

Chemical, Microbial and Sensory Evaluation of ‘Cake’ Using Fish Protein Concentrate from *Bagrus bayad*

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Abstract

The experiment was conducted to evaluate the sensory attribute, proximate composition, shelf life and microbial load of the ‘cake’ product made using fish protein concentrate from *Bagrus bayad*. Fish samples were collected from Shagari earth Dam landing site and dried at 60°C-70°C temperature for 6-12 hours. The sample was baked after the grinded fish powder is mixed with wheat flour at the percentage of 0%, 10%, 20%, 30% and 40% respectively. The result showed that there was significant difference ($p < 0.05$) in terms of sensory attribute while in the proximate composition, significant difference ($p < 0.05$) was recorded only in crude protein values of the product, with the highest % mean value in crude fibre (75.19) and least in crude protein (12.90). The microbial colony count was low at the initial week, increase subsequently and later reduces as the number of storage days increases. In terms of acceptability, cake with 10% and 20% inclusion rate is more acceptable but in terms of nutritional value, 40% is the best as it’s higher in protein. From the result obtained from this research, treatment II and III are recommended because they were highly acceptable by the panelists in terms of taste, texture, appearance, and odour.

Keywords

Bagrus bayad, Cake, Chemical Composition, Fish, Sensory Evaluation

1. Introduction

Global fish production has grown steadily in the last five decades with food fish supply at an average annual rate of 3.2 percent, outpacing world population growth at 1.6 percent [1]. According to Food and Agricultural Organization (FAO) [2], the contributions of fish and fish products to the Nigeria’s socio-economic wealth are huge when considered against the background of employment creation, income generation, provision of valuable animal protein with easy digestibility and cholesterol-free, rural development and foreign exchange inflow through exploitation of shrimps and smoked fish. However, high incidence of fish losses is recorded as a major impediment to the realization of

government approach towards increasing the contribution of the sector to the overall national economy [3, 10].

Approximately 17 plant species provide 90% of mankind’s food supply of which cereal grains supply the greatest percentage and the world’s four major cereals (wheat, maize, rice, and barley) contribute more tonnage [4]. But all cereal grains have nutritional shortcomings which are apparent upon analysis. They contain no vitamin A except for yellow maize, no vitamin C and vitamin B12. Vitamin A deficiency is a leading cause of xerophthalmia and blindness among children and a major determinant of childhood morbidity [5, 9, 13, 14].

Hence, it was felt that there is need to incorporate a dried form fish protein concentrate (FPC) in a daily carbohydrate food such as ‘cake’, chin-chin, biscuit, fish pie and other

easy-to-eat snacks in an attempt to facilitating fish consumption and alleviate malnutrition among this group of people. This research would assist greatly in enlightening the public about the importance of value-added products especially in increasing the protein level and carbohydrate-based diet. Also, it will help people who do not like eating fish because of its fishy smell to be able to consume and digest the nutrient efficiently without much difficulty by substituting the wheat flour with a little proportion of fish protein concentrate.

2. Materials and Methods

The fish samples were collected from Shagari river landing site, they were humanely killed, de-gutted and thoroughly washed with clean water to remove blood stain and dirt, drained and then oven-dried for Fish Protein Concentrate (FPC). The drying was done at 60°C-70°C temperature for 6-12 hours as stated by Harlan [4], oven-drying temperature of Fish protein powder (FPP) from lizardfish. The dried sample was pounded to powder by using pestle and mortar, fish was further grinded with a manual engine to a very fine powder particle so as it allows thorough mixture of flour and other

ingredients. The sample was baked after the grinded fish powder is mixed with flour at the percentage of 0%, 10%, 20%, 30% and 40% respectively.

Sensory evaluation was undertaken according to Eyo [6] using ten trained panelists. Proximate and microbial property of the product was conducted bi-monthly within the period of six weeks in which the shelf life of the product was also determined.

A completely randomized design (CRD) was used for the experiment. The data collected was subjected to statistical analysis using one-way analysis of variance (ANOVA) and Duncan's multiple range test was used for mean separation. The statistical analysis was conducted using IBM SPSS statistical software version 20.

3. Results and Discussion

The result in table 1 shows no significance difference ($P>0.05$) in all the parameters of proximate composition. However, the result obtained for proximate analysis of the 'cake' product showed that the moisture was between 19.25% to 8.44% which signifies the fluctuation in moisture content of the samples.

Table 1. Proximate composition of the "cake" made from wheat flour and dry fish powder.

Parameters	Treatments					%Mean value
	Control 0%FPC	10%FPC	20%FPC	30%FPC	40%FPC	
Ash	3.74±2.17 ^a	5.88±2.93 ^a	6.55±4.39 ^a	8.19±4.80 ^a	9.27±4.29 ^a	59.87
Moisture	13.69±2.88 ^a	8.44±2.83 ^a	10.63±3.28 ^a	9.50±2.92 ^a	19.25±6.14 ^a	56.16
Crude fiber	1.33±0.29 ^a	1.72±0.26 ^a	1.75±0.87 ^a	2.33±0.29 ^a	1.75±0.87 ^a	75.19
Lipids	20.50±6.72 ^a	16.88±1.93 ^a	19.00±3.74 ^a	16.00±4.20 ^a	19.25±5.72 ^a	21.95
Crude protein	6.01±0.31 ^a	6.56±0.33 ^b	6.47±0.72 ^{ab}	6.69±0.21 ^b	6.90±0.34 ^b	12.90
NFE	54.73±4.44 ^{ab}	60.50±5.51 ^b	55.60±4.19 ^b	57.29±6.22 ^b	43.6±5.71 ^a	27.93

Table 2. Effect of Storage period of the "cake" made using wheat flour and FPC.

Parameters	Storage period				%Mean value
	Day 1	Day 14	Day 28	Day 42	
Moisture	14.50±3.28 ^b	12.70±3.2 ^b	8.85±2.10 ^a	7.20±1.86 ^a	50.34
Ash	3.40±2.27 ^a	3.30±1.15 ^a	8.28±3.29 ^b	10.90±3.20 ^b	69.72
Lipids	23.40±5.19 ^c	13.80±2.08 ^a	16.40±1.08 ^{ab}	19.70±1.15 ^{bc}	41.03
Crude fiber	0.50±0.00 ^a	2.00±0.35 ^b	1.93±0.39 ^b	1.90±0.65 ^b	75.00
Crude protein	6.80±0.36 ^b	6.71±0.36 ^b	6.54±0.36 ^a	6.34±0.49 ^a	6.76
NFE	51.40±4.08 ^a	61.49±2.74 ^b	58.02±3.39 ^a	53.98±4.08 ^a	16.41

The result obtained as shown in table 2 shows that the highest level of moisture was recorded in day one while the lowest level was recorded in the 42nd day, the highest level of ash content was recorded in the 42nd day while the least was recorded in the 14th day, the highest crude lipid was

recorded in day one while the least was recorded in day 14th, the least fibre content was recorded in day one while the highest was recorded in the 14th day. The protein content gradually decreases throughout the storage periods.

Table 3. Microbial count of "cake".

Days	0%FPC	10%FPC	20%FPC	30%FPC	40%FPC
1st	4	9	5	6	4
14	80	72	66	70	78
28	298	252	281	102	186
42	56	43	38	77	64

The result obtained for mean total viable count as presented in table 3 indicated that the microbial count was higher in the first few weeks for all the treatment and later

decreases, while the least microbial count was observed in treatment IV. This showed that the microbial load in the product reduces as the storage days increases.

Table 4. Sensory evaluation of the 'cake' made product.

Parameters	Treatments	Day 1	Day 14	Day 28	Day 42
Taste	Control	5.20±2.35 ^a	8.00±0.00 ^b	7.20±1.03 ^{ab}	7.20±1.03 ^{ab}
	10%	6.40±0.84 ^b	6.80±1.03 ^a	6.40±1.27 ^b	6.40±1.26 ^b
	20%	8.00±0.00 ^c	7.20±1.03 ^{ab}	6.60±1.35 ^{ab}	6.60±1.35 ^{ab}
	30%	7.40±0.97 ^{bc}	6.60±1.65 ^a	7.60±0.84 ^b	7.60±0.84 ^b
	40%	7.20±1.03 ^{bc}	6.20±1.14 ^a	6.40±1.27 ^a	6.40±1.26 ^a
Odour	Control	6.00±0.00 ^a	6.00±0.00 ^a	6.40±1.27 ^b	7.20±1.03 ^{ab}
	10%	5.80±1.48 ^a	5.80±1.48 ^a	6.60±1.35 ^b	6.40±1.26 ^a
	20%	7.40±0.97 ^b	7.40±0.97 ^b	6.80±1.03 ^b	7.60±0.84 ^b
	30%	7.20±1.30 ^b	7.20±1.30 ^b	6.20±0.63 ^b	7.00±1.05 ^{ab}
	40%	7.00±1.05 ^b	7.00±1.05 ^b	4.90±1.27 ^a	6.70±1.49 ^{ab}
Texture	Control	7.80±0.63 ^b	7.80±0.63 ^b	7.40±0.96 ^b	7.10±0.84 ^a
	10%	8.00±0.00 ^b	7.80±0.63 ^b	5.20±1.03 ^a	6.60±1.35 ^a
	20%	8.00±0.00 ^b	6.60±1.65 ^{ab}	5.80±1.99 ^a	7.00±1.41 ^a
	30%	7.60±0.84 ^b	5.20±2.15 ^a	5.50±1.58 ^a	7.20±1.03 ^a
	40%	6.00±1.63 ^a	5.40±2.68 ^a	5.60±1.58 ^a	6.60±1.64 ^a
Appearance	Control	7.40±0.97 ^c	7.40±1.35 ^c	7.40±0.97 ^c	7.80±0.63 ^c
	10%	5.60±1.26 ^{ab}	5.40±1.65 ^{ab}	5.60±1.26 ^{ab}	6.60±1.64 ^{ab}
	20%	6.40±1.58 ^{bc}	4.60±2.12 ^a	6.40±1.58 ^{bc}	7.20±1.64 ^a
	30%	6.20±0.63 ^{ab}	5.20±2.53 ^a	6.20±0.63 ^{ab}	6.60±1.46 ^a
	40%	5.20±1.03 ^a	7.00±1.05 ^{bc}	5.20±1.03 ^a	6.40±1.57 ^a

From the result in table 4 above, the organoleptic properties of the cakes indicated that the products were acceptable although the samples with the inclusion rate of 10% and 20% were more acceptable. There was no significant difference ($P < 0.05$) between treatment III (20% inclusion of FPC in wheat flour) and treatment IV (30% inclusion of FPC in wheat flour), sensory evaluation revealed that as the inclusion rate of fish protein concentrate exceed 20%, the product tends to be less appreciable. Hence, from this research, it can be concluded that fish 'Cake' product was highly accepted by consumer immediately after processing it. This was similar to findings by Abraha *et al* [11, 12, 15] Decreases as the storage period increase thereby allowing for an increase in the lipid content). [6-8] reported that during refrigerated storage period of mackerel fish burgers, the decrease in the protein can be attributed to the leaching out of the water-soluble nitrogenous components of the product.

4. Conclusion

The present study provides information about the suitability of 'cake' produced with wheat flour and *B. bayad* FPC. Inclusion of fish in flour wheat produces a very stable and safe product with long storage life. By assessing the shelf-life quality as well as the feasibility of the processing method, it is revealed that flour treated with fish will contribute to nutritional balance of people consuming snacks in Nigeria. It can be concluded that 'fish cake' was highly accepted by consumer immediately after processing. Although, treatment I, II and III and IV were accepted by the consumers, but treatment I and II were mostly preferred. The inclusion of fish in wheat flour before processing has beneficial effects on the overall quality of the final products. This will not only reduce the substantial losses associated with catches but would also increase the nutritional intake of the consumers by substantially improving fish protein intake

in Nigeria and reduce protein malnutrition and its associated problems in the country.

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