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Preparation and preservation of fish protein concentrate (FPC) from five dried small indigenous fishes of the River Padma, Rajshahi, Bangladesh

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Abstract

A total of five dried fish species viz. Bele (*Glossogobius giuris*), Tit punti (*Puntius ticto*), Kholisa (*Colisa fasciata*), Bacha (*Eutropiichthyes vacha*), Kechki (*Corica soborna*) and some mixed fishes chanda, nama chanda, mola, guchi, kakila (*Chanda nama*, *Chanda ranga Amblypharyngodon mola*, *Mastacembelus pancalus*, *Xenentodon cancella*) were selected for preparation of powder (FPC) which can be preserved for a time period. This fishes were sun dried or oven-dried. Quality of the oven dried fish was better than that of the sun dried fishes. Weight of fish powder was found to range from 43.63 ± 14.63 g Bele to 84.24 ± 31.77 g Kholisa. After sun drying the maximum powder products from 1kg of fresh fish was 258.009 (25.80%) in Kechki and minimum 117.20g (11.72%) in Bele. The ratio between the fresh fish weight and sun dried fish weight was found minimum as 1: 0.123 Bele and maximum as 1: 0.259 Kechki and mixed fishes also more or less. The lowest duration of day was needed in Kechki (3-4 days) and the highest duration (7 days) was needed in Bele. The minimum and maximum weight of sun dried product (N=10) was obtained as 46.83 ± 15.31 g (Bele) and 89.44 ± 31.66 g (Kholisa) respectively. The oven dried fishes ranged from 44.93 ± 14.65 g (Bele) and 86.88 ± 31.62 g (Kholisa).

Keywords: Dried SIS fishes, fish powder (FPC)

1. Introduction

There are 260 fresh water species in Bangladesh of which belonging to 55 families^[1]. Of these over 150 species have been considered as "Small indigenous species (SIS)"^[2]. The small indigenous fishes (SIS) of Bangladesh are generally considered to be those which grow to a length of approximately 5-25 cm or 9 inches at maturity^[3]. These small fishes have been considered as an excellent source of protein, macro and micro nutrients, vitamins and minerals which can play an important role in the elimination of malnutrition problem in Bangladesh^[4, 5]. Bele, puti, kholisa, bacha, guchi, kechki, chanda, nama chanda, mola, kakilla are important SIS fishes of Bangladesh^[6] and commercially important. These species were abundant in rivers, streams, canals, beels, ponds and floodplains. Bele are the top commercially important fresh water indigenous species. Punti is identified as vulnerable while punti contains double amount of iron compared to many cultured carps. Mola are richer in vitamin A, iron and more calcium than any other larger species. All these small fishes are important item in the daily diet of the people of all categories.

Dried fish is an important source of animal protein and has been widely accepted as a good source of protein and other elements for the maintenance of health body^[7] at low cost. Dried fish is considered as a delicacy in the menu of food from all over the country. But at present, availability of majority SIS fishes is at stake due to degradation of natural habitats, excess exploitation using illegal gears, removal of these fishes from culture water bodies (mainly ponds) by applying toxic substances etc. So, Proper knowledge on catching, handling, processing and preservation by various methods are very much needed. Proper processing and preservation of fishes species decrease the loss quality and quantity after catch. Unfortunately for a long time the fish processing and preservation sectors remained neglected except a little expansion of export oriented processing. These processing industries virtually have no role in processing and preservation of huge inland or marine catches. Considerable number of works has been done on different processing and preservation methods of fishes^[8-13]. Very little works has been done on the percentage of usable and waste products during processing of the

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fish. For proper utilization safe shelf life dry powder of fishes is an easy processing technique.

Five popular small fishes and some mixed fishes were used. People used whole fish to preparing some fast food or simple regular food. Drying is regarded as a traditional and primitive method of fish processing which have been already been improved by many fisheries scientists by using polythene tent drier, solar tunnel drier, cabinet drier, along with low cost open sun drying [14]. Comparative studies between traditional sun dried and solar tent dried fishes were reported by [15, 16].

1.1 Objectives and Activities

The present work was designed to determined the percentages of flesh weight of five freshwater fish species and some mixed species after processing and preservation that of wastes and powder products (FPC).

2. Materials and Methods

Five different species and a group of mixed small fishes were collected from different spot and landing centers of Rajshahi City during July 2009 to July 2011. After collection samples were washed and preserved in refrigerator. Species as *Bele*, *puti*, *kolisa*, *bacha*, *kechki* and some mixed fishes (Chanda, nama chanda, mola, guchi, kakila). After collection the fishes were washed with tap water then, fin, scale, viscera was cleaned again and soaked using kitchen tissue paper. Then weight of a group (50/100g) and individual fresh fishes was taken. The data were recorded separately for each species. After weighing the fresh fishes were placed in clean and held for drying.

2.1 Sun drying

Sun drying was done in the open air using the solar energy to evaporate the water and was carried away by the natural air currents. The specimens were dried for minimum 6-7 days depending on the species and climatic condition. During drying, they were held covered by dense meshed nylon or mosquito net to prevent bird and fly infestation. The peak seasons was summer and winter for sun drying and off season was rainy or gloomy weather.

The process and principle of sun drying can be expressed by the model (Fig. 1).

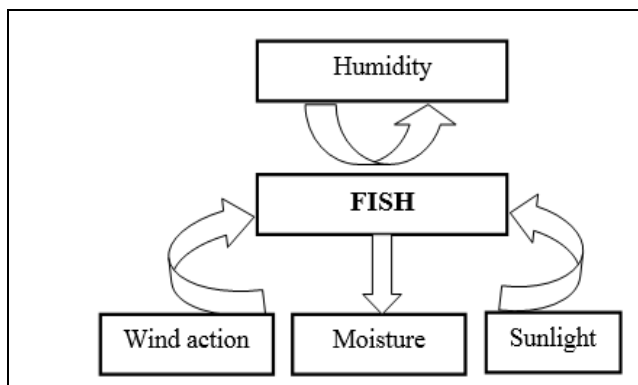


Fig 1: Process of sun drying of fishes (adapted from Nowsad, 2005 [18]).

2.2 Preparation and preservation of (FPC)

The dried fishes were kept separately species wise at normal room condition in plastic container. Within 6-7 days the dry fishes were powdered with a kitchen grinder. Then the powder was sieved by chaplain. Total scheme of processing for fish powder has shown in Fig 2. Electronic balance meter

was also used for taking weight of and waste of powders. The powdered fishes were again dried under sun. This fish powder was packed in a polythene bag and kept in a plastic contained at 6-7 month (normal room temperature) and then in a refrigerator for 1 year.

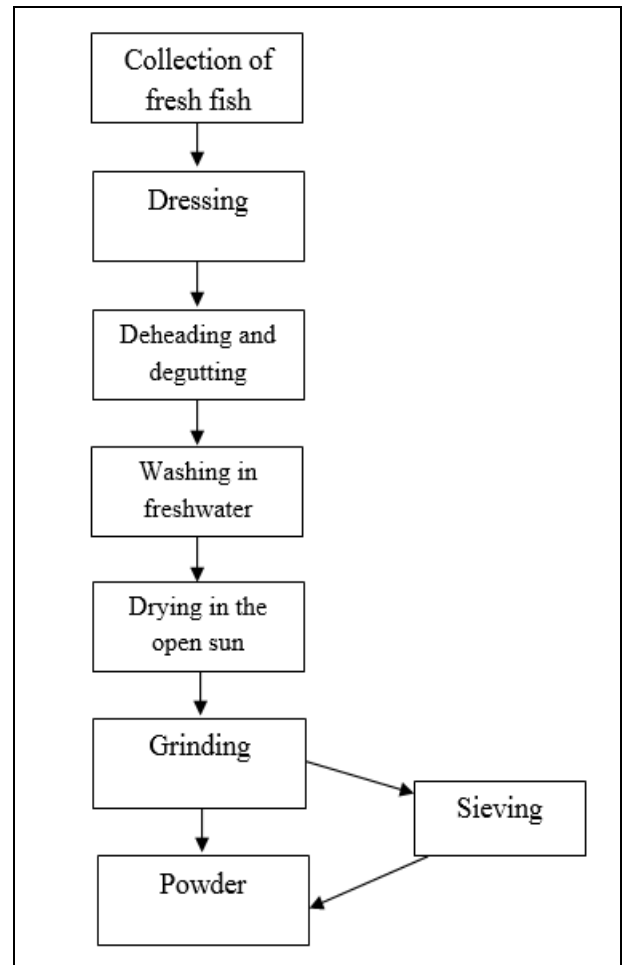


Fig 2: Scheme for processing steps as powder of sun drying fishes

3. Results and Discussion

The temperature and humidity (%) of the drying area were recorded for each species, as all the fishes were not processed at the same day. Temperature and humidity (%) on the air at the drying area and the time taken for proper drying are showing in the Table 1. For proper drying the highest temperature and day was needed for *G. giuris* (37-40)°c and 7 days and the lowest time was needed for *C. soborna* 4 days and *E. vacha* (36-38)°c in lowest temperature. Nowsad (2007) [17] and Flowra and Bhuiyan (2013) [13] reported on drying duration of different dried fishes which were more of less similar with this study. Different parameter for drying method of five small fish species and a group of mixed fishes are shown below.

Table 1: Different parameters during drying of fishes.

Species	Parameters		
	Temperature (°C)	Humidity (%)	Days required to dry up
<i>G. giuris</i>	37-40	78-84	7
<i>C. fasciata</i>	36-39	78-83	5
<i>P. ticto</i>	37-39	77-83	5
<i>E. vacha</i>	36-38	86-90	6
<i>C. soborna</i>	37-38	86-91	3-4
Mixed fishes	36-40	81-87	6

Weight of 10 specimens of each of five small fishes and that of the mixed fishes, and the percentage of sun dried and oven dried fishes to the fresh fish and that of fish powder are presented in Table 2. The average weight of fresh fish, sun dried fish, oven dried fish and powder was found 379.00, 46.83, 44.93, 43.63 g in *G. giuris*, 396.50, 89.44, 86.88, 84.24 g in *C. fasciata*, 298.00, 56.92, 54.06, 51.87 g in *P. ticto*, 340.00, 82.01, 79.67, 78.14 g in *E. vacha*, 277.00, 71.83, 69.29, 67.14 g in *C. soborna* and 320.00, 83.08, 80.24, 77.83 g in mixed (*C. nama*, *C. ranga*, *A. mola*, *M. pancalus*, *X. cancila*), fishes.

The result shows that minimum and maximum weight of

sundried product (N=10) was obtained as 46.83±15.31 g (*G. giuris*) and 89.44±31.66 g (*C. fasciata*) respectively. The sundried weight of the experimental fishes were found to range from 12.64% (*G. giuris*, initial weight 379.00±142.08 g, N=10) to 28.52% (*C. soborna*, initial weight 277.00±136.89 g, N=10) (Table-2). When these fishes were oven dried, the dry weight was found to range between 44.93±14.65 g (*G. giuris*) and 86.88±31.62 g (*C. fasciata*), which were 12.12% of fresh fish weight and 95.94% of sundry fish weight and 23.01% of fresh weight and 96.57% of sundry fish weight respectively.

Table 2: Average mean and percentage of powder product from fresh fish, sun-dried fish and oven dried of some small species and mixed fish species (N=10).

Species	Weight of fresh fish (g)	Weight of sun-dried fish and % of fresh fish (g)	Weight of oven dried fish and % of fresh fish and % of sun-dried fish	Weight of powder, % of fresh fish, % of sun dried and % of oven dried fish
<i>G. giuris</i>	379±142.08	46.83±15.31 (12.64%)	44.93±14.65 (12.12%) (95.94%)	43.63±14.63 (11.72%) (92.86%) (96.79%)
<i>C. fasciata</i>	396.50±159.68	89.44±31.66 (23.9%)	86.88±31.62 (23.01%) (96.57%)	84.24±31.77 (22.01%) (92.84%) (96.79%)
<i>P. ticto</i>	298±160.73	56.92±27.48 (19.78%)	54.06±27.53 (18.42%) (93.40%)	51.87±27.53 (17.29%) (87.70%) (93.84%)
<i>E. vacha</i>	340±180.72	82.01±44.46 (23.93%)	79.67±44.02 (22.89%) (95.60%)	78.14±43.78 (22.20%) (92.65%) (96.77%)
<i>C. soborna</i>	277±136.89	71.83±25.83 (28.52%)	69.29±26.42 (27.00%) (95.28%)	67.14±26.73 (25.80%) (91.42%) (95.83%)
Mixed fishes	320±144.42	83.08±40.90 (25.06%)	80.24±40.65 (23.92%) (95.19%)	77.83±40.48 (22.94%) (91.09%) (95.59%)

Dried fishes were grouped to produce the powder (dust). Weight of the fish powder was found to range from 43.63±14.63 g (*G. giuris*) to 84.24±31.77g (*C. fasciata*). The powder weight was 11.72%, 92.86% and 96.79% of fresh weight, sun dried weight and oven dried weight in case of *G. giuris* respectively. The powder of *C. soborna* was 25.80% of fresh fish 91.42% of sundry weight and 95.83% of oven dry weight (Table 2).

The powder weight/kg fresh fish was obtained minimum as

117.20 g (11.72%) for *G. giuris* and maximum 258.00 g (25.80%) for *C. soborna*. The ratio between the fresh fish weight and sun dried weight was found minimum as 1:0.123 (*G. giuris*) and maximum as 1:0.259 (*C. soborna*). This ratio was similar for all the small fishes used in the experiment (Table 3). Weight of the oven dried fishes and that of powder were of similar ratio with the weight of the fresh fish (Table 3). So, there is no weight loss during grinding the dry fishes.

Table 3: Average ratio between per kg weight of sun dried and oven dried fishes and their powder with the fresh fish weight (individual species and mixed species fishes).

Species	Weight of fresh fish (g)	Ratio		
		Fresh fish : Sun dried fish	Fresh fish : Oven dried fish	Fresh fish : Powder
<i>G. giuris</i>	379.00±142.08	1:0.123	1:0.118	1:0.115
<i>C. fasciata</i>	396.50±159.68	1:0.225	1:0.219	1:0.212
<i>P. ticto</i>	298.00±160.73	1:0.191	1:0.181	1:0.174
<i>E. vacha</i>	340.00±180.72	1:0.241	1:0.234	1:0.229
<i>C. soborna</i>	277.00±136.89	1:0.259	1:0.250	1:0.242
Mixed fishes	320.00±144.42	1:0.259	1:0.250	1:0.243

In Table 4 weight of dried powder of 1 kg fish are given for five species and a group of mixed species. The maximum weight was 258.00 g/kg (*C. soborna*) and the minimum weight was 117.20 g/kg (*G. giuris*). Weight of the powder was thus ranged from 11.72% to 25.80% (Table 4, Fig. 3).

Dried fish powder was preserved for off season in good condition for 5-7 months. But in -18°C the powder was in good condition throughout the year.

Table 4: Weight and percentage of powder product of five small fishes and a group of mixed fishes per kg weight.

Species	Constant weight (g)	Powder (g)	Percentage
<i>G. giuris</i>	1000	117.20	11.72
<i>C. fasciata</i>	1000	220.10	22.01
<i>P. ticto</i>	1000	172.90	17.29
<i>E. vacha</i>	1000	222.00	22.20
<i>C. soborna</i>	1000	258.00	25.80
Mixed fishes	1000	229.40	22.94

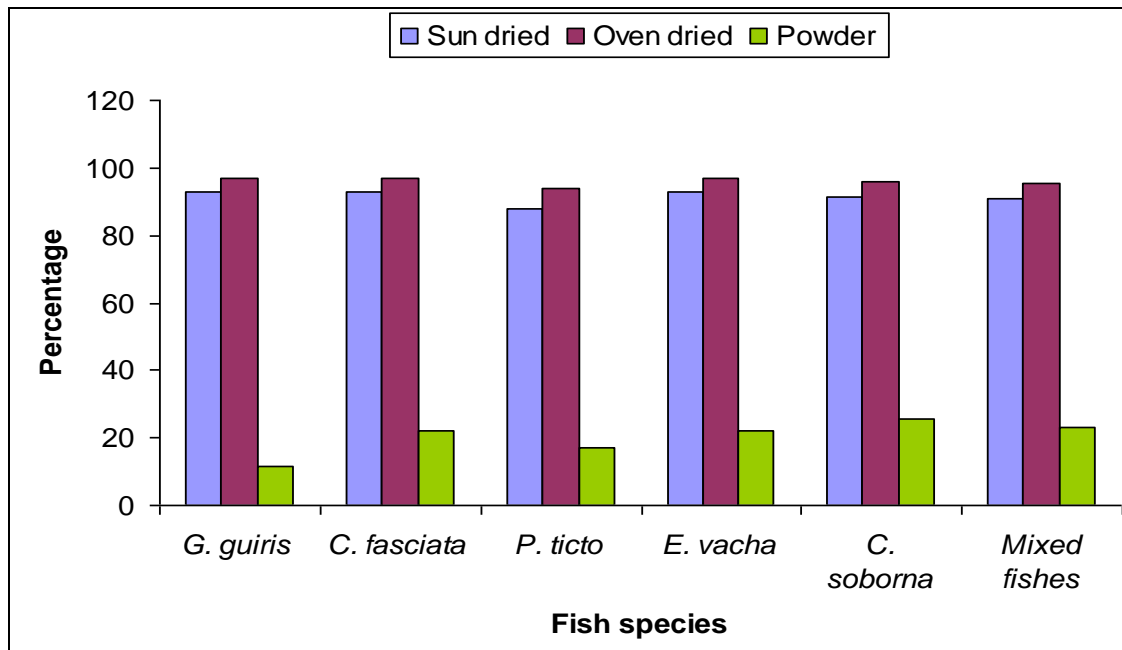


Fig 3: Percentage of weight of sun dried, oven dried fishes and powder of dried fishes to weight of fresh fishes.

4. Conclusions

Fish protein concentrate of fishes can be used in preparing regular or delicious snacks soups, fast food which are more acceptable to all especially children and adults and new generation of Bangladesh. Other portion (waste) of fishes is used in fish meal for fish or poultry. Preparing small indigenous fishes for cooking time are consuming. Therefore, fishes after dressing or even as dry powder (FPC), can attract consumer's interest and this can increase the marketing efficiency of the SIS fishes. Fish powder after proper drying can be served for quite a long time in air tight containers kept at a dry place. Powder of sun dried fishes is used in vegetables, curries, dal, bora, at different areas of Bangladesh.

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