Research Article

A Survey of Antibiotics Use and the Awareness of Antibiotics Resistance Among Farmers of Broiler Farms at Sylhet Sadar Upazilla in Bangladesh

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Abstract | Antibiotics serve as essential medicines for raising broiler chicken meat in Bangladesh therefore it is important to find out whether is any misuse of antibiotics. The goal of this study is to scrutinize the commonly used antibiotics, in broiler industries, to evaluate factors govern farmers "selection of antibiotics" and to assess the status of poultry farmers knowledge about antibiotic resistant (ABR). A cross-sectional survey was conducted over a period of around one year among 50 broiler farms of about 25000 birds at Sylhet district in Bangladesh. Data revealed that Amoxicillin, Enrofloxacin, Ciprofloxacin, Levofloxacin, Azithromycin, Cephalexin, Erythromycin, Neomycin and Colistin were found most commonly used antibiotics. Majority poultry farmer's bear's very poor educational status and knowledge about farm management, did not follow the registered veterinarian suggestions and attained any training. They are totally unaware about antibiotics resistance and its impact on public health. No monitoring or surveillance concerning ABR and haphazard and misuse of antibiotics from any government and non-government organization were observed during the study period. It is concluded that, misuse and haphazard use of antibiotics is the normal feature at broiler farms in the study area of Bangladesh, which plays a major role in the egress public health crisis of ABR. Therefore, regulative authorities must take deligent steps to control the uses of antibiotics in broiler industries, to stop the misuse of antibiotics, to ensure proper veterinary service and building mass awareness about ABR and its impact on public health.

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Introduction

Antibiotic resistance (ABR) is an emanate problem globally, and antibiotic usage (ABU) in poultry production is thought to be a subsidize factor (Marshal and Levy, 2011). The matter has created much argumentation, the recent resistance against antimicrobials such as colistin from animal

production (Liu *et al*., 2016) has substantiated the case that ABU in food animal and poultry production is a momentous patron to the universal drift of ABR in humans. ABU in poultry production is likely to accord propagation and sustainment of ABR bacteria on farms. Resistant bacteria, ABR antecedent, or the antibiotics themselves may be dispersed to the environment through farm waste, and may outreach humans because of direct contact with poultry, the depletion of polluted foods of animal and poultry origin, water, and vegetables (Costa *et al*., 2013). Antibiotics used in poultry production and in human medicine are very similar (FAO, 2007) and therefore resistance against antibiotics is off importance for human medicine (WHO, 2014). The high quantities of antibiotics currently used in animal and poultry production are expected to further increase due to increased demand, particularly in emerging economies (Van Boeckel *et al*., 2015). Southeast Asia (SEA) is a bloc of rapidly developing and linked economies (Richter *et al*., 2015; Walther *et al*., 2014) and can be considered a hotspot of ABR (Cocker *et al*., 2011; Von Wintersdorff *et al*., 2016; WHO, 2014). In Indian subcontinent, particularly in Bangladesh poultry sector is raising day by day. This may promote further risk of dissipation of ABR organisms and genes to consumers nationally and globally. The Center for Veterinary Medicine (CVM) of the US Food and Drug Administration (FDA) have banned the use of the fluoroquinolone antimicrobial enrofloxacin in poultry (OIE, 2001).

The actual quantity of antibiotics used in poultry production globally is unknown and important to valuation. In the US, for instance, more than 70 percent of medically important antibiotics are used in animals (O'Neill, 2015). It's a common trend to use antibiotics in poultry without a prescription of a registered veterinarian, even the feature is almost the same in human medicine also. No or least scientific report available in regard to random and haphazard or misuse of antibiotics in agriculture, livestock including poultry farming in Bangladesh. As it's now established that antibiotic use for food production is now increasing the risk of ABR, resistant bacteria transferring to humans and producing health threats, That'swhy, it is essential to know the real scenario of using antibiotics at poultry farms level in an area. Therefore, this study was undertaken as a basic study with following aims:

1. To investigate the commonly used antibiotics in broiler production in a study area of Bangladesh
2. To evaluate the factors govern farmers "selection of antibiotics" for use on their farms in Bangladesh perspectives.
3. To assess the status of poultry farmers' knowledge about antibiotic resistant.

Materials and Methods

Study area

Sadar Upazilla of Sylhet District in Bangladesh.

Target poultry farms and farmers

Probability proportional to size sampling was employed to select the farms 50 poultry (broiler) farms of remote area with at least 300 chickens/farm and farmers under the geographic arena of Sadar Upazilla of Sylhet District in Bangladesh were randomly selected for this study.

Study period

The study was conducted for a period of around one year between 01, July 2018 to 31, May 2019.

Survey design

In 2018, a cross-sectional study was conducted on 50 farms out of 64 following multi-stage sampling technique. Small to medium sized rural broiler farms of remote area were visited and conversation with farms owners recorded as a part of survey at Sylhet Sadar Upazilla of Syhlet district of Bangladesh. The owner of each surveyed farm was asked as per questionnaire formulated for this purpose.

Questionnaire preparation

A structured questionnaire was compiled and used for poultry farm level survey to obtain information relating to commonly used antibiotics in broiler production, factors govern farmers "selection of antibiotics" for use on their farms and perceptions and knowledge about antibiotic resistance and its impact on public health. To accomplish these objectives, the questionnaire was divided into following subsection, namely: (1) The category and magnitude of antibiotics use: includes commonly used antibiotics for both prophylactic and therapeutic purposes and its types, dosages, duration etc. (2) Factors govern farmers "selection of antibiotics" – includes socio-economic and educational status of the poultry farmers, experience and training on farm management, status of Veterinary services, role of agro-vet companies or chick and feed supplier, farmers

knowledge about poultry diseases and antibiotics, drug efficacy, and withdrawal period etc. (3) poultry farmers knowledge of and attitudes to antibiotic use includes farmers knowledge about haphazard or misuse of antibiotics, marketing authorization of antibiotics drug, antibiotics resistant and publicity about ABR by any government or non-government organization. The questionnaire were structured to reproduce information covering the extensive usages of antibiotics, antibiotics resistance, and dissipation of resistance factors.

Data collection

Data were collected by asking questions to poultry farmers as per formulated questionnaires during farm visit.

Data analysis

Descriptive statistics were used to examine characteristics of the study farms and farmers and no statistical tests were performed.

Results and Discussion

The survey revealed that, the poultry farmers use antibiotics for both therapeutic and prophylactic purposes. Subtherapeutic use of antibiotics was found common phenomena in broiler farming. Almost all (98%) farmers are involved with sub-therapeutic use of antibiotics. Enrofloxacin, Ciprofloxacin, Levofloxacin, Azithromycin, Cephalexin, Erythromycin, Neomycin, Amoxicillin and Collistin were found most commonly used and effective (as per farmer opinion and observation) antibiotics. Farmers were found influenced by different factors to choice antibiotics for their farm (Table 3). Mostly marginal farmers were found involved with broiler farming as a part-time occupation or in some cases full time. Data revealed that poultry farming is the co-income source of 70% farm personnel and main income source of 30% personnel. Most farmers (cent percent) trust on personal cognizance and practicality during antibiotic administration instead of seeking experts advice, even 22% farmers furnished treatment depending on their own decision, 10% and 68% farmers follow registered veterinarian and agro-vet companies/ poultry feed and chick supplier suggestion respectively (Tables 1, 2). 74% poultry farmers found habituated to use antibiotics as preventive tools, so that their birds don't get sick, even they are habituated to use antibiotics before clinical outbreak of disease or before confirmative diagnosis of disease is made. 82% farmers use antibiotics in their poultry flock to reduce any stress, particularly after vaccination (Table 3).

Table 1: *Percentage of Farms or farmers under supervision of agro-vet companies.*

Factors	%
Supervision of Agrovet companies (direct or indirect)	100
Under direct supervision/ suggestion of Agrovet companies	68

Table 2: *Farmers educational status, training and knowledge about farm management.*

Factors	%
Educational status under secondary school level	91
No training on poultry rearing or farm management	90
Poor knowledge about farm management	50

Table 3: *Category/ factors govern farmer to select antibiotics.*

Category/ factors governs farmer to select antibiotics	
Prophylectic use	74 (100)
Use after vaccination	82(100)
Rely on personal knowledge and experience	100 (100)
Treatment by farmers own decision	22 (100)
Follow registered Veterinarian suggestion	10(100)
Follow agro-vet companies suggestion	68 (100)

84% farmers normally use antibiotics as therapeutic or prophylactic purpose immediately prior to sell the broiler for meat purposes or even before completion of withdrawal period of drug residue. 50% farmers were found bears poor knowledge about farm management. 90% poultry farmers found lack of experience of attending any training on poultry farm management from any government or non-government organization. It also found that 91% farmers have the educational status under secondary school certificate level (Table 2). The study also revealed that 100% farmers are very unaware about antibiotics resistance and its impact on public health. No monitoring or surveillance concerning antibiotic resistance (ABR) and haphazard and misuse of antibiotics from any government or non –government organization were observed in study area during study period.

In this study, it is found that farmers are habituated and got good results from therapeutic use of Enrofloxacin,

Ciprofloxacin, Levofloxacin, Azithromycin and Cephalexin. This finding also supports the findings of study conducted by Xu *et al.* (2020) in China. It also found that, this is the main reason behind gradual decreasement of therapeutic use of penicillin's group of antibiotics. However, in this study, we did not perform any Antimicrobial Sensitivity Test but our findings were found almost in support of the results obtained in Antimicrobial Sensitivity Test performed in Bangladesh by Advance Laboratories, Advance Animal Science Co. Ltd., 2005 that was stated by Chowdhury *et al.* (2009). The findings are also in accordance with the findings stated by (Diarrassouba *et al.*, 2007; Forgetta *et al.*, 2012; Diarra *et al.* 2014; Diarra and Malouin, 2014). It is also found that, therapeutic use of Ampicillin, Amoxicillin, Doxycycline, Oxytetracycline and Tetracycline singly are very less frequent than quinolones groups of antibiotics such as Enrofloxacin and Ciprofloxacin, though sometimes used combinedly, but could not full fill farmer's expectation. Amoxicillin, Doxycycline, Oxytetracycline, Tilmicosin and Colistin were used routinely, for prophylaxis, in different surveyed farms. Amoxicillin and Colistin is a critically important and Doxycycline and Oxytetracycline are highly important antimicrobials (WHO, 2011; George *et al.*, 2012). Although Tilmicosin is not used in humans but considered analogous to macrolide group, therefore, could drive resistance (George *et al.*, 2012). The United States Food and Drug Administration (FDA) has approved the use of Amoxycillin, Doxycycline, Oxytetracycline and Tilmicosin in food-producing animals (Wellcome Trust, 2015; Seventh ESVAC Report, 2017; WHO, 2017). Colistin did not used in animals in the United States of America (EMA, 2016) by 2016. Colistin is currently considered to be the last defense against multidrug resistant bacteria (Walsh *et al.*, 2016). In China, use of Colistin in food animal production have resulted Colistin-resistance *mcr-1* gene by *Escherichia coli* (Liu *et al.*, 2016; Lancet, 2016). As a result, very recently, China banned the use of Colistin in animals (Walsh *et al.*, 2016). Therefore, it is certain that, in Bangladesh perspective frequent use of Colistin in raising broiler meat may be attributed to the Colistin-resistance *mcr-1* gene by *Escherichia coli.* In 2019, the drug administration of Bangladesh has banned single use of Colistin in poultry production. It is found that, therapeutic use of macrolide is common in poultry (broiler) farms of the study area though the Dutch government has restricted macrolide use in Dutch farms that raise chickens for meat between 2014 and 2015, British farmers reduced antibiotic use by 27% when raising chickens for meat (Welcome Trust, 2015). Most farmers (cent percent) have faith on personal knowledge and experience during antibiotic administration instead of seeking Veterinarian advice, even 22% farmers furnished treatment depending on their own decision. These finding are almost similar to the findings stated by Boamah *et al.* (2016). 68% of the farmer administered antibiotics as per suggestion of the agro-based companies or feed and chick supplier. It was also observed that farmers who sought veterinary advice from different agro-vet industries are more likely to use higher frequencies of antibiotic-containing agents for treatment and prevention of infections, as they are corporate people. The administration of antibiotics by such individuals could lead to under-dosing or over-dosing of antibiotics in birds (Chowdhury *et al.*, 2009; Maron *et al.*, 2013). In several European countries such as The Netherlands, Denmark, Norway and Sweden, the administration of antibiotics to food animals are strictly under the supervision of a veterinarian (Cogliani *et al.*, 2011). Bangladesh does not have enough Veterinarians to enforce such regulations and rules. Ethics, rules and regulation in regard to use of antibiotic drugs are not strictly followed in Bangladesh. Government has to ensure the appropriate use of antibiotics. Farmers are required to observe a withdrawal period after administration of antibiotics during which products from their farms are not to be sold (Darwish *et al.*, 2013; Mirlohi *et al.*, 2013). This study showed that over 84% of the farmers sold their broiler for meat purposes before withdrawal period of drug residue, in Ghana, which is 60% (Boamah *et al.*, 2016). This gap might be due to differences of socioeconomic status and label of awareness among farmers about antibiotic resistance and its impact on public health, as 91% farmers have the educational status under school secondary level and 100% farmers in our study area are found very unaware about antibiotic resistance (ABR). It is also observed that Veterinarians are influential in the use of antibiotics on farms and improvement in delivery of veterinary services could significantly decrease the use and possible misuse of antibiotics on these farms. Also, monitoring farmers access to antibiotics by instituting surveillance systems may lead to a decline in the use of antibiotic-containing agents on poultry farms. There is the need for policies and stricter regulations that would limit illegal access to antibiotics. Policy makers must also introduce programmes that would monitor the importation,

sale, distribution, use and consumption of antibiotics in animal production in Bangladesh. We propose that the extent and nature of antibiotic use in animals and birds should be officially and openly reported by each farm, sector and country. Also, the labels on animal products should contain information on antibiotic footprints. These measures may encourage a reduction in antibiotic use globally and lead to a reduction of drug-resistant bacteria. Misuse and random use of antibiotics is considered as the most important factor for emergence of antibiotic resistance. In this study, it is found that haphazard uses of antibiotics in broiler farming are very common. The misuse of antibiotics in poultry rearing has also been associated with the spread of antibiotic resistance (Carlet *et al*., 2012) which is in accordance with the findings of this study. Despite the increasing resistance of pathogenic bacterial strains in Bangladesh (WHO, 2017) there are only a few reports on antibiotics used in poultry production particularly in broiler industry, how they are used and possible factors influencing their selection, hence the need for this study but to get complete scenario it is essential to conduct a further study in a great extent.

In this situation, government should forward the activities concerning antibiotic resistance, the farms should be brought under direct supervision of government recruited registered veterinarian and farm personnel such as farm owners and caretaker/ managers should be adequately trained to perform such responsibilities. The administration of the correct dose of an antibiotic is as important as the completion of the antibiotic course. Incompletion of antibiotic treatment courses exposes the microorganisms to sub-inhibitory concentrations of the antibiotic (Davies and Davies, 2010; Kohanski *et al*., 2011) which leads to the development of resistance. The fact that only 43% of the selected farms completed the required antibiotic courses. This was also in accordance with the findings of Boamah *et al*. (2016) conducted a study in Ghana. This might be due to the absence of veterinarians on farms to supervise antibiotic administration or lack of knowledge on the farmers part on the outcome of such practices (Garforth, 2015) as we found by analyzing the socio-economic status of the farmers that 91% farmers have an educational status below secondary school level and 90% of them did not participated any training before coming this occupation. No monitoring or surveillance concerning antibiotic resistance (ABR) and haphazard and misuse of antibiotics from any government and non-government organization are observed. Therefore, regulatory authorities must take rigorous steps to curtail inappropriate use of numerous drugs for animal use in order to provide safe animal origin food to humans.

Conclusions and Recommendations

It is concluded that, Enrofloxacin, Ciprofloxacin, Levofloxacin, Azithromycin, Cephalexin, Erythromycin, Neomycin, Amoxicillin and Collistin were found most commonly used antibiotics. Different factors such as poor educational status and knowledge, trust on personal cognizance and tendency to follow agro-vet companies suggestion are mainly the factors govern farmers to select antibiotics. No programme concerning build mass awareness about antibiotics resistance was found. Therefore, controlling authorities must take rigorous steps to control the uses of antibiotics in broiler industries, to stop the misuse of antibiotics, to ensure proper veterinary service at marginal farmer's level and building mass awareness about ABR and its impact on public health.

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Author's Contribution

This research was conducted under the direct supervision of the first author- (Md. Saiful Islam Siddiqui). Sharmin Akter and Mohd. Riajul Islam conceived of the presented idea, verified the analytical methods and supervised the findings of this work. All authors discussed the results and contributed to the final manuscript writing.

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Ethics approval and consent to participate

- All experimental protocols were approved by the

institutional organization (Sylhet Agricultural University Research System (SAURES).
- Informed consent was obtained from birds owners before all experiments.
- All methods are reported in accordance with institutional guidelines (Sylhet Agricultural University Research System (SAURES) for the reporting of animal experiments.
- Informed consent was obtained from all subjects and/or their legal guardian(s) in regard to human data.

Availability of data and material

The datasets generated and/or analysed during the current study are not publicly available due to funder/institutional obligation but are available from the corresponding author (msisiddiqui2000@yahoo.com) on reasonable request.

Code availability

N/A

Consent for publication

Not applicable.

Conflict of interest

The authors have declared no conflict of interest.

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