

EFFECT OF SALT AND LIME JUICE ON PROXIMATE COMPOSITION AND SENSORY CHARACTERISTICS OF SMOKED AFRICAN CATFISH (*Clarias Gariepinus*)

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ABSTRACT

Fresh African catfish (*Clarias gariepinus*) were subjected to different concentrations of table salt (sodium chloride) and lime juice and smoked in a smoking kiln before evaluation for proximate composition and organoleptic characteristics. The experimental treatments are the control, 0g salt and 0ml lime juice-T1, 50g salt-T2, 100ml lime juice-T3, 50g salt and 50ml lime juice-T4, 50g salt and 75ml lime juice-T5 as well as 50g salt and 100ml lime-T6. Fish of average weight 5kg were randomly assigned to each treatment and the control. The fish were soaked in the respective treatment solutions for 1 hour after which they were gutted, washed and smoked for 15 hours in a smoking kiln. After smoking, the fish were stored in air-free netted sieves and placed on a shelf for 12 hours before they were packed in see through nylons. Samples were therefore subjected to proximate and sensory analysis. Results showed that crude protein of smoked *Clarias gariepinus* were better in lime juice (70.18 ± 0.94), salt and lime juice combination treated samples (70.38 ± 0.94 , 72.69 ± 0.94 , 72.93 ± 0.94) and increased with increasing level of lime juice and salt combinations compared to the control (68.39 ± 0.94) and the salt treated sample (67.08 ± 0.94). The treatments containing salt and lime juice in varying combinations also reduced the moisture content especially in T5 and T6 (6.84 ± 0.29 , 6.78 ± 0.29) respectively. There was no significant difference in the sensory assessment in terms of appearance, colour, taste, texture, aroma and general acceptability. These results indicated that using lime juice and salt combination may be useful in improving the nutritive value, shelf life and consumer acceptability of smoked *Clarias gariepinus*.

Keywords: Catfish, Lime juice, Salt, Proximate composition, Organoleptic characteristics.

INTRODUCTION

Clarias gariepinus is a very important freshwater fish in Nigeria as it accounts for about 80% of aquaculture production (FDF, 2008). It has enjoyed wide acceptability in most parts of the country because of its unique taste, flavour and good texture. It is widely distributed, extensively cultivated in ponds but under-priced (Kumolu-Johnson *et al.*, 2010). However, catfish like any other fish species, could result in significant economic loss due to its perishable nature, if adequate preservation techniques are not adopted (Clucas and Ward, 1996). Fish and fisheries products are among the most perishable commodities worldwide mainly due to microbial spoilage. About one-third of the world's food production is lost annually as a result of microbial

spoilage (Omojowo *et al.*, 2010). This may render it unacceptable and unfit for human consumption. Proper preservation starts the moment it is harvested until it reaches the consumer's table (Oluborode *et al.*, 2010). Due to susceptibility of fish to chemical, microbial and physical deterioration, various preservation techniques are put in place to check spoilage (Eyo, 1992). Processing of fish either through smoking or drying are widely used in fish preservation in the process, moisture content present in the fish is extracted through heating, thus inhibiting the action of micro-organisms and prolong shelf life (Clucas and Ward, 1996; Oyeleye, 2003; Amoo *et al.*, 2007). Fish smoking is a traditional method of processing globally, it accounts for about 3% of the world's catch and

also increases the shelf-life (Olowoniyan *et al.*, 1998; Gupta and Gupta, 2006). The flesh of smoked fish is delicate, succulent, delicious and can be readily consumed without further processing (Olowoniyan *et al.*, 1998; Eyo, 2001). The objectives of this study were to evaluate the effect of different combinations of salt and lime juice on nutritional qualities and sensory characteristics of smoked African catfish, *Clarias gariepinus*.

MATERIALS AND METHODS

Preparation of lime juice

Fresh limes were purchased from a local market in Ogbomoso after which they were washed, cleaned, cut and squeezed to obtain the lime juice. The juice was sieved and then poured into a clean container until it was ready for use.

Preparation of fish

A total of 30kg of *Clarias gariepinus* were obtained from the earthen production pond of Bioresources Development Centre of the National Biotechnology Development Agency, Ogbomoso, Oyo State. 5kg of the fish were weighed into each of the already prepared treatment solutions containing T2-50g salt; T3-100ml lime juice, T4-50g salt, 50ml lime juice; T5-50g salt, 75ml lime juice and T6-50g salt, 100ml lime juice respectively except T1-0g salt, 0ml lime juice (control) and left for 1 hour.

Smoking process

After soaking the fish in the respective treatment solutions for 1 hour, the fish were gutted and washed thoroughly with clean water and the samples were arranged on galvanized trays/racks and put in the smoking kiln. Smoking of the fishes lasted for 15 hours. The temperature in the smoking chamber was manually regulated using a thermometer to make sure it does not exceed 70°C. The smoke was produced by the burning of charcoal. After smoking, the products were allowed to cool in netted plastic sieves for 12 hours after which the fish were packed in transparent polyethylene bags and sealed to reduce microbial infestation before they were taken for analysis.

Determination of proximate composition

Samples were analyzed chemically according to the official methods of analysis described by the Association of Official Analytical Chemist (A.O.A.C., 18th Edition, 2005). The crude protein in the sample were determined by the routine semi-micro Kjeldahl, procedure/technique. This consists of three techniques of analysis namely Digestion, Distillation and Titration. The value of nitrogen obtained was then multiplied by 6.25 to get the crude protein value. Moisture content of the samples were determined by the method in which 2 g of the fish samples were oven-dried at 110 ± 1°C for 24 h to a constant weight. Loss in weight is equal to the moisture content of the original sample. The ash content was determined by heating the samples to a temperature of 550°C, the residue is equivalent to the ash content. The fat content was determined by extraction with petroleum ether by Soxhlet's method.

Sensory analysis

Sensory Evaluation was carried out on the fish samples by a 30 member panel drawn from staff of the BIODC centre. They were instructed on the parameters such as appearance, colour, taste, texture, aroma and acceptability to test using a nine point hedonistic scale. The scales of preference were ranked 1 – 9 which translates to 1-Like Extremely, 2-Like Very Much, 3-Like Moderately, 4-Like Slightly, 5-Neither Like Nor Dislike, 6-Dislike Slightly, 7-Dislike Moderately, 8-Dislike Very Much, 9-Dislike Extremely. The results were recorded inside the questionnaire given to them.

Statistical analysis

Completely Randomised Design (CRD) was adopted in carrying out the experiment. Data for proximate composition were presented as mean ± standard error. The data collected for sensory characteristics were subjected to a one way ANOVA (Analysis of variance) to determine the significant differences between the samples using Statistical Package for Social Science SPSS 17.0 for windows.

RESULTS AND DISCUSSION

Table 1 presents the percentage proximate composition of the treated smoked *Clarias gariepinus* fish. The highest crude protein were recorded in T5 and T6 (72.69 ± 0.94 , 72.93 ± 0.94) while the lowest was obtained in T2 (67.08 ± 0.94), the moisture content for T5 and T6 (6.84 ± 0.29 ; 6.78 ± 0.29) were the lowest which was in agreement with the work of Oluborode *et. al.* (2013) that the higher protein content of samples T5 and T6 respectively was as a result of decrease in moisture contents of the products. Besides, the moisture content of the dried catfish which is of great importance in storage is still at safe level of 7.3% which is in between the recommended safe moisture content of dried fish (6 to 8%) (Olayemi *et.al.* 2011). The results for the fat content followed similar pattern as were the values obtained for the crude protein in which T4, T5 and T6 present higher values than the other treatment samples. However, the ash content in T2 was higher than in other treatments which can understandably be attributed to the presence of sodium chloridethat in itself is a mineral salt. Though there were differences in the treatment samples but they were not statistically significant ($P > 0.05$).

The result for the sensory characteristics such as appearance, colour, taste, texture, aroma and general acceptability of the treatment samples is as presented in table 2. There was no significant difference in the tested parameters. Meanwhile, the scores for colour in T1 and T4 were more attractive than in other treatments so also are the taste and texture that got more appeal than other treatments. The aroma and general appearance in all samples were very good very close in values. Generally, the study showed that most of the properties as related in the analysis were organoleptically important.

CONCLUSION

This study demonstrated the effect of smoking, salt and lime juice treatment on proximate composition and organoleptic assessment of smoked *C. gariepinus*. The combination of salt and lime in the proportions as used in treatment samples T4, T5

and T6 can present quality products in terms of the increase in crude protein thereby improving the nutritive value of the product. Using lime juice and salt mixture may be useful in improving the nutritive value and consumer acceptability of smoked *C. gariepinus*.

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Table 1: Proximate composition of experimental *Clarias gariepinus* catfish.

Parameters	T1	T2	T3	T4	T5	T6	SEM
Crude Protein (%)	68.39	67.08	70.18	70.38	72.69	72.93	±0.94
Crude Fat (%)	11.54	11.76	11.93	12.25	12.23	12.12	±0.12
Crude Fibre (%)	0.00	0.00	0.00	0.00	0.00	0.00	±0.00
Ash (%)	10.86	11.21	9.94	9.84	8.22	8.11	±0.53
Moisture content (%)	8.36	8.44	7.54	7.32	6.84	6.78	±0.29
Carbohydrate (%)	0.83	1.52	0.42	0.23	0.03	0.07	±0.23

P>0.05=there was no significant difference

Table 2: Sensory properties of experimental *Clarias gariepinus* catfish

Parameters	T1	T2	T3	T4	T5	T6	SIG. TEST
APPEARANCE	2.17±0.26	2.55±0.29	2.63±0.28	2.25±0.23	2.29±0.24	2.61±0.25	N.S
COLOUR	1.96±0.15	2.46±0.19	2.42±0.23	1.76±0.18	2.14±0.25	2.05±0.21	N.S
TASTE	2.00±0.24	2.61±0.25	2.42±0.20	2.61±0.31	2.50±0.31	2.52±0.39	N.S
TEXTURE	2.00±0.25	2.38±0.21	2.72±0.37	2.32±0.24	2.52±0.20	2.67±0.28	N.S
AROMA	2.24±0.38	2.55±0.24	2.45±0.24	2.40±0.28	3.00±0.28	2.90±0.34	N.S
ACCEPTABILITY	2.29±0.31	2.55±0.25	2.45±0.23	2.90±0.24	3.32±0.33	3.15±0.41	N.S

P>0.05= there was no significant difference