Fagbenro, O.A.; Ajani, E.K.; Magawata, I.; Shinkafi, B.A.; Ayoola, S.O. and Orisasona, O. (Eds.) (2018) Proceedings of 1st Conference of Association of Nigerian Fisheries Scientists. "Science, Innovation and Aquabusiness: A Tripod for Sustainable Fisheries and Aquaculture Development in Nigeria" July 10-12, 2018 in the University of Ibadan, Ibadan, Nigeria

Nutritional Quality of Stored Fish Crackers made from Catfish (*Clarias gariepinus*) and Sardine (*Sardinella maderensis*)

*Adeosun, O. and Gbolagade, P.J.
Department of Fisheries Technology, Oyo State College of Agriculture and Technology, Igboora

*Corresponding Author E-mail:
moriyike2006@gmail.com

Abstract

This study focused on the effect of storage on the nutrient composition and consumer acceptability of fish cracker made from *Clarias gariepinus* and *Sardinella maderensis* with cassava starch. *Clarias gariepinus* and *S. maderensis* (Mean weight, 2.5kg each) were purchased locally. The fish were weighed, beheaded, gutted, filleted, deboned, and thoroughly washed with clean water and minced. The mince and other ingredients were made into fish crackers using standard methods and stored for six weeks at ambient condition for storage test. Proximate composition of expanded and non-expanded samples was determined and sensory evaluation was done for consumer acceptability. Analysis of variance was used to detect difference in crunchiness of the samples. Proximate composition showed that crackers had crude protein between 9.14% and 15.80% for *S. maderensis* and *C. gariepinus*. There was no significant difference in crunchiness between crackers made from *C. gariepinus* and *S. maderensis* ($p<0.05$). Result of t-test of consumer acceptability showed that there was significant difference in the two samples.

Keywords:
Clarias gariepinus,
Sardinella maderensis,
Cassava starch,
Hedonic scale

Introduction

Fish is widely acceptable because of its high palatability, low cholesterol and tender flesh (Eyo, 2001). In order to increase fish consumption, strategies are required to overcome or bypass certain limitations of commercialization and acceptability of fish, which include the cold chain distribution process and the presence of bones. A key element to increase fish consumption is to provide processed and manufactured fish products, preserving the high nutritional value of fish and meeting customer expectations (sensory attributes). Fish crackers are very popular delicacy in Malaysia and other Asian countries (Low, 1992). Cracker is traditionally produced by means of starch gelatinization, which is achieved through steaming (Kyaw *et al*., 1999). Cracker is made by forming dough from a mixture of starch, minced fish, salt, sugar and water. Before consumption, the dough is sliced, and the slices are fried in hot oil, which causes cracker to expand into a porous, low-density product (Kyaw *et al*., 2001). Catfish *Clarias gariepinus* is the species most commonly cultured in Nigeria. The fish has a well-established market in Nigeria and fingerlings are generally available. There are standard hatcheries all over Nigeria where the fingerlings of this fish can be easily procured. They are good species for culture because they tolerate many extremes water quality and generally adapt to culture environment. They are highly recommended food fish in Nigeria (Fagbenro and Arowosoge, 2002). *Sardinella maderensis* (Madeiran sardinella) is a species of small ray-finned fish in the genus *sardinella* which is found in the

Eastern Atlantic and Southeastern Mediterranean (Peter *et al.,* 1988). It is a silvery fish similar to the round *sardinella* (*Sardinella aurita*), but can be distinguished from that species by its grey caudal fins with black tips. This study investigated the effect of storage on the nutrient composition and consumer acceptability of fish cracker made from *C. gariepinus* and *S. maderensis.*

Materials and Methods

Fish Mince Preparation

Clarias gariepinus and *Sadinella maderensis* with mean weight of 2.5kg each were used for this experiment. Both species were collected in covered-plastic with crushed ice and transported to the Fisheries Laboratory, Oyo State College of Agriculture and Technology, Igboora. The fish samples were beheaded, gutted, deskinned, filleted and washed with portable water. Skin and bones were manually removed to produce pure fillets. Fillets were obtained using sharp knife and finally minced.

Fish Cracker Production

The recipes were prepared as shown in Table 1. The mixture obtained from each recipe was divided into 200g rolls and wrapped in nylon then steamed for four hours. The cooked rolls were put in freezer overnight for the starch to gelatinize. Frozen cracker was cut into thin slices and dried at 70^{o}C for four hours. Dried non- expanded crackers were packed in polythene bag and stored at ambient temperature for analysis. Proximate analysis and sensory evaluation were done bi-weekly.

Table 1: Recipe for fish cracker production

Materials	Recipe 1	Recipe 2
C. gariepinus mince (gm)	500	-
S. maderensis mince(gm)	-	500
Cassava starch(gm)	500	500
Salt(gm)	50	50
Sugar(gm)	50	50
Water	1 litre	1 litre

Proximate composition of fish crackers

Expanded and non-expanded fish crackers were analysed for proximate composition using the method of AOAC (1990).

Sensory evaluation- Twenty untrained panelists (comprising staff and students of Oyo State College of Agriculture and Technology, Igboora) evaluated the fish crackers in relation to crunchiness, and general acceptability using a nine-point hedonic scale varying from "dislike extremely" to "like extremely".

Data Analysis

Multiple comparison test was used to compare crunchiness of fish crackers. Analysis of variance and difference test using the method described by Ihekoronye and Ngoddy (1985) was used to analyse data obtained from panelists.

Results and Discussion

Results of proximate composition of fish crackers stored at ambient temperature are presented in Tables 2 and 3.

Table 2: Mean proximate composition of fish cracker from *C. gariepinus* stored under ambient condition (Recipe 1)

Storage Time (Weeks)	Sample Description	Moisture Content %	Crude protein %	ASH %	Crude Fibre %	Ether Extract %	Dry matter %
0	Expanded	6.50±0.02	13.50±0.01	9.10±0.03	0.50±0.01	12.65±0.01	93,50
	Non expanded	6.82±0.02	15.80±0.01	9.10±0.03	0.55±0.01	7.70±0.01	93.18
2	Expanded	8.14±0.01	10.85±0.01	10.02±0.01	0.17±0.01	11.50±0.01	91.86
	Non expanded	7.70±0.00	9.14±0.02	11.10±0.01	0.15±0/02	8.09±0.01	92.30
4	Expanded	7.89±0.01	12.84±0.01	10.12±0.02	0.14±0.01	11.95±0.01	92.11
	Non expanded	7.57±0.01	9.80±0.01	10.15±0.01	0.11±0.10	8.20±0.02	92.43
6	Expanded	8.47±0.01	12.36±0.01	10.16±0.01	0.12±0.01	11.80±0.01	91.53
	Non expanded	8.90±0.02	9.65±0.01	10.01±0.01	0.10±0.12	8.20±0.10	91.10

Table 3: Mean proximate composition of fish cracker from *Sardinella maderensis* stored at ambient condition (Recipe 2)

Storage Time (Weeks)	Sample Description	Moisture Content %	Crude protein %	ASH %	Crude Fibre %	Ether extract %	Dry matter %
0	Expanded	6.70±0.02	14.32±0.01	9.80±0.01	0.19±0.01	12.21±0.01	93.30
	Non expanded	6.90±0.02	13.20±0.01	9.50±0.01	0.18±0.01	7.60±0.02	93.10
2	Expanded	7.93±0.01	11.50±0.01	7.70±0.01	0.18±0.01	10.28±0.01	92.07
	Non expanded	7.75±0.02	9.44±0.01	9.66±0.01	0.17±0.01	7.59±0.01	92.25
4	Expanded	7.90±0.01	13.65±0.01	10.25±0.00	0.10±0.02	12.32±0.01	92.10
	Non expanded	8.37±0.01	10.49±0.01	9.45±0.02	0.10±0.12	8.50±0.01	91.63
6	Expanded	8.95±0.01	13.41±0.01	10.18±0.01	0.16±0.01	12.17±0.01	91.05
	Non expanded	8.85±0.01	10.30±0.01	9.40±0.01	0.10±0.13	8.39±0.01	91.15

Fish cracker is a dried product and is expected to have low moisture content. Moisture content recorded in this study ranged between 6.82% and 8.90% for non-expanded crackers and 6.50% and 8.95% for expanded crackers. Nurul *et al.,* (2010) reported moisture content between 0.37% and 13.83% for commercial crackers in Malaysia. King (2002) also reported 12% moisture content for fish cracker made from the Big-eye fish (*Brachydeuterus auritius*). Moisture content is an important factor in optimizing quality of fish crackers and production process. Moisture content of non-expanded fish cracker increased with storage time. The lower moisture content of the crackers made them to be shelf stable.

Protein is important in the diet for building tissues and repairing worn-out tissues. Crude protein recorded in this study ranged between 9.14% and 15.80%. It has been observed that the more fish used in fish cracker production, the higher the protein content of the fish (King, 2002 and Nurul *et al.,* 2010). Nurul *et al.,* (2010) reported that fish crackers with ratio of fish to flour that are 2 to 1 and 2.5 to 1 had protein contents between 18.23% and 23.81%.

The fat content in fish crackers may depend on the amount, fat content or the particular parts of fish or raw materials used. Fat content ranged between 7.59% and 8.50% for non-expanded fish crackers,

while 10.28% and 12.65% fat content was obtained for expanded crackers. This result is not in agreement with Nurul *et al.,* (2010) who reported fat content between 0.85% and 3.38% for commercial fish crackers in Malaysia. The fat content increased after drying due to absorption of oil during frying.
Ash content observed in this study ranged between 7.70% and 10.25% for expanded crackers and between 9.10% and 11.10% for non-expanded crackers. Variation in ash content could be due to difference in fish species used.

A multiple comparison test was conducted to compare the crunchiness of the fish cracker. One brand of prawn cracker was used as control. Analysis of variance was used to detect difference in crunchiness of the samples. Table 4 shows the result of analysis of variance. The result shows that there was no significant difference in crunchiness between the crackers made from *C. gariepinus* and crackers made from *S. maderensis* at 5% level. Crunchiness is one of the most important sensory attributes of crackers which can be affected by the nature of the material and the structure that the material forms (Cristiane *et al.,* 2011).

Table 4: ANOVA result of multiple comparison test of crunchiness of fish crackers made from *C. gariepinus* and *S. maderensis*

Source of Variance	df	S.S	M.S	Fcal	Ftab
Samples	1	2.68	2.68	2.27	4.38 at 5%
Judges	19	85.38	4.50	3.81	8.18 at 1%
Error	19	110.66	1.18	3.81	

Acceptability of fish crackers was conducted by using hedonic scale. Twenty- man panel was served crackers from the two samples and control. Each of them expressed his /her degree of likeness on a nine-point hedonic scale. Results of the difference test (Table 5) showed that there was significant difference between fish crackers made from *C. gariepinus* and *S. maderensis.* The results of the sensory evaluation of fish crackers showed that the fish crackers were widely accepted.

Table 5: Difference test between crackers from *C. gariepinus* and *S. maderensis*

Samples	Tcal	Ttab
A – B	5.76	2.131
A – C	4.06	2.131

Conclusion

This study shows that *Clarias gariepinus* , *Sardinella maderensis* and cassava starch are good raw materials for preparation of fish crackers and also acceptable by the panelists. Production of crackers from *Clarias* and sardine can lead to establishment of cottage industries giving rise to increased demand for *C. gariepinus*. This study showed that fish cracker can be stored for some time without loss of important nutrients.

References

AOAC, 1990. Method of analysis of the Association of Official Analytical Chemist, 15th ed. Washington D.C. USA.

Ihekoronye A.I and Ngoddy P. 1985. Integrated food science and technology for the tropics macmillan Publishers, London and Basingstoke, pp. 178-180.

Cristiane Rodrigues Pinheiro NeivaI, II; Thais Moron MachadoI; Rubia Yuri TomitaI; Érika Fabiane FurlanI; Marildes Josefina Lemos NetoI; Deborah Helena Markowicz Bastos II 2011. Fish crackers development from minced fish and starch: an innovative approach to a traditional product. *Food Science and Technology (Campinas)* Vol. 31 No. 4 Print version Ciênc. Tecnol. Aliment. http://dx.doi.org/10.1590/S0101-20612011000400024.

Eyo, A. A. 2001. Fish processing technology in the tropics: University of Ilorin Press, Nigeria 403pp.

Fagbenro, O.A. and Arowosoge, I.A. 2002. Replacement value of some household wastes as energy substitute in low cost rearing catfish, in South-western Nigeria. *Bio-resource Technology* 37:197-203.

King M. A. 2002. Development and Sensory acceptability of cracker made from the Big-eye fish (*Brachydeuterus auritus*). *Food and Nutrition Bulletin*, 23 (3): 317-320.

Kyaw, Z.,Y, Yu, S, Y, Cheow, C. S. Dzulkifly, M. H. & Howell, N. K . 2001. Effect of fish to starch ratio on visco-elastic properties and microstructure of fish cracker (keropok) dough *International Journal of Food Science and Technology*, 36(7), 741-747.

Kyaw,Z.Y. S.Y Yu, Cos Cheow and M. H. Dzulkifly 1999. Effect of steaming time on the liner expansion of fish Crackers (keropok') *Journal of the Science of food and Agriculture*, Vol.79, pp.1340-1344.

Low, S.L. 1992. Utilization of pre-gelatinized tapioca starch in the manufacture of a snack food, fish cracker (keropok) *International Journal of Food Science and Technology* Vol. 27, pp. 593-596.

Nurul Huda, Ang Li Leng, Cheng Xian Yee and Herpandi 2010. Chemical composition, colour and Linear expansion properties of Malaysian Commercial fish cracker (keropok). *Asian Journal of Food and Agro-industry* 3(05): 473-482.

Yu, S.Y. Mitchell, J.R., & Abdullah, A .1981. Production and acceptability testing of fish crackers (keropok).

ANIFS2018

Proceedings of the 1st Conference and Annual General Meeting
"Science, Innovation and Aquabusiness: A Tripod for Sustainable Fisheries and Aquaculture Development in Nigeria"
July 10-12, 2018 in the University of Ibadan,
Ibadan, Nigeria

ANIFS2018

Proceedings of the 1st Conference and Annual General Meeting
"Science, Innovation and Aquabusiness: A Tripod for Sustainable Fisheries and Aquaculture Development in Nigeria"
July 10-12, 2018 in the University of Ibadan,
Ibadan, Nigeria