Changes in Minerals Content of Traditionally fermented Nile-Fish Productin Sudan

Elagba Mohamed[1], LeelwaAl Hamadani[2]

[1]Natural History Museum, Faculty of Science, University of Khartoum, P.O. Box 321, Khartoum, Sudan

[2]Soil and Water Research Laboratory, College and Agriculture and Marine ScienсSultan Qaboos University, Sultanate of Oman

Running title: Minerals content of salted-fermented *Hydrocynus*

Abstract: ***The effect of fermenting process was evaluated by investigating the changes in minerals content of on the Nile tiger-fish (Hydrocynus spp)," fessiekh'', the traditional fermented fish product in Sudan. Total minerals content was (48.5µg/g) in fresh and (44.75µg/g) in fermented fish.Significant change (P<0.05) was detected in phosphorous (P), from (41.8µg/g) in fresh to (34.6µg/g) in fermented fish, constituting (86% and 77%) of total minerals, respectively. Mn also decreased from (0.184 ± 0.16µg/g) to (0.162 ± 0.17µg/g), and Ti decreased from (0.029 ± 0.02µg/g) to (0.025 ± 0.0417µg/g). The contents of Ba, Fe, Zn, Al and B increased in fermented fish forming (8.4%, 4.4%, 3.8%, 3.3% and 1.5%) of total minerals, respectively, compared to (4.8%, 2.7%, 2.5%, 1.3% and 1.3%), respectively, in fresh fish. Although fermenting process lead to slight changes of some mineral contents, the results revealed that fermented fish 'fessiekh' is a rich source of macro and micro-elements for human nutrition and health and the consuming rate of fermented fish should be encouraged.***

Keywords: Fermented fish, fessiekh, *Hydrocynus*, minerals, Sudan

1. Introduction

Fermentation is a popular traditional process used for fresh fish preservation in many of the African countries including Sudan [1],[2].F which flavor can be developed in the fish. Fermentation is known to cause some changes in quality of fish and in minerals contents[10][9],[8],,[7],[6][5],[4],.

The fish body usually contains small amount of these minerals, some of which are essential nutrients and components of many enzymes system and metabolic mechanisms. The deficiency in these principal nutritional mineral elements induces a lot of malfunctioning; as it reduces productivity and causes diseases[11]. Therefore, the present study was carried out to determine the change of minerals content in muscles of Sudanese fermented fish product "fessiekh" of *Hydrocynus* species compared to fresh fish, to ensure that it meetsthe requirements of food regulations and commercialspecifications as agood source of healthy food.

2. Material and Methods

Sample collection and preparation

Fermented and fresh specimens of the Nile tigerfish (*Hydrocynus* species) were purchased from the fish market in Khartoum. Fish samples were transported to the laboratory, gutted, prepared as a fillet, washed with fresh water, minced into fine particles and kept in separate glass containers for analysis.

Minerals analysis

The concentration of minerals was determined after wet digestion with a mixture of nitric, sulphuric and hydrochloric acids, using Atomic Absorption Spectrophotometer (AAS Model SP9). Each analysis was carried out in triplicates. The results are provided as (µg/g/ wet weight).

3. Results and Discussion

As shown in (Table 1) the total minerals content was not significantly different between fresh (48.5µg/g) and fermented fish (44.75µg/g). The contents of Ba, Fe, Zn, Al and B increased in fermented fish (Fig. 1) forming (8.4%, 4.4%, 3.8%, 3.3% and 1.5%) of total minerals, respectively, compared to (4.8%, 2.7%, 2.5%, 1.3% and 1.3%), respectively, in fresh fish. The content of Mn (Fig. 2) slightly decreased in fermented fish from (0.184 ± 0.16µg/g) to (0.162 ± 0.17µg/g), and Ti decreased from (0.029 ± 0.02µg/g) to (0.025 ± 0.0417µg/g), although both mineral constituted the same percentage of total minerals in both tissues, while Pb, Cr, Co and Ni were not significantly different. A significant change (P<0.05) was detected in phosphorus (P) content of fermented fish (Fig. 3) where, P decreased from (41.8 µg/g) in fresh to (34.6 µg/g) in fermented fish, constituting (86% and 77%) of total minerals, respectively. Trace amounts of Cu and Cd were detected in both fermented and fresh fish.

The high level of phosphorus in both fermented and fresh fishcan be attributed to the fact that phosphorous is a component of protein and nucleotides[12].Enzymatic degradation of nucleotides and nucleosides in the flesh during fermentation and breakdown of protein result in subsequent release ofphosphorous. A reduction of P contents in fermented fish was in accordance with the results reported by [13]in the traditional Ivorian fermented fish condiment *Chloroscombrus chrysurus*compared to fresh fish,and with results reported in tilapia *Oreochromis niloticus*[14]. The change in other minerals content was not significant. The variations recorded in content of fermented compared to fresh fish could have been as a result of their concentrations in the local water body, and the ability of the fish to absorb these inorganic elements from their diets[16][15] ,.

Variations observed could also, probably, be due to some micro-organisms capable of using these inorganic elements during their metabolism such as in nitrogen and phosphorous cycles. Fermentation may contribute positively to the development of flavour of the product, and the degradation process initiated by proteolytic bacteria is responsible of the characteristic odor of fermented fish[17], [18] .A general observation shows that fermentation does not adversely affect the minerals content of Sudanese fermented fish product "fessiekh". However, the content of minerals in the fermented fish was within the range recorded in other fresh Nile fish[19].The present study, therefore, revealed that fermented fish products are generally good sources of minerals required for human health and encourages theconsumption of "fessiekh" as a rich nutritive fish product.

References

[1] Asiedu, M. and Sanni, A.I.(2002) Chemical composition and microbiological changes during spontaneous and starter culture fermentation of enam ne-setraky, a West African fermentation fish-carbohydrate product.*Europe Food Research and Technology* 215, 8-12.

[2] Cho, S.H., Jahncke, M.L. and Eun, J.B. (2004) Nutritional composition and microflora of fresh and fermented skate (*Raja Kenojei*) skins.*International Journal of Food Science and Nutrition*1, 45-51.

[3] Nwabueze, A.A. and Nwabueze, E.O. (2010) Consumer attitude to fermented fish (*Heterotis niloticus*) in Ndokwa-East, Delta State, Nigeria. *Agriculture Biology Journal of North America* 1, 694-696.

[4] El-Sebaiy,L. andMetwalli, S.M. (1989)Changes in some chemical characteristics and lipid composition of salted fermented Bouri Fish muscle (*Mugil cephalus*). *Food Chemistry*31(1), 41–50.

[5] Yankah, V.V., Ohshima, T. and Koizumi, Ch. (1993) Effects of processing and storage on some chemical characteristics and lipid composition of a Ghanaian fermented fish product. *Journal of the Science of Food and Agriculture* 63(2), 227–235. Article first published online: 2006. DOI: 10.1002/jsfa.2740630209.

[6] Rodrigo, J., Ros, G., Periago, M.J., Lopez, C. and Ortuiio, J. (1998) Proximate and mineral composition of dried salted roes of hake (*Merltcccircs merluccius*, L.) and ling (*Molva molva*, L.). *Food Chemistry* 63, 221-225.

[7] Montaño, N., Grace, G. and Victor, C.G. (2001) Polyunsaturated fatty acid contents of some traditional fish and shrimp paste condiments of the Philippines. *Food Chemistry* 75(2), 155-158.

[8] Andesen, E., Andersen, M.L. and Baron, C.P. (2007) Characterization of oxidative changes in salted kutum roe and herring (*Clupea harengus*) during ripening. *Journal of Agriculture and Food Chemistry* 55, 9545-9553.

[9] Chanthilath, B., Chavasit, V., Chareonkiatkul, S. and Judprasong, K. (2009) Iodine stability and sensory quality of fermented fish and fish sauce produced with the use of iodated salt.*Food Nutrition Bulletin* 30(2), 183-188.

[10] Taghiof, M., Nikoo, M. and Pourshamsian, K. (2012) Proximate and fatty acid composition of salted caspian kutum (*Rutilus frisii*) roes influenced by storage temperature and vacuum-packaging. *World Journal of Fisheries and Marine Sciences*4 (5), 525-529.

[11] Waterman, J.J. (2000)*Composition and Quality of Fish*. Torry Research Station, Edinburgh.

[12] Hogstrand, C. and Wood, C.M. (1996) The Physiology and Toxicology of Zink in Fish, In: *Toxicology of Aquatic Pollution* (Taylor W. Editor), University Press, Cambridge, pp. 61-84.

[13] Koffi-Nevry, R., Ouina, T.S.T., Koussemon, M. and Brou, K. (2011) chemical composition and lactic microflora of adjuevan, a traditional Ivorian fermented fish condiment. *Pakistan Journal of Nutrition* 10 (4), 332-337.

[14] Chaijan, M. (2011) Physicochemical changes of tilapia (*Oreochromis niloticus*) muscle during salting. *Food Chemistry* 129, 1201-1210.

[15] Window, H., Stein, D., Scheldon, R. and Smith, J.R. (1987) Comparison of trace metal concentrations in muscle of a Benthopelagic fish *Coryphaenoides armatus* from the Atlantic and Pacific oceans. *Deep Sea Research*34, 213-220.

[16] Adewoye, S.O. and Omotosho, J.S. (1997) Nutrient composition of some freshwater fishes in Nigeria. *Bioscience Research Community* 11, 333-336.

[17] Mensah, P. (1997) Fermentation-the key to food safety assurance in Africa. *Food Contents* 5(6), 271-278.

[18] Anihouvi, V.B., Ayernor, G.S., Hounhouigan, J.D. and Sakyi-Dawson, E. (2006) Quality characteristics of lanhouin: A traditionally processed fermented fish product in the republic of Benin. *African Journal of Food Agriculture, Nutrition and Development* 6, 1-15.

[19] Mohamed, E.H.A., Al-Magbaly R. and Mansour M.H. (2010) Proximate composition, amino acid and mineral contents of five commercial Nile fishes in Sudan. *African Journal of Food Science* 4(10): 650-654.

Table 1: Mean mineral contents (µg/g dry weight) and percentage (%) in fresh and fermented tigerfish (Hydrocynus species).

Minerals	Fresh fish		Fermented fish	
	(µg/g)	%	(µg/g)	%
P	41.78 ± 3	86	34.55 ± 3.57	77
Ba	2.32 ± 0.19	4.8	3.74 ± 2.23	8.4
Fe	1.33 ± 0.62	2.7	1.98 ± 0.77	4.4
Zn	1.23 ± 0.55	2.5	1.71 ± 0.42	3.8
Al	0.63 ± 0.01	1.3	1.48 ± 1.30	3.3
B	0.60± 0.25	1.3	0.68 ± 0.16	1.5
Pb	0.22 ± 0.01	0.5	0.24 ± 0.02	0.6
Mn	0.18 ± 0.16	0.4	0.16 ± 0.17	0.4
Cr	0.07 ± 0.02	0.1	0.06 ± 0.02	0.1
Co	0.07 ± 0.02	0.1	0.06 ± 0.01	0.1
Ni	0.03 ± 0.05	0.1	0.03 ± 0.04	0.1
Ti	0.03 ± 0.02	0.1	0.02 ± 0.03	0.04
Cu	<0.0004		<0.0004	
Cd	<0.001		<0.001	
Total minerals	48.50		44.7	

Ligands

Figure 1. Percentage of mineral contents (%) in fresh and fermented tigerfish (*Hydrocynus* species).
Figure 2. Mean mineral contents (µg/g) in fresh and fermented tigerfish (*Hydrocynus* species).
Figure 3. The concentration of phosphorus (P) (µg/g) in fresh and fermented tigerfish (*Hydrocynus* species).

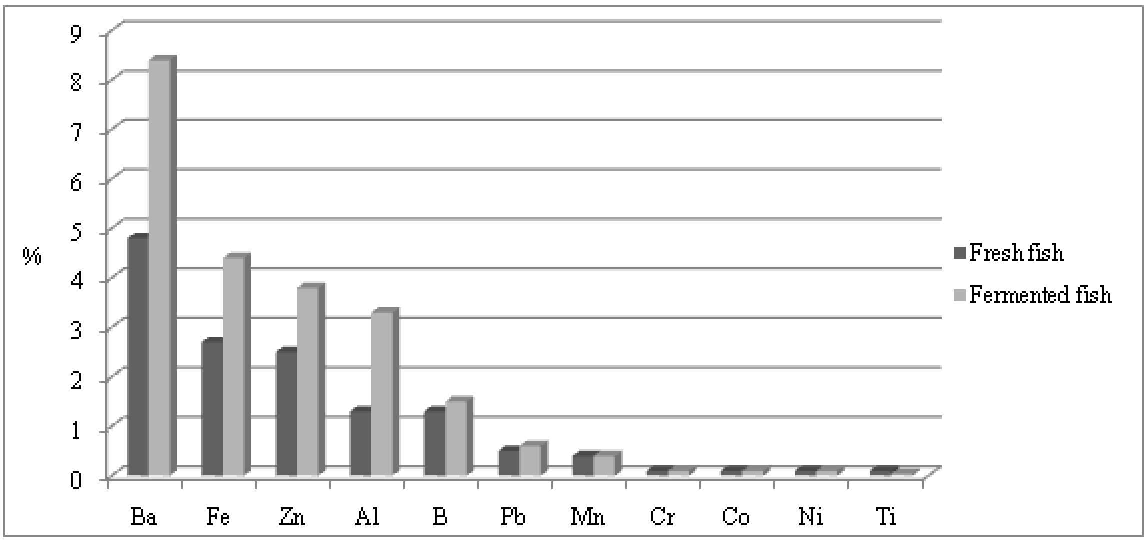

Figure 1

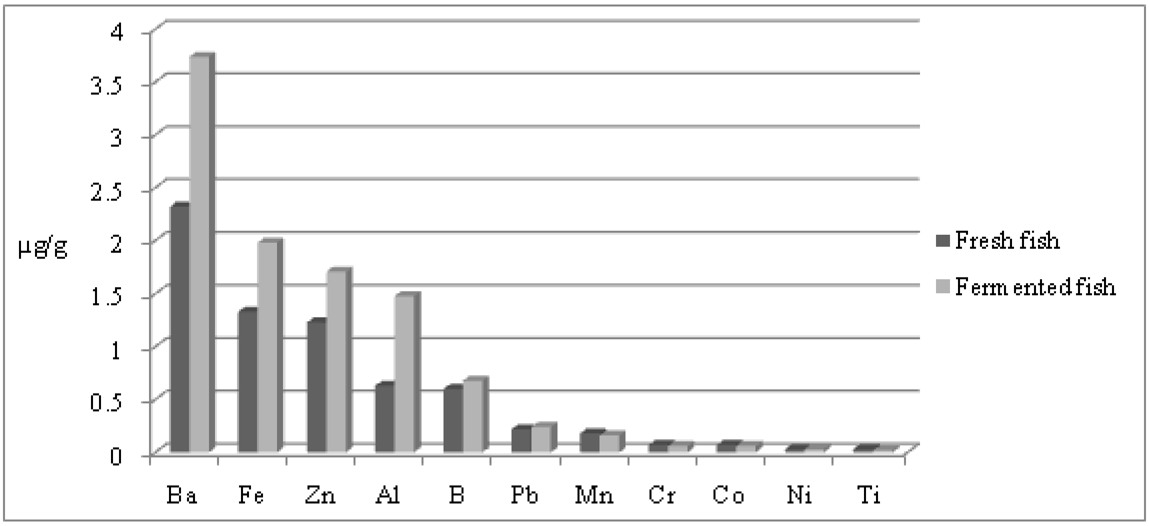

Figure 2

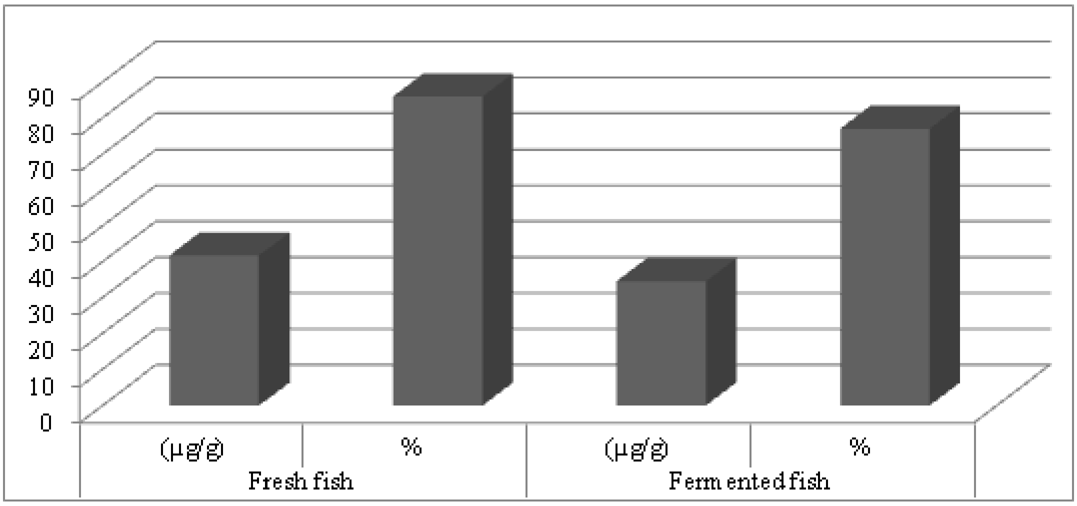

Figure 3