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Comparative analysis of nutritional quality between Pomfret (*Pampus argenteus*) and Hilsa (*Hilsa ilisha*), preserved and cooked under different conditions

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Abstract
The present study was conducted to compare the nutrients between *Pampus argenteus* and *Hilsa ilisha*. The nutrient contents of *P. argenteus were* higher than *H. ilisha* in the raw condition. They were both subjected to conventional cooking methods like open pan dry roasting, boiling, shallow frying and deep frying. They were also preserved raw up to 15 days with the preservative *viz*. a combination of salt and turmeric. The nutrient contents had changed due to preservation and cooking but the losses could be retained by the use of preservative. Nutrient retention mostly occurred in pomfret than in *hilsa*. The present study significantly revealed that cooked pomfret was beneficial due to adequate nutrient restoration and it could be preserved with preservative up to 15 days with minimal loss as compared to *hilsa*. Nutrient retention occurred mostly in deep frying method.

Keywords: Macronutrients, mineral contents, pomfret, *hilsa,* cooking methods, preservative

1. Introduction
Fish and other aquatic species are rich sources of protein commonly consumed in many parts of the world. But the nutrient contents change when they are cooked as shown in some studies previously carried out, which include- three commonly available species of marine fish in Nigeria were subjected to boiling, frying and roasting and the effects of these cooking methods on the fish were observed. The results showed reduced protein content for all the fish types [1]. In yet another research, amino acid and proximate compositions were determined in six commonly consumed raw and cooked marine fish in Turkey. The changes in amino acid and proximate contents were found to be significant for all cooking methods in all fish species [2]. Another research showed that cooking methods were also applied for vegetable samples which could also be a reference for this present study. Three cooking methods, namely boiling, steaming and stir-frying were used to evaluate the effect on nutrient components of bamboo shoots, resulting in decreased contents of protein, soluble sugar, and ash. Results indicated an appreciable loss in the total free amino acids in boiling method. All procedures were carried out for 10 minutes [3]. The effects of five domestic cooking methods, including steaming, microwaving, boiling, stir-frying and stir-frying followed by boiling on the nutrients and health-promoting compounds of broccoli were investigated. The results showed that all cooking treatments, except steaming, caused significant losses of total soluble proteins and soluble sugars [4]. The effects of different cooking methods (boiling, baking, frying and grilling) on proximate and mineral composition of snakehead fish were investigated. The changes in the amount of protein and fat were found to be significantly higher in frying and grilling fish [5]. The present study is significant due to the comparison of macronutrient and micronutrient contents between prawn and lobster after being subjected to cooking and preservation up to 15 days. Cooking methods can cause loss of nutrients and the species that can restore more nutrients after preservation and cooking is investigated in this study. The present study had three objectives as follows:

- This study aims to compare the nutritive values of the two sea fish under both raw and cooked conditions.
- It aims at finding the nutritive values restored after cooking and preservation with preservative.

- To find the fish that is beneficial in the perspective of nutrition is the most important concern of this study.

2. Materials and Methods

2.1. Sample preparation and cooking

Pomfret (*Pampus argenteus*) with a length of 12cm and weight of 250–300 g and *hilsa (Hilsa ilisha)* with a length of 25–30 cm and weight of 1 kg were obtained from the local fish market in Kolkata. They were kept in a plastic container, transported to the laboratory (University of Calcutta, Laboratory of Food Science) and washed with tap water several times to remove adhering dirt. Subsequently the samples were filleted and divided into three sections. The first section was sub-divided into five groups, one group was left uncooked while the other four were boiled, dry roasted in open pan, shallow fried and deep fried. Another section was preserved in the refrigerator at -20 °C up to 15 days without preservative and the other section was preserved up to 15 days with the combination of salt and turmeric (2% of the weight of the fish). The preservatives were used in the ratio of 1:1. Boiling was performed at 99–101 °C (water temperature) for 10 minutes. Open pan dry roasting of fillets was performed in a pan at 180 °C for 10 minutes. The frying of fillets was performed in a domestic frying pan of 2 L capacity at a temperature of approximately 180 °C for 10 minutes. Mustard oil was used as the medium for frying. In case of shallow frying 10 ml oil was used and 20 ml for deep frying. The fresh, preserved raw and cooked samples were then subjected to analysis.

2.2. Nutrient analysis

Nutrient analyses for homogenized samples of cooked and raw fish fillets were done in triplicate for carbohydrate, protein and lipid contents. The carbohydrate content was determined by Anthrone method [6] whereas the protein content was determined by the Lowry method [7]. Total lipid was extracted from the muscle tissues by soxhlet [8], Moisture and ash were determined by weight difference method [9], mineral content was estimated by AOAC method [10] and energy content by energy conversion factor [11].

2.2.1. Estimation of carbohydrate by Anthrone Method

100mg of the sample was taken into a boiling tube. Hydrolysis was carried out by keeping it in boiling water bath for three hours with 5mL of 2.5 N HCl and cooled to room temperature. Then it was neutralized with solid sodium carbonate until the effervescence ceased. Volume was made up to 100 ml and centrifuged at 3000 RPM for 15 minutes. The supernatant was collected and from it 1 ml was used for analysis. Then 4 ml Anthrone reagent was added to the solution. After that it was heated for eight minutes in a boiling water bath, cooled rapidly when green to dark green colour appeared. Then the reading was taken at 630 nm by spectrophotometer (Perkin Elmer Lambda 25) [6].

2.2.2. Estimation of Protein by Lowry Method

200 mg of sample was taken and 20 ml of buffer, containing sodium dihydrogen phosphate and disodium hydrogen phosphate, was added and homogenized finely. Then it was kept overnight. After that it was cold centrifuged at 5000 RPM for 20 minutes. The supernatant was collected and 1 ml of it was used for analysis. Then 5 ml of Lowry reagent was added to the supernatant and allowed to incubate for 10 minutes. After that 0.5 ml of Folinciocaltue reagent was added and incubated for 30 minutes until a dark blue colour appeared. The reading was taken at 660 nm by spectrophotometer (Perkin Elmer Lambda 25) [7].

2.2.3. Estimation of fat by Soxhlet Extraction Method

5gm of dried sample was placed inside the thimble of the apparatus, the extraction solvent petroleum ether of 60- 80 ^{0}C boiling range placed in a distillation flask and then on the heating mantel. The solvent was heated to reflux. The solvent vapour travelled up a distillation arm and flooded into the chamber housing the thimble. The condenser ensures that any solvent vapour that cooled, dripped back down into the chamber housing the solid material. The chamber containing the solid material slowly filled with warm solvent. The fat present in the sample was dissolved in the solvent which was returned to the distillation flask. This cycle was allowed to repeat for 12hours. After complete extraction of fat, the solvent was poured into a weighed petri dish, evaporated and the final weight of the petri dish containing the fat was taken. From this, the amount of the fat was calculated [8].

2.2.4. Estimation of moisture by weight difference method

10 gm sample was taken in a previously weighed petri dish and placed in an oven, maintained at 60 ^{0}C. The sample was placed there for 7 consecutive days and the weight of the sample was checked at specific intervals until the weight became constant. The difference between the initial weight and the final weight of sample containing Petri dish was converted into a percentage of moisture present in the sample [9].

2.2.5. Estimation of ash by weight difference method

5 gm of dried sample was taken in a previously weighed crucible and placed in a muffle furnace at temperature 600 ^{0}C for 8 hours. The weight was checked after that and the crucible was again placed in the furnace for at least 4 hours. The weight was checked again and the process was repeated until the weight became constant. The difference between the initial and the final weights of the sample containing crucible was used for the calculation of ash content of the sample [9].

2.2.6. Estimation of mineral by AOAC method after wet digestion

Dried sample (500 mg) was taken in a 25 ml volumetric flask and 10 ml of concentrated nitric acid was added to it and kept overnight. After that the volumetric flask was placed on the hot plate and allowed to boil for 8 hours. Then 4 ml of perchloric acid was added and boiled until brown fumes from the digestion stopped. After that the volume was made up to the mark by double distilled water and this solution was used for the analysis of iron and calcium by atomic absorption spectrophotometer (Perkin Elmer) [10].

2.2.7. Determination of energy content by energy conversion factor

The energy content of the sample was determined by the summation of the amount of energy from carbohydrate, protein and fat. The carbohydrate and protein contents were multiplied by the conversion factor 4.1 and 4 respectively and the fat content was multiplied by 9.3 and the total calorie content was represented in Kcal per 100 gm of a sample [11].

3. Statistical analysis

The effects of preservative and different cooking methods on the nutrient content of sea fish were analyzed by using Mean and Standard Deviation. One way ANOVA was applied for

comparing the nutritive values between the two fish. Differences were considered to be significant when p value is < 0.05. Data were analyzed by using SPSS package (Version 17).

4. Results

4.1. Nutrient content

Table 1, 2, 3, 4, 5, 6, 7, 8 showed the nutrient contents like carbohydrate, protein, fat, iron, calcium, moisture, ash, and energy contents of pomfret and hilsa. The raw and cooked values were displayed here along with the preservation days with and without preservative up to 15th. The proximate compositions and the mineral contents were reduced due to application of different cooking methods and preservation up to 15days. The table showed the changes between the raw and the cooked values.

Table 1: Carbohydrate content of samples (gm/100gm)

Sample	Duration	Raw	Boiling	Dry roasting	Shallow frying	Deep frying
Pomfret	Fresh	2.17±0.17	1.42±0.07	1.74±0.11	1.90±0.10	2.14±0.09
	15 days	2.63±0.11	1.33±0.12	2.59±0.09	2.60±0.07	4.33±0.10
	15 day (S+T)	4.19±0.11	2.08±0.08	2.08±0.07	2.76±0.04	3.20±0.05
Hilsa	Fresh	3.59±0.14	2.37±0.15	1.72±0.14	2.30±0.10	3.25±0.10
	15 days	1.72±0.08	2.40±0.10	1.27±0.08	2.05±0.05	2.50±0.08
	15 day (S+T)	3.25±0.05	0.65±0.05	1.65±0.05	1.75±0.05	2.62±0.13

Table 2: Protein content of samples (gm/100gm)

Sample	Duration	Raw	Boiling	Dry roasting	Shallow frying	Deep frying
Pomfret	Fresh	16.36±0.31	4.22±0.20	6.24±0.04	6.82±0.02	7.93±0.12
	15 days	7.50±0.25	6.66±0.33	11.04±0.52	10.43±0.43	10.00±0.55
	15 day (S+T)	7.50±0.25	3.33±0.33	8.40±0.55	6.95±0.43	7.75±0.25
Hilsa	Fresh	24.07±0.11	6.58±0.20	9.64±0.18	10.73±0.17	11.92±0.11
	15 days	11.42±0.87	4.84±0.41	4.09±0.19	2.96±0.37	3.85±0.30
	15 day (S+T)	5.25±0.25	2.80±0.40	2.98±0.44	3.36±0.40	3.50±0.50

Table 3: Fat content of samples (gm/100gm)

Sample	Duration	Raw	Boiling	Dry roasting	Shallow frying	Deep frying
Pomfret	Fresh	1.71±0.09	2.78±0.07	5.78±0.08	5.43±0.04	4.47±0.04
	15 days	13.07±0.03	8.83±0.04	11.76±0.07	12.59±0.03	7.38±0.04
	15 day (S+T)	21.95±0.04	9.69±0.07	13.88±0.08	15.65±0.05	9.06±0.05
Hilsa	Fresh	13.21±0.17	13.12±0.10	6.28±0.03	6.14±0.04	3.62±0.04
	15 days	29.10±0.10	20.52±0.03	14.89±0.09	13.18±0.03	9.64±0.06
	15 day (S+T)	21.98±0.04	20.37±0.06	14.62±0.10	16.10±0.10	10.81±0.10

Table 4: Iron content of samples (mg/100gm)

Sample	Duration	Raw	Boiling	Dry roasting	Shallow frying	Deep frying
Pomfret	Fresh	2.84±0.00	1.56±0.02	2.09±0.07	1.07±0.05	4.53±0.03
	15 days	0.03±0.01	0.75±0.03	1.43±0.02	0.47±0.02	0.32±0.02
	15 day (S+T)	3.52±0.02	2.21±0.01	1.12±0.02	1.02±0.02	1.72±0.02
Hilsa	Fresh	3.28±0.01	1.27±0.02	2.38±0.02	1.65±0.03	1.82±0.05
	15 days	1.56±0.03	2.55±0.03	3.52 ±0.02	2.56±0.03	2.54±0.04
	15 day (S+T)	1.62±0.02	1.51±0.01	1.92±0.02	1.92±0.02	2.42±0.02

Table 5: Calcium content of samples (mg/100gm)

Sample	Duration	Raw	Boiling	Dry roasting	Shallow frying	Deep frying
Pomfret	Fresh	151±1.52	151±1.52	156±1.52	86±1.52	246±1.52
	15 days	166±1.52	362±2.51	282±2.00	213±3.21	208±3.21
	15 day (S+T)	284±2.00	64±2.00	68±1.52	42±2.00	64±3.05
Hilsa	Fresh	201±1.52	277±2.08	301±1.00	351±2.00	151±1.52
	15 days	202±2.00	227±2.08	501±1.52	242±2.51	251±1.52
	15 day (S+T)	602±2.51	552±2.00	504±4.16	337±2.51	351±1.00

Table 6: Moisture content of samples (gm/100gm)

Sample	Duration	Raw	Boiling	Dry roasting	Shallow frying	Deep frying
Pomfret	Fresh	80.74±1.97	55.78±0.05	25.31±0.10	31.64±0.14	18.41±0.07
	15 days	76.03±0.04	51.02±0.62	42.93±0.52	45.21±0.50	30.77±0.24
	15 day (S+T)	75.36±0.47	39.90±0.26	46.98±0.58	45.53±0.31	29.60±0.36
Hilsa	Fresh	69.76±0.25	50.06±0.0.05	36.81±0.10	24.54±0.06	11.53±0.05
	15 days	66.60±3.32	59.47±0.50	27.30±0.77	32.94±0.48	23.81±1.80
	15 day (S+T)	57.36±0.47	54.67±0.22	35.57±0.49	41.24±0.66	24.57±0.50

Table 7: Ash content of samples (gm/100gm)

Sample	Duration	Raw	Boiling	Dry roasting	Shallow frying	Deep frying
Pomfret	Fresh	4.19±0.10	1.68±0.05	1.08±0.07	0.97±0.03	1.06±0.05
	15 days	3.05±0.05	1.03±0.04	1.27±0.04	2.65±0.05	3.35±0.03
	15 day (S+T)	2.30±0.05	1.59±0.08	1.40±0.05	1.82±0.03	3.24±0.04
Hilsa	Fresh	2.07±0.06	1.08±0.08	1.49±0.07	1.10±0.10	3.69±0.07
	15 days	1.25±0.08	0.60±0.10	0.34±0.03	0.34±0.02	0.93±0.04
	15 day (S+T)	3.36±0.06	2.75±0.03	1.78±0.08	2.43±0.04	2.66±0.06

Table 8: Energy content of samples (kcal/100gm)

Sample	Duration	Raw	Boiling	Dry roasting	Shallow frying	Deep frying
Pomfret	Fresh	89.22±0.23	48.45±0.17	85.72±0.95	85.38±0.76	81.85±0.49
	15 days	162.00±1.30	114.14±1.90	163.96±2.04	169.24±1.43	125.99±2.18
	15 day (S+T)	250.97±1.30	111.79±1.76	171.05±2.79	184.46±2.18	128.08±1.01
Hilsa	Fresh	233.90±0.14	161.15±5.41	103.83±0.60	109.28±0.50	94.63±0.38
	15 days	323.16±3.71	219.94±1.43	159.95±1.09	142.66±1.35	114.25±2.73
	15 day (S+T)	238.42±1.19	203.27±1.65	154.48±1.57	170.16±1.42	125.03±1.98

4.2. Comparison between Pomfret and Hilsa

Table 9 showed the comparison between the two sea fish. Most of the values are significant (P<0.05) which means there is significant difference present between the fresh and preserved with and without preservative raw and cooked samples.

Table 9: One way ANOVA for comparison of sea fish

Nutrient	Duration	Raw	Boiling	Dry roasting	Shallow frying	Deep frying
Carbohydrate	Fresh	0.000(S)	0.000(S)	0.797(NS)	0.009(S)	0.000(S)
	15days	0.000(S)	0.000(S)	0.000(S)	0.000(S)	0.000(S)
	15day (S+T)	0.000(S)	0.000(S)	0.001(S)	0.000(S)	0.002(S)
Protein	Fresh	0.000(S)	0.000(S)	0.000(S)	0.000(S)	0.000(S)
	15days	0.002(S)	0.004(S)	0.000(S)	0.000(S)	0.000(S)
	15day (S+T)	0.000(S)	0.151(NS)	0.000(S)	0.000(S)	0.000(S)
Fat	Fresh	0.000(S)	0.000(S)	0.000(S)	0.000(S)	0.000(S)
	15days	0.000(S)	0.000(S)	0.000(NS)	0.000(S)	0.000(S)
	15day (S+T)	0.054(NS)	0.000(S)	0.001(S)	0.002(S)	0.000(S)
Moisture	Fresh	0.001(S)	0.000(S)	0.000(S)	0.000(S)	0.000(S)
	15days	0.008(S)	0.000(S)	0.000(S)	0.000(S)	0.003(S)
	15day (S+T)	0.000(S)	0.000(S)	0.000(S)	0.001(S)	0.000(S)
Ash	Fresh	0.000(S)	0.000(S)	0.002(S)	0.107(NS)	0.000(S)
	15days	0.000(S)	0.002(S)	0.000(S)	0.000(S)	0.000(S)
	15day (S+T)	0.000(S)	0.000(S)	0.002(S)	0.000(S)	0.000(S)
Iron	Fresh	0.000(S)	0.000(S)	0.003(S)	0.000(S)	0.000(S)
	15days	0.000(S)	0.000(S)	0.000(S)	0.000(S)	0.000(S)
	15day (S+T)	0.000(S)	0.000(S)	0.006(S)	0.000(S)	0.000(S)
Calcium	Fresh	0.000(S)	0.000(S)	0.000(S)	0.000(S)	0.000(S)
	15days	0.000(S)	0.000(S)	0.000(S)	0.000(S)	0.000(S)
	15day (S+T)	0.017(S)	0.033(S)	0.000(S)	0.000(S)	0.000(S)
Energy	Fresh	0.000(S)	0.000(S)	0.000(S)	0.000(S)	0.000(S)
	15days	0.000(S)	0.000(S)	0.000(S)	0.000(S)	0.000(S)
	15day (S+T)	0.000(S)	0.000(S)	0.000(S)	0.000(S)	0.000(S)

(P value = <0.05 = significantly different) (S= significant, NS= Non- significant)

Table 10, 11 showed the percentage of loss due to preservation with and without preservative of pomfret and hilsa up to 15 days. The values showed that nutrient loss occurred due to preservation for long period but most of the nutrient restoration could be done by using salt and turmeric.

Table 10: Percentage of loss of preserved Pomfret and Hilsa up to 15days without preservative

Nutrients Loss (%)	Raw		Boiling		Open pan Dry roasting		Shallow fry		Deep fry	
	Pomfret	*hilsa*	Pomfret	*hilsa*	Pomfret	*hilsa*	Pomfret	*hilsa*	Pomfret	*hilsa*
Carbohydrate	-21.19	52.08	6.33	-1.26	-48.85	26.16	-43.68	10.86	-102.33	23.07
protein	54.15	52.55	-57.81	26.44	-76.92	57.57	-52.93	72.41	-26.10	67.70
Fat	-664.32	-120.2	-217.62	-56.40	-103.46	-137.10	-131.86	-114.6	-65.10	-166.29
Moisture	5.83	4.52	8.53	-18.79	-69.61	25.83	-42.88	-34.22	-67.13	-106.50
Ash	25.79	39.61	38.69	44.44	-17.59	77.18	-173.19	69.09	-216.03	74.79
Iron	98.94	52.43	51.92	-100.7	31.57	-47.89	56.07	-55.15	92.93	-39.56
Calcium	9.93	-0.49	-139.73	18.05	-66.44	-66.44	-31.05	31.25	-66.22	-66.22
Energy	-81.57	-38.16	-135.57	-36.48	-91.27	-54.04	-98.21	-30.54	-53.92	-20.73

Table 11: Percentage of loss of preserved Pomfret and Hilsa up to 15days with salt and turmeric

Nutrients Loss (%)	Raw		Boiling		Open pan Dry roasting		Shallow fry		Deep fry	
	Pomfret	*hilsa*	Pomfret	*hilsa*	Pomfret	*hilsa*	Pomfret	*hilsa*	Pomfret	*hilsa*
Carbohydrate	-93.08	9.47	-46.47	72.57	-48.85	4.06	-45.26	23.91	-96.72	19.38
protein	54.15	78.18	21.09	57.44	-34.61	69.08	-1.90	68.68	2.26	70.63
Fat	-1183.6	-66.38	-248.56	-55.25	-140.13	-132.80	-188.21	-162.21	-102.68	-226.2
Moisture	6.66	17.77	28.46	-9.20	-85.61	3.36	-43.90	-68.05	-60.78	-113.0
Ash	44.03	-62.31	5.35	-154.6	-29.62	-19.46	-87.62	-120.90	-205.66	27.91
Iron	-23.94	68.90	-41.66	0.00	46.41	57.14	4.67	-10.30	62.03	43.95
Calcium	-88.07	-199.5	-23.46	-23.46	-116.61	-116.61	-14.81	-14.48	-148.34	-148.3
Energy	-181.29	-1.93	-130.73	-26.13	-99.54	-48.78	-116.04	-55.71	-56.48	-32.12

4.3. Comparison of percentage of nutrient loss due to cooking

Fig. 1, 2, 3, 4, 5, 6, 7, 8 showed the percentage of loss of nutrients of pomfret and hilsa due to cooking of both fresh and preserved with and without preservative. The carbohydrate, protein, moisture, iron and energy content were reduced more in hilsa than in pomfret whereas ash and calcium content were reduced more in pomfret than in hilsa.

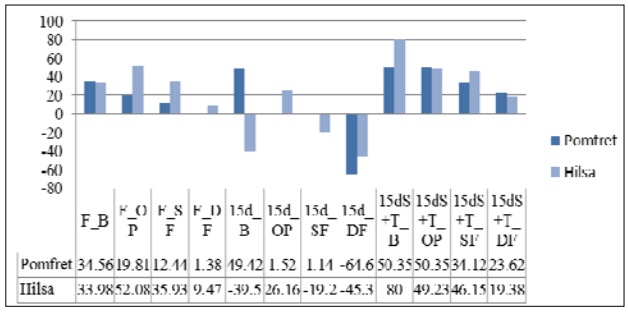

Fig 1: Carbohydrate content of Pomfret and Hilsa

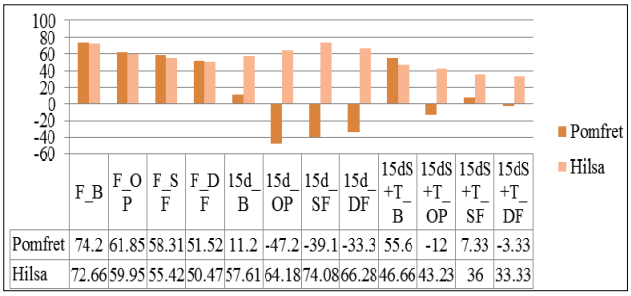

Fig 2: Protein content of Pomfret and Hilsa

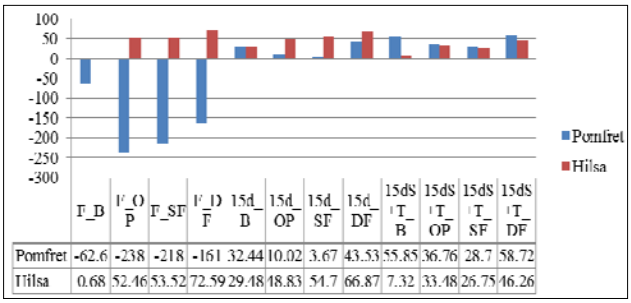

Fig 3: Fat content of Pomfret and Hilsa

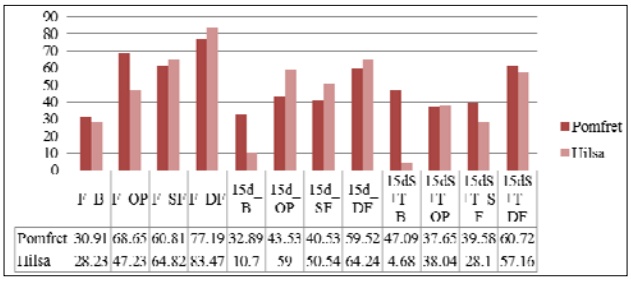

Fig 4: Moisture content of Pomfret and Hilsa

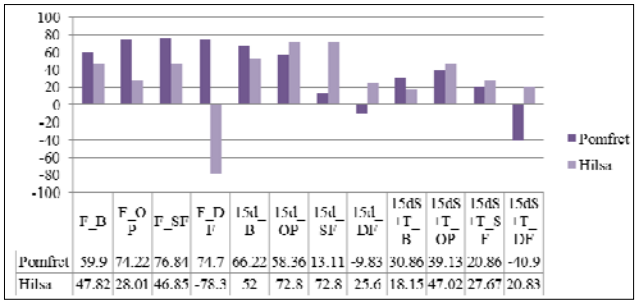

Fig 5: Ash content of Pomfret and Hilsa

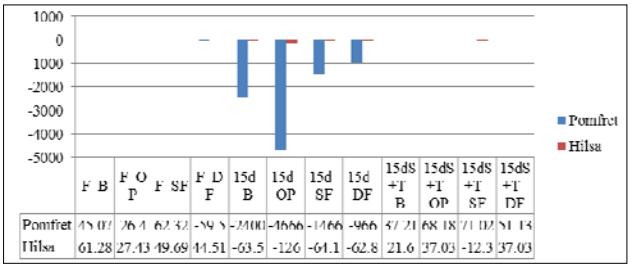

Fig 6: Iron content of Pomfret and Hilsa

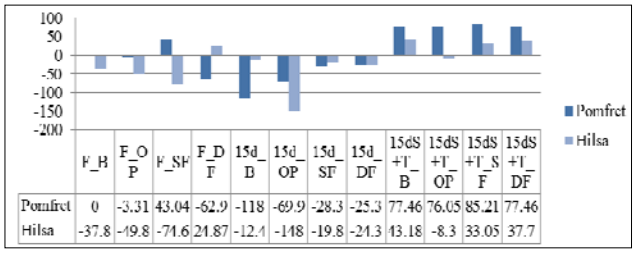

Fig 7: Calcium content of Pomfret and Hilsa

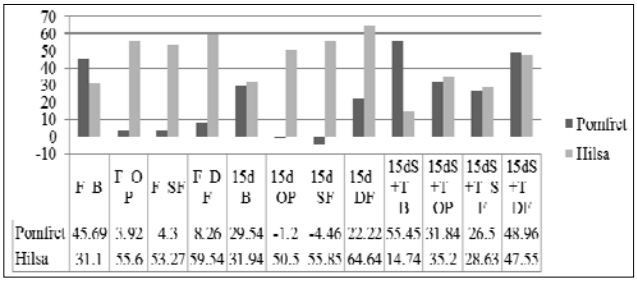

Fig 8: Energy content of Pomfret and Hilsa

5. Discussion

In fresh condition carbohydrate, protein, moisture, ash and energy contents were higher in hilsa but during cooking and preservation nutrient restoration occurred in pomfret. Fat, iron and calcium contents were higher in hilsa rather than in pomfret both in fresh, preserved and cooked conditions. The nutrient content reduced after cooking for both the fish due to application of heat, cooking oil, water [4]. Due to prolonged preservation moisture loss occurred from the sea fish so the nutrients become more concentrated and when these were subjected to cooking, further some moisture loss occurred which could increase the amount of some nutrients than in fresh condition. Pomfret could restore most of the nutrients than hilsa during preservation, mainly when preserved with salt and turmeric. Some nutrient contents were increased in some conditions for both of the fish due to moisture loss as a result of application of heat. Iron content also increased for both of them due to use of iron pan for cooking. Iron content mostly increased in pomfret than in hilsa whereas calcium content reduced mostly in pomfret rather than in hilsa. Energy and fat content is increased in shallow frying mainly due to excess oil consumption whereas other nutrient contents were increased in deep frying. In deep frying method the fish were exposed to excess oil which create a layer of fat surrounding the fish, intern a barrier was formed which reduced the elimination of nutrients from the fish [2]. Most of the losses occurred in boiling. The nutrients were dissolved in cooking water during boiling and throwing out this boiled water could reduce the nutrient contents of the fish [3]. The percentage of loss due to cooking could be reduced by using salt and turmeric. These are the natural preservative which can prevent the microbial growth as well as reduce the protein denaturation and reduce the moisture content of the fish during storage which help to increase the nutrient content of the fish but it is most effective for pomfret rather than hilsa.

6. Conclusion

The maximum losses occurred in hilsa after preservation and cooking rather than in pomfret. The loss percentage due to cooking and preservation for carbohydrate, protein, fat, moisture, iron and energy were higher in hilsa rather than in pomfret, whereas ash and calcium content were better restored in hilsa. Boiling mostly reduced the nutrient content whereas deep frying retained more nutrients. They could be preserved almost up to two weeks but the nutrient retention was better in both the sea fish when preserved with salt and turmeric. After considering all pros and cons, it can be concluded that pomfret is better than hilsa in terms of nutrient restoration after cooking and preservation and the use of combination of salt and turmeric as preservative is effective.

7. Acknowledgement

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