

# COMPARATIVE STUDY ON NUTRITIONAL QUALITY OF SUN DRIED FISH AND OVEN DRIED FISH

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**Abstract** - The aim of the present study was to assess and compare the nutritional quality of sun dried fishes and oven dried fishes during July 2016 to December 2016. Five fish species (*C. punctatus*, *M. cavasius*, *M. pancalus*, *C. striatus* and *W. attu*) were collected from the Chalan beel area and brought into the laboratory of Department of Fisheries of University of Rajshahi. All species were processed and dried by the sun rays and in the oven (105°C) for different hours depending on the different species. Then the nutritional analyses were done by using standard method. The highest lipid content was found in oven dried *W. attu* (11.32±0.30%) and the lowest was found in sun dried *C. striatus* (5.48±0.70%). The highest protein content was found in oven dried *M. pancalus* (77.12±0.36%) and the lowest was found in sun dried *M. cavasius* (55.38±0.67%). The ash content was varied from 4.34±0.23% (oven dried *M. pancalus*) to 18.43±0.77% (oven dried *M. cavasius*). The highest moisture content was observed in sun dried *C. punctatus* (13.07±0.57%) and the lowest was observed in oven dried *M. cavasius* (6.25±0.24%). Calcium content was varied from 5.34±0.36 mg/100g (sun dried *M. cavasius*) to 29.31±0.47 mg/100g (oven dried *C. punctatus*). Iron content was ranged from 0.82±0.00 mg/100g (sun dried *M. cavasius*) to 2.82±0.04 mg/100g (oven dried *W. attu*). No significant difference was found between the sun and oven dried fishes for proximate composition (lipid, protein, ash and moisture) and mineral contents (calcium and iron).

**Key words** - *Channa punctatus*, *Mystus cavasius*, *Mastacembelus pancalus*, *Channa striatus*, *Wallago attu*, sun drying, oven drying, proximate compositions, minerals.

## I. INTRODUCTION

Fish is rich in vitamin and minerals for both young and old age consumers [1]. Fish have some usual composition features that don't apply to many other foods [2]. At the present time fish is said to be healthier and cholesterol free source of protein as well as the richest source of calcium, phosphorus, irons, fats, minerals and vitamins [3]. So, Fish products also contain most important nutritional components and can serve as a source of energy for human beings [4]. As fish is a perishable commodity, a sizeable quantity of fish is preserved by sun drying in Bangladesh from inland water fish as well as from sea fish. Domestic consumers as well as the ethnic community in developed countries eat dried fish. Bangladesh earns a good quantity of foreign exchange by exporting dried fish every year. The food value of dried fish is well established by the scientists (5,6,7,8,9,10,11). Drying increases the shelf life, enhance the quality, provide ease of handling, further processing and sanitation [12]. But during rainy season, the major problems associated with sun drying fish are the infestations by blowflies, insects and mites due to absorb moisture which can cause extensive damage resulting in heavy financial loss. Fish processors sometimes use insecticides directly on dry fish for the prevention of infestation which are most harmful for human health [13, 14]. To minimize the sun drying related problem some technology like oven drying, solar drying etc. are developed to dry fish. Oven drying can prevent insect infestation of dried fish product and improve the hygienic and nutritional status of the dried fishery

products [15]. Different drying methods (sun and oven) have different effects on nutrient composition of fish. However, the methods selected by a process of drying fish depend on fish species and consumer demand [16]. The effect of traditional drying processes on the nutritional values range of fish was studied [17]. Some studies have been carried out on nutritional composition of different marine and fresh water fishes [18, 19, 20, 21, 22]. But no such work has been carried out on the species of Chalan beel to compare the nutritional quality of sun dried product and oven dried product though Chalan beel is a big resource of freshwater fish and a huge amount of fish are dried in this area. Therefore, this study was carried out to evaluate the nutritional composition of five fish species of Chalan beel using two methods with a view to comparing the nutritional quality.

## II. DETAILS EXPERIMENTAL

### 2.1 Materials and Procedures

**Collection of sample:** The study was carried out during July 2016 to December 2016 on five species of fishes (*Channa punctatus*, *Mystus cavasius*, *Mastacembelus pancalus*, *Channa striatus* and *Wallago attu*) were collected from Attrai Upazila of Naogaon district in the Chalan beel area, Bangladesh. It is the biggest beel of the country and in Chalan beel area huge amount of dried fishes are processed.

**Process of the collected species:** Collected samples were taken in ice box and brought into the laboratory of department of fisheries of University of Rajshahi, for the further study. Fishes were gutted and scaled with the help of kitchen knife, then washed with clean

tap water. Fishes were salted (4:1) and dried in the sun covered with net and in electric oven at 105°C whereas salt was not used in oven drying.

Nutritional analysis: After sun drying and oven drying dried fishes were powdered with the help of electric blender and analyzed for the determination of lipid, protein, ash, moisture, calcium and iron contents by different methods. Lipid content was estimated by the methods of Bligh and [23], protein was estimated by the methods of Lowry et al. (24), ash was estimated by the methods of AOAC (25), moisture was estimated by oven method [26], calcium and iron was estimated by flame method by using atomic absorption spectrophotometric procedure [27] using atomic spectrophotometer (Model 372). Each analysis was carried out in triplicates.

Data analysis: All the experimental data were analyzed by computer software SPSS (version 20.0). One-way analysis of variance (ANOVA) and values were presented as the mean  $\pm$  standard deviation of triplicate determinations and the significance was defined at  $P < 0.05$ .

### III. RESULTS AND DISCUSSION

The nutritional compositions vary with species and mode of drying method (Sun and Oven). Mean  $\pm$  Standard Deviation values obtained from proximate compositional analysis of both sun dried and oven dried fish which includes moisture, protein, lipid and ash as well as calcium and iron are tabulated in Table 1 and Table 2.

**Table-1: Average proximate composition of the sun dried and oven dried fishes**

Species	Method (Drying)	Lipid (%)	Protein (%)	Ash (%)	Moisture (%)
C. punctatus	Sun	6.14 $\pm$ 0.14 <sup>a</sup>	63.52 $\pm$ 0.63 <sup>a</sup>	5.42 $\pm$ 0.50 <sup>a</sup>	13.07 $\pm$ 0.57 <sup>a</sup>
	Oven	7.86 $\pm$ 0.42 <sup>a</sup>	64.36 $\pm$ 0.38 <sup>a</sup>	5.41 $\pm$ 0.48 <sup>a</sup>	11.45 $\pm$ 0.72 <sup>a</sup>
M. cavasius	Sun	8.46 $\pm$ 0.54 <sup>a</sup>	55.38 $\pm$ 0.67 <sup>a</sup>	16.44 $\pm$ 0.50 <sup>a</sup>	8.24 $\pm$ 0.80 <sup>a</sup>
	Oven	10.45 $\pm$ 0.79 <sup>a</sup>	56.71 $\pm$ 0.75 <sup>a</sup>	18.43 $\pm$ 0.77 <sup>a</sup>	6.25 $\pm$ 0.24 <sup>a</sup>
M. pancalus	Sun	8.32 $\pm$ 0.39 <sup>a</sup>	74.63 $\pm$ 0.60 <sup>a</sup>	4.38 $\pm$ 0.23 <sup>a</sup>	9.20 $\pm$ 0.18 <sup>a</sup>
	Oven	9.58 $\pm$ 0.63 <sup>a</sup>	77.12 $\pm$ 0.36 <sup>a</sup>	4.34 $\pm$ 0.23 <sup>a</sup>	8.16 $\pm$ 0.17 <sup>a</sup>
C. striatus	Sun	5.48 $\pm$ 0.70 <sup>a</sup>	73.92 $\pm$ 0.33 <sup>a</sup>	5.04 $\pm$ 0.14 <sup>a</sup>	12.34 $\pm$ 0.33 <sup>a</sup>
	Oven	7.26 $\pm$ 0.89 <sup>a</sup>	75.41 $\pm$ 0.51 <sup>a</sup>	4.65 $\pm$ 0.67 <sup>a</sup>	11.00 $\pm$ 1.00 <sup>a</sup>
W. attu	Sun	11.09 $\pm$ 0.21 <sup>a</sup>	71.66 $\pm$ 0.68 <sup>a</sup>	4.58 $\pm$ 0.80 <sup>a</sup>	11.00 $\pm$ 0.05 <sup>a</sup>
	Oven	11.32 $\pm$ 0.30 <sup>a</sup>	72.40 $\pm$ 0.52 <sup>a</sup>	4.62 $\pm$ 0.65 <sup>a</sup>	10.56 $\pm$ 0.64 <sup>a</sup>

Data are expressed as mean  $\pm$  standard deviation

Same letters in each column indicates the lack of significant differences ( $P < 0.05$ )

Moisture content: The highest moisture content was found in sun dried C. punctatus (13.07 $\pm$ 0.57%) and the lowest moisture content was found in oven dried M. cavasius (6.25 $\pm$ 0.24%). One study [15] observed that, the moisture content was varied from 3.82% (O. niloticus) to 10.26% (C. striatus). Another study [16] reported that the range of moisture content was 8.24 $\pm$ 0.02% (Hamoor) to 14.35 $\pm$ 0.13% (Govazym stranded tail). Low moisture content is very important because the low moisture content increase the protein content in the fish species by coagulating the crude protein. One study [32], reported that a fish with moisture content reduced to 25% is well dried

Lipid content: Lipid content varied from 5.48 $\pm$ 0.70% (sun dried C. striatus) to 11.32 $\pm$ 0.30% (oven dried W. attu). In one study [28] recorded that C. striatus (Shol) contains 4.92% lipid and W. attu contains 11.00% lipid which is strongly agreed with the present study. Another study [15] stated that fatty fish contains more fat than other fish. The mean values of lipid was not significantly varied ( $P < 0.05$ ) between the sun and oven dried fishes.

Protein content: The highest protein content was found in oven dried M. pancalus (77.12 $\pm$ 0.36%) and was found in sun dried M. cavasius (55.38 $\pm$ 0.67%). One study [29] observed that the protein content in dry fish in the range of 55.75-64.49%. Another study [16] found that the protein content varied from 72.49 $\pm$ 0.39% (Zeminkan) to 85.66 $\pm$ 0.26% (Hamoor) which is more or less similar with the present study. The mean values of protein was not significantly varied ( $P < 0.05$ ) between the sun and oven dried fishes.

Ash content: The ash content was ranged from 4.34 $\pm$ 0.23% (oven dried M. pancalus) to 18.43 $\pm$ 0.77% (oven dried M. cavasius). One study [15] stated that the range of ash content varied from 8.96% (C. gariepinus) to 13.42% (O. niloticus). These findings are more or less similar with the present study. Another study [30, 31] also stated that oven dried C. gariepinus contains 13.15% and 3.06% ash. The mean values of ash was not significantly varied ( $P < 0.05$ ) between the sun and oven dried fishes.

and if further reduced to 15% growth of mould will cease and shelf life will be increased. The mean values of moisture was not significantly varied ( $P < 0.05$ ) between the sun and oven dried fishes.

Calcium content: Calcium is essential for the growth, bone formation, blood coagulation, milk formation, vitamin D, absorption, etc. [33]. The calcium content was found to be ranged from 5.34 $\pm$ 0.36 mg/100g (sun dried M. cavasius) to 29.31 $\pm$ 0.47 mg/100g (oven dried C. punctatus) (Table-2). One study [34] analyzed fourteen species of SIS and showed that iron content of fish was in the range of 19.03-255.55 mg/100g. Another study [35] found that oven dried

Shark contains  $34.87 \pm 0.58$  mg/100g calcium which is more or less similar with the present study. Iron is a macronutrient. Iron function mainly in the transportation of oxygen to the tissues (hemoglobin) [33]. The mean values of calcium was not significantly varied ( $P < 0.05$ ) between the sun and oven dried fishes.

Iron content: The highest iron content was found in oven dried *W. attu* ( $2.82 \pm 0.04$  mg/100g) and the lowest iron content was found in sun dried *M. cavasius* ( $0.82 \pm 0.00$  mg/100g). One study [34]

analyzed fourteen species of SIS and showed that iron content of fish was in the range of 0.28-2.09 mg/100g. Another study [36] worked on seven SIS and obtained iron ranged from 1.8 to 12.0 mg/100g. One another study [37] showed that oven dried *Heterotis niloticus* contains  $4.20 \pm 0.01$  mg/100g iron. These findings are more or less similar with the present study. No significant difference ( $P < 0.05$ ) was found between the sun and oven dried fishes for iron contents also.

**Table-2: Average mineral content of the sun dried and oven dried fishes**

Species	Method (Drying)	Calcium (mg/100 g)	Iron (mg/100 g)
C. punctatus	Sun	$26.65 \pm 0.42^a$	$1.06 \pm 0.01^a$
	Oven	$29.31 \pm 0.47^a$	$1.25 \pm 0.02^a$
M. cavasius	Sun	$5.34 \pm 0.36^a$	$0.82 \pm 0.00^a$
	Oven	$5.82 \pm 0.16^a$	$0.86 \pm 0.01^a$
M. pancalus	Sun	$10.68 \pm 0.18^a$	$1.21 \pm 0.01^a$
	Oven	$12.54 \pm 0.03^a$	$1.32 \pm 0.01^a$
C. striatus	Sun	$15.93 \pm 0.04^a$	$1.08 \pm 0.01^a$
	Oven	$17.69 \pm 0.12^a$	$1.35 \pm 0.03^a$
W. attu	Sun	$12.05 \pm 0.05^a$	$2.14 \pm 0.01^a$
	Oven	$13.34 \pm 0.09^a$	$2.82 \pm 0.04^a$

Data are expressed as mean  $\pm$  standard deviation

Same letters in each column indicates the lack of significant differences ( $P < 0.05$ )

## CONCLUSIONS

Sun drying is one of the easiest and cheapest methods for preservation of fish. But the result indicate that oven drying was taken short time than sun drying to dry fish as well as insect infestation will not be occurred also. It is also concluded on the basis of result that the oven dried products were rich and comparatively higher in protein, lipid and mineral content than sun dried products.

## REFERENCES

- [1] D.O. Edem, "Vitamin A: A review", Asian Journal Clinical Nutrition, vol. 1, pp. 65-82, 2009.
- [2] J.A. Nettleton, "Nutrients and substances in fish water sea food. In: sea food nutrition, fats tissue and marketing of nutrition in fish and shellfish", Van Noster and Reinhold, New York. pp. 30-64, 1985.
- [3] M.A. Hossain, and S. Afroze, "Small fish as a resource in rural Bangladesh", Fishbyte, vol. 2, pp. 16-18, 1991.
- [4] R. Koffi-Nevry, T.S.T. Ouina, M. Koussemon, and K. Brou, "Chemical composition and lactic microflora of Adjuvan, a traditional Ivorian fermented fish condition" Pakistan Journal of Nutrition, vol. 10, pp. 332-337, 2011.
- [5] S.N. Jahan, M.A. Bayezid, B. Islam, M. A. B Siddique, P.K. Karmokar, F. A. Flowra. Biochemical Quality Assessment of Fish Powder. American Journal of Food and Nutrition, vol. 5 no. 3, pp.110-114, 2017.
- [6] S. Sultana, S. Parween, and M.A. Hossain, "Biochemical analysis of some dried sis fishes of the river padma in Rajshahi", Journal of Life and Earth Science. vol. 6, pp. 39-43, 2011.
- [7] F.A. Flowra, "Utilization of some fishes and other fisheries items", Ph.D thesis, Department of Fisheries, University of Rajshahi, 2006.
- [8] M. Quadrat-I-Khuda, H.N. De, N.M. Khan, J.C. Debnath, "Biochemical and nutritional studies on East Pakistan Fish, Part-VII. Chemical Composition and Quality of the Traditionally Processed fish", Pakistan Journal of Science and Industrial Research, vol. 5, no.20, pp. 70-73, 1962.
- [9] H.N. De, "Processing of fish protein concentrate in East Pakistan", Transaction of the fish protein concentrate seminar, Dhaka, November 7-8, pp. 15-23, 1967.
- [10] S.K. Bhattacharya, J.K. Bandyopadhyay, A.K. Chattopadhyay, "Improved dried product on Blanching of Gudusia chapra prior to sun-drying", In: Harvest and Post-Harvest Technology of Fish, Society Fish Technology, p. 531, 1985.
- [11] N.M. Humayun, "Studies on the improvement of traditional preservation method of fish drying segment the quality and the shelf life of the product". M.Sc thesis. Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh, p. 65, 1985.
- [12] A.S. Mujumdar, "Handbook of Industrial drying", Third edition, Taylor and Francis group, Boca Raton, FL, p. 1312, 2007.
- [13] M.A.K. Ashraful, and Y. S. A. Khan, "Study on the Abundance and Infestation of Blowfly during Drying of Fish in the Coastal Area of Bangladesh", Online Journal of Biological Science, Vol. 2, No. 7, pp. 499-501, 2002.
- [14] M.N.H. Bhuiyan, H. R. Bhuiyan, M. Rahim, K. Ahmed, K.M.F. Haque, and M.T. Hassan, and M.N.I. Bhuiyan,

- “Screening of Organochlorine Insecticides (DDT and Heptachlor) in Dry Fish Available in Bangladesh”, *Bangladesh Journal of Pharmacology*, Vol. 3, No. 2, pp. 114-120, 2008.
- [15] M.K. Mustapha, T.B. Ajibola, S.K. Ademola, and A.F. Salako, “Proximate analysis of fish dried with solar driers”, *Italian Journal of Food Science*, vol. 26, p. 222, 2014.
- [16] Aberoumand, and M.K.R. Abad, “Influences of drying methods processing on nutritional properties of three fish species Govazym stranded tail, Hamoor and Zeminkan”, *International Food Research Journal*, vol. 22, no. 6, pp. 2309-2312, 2015.
- [17] Eves, and R. Brown, “The Effect of Traditional Drying Processes on the Nutritional Values of Fish”, *Tropical Science*, vol. 33, pp. 183-189, 1993.
- [18] S. Gheyasuddin, A.M.M. Rahman, and M. Kamal, “Nutritive quality of some of the commercial marine fishes of Bangladesh”, *Bangladesh Journal of Agriculture*, vol. 5, pp. 1-38, 1980.
- [19] C.P. Banu, B. Nahar, and K. Ahmed, “Studies on the Protein, Riboflavin and Iron Content of Some Fresh Water Fish and a Prawn of Bangladesh”, *Bangladesh Journal of Zoology*, Vol. 13, No. 1, pp. 25-28, 1985.
- [20] S.S. Saha, “Studies on the production, marketing and nutritional aspects of traditional dried products of freshwater small indigenous species of Bangladesh”, M.S thesis, Department of Fisheries Technology, Bangladesh Agriculture University, Mymensingh, Bangladesh, 1999.
- [21] K. Azam, M.Z. Basher, M. Asaduzzaman, M.H. Hossain, and M.Y. Ali, “Biochemical quality assessment of fourteen selected dried fish”, *University Journal Zoology*, vol. 22, pp. 23-26, 2003.
- [22] M.T. Islam, S. Ahmed, M.A. Sultana, A.S. Tumpa, and F. A. Flowra, “Nutritional and food quality assessment of dried fishes in Singra upazila under Natore district of Bangladesh”, M.S thesis, Department of Fisheries, University of Rajshahi, Bangladesh, 2013.
- [23] E.G. Bligh, and W.J. Dyer, “A rapid method for total lipid extraction and purification” *Canadian Journal Biochemistry Physiology*, vol. 37, pp. 911-917, 1959.
- [24] O.H. Lowry, N.J. Roserbrough, A. L. Farr, and R.J. Randall, “Protein measurement with the folin phenol reagent”, *The journal of biological chemistry*, vol. 193, no. 1, pp. 265-75, 1951.
- [25] AOAC, “Official method of analysis”, Association of Official Analytical Chemist, 13th edition. Washington D.C, pp. 376-384, 1980.
- [26] IUPAC, “Standard Methods for the Analysis of Oils, Fats and Derivatives”, 6th edition, Pergamon Press, Paris, 1977.
- [27] Perkin-Elmer, “Analytical methods for Atomic Absorption Spectrometry” Perkin-Elmer Corporation, U.S.A. 1982.
- [28] M.A. Mansur, S. Rahman, M.N.A. Khan, M.S. Reza, Kamrunnahar and S. Uga, “Study on the quality and safety aspect of three sun dried fish”, *African Journal of Agricultural Research*, vol. 8, no. 41, pp. 5149-5155, 2013.
- [29] M.A. Rahman, S. Gheyasuddin, M.H. Rashid, and M.F.Z. Chowdhury, “Proximate Composition and Nutritive Quality of Fresh Water Zeol Fishes of Bangladesh”, *Bangladesh Journal of Fisheries*, vol. 2-5, No. 2, pp. 37-43, 1982.
- [30] N.F. Oparaku, and F.C. Nwaka, “Effect of processing on the nutritional qualities of three fish species (*Synodontis clarias*, *Trachurus trecae* and *Clarias gariepinus*)”, *International Journal of Biology and Biological Sciences*, Vol. 2, No. 10, pp. 143-149, 2013.
- [31] Ogbonnaya, and I.M. Shaba, “Effects of Drying Methods on Proximate Compositions of Catfish (*Clarias gariepinus*)”, *World Journal of Agricultural Sciences*, Vol. 5, No. 1, pp. 114-116, 2009.
- [32] J.J. Clucas, “Fish handling Processing and Preservation in the tropics. Part 2”. Report of the London Tropical Products Institute, London U.K. pp. 144-145, 1982.
- [33] D.K. Paul, R. Islam, and M.A. Sattar, “Physico-chemical studies of Lipids and Nutrient contents of *Channa striatus* and *Channa marulius*”, *Turkish Journal of Fisheries and Aquatic Sciences*, vol. 13, pp. 487-493, 2013.
- [34] M. Rahman, S. Barua, S. Sayeed, M.A. Hassan, S. Haque, S.N. Islam, and S.H. Thilsted, “Fat and Mineral Content in Small Indigenous fish species in Bangladesh”, *South-Asian Journal of Nutrition*, vol. 3, no. 2, pp. 1-6, 2001.
- [35] R.S. Dewi, N. Huda, and R. Ahmad, “Changes in the Physicochemical Properties, Microstructure and Sensory Characteristics of Shark Dendeng Using Different Drying Methods”, *American Journal of Food Technology*, vol. 6, pp. 149-157, 2011.
- [36] N. Ross, S.H. Thilsted, and M.M. Islam, “Small indigenous fish species in aquaculture in Bangladesh: contribution to vitamin A, calcium and iron intakes”, *International Journal Food. Science and Nutrition*, vol. 53, pp. 425-437, 2006.
- [37] J.O. Akinneye, I.A. Amoo, S.T. Arannilewa, and O.O. Bakare, “Effect of drying methods on nutritional composition of three species of fish”, *Journal of Fishery International*, vol. 2, no. 1, pp. 99-103, 2007.

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