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Effect of different cooking methods on proximate composition of Indian mackerel (*Rastrelliger kanagurta*)

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Abstract
Seafood is an excellent source of metabolically essential proteins, vitamins, trace elements and polyunsaturated fatty acids. In this study, the effects of frying, roasting and boiling on the proximate composition and quality of Indian mackerel (*Rastrelliger kanagurta*) were studied. The proximate compositions were affected significantly by all cooking methods. Mean moisture, protein, fat and ash contents of raw fish were 76.2 ± 0.15, 7.89 ± 0.31, 5 ± 0.10 and 0.92 ± 0.14%, respectively. The changes in amount of protein contents were found to be significantly higher in frying than boiling and roasting. The fat contents in fresh, fried, boiled and roasted mackerel were found to be 5%, 13%, 7.5%and 9.6% respectively. The present study demonstrate that roasted and boiled fish which are considered as beneficial to human health

Keywords: Indian mackerel raw and cooked fish, proximate composition

Introduction

Fish has long been recognized as a valuable food source of high-quality protein, essential fatty acid, vitamins and trace elements in the human diet. Many studies carried out by scientist and researcher on Omega-3 fatty acid and Omega-6 fatty acid for their protective effect on cardiovascular diseases in people. It is rich source of long-chain fatty acid, namely Eicosapentaenoic acid and Docosahexaenoic acid. They find out that good source of fatty acid, protein and vitamins found in marine water fish compare to freshwater fish. In marine water *R. kanagurta*is one of major source of Omega-3 fatty acid and Omega-6 fatty acid and it levels is up to 2700 mg. Fat content is <2%, protein is 19 gm and mineral is 2 gm (Gopalan *et al*.,2004) [11]. It provides a significant amount of poly unsaturated fatty acids intake to people of developing countries. It plays vital role by preventing anti-inflammatory, heart-diseases, and anti-thrombosis effect because these fatty acid is not synthesize in human body so it obtained through good diet.

The *R. kanagurta*or Indian mackerel is marinewater fish, found along on Indian coast and it has attracted consumer for its taste, carcass quality and odour. It is most popular food fish. Method of preparing for consumption is different in different parts of India. It available in market as raw fish or ready to eat fish or by making smoky, frying, gravy, boiling, and in roasting form. The Frying and boiling are two widely accepted cookingmethod for fish. However, frying is more popular than boiling and roasting fish because it is one of the fastest and simplest methods of fish cooking. Since frying involves with a very high temperature (usually 170-180 °C) it breakdown chemical structures of nutrient through hydrolysis and oxidation of the fatty acid. The breakdown products can give rise to good flavor and taste. However, different cooking methods are very important for nutritive value of fish because it can change complex form of nutrient into simple form which takes less time for breakdown.

Heating include boiling, grilling, baking, and fryingis different methods applied to enhance its flavor and taste, inactivate pathogenic microorganisms and increase shelf life (Bognar, 1998). Present study conducted to determine the three cooking methods (roasting, frying, boiling in cottonseed oil) on the proximate analysis of *R. kanagurta* be-headed and eviscerated.

Materials and Methods

Samplling procedure

Samples of Indian mackerel (*R. kanagurta*) were obtained from a local fish market (Veraval, Gujarat, India) during the November of 2017. They were eviscerated, beheaded and washed fish preserved in ice-box at 0ºC and transported to laboratory. Fresh fish were washed with tap water several times to remove blood and slime; they were then prepared using common household practices. The fish were score apart between pectoral fin and tail which were assigned to three repetitions of each one of three cooking methods.

Cooking methods

Common household practices were used. Boiling was done at approximately 97 ^{O}C (water temperatures) for 10-15 minutes. Frying was performed at 150-160 ^{O}C for 10-12 minutes in cotton seed oil. To prepare conventionally roastedfish by using charcoal and roast fish for 18-20 minutes. Samples of cooked fish were immediately homogenized and used to determine proximate composition.

Analysis

Proximate composition of cooked and uncooked fish was done in duplicate for moisture, protein, lipid and ash contents. The moisture content was determined by moisture meter at above 100 °C to a constant weightTotal lipid was extracted from the muscle tissue by Socs plus solvent extraction system. The lipid contentwas gravimetrically determined (AOAC 2006) [1]. Ash content was determined gravimetrically in a muffle furnace by heating at 550°C to a constant weight (AOAC 1995).

Result and Discussion

The proximate composition of raw fish and beheaded fish after various cooking methods of Indian mackerel (*R. kanagurta*) are presented in Table 1. The proximate composition of raw fish is similar to earlierreports in Indian mackerel (Zuraini *et al*., 2006) [26]. Proximate composition of moisture, protein, fat and ash of Indian mackerel fish was varied in all the cooking methods. Significantly higher protein content (8.59 ± 0.12) was recorded in fried fish followed by (8.29 ± 0.07) in roasting than the rest of the cooking methods. Significantly higher fat content (13 ± 0.57) was observed in fried fish followed by (9.6 ± 0.57) in roasting fish than boiled and raw fish. There was no significant difference observed in fat content among boiled, roasting and raw fish. The increase in fat content of the fried fish and roasted fish 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, 2003) [21]. Similar results were reported for sardine and African catfish fried in vegetable oil (Candela *et al*. 1996) [4]. The highest moisture content (76.2 ± 0.15) was recorded in raw fish and decreased moisture content was noticed in all method of cooking except for the boiled fillets (Table 2). Increased ash content was noticed in the entire cooked fish product when compared to raw fish. However, dehydration rate comparatively lower than during frying and roasting. These changes were similar to those reported by (Gokoglu *et al*. 2004) [11] in rainbow trout and in sardines (Garcia-Arias *et al*. 2003) [9]. Water losses, occurring during frying and roasting method resulted in higher protein content in fried and roasted fish as compared to the raw fish (Garcia-Arias *et al*. 2003) [9]. Accordingly, level of ash, protein and fat content found in cooked Indian mackerel fish is explained by the reduction in moisture level. This finding also supported by (Gall *et al*. 1983) [8], that deep fried fish had significantly higher protein content than raw fish.

Table 1: Proximate composition of Indian mackerel in Different cooking methods.

Proximate composition (%)	Raw fish	Boiled fish	Fried fish	Roasted fish
Moisture (%)	76.2 ± 0.15	73.8 ± 0.15	71 ± 0.45	69.42 ± 0.48
Protein (%)	7.89 ± 0.31	8.09 ± 0.12	8.59 ± 0.07	8.29 ± 0.07
Lipid (%)	5 ± 0.10	7.5 ± 0.23	13 ± 0.57	9.6 ± 0.57
Ash (%)	0.92 ± 0.14	1.4 ± 0.7	1.74 ± 0.07	2.1 ± 0.08

Conclusion

In this present study increased dry matter protein, ash content was observed in fried and roasting fish. The fat content was higher in fried fish due to absorption of oil by the fish during frying. Therefore, frying cannot be recommended to prepare a healthy diet. More research is needed in this area to finding best cooking method for preparing healthy diet and also need to research on cooking oil which not changes lipid value of diet after cooking. This would be very helpful to select a healthy diet. Fish Age, size and location are very important factor for nutritional value of fish because it contains harmful level of mercury found in fishes. Fish contain many important fatty acids and amino acids which might be lost during frying. Based on the results obtained for proximate composition, the boiling and roasting fish of Indian mackerel were found to be the best among fried cooking method for healthy eating.

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