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AQUA-DRUGS AND CHEMICALS: IMPACT ON FISH HEALTH AND PRODUCTION IN MYMENSINGH, BANGLADESH

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ABSTRACT

The present study was conducted to evaluate the impacts of aqua-drugs and chemicals on fish health and production in Mymensingh, Bangladesh from July 2013 to June 2014. Data were collected through personal contact, market survey, focus group discussion and participatory rural appraisal with fish farmers, associations and aqua-drug sellers. Fifty five different types of aqua-drugs and chemicals were recorded in the study area, among those, 20 types were widely used by the farmers for different fish disease treatment. It was recorded that renamycine, cotrim vet, ossi-c, polgard plus and timsen were used for the treatment of EUS in pangus, tilapia and koi which had an average recovery of 75-85%. For the treatment of edwardsiellosis in pangus and koi, farmers used potassium permanganate, timsen, polgard plus, geolite gold and renamycine which had an average recovery of 65-80%, and for the treatment of dropsy in tilapia, aquamycine, ossi-c and potassium permanganate were used which had an average of 80-85% recovery. Histopathology of gill and liver of fishes were almost normal in control ponds, whereas, in drugs treated ponds the organs had pathological changes like necrosis, pyknotic cells, hemorrhage, hypertrophy, lamellar missing, talengiactasis and vacuums. However, production of pangus, tilapia and koi was 12000 kg/acre, 15000 kg/acre and 14000 kg/acre in drug treated ponds respectively, whereas, it was 5000 kg/acre, 9000 kg/acre and 8000 kg/acre in non-treaded ponds respectively.

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INTRODUCTION

Over the last decade the rapid expansion of fish culture has been drawn an outstanding development in Bangladesh fisheries sector and it contributes 4.43% to the Gross Domestic Product (DoF, 2014). Aquaculture expands through the practice of improved extensive and semi intensive fish culture systems. For the successful aquaculture, technology is most needed (Subasinghe *et al*., 1996) as well as the application of different aqua-drugs and chemicals which enhance the production and disease resistance capacity. There is a long history behind the using of drugs and chemicals in aquaculture. A variety of aqua-drugs and chemicals are used in both inland and coastal aquaculture. The purposes of using chemicals and antibiotics are to improve health condition of aquatic animal, growth promotion (Ahmed *et al.,* 2014), feed formulation, manipulation of production, transportation of live fish, pond construction, and overall the management of natural pond environment and water quality (GESAMP, 1997; Faruk *et al*., 2004 and Khan *et al*., 2011).

In past farmers used only some traditional chemicals like lime, salt, potassium permanganate, copper sulphate, formalin and bleaching powder (Hasan and Ahmed, 2002 and Plumb, 1992) but in recent years several pharmaceutical companies play a vital role to produce various types of commercial aqua-drugs and chemicals (Faruk *et al.*, 2008). For health management of fish several types of antibiotics are used by farmers. The antibiotics, which have been applied in aquaculture for over fifty years for treating bacterial infections in fish (Shamsuzzaman and Biswas, 2012). The common ingredients of antibiotics are oxytetracycline, chlorotetracycline, amoxicilin, co-trimoxazoie, sulphadiazine and sulphamethoxozole (Plumb, 1992). Some common chemicals are used for health management including sodium chloride, formalin, malachite green, methyl blue, potassium permanganate and hydrogen per-oxide (Plumb, 1992). Potassium permanganate is the most widely used chemical for treating external protozoa and external bacterial infection. For treating fungal infection, external parasite on fish and fish eggs as flush, prolonged or indefinite treatment or fungal control sodium chloride and formalin is an old treatment used by the farmers (Plumb, 1992). Thus, present study was carried out to evaluate the impact of aqua-drugs and chemicals on fish health and production in inland aquaculture of Bangladesh.

MATERIALS AND METHODS

The present study was carried out in Trishal and Bhaluka upazillas in Mymensingh district from July 2013 to June 2014. Data were collected through questionnaire interview, personal contact, participatory rural appraisal (PRA) and focus group discussion (FGD) with fish farmers and associations, market survey and retailers of aqua-drugs and chemicals. The sample size varied from different target groups such as 12 to 15 farmers, 3 to 4 drug sellers or drug shops and 1 to 2 farmers association from each sampling stations.

The impact of different aqua-drugs and chemicals on fish health and production was measured through the farmer's opinions. Fish production was compared between culture systems using aqua-drugs and chemicals and without chemicals.

The samples were collected from the field level for health check through histological observation. Fish samples were collected from gill and liver. Sampling was done by a sharp scalpel and forceps and fixed in 10% neutral buffer formalin and kept in transparent plastic vials. Fish samples were processed in an automatic tissue processor (SHANDON, CITADEL 1000), embedded, sectioned using a microtome (Lecia JUNG RM 2035), stained with haematoxyline and eosin, mounted with Canada balsam and the slides were examined under a compound microscope (OLYMPUS, Model CHS, Japan). Then photomicrographs were taken by a photographic camera in Fish Disease Laboratory at BAU, Mymensingh.

RESULTS AND DISCUSSION

During the present investigation, seven categories and 34 pharmaceutical companies were recorded in the study area. From the research findings of Faruk *et al.* (2008) 33 pharmaceutical companies were found either producing or marketing aqua-drugs in Mymensingh district. Farmers used chemicals which were categorized as pond preparatory and water quality maintenance, oxygen supplementary, gas removal,

growth promoters, disinfectants, antibiotics and disease treatment. According to Faruk *et al.* (2008) farmers of Mymensingh regions used different types of aqua-drugs and chemicals for various purposes like pond preparation, growth promotion, increasing oxygen concentration, disinfection, probiotics and disease treatment. In present study, 55 different types of aqua-drugs and chemicals were recorded in the study area. Among those, 20 types were widely used by the farmers for different disease treatment of fish such as bactitab, chlorsteclin, orgacycline, orgamycine-15%, oxy-d vet, oxysentin, renamox, renamycin, malachite green, methylene blue, bleaching powder, potassium permanganate, eco-solution, basudin, timsen, oxytetracycline, lime, formalin, oxolinic acid and sarafloxacin. From the research findings of Ahmed *et al.* (2014) in Mymensingh district farmers used 50 different types of aqua-drugs and chemicals on various purposes among those, 15 types of antibiotics and drugs were used by the farmers for the treatment of different fish diseases.

Impact on fish health and disease

In case of inland aquaculture of Mymensingh region various types of fish diseases were detected. EUS, edwardsiellosis, dropsy, pop eye, white spots and fin root diseases were found in pangus, tilapia and koi. From the research findings of Ahmed *et al.* (2014) in Mymensingh region EUS, dropsy and edwardsiellosis were observed in pangus, koi and tilapia. From the present study in Trishal upazilla farmers used zeolite, gastab, timsen, renamycin and polgard plus for the treatment of EUS in pangus, which had an average of 75-80% recovery (Table 1). However, in Bhaluka upazilla farmers used potassium permanganate, renamycine, cyprocine and cotrimvet for the treatment of EUS in pangus, which had an average of 80-85% recovery. According to Rahman (2012) in case of EUS, farmers of Jamalpur used oxysentin 20%, aquamycin and acimox powder and achieved 90% recovery with tilapia, rui, catla and pangus. In EUS affected tilapia and koi, farmers of Trishal upazilla used renamycin, polgard plus, ossi-c and aquamycine which had an average recovery of 80-85%. However, for the treatment of EUS affected tilapia in Bhaluka upazilla farmers used renamycin and ossi-c which had an average of 70-80% recovery (Table 1). According to Ahmed *et al.* (2014) to treat EUS affected tilapia farmers of Fulpur upazilla used renamycin, polgard plus and ossi-c with a result of 80-95% recovery. Rahman (2011) mentioned that EUS affected tilapia were treated with renamycin, polgard plus and ossi-c and achieved 95% recovery.

In the present study, farmers of Trishal upazilla used renamycin, timsen, ossi-c and polgard plus for the treatment of edwardsiellosis in pangus and koi with a result of 75-80% and 65-70% recovery respectively (Table 1). From the research findings of Ahmed *et al.* (2014) in edwardsiellosis affected pangus, farmers used renamycin, polgard plus, timsen and ossi-c having 80% recovery. Whereas, in Bhaluka upazilla, for the treatment of edwardsiellosis affected pangus and koi farmers used renamycin, polgard plus, timsen, geolite gold and ossi-c which had an average 75-80% recovery (Table 1). Rahman (2011) mentioned that edwardsiellosis affected Thai pangus were treated with renamycin, timsen, polgard plus and ossi-c having 80% recovery.

For the treatment of pop eye, tail and fin rot and dropsy farmers of both upazillas used aquamycin, ossi-c, lime, salt and renamycin having 70-85% recovery (Table 1). According to Ahmed *et al.* (2014) in dropsy affected tilapia farmers of Fulpur upazilla used aquamycin and ossi-c with a result of 95% recovery. In the present study it was observed that various spots on skin and scale dropped in some parts of koi, farmers of both upazillas used lime, salt, aquamix and vitamix with a result of 70-80% recovery (Table 1) according to the research findings of Ahmed *et al.* (2014).

Histological observations

From the present investigation section of gill of tilapia from Trishal were seen normal in control ponds (Figure 1), except hypertrophy and some lamellar missing of gill of koi from Trishal (Figure 3) and some lamellar missing of gill of koi from Bhaluka (Figure 4) in control ponds, which were in accordance with the findings of Rahman (2012). According to Ahmed *et al*. (2012) section of gill had almost normal structure in control ponds. However, in treated ponds, gill of tilapia from Bhaluka had lamellar missing, necrosis and hemorrhage (Figure 2). Section of gill of pangus from Trishal, there were seen talengiactasis and lamellar missing (Figure 5), and section of gill from Bhaluka having clubbing, cyst, talengiactasis and hemorrhage in

treated ponds (Figure 6). Ahmed *et al.* (2014) mentioned that in case of gills of aqua-drugs and chemical treated ponds exhibited pathological changes like hypertrophy, hemorrhage, missing of secondary gill lamellae, clubbing and necrosis.

Photomicrograph of liver of tilapia and pangus from Trishal were normal in control ponds (Figure 7 and Figure 11). Section of liver of koi and pangus from Trishal and Bhaluka were almost normal except some vacuums in control ponds (Figure 7, Figure 9, Figure 11 and Figure 12). According to Rahman (2012) liver of fishes were almost normal in control ponds. From the research findings of Ahmed *et al.* (2014) in control ponds section of fish liver were almost normal except some vacuums. However, in treated ponds, section of liver of tilapia from Bhaluka had vacuums, necrosis and pyknotic cells (Figure 8). Section of liver of koi from Bhaluka had vacuums and hemorrhage in treated ponds (Figure 10). Ahmed *et al.* (2014) reportated that some important pathological changes such as hemorrhage, necrotic hepatocytes, pyknotic cells and vacuums were recorded in the liver of chemical treated fishes. According to Rahman (2012) liver of chemical treated fish had some important pathological changes such as hemorrhage, necrosis, pyknotic cell and vacuums.

Table 1. Impact of aqua-drugs on fish health and disease in Mymensingh

Study areas	Species	Diseases	Drugs/chemicals with dose	Recovery (%)
Trishal	Pangus	EUS	Zeolite 200g/dec, Gastab 2-3g/dec , Timsen 0.6g/dec, Cotrimvet 2g/kg feed	75-80
		Edwardsiellosis	Renamycin 5g/kg feed, Timsen 80 gm/33 dec, Ossi-C 3 gm/kg feed, Polgard plus 5 ml/decimal	75-80
		Fin root	Lime 0.5-1 kg/dec, salt 0.5-1 kg/dec	60-65
	Tilapia	EUS	Renamycin 50mg/kg body weight, Polgard plus 500 ml/acre, Ossi-C 3 g/kg feed	80-85
		Dropsy	Aquamycine 1-2 g/feed, Ossi-C 3 g/kg feed	80-85
	Koi	Edwardsiellosis	Renamycin 5g/kg feed, Ossi-C 3 gm/kg , Polgard plus 5 ml/decimal	65-70
		EUS	Aquamycine 1-2 gm/feed, Ossi-C 3 g/kg feed, Polgard plus 5 ml/decimal	80-85
Bhaluka	Pangus	EUS	$KMnO_4$ 3kg/dec, Renamycine 5g/kg feed , Cotrimvet 2g/kg feed, Revoflavin 50 tab/kg feed, Tetravet 5g/kg feed, Fish curapus 20g/dec	80-85
		Edwardsiellosis	Renamycin 5g/kg feed, Ossi-C 3 g/kg feed, Polgard plus 5 ml/decimal, Geolite gold 200-250 g/decimal	75-80
		Fin rot	Lime 0.5-1 kg/dec, salt 0.5-1 kg/ dec	70-75
		Pop eye	Renamycine 5g/kg feed	70-75
		Fat deposition	Livabid 10ml/kg feed, Cholin chloride 10ml/kg feed	50-55
	Tilapia	EUS	Renamycin 50 mg/kg body weight, Ossi-C 3 g/kg feed	75-80
		White spot	Lime 0.5-1kg/dec, salt 0.5-1kg/dec, Aqua mix 5g/kg feed, Vita mix-F-Aqua5g/kg feed	75-80
	Koi	Edwardsiellosis	Renamycin 5g/kg feed, Ossi-C 3 g/kg , Polgard plus 5 ml/decimal	75-80
		White spot	Lime 0.5-1kg/dec, salt 0.5-1kg/dec, Aqua mix 5g/kg feed, Vita mix-F-Aqua5g/kg feed	70-75

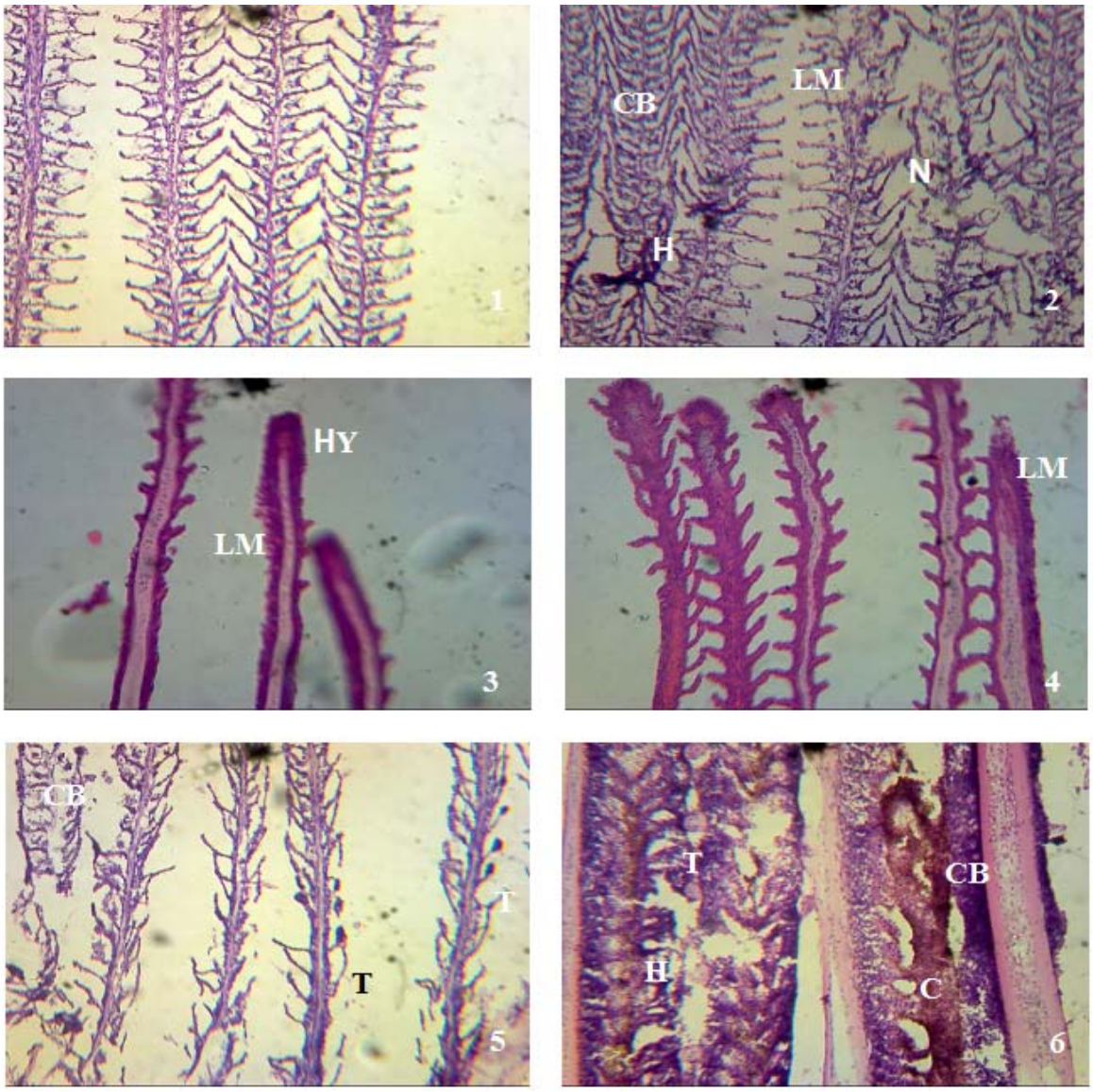

Figure 1. Cross section of normal gill of tilapia from Trishal from a control pond; **Figure 2.** Photomicrograph of gill of tilapia from Bhaluka having clubbing (CB), hemorrhage (H), lamellar missing (LM) and necrosis (N) from a treated pond; **Figure 3.** Section of gill of koi from Trishal having hypertrophy (HY) and lamellar missing (LM) from a treated pond; **Figure 4.** Cross section of almost normal gill of koi from Bhaluka except showing some lamellar missing (LM) from a control pond; **Figure 5.** Photomicrograph of gill of pangus from Trishal having clubbing (CB) and talengiactasis (T) from a treated pond; **Figure 6.** Section of gill of pangus from Bhaluka having clubbing (CB), talengiactasis (T), cyst (C) and hemorrhage (H) from a treated pond (All figures: H & E x 125).

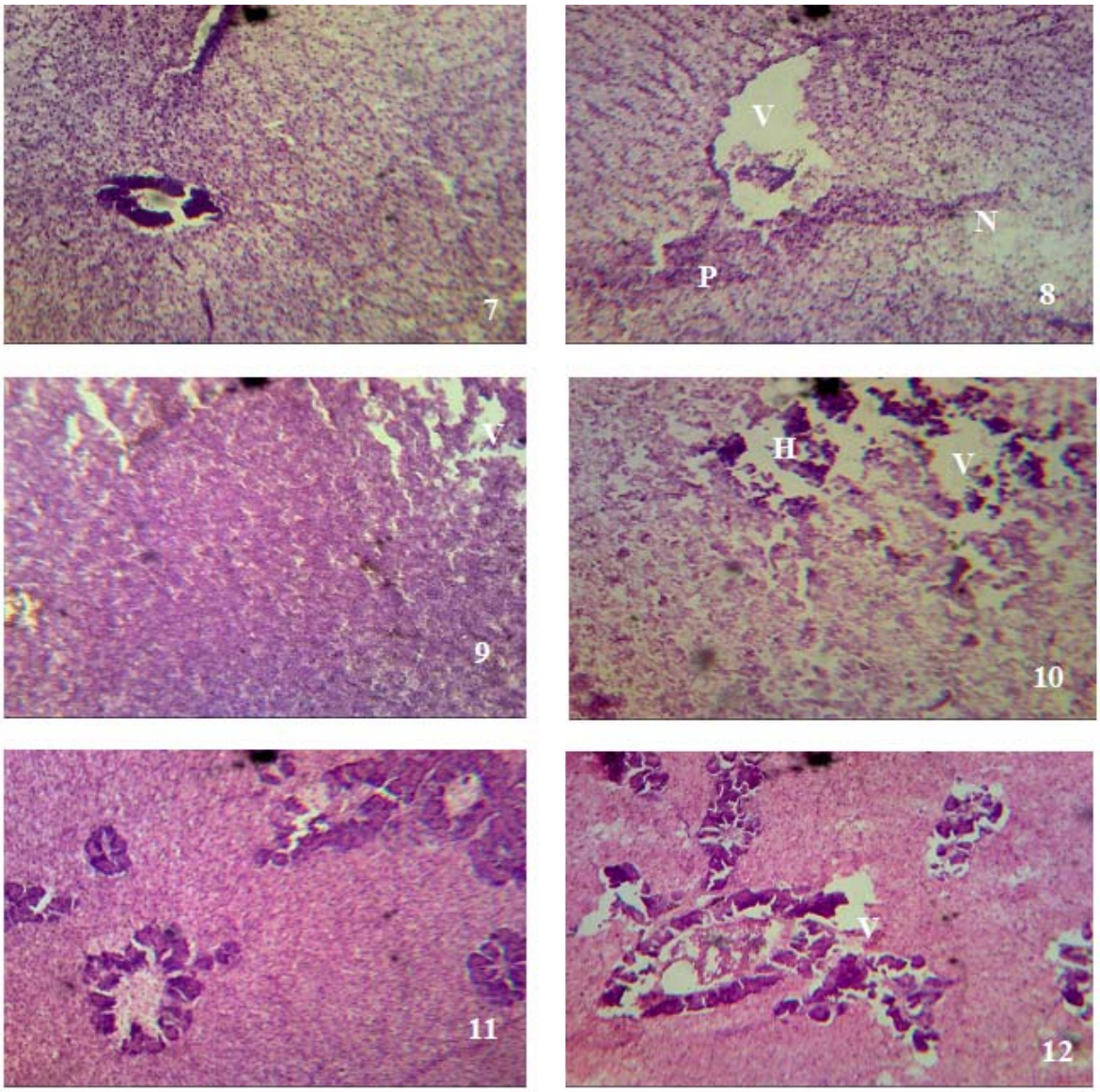

Figure 7. Photomicrograph of normal liver of tilapia from Trishal from a control pond; **Figure 8.** Cross section of liver of tilapia from Bhaluka having vacuum (V), necrosis (N) and pyknotic cell (P) from a treated pond; **Figure 9.** Section of an almost normal liver of koi from Trishal except showing vacuums (V) from a control pond; **Figure 10.** Photomicrograph of liver of koi from Bhaluka having vacuums (V) and hemorrhage (H) from a treated pond; **Figure 11.** Cross section of normal liver of pangus from Trishal from control pond; **Figure 12.** Section of almost normal liver of pangus except having vacuums (V) from a control pond from Bhaluka (All figures: H & E x 125).

Impact on fish production

In Mymensingh region, in Trishal upazilla Pangus production was 6000 kg/acre in control ponds, whereas, 12000 kg/acre in treated ponds. However, in Bhaluka upazilla pangus production was 5000 kg/acre in control ponds, whereas, 10000 kg/acre in treated ponds (Figure 13). From the research findings of Ahmed *et al.* (2012) in farmer's pond, production of Thai pangus in chemical treated ponds was higher 8100 kg/acre than in the non-treated ponds having 4800 kg/acre. Tilapia production was 9000 kg/ acre and 14000 kg/acre in control

and treated ponds respectively in Trishal upazilla (Figure 13). However, in Bhaluka upazilla tilapia production was 10000 kg/acre and 15000 kg/acre in control and treated ponds, respectively. Koi production in Trishal upazilla was 9000 kg/acre and 14000 kg/acre in control and treated ponds respectively, however in Bhaluka upazilla 8000 kg/acre and 13000 kg/acre in control and treated ponds respectively (Figure 13). Shamsuddin (2012) mentioned that production of Thai pangus and Thai koi in Gouripur and Muktagacha Upazillas were almost double in the chemical treated ponds compared with non-treated ponds. According to the author, production of Thai pangus in BAU experimental ponds of control one was higher 7328.16 Kg/acre and in the treated one was 6400.08 Kg/acre (Figure 13).

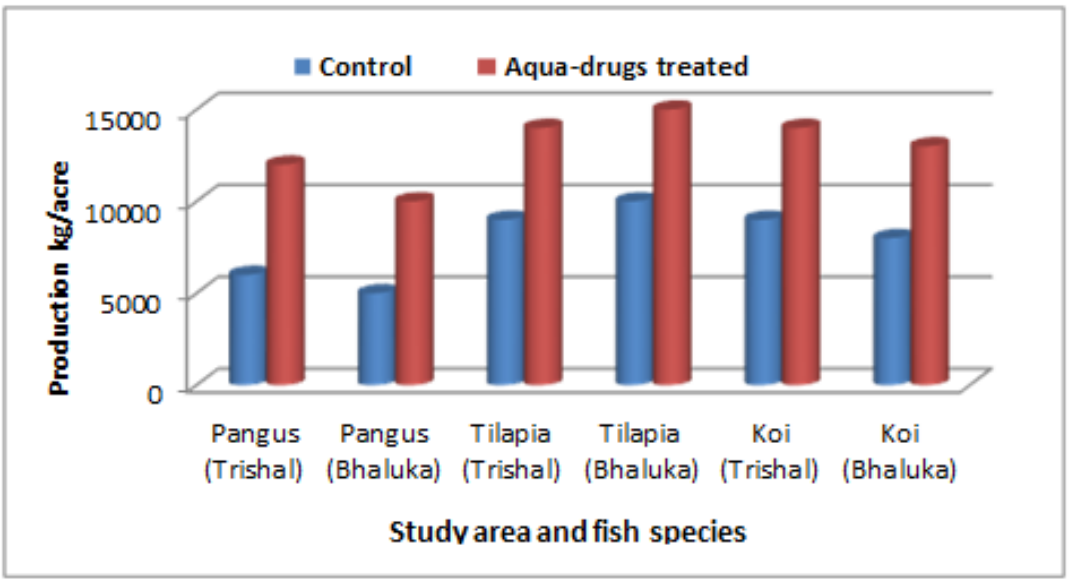

Figure 13. Fish production (kg/acre) in Mymensingh district.

CONCLUSION

Fifty five different types of aqua-drugs and chemicals were recorded in the study area, among those, 20 types were widely used by the farmers for different fish disease treatment. In Mymensingh region common fish diseases were recorded as EUS, fin rot, dropsy, white Spots, pop eye and edwardsiellosis. Potassium permanganate, renamycine, cyprocine and cotrimvet had an average recovery of 80-85% on EUS of pangus, whereas, renamycin, timsen, ossi-c and polgard plus had an average recovery of 75-80% on the treatment of Edwardsiellosis of pangus. From histological section of fish gill and liver, there were some pathological changes like necrosis, hemorrhage, pyknotic cell, lamellae missing, talengiactasis, clubbing and hypertrophy were observed in the above mentioned organs in drug treated ponds, whereas, some vacuums were observed in control ones. Production of pangus, was 12000 kg/acre, in drug treated ponds, whereas, 5000 kg/acre in control ponds. Aqua-drugs and chemicals had positive impacts on fish production and disease recovery, on the other hand, some remarkable pathological changes were observed in fish organs from drug treated ponds. So, the use of aqua-drugs and chemicals in ponds and ghers should be reduced in order to overcome adverse pathologies in fish organs.

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