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Proximate Composition and Energy Values of Canned Tuna Fish Obtained from Iran

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Abstract: Canning processing made fish less susceptible to spoilage. Fish are rich in protein content but the protein content is reduced with processing gave a better result when long-time preservation was carried out. Two species of tuna fish were selected for processing. Canning process reduced the protein content for *Orcynopsis unicolor,* But increased in protein content for *Euthynnus affinis.* Fresh and four monthly canned *E. affinis* fish had 22 % and 23.9 % protein content respectively, while *O. unicolor* had 19.8 % and 21 %, after four and six months of storage in cans respectively. Canned *Euthynnus affinis* was the most nutritious; the nutritive value did not diminish with the method of preparation. The results also showed that *Orcynopsis unicolor* had the highest oil content (28.3%) followed by *Euthynnus affinis* (21.4%) which has the lowest oil content due to the processing method. This work showed the effect of the treatment on a fish sample is dependent on the fish species. Because all fish species are not available in the fresh form in all seasons this processing is a good preservation method for consumers in Iran.

Key words: Canning Processing · Nutritive Value · Marine Fishes

INTRODUCTION

The fat content of raw fishes can also influence fat exchanges and interactions between the culinary fat and that of the fish during processing, Harris [1]. Generally fish contains very little carbohydrate, while the moisture content is very high. In most fish species the moisture content is between 60-80%, protein between 15-26% and 2-13% for fat. The fat content of fishes varies with species, age, size and also season. Since fish is not normally consumed raw, various processing methods are employed in preparing them for consumption and some of these processes include boiling, frying, roasting, smoking, which could have varying effects on their nutrient contents, texture and flavor, Holland *et al*. [2]. The marine fish is generally cheaper and more abundant when compared with fresh water fishes, which are relatively more expensive in Iran. The major constituents of fish are moisture, protein and fat with minerals occurring in trace amount, Pearson and Cox [3]. Fishes are a rich source of protein commonly consumed as an alternative source of protein due to the higher cost of meat and other sources of animal protein. Fish has lower cholesterol content when compared with meat, Eriksson [4] and thus often recommended for consumption especially among the adult population. Previous workers had reported the effects of processing methods on different fish types. For example, Greenfield and Kosulwat said the type of food and cooking procedures influence the fat content and other nutrients Greenfield and Kosulwat [5]. Data on the macronutrient content of fish is only available for raw fish and there seems to be a scarcity of information on the processed ones, Sanchez-Muniz *et al*. [6]. The need to look at the effect of processing on the nutrient composition of fish is therefore high. The heat and dryness associated with hot smoking reduces the water activity of the food (fish) thereby limiting microorganisms, a prerequisite for spoilage Abolagba and Osifo, [8]. The methods commonly used are the traditional techniques such as salting/brining, sun-drying and smoking, which also increase fish availability to the consumers Abolagba *et al*. [9]. Preservation methods such as canning and freezing are technologies that are hardly used in the artisanal sub-sector, basically due to cost and non-availability of equipment and cold storage system Eyabi-Eyabi, [10]. This work is thus a preliminary

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investigation of the effect of common processing method - canning on the macronutrient content of some marine fishes that are commonly consumed in Iran as the major source of animal protein for the average individual and family.

MATERIALS AND METHODS

Materials and Preparation of Sample: The fish types used in this study were *Euthynnus affinis* and *Orcynopsis unicolor* in south Iran. These fishes were chosen because they are readily available, cheap, affordable and within the reach of an average Iran. The fishes were purchased from two popular markets (Behbahan) in Iran. They were thoroughly washed, cut into about 75g-pieces and washed again with tap and distilled water. The 2 categories of fishes, fresh and canned were analyzed for fat, ash, moisture and protein content as described by association of official analytical chemists [7].

Analytical Methods: In this study, The concentration of the different nutritional components in raw and canned muscle were analyzed. The results are expressed in g/100 g wet weight of raw, canned muscle, respectively. Moisture, ash, protein and lipid contents were determined in each specimen's tissue according to the Association of Official Analytical Chemists procedures [7]. Briefly, the moisture content was obtained by drying the sample overnight at 105°C, ash was quantified after combustion for 16h at 550°C, crude protein content was determined by the Kjeldahl method [7] using a conversion factor of 6.25 and total lipid was determined with the Soxhlet extraction method [7] using ethyl ether. The energy value, expressed as kcal/100g edible part, was estimated using FAO (1989) factors: 9.02 and 4.27 kcal/g for fat and protein, respectively.

Statistically Analysis: Analysis of variance was used to evaluate the analysis data and significant differences among means were determined by Independent Samples-T Test (P=0.05). Statistical calculation was performed with SPSS 15.0 for windows.

RESULTS AND DISCUSSION

The average values of the four main constituents, moisture, fat, protein and ash in *Euthynnus affinis* and *Orcynopsis unicolor* are shown in Figures 1-10.

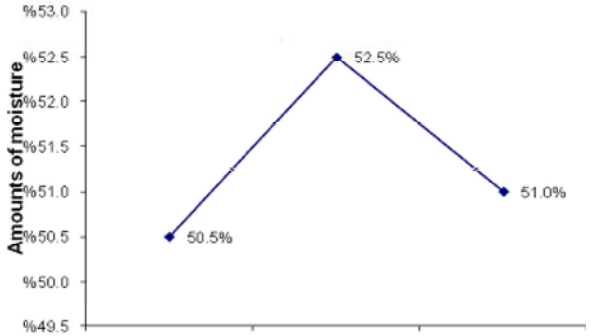

Fig. 1: Comparison of moisture levels in canned *Euthynnnus affinis* after 1,2 and 4 months of storage

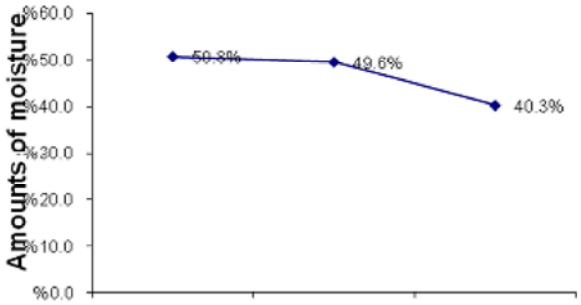

Fig. 2: Comparison of moisture levels in canned *Orcynopsis unicolor* fish after 2,4 and 6 months of storage

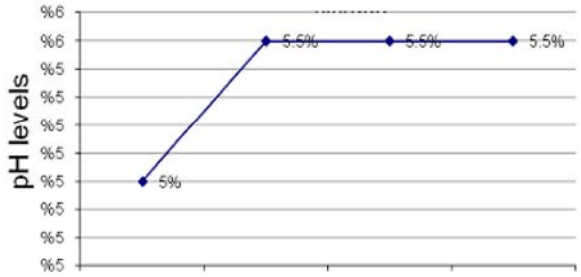

Fig. 3: Comparison of pH levels in fresh and canned *Euthynnnus affinis* fish after 1,2 and 4 months of storage

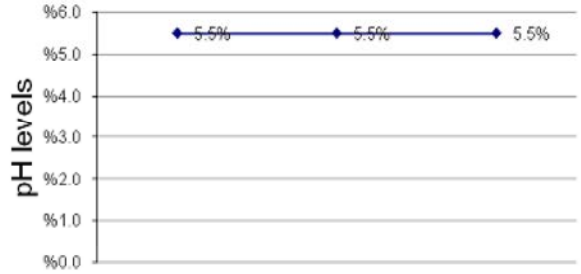

Fig. 4: Comparison of pH levels in canned *Orcynopsis unicolor* fish after 2,4 and 6 months of storage

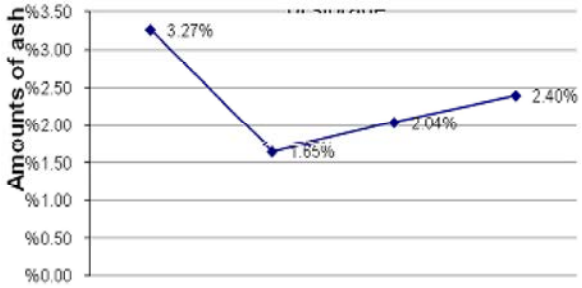

Fig. 5: Comparison of ash levels in fresh and canned *Euthynns affinis* fish after 1,2 and 4 months of storage

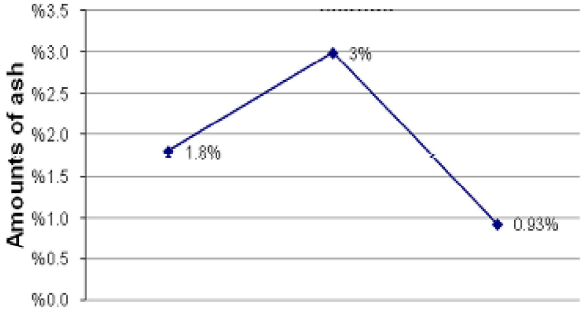

Fig. 6: Comparison of ash levels in canned *Orcynopsis unicolor* fish after 2,4 and 6 months of storage

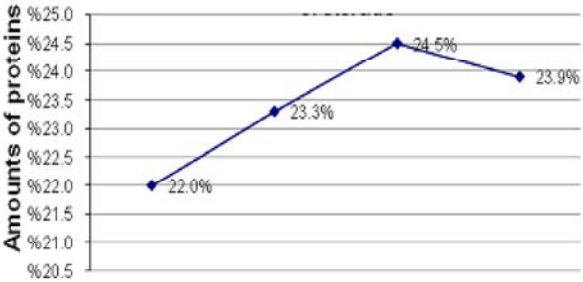

Fig. 7: Comparison of protein levels in fresh and canned *Euthynnus affinis* fish after 1,2 and 4 months of storage

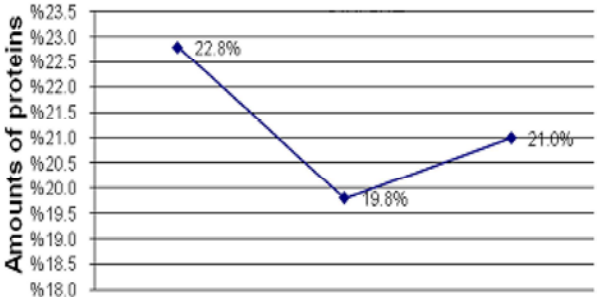

Fig. 8: Comparison of protein levels in canned *Orycynopsis unicolor* fish after 2,4 and 6 months of stotage

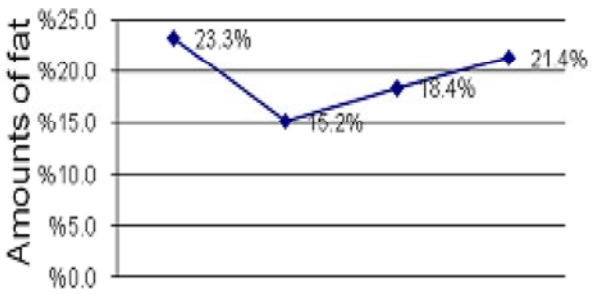

Fig. 9: Comparison of fat levels in fresh and canned *Euthynnus affinis* fish after 1,2 and 4 months of storage

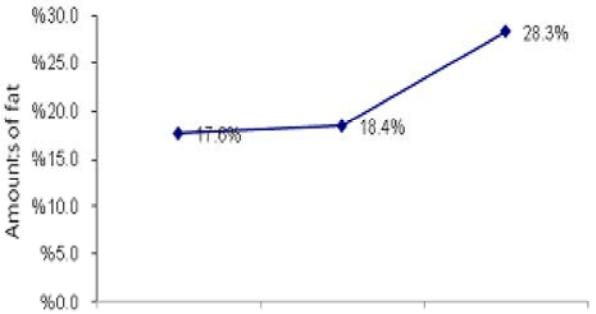

Fig. 10: Comparison of fat levels in canned *Orcynopsis unicolor* fish after 2,4 and 6 months of storage

The moisture content (% wet weight) was lower in *Orcynopsis unicolor* (49.6%) than in *Euthynnus affinis* (51%) after 4 months of storage in the cans (Figures 1 and 2). The crude protein content (% wet weight) was lower in *Orcynopsis unicolor* (19.8%) than in *Euthynnus affinis* (23.9%) after 4 months of storage in the cans (Figures 7 and 8) and the ash between 1.65% and 3.27 % (Figure 5). As can be seen, the total lipid content was always higher in *Euthynnus affinis* (21.4%) than in *Orcynopsis unicolor* (18.4%) (Figures 9 and 10). The pH levels was 5 in fresh *Euthynnus affinis*, but was higher in canned *Euthynnus affinis* and *Orcynopsis unicolor* fishes (5.5) (Figures 3 and 4). The energy values (% wet weight) was lower in *Orcynopsis unicolor* (281.6kcal/100g) than in *Euthynnus affinis* (293.4kcal/100g) (Table 1) after 4 months of storage in cans. Results are expressed as mean of triplicate trials. Data were analyzed by one way analysis of variance.

Canned fish samples have the least moisture content (Figures 1 and 2) and this is because the water in the fish forms aqueous/oil mixture during processing and the water is expelled before the processing is accomplished since the boiling point of the oil is far greater than that of water hence the reduction in the moisture content.

Table 1: Proximate and physicochemical analysis of canned *rcynopsis unicolor* and *Euthynnus affinis* fishes after four months of storage

	Storage time fat (%)	Protein (%)	Ash (%)	Moisture (%)	Carbohydrate (%)	Energy value (Months) Kcal/100g
Four	18.4±0.17[a]	19.8±0.28[c]	3±0.06[e]	49.6	9.2	281.6[a]
Four	21.4±0.14[b]	23.9±0.19[d]	2.40±0.09[f]	51.0	1.3	293.4[b]

Results are means ± standard deviation of triplicates

Means within the same column that have no common letters are significantly different (P<0.05)

The moisture contents of the fresh fish type were more. The reactions of water/oil with food items particularly at high temperature as obtained during processing have been shown to affect some nutrients in the food item as well as causing alteration of the structure of the oil and denaturing of the food nutrients (Eriksson [4]; Greenfield and Kosulwat [5]; Kubow [11]; hence the significant difference recorded in moisture content after the different processing method.

Since fishes are consumed as a major protein source in food, it is very important that the protein content should not be compromised during table preparation. It is significant to note, therefore that all the tables processing methods reduced the crude protein contents but the reduction did not follow a particular order or fish type. Fresh *O. unicolor* had the highest crude protein content (22.8%) while *E. affinis* had the least (22%) (Figures 7 and 8). Comparison of proximate composition between fresh and canned fishes showed fat content has been increased and amounts of protein, ash and carbohydrate has been decreased and overall energy value will be increased after three months of storage. Fat and moisture content for anyone species fluctuates depending on season and location of catch, size, spawning cycles, etc. and variability can be expected in the data. Moisture content may also fluctuate on canned samples depending on drip loss during storage, thus affecting the drip loss and subsequent moisture determination. This loss in moisture content is reflected as a gain in the other constituents of the proximate composition.

Recent studies suggest that eating fish oil daily reduces the risk of heart disease death. The most efficient way to add these important oils to your diet is to eat two meals per week of fish rich in this fatty acid prepared without additional oil. The British Nutrition Foundation has recommended that for a balanced and healthy diet, we should all consume 0.2 g of EPA+DHA daily or 1.5 g on a weekly basis.

CONCLUSIONS

The results of the processing methods examined for preparation of fish for human consumption showed that, canning is the best when preservation of the fish is of priority but when nutrient conservation is the focus, boiling is a better option. Therefore, it was concluded that *Euthynnus affinis* nutritional value after four months of storage with energy value (293.4 kcal/100g).

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