Contents lists available at Sjournals

Scientific Journal of
Onimal Science

Journal homepage: www.Sjournals.com

Original article

Evaluation of slurry formulations for processing of kilishi of bony tongue (Heterotis Niloticus, Cuvier)

I. Magawata[a],*, I.S. Jega[b], J.K. Ipinjolu[a] , M. Jibir[c]

[a]Department of Forestry and Fisheries, Usmanu Danfodiyo University, Sokoto, Nigeria.
[b]Department of Forestry and Fisheries, Kebbi State University of Science and Technology, Aliero.
[c]Department of Animal Science, Usmanu Danfodiyo University, Sokoto, Nigeria.

*Corresponding author; Department of Forestry and Fisheries, Usmanu Danfodiyo University, Sokoto, Nigeria.

ARTICLE INFO

ABSTRACT

The kilishi of Heterotis niloticus was produced for determination of appropriate slurry formulations for fish kilishi preparation. Thirty six freshly caught samples of H. niloticus with average weight of 306.20±18.33g, obtained from Kware Lake in Sokoto State were used. Kilishi of this species was prepared with three different slurry formulations of high (F1), medium (F2) and low (F3) proportions of groundnut dough to spice mixture in the ratio of 1.3:1.0, 1.0:1.2 and 1.0:1.8, respectively. Results of proximate composition indicated that kilishi of the H. niloticus prepared with formulation 3 (F3) recorded significantly higher (p<0.05) protein content (54.22 ± 0.01%) and lower lipid content (8.00 ± 0.00%), despite recording significantly higher (p<0.05) moisture content (9.93 ± 0.07%). Sensory score of kilishi of H. niloticus processed with F3 formulation rated significantly higher (p<0.05) for taste, flavour and general acceptability with mean scores of 5.94 ± 0.21, 5.77 ± 0.20 and 5.50 ± 0.22, respectively. It could be concluded that kilishi of H. niloticus prepared with F3 formulation was the most acceptable hence, recommended for use in kilishi production.

1. Introduction

Fish is liable to accelerated physiological, chemical and microbial processes after harvests that invariably lead to deterioration and loss of wholesomeness. It is therefore necessary to come up with some measure of processing such as reduction in moisture content, denaturation of endogenous enzymes and microorganisms or packaging in order to curtail perishability (Vadivel, 2008). Processing methods include raising the temperature by canning, boiling, and removal of moisture by natural drying, mechanical drying, smoking and salting, and fish products development such as fish sauces and pastes, marinades (Clucas and Ward, 1996) and of recent fish kilishi (Magawata and Oyelese, 1999). Kilishi is a technique hitherto restricted to the processing of animal meat in northern Nigeria which involves dressing, slicing, air drying, application of slurry of ingredients and roasting over glowing coals (Igene, et al., 1989) and which was first applied to processing and preservation of fish by Magawata and Oyelese (1999). The use of natural spice in meat and fish processing to curtail rancidity is recommended by many research workers. Prattt and Watt (1964) ascertained the antioxidant effectiveness of hot water extracts of green onion, green pepper seeds and tomato peel on roasted beef. Ikeme (1988) used hot water onion extract, black pepper and ginger to control rancidity development during storage of hot smoked mackerel.

Little has been documented on fish kilishi : Magawata and Oyelese (2000), Ipinjolu et al. (2004) and Aliyu and Falusi (2006). However Magawata and Oyelese (2000) and Ipinjolu et al. (2004) suggested further work on the appropriate mix of spices being used for production of fish kilishi in order to enhance quality.

In view of this and in consideration for value addition, product diversification and reduction of post harvest fish losses, an evaluation of kilishi processed Heterotis niloticus using 3 different slurry formulations was conducted. H. niloticus was chosen for kilishi preparation because it is available locally (but has less market value) and have higher flesh to bone ratio (Achionye–Nzeh et al., 2002) The aim of the present study were to determine the nutrient contents of the ingredients and fish samples and to derive appropriate slurry formulation for preparation of kilishi of the fish species.

2. Materials and methods

2.1. Fish samples

Thirty six freshly caught samples of Bony tongue (Heterotis niloticus) with average weight of 306.20±18.33 g were obtained from Kware Lake in Sokoto State, Nigeria in April, 2011. These were transported to the Forestry and Fisheries Laboratory of the Usmanu Danfodiyo University, Sokoto, where they were weighed, washed, descaled, degutted and deboned according to the method of Magawata and Oyelese (2000) and then sliced while still in their fresh form.

2.2. Slurry formulation

Three different combinations of ingredients and spices were prepared using that of Ipinjolu et al. (2004) as a reference point. This formulation was too thick due to high proportion of the principal ingredient. The present formulations were varied with lower concentrations of groundnut dough and increase in proportion of spices to have high, medium and low proportion of ingredient to spice mixtures (F1, F2 and F3) in the ratio of 1.3:1.0, 1.0:1.2 and 1.0:1.8 respectively as shown in Table 1. Each formulation was used on the 36 fish samples used for the study. The three formulations (F1, F2 and F3) constituted the treatments of the experiment and each was replicated three times in a Completely Randomized Design (CRD) with a view to coming up with the best slurry formulation.

2.3. Fish kilishi processing stages

The stages followed in the fish Kilishi processing were as described by Magawata and Oyelese (2000) summarised in Figure 1.

2.4. Quality assessment of the fish kilishi

2.4.1. Proximate analyses

The proximate composition of the ingredients and spices used for slurry formulation, the samples of fresh (wet) fish and fresh kilishi of Heterotis niloticus were analysed according to AOAC (1995) procedures. Moisture

content was quantified after oven drying at 1050C for 24 hrs, protein content was determined using the Kjeldahl method. Fat contents was determined using the Soxhlet Extraction Method, Ash content was determined by placing 2.0 g of the sample in the Muffle furnace at 5000C for 3 hrs, while nitrogen free extracts were obtained by difference.
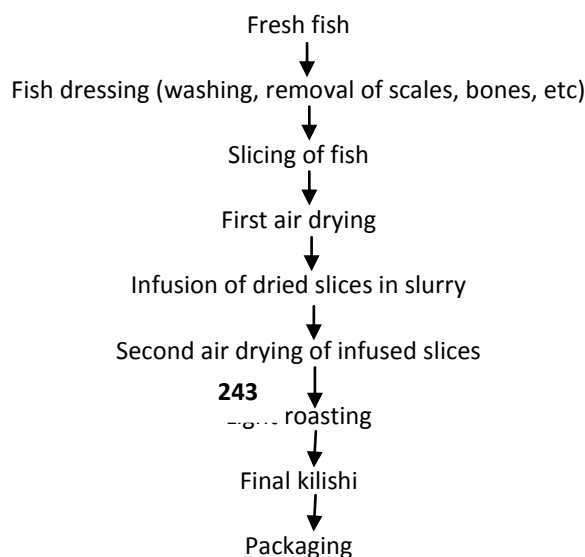
Fresh fish
↓
Fish dressing (washing, removal of scales, bones, etc)
↓
Slicing of fish
↓
First air drying
↓
Infusion of dried slices in slurry
↓
Second air drying of infused slices
↓
243
roasting
↓
Final kilishi
↓
Packaging

Fig. 2.1. Flow chart summarizing stages/processes followed in kilishi production (Magawata and Oyelese (2000).

2.4.2. Organoleptic assessment

Samples from the freshly prepared kilishi products were weekly subjected to sensory evaluation for 3 weeks to obtain data for the selection of the best out of the three formulations. A 12-member taste panel consisting of staff, students and other members of the Usmanu Danfodiyo University Community was constituted. The samples were blind coded to reduce bias. Organoleptic parameters assessed included texture, taste, flavour and general acceptability in accordance with Post et al. (1991). The panelists judged the characteristics on a 7-point hedonic scale ranging from highly acceptable, very acceptable, slightly acceptable, acceptable, slightly unacceptable, and very unacceptable to highly unacceptable. Pencils, tissue paper and water were provided to the judges.

2.4.3. Data analyses

The data obtained were subjected to Analysis of Variance (ANOVA) using S.P.S.S. version 16.0 (2007) computer packages. Duncan Multiple Range Test (DMRT) was further used to separate treatment means where there was significant difference. Tables and figures (graphs) were also used to illustrate results as appropriate.

3. Results and Discussion

3.1. Nutrient contents of fish samples and ingredients

The results of the proximate compositions of ingredients and spices (Table 2) shows that the highest value of all the constituents determined was the nitrogen free extracts. This ranged from 19.49±0.95% in onions to 82.03±0.32% in candle wood stem. This indicates that most of the spices had very small quantity of protein and fat and high proportion of carbohydrate. This is in line with Nwinuka et al. (2005) who noted that the highest value of all the parameters determined was the total carbohydrate composition (76.71%) in onion. These may be why these samples are used as mere spices and not as sources of nutrients (Farrel, 1985). The proximate composition of defatted groundnut dough shows that it is a good source of protein (20.60±0.20%) and fat (15.00±0.29%) while salt, magi and curry powder are good sources of ash thereby making kilishi nutrient rich.

Proximate composition of the fresh H. niloticus fish (Table 3) was within the reported limits. Chukwu and Shaba (2009) reported similar moisture content in raw catfish as 71.85±0.07%. The protein content (18.08±0.09%) observed in the fresh H. niloticus, although lower than the values reported by Chukwu and Shaba (2009) but is still

within the reported values by Magawata and Oyelese (1999). Clement and Lovelli (1994) stressed that the nutritional component of fresh fish influenced post harvest processing and affect shelf life of the fish. The results also agreed with those obtained by Ahmed et al. (2010). Information concerning the chemical composition of freshwater fishes is of concern to fish technologist/processor who is interested in developing them into high–protein foods while ensuring the finest quality flavour, texture, taste and safety.

3.2. Selection of more appropriate mix of ingredients and spices

From the results of proximate composition of kilishi of H. niloticus (Table 4) prepared with three different formulations (F1, F2 and F3), F3 was considered more appropriate spice mix for kilishi production of the fish species because it recorded significantly ($p<0.05$) higher protein content ($54.22\pm0.01\%$) and lower lipid content ($8.00\pm0.00\%$). The lower protein content recorded in the other two formulations (F1 and F2) must have been as a result of the higher proportion of groundnut dough used in the mixture; Doe and Olley (1983) noted that heating (smoking) resulted in concentration of nutrients like crude protein. Mohammed et al. (2010) ascertained that it is important to assess the contents of proteins, fat and moisture in fish tissues as they could affect the post harvest processing and storage of the fish. The nutritional quality of fish depends largely on the quantity and quality of its crude protein (Oni, 2002). The lower lipid content observed in the F3 could be attributed to lower concentration of groundnut dough. High lipid in fish could affect the storage quality because it is the hydrolysis of the lipid that leads to rancidity, which is one of the causes of fish spoilage. Though kilishi prepared with F3 formulation recorded the highest moisture content ($9.93\pm0.07\%$), this moisture level was still below the limit beyond which spoilage can occur. Daramola et al. (2007) stated that moisture content of 12 % is the level beyond that can support growth of microorganisms.

Table 1
Proportion of ingredients and spices used for slurry preparation.

Ingredients/spices (Common name) (Common name)	Scientific name	Reference formulation (F0)		Treatment (Proportion %)		
		Weight (g)	Proportion (%)	F1 (High)	F2 (Medium	F3 (Low)
Defatted groundnut dough		1980	66.0	56.0	46.00	36.00
Onion	Allium cepa	420	14.0	18.11	22.24	26.36
Ginger	Zingiber officinale	180	6.0	7.76	9.54	11.30
Dried (hot) pepper	Capsicum frutescens	90	3.0	3.88	4.76	5.65
Cloves	Eugenia caryophyllata	60	2.0	2.59	3.18	3.76
Candle wood	Fagara zanthoxyloides	60	2.0	2.59	3.18	3.76
Black pepper	Piper guinensis	90	3.0	3.88	4.76	5.65
Salt	Sodium chloride	30	1.0	1.30	1.58	1.88
Curry powder		30	1.0	1.30	1.58	1.88
Magi cube		60	2.0	2.59	3.18	3.76
Ratio (Groundnut				1.3:1.0	1.0:1.2	1.0:1.8
Total			100	100	100	100

The results of sensory evaluation as depicted in Table 5 revealed that formulation 3 was the most preferred by the panelist for taste (5.94 ± 0.21), flavour (5.77 ± 0.20) and general acceptability(5.50 ± 0.22), of kilishi of H. niloticus. The lower concentration of the groundnut dough in the F3 formulation which enabled the 'fishy´ taste to be more prominent must have influenced the panelist´s decision. The overall result of merit analysis conducted indicated that kilishi prepared with F3 was organoleptically more acceptable which suggests that the value addition had transformed the species product in the eyes of consumers who hitherto could have rejected it if it were to be fresh.

Table 2
Proximate composition of ingredients and spices.

Ingredients and Spices	Moisture (%)	Ash (%)	Lipid (%)	Fibre (%)	Protein (%)	NFE (%)
Defatted groundnut dough	18.83± 0.00	3.50 ± 0.00	15.00 ± 0.29	0.04 ± 0.17	20.60± 0.20	42.19 ± 0.34
Onion	60.67± 1.00	8.56 ± 1.00	0.83 ± 0.02	Trace	10.45 ± 1.05	19.49 ± 0.95
Ginger	8.47± 0.06	6.67 ± 0.29	7.33 ± 0.29	1.50 ± 0.00	4.83 ± 0.15	71.20 ± 0.62
Chilli pepper	1.67 ± 0.28	9.33 ± 0.29	12.50 ± 0.00	2.50 ± 0.00	4.63 ± 0.15	69.37 ± 0.42
Cloves	27.01± 0.12	10.50 ± 0.06	11.50 ± 0.00	1.50 ± 0.00	3.73 ± 0.12	45.76 ± 0.21
Candle wood	4.50 ± 0.00	6.50 ± 0.00	3.50 ± 0.00	1.83 ± 0.29	2.13 ± 0.06	82.03 ± 0.32
Black pepper	17.83± 0.17	11.00 ± 0.00	13.86 ± 0.29	3.17 ± 0.29	6.50 ± 0.12	47.47 ± 0.36
Salt	Trace	98.47 ± 1.00	Trace	Trace	0.02 ± 0.01	1.51 ± 0.10
Curry powder	1.67 ± 0.28	15.50 ± 0.29	7.50 ± 0.00	1.07 ± 0.00	5.87 ± 0.12	68.57 ± 0.12
Maggi cubes	1.50 ± 0.00	71.50 ± 0.10	5.00 ± 0.00	0.17 ± 0.12	3.87 ± 0.15	17.9 ± 0.15

Table 3
Proximate composition of the fresh experimental fish.

Species	Composition (%)						
	Dry matter	Moisture	Ash	Lipids	Fibre	Protein	NFE
H. niloticus	30.64±0.02	69.36±0.07	3.00±0.00	1.47±0.23	0.50±0.00	18.08±0.09	7.59±0.04

Table 4
Proximate composition of kilishi of H. niloticus.

Formulation	Moisture (%)	Ash (%)	Ether Extract (%)	Fibre (%)	Protein (%)	NFE (%)
1	6.47 ± 0.03 [b]	10.27± 0.07 [a]	14.83 ± 0.20[a]	1.40 ± 0.10 [a]	36.65 ± 0.04[c]	30.39 ± 0.21 [a]
2	2.50 ± 0.00 [c]	8.47 ± 0.03 [b]	13.63 ± 0.09 [b]	1.00 ± 0.00 [b]	43.58 ± 0.01[b]	30.82 ± 0.07 [a]
3	9.93 ± 0.07 [a]	7.47 ± 0.03 [c]	8.00 ± 0.00 [c]	1.07 ± 0.07 [b]	54.22 ± 0.01[a]	9.31 ± 0.03 [b]
SEM	0.043	0.047	0.128	0.069	0.025	0.127

Values are mean ± standard error of 3 replications.
Means in a column with same letter are not significantly different (P>0.05).
SEM = standard error of means.

Table 5
Sensory ratings of kilishi of H. niloticus according to formulations.

Formulation	Organoleptic properties			
	Texture	Taste	Flavour	General acceptability
1	5.75 ± 0.21 a	5.64 ± 0.22 a	5.64 ± 0.20 a	5.22 ± 0.25 a
2	5.83 ± 0.18 a	4.97 ± 0.21 b	5.00 ± 0.24 b	5.06 ± 0.24 a
3	5.25 ± 0.22 a	5.94 ± 0.21 a	5.77± 0.20 a	5.50 ± 0.22 a
SEM	0.202	0.211	0.210	0.234

Values are mean ± standard error of 12 panelists replicated 3 times.
Means in a column with same letter are not significantly different (P>0.05).
SEM = standard error of means.

4. Conclusion

From the findings on the chemical and organoleptic characteristics of the kilishi prepared, the F3 formulation (with a ratio of 1.3:1.0 groundnut dough to spice mixture) was most acceptable. This was based on higher protein content, less fat, lower moisture and higher preference in terms of taste, flavour and general acceptability. It is recommended that the ingredients slurry for fish kilishi production should not be laden with high percentage of groundnut dough so as not to mar the nutrient contents and fishy taste.

References

Achionye–Nzeh, G.C., Omoniyi, O.G., 2002. Lipid composition of the fishes Heterotis niloticus, Brycenus nurse, Gnathonemus cyprinoides and Sarotherodon galilaeus from a small lake in Nigeria. Int. J. Trop. Biol. Conservat., 50 (1), 253—257.

Ahmed, E., Ali M.E., Ali, H.A., 2010. Quality changes of salted Kass (Hydrocynus forskalii) during storage at ambient temperature (37±10C). Pakistan. J. Nutrit., 9 (9), 877—881.

Aliyu, M., Falusi, F., 2006. Production and microbiological quality assessment of a locally processed marinated (kilishi) fish product. J. Susta. Trop. Agr. Res., 18, 13–16.

A.O.A.C., 1995. Official Methods of Analysis. 15th edition. Associ. Offic. Analyt. Chem.

Chukwu, O., Shaba, I.M., 2009. Effects of drying methods on proximate compositions of Catfish (Clarias gariepinus). World J. Agr. Sci., 5(1), 114–116.

Clement, S., Lovelli, R.T., 1994. Comparison of processing yield and nutrient composition of Nile tilapia and Catfish. Aquaculture J., 119, 299 – 310.

Clucas, I.J., Ward, A.R., 1996. Post Harvest Fisheries Development: A Guide to Handling, Preservation, Processing and Quality. Chatham Maritime, Kent ME4 4TB, United Kingdom.

Daramola, J.A., Fasakin, E.A., Adeparusi, E.O., 2007. Changes in physicochemical and sensory characteristics of smoke dried fish species stored at ambient temperature. Afr. J. Food. Agr. Nutr. Dev., 7(6), 25–30.

Doe, P.E., Olley., 1983. Drying and dried fish products. In: The production and storage of dried fish, FAO Fish Report., 279, 56–62.

Farrel, K.T. 1985. Spices, Condiments and Seasonings. AVI Westport, Conn., USA, 102p.

Igene, J.O., Farouk, M.M., Akanbi, C.T., 1989. Preliminary studies on the quality and drying characteristics of kilishi. Nigeria Food J., (1), 29-37.

Ikeme, A.I., 1988. Control of lipid oxidation in smoked Mackerel by hot water onion extract. Proceedings of the FAO expert consultation on fish technology in Africa, FAO Fisheries Report, Cote d' Ivoire., 25-28th April, Rome. No 400

Ipinjolu, J.K., Olopade, J.O., Shehu, R.A., Hassan, W.A., 2004. Assessment of consumer acceptance of kilishi of African Carp (Labeo coubie, RUEPPELL) and Elephant Snout (Hyperopisus bebe occidentalis, GUENTHER). In: P.A. Araoye (Ed), Proceedings of the 19th Annual Conference of the Fisheries Society of Nigeria (FISON), 29th November – 3rd December, Ilorin, Kwara State., p 377-381.

Magawata, I., Oyelese, O.A., 1999. Fish kilishi: An alternative means of reducing post harvest losses and improving the quality of processed fish. In: Otubusin S.O., Ezeri G.N.O., Ugwumba O.A., Ugwumba A.A.A. (Eds). Sustainable Utilization of Aquatic Resources, Proc. Nigerian Assoc. Aquat. sci.

Magawata, I., Oyelese, O.A., 2000. Quality changes and shelf life of processed Clarias gariepinus and Bagrus bayad. J. Agr. Env., 1 (i), 101-110

Mohammed, H.A., Almaqbaly, R.A., Mansur, H.M., 2010. Proximate composition, amino acid and mineral contents of five commercial Nile fishes in Sudan. Afr. J. Food Sci., 4 (10), 650–654, http://www.academicjournals.or/ajfs

Nwinuka, N.M., Ibeh, G.O., Ekeke, G.I., 2005. Proximate composition and levels of some toxicants in four commonly consumed spices. J. Appl. Sci. Env. Manag., 9(1), 150–155

Oni, M.D., 2002. Biochemical and Nutritional Evaluation of Six Freshwater Fish Species in North West Nigeria. M. Sc. Dissertation, Usmanu Danfodiyo University. Sokoto. Nigeria., 94.

Post, L.M., Mackie, D.A., Butler, G., 1991. Laboratory Methods for Sensory Analysis of Food. Res. Branch Agr. Publicatiion, Ottawa, Canada., 90 p.

Pratt, D.E., Watts B.M., 1964. Antioxidant activity of vegetable extracts 1 Flavones Aglycones. J. Food sci., 29 (27), 23–25.

S.P.S.S. 16.0 (2007). Statistical Package for Social Sciences. http://www.winwrap.com/.

Vavidel, E., 2008. Post Harvest Technology: Introduction. TNAU Agritech Portal, India., 3 p.