

Quality Assessment of Oven Dried and Traditional Sun Dried *Channa Punctatus*

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Abstract: The aim of the present study was to compare the quality assessment in terms of freshness, chemical composition and bacterial load of sun dried fishes and oven dried *Channapunctatus* during July 2017 to December 2017. Traditionally dried and fresh raw *C. punctatus* were collected from the Singrabajar of Chalanbeel area, Bangladesh and brought into the laboratory of Department of Fisheries of University of Rajshahi, Bangladesh. Fresh species were processed and dried in the electric oven at 105°C. After the organoleptic analysis it was observed that the appearance, odor, color, texture and overall acceptability of traditionally sun dried fishes were 6.75±0.43, 7.00±0.00, 7.12±0.78, 6.62±0.51, 6.75±0.46 and oven dried fishes were 7.75±1.29, 6.87±0.92, 7.25±1.63, 7.5±1.30 and 7.50±1.30, respectively. Significant difference was found between the sun dried and oven dried *C. punctatus* for the mean values of all organoleptic characteristics. In case of proximate composition the lipid, protein, ash and moisture contents were 3.10±0.60%, 57.50±2.30%, 21.00±1.20% and 14.83±1.45% in sun dried fishes and 5.85±1.25%, 70.15±1.30%, 13.00±1.50% and 8.50±1.40% was observed in oven dried fish. Significant difference was found in proximate composition. The pH contents varied from 6.3±0.31 (oven dried) to 6.75±0.70 (sun dried). The lowest TVB-N content (3.85mg/100g) was found in oven dried fishes and the highest (4.02mg/100g) was found in sun dried fishes and the microbial load varied from 4.9×10² (oven dried) to 3.9×10³ (sun dried). Significant difference was found between the sun and oven dried *C. punctatus* for the aerobic plate count and TVB-N, but those are belongs in acceptable range.

Keywords: Quality Assessment, Chemical Composition, TVB-N, Organoleptic Test

1. Introduction

In Bangladesh, fish harvesting is mostly seasonal and each of the catch fish reaches its peak during late spring and early summer. Due to lack of adequate transport, storage and preservation facilities, every year a huge amount of fish cannot be utilized properly. So, different types of preservation system are developed. Among them drying is one of the most important methods of fish preservation in Bangladesh which is regarded as a traditional and primitive preservation method of fish. Drying method is considered as the least expensive method of fish preservation [1]. The process of fish drying is mainly performed by the households in the fishing communities. There are frequent complaints from the consumers about the quality of the products and the major problems associated with sun drying fishes are the infestations by blow flies and insect larvae, poor sanitation

and improper process that often lead to contamination and spoilage and ultimately they use pesticides to prevent those [2, 3]. On the other hand, in rainy season, due to less sunlight, dried fishes are susceptible to infestation by certain species of insects and mites which can cause extensive damage resulting in heavy financial loss. To minimize the sun drying related problem some technology like oven drying, solar drying etc. are developed to dry fish. By oven drying moisture is evaporated from the fish. It can be prevent insect infestation of dried fish product and improve the hygienic and nutritional status of the dried fishery products. Oven drying do not depends on weather but in sun drying rough weather has a big effect on drying and in rough weather different types of microbes can grow. The oven drying method is safer than the sun drying method. But this is important to know the quality of oven dried fish. The biochemical composition is an important aspect of fish

quality and it influences both the keeping quality and technological characteristics of fish. Existing data regarding oven drying is very rare. Therefore, the present study has been carried out to compare the nutritional quality of oven dried and traditional sun dried *C. punctatus* to compare the organoleptic characteristics, chemical composition and bacterial load of oven dried and sun dried *C. punctatus*. *C. punctatus* is a popular fish species in Bangladesh. This species is available in raw and dried condition on Chalanbeel area.

2. Materials and Methods

The study was carried out at the laboratory of Department of fisheries of University of Rajshahi during July 2017 to December 2017. Traditionally sun dried and fresh raw *Channapunctatus* was collected from the Singrabajar of Chalanbeel area, Bangladesh and brought into the laboratory of Department of fisheries of University of Rajshahi. After collecting, traditionally dried fishes were preserved in plastic container and raw fishes were prepared for the drying.

2.1. Preparation of Samples

2.1.1. Dressing of the Fresh Samples

At first the collected fresh raw fishes were gutted, beheaded and scaled with the help of kitchen knife, and washed with tap water.

2.1.2. Oven Drying

After washing fishes were dried in the oven of laboratory of department of fisheries of University of Rajshahi, in a electric oven at 105°C.

2.2. Organoleptic Test

After oven drying traditional sun dried and oven dried fishes were assessed by organoleptic test by a test panel of eight members including teachers and students. All the dried fishes were served to the test panel and appearance, odour, colour, and texture were determined by using hedonic scale of 1 to 9 and the dried fishes were rated as 9 for excellent, 7 for good, 6 for acceptable and below 4 for poor or unacceptable [4].

2.3. Chemical Test

2.3.1. Estimation of Protein

Protein content in the fish was determined by the method of Lowry et al. [5].

2.3.2. Estimation of Lipid

Lipid content of the fish was estimated by the methods of Bligh and Dyer [6].

2.3.3. Estimation of Ash

Ash content of fish was estimated by the methods of AOAC [7].

2.3.4. Estimation of Moisture

Moisture content was determined by standard IUPAC method [8].

2.3.5. Estimation of pH

The pH was measured using a pH meter Cyberscan 510.

2.4. Total Volatile Base Nitrogen (TVB-N)

TVB-N was determined according to the methods given by AOAC [7].

2.5. Aerobic Plate Count (APC) of Bacteria

Total aerobic plate count expressed as colony forming units (CFU/g). APC were determined by standard plate count method on plate count agar following the serial dilution technique described by Seeley and Vandemark [9].

2.6. Data Analysis

All the experimental data were analyzed by using computer software MS Excel. Data was expressed as mean and standard deviation and t-test was done for the determination of level of significance between sundried and oven dried fishes with the support of the computer software SPSS (statistical package for social sciences 20.0 software) and the significance level was defined at $P < 0.05$ and $P < 0.01$.

3. Results and Discussion

3.1. Organoleptic Test

According to the justification of panel members the result of appearance was highest (7.75 ± 1.29) in the oven dried *C. punctatus* which indicate excellent result and lowest (6.75 ± 0.43) in the sun dried *C. punctatus* which indicate the acceptable result and significantly differed ($P < 0.05$) from each other. Appearance of oven dried fish was comparatively more attractive than sun dried fishes. It was observed that the odour was highest (7 ± 0.00) in the sun dried *C. punctatus* and lowest (6.87 ± 0.92) in the oven dried *C. punctatus*. Significant difference was found in the sun dried and oven dried fishes. Odour was good in sun dried *C. punctatus* (7 ± 0.00). Acceptable result was observed in oven dried *C. punctatus* (6.87 ± 0.92). The highest (7.25 ± 1.63) colour was found in the oven dried *C. punctatus* and lowest (7.12 ± 0.78) was observed in the sun dried *C. punctatus*. Significant difference was found in the colour of sun dried and oven dried fishes. The highest value of colour was 7.25 ± 1.63 (oven dried *C. punctatus*) which indicate good result and the lowest value of colour was 7.12 ± 0.78 (sun dried *C. punctatus*) which indicate acceptable result.

The texture was highest (7.5 ± 1.30) in the oven dried *C. punctatus* which indicate good result and lowest (6.62 ± 0.51) in the sun dried *C. punctatus*. But the present study indicate that high significant difference ($P < 0.01$) was found between the texture of oven dried and sun dried fishes. The texture of oven dried fishes was comparatively hard and brittle than sun dried fishes might be due to high temperature. It can be said

that oven drying was practiced in hygienic condition. Oven dried *C. punctatus* showed to emit their characteristic odour, assume whitish to slightly brown colour, process firm and flexible texture without manifestation of infestation or broken pieces and appeared to be of excellent quality. The lowest value of overall acceptability was 6.75 ± 0.46 (sun dried *C. punctatus*) and the highest value was 7.50 ± 1.30 (oven dried *C. punctatus*). Significant difference was found between the sun and oven dried *C. punctatus* for the mean

values of overall acceptability.

In one study [10], it was recorded that the organoleptic characteristics of the dried fishes are more or less similar to that solar dried silver Jew fish (*Johnius argentatus*), Bombay duck (*Harpodon nehereus*) and ribbon fish (*Trichiurus haemela*), that the excellent products were produced without any infestation with firm and flexible texture and natural odours.

Table 1. Average values of organoleptic test of the sun dried and oven dried fishes.

Species	Method (Drying)	Appearance	Odour	Colour	Texture	Overall acceptability
<i>C. punctatus</i>	Sun	6.75 ± 0.43	7.00 ± 0.00	7.12 ± 0.78	6.62 ± 0.51	6.75 ± 0.46
	Oven	7.75 ± 1.29	6.87 ± 0.92	7.25 ± 1.63	7.5 ± 1.30	7.50 ± 1.30
Level of Significance		**	*	*	**	**

Data are expressed as mean \pm standard deviation, * at $P < 0.05$ and ** at $P < 0.01$ of Significance level

3.2. Chemical Composition of the Studied Species

In the present study, lipid, protein, ash and moisture was estimated for the assessment of quality of the dried fishes.

3.2.1. Lipid Content

In this study, lipid content varied from $3.10 \pm 0.60\%$ (sun dried *C. punctatus*) to $5.85 \pm 1.25\%$ (oven dried *C. punctatus*) (Table 2). One study [11] stated that *C. striatus* (Shol) contains 4.92% lipid which is within limit with the present study. Another study [12] stated that oven *C. punctatus* (Taki) contains 4.90% lipid and the study was carried out in Singraupazila under Natore district of Bangladesh. In case of oven drying, lipid content of oven dried *C. punctatus* was $5.85 \pm 1.25\%$ which indicated that in oven drying it is possible to get more lipid contents. In one another study [13] it was observed that oven dried *Channapunctatus* contained 5.89-5.93% lipid which is strongly agreed with the present study. From the above discussion it can be stated that electric oven dried fishes retained comparatively higher lipid content than sun dried fishes. Lipid is necessary for human consumption because it is a big source of energy.

3.2.2. Protein Content

Protein is one of the major food content in fish body. In the present study protein content varied from $57.50 \pm 2.30\%$ (sun dried *C. punctatus*) to $70.15 \pm 1.30\%$ (oven dried *C. punctatus*) (Table 2). The highest protein content was found in oven dried *C. punctatus* and the lowest protein content was found in sun dried *C. punctatus*. Significant difference ($P < 0.01$) was found between the sun and oven dried fishes for protein contents. In one study [14] it was found that the protein contents varied between 40.69 to 66.52% among fourteen selected dried fish species. The average protein content of sun dried *C. punctatus* was $57.50 \pm 2.30\%$. This finding agreed with another study [12] who found that sun dried *C. punctatus* contained 63.11% protein. On the other study, it was found that protein content of oven dried *C. punctatus* was 70.15 ± 1.30 which is agreed with one study [15] who showed that oven dried *C. gariepinus* contain 64.62% protein. In one study [16], the range of protein content was 31.40% (*Clarias gariepinus*) to 56.915% (*Synodontis clarias*) which is more or less similar with this study.

Table 2. Chemical composition of sun and oven dried *C. punctatus* with.

SL	Chemical composition	Sun	Oven	Level of significance
1	Protein (%)	57.50 ± 2.30	70.15 ± 1.30	**
2	Lipid (%)	3.10 ± 0.60	5.85 ± 1.25	*
3	Ash (%)	21.00 ± 1.20	13.00 ± 1.50	**
4	Moisture (%)	14.83 ± 1.45	8.50 ± 1.40	*
5	pH	6.30 ± 0.310	6.75 ± 0.70	NS

Data are expressed as mean \pm standard deviation, *Significant at $P < 0.05$, **Significant at $P < 0.01$ and NS- not significant level of Significance.

3.2.3. Ash Content

In the present study it was assessed that the ash content ranged from $13.00 \pm 1.50\%$ (oven dried *C. punctatus*) to $21.00 \pm 1.20\%$ (sun dried *C. punctatus*). One author [12] worked on nutritional and food quality assessment of dried fishes in SingraUpazila under Natore district of Bangladesh and stated that *C. punctatus* (Taki) contains 31.63% ash. Another study [17] found that the ash content of sun dried fish to be ranged from 11.177 to 29.197% which is more or

less similar with the ash content of sun dried *C. punctatus*. Ash content between sun dried and oven dried *C. punctatus* was significantly ($P < 0.01$) varied from each other.

3.2.4. Moisture Content

In the present study, ash content varied from $8.50 \pm 1.40\%$ (oven dried *C. punctatus*) to $14.83 \pm 1.45\%$ (sun dried *C. punctatus*). The moisture of all living systems contributes as much to the essential properties of life. Significant difference was found between the sun and oven dried fishes for

moisture content. In case of sun dried *C. punctatus*, more or less similar result was found in past. One study [11] stated that the moisture content of *C. striatus* was 19.17%. Another study [18] reported that the moisture content of the dried

fishes ranged from 14.38 to 18.48%. One another study [19] stated that the sun dried fish normally contain an average of 10-20% moisture. The moisture content of the present study is agreed within the recommended value of Haq[19].

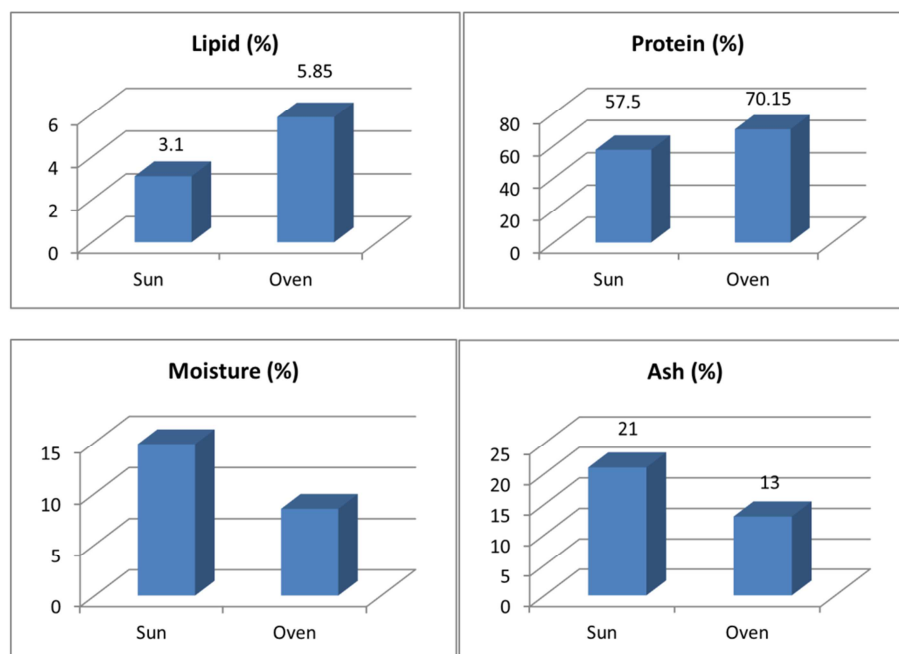


Figure 1. Column graph of Chemical composition of sun dried and oven dried fishes.

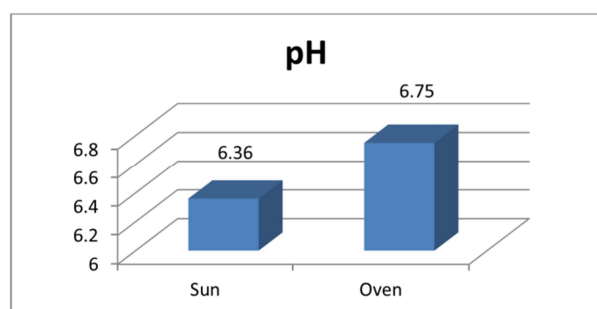


Figure 2. Column graph of pH of sun dried and oven dried fishes.

3.2.5. pH Content

The lowest pH content was found in sun dried *C. punctatus* (6.30 ± 0.31) and the highest was found in oven dried *C. punctatus* (6.75 ± 0.70). No significant difference was found between the sun dried and oven dried *C. punctatus* in

pH level. One study [20] stated that the pH value of fresh shol fish was 6.9.

3.3. Microbial Content

In this study, the total bacterial count in colony forming unit per gram of the dried *C. punctatus* was counted as 3.90×10^3 cfu/g in sun dried sample and 4.9×10^2 cfu/g in oven dried sample. One study [21] stated on the qualities of commercially and experimentally sun dried fish (*Scomberoides*) and found that the total plate count of bacteria was 28×10^4 to 60×10^4 cfu/g. Another study [22] recommended that the acceptable limit of bacterial count for dried fish is 1×10^5 at 37°C temperature. In the present study the TPC was lower than the referred value. So, the quality of the dried fish products are good and oven dried fish contain lower amount of bacteria.

Table 3. Microbial quality of the studied species.

Species	Method of drying	TPC	TVB-N value mg/100g
<i>C. punctatus</i>	Sun	3.9×10^3	4.02
	Oven	4.9×10^2	3.85
Level of significance		**	*

Data are expressed as mean \pm standard deviation, * at $P < 0.05$ and ** at $P < 0.01$ of Significance level

3.4. TVB-N Content

TVB-N values test were considered for the freshness of the fish. In the present study the lowest TVB-N value was 3.85 mg/100g (oven dried *C. punctatus*) and the highest value

of TVB-N was 4.02 mg/100g (sun dried fish). Significant difference was found between two samples. One study [23] observed that the TVB-N content were 3.5 to 25.2, 1.9 to 8.9, 2.5 to 15.2, 3.6 to 15.6 and 5.3 to 19 mg/100g for silver jew fish and chinesepomfret ranged from 16.56-44.83 mg/100g.

But in the present study TVB-N value was very low which indicate that the dried fishes were in fresh condition and here

also the TVB-N value is lower in oven dried fishes.

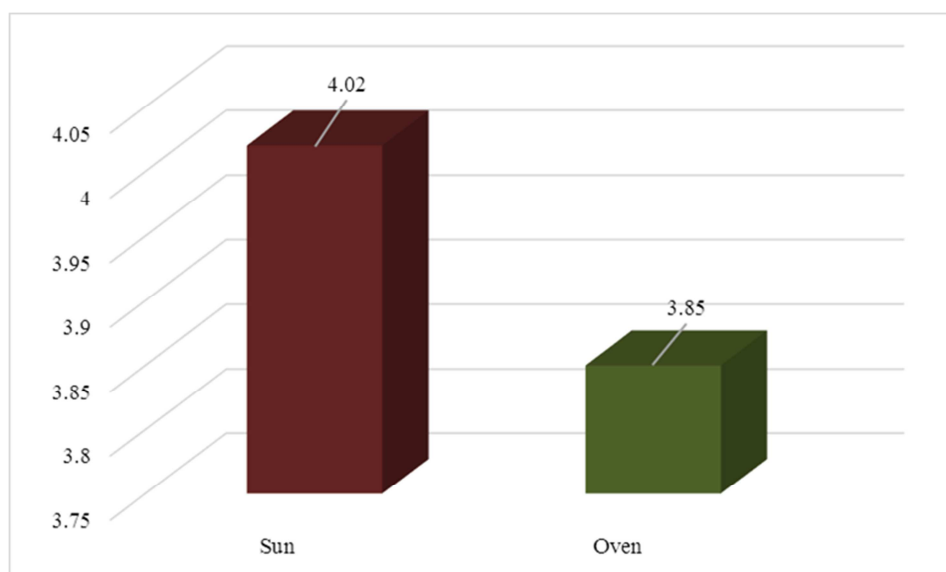


Figure 3. TVB-N value in Column graph.

4. Conclusion

The results demonstrated that sun drying and oven drying methods affect organoleptic characteristics. Oven dried fishes are more attractive than sun dried *C. punctatus* on the basis of organoleptic test. It was also concluded on the basis of result that the oven dried products were rich and comparatively higher in protein, lipid and lower content in ash, moisture than sun dried products. The microbial load and TVB-N are lower in case of oven dried fish than that of sun dried fish and in case of both the values are in acceptable limit. During oven drying, no insect infestation was occurred in dried fish and so that shelf life of products might be increased.

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