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Assessment of proximate composition of oven dried *Channa punctatus* at three different temperatures

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Abstract

In Bangladesh malnutrition remains a significant development challenge where fish is an irreplaceable animal-source food in the diet of millions of people. However, dried fish is also a great source of nutrition but it may be infected or destroyed during drying due to insect infestation. In that case oven drying is a great solution against insect infestation. However existing data on the proximate composition and optimum temperature of oven dried fish is not available. The purpose of the study was to fill-up the gap in the necessary data on proximate composition by estimating the protein, lipid, ash and moisture as well as to find out the optimum temperature for drying fish at oven. The experiment was conducted at the laboratory of Department of Fisheries, University of Rajshahi, Bangladesh. The species was collected from the local fish market of Rajshahi city and brought into the quality control laboratory of Department of Fisheries and measured, weighted, processed and finally dried in oven at the temperature of 60 °C, 65 °C and 70 °C, respectively. The average length and weight of the selected species was 16.40±0.80cm and 47.40±6.01gm, respectively. Average drying period were 23.30±1.00 (60 °C), 21.10±1.00 (65 °C) and 18.05±1.00 (70 °C) hr, respectively. The proximate compositions (protein, lipid, ash, and moisture) were analyzed using standard method. The protein content varied from 59.31±0.45% (70°C) to 66.29±0.75% (60°C), lipid content ranged from 5.89±0.63% (70 °C) to 5.93±0.68% (60°C), moisture content varied from 12.33±0.66% (70 °C) to 16.10±0.79% (60 °C) and ash content ranged from 1.53±0.09% (70°C) to 2.61±0.39% (60°C), respectively. Protein, ash and moisture contents were significantly varied from each other. The proximate composition showed better result in 60 °C temperature among three temperatures.

Keywords: Oven drying, nutrition, protein, lipid, ash

Introduction

Drying is one of the most important methods of fish preservation in Bangladesh which is considered as the least expensive method of fish preservation [1]. Drying of fish is also an age long practice for preserving fish for a fairly long time to prevent deterioration and spoilage in the quality of the product. It is also to reduce post-harvest losses and make available the product in times of shortage, thereby ensuring cheap protein availability to people [2]. It is easy and financially affordable process. Dried fish (SHUTKI in Bengali) is an important source of protein in Bangladesh. It is relished by many people of coastal, central and North-eastern districts [3]. It contains different component in their body such as moisture (18.23 to 24.46%), protein (40.69 to 68.09%), lipid (2.97 to 26.13%) and ash (5.08 to 16.02%) [4]. However, the physical and organoleptic qualities of many traditional sun-dried products available in the market are un-satisfactory for human consumption [3]. Because, traditional sun drying is carried out by exposing target fish directly under the sun as well as in the open air in the household of the processors which is absolutely dependent on the climate. Sun drying of fish is a slow process. It takes more time when the air is more humid. The problems of drying fish are more dangerous during drying in rainy season. It is also very difficult to protect fish from rain water on the ground. The major problems associated during drying and the storage period of the dried products is the infestation by the blow fly and beetle larvae as well as the contamination [3]. To prevent the infestation, fish processors sometimes use insecticides directly on dry fish which are most harmful for human health [5]. Oven drying can be a good solution of this problem. Because there is no chance to occur infestation by any flies or beetle in oven during drying. Dried fish is also a good earning source of foreign currency. Every year a good amount of dried fishes are export from Bangladesh. In 2015-2016 and 2016-2017 Bangladesh export 2,229 and 2,297 metric tons dry fish value of Tk. 30.12 Crore and 30.19

Crone [6], respectively. If necessary steps could be taken to set up modern fish drying factories based on oven, the products can be made easily and hygienic ways as well as demand of this commodity will rise up and Bangladesh will earn more foreign currency. Some works [7, 2, 8, 9] have been taken on fish drying. But works on oven drying is very rare in Bangladesh. Therefore, the present study is a step to know the nutritional quality of oven dried fish at different temperature as well as to find out the optimum temperature which can be used in fish drying.

Materials and Methods

Study period and selection of species

The study was conducted for a period of six months during August 2017 to January 2018. *Channa punctatus* was selected for the study. This species was chosen for the study because of its availability as dry fish and preference by the Bangladeshi people and collected as fresh condition from Shaheeb Bazar fish market, Boalia Thana in Rajshahi district, Bangladesh as well as taken in ice box and brought into the laboratory of Department of Fisheries of University of Rajshahi.

Measurement of length and weight

The total length of fishes was measured with the help of measuring board and the weight of fishes was measured with the help of weighing balance.

Processing of sample

Gutting, scaling and washing

Firstly the collected fishes were gutted and scaled with the help of kitchen knife. After gutting and scaling, fishes were washed with clean tap water that removed the slime, blood, dirt and unwanted particles from the fishes.

Oven drying

After washing fishes were dried in the oven at 60°C, 65°C and 70°C temperature in an electric oven of laboratory of Department of Fisheries, University of Rajshahi, Bangladesh.

Estimation of proximate composition

After drying the proximate compositions of dried fish samples were analyzed. Fish sample in its fresh state was subjected to chemical analysis in triplicate. Protein content was determined by the method of Lowry *et al.* [10]. Lipid content of the dried fish was estimated by the method of Bligh and Dyer [11]. Ash content was determined according to Association of Official Analytical Chemists [12] and moisture content was determined according to International Union of Pure and Applied Chemistry [13].

Data analysis

All the experimental data were analyzed by using a computer program MS Excel and one-way analysis of variance (ANOVA) and values were presorted as the mean and standard deviation of triplicate determinations. This statistical analysis was performed with the support of the computer software SPSS (statistical package for social sciences 20.0 software).

Results and Discussion

Length and weight of the selected species

In the present study it was found that the average length and weight of the selected species was 16.40±0.80 cm and

47.40±6.01g, respectively (Table 1).

Table 1: Number, length and weight of *C. punctatus* utilized in the experiment

Total No.	Particulars	Length (cm)	Weight (g)
15	Minimum	15.00	40.8
	Maximum	17.9	63.7
	Average	16.40±0.80	47.40±6.01

Oven drying

The average drying period were 23.30±1.00 (60 °C), 21.10±1.00 (65 °C) and 18.05±1.00 (70 °C) hr., respectively (Figure 1). Variation of drying period might be occurred due to the variation of temperature.

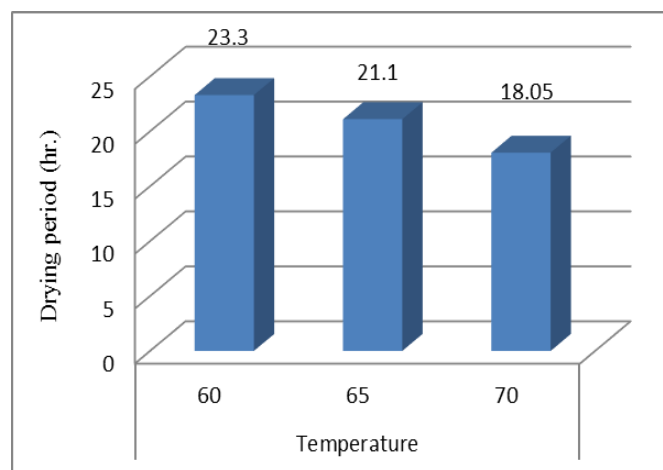


Fig 1: Drying period of *C. punctatus* in oven at different temperature

Protein content

In the present study the protein content of the selected species at 60°C, 65 °C and 70 °C temperatures were 66.29±0.75%, 63.74±0.89% and 59.31±0.45%, respectively (Table 2, Fig. 2). Protein content of *C. punctatus* at different temperature was significantly varied from each other. The proximate composition (crude protein and crude fat) of oven dried fish is generally higher as compared to raw fish due to loss of moisture content. This could be attributed to the extent of drying which lowered moisture and concentrated proteins. In one study [14] it was found that the range of protein content varied from 44 to 71% in Indian different dried fish species which is within the limit of the present study. In another study [15] it was observed that the protein content in dried fish was ranged from 55.75 to 64.49% which is most agreed with the present study. From the above discussion it can be stated that at 70 °C temperature oven dried fish contained lower amount of protein than that of 60 °C and 65 °C temperature oven dried fish as well as at 60 °C temperature oven dried fish contained highest amount of protein.

Lipid content

In the present study it was observed that the lipid content at 60 °C temperature oven dried fish was 5.93±0.68% (Table 2, Fig. 3). The lipid content at 65°C and 70°C temperatures of the selected species were 5.92±0.58% and 5.89±0.63%, respectively (Table 2, Fig. 3). There is no significant difference among the lipid contents of oven dried fish at 60 °C, 65 °C and 70 °C temperature. In one study [16] it was stated that oven dried *C. striatus* contained 5.04% and *C. punctatus* contained 7.86% lipid. In another study [17] it was

observed that dried *C. punctatus* contained 2.31% lipid which is lower than the present study. In another one study [18] it was also found that dried *C. punctatus* contained 6.01% lipid. The lipid contents were reported to vary greatly even within the species according to age, sex, season, feeding habit and habitat [19]. In one another study [20] it was found that the lipid content varied from 3.7 to 17.8% which is within the limit of the present study. In the present study at 70 °C temperature oven dried fish contained comparatively low amount of lipid than that of 60 °C and 65 °C temperature oven dried fish as well as at 60°C temperature oven dried fish contained highest amount of lipid.

Table 2: Average proximate composition at different temperatures of the oven dried fishes.

Temperature (°C)	Protein (%)	Lipid (%)	Ash (%)	Moisture (%)
60	66.29±0.75 ^a	5.93±0.68 ^a	2.61±0.39 ^a	16.10±0.79 ^a
65	63.74±0.89 ^b	5.92±0.58 ^a	1.85±0.15 ^b	14.15±0.59 ^b
70	59.31±0.45 ^c	5.89±0.63 ^a	1.53±0.09 ^c	12.33±0.66 ^c

Data are expressed as mean ± standard deviation same letters in each column indicates the lack of significant difference (p> 0.05)

Ash content

The ash content at 60°C temperature oven dried fish species was 2.61±0.39%. The ash content of the selected species at 65 °C and 70 °C temperature were 1.85±0.15% and 1.53±0.09%, respectively (Table 2, Fig. 4). Ash content of *C. punctatus* at different temperature was significantly varied

from each other. In one study [21] it was reported that the ash content ranged from 1.4-21.6% which is within the limit of the present study. In another study [22] it was found that lower amount of ash content in six freshwater fishes such as *L. rohita* (1.31%), *Catla catla* (0.93%), *C. cirrhosus* (1.40%), *L. calabasu* (1.02%), *Mystus seenghala* (0.91%) and *Wallago attu* (0.72) which is more or less similar with the present study. At 60°C temperature oven dried fish contained highest amount of ash than 65°C and 70°C temperature oven dried fish.

Moisture content

The moisture content of the selected species varied from 12.33± 0.66% (70 °C) to 16.10±0.79% (60 °C). The moisture content at 65 °C of the selected species was found 14.15±0.59% (Table 2, Fig. 5). Moisture content among different temperature was significantly varied from each other. In one study [23] it was stated that normally the sun-dried fishes contain an average of 10 to 20% of moisture which is more or less similar with the present study. In another study [16] observed that oven dried *C. punctatus* contained 11.45% and *C. striatus* contained 13.59% moisture. In another one study [18] it was stated that there is a tendency in our country for fish processors and retailers sometimes allow more moisture in dried fish products to gain weight for economic benefit. It was also stated that at 70 °C temperature oven dried fish contained lower amount of moisture and at 60°C and 65 °C temperature oven dried fish contained comparatively higher amount of moisture.

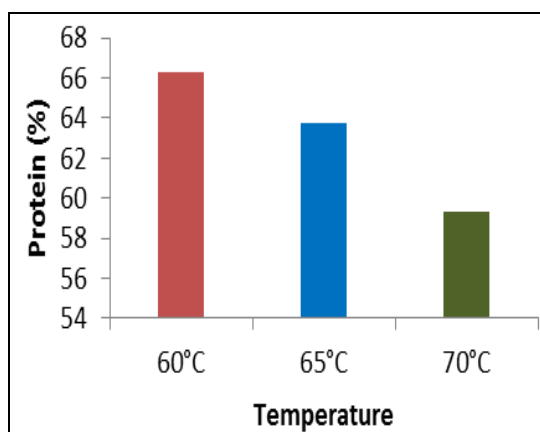


Fig 2: Protein content of the selected species

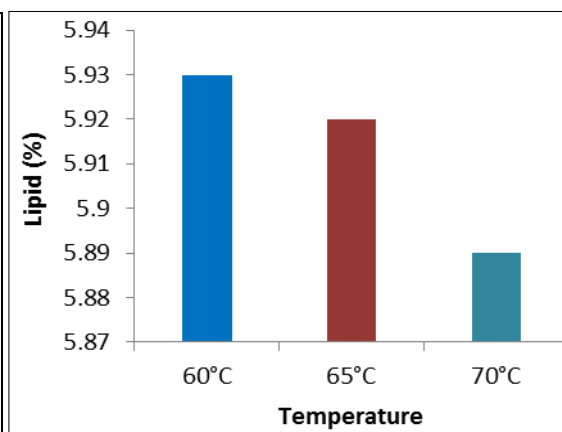


Fig 3: Lipid content of the selected species

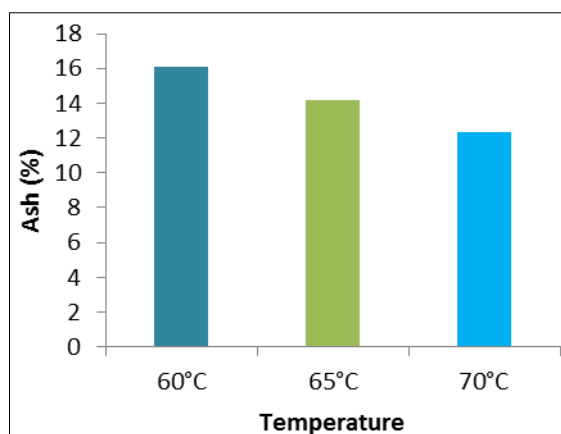


Fig 4: Ash content of the selected species

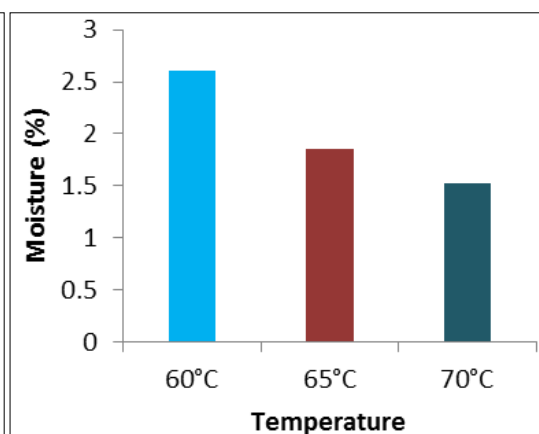


Fig 5: Moisture content of the selected species

Conclusion

The present study provides a possible application of electric oven drying as an efficient drying as well as to find out the optimum temperature for drying fish in oven. It is concluded that among three temperature (60°, 65° and 70°) nutritional compositions showed better result at 60°C. It can be also concluded that oven drying is the suitable method to dry fish which will be more suitable for dry fish processors if it will be taken in large scale and establish large industry because chemical characteristics of oven dried fishes were higher. So dry fish processor can be benefited more and a large amount of people can also be employed to involve with this work and can get quality dried fish product.

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