| Dislike extremely | 1 |

the time frame when the samples were assumed to be in the conditions acceptable to consumers to allow organoleptic testing without causing any harm to them. The evaluation was carried out using the taste-test method (Peryam and Girardot, 1998; Adibe *et al*., 2018). Thirty lumps of 35.00 gm each of fish *kilishi* were served to the panellists and to score on the following organoleptic properties colour, texture, taste, aroma and general acceptability ranking were assessed for sensory evaluation of the prepared *kilishi* using the 9-point Hedonic scales shown in Table 2. The panellists were asked to rinse their mouths thoroughly and the same process was repeated for beef *kilishi* and scored.

## RESULTS AND DISCUSSION

Table 3 shows the cost per kilogram of both beef and fish meat samples of ₦1.250.00 ($2.275) and ₦2,500.00 ($4.55) respectively used in this study. While Plates 1 and 2 shows the final products of fish and beef *kilishi*, respectively. The results of the sensory evaluation of the fish and meat *kilishi* are shown in Table 4 while the results obtained from gender comparison of the products are presented in Table 5. There was no significant difference ($p>0.05$) in the gender preference for any of the products. The organoleptic (flavour, texture, taste, aroma and general acceptability) sensory score for fish and beef *kilishi* are given in Table 3. The result showed significant difference ($p<0.05$) between the colour of the products, with beef *kilishi* recording higher score of 7.50±0.90, which translate to 'like very much' on the 9-point hedonic scale, while fish *kilishi* had a lower score of 6.83±1.21, which translate to 'like moderately'. The choice of colour was based on how the product appearance appealed to the panellist. Okeke *et al*. (2020) recorded that colour of products can be influenced by the flesh make-up, the species of the fish involved and the source of the drying energy. Since the flesh of fish is tender, is prone to charring at high temperature. Also, Bichi *et al. (*2016) opine that the method of processing of fish *kilishi* is essential in maintaining the nutrient composition and organoleptic properties of the fish, as this was evident in the nutrient

**Plate 1.** Final product of fish *kilishi*

**Plate 2.** Final product of beef *kilishi*

and organoleptic analysis of fried and smoked fishes from three major markets in Katsina, Katsina State, Nigeria.

The **taste** of beef *kilishi* was most preferred by the panellist as it recorded a higher mean score value of 7.30

**Table 3.** Cost of beef and fish samples.

| Samples | Unit cost/Kg (₦ & $) | Quantity (kg) | Total cost (₦ & $) |
|---|---|---|---|
| Beef | 2,500.00 & 4.55 | 8.00 | 20,000.00 & 36.40 |
| Fish | 1,250.00 & 2.75 | 8.00 | 10,000.00 & 23.20 |
| Price difference | 1,250.00 & 2.75 | - | 10,000.00 |

Percentage (%) cost difference in the price of fish and beef meat is = Cost of beef – Cost of fish/Cost of beef × 100/1. Which is = ₦2,500.00 - ₦1,250.00/ ₦2,500.00 × 100/1 = 50%. This cost does not include the prices of ingredients, because the same quantity of ingredients per kilogram was used for both beef and fish *kilishi.*

**Table 4.** Mean and standard deviation of sensory scores for fish and beef *Kilishi.*

| Attribute | Fish *kilishi* | Beef *kilishi* |
|---|---|---|
| Colour | $6.83^{b}$±1.21 | $7.50^{a \pm 0.90}$ |
| Taste | $6.40^{b}$±1.48 | $7.33^{a}$±1.09 |
| Aroma | $6.57^{b}$±1.38 | $7.23^{a}$±1.10 |
| Texture | $6.93^{a}$±1.26 | $7.10^{a}$±1.16 |
| Overall acceptability | $7.37^{a}$±0.99 | $7.77^{a}$±0.94 |

*Means in the same row with the same superscript are not significantly different (p>0.05).

**Table 5.** Mean and standard deviation of fish and beef *kilishi* based on gender.

| Parameters | Fish *kilishi* | | beef *kilishi* | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| Colour | 6.47±1.35 $^{a}$ | 7.20±0.94 $^{a}$ | $7.47±0.83^{a}$ | $7.53±0.99^{a}$ |
| Taste | 6.20±1.56 $^{b}$ | $6.60±1.40^{b}$ | $7.47±0.92^{a}$ | $7.47±1.30^{a}$ |
| Texture | 6.67±0.82 $^{a}$ | 7.13±1.90 $^{a}$ | $6.87±1.25^{b}$ | $7.40±1.21^{b}$ |
| Aroma | 6.40±1.40 $^{b}$ | 6.73±1.39 $^{b}$ | $7.13±1.06^{b}$ | $7.33±1.05^{b}$ |
| Overall acceptability | 7.47±0.99 $^{a}$ | 7.40±1.21 $^{a}$ | $7.80±1.01^{a}$ | $7.73±0.88^{b}$ |

*Means with different superscript across the row are significantly different at (p<0.05).

which translate to ‘like moderately’ while fish *kilishi* had a lower score of 6.40 which translate to ‘like like slightly’’ on the 9-point hedonic scale. The result may have been influenced by the facts that fish *kilishi* is rather new *kilishi* snack to the panellist. Bichi *et al.* (2016) and Okeke *et al*. (2020) reported that fish is very palatable, highly nutritious, and rich in protein and minerals with less connective tissue.

The **aroma** result showed significant difference (p<0.05) between samples. Beef *kilishi* recorded higher score of 7.33 which translate to ‘like moderately’ on the 9-point hedonic scale, while the fish *kilishi* recorded 6.33 which translate to ‘like slightly’. Okereke *et al*. (2016) opine that colour and aroma or flavour of fish is usually influenced by the species and part of the species, the type of energy source used in the processing and ingredients used as seasoning or spice.

The sensory score for **texture** showed that beef *kilishi* had higher score of 7.10, which translate to ‘like moderately’ on the 9-point hedonic scale while fish *kilishi* recorded a lower score of 6.67, which translate to ‘like like slightly. This agrees with Okeke *et al.* (2020) who observed that fish flesh is soft and tender with less connective tissue.

However, there was no significant difference (p>0.05) between the samples based on **general acceptability**. Although beef *kilishi* was most preferred as it has a higher score of 7.77±0.94 translating to ‘like moderately’, while fish *kilishi* scored 7.37±0.99 translating to ‘like moderately’. This is contrary to the result obtained by Muhd *et al*. (2016) with their specimen product, where they recorded significant difference (p<0.05) for general acceptability of *Clarias gariepinus.* This they attributed to the type of preservative ingredient Jerusalem (*Cnidosculus aconitifolus*) leaf extact used in the processing. These natural spices, has dual functions of flavour cum aroma enhancing properties and preservative power with wide spectrum of actions, which include; antibacterial, antifungal and anti-oxidative effects as reported by Barceloux (2000).

The result of the sensory scores of *kilishi* prepared with fish and beef revealed that the panellists preferred the beef *kilishi*. This choice could be because most of the panellists

may have in the past, tasted the beef *kilish*i and have not tested the fish *kilishi* before. The result equally showed that fish *kilishi* could be accepted considering the high scores recorded, even though it is lower than the scores of beef *kilishi*. It was observed that gender evaluation of the products showed that there was an equal and fair judgement from both gender during sensory evaluation, as result obtained recorded no significant difference ($p>0.05$) in all sensory tested attributes. Hence there was no preference in terms of gender when it comes to eating *kilishi* as a snack. Therefore, it can be said that the overall result of the analysis conducted indicates that *kilishi* prepared with fish have acceptable qualities to having it as a replacement for beef. It is therefore recommended for consumption and should be made available to consumers for wider acceptability. There is also need to carry out further research on the microbiological and nutrient proximate composition of fish *kilishi*

## Conclusion

The continuous rise in the cost of livestock production, which has direct effect on the price of beef *kilishi*, necessitates the need for the use fish *C. gariepinus* as a substitute for beef *kilishi* snack. This is based on the fact that fish production through aquaculture, is increasing due to improved fish farming techniques. This study has shown that there is a huge cost disparity between 1 kg weights of beef and fish. It equally showed that there was no apathy from both genders in acceptance of fish *kilishi* as a food snack. Therefore, consumers can accept fish *kilishi* in the absence of beef *kilishi*. Finally, fish *kilishi* will provide option to the consumers in terms of variety and alternative source of animal protein and value addition in fish food processing.

## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

## ACKNOWLEDGEMENT

We want to acknowledge the assistance rendered throughout the duration of this research by the final year students of the Department of Fisheries and Aquaculture of Nnamdi Azikwe University, Awka, Anambra State, Nigeria.

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