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# Comparative Study on Farm Materials and Quality Parameters of Pangus (*Pangasianodon hypophthalamus*) of Different Farms in Trishal Area

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**Abstract**

The present study was conducted to carry out a comparative study on farm materials (water, soil, feed) and the quality parameters of pangus (*Pangasianodon hypophthalamus*) of five different farms in Trishal area under Mymensingh district. The study was carried out during May-June, 2016. Most of the pangus farmers used homemade or farm made supplementary feeds for pangus culture The percent moisture, protein, lipid and ash content in fresh fish ranged from 77.05 to 78.79, 14.21 to14.84, 3.55 to 4.49 and 2.03 to 2.67 whereas after 24 hrs of death of fishes, these percent values changed as 77.05 to 78.79, 14.21 to14.84, 3.55 to 4.49 and 2.03 to 2.67. Slight changes observed in different quality parameters in the fish samples 24 hrs after death as dead fishes were preserved at chilling temperature in a homestead refrigerator till analysis. Therefore, the study could be concluded that- though the values for different parameters of farm materials (water, soil, feed) and quality parameters of fish samples differed but was mostly not significant. The differences observed in the parameters might be due to the variations in management techniques of each farm.

**Key words:** Comparative study, Farm material, Pangus, Quality parameter

## Introduction

Farmers have been converting their rice fields into *Pangasianodon hypophthalamus* farms for quick profit. In Mymensingh District, there are about 1,364 pangus farms covering an area of 774 ha producing 19, 203 tons fish per year (DOF, 2003). In recent years, pangus has become one of the most popular commercial cultural species due to its high yield and low production cost. Pangus is well grown in the earthen ponds where water remains for 4 to 5 months. The climate, water and soil conditions of the study area have proved suitability for pangus farming. Within 4 to 5 months it is possible to produce more than 500g of individual catfish having marketing demand (Hossain, 2001).

Fish feed and feeding play important roles in the sustainable development of aquaculture. Fish production largely depends on the quality of feed too. Improved feed composition and better-feed efficiency will result in higher fish production, lower feed cost and low waste production. Farmers are as well as different companies are producing feed which may not contain appropriate nutrient for pangus as they have no quality assessment system (Lazu, 2011). About 100% of the pangus farmers used supplementary feeds for pangus culture. Commercial fish feeds produced by different industries and farm made feeds were found to be used for pangus culture (Monir, 2009). Among various culture systems pangus and tilapia farming may be considered as one of the best options for enhancing sustainable production; however there is a need of optimization of the technology to maintain the water quality through better system approach. Maintenance of a healthy aquatic environment is necessary for better fish production. Environmental parameters exert an immense influence on the maintenance of a healthy aquatic environment and production of food organisms. Considering these points the present experiment was designed to carry out a comparative study on farm materials and fish samples of randomly selected five farms of Trishal area under Mymesingh district which might produce necessary information for pangus aquaculture.

## Materials and Methods

### *Period of the study*

The study was carried out during May-June, 2016. Within this period the sampling of pangus was done and the biochemical and microbiological analysis of waters, soil (sediment), feed and fish samples were done in the laboratories of Fish Processing and Fish Microbiology, Department of Fisheries Technology and Central Laboratory, Bangladesh Agricultural University.

### *Sampling of farm*

The study was conducted on a total of 5 pangus aquaculture farms of Mathbari, Dhanikhola and Sakhua village in Trishal upazila under Mymensingh district. The sampling was done in random manners.

### *Collection of water samples*

Water samples were collected from three different places of each selective pond (where the depth of water

was of 20 cm from surface). Water samples were collected in clean plastic bottles marked with respective farm numbers and transferred to Professor Muhammed Hussain Central Laboratory, Bangladesh Agricultural University, Mymensingh to determine the $P^H$ and TDS (Total Dissolved Solids) in water.

***Collection of soil samples***

Small plastic bags marked with the farm numbers were used for soil samples collection. Bottom soil samples from three different places of each selected ponds were collected, brought to Fish Processing Laboratory, Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh and kept for drying in the air. After completion of drying, the soil samples were ground and sieved by fine mesh sieve for analysis. pH and TDS (Total Dissolved Solids) of soil samples were analyzed in Professor Muhammed Hussain Central Laboratory, BAU, Mymensingh.

**Plate 1.** Collection of water and soil sample from the farms of study area

***Collection of feed samples***

Feed samples from five different farms were collected in plastic bags and marked. The samples were then brought to Fish Processing Laboratory, Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh for proximate composition analysis. Before proximate composition analysis the feed samples were ground and sieved by fine mesh. AOAC (1990) method was followed for proximate composition analysis.

**Plate 2.** Collection of feed samples from farms

***Collection of pangus fish samples and biochemical analysis of quality parameters of sample fishes***

Ten live freshwater pangus (*Pangasianodon hypophthalamus*) were collected from five farms of Trishal, Mymensingh during harvesting and brought to the laboratory of Fisheries Technology and kept in different buckets containing tap water. At first five live fishes collected from different farms were sacrificed for biochemical analysis. The other five fishes were kept in separate buckets until they die and pass in rigor stage. After 24 hrs of death of the fishes another set of biochemical analysis was done. The samples collected from dorsal, ventral and caudal part of fish body.

***Proximate composition***

AOAC (1990) method was followed for bio-chemical analysis (percent moisture, ash, protein, lipid of feed samples and fish samples). Homogeneity of the samples was maintained by using a blender. For each analysis of proximate triplicate samples were used.

***TVB-N (Total volatile base nitrogen)***

Total Volatile Base Nitrogen (TVB-N) of fish samples was determined according to the methods given in AOAC (1990) with certain modification.

***Muscle pH***

For the determination of fish muscle pH 10g of sample was taken and homogenized with 50ml of distilled water in a blender. After adjusting the temperature, the electrode of the pH meter was put on the tube and the pH was measured by the pH meter (Lutron pH - 222) in duplicate.

***pH of water and soil***

pH of collected water and soil samples from five selected farms of Trishal area was measured in Professor Muhammed Hussain Central Laboratory,

Bangladesh Agricultural University, Mymensingh using a pH meter (Meltler Toledo EL-20).

***TDS (Total dissolved solids) in water and soil***

TDS (total dissolved solids) of collected water and soil samples from five selected farms of Trishal area was determined in Professor Muhammed Hussain Central Laboratory, Bangladesh Agricultural University, Mymensingh using a TDS machine (Hanna Instrument Model-Hl 98194).

**Microbiological Analysis**

***Water sample***

Appropriate dilutions of water samples (three samples from each pond) were made ($10^{-1}$ to $10^{-6}$) with sterile physiological saline in deionized water. Aliquots of 0.1 ml of the serial dilutions were inoculated onto nutrient media in duplicate using the spread plate method. The samples pipetted were spread by L-shaped glass rods and put in incubator.

***Soil sample***

Five gram of wet sediment sample from each pond was weighted and dissolved in 200 ml physiological saline to make stock solution. One milliliter of the homogenate was serially diluted ($10^{-1}$ to $10^{-6}$) and treated in the same way as the water samples. Microbial study of sediment samples was done in similar manner as done for water sample.

***Fish sample***

10 gm of fish sample was taken out aseptically with sterile knife from the body of fish of each pond and then homogenized with 90ml of sterile saline solution (0.85% NaCl) in a sterile blender to obtain 1:10 dilution. One ml of diluted samples was transferred with a sterile pipette to a test tube containing 9.0ml of 0.85% physiological saline and the test tube was shaken thoroughly for mixing. Using similar process several dilutions were made up to the desired level. For microbiological analysis of fish sample also same procedure followed and calculation was done using the formula given below.

Aerobic plate count (APC) in CFU/g of fish = $\frac{\square\square\square\square\square\square\square\square\square}{\square}$

Where, C = Number of colonies found; D = Dilution factor; V = Volume of original sample; S= Weight of sample in grams and CFU = Colony forming unit.

***Data analysis***

Statistical analysis was done using Microsoft excel. Data are represented within the view of bar diagram table form.

## Results and Discussion

**Water and Soil Quality**

***Pond water quality***

After analyzing the water sample collected from selected ponds it was observed that-the pH of water of pangus ponds ranged between 7.17 to 7.65 which was not so acidic nor so alkaline and more or less suitable for pangus culture (Fig. 1). On the other hand, TDS (total dissolved solids) content in pond water ranged from 202 to 343 ppm (Fig. 2). This range of TDS (total dissolved solids) were within the referred range (the maximum limit of total dissolved solids in freshwater is 500 ppm; DeZuane, John; 1997). The pH of water is related to photosynthesis and concentration of $CO_2$. So the obtained pH values for water in this study may change by the action of sunlight with phytoplankton within 24 hours.

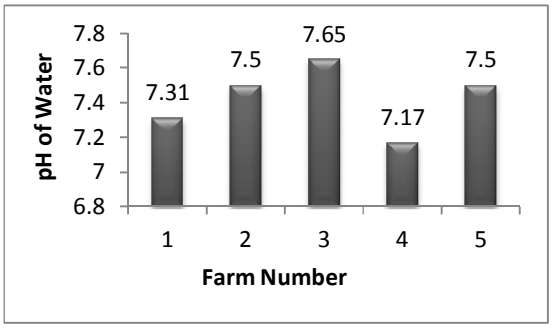


**Fig. 1.** pH of water in five different farms of the study area

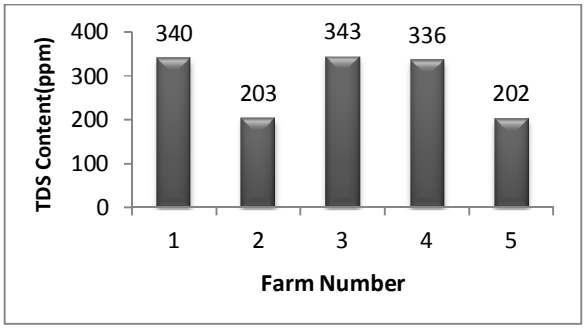


**Fig. 2.** TDS (total dissolved solids) content of water in five different farms of the study area

***Pond soil quality***

In this study the pH of soil of pangus ponds ranged from 7.44 to 7.6 and TDS (total dissolved solids) content ranged from 44 to 77 ppm (Fig. 3 and 4). Chowdhury (1992) reported the available sulphur of soil in Brahmaputra River ranged within 4 to 20 ppm which was lower than the values of present study. Removal of sediment and changing of water from the culture ponds in regular basis might ensure better production of pangus of the farm.

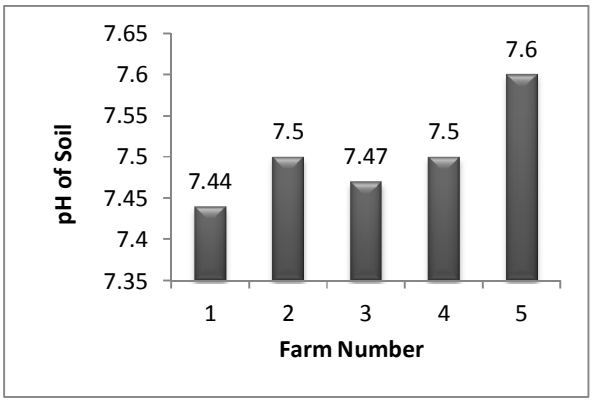


**Fig. 3.** pH of soil in five different farms of the study area

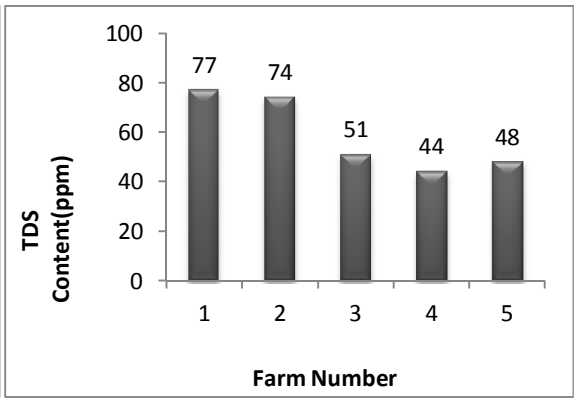


**Fig. 4.** TDS (total dissolved solids) content of soil in five different farms of the study area

**Nutritional quality of different feeds for pangus**

***Moisture percent***

The moisture content of feed sample collected from five different farms of the study area ranged from 12.83% to 13.47%. (Table 1). The present findings are more or less similar to the findings of Kader *et al.* (2003) who observed that the mean moisture content of different commercial fish feeds varied from 8.83 to 14.28 which gave better result in pangus culture. Again Seenapa *et al*. (1991) found that a diet containing 9.9% moisture was optimum for the growth of catla fry. Roy (2002) reported that a diet containing 9.8% moisture were more suitable for GIFT tilapia.

**Table 1.** Proximate composition of feeds used in five different farms of the study area

| Farm Number | Proximate Composition | | | |
|---|---|---|---|---|
| | Moisture (%) | Ash (%) | Protein (%) | Lipid (%) |
| 1 | 13.47 | 11.03 | 20.53 | 10.23 |
| 2 | 13.16 | 11.19 | 19.87 | 10.12 |
| 3 | 12.99 | 10.39 | 19.53 | 12.33 |
| 4 | 13.27 | 13.80 | 18.90 | 9.01 |
| 5 | 12.83 | 12.99 | 19.69 | 12.20 |

***Crude protein percent***

The crude protein content of feed sample collected from five different farms of the study area ranged from 18.90% to 20.53% (Table 1). The present findings is quite similar to the findings of Kader *et al.* (2003) who observed that the mean protein content of different commercial fish feeds varied from 19.27 to 32.47% which gave better result in pangus culture. Lall (1991) reported that protein requirement of tilapia was 30-40% but the feed having protein percent15.07 supplied by different industry in Trishal is much lower than this optimum requirement. Mollah and Hossain (1990) reported that 39.5% protein appeared suitable for rearing of *C. batrachus*.

***Lipid percent***

The lipid content of feed sample collected from five different farms ranged from 9.01% to 12.23% (Table 1). The obtained percent lipid in feeds in the present study is higher than the findings of Kader *et al*. (2003) who observed that the mean lipid content of different commercial fish feeds varied from 5.91 to 9.98% which gave better result in pangus culture . Wilson (2000) reported that lipid level in catfish feeds should be 5 to 6%. On the other hand, Luquet (2000) also stated that dietary lipid levels of 5 to 6% are often used in tilapia diet. Singh (1991) reported that the optimum lipid requirements of Indian major carp were determined to be 4-6%. Song (1994) found that the dietary requirement for lipid of Grass carp, black carp and tilapia were 5, 0.5 and 6.8% respectively. Roy (2002) reported that a diet containing 9.48% lipid were more suitable for GIFT tilapia. Ali *el al*. (2008) found that the diet containing 14% lipid were more suitable for Nile tilapia. Bhuiyan (2002) found that the diet containing 9.94% lipid appears to be more suitable for carp polyculture. Results revealed that percentage (%) of lipid was maintained near to optimum level among the different fish feed manufacturers.

***Ash percent***

The ash content of feed sample collected from five different farms ranged from 10.39% to 13.80% (Table 1). The present finding is more or less similar to the findings of Kader *et al.* (2003) who found that the mean ash content of different commercial fish feeds varied from 12.49 to 19.32% which gave better result in pangus culture. Seenapa and Devaraj (1991) found that a diet containing 12.25% ash to catla fry at 10% body weight would be optimal. Bhuiyan (2002) found that the diet containing 11.02% ash were more suitable for carp polyculture.

**Biochemical analysis of quality parameters of pungus collected from different farms**

***Proximate composition of pangus***

The chemical composition of fish varies greatly from one individual to another depending on age, sex, environment and season with protein levels ranging from 16-21%, lipids 0.1-25%, ash 0.4 -1.5%, moisture 60-81% with extremes of 96% having been reported ( Huss, 1995).

In this study fish samples were collected from five different farms of Trishal. The moisture content (%) of those five fresh samples was 78.79±0.25, 78.28±0.28, 77.64±0.08, 78.38±0.15 and 77.05±0.18 respectively. Whether after 24 hours of death the values (%) increased as 78.88±0.32, 78.17±0.13, 77.73±0.02, 78.44±0.20 and 77.16±0.12 respectively (Fig. 5).

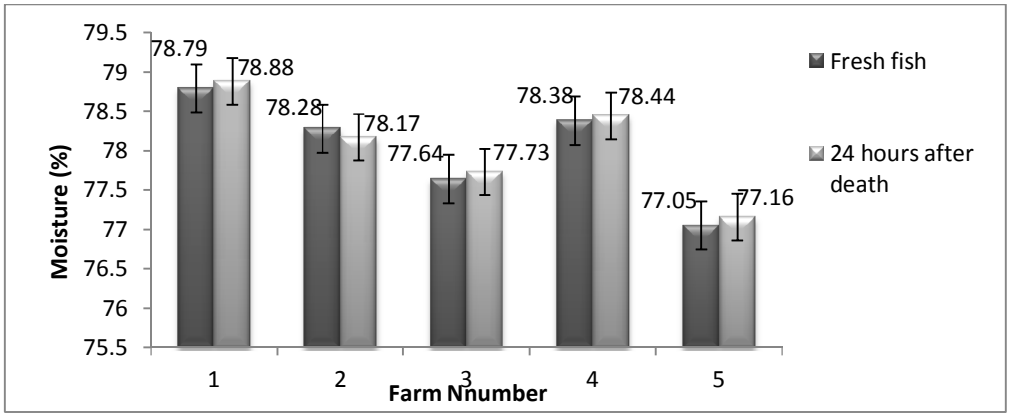


**Fig. 5.** Moisture content (%) in fresh fish and fish samples 24 hrs after death collected from five different farms of the study area

The protein content (%) of five different fresh pangus samples were 14.84±0.28, 14.61±0.30, 14.43±0.18, 14.21±0.20 and 14.45±0.29 respectively. After 24 hours of death, protein content (%) decreased as 14.83±0.29, 14.59±0.30, 14.30±0.10, 14.09±0.11 and 14.42±0.28 respectively (Fig. 6).

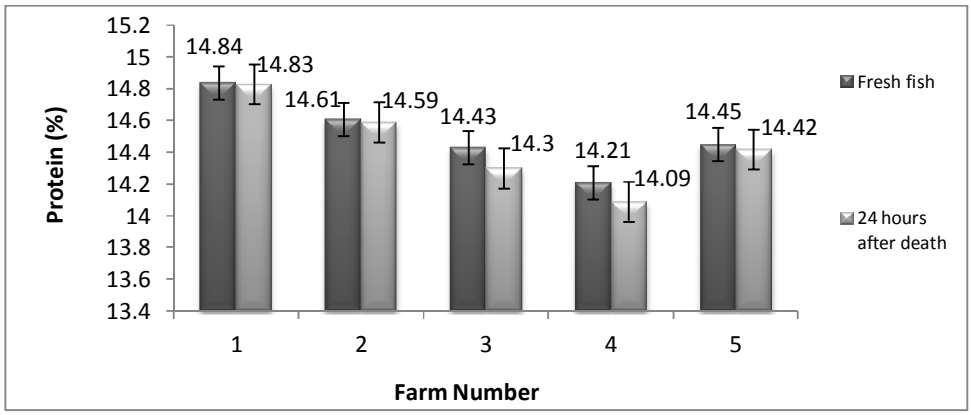


**Fig. 6.** Protein content (%) in fresh fish and fish samples 24 hrs after death collected from five different farms of the study area

The lipid content (%) of the fish samples obtained 3.55±0.17, 3.59±0.09, 4.39±0.06, 3.61±0.12 and 4.49±0.39, respectively. But 24 hours after death lipid content (%) decreased as 3.53±0.16, 3.58±0.10, 4.38±0.09, 3.57±0.11 and 4.45±0.36, respectively (Fig. 7).

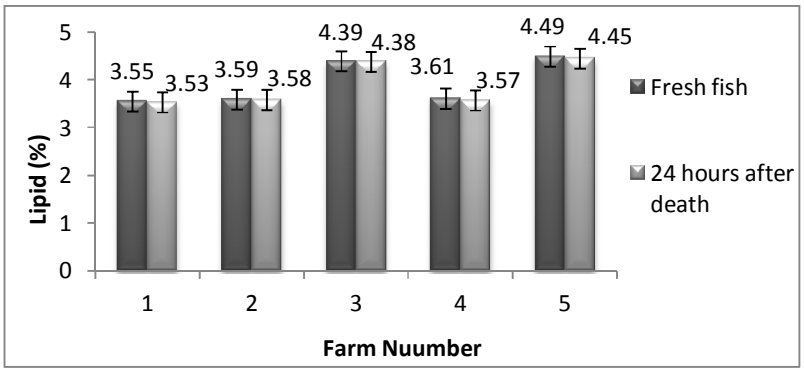


**Fig. 7.** Lipid content (%) in fresh fish and fish samples 24 hrs after death collected from five different farms of the study area

The ash content (%) found in those five samples 2.04±0.02, 2.03±0.02, 2.13±0.19, 2.67±0.20 and 2.42±0.17, respectively and 24 hours after death the ash content (%) were found 2.03±0.03, 2.02±0.02, 2.16±0.16, 2.65±0.18 and 2.43±0.13, respectively (Fig. 8).

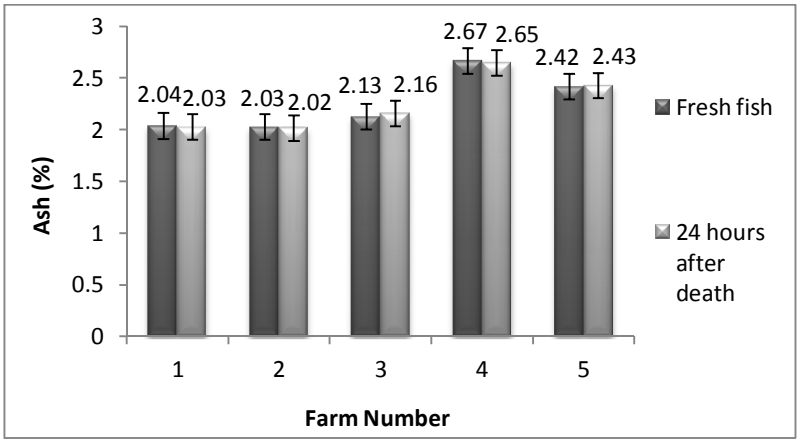


**Fig. 8.** Ash content (%) in fresh fish and fish samples 24 hrs after death collected from five different farms of the study area

The proximate composition and its variation in edible and inedible parts of freshwater species of Bangladesh have been reported by Chakraborty *et al*. (2003). The highest protein, lipid and ash content of edible parts were 20.14, 17.80 and 4.38% respectively in *Labeo boga*, *Tenualosa ilisha* and S*etipinna phasa.* On the other hand the lowest values of these parameters were 13.50, 1.30 and 1.00% respectively in *Chanda nama*, *Glossogobius guiris* and *Chanda reticulata.* This finding establishes the fact that freshwater fishes of Bangladesh are in the category of high protein food. The proximate composition of fish reported by Stansby (1962) was in the ranges of water 28 to 90%, protein 6 to 28.9%, crude fat 0.2 to 64% and ash 0.4 to 1.5%.

Proximate composition of the fresh catfish meat showed 77 % moisture, 16.5% protein, 4% crude fat and 0.97% ash (Viji P *et al*., 2004). Guimaraeset C.F.M. *et al*., (2015) reported, the moisture, protein, lipid and ash values of *Pangasianodon hypophthalmus* between 83.83ï 85.59, 12.51-14.52, 1.09ï 1.65, and 0.76ï 2.38 g 100 $g^{-1}$, respectively.

Generally moisture content shows inverse relationship with lipid content also found in the pangus fish (Fig. 9). The inverse relationship has also been reported in marine fishes such as *Mugil cephalus* (Das, 1978); *Sarda sarda* (Zaboukas *et al*., 2006) and freshwater fishes *Mystus seenghala* (Jafri, 1968) and *Ophicephalus punctatus* (Jafri and Khawaja, 1968). Jacquot (1961) in his experiment found that fatty fish contained 68.6% moisture, semi fatty fish contained 77.2% and lean fish contained 81.8% moisture which showed the inverse relationship between fat and moisture content. Therefore, this fish can play a significant role to fulfill the nutrient demand of the people in Bangladesh.

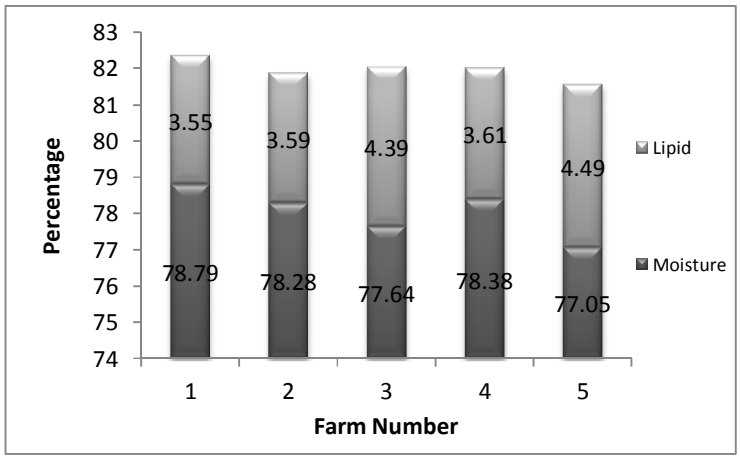


**Fig. 9.** Inverse relationship observed between moisture (%) and lipid (%) in fresh fish samples collected from five different farms of the study area

***pH value***

Due to the post-mortem anaerobic formation of lactic acid, pH decreases during the early stage of storage and during the later post-mortem changes, pH slightly increased due to formation of basic compounds. Many workers reported that low muscle pH of the post-mortem fish muscle is associated with the quality changes in fish (Penny, 1967, 1969; Konagaya, 1979; Kramer and peters, 1981). Live sardine muscle has a $P^H$ 7.2 have been reported by (Pacheco-Aguiler *et al*., 2000). After death, the muscle $P^H$ decreases to 6.8 after 2 h, to 6.2 after 8h and to 5.8 after 24h have been reported by (Watabe *et al*., 1991). Islami *et al*. (2015) reported pH values between 6.88ï 7.07 in Pangasius fillets stored in ice for 21 days. Nayak *et al*. (2015) demonstrated pH values ranging from 6.54 to 7.27 after 12 days of refrigerated storage (6 ± 2°C) of *Pangasius hypophthalmus*.

In the present study, the muscle pH of pangus fish immediately after death was close to neutral. The pH values of fresh pangus collected from different farms were 6.89, 6.91, 6.87, 6.95 and 6.73, respectively. But 24 hours after death the pH value decreased to 6.00, 6.30, 6.28, 6.21 and 6.15 which may be caused by the formation of lactic acid or other reasons resulted from rigor-mortis (Fig. 10).

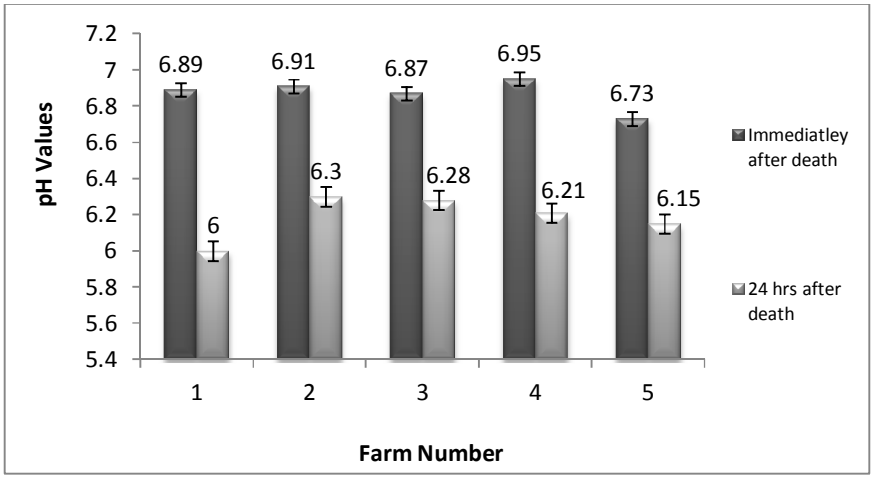


**Fig. 10.** Changes in pH values of fish samples immediately after death and 24 hrs after death collected from five different farms of the study area

***TVB-N value***

The amount of TVB-N in fish increases as spoilage progresses. TVB-N is a term that includes the measurement of trimethylamine, dimethylamine, ammonia and other compounds. The TVB-N content of pangus fishes collected from five farms found 3.35 mg/100g, 2.18mg/100g, 2.72mg/100g, 2.34mg/100g and 2.35mg/100g, respectively. After 24 hours of death the TVB-N values found slightly increased as 3.36mg/100g, 2.23mg/100g, 2.74mg/100g, 2.34mg/100g, and 2.41mg/100g, respectively (Fig. 11).

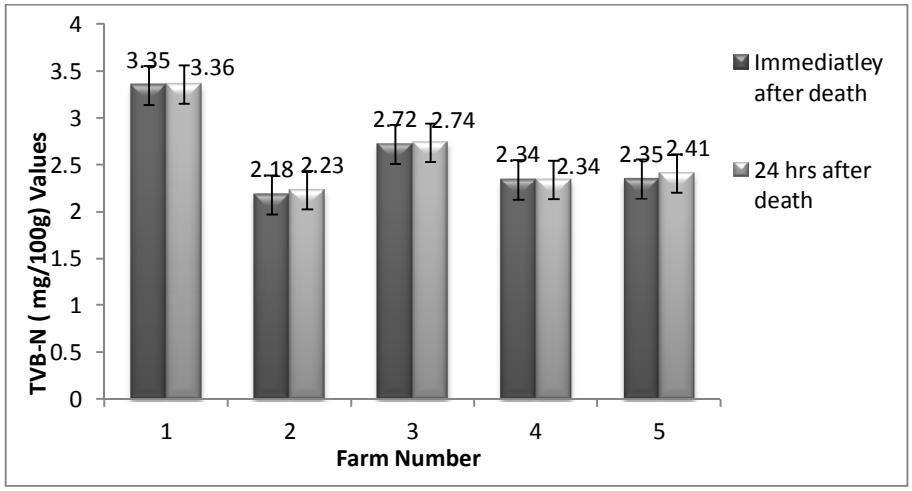


**Fig. 11.** Changes in TVB-N values 9mg/100g) values of fish samples immediately after death and 24 hrs after death collected from five different farms of the study area

Connell (1980) reported that the acceptable value of TVB-N ranges 30mg/100g sample. Reza *et al*., (2008) observed the Total Volatile Base Nitrogen 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 19.0 mg/100g for silver jew fish, bombay duck, big-eye tuna, Chinese pomfret and ribbon fish, respectively. Islam (2001) found the 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. However the findings of this study showed that- the TVB-N content obtain from the fresh and 24hrs dead sample are very close with the previous studies and it is within the acceptable limit.

**Microbiological Analysis**

The results of the study on bacterial loads of water, sediment and fish samples collected from five different pangus farms of Trishal area are shown Table 2 and 3. The aerobic plate count ranged from $5.13\times10^5$-$7.25\times10^5$ cfu/ml in water and $7.95\times10^5$-$6.91\times10^7$ cfu/g in sediment (Table 2). In case of fish at first, muscle samples were taken from live fish and bacterial colony found ranged from $6.11\times10^3$-$5.91\times10^4$ cfu/g. The samples which were collected from the fishes 24 hrs after death and kept in homestead refrigerator for further culture, the total aerobic count ranged from $5.97\times10^3$-$5.85\times10^4$ cfu/g. The obtained values were slightly lower than those for fresh fish. This is might be due to preserving the dead fishes in lower temperature in homestead refrigerator.

**Table 2.** Aerobic plate count in water and soil samples collected from five different farms of the study area

| Pond Number | In Water (cfu/ml) | In Soil (cfu/g) |
|---|---|---|
| 1 | $7.20\times10^5$ | $8.60\times10^6$ |
| 2 | $7.25\times10^5$ | $7.23\times10^6$ |
| 3 | $6.10\times10^5$ | $6.91\times10^7$ |
| 4 | $7.11\times10^5$ | $7.95\times10^5$ |
| 5 | $5.13\times10^5$ | $6.80\times10^7$ |

Bacterial loads of water, sediment and pangus samples of five farms were different because the management conditions were not similar and the water sources of the farms were different. The organic matter influences the load and composition of microbial population (Rheinheimer, 1985). Sediment bacterial composition and load greatly influence by effluent characteristics. The variation also may influenced by nutritional composition among the farms. In sediments, organic enrichment and the consequent modification of the characteristics of the benthic environment, determined an increase in bacterial population (Grimes *et al*.1986; LaRosa *et al*. 2002). The bacterial flora on fish is a reflection of the aquatic environment (Shewan and

Hobbs 1967) and it affects the storage life and quality of the fishery products. Al-Harabi and Uddin (2006) reported that total viable counts (TVC) of bacteria in the pond sediments varied between $5.2\pm2.7\times10^7$ to $1.4\pm2.3\times10^8$ cfu/g in early summer, $6.6\pm2.4\times10^8$ to $8.9\pm2.0\times10^9$ cfu/g, significantly higher ($P < 0.005$) in summer, $4.2\pm2.8\times10^7$ to $6.3\pm1.7\times^{108}$cfu/g, significantly lower ($P < 0.005$) in autumn, and $7.9\pm1.9\times10^5$ to $8.6\pm2.1\times10^6$ cfu/g in winter. The bacterial flora of the water, which in part depends on nutrient loads, may affect the quantities and types of bacteria present in the gastrointestinal tract of fish (Buras *et al*. 1987).

Table 3 showed a slight decrease in total plate count in dead fish muscle which was kept in refrigerator. Rao B. M. *et al*., (2013) reported an initial reduction in APC up to 3rd day, gradual increase till 9th day followed by rapid increase between 9th and 12th day of chilled storage of Chilled controlled, Chilled treated, Vacuum controlled and Vacuum treated fillets. Ozogul *et al*., (2004) reported that bacteria grew more quickly in fish stored in air than when vacuum packed at 0 °C. Highest APC value obtained was in chilled controlled (4.4 x 105 cfu g-1) at the end of 12 days of chilled storage. However, it was observed that the APC values of *P. hypophthalmus* fillets were less than the acceptable level of $5 \times 10^5$ cfu $g^{-1}$ (EIC, 1995; FSSAI, 2011) even after 24 hours of death at refrigeration temperature. Theses finding coincide well with the present finding.

**Table 3.** Aerobic plate count fresh fish and fish samples after 24 hrs of death collected from five different farms of the study area

| Farm Number | In Fresh Fish (cfu/g) | In Fish after 24 hrs of Death (cfu/g) |
|---|---|---|
| 1 | $4.11\times10^4$ | $4.09\times10^4$ |
| 2 | $5.91\times10^4$ | $5.85\times10^4$ |
| 3 | $4.25\times10^4$ | $4.20\times10^4$ |
| 4 | $4.58\times10^4$ | $4.47\times10^4$ |
| 5 | $6.11\times10^3$ | $5.97\times10^3$ |

## Conclusions

From the obtained results the study could be concluded that- differences observed for various parameters of farm materials (water, soil, feed) and fish samples among randomly selected five farms was mostly not significant and the little differences occurred might be due to the variation in the management techniques of each farm.

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