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Proximate composition analysis of five important dried sea fish and evaluate their nutritive value

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ABSTRACT

Present study was conducted on the proximate composition and quality aspects of sundried sea fish species *Stromateus chinensis*, *Harpodon nehereus*, *Trichiurus haumela*, *Strongylura leiura* and *Engraulis tellara* which were collected from the local market of Cox's Bazar. Organoleptically, the fish available in local market of Cox's Bazar and sundried sea fish species were excellent in quality. Crude Protein, lipid, moisture and ash content (%) of sundried *Stromateus chinensis* was 60.61±0.25, 7.35±0.09, 22.62±0.81 and 8.56±0.32, respectively. Crude Protein, lipid, moisture and ash content (%) of sundried *Harpodon nehereus* was 61.53±1.01, 7.44±0.48, 17.93±1.04 and 12.78±0.75, respectively. Crude Protein, lipid, moisture and ash content (%) of sundried *Trichiurus haumela was* 58.36±0.46, 11.24±0.36, 18.66±0.42 and 11.22±0.34, respectively. Crude Protein, lipid, moisture and ash content (%) of sundried *Strongylura leiura was* 50.16±0.44, 9.17±0.55, 22.09±0.90 and 17.57±0.38, respectively. Crude Protein, lipid, moisture and ash content (%) of sundried *Engraulis tellara was* 52.82±0.18, 10.40±0.73, 22.13±0.60 and 15.17±0.66, respectively. TVB-N contents (%) of sundried *Stromateus chinensis*, *Harpodon nehereus*, *Trichiurus haumela*, *Strongylura leiura* and *Engraulis tellara* was 16.81±0.82, 9.92±0.80, 20.26±0.70, 13.89±0.47 and 19.62±0.30, respectively. Organoleptically the experimental traditional dried sea fishes were excellent and acceptable. The protein content of five dried fish was very high and moisture was minimum level. The lipid and ash content of these products were within the limit. TVB-N of five dried sea fishes were within acceptable level.

INTRODUCTION

Bangladesh is one of the resourceful countries with its wide range of marine aquatic bio-diversities. There are about 1093 marine aquatic organisms where 44.35% are finfish, 32.23% shellfish, 15.10% seaweeds and only 8.32% are other organisms including shrimps. Drying, the oldest, easiest and excellent way of fish processing has been introduced in our country by the Arabian saints and businessmen who have been believed to be pioneer in the production and marketing of the dried fish products throughout the world since the Egyptian civilization (Kreuzer, 1974). Sun drying is a cheaper method of fish preservation and solar energy is used for the removal of moisture from the fish. Dried fish is a source of protein and plays a major contribution in providing nutrition for the poor as well as economically disadvantaged people of our country (Reza et al., 2005). The product of dried fish is easily transportable, marketable and storable (Alam, 2007).Although dried fishes do not give similar flavor, taste or texture of fresh fish, it is liked and consumed by a large number of people in the world due to its characteristic taste and flavor. It is an important source of animal protein in providing nutrition of the poor and economically disadvantaged people. In Bangladesh, sun-drying of fish is carried out in the open air using the energy of the sun to evaporate the water and air flow to carry away the vapor. Proximate composition generally comprises the estimation of moisture, protein, lipid and ash contents of the fresh fish body. The percentage composition of these constituents accounts for about 96-98% of the total tissue constituents in fish. The assessment of the proximate composition of the fish is not only important to know its

nutritive value, but also for its better processing and preservation. In the present investigation, attempts have been made to collect data which will be helpful in preparing a commodity satisfying the above requirements. The fish products obtained are sun dried and marketed in substantial quantities. The annual landing of these fish products are increasing steadily with higher potential in coming years. Considering the magnitude of fishing and trade of the dried products it was felt necessary to carry out a survey on the quality of these products available in marking outlets. Considering all the circumstances this study was undertaken to analyze the proximate composition of five important dried sea fish and evaluate their nutritive value, observation of degree of freshness by evaluating the Total Volatile Base Nitrogen (TVBN).

Methodology

The present study was done by collecting samples and studying various parameters. Sample collection, organoleptic assessment, proximate composition analysis (crude protein, lipid, ash and moisture) were done during January 2014 to June 2015. Traditionally five sundried sea fish speceis were selected to accomplish the research work, and these were Chinese pomfret (*Stromateus chinensis),* Bombay duck (*Harpodon nehereus*), Ribbon fish (*Trichiurus haumela*), Banded Needle Fish (*Strongylura leiura*) and Phasa (*Engraulis tellara*). Dried samples were collected from the local market of Cox's Bazar. Dried fish samples were packed tightly in polyethylene bags and stored at room temperature for subsequent studies.

Physical characteristics

Physical characteristics such as color, odor, taste, flavor and texture of the traditional dried fishes were observed by organoleptic method (Howgate *et al*., 1992).

Proximate composition

AOAC (1980) method was followed for proximate composition of the sun dried fish products. Homogeneity of the samples was done by using a blender. All the determinations were made in duplicate or in triplicate. Prior to analysis the dried fishes without any pretreatment were first chopped with large knife in order to make small pieces.

Crude protein

Kjeldahl apparatus was used to determine protein content of the dried fish samples.

Procedure

For the determination of crude protein by kjeldahl apparatus first of all the dried fish sample was taken and chopped into small pieces and was grinded by grinder. Approximately 1.0g of sample was taken in a clean kjeldahl flask and 4g of digestion mixture was added along with 25ml of conc. H_2SO_4 by swirling the flask. Then we placed the kjeldahl flask in an inclined position on heating device of kjeldahl apparatus and were heated at 70°C for about 1-1.5 hours. The end point of digestion was indicated by a completely clear and of light blue color solution. The content of the flask were cooled at room temperature and 100ml of distilled water and 25ml of $Na_2S_2O_3$ were continuously added in each flask and were mixed and cooled. A few glass beads were added in each flask to prevent bumping. Then 100-120ml of 40% NaOH was added in each flask to make the solution sufficiently alkaline. The flask was immediately connected to distilling bulb on condenser. A conical flask containing 50ml of 2% H_3BO_3 with 2 drops of mixed indicator was placed under the condenser against kjeldahl flask to collect the distillate. After completion of distillation (about 100ml distillate) the collected distillates were titrated with standard HCl. The end point was indicated by light pinkish color.
Total nitrogen was calculated by using the following formula-

$$\text{Nitrogen (\%)} = \frac{\text{ml.Acid titrated} \times \text{normality of acid titrated} \times \text{milli equivalent of N (0.014)}}{\text{Weight of sample}} \times 100$$

% of crude protein= Nitrogen% × 6.25

Lipid

Lipid content was determined by soxhlet apparatus using acetone as solvent. Prepared fish sample was

weighed and taken in a paper thimble and placed it inside the Soxhlet apparatus. Sufficient amount of acetone was poured into the round joint flask of the apparatus and heated on water bath at 70^0C for 1-1.5 hours. The solvent evaporates upon heating but allowed to drop slowly after condensing on the sample inside the thimble until the entire lipid in the sample was extracted. Finally the solvent containing lipid was transferred to a pre-weighed beaker. The residual lipid content was obtained after removal of solvent by evaporating on heating on water bath.

$$\text{Lipid content (\%)} = \frac{\text{Weight of lipid}}{\text{Weight of sample}} \times 100$$

Moisture

Moisture was determined by placing an accurately weighed known amount of ground sample in a pre-weighed porcelain crucible in an electric oven at 105^0c for about 24 hours until constant weight was obtained. The loss of moisture was calculated as percent moisture.

$$\text{Moisture content (\%)} = \frac{\text{Weight of wet material} - \text{Weight of dry material}}{\text{Weight of wet material}} \times 100$$

Ash

About 3-5g prepared sample was taken in pre-weighed porcelain crucible and was placed in muffle furnace at 550^0c for 6 hours. Then the crucibles were cooled in desiccators. The average in percentage of each sample of the remaining materials was taken as ash.

$$\text{Ash content (\%)} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

TVB-N

For chemical evaluation of shelf-life, TVB-N test was used. TVB-N was determined according to the methods given in AOAC (1980) with certain modification.

Sample preparation

Exactly 10g of ground sample are weighed, mixed with 90ml of 6% perchloric acid and homogenized for 2 minutes with a blender. This was done in cooled condition.

Steam distillation & titration

100ml of extract with 4 -6 drop phenolphthalein is put in a kjeldahl flask after placing on the distillation on it and distillation should be continued for more or less 15 minutes. The distillate is collected in the conical flask containing 50ml of 3% boric acid and 1 drop mixed indicator. Distillation confirmed through changing in color of mixed indicator, i.e. violate to greenish. After distillation the collected distillate was titrated with 0.01N HCl and regarding the violet color of mixed indicator confirms the end point. The result can be calculated by the following formula-

$$\text{TVB-N (mg/100 g sample)} = \frac{\text{ml of titrant x 0.014 x Normality of titrant}}{\text{Weight of sample (gm)}} \times 100$$

RESULTS AND DISCUSSION

Studies were conducted on the quality attributes of five sundried sea species Chinese pomfret (*Stromateus chinensis*), Bombay duck (*Harpodon nehereus*), Ribbon fish (*Trichiurus haumela*), Banded needle fish (*Strongylura leiura*) and Phasa (*Engraulis tellara)* prepared by different methods, to detect TVB-N.

Physical and organoleptic characteristics of dried fish products

Results of the observations of physical and organoleptic characteristics of market samples of dried fishes are presented in Table-1. The quality of the dried fish products was assessed on the basis of color, odor, texture, insect infestation, presence of broken pieces and overall quality. The color of dried Chinese pomfret, Bombay duck and ribbon fish were from slightly silver to whitish color, which exhibit excellent color for the dried fish products. Texture was firm and flexible and odor was very much natural in all samples. Some insect infestation and no broken pieces were found in the products. It was observed that the flavor and color are important factors influencing the overall consumer acceptance. So, the overall quality of these samples was of acceptable limit.

Table-1
Organoleptic characteristics of dried sea fishes.

Fish sample	Color	Odor	Texture	Broken pieces	Overall quality	Color
Chinese pomfret	Brownish silver	Characteristic odor	Rigid	No broken pieces	Acceptable	Brownish silver
Bombay duck	Brownish color	Characteristic odor	firm and elastic	No broken pieces	Acceptable	Brownish color
Ribbon fish	Deep Brownish	Characteristic odor	firm and elastic	Some broken pieces	Acceptable	Deep Brownish
Banded needle Fish	Brownish color	Characteristic odor	firm and elastic	No broken pieces	Acceptable	Brownish color
Phasa	Light Brownish	Characteristic odor	firm and elastic	No broken pieces	Acceptable	Light Brownish

Table 2
Biochemical Characteristics of Dried Sea Fish Products.

Species	Crude Protein (%)	Crude Lipid (%)	Moisture (%)	Ash (%)	TVB-N (mg/100g)
Chinese pomfret	60.61±0.25	7.35±0.09	22.62±0.81	8.56±0.32	16.81±0.82
Bombay duck	61.53±1.01	7.44±0.48	17.93±1.04	12.78±0.75	9.92±0.80
Ribbon fish	58.36±0.46	11.24±0.36	18.66±0.42	11.22±0.34	20.26±0.70
Banded needle Fish	50.16±0.44	9.17±0.55	22.09±0.90	17.57±0.38	13.89±0.47
Phasa	52.82±0.18	10.40±0.73	22.13±0.60	15.17±0.66	19.62±0.30

*mean value± standard deviation of 3 individual measurements

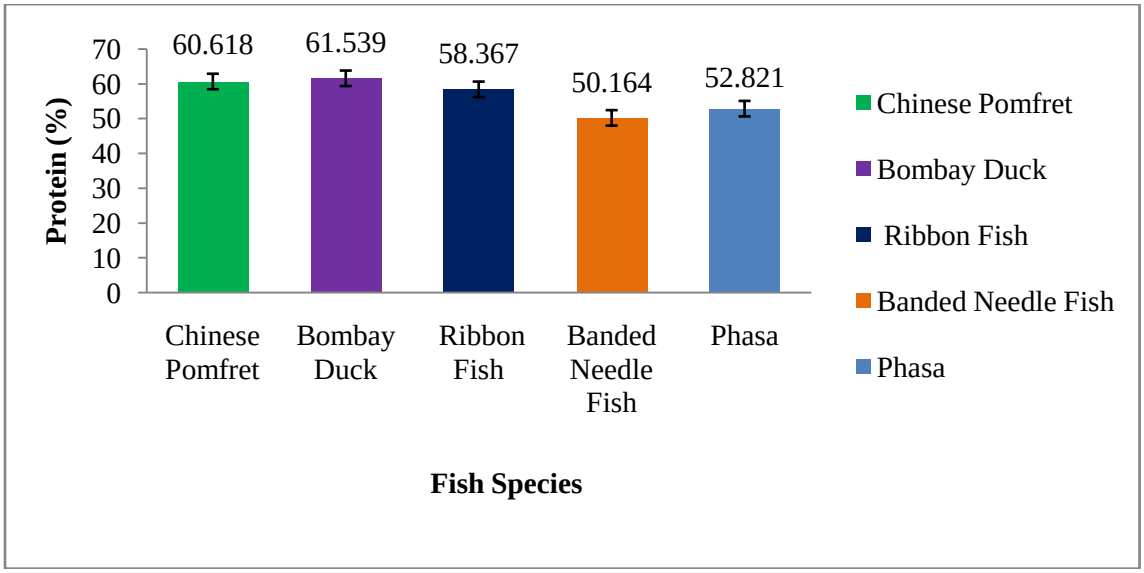

Figure 1
Crude protein contents (%) of dried chinese pomfret, bombay duck, ribbon fish, banded needle fish and phasa.

Biochemical characteristics of dried fish products

The result of proximate analysis (moisture, protein, lipid and ash) in wet weight basis and TVB-N content of dried Chinese pomfret, Bombay duck, Ribbon fishes, Banded Needle Fish and Fasha are shown in table- 2.

Protein

The crude protein content (%) of dried chinese pomfret was 60.61±0.25, dried bombay duck was 61.53±1.01, dried ribbon fish was 58.36±0.46, dried banded needle fish was 50.16±0.44 and the protein content (%) of dried phasa was 52.82±0.18. The lowest value obtained from dried banded needle fish and the highest value from dried bombay duck. Siddique *et al.* (2011) observed that the protein level of three marine dried fishes (*Harpodon nehereus*, *Johnius dussumieri* and *Lepturacanthus savala*) was varied from 58.33%-51.98%, 64.39%-56.46% and 71.90%-67.22%, respectively during changes of storage period. Bhuiyan (1992) observed 55.8% - 75.9% protein in dried fish sample (*Harpodon nehereus* and Johnius *dussumieri*, respectively).

Lipid

The lipid content (%) of dried chinese pomfret was 7.35±0.09 dried bombay duck was 7.44±0.48, dried ribbon fishes was 11.24±0.36, dried banded needle fish was 9.17±0.55 and the lipid content (%) of dried phasa was 10.40±0.73. The lowest value obtained from dried chinese pomfret and the highest value from dried ribbon fish.

Siddique *et al.* (2011) observed that the lipid level of three marine dried fishes (*Harpodon nehereus, Johnius dussumieri* and *Lepturacanthus savala*) was varied from 7.78%-5.86%, 5.54%-4.87% and 7.79%-6.66%, respectively during changes of storage period. Bhuiyan (1992) observed 9.21% - 6.84% lipid in dried marine fishes.

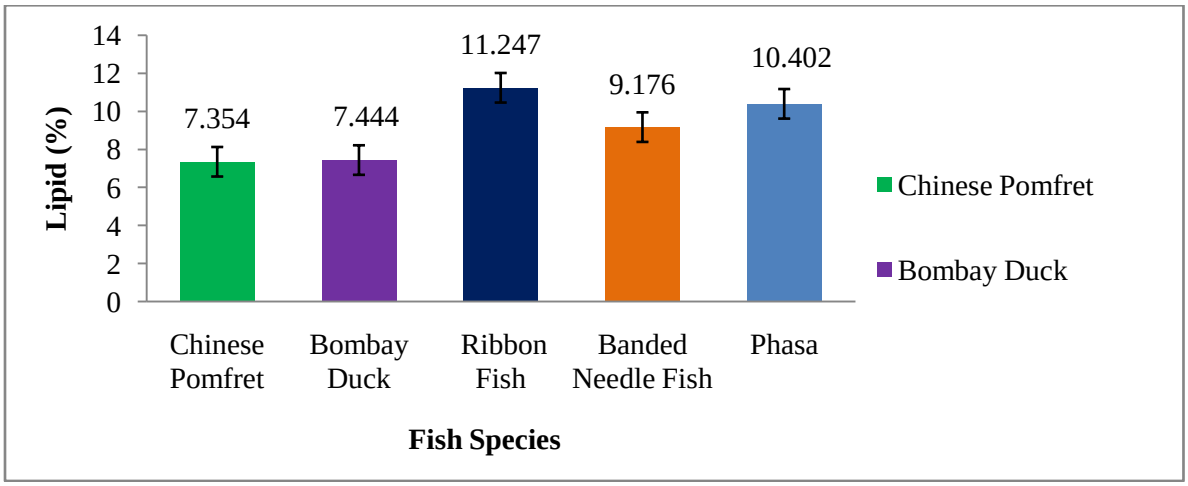

Figure 2
Crude lipid contents (%) of dried chinese pomfret, bombay duck, ribbon fish, banded needle fish and phasa.

Moisture

Moisture content (%) of dried chinese pomfret was 22.62±0.81, dried bombay duck was 17.93±1.04, dried ribbon fish was 18.66±0.42, dried banded needle fish was 22.09±0.90 and the moisture content (%) of dried phasa was 22.13±0.60. The lowest value obtained from dried Bombay duck and the highest value from dried Chinese pomfret. Siddique *et al.*, (2011) studied the changes of nutritional value of three marine dried fishes (*Harpodon nehereus, Johnius dussumieri* and *Lepturacanthus savala*) during storage. They showed that the moisture level in the analyzed dried samples were varied from 22.22%-34.99%, 20.76%-32.65% and

13.81%-20.50%, respectively during changes of storage period. For 2 years storage period the moisture content is increased by 12.77%, 11.89% and 6.69% for these three dry fishes. Bhuiyan **(**1992) observed 6.9% - 14.2% moisture in dried marine fishes. It shows dissimilarities from present study because the dry fish traders keep the dry fish in wet and unhygienic condition and do not control the moisture and air temperature of the warehouse.

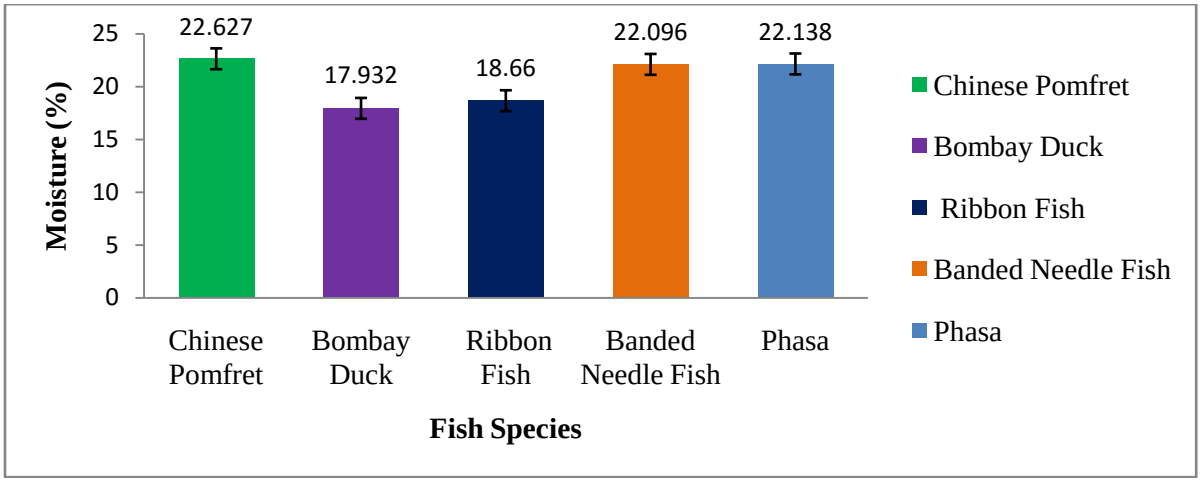

Figure 3
Moisture contents (%) of dried chinese pomfret, bombay duck, ribbon fish, banded needle fish and phasa.

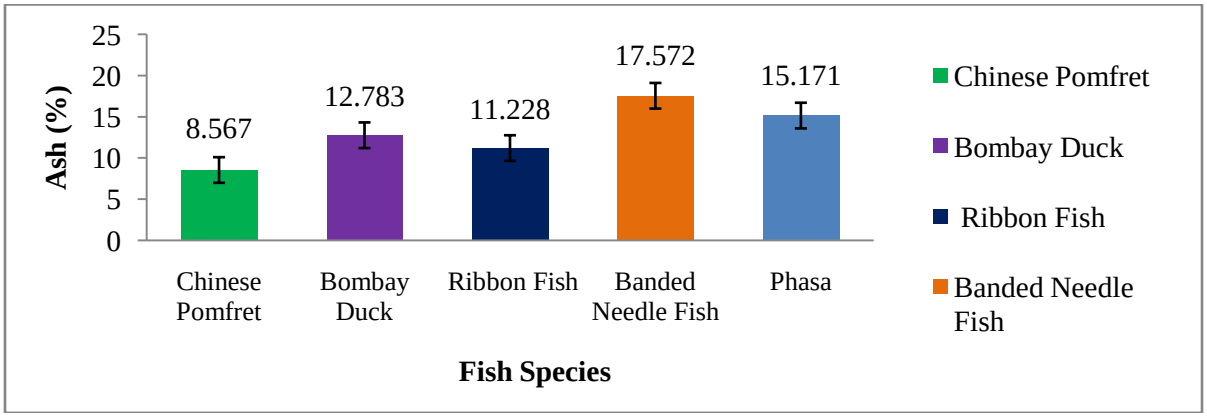

Figure 4
Ash contents (%) of dried chinese omfret, bombay duck, ribbon fish, banded needle fish and phasa.

Ash

The ash content (%) of dried chinese pomfret was 8.56±0.32, dried bombay duck was 12.78±0.75, dried ribbon fish was 11.22±0.34, dried banded needle fish was 17.57±0.38 and the ash content (%) of dried phasa was 15.17±0.66. The lowest value obtained from dried chinese pomfret and the highest value from dried banded needle fish. Siddique et al. (2011) observed that the ash level of three marine dried fishes (*Harpodon nehereus, Johnius dussumieri* and *Lepturacanthus savala*) was varied from 7.56%-4.76%, 6.37%-4.89% and 4.86%-4.64% respectively during changes of storage period. Bhuiyan (1992) observed 6.6% - 16.2% ash in dried fishes. Gheyasuddin *et al*., (1979) found 9.98% - 4.56% ash in dry fishes which is in close quarters with the present investigation.

TVB-N

The TVB-N content (%) of dried chinese pomfret, dried bombay duck, dried ribbon fishes, dried

banded needle fish and dried phasa were 16.810±0.826, 9.92±0.80, 20.26±0.70, 22.13±0.60, 15.17±0.66 mg/100g respectively in dry weight basis, where the lowest value obtained from dried bombay duck and the highest value from dried ribbon fish. Reza et al. (2008) 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 & 5.3 to 19.0 mg/100 g for silver jew fish, bombay duck, big-eye tuna, chinese pomfret and ribbon fish respectively. Islam (2001) observed that Total Volatile Base Nitrogen (TVB-N) content of traditional dried ribbon fish, bombay duck, big-eye tuna, silver jew fish and chinese pomfret ranged from 16.56-44.83 mg/100g. According to Connell (1995) the upper limit of TVB-N is 30 mg/100g for fin fish dried products acceptability.

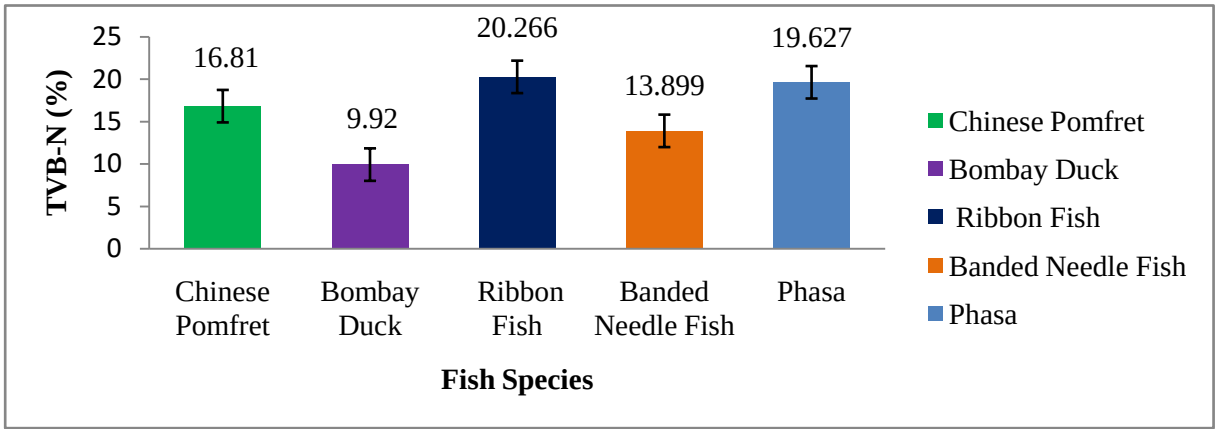

Figure 5
TVB-N contents (%) of dried chinese pomfret, bombay duck, ribbon fish, banded needle fish and phasa.

CONCLUSION

In this study proximate composition of the fish is variable and dependent upon the species, size, sex and age of the fish, its geographical distribution and the season of the year. Organoleptically the color of dried chinese pomfret, bombay duck, ribbon fish, banded beedle fish and fasha were from slightly silver to whitish color, which exhibit excellent color for the dried fish products. Texture was firm and flexible and odor was very much natural in all samples. The flavor and color are important factors influencing the overall consumer acceptance. So the overall quality of these samples was of acceptable limit. Organoleptically it was observed that the experimental traditional dried sea fishes were excellent and acceptable. The protein content of five dried fish was very high and moisture was minimum level. The lipid and ash content of these products were within the limit. TVB-N of five dried sea fishes were within acceptable level.

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