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## Quality evaluation of fried fish sold in Sokoto Metropolis

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**Abstract**

The quality of fried fish products sold within Sokoto metropolis was evaluated. Six samples were obtained from six locations each week (Arkilla, Dandima, Kwalkwalawa, Sokoto Central market, Sokoto Old Market and Tashar Illela) were taken to Faculty of Agriculture laboratory, Usmanu Danfodiyo University, Sokoto for proximate composition, bacterial determination and sensory evaluation. The result from the proximate composition revealed that crude protein and moisture varied significantly ( $P < 0.05$ ). The lipid content of the products were not significantly different ( $P < 0.05$ ). The results of the bacteria determination were found to be decreasing during the study period and this was because the samples were fresh fried products. Frying dehydrates the fish flesh and therefore kills many bacteria. The result of the sensory evaluation were found to be fluctuating during study period and there was significant difference ( $P < 0.05$ ) in the fried products from the six locations. The fried products need to be protected from contaminations/infestations by flies and other microbial organisms through provision of cover at all times to ensure microbe free products.

**Keywords:** Frying, Proximate composition, Sensory evaluation, Bacteria and Infestation.

**1. Introduction**

Fish is one of the most valuable sources of food worldwide. People obtain about 20% of their animal protein from fin fish and shell fish. FAO [1] reported that about 35% of all fish is eaten fresh, chilled or frozen. Fish and marine products are used as medicine, ground into vitamins or processed into cosmetics and perfumes, lubricants, varnishes soap and margarine Omega-3-fatty acids are very important for normal growth particularly for the blood vessels and nerves and keeping our skin and other tissues youthful. Research studies have revealed that in population that consume large quantities of fish, with a high utilization of omega 3s, there is reduced risk of heart diseases [2].

The world's fish population from capture fisheries and aquaculture reached 121 millions tones in 1996. The figure is 3.7 million tones more than in 1995. A breakdown shows that 72 percent of the total fish production comes from marine catches, 9 percent from aquaculture [3]. In developing countries like Nigeria, artisanal fishermen supply most of the fish used for direct human consumption and provide a large number of people with relatively low-cost of nutritious food. In many cases, they are responsible for between 50 to 70 percent of the nations catch.

In Nigeria, fish alone contributes on the average 20-25% per caput animal intake and could be as high as 80% in coastal and riverine communities. FAO [4] estimated the projected population and fish demand and supply from 1997 to 2025, with domestic fish population by the year 2007 as 0.77 million tones.

A decline in fish availability will have a detrimental effect on the nutritional status of the citizenry in places where fish contributes significantly to the protein intake of the people [3]. Fish losses arising from bacteria and autolytic spoilage are enormous. Ibru [5] analyzed and enumerated some of the problems as inadequate modern inputs for fishing, poor and most often non-existing access roads and other means of communication between key production areas and marketing as well as administrative centres, others are lack of processing, storage, distribution and marketing. A global study published in nature concludes that 90% of all large fishes have disappeared from world oceans in the past half century, the devastating result of industrial fishing [6].

The main objective of this study was to determine the quality of the fried fish products sold

at strategic locations in Sokoto metropolis through analysis of the proximate composition of the fried products, analysis of bacteria load and conduct sensory evaluation through sensory assessment of the products.

## 2. Materials and Methods

### 2.1 Description of the Study Area

Sokoto state is located to the extreme North western part of Nigeria between longitude 4°E and 6°54E and latitude 12°N and 13°58N. It shares common borders with Niger republic to the North, Kebbi state to the southwest and Zamfara to the East. The total land area is about 32,000 km<sup>2</sup>, while the total population in 1999 is 2,809,156 [7].

### 2.2 Sample collection and Treatment

Fried fish samples were purchased from the different processing locations already identified in the Sokoto metropolis, the experiment was set to cover a period of six weeks. On weekly basis, samples were procured from the processors and were brought to the central laboratory, Faculty of Agriculture, Usmanu Danfodiyo University for analysis. The sampling stations were as follows: Arkilla-Wamakko Junction, Dandima Junction, Kwalkwalawa, Sokoto Central Market, Sokoto Old Market, and Tashar Illela. The samples were taken to the laboratory for proximate analysis, bacteriological analysis and sensory evaluation.

### 2.3 Proximate composition

Moisture was determined by oven drying the samples of fried fish products obtained from the six sampling locations at 105 °C for 24 hours. Crude protein was determined by the Microkjeldahl methods as described by AOAC [8].

### 2.4 Bacteriological Test

Bacteriological analysis was conducted in triplicate using the standard plate count. One gram of the fried products for each of the six centres was diluted into 9mls of distilled water (1 g: 9 mls) in sterilized universal tubes [9].

## 2.5 Sensory evaluation

### 2.5.1 Taste Panelist

Ten taste panels were selected from student of the Department of forestry and fisheries for the sensory evaluation of the purchased products. The taste panelists were all efficient in sensing odour, smell and feeling. Efforts were made to ensure that they are non-smokers.

Every week, samples were brought to the tasting room in special plates to allow the panelists taste and record their observations based on the hedonic scale provided below

Extremely acceptable	-	6
Very acceptable	-	5
Slightly acceptable	-	4
Slightly unacceptable	-	3
Very unacceptable	-	2
Extremely unacceptable	-	1

### 2.6 Statistical analysis

The data obtained were analysed on the level of biochemical and sensory evaluation of fried fish. Analysis of variance was employed, using statistical package for social statistics (SPSS) computer package and descriptive statistics was also employed, mean, standard deviation, LSD difference were also determined.

## 3. Results

Table 1 shows the average composition of the fried products from the six sampling locations. The overall moisture ranged from 48.17% to 51.33% in the fried products purchased from Sokoto central market and Dandima respectively. The crude protein were significantly different ( $P < 0.05$ ) between some of the sampling locations.

Table 2 shows the results of the total viable count of bacteria from six sampling locations. The mean counts were ranged 5 to 63, respectively. Sokoto central market had the highest and kwalkwalawa had the least.

Table 3 predicts the results of the taste panels scores of fried products purchased from the six sampling locations. The results indicated that samples from Arkilla had the highest score in terms of texture and flavor during week 3 while the least score (1.0±0.89) was obtained in the flavor of samples from Sokoto Old Market during the 5th week of sampling.

**Table 1:** Average proximate composition of fried fish samples from six locations.

Treatments	Parameters				
	Moisture	Crude Protein	Lipid	Ash	NFE
Arkilla	43.33±0.58 <sup>c</sup>	18.55±1.17 <sup>b</sup>	6.38±0.24	9.22±0.51	16.93±1.54
Dandima	51.33±0.67 <sup>a</sup>	17.38±1.16 <sup>b</sup>	5.72±0.24	9.56±0.36	15.53±1.33
Kwalkwalawa	49.0±0.67 <sup>ab</sup>	21.09±1.18 <sup>a</sup>	6.28±0.15	10.32±0.42	14.01±1.69
Sokoto Central Market	48.17±0.58 <sup>b</sup>	21.39±1.16 <sup>a</sup>	6.03±0.22	9.56±0.24	14.78±1.43
Sokoto Old Market	50.50±0.58 <sup>a</sup>	17.40±1.21 <sup>b</sup>	5.49±0.76	9.38±0.26	14.49±0.7
Tashar Illela	50.67±0.56 <sup>a</sup>	17.22±1.13 <sup>b</sup>	6.36±0.34	9.8±0.62	15.74±1.33

**Table 2:** Mean weekly bacterial count of the fried products in 10<sup>5</sup> dilution

WK	Location	Mean Count (CFU/g)	Standard
1	Arkilla	50	5.0 x 10 <sup>6</sup>
	Dandima	28	2.8 x 10 <sup>6</sup>
	Kwalkwalawa	21	2.1 x 10 <sup>6</sup>
	Sokoto Central Market	63	6.3 x 10 <sup>6</sup>
	Sokoto Old Market	35	3.5 x 10 <sup>6</sup>
	Tashar Illela	44	4.4 x 10 <sup>6</sup>

2	Arkilla	43	$4.3 \times 10^6$
	Dandima	25	$2.5 \times 10^6$
	Kwalkwalawa	18	$1.8 \times 10^6$
	Sokoto Central Market	59	$5.9 \times 10^6$
	Sokoto Old Market	29	$2.9 \times 10^6$
	Tashar Illela	40	$4.0 \times 10^6$
3	Arkilla	37	$3.7 \times 10^6$
	Dandima	24	$2.4 \times 10^6$
	Kwalkwalawa	13	$1.3 \times 10^6$
	Sokoto Central Market	42	$4.2 \times 10^6$
	Sokoto Old Market	22	$2.2 \times 10^6$
	Tashar Illela	29	$2.9 \times 10^6$
4	Arkilla	34	$3.4 \times 10^6$
	Dandima	15	$1.5 \times 10^6$
	Kwalkwalawa	13	$1.3 \times 10^6$
	Sokoto Central Market	42	$4.2 \times 10^6$
	Sokoto Old Market	22	$2.2 \times 10^6$
	Tashar Illela	27	$2.7 \times 10^6$
5	Arkilla	28	$2.8 \times 10^6$
	Dandima	14	$1.4 \times 10^6$
	Kwalkwalawa	7	$7.0 \times 10^6$
	Sokoto Central Market	29	$2.9 \times 10^6$
	Sokoto Old Market	10	$1.0 \times 10^6$
	Tashar Illela	15	$1.5 \times 10^6$
6	Arkilla	20	$2.0 \times 10^6$
	Dandima	14	$1.4 \times 10^6$
	Kwalkwalawa	5	$5.0 \times 10^5$
	Sokoto Central Market	15	$1.5 \times 10^6$
	Sokoto Old Market	7	$7 \times 10^5$
	Tashar Illela	12	$1.2 \times 10^6$

**Table 3:** Taste Panels scores of fried products

WK	Location	Odour	Flavour	Texture
1	Arkilla	3.0±0.78	2.0±0.60	2.3±0.78
	Dandima	3.1±0.54	3.2±0.82	1.7±0.78
	Kwalkwalawa	2.0±0.89	3.6±1.11	4.6±1.20
	Sokoto Central Market	3.9±1.81	2.0±0.97	2.6±1.90
	Sokoto Old Market	2.5±0.92	2.5±0.84	4.0±1.88
	Tashar Illela	2.2±0.86	4.2±1.66	4.6±1.11
2	Arkilla	4.0±1.89	2.0±0.63	3.6±1.69
	Dandima	3.5±1.26	3.5±0.84	1.8±0.81
	Kwalkwalawa	2.7±0.94	2.5±1.91	2.9±0.44
	Sokoto Central Market	3.6±1.27	3.4±1.11	2.0±0.63
	Sokoto Old Market	3.9±1.81	2.7±0.94	2.1±0.83
	Tashar Illela	2.5±0.86	2.8±0.99	4.0±1.89
3	Arkilla	3.4±0.19	4.6±0.86	4.8±1.60
	Dandima	2.5±0.92	2.3±0.96	2.7±0.78
	Kwalkwalawa	4.6±1.2	2.0±0.77	2.8±1.60
	Sokoto Central Market	2.8±0.77	3.6±0.66	3.3±1.75
	Sokoto Old Market	4.2±0.87	3.6±0.66	3.3±0.78
	Tashar Illela	3.6±1.14	4.0±1.78	3.9±0.83
4	Arkilla	3.6±1.11	2.1±0.63	2.3±0.78
	Dandima	2.6±0.96	3.4±0.84	1.7±0.78
	Kwalkwalawa	2.2±0.97	3.0±0.77	2.0±0.87
	Sokoto Central Market	2.1±0.74	3.4±0.84	4.7±0.64
	Sokoto Old Market	2.1±0.95	3.0±0.78	3.2±0.87
	Tashar Illela	3.0±0.77	2.6±1.02	3.3±0.90
5	Arkilla	2.9±0.94	3.9±0.74	3.6±1.69
	Dandima	2.5±1.91	2.3±0.91	2.0±0.63
	Kwalkwalawa	3.1±1.04	3.6±1.69	2.0±0.63
	Sokoto Central Market	1.4±1.13	2.8±0.75	2.2±0.74

	Sokoto Old Market	1.0±0.89	4.3±1.90	3.1±1.04
	Tashar Illela	3.4±1.02	3.1±0.74	2.0±0.63
6	Arkillla	3.6±1.11	4.2±1.66	4.3±1.9
	Dandima	3.8±0.97	3.3±1.26	2.7±0.78
	Kwalkwalawa	4.0±0.89	2.7±0.64	3.8±0.96
	Sokoto Central Market	3.6±1.74	2.8±0.74	2.9±0.94
	Sokoto Old Market	3.9±1.81	3.6±1.36	2.8±0.74
	Tashar Illela	4.4±1.69	3.5±1.17	3.2±0.87

#### 4. Discussion

The proximate composition, bacteriological assessment and sensory evaluation of fried Fish sold within Sokoto metropolis were studied. The variation in moisture content was due to the temperature of the oil used in frying. The percentage of moisture content was higher than the percentage recorded by Eyo <sup>[3]</sup>. Drying and frying of fish removed moisture content making it unavailable for the spoilage activities of bacteria.

The protein content of each of the fried products differed significantly ( $P < 0.05$ ). This variation may be due to the fact that moisture removed made the protein be more concentrated. Similarly, the percentage protein content in the fish products exceeded the limit of Magawata and Obafemi <sup>[10]</sup> and Stansby <sup>[11]</sup> on fish fillet. The protein content of the fried products was not of the same quality because of the differences in the quality of protein in each of the products.

Frying dehydrates the fish flesh and kills many of the bacteria in the fish <sup>[12]</sup>. The presence of moisture in fried fish permits the growth of bacteria and mould in fish flesh during storage <sup>[3]</sup>. Samples from Sokoto central market had the highest number of bacteria due to the presence of dust, drainage and too much heat. Kwalkwalawa had the least number of bacteria because they normally open in the evening and microbial activity is normally low when there is decrease in temperature i.e. the environment is not favourable for bacterial growth.

The sensory quality of the products were observed to be fluctuating throughout the experimental period and there was significant difference  $P < 0.05$  in the products. The less acceptability was found in Arkilla. This implies that the fresh products must have been bought when rancidity has set in. Magawata and Shina <sup>[13]</sup> reported similar trend in the dried *Clarias gariepinus*.

#### 5. Conclusion

The fried products in all the six sampling locations were found to be nutritionally good throughout the six weeks of the experiment. Crude protein and moisture were found to be significantly different and within the values observed by many authors. The bacterial load fluctuated during the study period but all values were within the acceptable ranges.

Due to mal-handling of the fried products in all the sampling locations the following recommendations are hereby forwarded to ensure good quality products for consumers; the fried products need to be covered with hygienic material at all the times. Packaging of the products in special containers will ensure microbe free products and containers used in drying should always be a good sanitary.

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#### 7. References

1. Food and Agriculture Organization. Technology in Africa, Fisheries Report no. 400D FAO, Rome, Food Technical. 2008; 5:305-315.
2. Ackman RG. Nutritional composition of fats in Sea Foods. Progress on Food Nutri Sci 1992; 13:161-241.
3. Eyo AA. Fish Processing Technology in the Tropics. Edn 2, National Institute for Freshwater Fisheries Research. New-Bussa, 2001, 7-200.
4. Food and Agriculture Organization. FAO Fisheries Technical paper. Journal of Food Microbiology 1977; 15:167-183.
5. Ibru MCO. Key Note address delivered at the 5<sup>th</sup> Annual National Conference of the Fisheries Society of the Nigeria (FISON) Ilorin, 1986.
6. Wilson E. The diversity of Life penguin. The impairment of the Ecosphere, Animals, Fish and Birds. Journal on Religious Tolerant 2001; 43:4-8.
7. Mamman AB, Oyebanji JO, Peters SW. Nigeria: A people united, a future assured (Survey of States) Vol. 2, Gabumo Publishing Co. Ltd., Calabar, Nigeria. 2000, 2988.
8. AOAC. Official Methods of Analysis. Edn 17, Association of Official Analytical Chemists. Arnington Wshington DC, 2002.
9. Ogundana SK. Introductory Microbiology: A Laboratory Manual. Girardet Press, WA. Co. Ibadan. 1989, 215.
10. Magawata I, Obafemi T. Preliminary Investigation on the Nutritive Value of Dehydrated Shredded Muscles of *Clarias gariepinus* (Burchell, 1822). Biological and Environmental Sciences Journal for the Tropics 2010; 7(4):62-66.
11. Stansby ME. Proximate composition of fish. In fish nutrition. Heen E and Frunzer (Ed.) London. Fishing News Books for FAO, Food Science 1962; 40:50-36.
12. Taofiq S. The quality of fish products sold at Sokoto Central Market, PAD Project, Fisheries Department, UDUS, 2005.
13. Magawata I, Shina AA. Effect of spice treatment on the quality of solar dried African Catfish, of *Clarias gariepinus* (Burchell, 1822) in Sokoto, Nigeria. Food Science and Quality Management Journal 2013; 19:7-14.