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Nutrient composition analysis of gish fish fillets affected by different cooking methods

Ali Aberoumand

Department of Fisheries, Behbahan Katam Alanbia University of Technology, Behbahan, Iran

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Abstract

The effects of different cooking methods (boiling, frying and roasting) on proximate composition of the fish *Carangoides malabaricus* were investigated. The mean content of moisture, protein, fat and ash of raw fish was found to be 57.97 ± 2.39, 31.49 ± 2.89, 16.8 ± 0.45 and 8.04 ± 0.12% respectively. The changes in the amount of protein were found to be significantly higher in frying and boiling fish. The changes in the amount of fat were found to be significantly higher in frying and boiling fish. The ash content decreased significantly in all cooking methods. In the present study, the boiling method of cooking is found to be the best for healthy eating.

Introduction

In Iran, Gish fish is rarely eaten raw and it is usually processed by various cooking methods, such as boiling, roasting, and frying, before consumption. Heating process (boiling, roasting and frying) is applied to enhance flavor and taste of food and inactivate pathogenic microorganisms (Bognar, 1998). In recent years, fish lipids have also assumed great nutritional significance, because of their high polyunsaturated fatty acid levels. Fish are also considered very rich source of minerals and vitamins. The total content of minerals in the raw flesh of fish and invertebrates is in the range of 0.6–1.5% of wet weight. Mineral components such as sodium, potassium, magnesium, calcium, iron, phosphorus and iodine are important for human nutrition (Sikorski *et al*., 1990). The contents of Na, K, Ca, Mg and P are up to 1 mg/100 g, whereas those of Fe, Zn and I are less than 1 mg/100 g (Kietzmann *et al*., 1969). The use of the microwave oven roasting method of cooking has increased greatly during the recent decades (Garcia-Arias *et al*., 2003a). The various cooking methods invariably affect the nutritive value of fish and especially vitamins, flavor compounds and polyunsaturated fatty acids. The effects of different cooking methods on proximate and mineral composition of several fish species have been reported (Ersoy *et al*., 2006; Kucukgulmez *et al*., 2006; Weber *et al*., 2008; Stephen *et al*., 2010). Early developments in the field of nutrition predicted that certain substances, important for the proper functioning of the human body, are lost during cooking of foods. It is imperative to conserve nutrients of food products and also is a major consumer concern related to food preparation. Therefore, it is important to determine the retention of nutrients in fish cooked using several common domestic practices, namely boiling, roasting and frying. To date there is no information available in the literature on the nutritive values of raw and cooked fishes. In general fish has long been recognized as an excellent source of animal protein in the human diet. Fish is widely consumed in many parts of the world by humans not only for its high quality protein content but also for the low saturated fat. It contains important *n*-3 polyunsaturated fatty acids that are likely to lower the risk of heart diseases in adults and are important for neuro-development in infants and young, and are known to support good health (Uauy *et al*., 2003).

Hence the present study was aimed to investigate the effects of different cooking methods on the proximate composition of fish *Carangoides malabaricus*. The possible effects of different cooking methods on the nutritive value of this species were evaluated; the values obtained in the cooked samples were compared with the values found in raw fish.

Materials and Methods

Sample preparation and cooking

A total of 25 live Gish fish (*Carangoides malabaricus*), with a length (20–30 cm) and weight of (260–450 g) were obtained from the local fish market in Behbahan, Iran. They were kept in a plastic container and transported to the laboratory. Upon arrival at the laboratory, the fish were washed with tap water several times to remove adhering blood and excessive mucus. The fish were then placed in ice-cold water (hypothermia) for five minutes prior

*Corresponding author.
Email: *aberoumandali@yahoo.com*
Tel: +98 9166716540; Fax: +98 6712229969

to eviscerating and beheading. Subsequently the fish samples were filleted and fillets were divided into five groups and each group consisted of five fillets. The first group was uncooked while the other four groups were cooked in the following methods; boiling, frying and roasting. Boiling was performed at 99–101°C (water temperature) for 12 min. Roasting of fillets was performed in a conventional oven with the temperature set at 200°C for 20 min. The frying of fillets was performed in a domestic frying pan of 2 L capacity at temperature approximately of 180°C for 15 min. Sunflower oil was used as the medium for frying. The fresh and cooked fish were hand de-boned and ground in a kitchen blender to ensure homogeneity and representative samples taken for analysis. Samples were packed in a polythene bags and kept under frozen conditions (−20°C) until analysis.

Proximate composition analysis

Proximate composition analysis for homogenized samples of cooked and raw fish fillets were done in triplicate for protein, moisture, lipid and ash contents. The crude protein content was determined by the Lowry method (Lowry *et al*., 1951). Moisture content was determined by oven drying at 105°C to a constant weight. Total lipid was extracted from the muscle tissues by chloroform: methanol (2:1, v/v) solvent system (Folch *et al*., 1957). The lipid content was gravimetrically determined. Ash content was determined gravimetrically in a muffle furnace by heating at 550°C to a constant weight (AOAC, 2000).

Statistical analysis

Data was analyzed using one-way analysis of variance (ANOVA) and the significant differences between means were determined by post hoc Duncan's multiple range test. Differences were considered to be significant when $p < 0.05$. Data were analyzed using SPSS package (Version 11).

Results and Discussion

The proximate composition of raw fish and fish fillets after various cooking methods of fish (*C. malabaricus*) are presented in Table 1. The proximate composition of raw fillets is similar to earlier reports in the fish (Zuraini *et al*., 2006). Proximate composition of moisture, protein, fat and ash of the fish was varied in all the cooking methods. Significantly higher protein content (41.73 ± 1.82) was recorded in roasted fillets followed by (40.41 ± 0.96) in boiling than the rest of the cooking methods ($P < 0.05$). Significantly

Table 1. Proximate (% in dried matter) and of raw and cooked fillets samples of *C. malabaricus*

Nutrients	Raw	Boiled	Roasted	Fried
Moisture (%)	52.42 ± 1.39a	42.40 ± 0.31b	41.77 ± 0.33b	25.63 ± 1.48c
Protein (%)	31.49 ± 2.89b	40.41 ± 0.96a	41.73 ± 1.82c	14.78 ± 1.26d
Lipid (%)	12.8 ± 0.45a	9.06 ± 1.46b	4.48 ± 0.39ab	32.15 ± 1.85c
Ash (%)	3.29 ± 0.12a	8.13 ± 0.13c	12.02 ± 0.12b	7.00 ± 0.13c

Values are shown as mean ± standard deviation of triplicates. Values within the same row have different superscripts are significantly different ($p < 0.05$).

higher fat content (32.15 ± 1.85) was observed in fried fillets followed by (12.80 ± 0.45) in raw fish fillets followed by (9.06 ± 1.46) boiled fish fillets ($P < 0.05$). There was no significant difference observed in fat content among boiled, raw fish fillets ($P > 0.05$). The increase in fat content of the fried fish fillets is related to oil absorption during the cooking process. Further the increase of fat content can be attributed to the oil penetration on the food after water is partially lost by evaporation (Saguy and Dana, 2003). Similar results were reported for sardine and African catfish fried in vegetable oil (Candela *et al.*, 1996). Increased in dry matter content was observed in boiled, roasted and fried fish fillets. The highest moisture content (52.42%) was recorded in raw fillets and decreased moisture content was noticed in frying method of cooking (Table 1). Increased ash content was noticed in roasted and boiled fillets when compared to raw fish fillets. Moisture loss was also recorded in fried fillets of the fish. However, dehydration rate comparatively was lower than during boiling and roasting. These changes were similar to those reported in sardines (Garcia-Arias *et al*., 2003a). Water losses, occurring during frying resulted in lower protein content in fried fish as compared to the raw fish fillets (Garcia-Arias *et al*., 2003b). Accordingly, the increase in ash, protein and fat content found in cooked silver catfish fillets is explained by the reduction in moisture. Differences in water contents between fresh and smoked rainbow trout were found to be significant (Unlusayin *et al*., 2001). This findings also supported by that deep fried fish fillet had significantly lower protein content than roasted and boiled fillet (Gall *et al.*,1983).

The increased dry matter, protein and ash content were observed in boiled and roasted fish fillets. The fat content in fried fish fillet increased due to absorption of oil by the fish during frying. Hence this method of cooking is not advisable. On comparing the raw and cooked fish fillet, the results indicate that cooking had considerable effect on the proximate composition of fish fillets. Based on the results obtained for proximate composition, the boiling fish fillets of the fish were found to be the best among all the cooking method for healthy eating. Boiled fish fillet was best option in

diet from nutritional values point of view.

Conclusion

Results of the present study have shown that changes in the amount of protein were found to be significantly higher in frying and boiling fish. The changes in the amount of fat were found to be significantly higher in frying and boiling fish. Based on the results obtained for proximate composition, the boiling fish fillets of the fish were found to be the best among all the cooking method for healthy eating.

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References

AOAC, 2000. Official methods of Analysis, (17th Edn). Association of Official Analytical Chemists, Washington. D.C.

Bognar, A. 1998. Comparative study of frying to other cooking techniques influence on the nutritive value. Grasas y Aceites 49(3-4): 250-260.

Candela, M., Astiasaran, I. and Bello, J. 1996. Effects of frying and warmholding on fatty acids and cholestrol of sole (*Solea solea*) codfish (*Gadus morhua*) and hake (*Merluccius merluccius*). Food Chemistry 58(3): 227–231.

Ersoy, B., Yanar, Y., Kucukgulmez, A. and Celik, M. 2006. Effects of four cooking methods on the heavy metal concentrations of sea bass fillets (*Dicentrarchus labrax* Linne, 1785). Food Chemistry 99(4): 748–751.

Folch, J., Lees, M. and Sloan-Stanley, G.H. 1957. A simple method for the isolation and purification of total lipids from animal tissues. Journal of Biological Chemistry 226: 497–509.

Gall, K.L., Otwell, W.S., Koburger, J.A. and Appledorf, H. 1983. Effects of four cooking methods on proximate, mineral and fatty acid composition of fish fillets. Journal of Food Science 48:1068–1074.

Garcia Arias, M.T., Pontes, E.A., Fernandez, M.C.G. and Muniz, F.J.S. 2003a, Freezing/defrosting/frying of sardine fillets. Influence of slow and quick defrosting on protein quality. Journal of Science of Food and Agriculture 83:602–608.

Garcia Arias, M.T., Pontes, E.A., Garcia-Linares, M.C., Garcia-Fernandez, M.C. and Sanchez Muniz, F.J. 2003b. Cooking-freezing-reheating (CFR) of sardine (*Sardina pilchardus*) fillets. Effect of different cooking and reheating procedures on the proximate and fatty acid compositions. Food Chemistry 83:349–356.

Kietzmann, U., Priebe, K., Rakou, D. and Reichstein, K. 1969. Seefisch als Lebensmittel. Berlin: Paul Parey Verlag Hamburg.

Kucukgulmez, A., Celik, M., Yanar, Y., Ersoy, B. and Cıkrıkcı, M. 2006. Effects of different cooking methods on the proximate composition and mineral contents of sea bass (*Dicentrarchus labrax*) Advances in Food Science 28(4):223–227.

Lowry, O.H., Rosenberg, N.H., Farr, A. and Randell, K.S.L. 1951. Protein measurement with folinphenol reagent. Journal of Biological Chemistry 193:263–275.

Saguy, I.S. and Dana, D. 2003. Integrated approach to deep fat frying: Engineering, nutrition, health and consumer aspects. Journal of Food Engineering 56:143–152.

Sikorski, Z.E., Lolakowska, A. and Pan, B.S. 1990. The nutritive composition of the major groups of marine food organisms. In: Resources Nutritional Composition and Preservation. Sikorski Z.E (Ed). P.30–52. USA. Florida. CRC Press-Inc. Boca Raton.

Stephen, N.M., Shakila, R.J., Jeyasekaran, G. and Sukumar, D. 2010. Effect of different types of heat processing on chemical changes in tuna. Journal of Food Science and Technology 47(2):174–181.

Uauy, R., Hoffman, D.R., Mena, P., Llanos, A. and Birch, E.E. 2003. Term infant studies of DHA and ARA supplementation on neurodevelopment: Results of randomized controlled trials. Journal of Pediatric 143(4):17–25.

Unlusayin, M., Kaleli, S. and Gulyavuz, H. 2001. The determination of flesh productivity and protein components of some fish species after hot smoking. Journal of Science of Food and Agriculture 81: 661–664.

Weber, J., Bochi, V.C., Ribeiro, C.P., Victorio, A.M. and Emanuelli, T. 2008. Effect of different cooking methods on the oxidation, proximate and fatty acid composition of silver catfish (*Rhamdia quelen*) fillets. Food Chemistry 106:140–146.

Zuraini, A., Somchit, M.N., Solihah, M.H., Goh, Y.M., Arifah, A.K., Zakaria, M.S., Somchit, N., Rajion, M.A., Zakaria, Z.A. and Mat Jais, A.M. 2006. Fatty acid and amino acid composition of three local *Malaysian Channa* spp. Food Chemistry 97:674–678.