

## ORGANOLEPTIC, BIOCHEMICAL, AND MICROBIAL ANALYSES OF *BRYCINUS NURSE* PROCESSED USING DIFFERENT SOURCES OF ENERGY

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### ABSTRACT

Organoleptic, biochemical, and microbial analyses of smoked dried *Brycinus nurse* stored at room temperature for 28 days were investigated. A modified drum-type smoking kiln (SABAMY) was used for smoking the fish. One hundred and fifty (150) *B. nurse* samples were obtained from Gubi dam, Ganjuwa, Bauchi State. The fish were divided and processed using three different methods: Smoke-dried with firewood (A), smoke-dried with charcoal (B), and Smoke-dried with sawdust (C). Non-parametric ANOVA analysis revealed that there were significant differences ( $x \geq 3$ ) in the sensory parameters (taste, colour, odour, and texture) assessed. The fish samples from treatment C were better in terms of taste, colour, odour, and texture. The ANOVA of the proximate compositions of the processed fish within the storage period showed that samples from treatment A were significantly different ( $P > 0.05$ ) in all the parameters (moisture, ash, crude protein, and lipid) except in fibre, where there was no significant difference. Bacterial count within the first 7 days and the last 7 days for all the methods were within the acceptable limit of  $1.0 \times 10^6$  cfu/g. Further studies should be conducted on using SABAMY smoking kiln in processing other fish species, and the comparative efficiency of SABAMY with other smoking kilns.

**Key Words:** Microbial loads, moisture content, crude protein, ash, crude fibre.

### INTRODUCTION

Fish plays a vital role in feeding the world's population and contributing significantly to the dietary protein of millions of the populace (Ayo-Olusi, 2014). Fish is a highly perishable food. It has been estimated that approximately twenty-five percent (25%) of fish caught in Nigeria is lost through microbial, enzymatic, and oxidative spoilage before consumption (FAO, 1982). It is therefore important to reduce waste and losses of fish to the lowest level. Invasion of fish tissue by bacteria is very easy in fish that is not gutted. Bacterial spoilage of fish set in immediately after rigor mortis. Therefore, delaying rigor mortis would extend the keeping time of fish (Eyo, 2001). Saliu (2008), observed that fish spoilage in Nigeria is influenced to a large extent by high ambient temperatures, considerable distances of landing ports to points of utilization, and inadequate infrastructure for post-harvest landing and processing. There is a need for readily available energy in both wet and dry seasons for effective fish processing and preservation. Organoleptic assessment is commonly used for the sense of taste, colour, odour, and texture (Eyo, 2001). Kumolu – Johnson *et al.* (2010), observed that fish smoking concentrates nutrients especially crude protein and fat. They reported that processing methods, quality of feeds given to the fish, and storage are some of the factors responsible for differences in proximate compositions of smoked fish.

Sun-drying and the roasting effects of smoking increase the lipid content of fish (Abdulkarim *et al.*, 2017). Traditional smoking kilns used in Nigeria vary from simple pit to the drum or mud-walled type which may be circular or

rectangular in shape. According to Eyo (1997), modern smoking kilns which have been tested in Nigeria's inland fisheries include Modified Altona or Watanabe Smoking Kiln (WSK), Altona Smoking Kiln (ASK), Chorkor oven, and Kainji Gas Kiln (KGK). *B. nurse* (Nurse tetra) is a fish species liked by its consumers (Abdulkarim, 2005). There is a paucity of research on the processing and preservation of *B. nurse*. Therefore, this research aimed to evaluate the effects of smoking *B. nurse* using SABAMY smoking kiln by utilising three different sources of energy.

### MATERIALS AND METHODS

#### Fish Sampling

One hundred and fifty (150) *B. nurse* were collected from commercial catches in Gubi dam, Ganjuwa Local Government Area, Bauchi State, Nigeria. The fish samples were preserved with ice in a chest during transportation from the site to the laboratory before divided into three groups of fifty (50) fish each. Each group was processed using one of the processing methods: smoke-dried with firewood (A), smoke-dried with charcoal (B), and smoke-dried with sawdust (C) respectively.

#### Fish Processing and Preservation

##### Newly Fabricated Smoking Kiln (SABAMY)

SABAMY kiln, a modified drum-type of the kiln was fabricated in the course of this research, the kiln was named after the researchers (SALISU Buba, Abdulkarim, Mancha, and Yusuf forming the acronym SABAMY). It was designed to accommodate three different sources of energy (firewood, charcoal, and sawdust), for smoking and roasting: depending on what type of energy source

is readily available and affordable to the processor (Plate 1).

**Smoking Process**

The fish samples were gutted and washed thoroughly with clean water, salted, and placed on racks in a chamber of the SABAMY kiln. Smoking of the fish was carried out for two hours, from the smoke generated by the combustion of firewood, charcoal, and sawdust from different kinds of wood adopted after Salan *et al.* (2006). The processed fish after getting dried were packed in different cartons (based on the treatment) to prevent microbial attack and stored at room temperature between 24°C and 27°C for 28 days in the Animal Production Laboratory of Abubakar Tafawa Balewa University, Bauchi, Bauchi State, Nigeria.



Plate 1: SABAMY Smoking Kiln

**Microbial Analysis**

The total coliform count of the bacteria was determined according to the method used by Fawole and Oso (1995).

**Proximate Analysis**

The determination of the crude protein, moisture, ash, and fat contents of the smoke-dried *B. nurse* was carried out based on the method adopted after AOAC (1995).

**Organoleptic Analyses**

Sensory evaluation of the smoke-dried *B. nurse* using the three energy sources (A, B, and C) was carried out by ten trained panelists following the method adopted after Poste *et al.* (1991) and Abdulkarim and Sadiqu (2015). Sensory evaluation was carried out weekly throughout the 28 days storage period using a hedonic scale (Excellent = 5, Very Good = 4, Good = 3, Fair = 2, and Bad = 1).

**Statistical Analysis**

The data collected using the hedonic scale were assessed using the Likert scale as described by Joshi *et al.* (2015). Data obtained on organoleptic parameters (taste, colour, odour, and texture) were processed using a non-parametric analysis of variance (Kruskal Wallis). Parametric Analysis of Variance (ANOVA) was used to determine the significant differences among the proximate composition parameters (crude protein, moisture, ash, and fat contents) according to Ogbeibu (2005).

**RESULTS**

Table 1 shows the weekly assessment of the sensory evaluation by the 10 panelists scored based on a scale of 1 – 5. The scores ranged from 3.2 to 4.0 and their results showed significant differences ( $x \geq 3.0$ ) over a period of 28 days.

**Table 1: Weekly Mean Organoleptic Scores for Fish from each Treatment**

Range of days	Mean Score			Remark
	Treatment A	Treatment B	Treatment C	
0-7	3.7	4.0	3.7	Significant*
14	3.9	3.7	3.9	Significant*
14-21	3.9	3.3	3.9	Significant*
21-28	3.4	3.2	3.9	Significant*

Keys: A = Smoke-dried with firewood, B = Smoke-dried with charcoal, C = Smoke-dried with sawdust.

\*Mean score ( $x \geq 3.0$ ) implied significant on a scale of 1 – 5 for all the organoleptic parameters.

Table 2 shows sensory evaluation of processed *B. nurse* using a different form of energy. Treatment C was significantly ( $P < 0.05$ ) better than A and B in all the sensory parameters tested.

**Table 2: Sensory Evaluation of Processed *B. nurse* Using Different Form of Energy**

Parameters	Treatments		
	A	B	C
Taste	32.90 <sup>b</sup>	31.60 <sup>c</sup>	35.50 <sup>a</sup>
Colour	33.64 <sup>b</sup>	31.33 <sup>c</sup>	35.02 <sup>a</sup>
Odour	33.56 <sup>b</sup>	31.28 <sup>c</sup>	35.16 <sup>a</sup>
Texture	34.63 <sup>a</sup>	30.73 <sup>b</sup>	34.63 <sup>a</sup>

Key: Average Scores of parameters bearing different alphabetic superscripts within rows significantly differ ( $P < 0.05$ ).

Table 3 shows the proximate composition of smoke-dried *B. nurse* processed using the three forms of energy. There were significant differences ( $P < 0.05$ ) between the treatments except in fibre contents.

**Table 3: Proximate Composition of Smoke-dried *B. nurse* using the Three Form of Energy**

Treatments	Moisture (%)	Ash (%)	Crude Protein(%)	Lipid (%)	Fibre (%)
A	89.37 <sup>a</sup>	14.12 <sup>a</sup>	62.40 <sup>a</sup>	10.07 <sup>a</sup>	0.53 <sup>NS</sup>
B	88.42 <sup>b</sup>	13.94 <sup>b</sup>	61.05 <sup>b</sup>	9.69 <sup>b</sup>	0.48 <sup>NS</sup>
C	80.26 <sup>c</sup>	13.92 <sup>b</sup>	60.86 <sup>b</sup>	9.46 <sup>c</sup>	0.51 <sup>NS</sup>

Key: Means bearing different alphabetic superscripts within the column differ significantly (P < 0.05).

Table 4 shows the initial and final bacterial count of smoked-dried *B. nurse* stored for four weeks under room temperature (24 – 27°C). The Initial and final bacterial counts ranged from 3.8× 10<sup>5</sup> to 7.7 ×10<sup>5</sup> cfu/g and 8.1 x 10<sup>5</sup> to 9.5 x 10<sup>5</sup>cfu/g respectively.

**Table 4: Initial and Final Bacterial Counts of Smoked - Dried *B. nurse* Stored for Four Weeks under**

**Room Temperature (24 – 27°C)**

Treatments	Initial Mean Count at First Week (cfu/g)	Final Mean Count at fourth Week (cfu/g)
A	7.7 ×10 <sup>5</sup>	9.5 x 10 <sup>5</sup>
B	3.8× 10 <sup>5</sup>	8.1 x 10 <sup>5</sup>
C	5.1× 10 <sup>5</sup>	9.3x 10 <sup>5</sup>

Where: A = Smoked with firewood; B = Smoked with charcoal; C = Smoked with sawdust

## DISCUSSION

The organoleptic parameters (taste, colour, odour, and texture) of smoked-dried *B. nurse* using three forms of energy were determined, the differences in the sensory parameters (Table 1) determined over the storage period of 28days were significant (x ≥ 3) based on Likert scale. Table 2 revealed that *B. nurse* smoked with sawdust (C) had the highest mean value of 35.08 and differed significantly (P<0.05) while *B. nurse* smoked with charcoals (B) recorded the lowest mean value of 31.24. This was in agreement with the findings of Bilgin *et al.* (2008), that, fish species smoked with sawdust were preferred by the panelists. Sensory qualities examined indicated that smoked *B. nurse* scored above average, this implied that the processed fish was acceptable after smoking, up to 28 days of storage.

The mean proximate compositions of smoke-dried *B. nurse* (Table 3), showed that samples from treatment A were significantly higher (P < 0.05) than the other treatments except for crude fibre contents which were not significantly different (P > 0.05). This was in agreement with the findings of Salan *et al.* (2006); Kumolu-Johnson andNdimele (2001), who commented that spoilage of fish resulting from the action of enzymes and bacteria can be slowed down by the addition of salt as well as, reduction in moisture content of theprocessed fish species by sun-drying or smoking. The results for the proximate composition of the smoked fish were similar to reports of previousstudies by Goulas and Kontominas (2005) and Bilgin *et al.* (2008).

For the microbial counts, in the first and last weeks of the smoked-dried *B. nurse* (Table 4), during storage, the highest bacterial counts of 9.5 x10<sup>5</sup>cfu/g were recorded in *B. nurse* smoked with firewood (A), the sample with the highest proximate composition, hence, attracted more bacteria load. While *B. nurse* smoked with charcoal (B) had the least bacterial count of 8.1 x 10<sup>5</sup>cfu/g. These values fell within the acceptable limit, 1.0 x 10<sup>6</sup>cfu/g. There was an increase in the microbial load during the storage period in the three samples from the three treatments probably due to an increase in the moisture contents, this agreed with the studies of Dolakolu (2004) and Bilgin *et al.* (2008). Hood *et al.* (1983), also reported that microbial load increases with duration of storage and temperature.

## CONCLUSION

The samples of *B. nurse* smoked with sawdust were better in terms of taste, colour, odour, and texture while *B. nurse* smoked with firewood were better with respect to the proximate compositions using SABAMY kiln. SABAMY smoking kiln can therefore be used for fish processing due to its portability and use of different sources of energy. Further studies should be carried out to determine the quality of other fish species when processed using SABAMY kiln and as well as, compare the efficiency of other smoking kilns with SABAMY smoking kiln.

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