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Antibiotic Use and Practices in Selected Fish Farms in the Ashanti Region of Ghana

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Abstract

Background: Antibiotics may be used in fish farms to prevent or treat bacterial infections especially in hatcheries. This affects a wide range of bacteria and has potential impact on receiving water bodies and fish pathogens and has been reported to contribute to antibiotic resistance in other parts of the world but there is no available report from Ghana.

Aim: This study was carried out to assess some fish farming practices among catfish and tilapia farmers which may contribute to antibiotic resistance.

Method: Validated questionnaires were administered to 63 fish farmers and 9 fishery officers in six zones of the Ministry of Fisheries, Ashanti Region of Ghana.

Results/Findings: Seventy three percent of farmers claimed not to use antibiotics on their farms. Three farmers (4.8%) used tetracycline on the fish farms whilst two hatchery farmers add antibiotics (tetracycline or chloramphenicol) to fish feed. 93.6% of respondents who use manure on fish farms use poultry manure from commercial poultry farms and use it mainly to fertilize fish ponds.

Conclusion: Most of the fish farmers interviewed do not use antibiotics on fish farms, practices such as manure use and untreated waste disposal may contribute to antibiotic resistance on fish farms in Ghana.

Keywords: Antibiotics; Antibiotic practices; Antibiotic resistance; Fish farms practices

indiscriminate use of antibiotics both in humans and in food producing animals and in aquaculture [1-3]. Bacterial diseases in fish which usually occur under stress conditions result in high morbidities and mortalities leading to significant economic loss [4]. To avoid such huge losses, fish farmers use antibiotics and other antimicrobial agents mostly for the prevention and treatment of diseases in fish [5]. They may also be used to ensure good water quality and to disinfect eggs and equipment [6]. There has been an alarming increase in global reports of antibiotic resistance on fish farms over the years [7,8]. Though some farms do not use antibiotics directly, fish farming practices such as the use of animal manure, waste water, human excreta in fish farms and disposal of untreated effluents from fish farms may contribute to antibiotic resistance in fish farms and adjoining water bodies [9,10]. Ghana has a thriving freshwater aquaculture industry with tilapia and catfish being the most farmed species in freshwater farms with tilapia farming alone contributes 88% of total fish farming in Ghana [11]. Previous studies on some fish ponds in Ghana have indicated the use of animal manure on fish farms in Ghana mainly to fertilize the pond [12,13]. This study sought to examine some fish farming practices in selected fish farms in Ashanti Region of Ghana which may contribute to antibiotic resistance.

Materials and methods

Survey areas

A survey was conducted in six zones of the Fisheries commission of Ghana in the Ashanti Region. The region lies in the southern half of the country and occupies 24,389 sq. km. or 10.2 percent of the total land area of Ghana. The region has several water bodies including Lake Bosumtwi and many rivers such as Offin, Pra, Afram and Owabi which serve as sources of drinking water for residents of many localities in the region. There are 30 metropolitan, municipals and districts which have been designated into six zones (Kumasi, Atwima, Ejura-sekyere, Amansie, Adansi and Kwabre) by the Ashanti region Fisheries commission. The region has a population of

Introduction

Antibiotic resistance is one of the major health challenges, which is largely attributed to varying factors such as

4,780,380 representing the highest proportion (19.4%) of the total population [14]. Fish farming is a growing business in Ghana and is becoming widely practiced in across parts of the country including the Ashanti Region [15].

Ethical approval

The ethical clearance for the study was obtained by the Fisheries Division of the Ministry of Food and Agriculture, Ashanti region, Ghana and a written consent were obtained from all farmers, managers and workers.

Method

A survey of fish farming practices among fish farmers in six zones of the Fisheries Commission of the Ashanti Region was conducted in from February to March, 2014. These zones are Kumasi, Atwima, Ejura-Sekyere, Amansie, Adansi and Kwabre (Figure 1) [16,17].

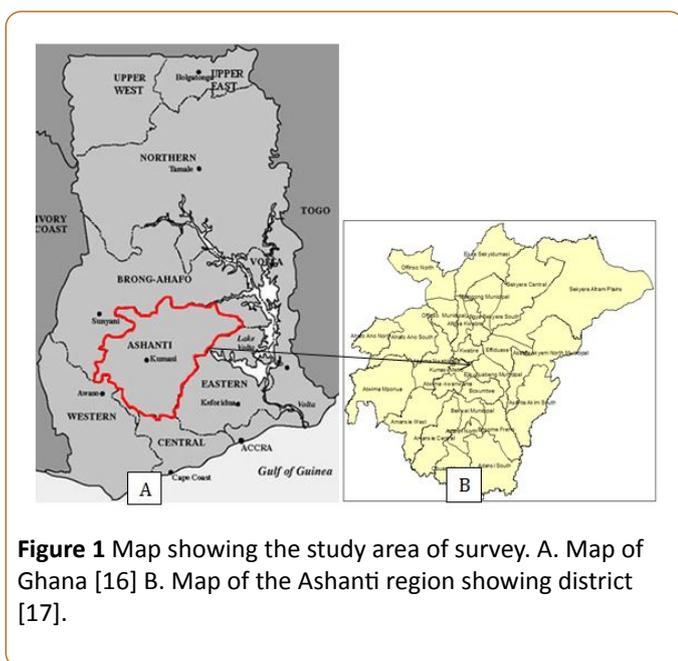


Figure 1 Map showing the study area of survey. A. Map of Ghana [16] B. Map of the Ashanti region showing district [17].

Preliminary questionnaires were developed after conducting a literature search on fish farming practices and informal interviews with few target respondents and non-respondents. A pilot study was done to validate the questionnaires which were then administered to 63 fish farmers from the six different zones as well as to fishery officers, from the Ministry of Fisheries, superintending the six zones. Farmers were selected from the six zones based on their availability at the time of the survey. Inclusion criteria for selection of farmers include: Officially registered by the Fisheries commission, existing ponds, produces either catfish or tilapia, available at the time of survey. Farmers whose farms were not officially registered by the fisheries commission or unavailable at the time of survey were excluded. Fish farmers who had no existing ponds for production were excluded. Structured questionnaires addressed the type of antibiotics used on fish farms, source of antibiotics and method of administration if used, record of any disease outbreak on farms, use and source

of manure for fish farming, how pond waste is disposed of and type of feed and additives used. For fisheries officers, questionnaires were self-administered.

Results

Antibiotic use and disease prevention practices on fish farms

A total of 63 farmers in the Ashanti Region were interviewed of which 73% of farmers reported no use of antibiotics on the fish farms. Three farmers used tetracycline on the fish farms whilst one used chloramphenicol. Nearly 83% of farmers had never experienced any disease outbreak on their farms. Twenty seven percent (27%) use hygienic practices and best management practices to prevent diseases on their farm and these include water re-use, adequate aeration and circulation of ponds, moderate stocking levels and use of good quality fish feed (Table 1).

Table 1 Antibiotic use in fish farms.

Antibiotic practice use	Response	Number of farmers	%
Antibiotic used in farm	Tetracycline	3	4.8
	Chloramphenicol	1	1.6
	None	56	73
	Non-response	3	4.8
Source of antibiotic	Pharmacy	1	1.6
	Chemical seller	1	1.6
	Veterinary shops	2	3.2
Method of antibiotic administration	Feed	1	1.6
	Water bath	2	3.2
	Feed and water bath	1	1.6
Record of disease outbreak	Yes	11	17.5
	No	52	82.5

Disease prevention	Best management practices	17	27
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Source of water and waste water disposal practices

Fifty-five percent of farmers used underground water mainly springs as source of water for the ponds. 25.4% of farmers discarded water from ponds into rivers or streams whilst 58.7% had outlets leading to drains for discarding water (Table 2).

Table 2 Source of water and disposal practices among fish farmers.

Water source and disposal practice	Response	Number of farmers	%
Source of water	River	17	27
	Stream	11	17.5
	Wells, boreholes, springs	35	55.6
Frequency of water change	1-3 months	4	6.3
	4-6 months	6	9.5
	7-12 months	14	22.2
	>12 months	23	36.5
	Never	8	12.7
	Non-response	8	12.7
Method of discarding water	Outlets into river/stream	16	25.4
	Outlets into bush	3	4.8
	Outlets into drains and pond	38	60.3
	Non-respondents	6	9.5

Feeding and organic waste practices

Almost half of farmers (47.6%) fed their fish with both commercially formulated feed and food residues such as groundnut husks and rice bran. Two hatcheries added antibiotics to fish feed (Figure 2). Most of the respondents (93.6%) used poultry manure from commercial poultry farms to mainly fertilize the fish ponds (Figure 3).

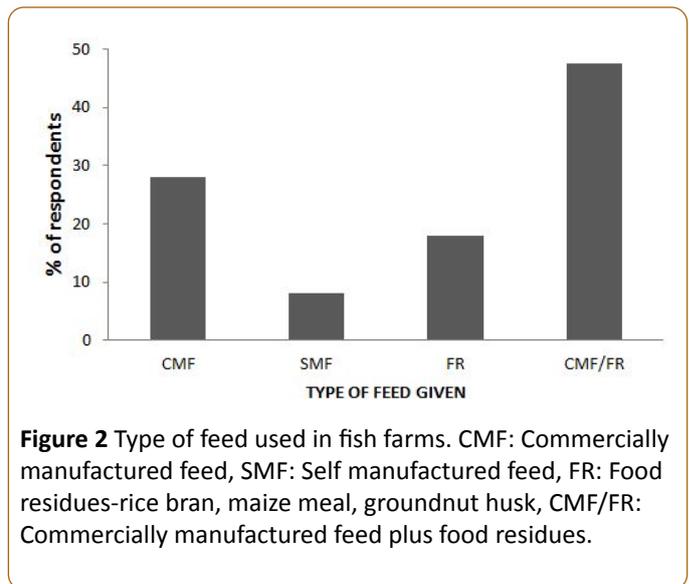


Figure 2 Type of feed used in fish farms. CMF: Commercially manufactured feed, SMF: Self manufactured feed, FR: Food residues-rice bran, maize meal, groundnut husk, CMF/FR: Commercially manufactured feed plus food residues.

Antibiotic use in fish hatcheries

Six out of nine fisheries officers confirmed the use of antibiotics in fish farming to either prevent or treat diseases in fishes especially in hatcheries. According to 5 out of the 9 fishery officers, the antibiotics are administered either by mixing with feed or water. The fisheries officers recommended either poultry or pig manure to farmers for use on the main farms (Figure 4) (Table 3).

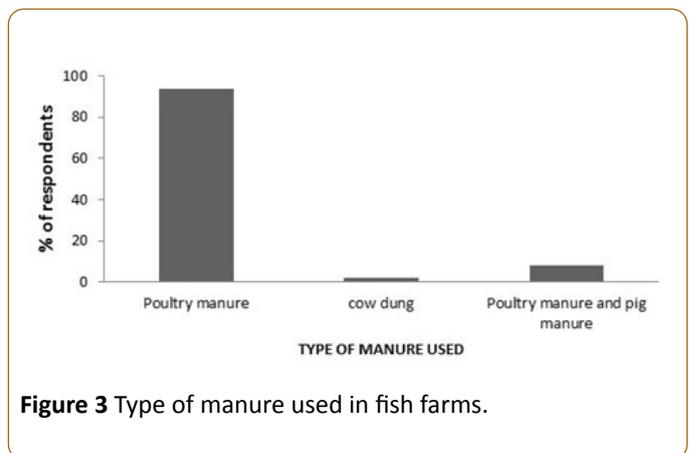


Figure 3 Type of manure used in fish farms.

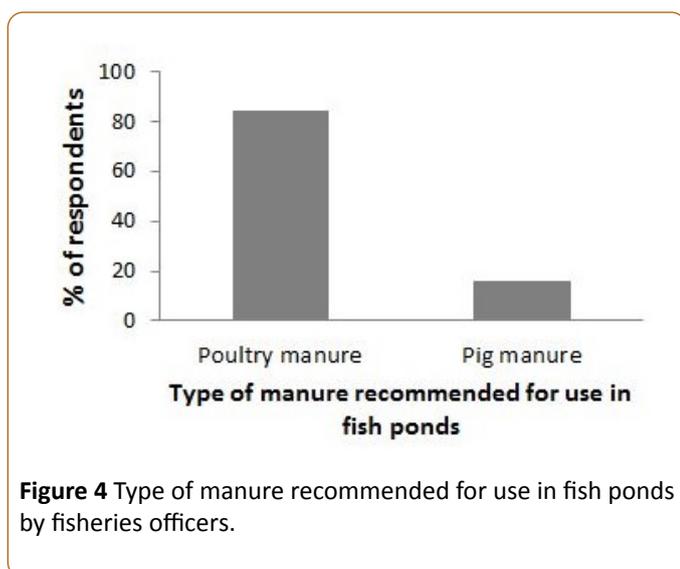


Figure 4 Type of manure recommended for use in fish ponds by fisheries officers.

Table 3 Responses on use of antibiotics in fish farms by fisheries officers.

	Response	Number of officers
Reason for antibiotic use in fish farms	Prophylaxis	3
	Therapeutic	1
	Both	3
Recommended stage	Hatcheries	6
Method of administration	Feed	1
	Water	1
	Feed and water bath	3

Discussion

Antibiotics are used on fish farms for prophylaxis and treatment of diseases and same antibiotics used in humans, have been used in fish farming and may be administered through feed or direct application in pond water [18]. Antibiotics administered to fish may accumulate in the water and sediments of fish ponds and may result in selective pressure in the pond environment leading to antimicrobial resistance of fish pathogens [19]. From the survey on antibiotic use in fish farms in the Ashanti region, only 7.8% of respondents used antibiotics on fish farms. This may be because they had not experienced any disease outbreaks on their farms and depend on fisheries officers to make interventions in the event of outbreaks of diseases. It could also be attributed to the fact that most of the farms visited engaged in practices such as maintaining water hygiene, using appropriate stock densities and the use of quality feed. Faruk et al. [20] reported these practices to be associated with prevention of diseases on fish farms and thus eliminate the need for use of antibiotics on the farms. Diseases in fish do not usually occur and are often associated with high stocking densities and poor water quality [21]. The antibiotic of choice

used by the farmers is tetracycline which is mainly in hatcheries for prophylaxis in fingerlings. This was also affirmed by the fisheries officers interviewed. Tetracycline is known to be one of the most commonly used antibiotics in fish farms especially in hatcheries [22,23].

Antibiotics may be administered through feed and hence undigested fish feed may leach into the environment and accumulate resulting in resistance [23]. From the study, 47.6% of farmers use both commercially manufactured feed and food residues such as groundnut husks and rice bran. The commercially manufactured feed presumably had no antibiotics added as stated on the labels by manufacturers. Gabriel et al. [24] reported that in most sub-Saharan African regions, fish farmers depend largely on imported fish feed or on non-conventional feed such as kitchen waste and plant sources as few are produced locally. With the exception of the hatchery farmers who add tetracycline to the fish feed for fingerlings, the farmers do not add antibiotics to their fish feed.

With the rapid increase in freshwater fish farming, there is the need for enforcement of regulations on use of antibiotics in fish farms and in animal production in Ghana as this may control the development of antibiotic resistance in these farms. Regulations on antibiotic use in aquaculture have been enforced in some countries in North America and Europe in a bid to control antibiotic resistance [25]. Surveillance on antibiotic resistant isolates from the studied farms is important to control the spread of antibiotic resistance.

Pond effluents may be a source of microbiological pollutants to receiving water bodies [26]. From this study, 25.4% of farmers interviewed dispose of effluent from their fish ponds into rivers or streams whilst 58.7% dispose effluents through drains. The disposal of water from ponds into nearby water bodies may contribute to the transfer of antibiotic resistant microorganisms into receiving water bodies. Though this study did not investigate the levels of bacteria at the receiving water bodies, the high numbers of resistant bacteria isolated from the fish pond environment could be transferred to receiving water bodies as observed in a study of water from fish ponds and receiving streams from selected farms in the Ashanti Region, significant levels of bacteria upstream, downstream and reference locations of the streams receiving effluents from the fish ponds [27]. Gordon et al. [28] reported a high number of resistant bacteria isolates from a river receiving effluents from fish ponds indicating the transfer of antibiotic resistant isolates to adjoining water bodies.

Most of the respondents (93.6%) use poultry manure for fertilizing the ponds. This is in agreement with findings reported in a study of some fish ponds in Ghana by Ampofo et al. [13] where fish farmers used poultry waste, blood waste, sewage, cow dung and pig dung to fertilise ponds. The use of organic manure by farmers may contribute to antibiotic resistance on the farms by transfer of antibiotic residues and resistant bacteria to fish farms if the commercial farms from which the manure is sourced use antibiotics [9,29,30]. Elsaidy et al. [29] in a study of bacterial isolates from water and fish raised in ponds receiving chicken manure recommended the

use of fermented chicken manure as a bacteriologically safe fish pond fertilizer.

The findings of this study highlight some fish farming practices which may indirectly contribute to antibiotic resistance both on fish farms and their environs. This calls for regulations to control practices which may contribute to antibiotic resistance on these farms.

Conclusion

Seventy three percent of fish farmers in the Ashanti region do not use antibiotics on their fish farms. Tetracycline is mostly used for prophylaxis in fish hatcheries and the use of organic manure and disposal of water into nearby water bodies may contribute to the spread of antibiotic resistance.

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Conflict of Interest

Authors declare no conflict of interest.

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