International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Impact Factor (2012): 3.358

Microbiological Assessment of Rui (*Labeo rohita*), Catla (*Catla catla*), Tilapia *(Oreochromis mossambicus*) of Cultured Ponds and Different Markets of Bangladesh

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Abstract: ***The microbiological quality of Rui (Labeo rohita),Catla (Catla catla), Tilapia (Oreochromis mossambicus) of cultured ponds and different markets of Dhaka city were analyzed. The microbial quality parameters varied with different markets and sources and the quality was found poor in Local Retail Market fish samples. In total 27 samples were considered for microbiological quality analysis. Total Viable Bacterial Counts ranging from $2.75x10^5$to $6.29x10^6$ cfu/g. Total Coliform count was always >240 MPN/g. Furthermore Total Pseudomonas and Staphylococcus spp. ranging from $1.20x10^3$ to $3.68x10^5$ and $1.63x10^2$ to $5.20X10^3$ respectively. Salmonella spp. were absent in pond fish samples and were present in all wholesale and local retail market samples. The finding proved that fish under this study were more or less contaminated and comparatively local retail market samples were poor in quality.***

Keywords: microbiological, rui, catla, tilapia, Bangladesh

1. Introduction

Fish and fish products have long been used as a major food component for humans and animals [1].Fish and Fisheries have been playing a very significant role in nutrition, culture and economy of Bangladesh from time immemorial. Currently, about 80 percent of the animal protein intake in the daily diet of the people comes from fish [2]. This sector contributes 4.39% to the national GDP and almost one-fourth (22.76%) to the agricultural GDP (Bangladesh Economic Review 2012). Bangladesh is one of the world's leading fish producing countries with a total production of 32.62 MT in the financial year 2011-12 [3]. Microorganisms have major roles in pond culture, particularly with respect to productivity, nutrient cycling, the nutrition of the cultured animals, water quality, disease control and environmental impact of the effluent [4].The bacterial counts of fish shows a considerable variation with the environmental and different markets of Bangladesh [5-7]. Unfortunately, a large amount of fish spoils every year in Bangladesh for the growth of pathogenic bacteria. A variety of fishes consumed regularly are prone to pathogenic spoilage especially by different microbes [8]. Lack of proper amenities like proper handling during loading and unloading, time and exposure of the fish to the high environmental temperature and sufficient knowledge about scientific and hygienic methods of handling from the time of catch until it is processed into finished products contributes significantly to the loss of quality of fish [9].

So, it is important to find out microbiological quality of fish that we consume regularly. This study was carried out to microbiological quality assessment of the locally available Rui, Catla and Tilapia.

2. Materials and Methods

2.1 Collection of Samples

Fish samples were collected from 3 cultured ponds of Comilla, 3 wholesale market of Dhaka, and 3 retail local retail market of Dhaka using a sterile aseptic container together with ice .They were transported to laboratory with isolated iceboxes. For the analysis 3 species of fish were selected. These were *Labeo rohita, Catla catla, Oreochromis mossambicus.* In present study, following parameters of fish samples were examined- Total Viable Bacterial Counts *(TVBC),* Total Coliform Counts *(TCC), Total Pseudomonas* Counts *(TPC), E. coli, Salmonella spp., Staphylococcus aureus.*

2.2 Preparation of Sample

After reaching to laboratory samples for microbiological analysis were taken from skin and muscle parts of the fish in aseptic condition. Fish was cut into small pieces and each 10 gm of skin-and-muscle were mixed with 90 ml Ringer's solution, which were then homogenized in homogenizer. Each sample was serially diluted and aliquots of each sample were plated for microbiological count. Microbiological analyses were carried out according to the American Public Health Association (APHA, 2001) [10]. Media used for microbiological analysis were obtained from Hi-Media, India.

Microbial count was counted manually and expressed as colony forming unit (cfu/g).The total Coliform and *E. coli* were enumerated by Most Probable Number (MPN) procedure.

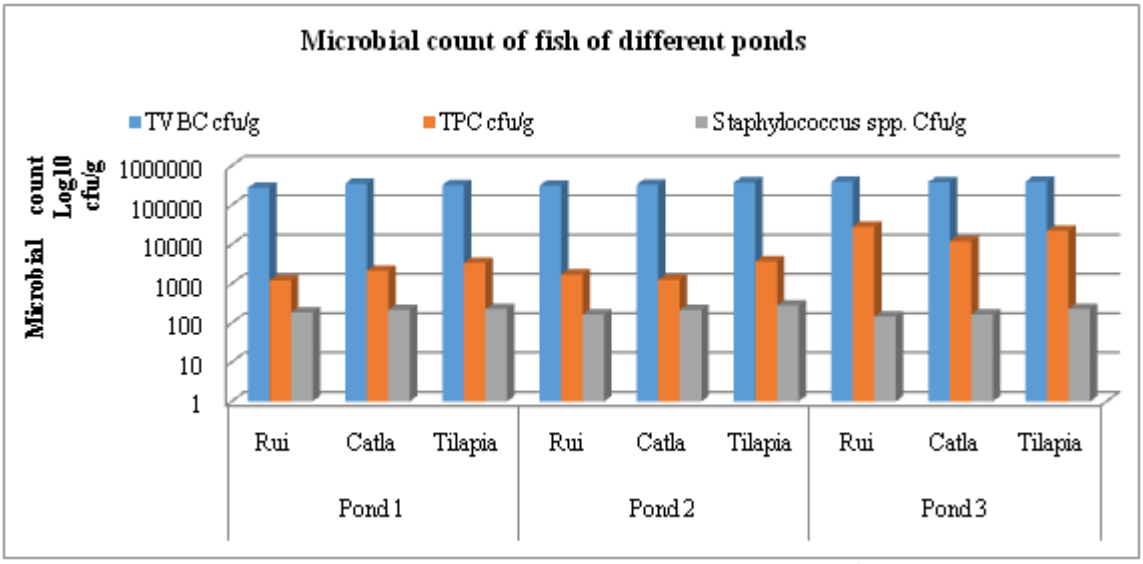
3. Results and Discussion

In present study, following microbiological parameters of fish samples were examined- Total Viable Bacterial Counts (TVBC), Total Coliform Counts (TCC), Total *Pseudomonas* Counts (TPC), *E. coli*, *Staphylococcus aureus*, *Salmonella spp.* Study showed a great variation from species to species as well as from market to market and environment as shown in Table 1 to 3.According to Shewan [10] the bacterial flora on newly fish depends on the environment in which it is caught rather than on the fish species. This study also shows that bacterial count changes depending on environment or market.

Table1: Microbial assessments of fish samples collected from cultured ponds

Sampling Sites	Sample (Skin-and-muscle)	Microbial Count					Occurrence
		TVBC cfu/g	TCC MPN/g	E. coli MPN/g	TPC cfu/g	Staphylo Coccus spp. (cfu/g)	Salmonella /25g
Pond-1	Rui	$2.75X10^5$	>240	0.4	$1.20x10^3$	$1.82x10^2$	Absent
	Catla	$3.50x10^5$	>240	0.9	$2.10x10^3$	$2.14x10^2$	Absent
	Tilapia	$3.21x10^5$	>240	0.9	$3.33x10^3$	$2.25x10^2$	Absent
Pond-2	Rui	$3.10X10^5$	>240	0.7	$1.69x10^3$	$1.63x10^2$	Absent
	Catla	$3.30x10^5$	>240	0.7	$1.24x10^3$	$2.12x10^2$	Absent
	Tilapia	$3.75x10^5$	>240	0.7	$3.67x10^3$	$2.75x10^2$	Absent
Pond-3	Rui	$3.90X10^5$	>240	0.4	$2.80x10^4$	$1.44x10^2$	Absent
	Catla	$3.82x10^5$	>240	0.7	$1.20x10^4$	$1.64x10^2$	Absent
	Tilapia	$3.92x10^5$	>240	0.9	$2.20x10^4$	$2.28x10^2$	Absent

**Total Viable Bacterial Counts (TVBC), Total Coliform Counts (TCC), Total *Pseudomonas* Counts (TPC),



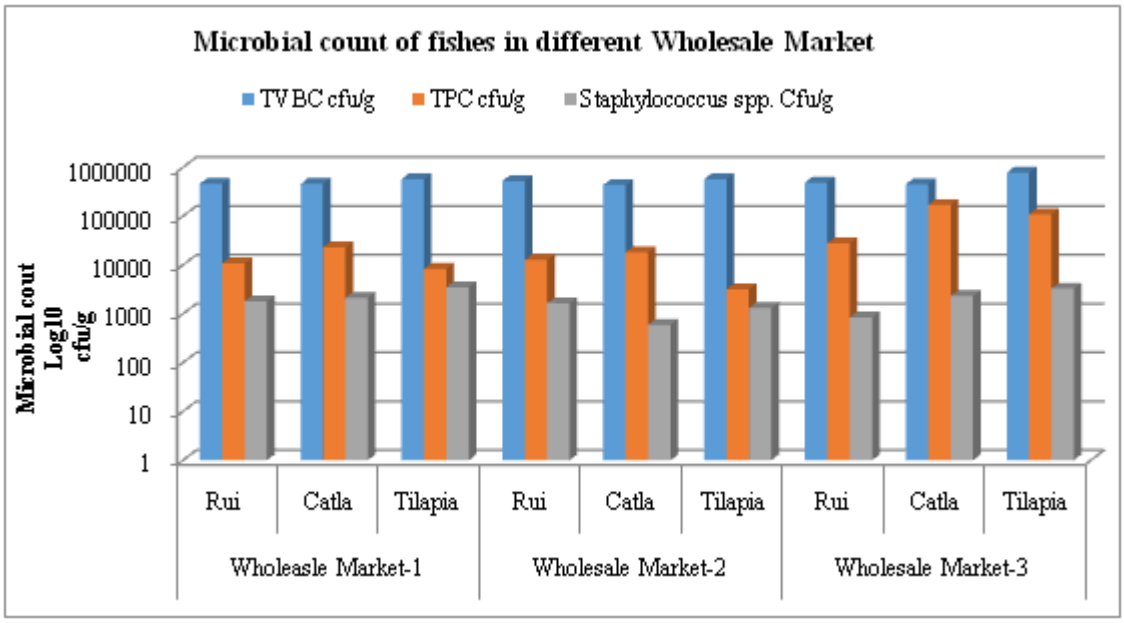
**Total Viable Bacterial Counts (TVBC), Total Coliform Counts (TCC), Total *Pseudomonas* Counts (TPC)

Among the 9 samples of different ponds of Comilla, TVBC ranging from $2.75x10^5$ to $3.92x10^5$ which is within the limit $5x10^5$ cfu/g set by International Commission on Microbiology Specifications for Foods [12].The highest bacterial presence was found in Pond-3 Tilapia samples and lowest was found in Pond-1 Rui samples. This results also comply with the previous study of of Chowdhury *et al.* about bacterial count of Rui fishes of Bangladesh between $5.2x10^3$ to $7.7x10^6$ [13].Total *Coliform* found in all samples and they are always <240 MPN/g. *E. coli* also found in all samples and ranging from 0.4 MPN/g to 0.9 MPN/g. Total *Pseudomonas* and *Staphylococcus spp.* was found in all 9 samples of ponds ranging between$1.20x10^3$ to $2.20x10^4$ and $1.63x10^2$ to $2.28x10^2$ respectively. *Salmonella* spp. are absent in all 9 samples of ponds.

Table 2: Microbial assessments of fish samples collected from Wholesale Market

Sampling sites	*Sample (skin-and-muscle)*	*Microbial Count*					*Occurrence*
		TVBC cfu/g	*TCC MPN/g*	*E coli MPN/g*	*TPC cfu/g*	*Staphylo Coccus spp. (cfu/g)*	*Salmonella spp. (cfu/g)*
Wholesale Market -1	Rui	$4.60X10^5$	>240	1.5	$1.08x10^4$	$1.80x10^3$	positive
	Catla	$4.62x10^5$	>240	2.3	$2.31x10^4$	$2.13x10^2$	positive
	Tilapia	$5.75x10^5$	>240	2.3	$8.30x10^3$	$3.50x10^3$	positive
Wholesale Market-2	Rui	$5.23X10^5$	>240	2.3	$1.27x10^4$	$1.65x10^3$	positive
	Catla	$4.36x10^5$	>240	2.3	$1.82x10^4$	$5.96x10^2$	positive
	Tilapia	$5.72x10^5$	>240	2.3	$3.17x10^3$	$1.32x10^3$	positive
Wholesale Market-3	Rui	$4.88X10^5$	>240	1.5	$2.80x10^4$	$8.46x10^2$	positive
	Catla	$4.52x10^5$	>240	2.3	$1.70x10^5$	$2.32x10^3$	positive
	Tilapia	$7.75x10^5$	>240	2.8	$1.10x10^5$	$3.28x10^3$	positive

**Total Viable Bacterial Counts (TVBC), Total Coliform Counts (TCC), Total *Pseudomonas* Counts (TPC)



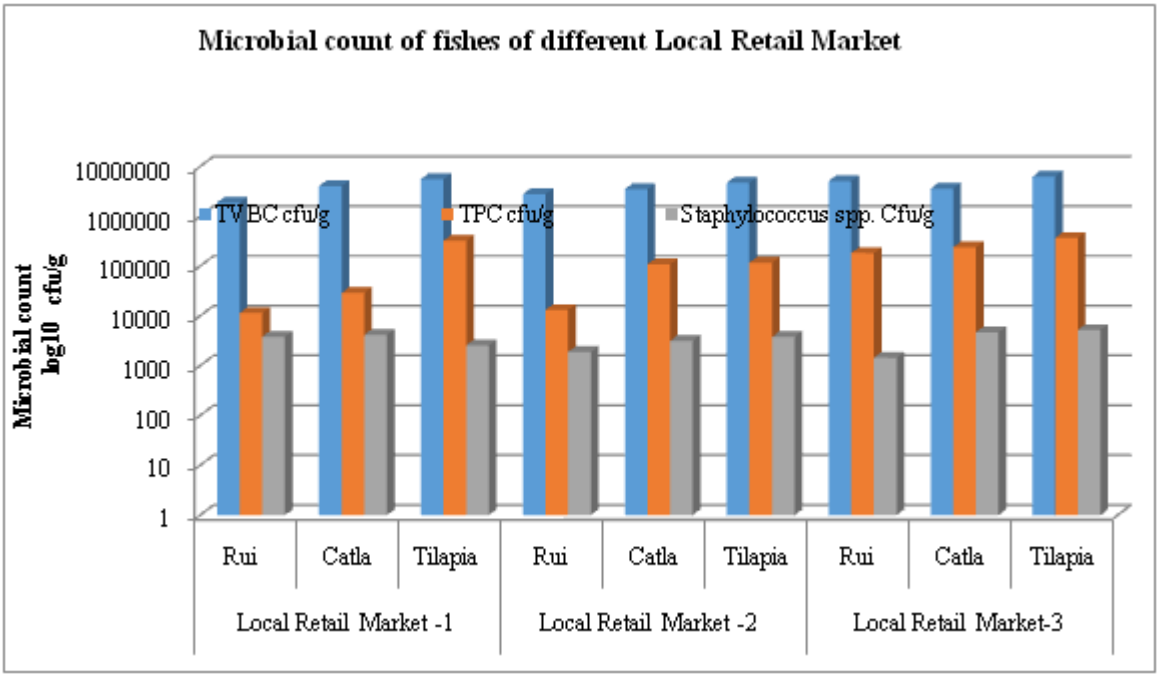
**Total Viable Bacterial Counts (TVBC), Total *Pseudomonas* Counts (TPC)

Samples collected from Wholesale Market-3 of Dhaka city shows relatively higher bacterial counts. Among these 9 samples highest TVBC shows in Wholesale Market-3 Tilapia $7.75x10^5$ and lowest in Wholesale Market-1 Rui $4.60x10^5$.Total Coliform was always >240 MPN/g. *E. coli* ranging between 1.5 to 2.8 MPN/g. Among the wholesale market sample Total *Pseudomonus* was predominantly present in all samples between $3.67x10^3$ to $1.70x10^5$. Highest *Staphylococcus* spp. found in Wholesale Market-1 Tilapia $3.50x10^3$ and lowest found in Wholesale Market-1 Catla $2.13x10^2$.*Salmonella* present in all samples of wholesale market.

Table 3: Microbial assessments of fish sample from Local Retail Market

Sampling sites	Sample (skin-and-muscle)	Microbial Count					Occurrence
		TVBC cfu/g	TCC cfu/g	E coli MPN/g	TPC cfu/g	Staphylo coccus spp. (cfu/g)	Salmonella spp. (cfu/g)
Local Retail Market -1	Rui	$1.89X10^6$	>240	2.8	$1.14x10^4$	$3.82x10^3$	positive
	Catla	$4.03x10^6$	>240	2.3	$2.90x10^4$	$4.16x10^3$	positive
	Tilapia	$5.60x10^6$	>240	2.8	$3.25x10^5$	$2.56x10^3$	positive
Local Retail Market -2	Rui	$2.78X10^6$	>240	2.3	$1.31x10^4$	$1.89x10^3$	positive
	Catla	$3.50x10^6$	>240	2.3	$1.09x10^5$	$3.16x10^3$	positive
	Tilapia	$4.72x10^6$	>240	2.8	$1.17x10^5$	$3.77x10^3$	positive
Local Retail Market-3	Rui	$5.10X10^6$	>240	2.3	$1.83x10^5$	$1.45x10^3$	positive
	Catla	$3.60x10^6$	>240	2.3	$2.39x10^5$	$4.69x10^3$	positive
	Tilapia	$6.29x10^6$	>240	2.8	$3.68x10^5$	$5.20x10^3$	Positive

**Total Viable Bacterial Counts (TVBC), Total Coliform Counts (TCC), Total *Pseudomonas* Counts (TPC)



**Total Viable Bacterial Counts (TVBC), Total *Pseudomonas* Counts (TPC)

In 9 Local Retail Market samples Local Retail Market-3 Rui samples shows lowest TVBC count $1.89X10^6$ and Local Retail Market-3 Tilapia shows highest TVBC count $6.29x10^6$.These results are similar with the study of local market fish samples of (Mahmuda 2010).TVBC found in some samples exceed the limit of (ICMSF, 1986) indicates they are not good in condition. Total Coliform Count was >240MPN/g. *E coli* was present in all samples ranging between 2.3-2.8.Total *Pseudomouns* Count and *Stapylococcus* spp. count was ranging between $1.20x10^4$ to $3.68x10^5$ and $1.69x10^4$ to $4.16x10^3$ respectively. *Salmonella* was present in all samples.

Overall the current findings reveal that Local Retail Market samples of total bacterial counts and pathogenic micro organisms were above the acceptable limit. The bacterial ecology of fish products is connected to environmental factors such as water pollution, anthrop activities, fish feed quality, hygienic procedures of slaughter, handling, transport, commercialization and storage condition [5]. So, we have to maintain proper hygienic condition for fish handling, packaging, storage and transport.

From the result, it can be concluded that the fish of local retail markets are not in good quality as microbial levels are always higher than the standard levels but fish of ponds are within the standard level. We also recommend improving the quality of retail market hygiene so that we can get good quality of fish in microbial aspects. We need take some steps to follow post harvesting procedures and storage to maintain quality of fish.

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