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Original Article

Effect of Drying System on Chemical and Physical Attributes of Dried Catfish Meat (Clarias Sp.)

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ABSTRACT

The aim of this study was to identify the effect of drying system on quality and physical characteristics (chemical proximate and sensory analysis) of dried fish (Cat fish, *Clariassp*) flesh. Three drying methods were used in this study: open air and solar tents comprising the plastic sheet and rabbit wire net. Before drying, the slices of fish flesh were prepared and soaked in 25% salt solution for 1 hour. The results of chemical composition parameters moisture, protein, fat, and ash content of the studied samples were found to be 4.55-5.95%, 52.65-61.75%, 6.8-7.95%, and 8.1-8.85%, respectively. The findings of this study revealed no significantly differences in moisture, dry matter and ash among the studied samples, but the protein and fat contents levels showed significant difference. Sensory evaluation attributes showed no significant difference among the studied fish. The color values of the open air, plastic sheet and rabbit wire net samples were found to be 6.17, 6.67, and 6.67 respectively. Texture values of dried fish meat recorded 6.33for rabbit wire net followed by 6.17 for plastic sheet tent and 5.58 for open air drying method. Flavour values scores were 6.58 for plastic sheet, 5.58 for rabbit wire net and 5.42 for open air drying system. Juiciness results were 4.33 for rabbit wire net, 4.25 for open air and 4.17 for plastic sheet. There was no significant difference for sensory evaluation characteristics. It could be concluded the best drying method for the fish (*Clariassp*) meat is plastic sheet tent system, which gave the best results among the three studied drying methods.

Keywords: Drying system, chemical, physical, attributes, catfish, fish meat

INTRODUCTION

During the last decades in this century, healthy eating habits have received increased attention, and it is widely recognized that regular fish consumption is one possible health improving practice (Hoge, 2004; Sidhu, 2003).

Fish represents a valuable source of protein and nutrients in the diet of many people and its importance in contributing to food security is rising significantly. The total food supply available from fisheries in the live weight terms is estimated to be slightly higher than 16 Kg/year for each of the world inhabitants.

Post-harvest, handling, processing and transportation of fish require particular care in order to ensure proper quality and safety. Retaining the nutritional value of the fish, preserving the benefits of its rich composition and avoiding costly and debilitating effect of fish-borne diseases are vital. Many different techniques have been used to preserve fish quality and to increase shelf life. Techniques are designed to inhibit or reduce the metabolic changes that lead to fish spoilage by controlling specific parameters of the fish and/ or its environment (FAO, 2009).

In many parts of the world there is no access to refrigeration or ice. This places stress on the physical, chemical and biological processes that lead to spoilage and deterioration of freshly caught fish. Reducing moisture content through drying, smoking or curing will result in stable source of protein that can be transported to communities with limited access to fresh fish. Smoking, drying and curing of fish either as a means of prolonging shelf life, or to produce desired flavors and texture has been practiced by many societies for centuries. In tropical countries there are many traditional methods including direct sun drying with the fish placed either directly on the ground or on mats or racks. Some of these processes involve brining or dry salting. The quality of smoked, cured and dried fish can be assessed using a range of physical, chemical and organoleptic methods. Modern quality control procedures such as HACCP (Hazard Analysis Critical Control Point) programs are increasingly used in smoked, cured and dried fish industries (Doe, 2003).

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Sudan is endowed with diversified surface and underground water source and resource, and arable lands that are suitable to support vigorous capture fisheries and aquaculture industry. Currently, capture fisheries activities are centered around the River Nile and its tributaries, and the territorial waters of Sudan on the Red Sea (FAO, 1999).

Abu Gideiri, (1973) stated that in the Sudan the importance of fish in the diet seems to follow a markedly regional pattern. Handling and postharvest treatment of fish in Sudan show a wide spectrum as regards choice, consumption and ways of utilization. People consume fresh fish or preserved in one way or another (smoked, salted, or dried).

Sudan as one of the developing countries is no exception to the problems of malnutrition, in spite its endowed with numerous rivers and the extending inland, traversing the country from Uganda and Ethiopian borders up to the Mediterranean Sea, covering an area of about two million hectares (Medani, 1973).Sun-drying is an important step in traditional method of fish processing in many African countries. Most of the research which was carried out on fish drying methods was started since about fifteen years ago. The main objective of this trial was to find out the best drying parameters in order to obtain the best products qualities and to optimize the drying processes.

MATERIALS AND METHODS

Fish Samples

Fifty four fish samples of moderate weight of African catfish (*Clarias sp.*) were purchased from Elmourda Fish Market, Oumderman, Sudan. The length and total weight of individual samples were taken using measuring board and normal balance.

Experimental Trials

The fish samples were washed thoroughly with tap water to remove all the adhesive materials and blood, and weighed individually and degutted using sharpens and cleans knives. The studied sample were reweighed to determine the losses in the fish weight and immersed in plastic container with brine at concentration (25%salt concentration), for one hour, then the fish samples were taken out and divided into three groups, each group weighed eighteen kilograms as a desirable weight.

Each group was exposed to the three different methods of drying (open air, plastic sheet and rabbit wire net) while temperature and humidity levels were measured and recorded every day.

In the open air drying method the fish was hanged up horizontally from the head on hooks and strings, at 60 cm off the ground level.

The plastic and rabbit wire net tent dryers were made from wooden frame works with dimensions ($1.\times1.5\times1.0m^3$) and bottom area of ($1.5\times1.0m^2$).One of this was covered by rabbit wire net, and the other by polythene plastic sheet). The studied fish samples were suspended inside each tent, at 60 cm off the bottom of tent to satisfy the experimental requirements.

The Chemical Composition analysis

Random samples from each studied group were minced separately, thoroughly and packed in three plastic bags and sent to the Central Veterinary Research Laboratory, Soba-Sudan to determine the chemical composition parameters (moisture, protein, fat, dry matter and ash)following the methods of Association of Analytical Chemists AOAC, (1990).

Sensory Evaluation

Sensory evaluation of product quality was carried out using 12 Panelists including members of the staff, Department of Fisheries and Wildlife Science, the samples were prepared and cooked carefully, and every treatment was given a random code number, and introduced to the assessors. The assessors scored for overall acceptability ofcolour, texture, flavour, and juiciness using an eight point hedonic scale where (8) was extremely desirable and(1) was extremely undesirable.

Statistical analysis

The data of this study were analyzed using computer statistical package of social science software (SPSS, version 10, one way ANOVA to test significance level.

RESULTS and DISCUSSION

This study was conducted to determine the effect of different drying methods on fish meat using different techniques (open air, plastic sheet and rabbit wire net; photos, 1, 2 and 3) as shown in the following tables:

Table 1. Effect of different drying methods (open air, plastic sheet, and rabbit wire), on (mean ±SD) proximate composition of *Clarias sp:* meat.

Parameter / Treatment	Moisture %	Dry matter %	Crude protein %	Fat %	Ash %	Nitrogen free extract %
Open air	5.95± 0.07	94.05±0.07	52.65±0.77**	7.95± 0.07**	8.1±0.14	25.35±0.49
Plastic sheet	5.05±0.49	94.95±0.91	59.00±0.28**	6.8± 0.14**	8.85±0.07	20.45±0.90
Rabbit wire	4.55±0.63	95.45±0.63	61.75±0.35**	7.1±0.14**	8.55±0.02	18.05±0.49

Values represent the mean ± standard deviation of 18 fish for each treatment. ** Significant at (P<0.01).SD: Standard Deviation.

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Table 2. Values of overall acceptability of organoleptic indices

Parameter / Treatment	Colour	Texture	Flavour	Juiciness	General acceptability
Open air	6.17±1.53	5.58±1.93	5.42±1.83	4.25±1.36	5.36 ±1.66 ^{NS}
Plastic sheet	6.67±0.98	6.17±0.94	6.58±1.08	4.17±1.64	5.90±1.16^{NS}
Rabbit wire	6.67±1.30	6.33±1.23	5.58±1.73	4.33±1.83	5.73±1.52^{NS}

Values represent the mean ± standard deviation of 18 fish for each treatment.SD: Standard Deviation.NS: Not significant.

Table 3. Effect of drying system on body weight of studied fish *(Clariassp)*

Parameter / Treatment	Total weight (g)	Total length (cm)	Weight after gutted (g)	Weight after drying (g)	Weight loss %
Open air	331±178.6	33.9±7.2	305±178.5	94±49.1	69±4.3^{NS}
Plastic sheet	346±187.4	35.3±7.7	321±187.9	96±43.2	70±5.4^{NS}
Rabbit wire	298±145.4	33.9±6.1	272±145.7	86±45.6	68±7.3^{NS}

Values represent the mean ± standard deviation of 18 fish for each treatment.SD: Standard Deviation. NS: Not significance.

Photo 1. Samples preparation for experimental trials

Photo 2. Open Air Drying Method

Photo 3. Solar plastic sheet tent method

Results are shown on Tables (1, 2 and 3) of studied fish meat (*Clarias sp.*) using different types of drying methods. The chemical composition revealed no significant difference (P> 0.01) among the moisture, dry matter, and ash content, but fat and protein revealed recorded a significant difference (P<0.05). These results are in line with those

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reported by many authors. For example, Dirar (1993) studied the proximate composition of *Hydrocynus sp*. and recorded (34% moisture, 8.7% protein, 6.7% fat, 16.6% ash), and Ikeme (1991) who studied characterization of traditional smoked dried fish in Nigeria and found that the ranged of chemical composition parameter of protein (60-80%),fat(6-15%), moisture (7-19%) and ash (5.4–15).

The findings of this study are also in agreement with Ali et al.(1996) and Babiker and Dirar (1993) who studied the fermented and dried fish species of Sudan, *Labeosp*., *Tilapia sp*. and *Clarias sp*. and found, the chemical composition of moisture was ranged between 7.1- 9%, protein 55- 65%, fat 11.3-18.2% andash 12.5 - 22.9%.

Table 1 shows that the highest average values of chemical composition parameters of dried fish were by using the open air drying method (5.95 % moisture, 94.05 % dry matter, 52.65 % crude protein, 7.95% fat, 8.1 % ash, and 25.35% nitrogen free extract N.F.E) followed by plastic sheet method (5.05% moisture, 94.95% dry matter, 59% crude protein, 6.8% fat, 8.85% ash and 20.45% N.F.E) and rabbit wire tent method (4.55% moisture, 95.45% dry matter, 61% crude protein, 7.1% fat, 8.55% ash and 18.05% N.F.E).This result is in agreement with the findings of Mahmoud (1977)who studied the meat quality of some common Nile fishes. The later author reported that the proximate composition of the fish species were in the range of 63.29-75.19%, 14.99-22.01%, 0.36-2.50%, and 0.45-1.94% for moisture, protein, fat, and ash, respectively.

Chemical composition may vary widely, not only for fish of the same species, but also within an individual fish, according to age, sex, and environmental conditions (FAO, 2005).

Sensory assessment as judged by the organoleptic test carried out on dried fish generally depends on the taste of panelists as presented in Table 2. The results show the color, texture, flavour and juiciness appears higher in plastic sheet than rabbit wire and open air methods.

The effect of drying method on fish meat using plastic sheet was found to be better in terms of the overall acceptability (5.90) than chicken wire and open air methods which were recorded 5.73 and 5.36 respectively. This result is in agreement with other investigations (Verbeke, 2005; Greenhoff, 1994; McEwan, 1996). Most of these studies showed that, the consumers may have strong opinions and they usually find it difficult to explain in detail why they prefer one product to another. Results may be difficult to interpret; they also mentioned that, the descriptive sensory analysis carried out by trained sensory panels provides accurate and detailed description of the sensory properties of the products under study. The consumer acceptance or preference might be related to the sensory characteristics of products and preference mapping. It could be concluded that, the solar dryer tents covered by sheet (plastic and rabbit wire) in this study produce well-dried products in the terms in chemical, organoleptic indices and hygienic conditions

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