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The dynamics of anticoccidial drug usage in poultry within Umuahia, Abia state, Nigeria

CJ Okonkwo[1]* & EC Uwalaka[2]

[1.] *Department of Veterinary Medicine, College of Veterinary Medicine, Michael Okpara University of Agriculture, Umudike, Nigeria*

[2.] *Department of Veterinary Parasitology and Entomology, College of Veterinary Medicine, Michael Okpara University of Agriculture, Umudike, Nigeria*

*Correspondence: Tel.: +2348164843428; E-mail: chidi707@yahoo.com

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Abstract

Coccidiosis is one of the most important parasitic diseases of poultry worldwide. Chemotherapy remains the principal means to control this disease albeit the increasing problems of drug resistance. The aim of this study was to examine the drug usage of anticoccidials in the six communities of Umuahia, Abia state. Data such as type, class and composition of drugs used, level and frequency of usage, route of administration and anticoccidial program adopted by different farms were collected from 85 poultry farms within the study region. Results showed that the ionophores anticoccidials were not in use whereas the sulphonamides constituted the bulk of the drugs used (79.3%). Others were; thiamine analogue (21.1%), aminopyrimidine (33.7%), guanidine (14.4%), pyrimidine derivative (15.1%) and nitroimidazol (8.6%). Most of the drugs (>60) contained vitamin A and K. The most popular drug combinations were sulphaquinoxaline and diveradine with vitamin A and K (Embazine Forte) among thirteen trade-marked drugs under use. Close to 25.0% of farms practiced shuttle program and the rest continuous program of administration. Anticoccidials were administered through in-water medication for prophylactic and therapeutic use, and for both in the different farm applications in 43.5, 27.7 and 31.8 (%) respectively. The lack of usage of the ionophores and the massive use of sulphonamides coupled with low application of the right anticoccidial programs in this region presents a serious danger of anticoccidial resistance with consequent high prevalence of the disease.

Keywords: Anticoccidials, Coccidiosis, Drug resistance, Ionophores, Poultry, Sulphonamides

Introduction

Avian coccidiosis is an enteric parasitic disease caused by multiple species of the protozoan parasite belonging mainly and almost exclusively to the genus *Eimeria* in poultry. A few other coccidia of poultry belong to other genera, namely Isospora, Tyzzeria and Wenyonella. Coccidiosis is one of the most common and economically most important diseases of poultry worldwide (Adene & Oluleye, 2004; Shirley *et al*., 2005; Olarenwaju & Agbor, 2014). The annual loss due to coccidiosis to the global poultry industry has been estimated to be in excess of US$ 3 billion

(Dalloul & Lillehoj, 2006; Ola-Fadunsin & Ademola, 2013).

Coccidiosis is usually controlled by a combination of good hygienic practices, chemoprophylaxis and vaccination, although there is a rising problem of drug resistant strains of *Eimeria* (Chapman, 2000, 2014; Adewole, 2012). Chemotherapy involving the use of anticoccidial drugs over the past years has been employed as ingredients in medicated food or drinking water and has played a major role in the growth of the poultry industry (Klotz *et al*., 2005). These drugs can be classified as synthetic drugs (chemicals) and polyether ionophores (fermentation products of Streptomyces and other fungi species). The recent anticoccidial drugs used in the control of coccidiosis are diclazuril and toltrazuril which are synthetic drugs (Chapman, 1999). Whereas synthetic drugs act by destroying the intracellular stages of the parasite once it has invaded host cells in the intestine. The polyether antibiotics or ionophores destroy coccidia by interfering with the balance of important ions like sodium and potassium (Peek & Landman, 2011). The third category of anticoccidials include a few drug mixtures, consisting of either a synthetic compound and ionophore or two synthetic compounds (Markazi, 2015). Most of these drugs would provide the needed efficacy as long as the right choice of drugs can be made and all those factors which lead to resistance are put under check. However, no existing anticoccidial has been able to override the propensity for drug resistance which has become widespread in the parasite (Peek & Landman, 2011). The indiscriminate and inappropriate use of these anticoccidial agents has further compounded the problem of drug resistance (Mund *et al*., 2017). A study conducted in the South Western part of Nigeria by Arowolo et.al. (2012) on the awareness and usage of anticoccidials indicate a high level of awareness dominated by very high usage of synthetic anticoccidials and minimal application of ionophores. A similar work conducted in Aba and Umuahia by Okonkwo and Ogbonna, (2015), on the pattern of antimicrobial usage in poultry farms highlighted a high level of antimicrobial misuse. The aim of this study was to examine the drug usage of anticoccidials within six communities of Umuahia, Abia state.

Materials and Methods

Study area

The study was carried out in Umuahia, Abia state in the South – East of Nigeria. The study area comprises of two local government areas - Umuahia North and Umuahia South of which six communities were involved. It lies within the latitude and longitude of 4.4’6.1”N and 7’8”E respectively with a mean annual rainfall of about 187.7mm/year which is intense from April to October.

Study population

The study population includes all the identifiable poultry farms most of which were small holding units with capacity ranging from 100 to 6000 birds per farm. The 85 farms investigated in Umuahia included 8, 20, 13, 9, 13 and 22 from Ohiya, Ibeku, Olokoro, Umuopara, Ohuhu, and Ubakala respectively. The birds consisted of 34,542 broilers, 16,100 pullets, 20,008 layers, and 6,900 turkeys making a total of 87,500 birds encountered during the course of the investigation.

Method

A structured questionnaire was designed to collect qualitative and quantitative data on anticoccidial drug usage, including classes and components of drugs, prophylactic and chemotherapeutic applications of the drugs, method of administration, route and duration of administration and types of control programs adopted. The active components of the drugs used were noted. Results were tabulated as percentages and frequencies, and subjected to descriptive analysis.

Results

Anticoccidial contents

Six classes of these drugs used are shown, (Table 1). Most of them are sulphonamides with sulphaquinoxaline making up 57% of the total drug usage. Results also showed that whereas some of the drugs: amprolium, toltraziunil, diaclazuril and metronidazole were used alone oftentimes; most others were used in combination. Sulphonamides and diaveradine which composed of the bulk of the drugs were the most combined of the anticoccidials as shown, (Table 2). Thirteen trade-marked anticoccidials are in us in the region but most of them were similar in their anticoccidial content. However, the most patronized were those supplemented with vitamin K which made up nearly 60% of the entire usage.

Anticoccidial usage pattern

Out of the three programs of anticoccidial administration; i.e. shuttle, rotation and continuous, only the shuttle and continuous are practiced in the region. Whereas 21(24.7%) farms adopted the shuttle method, the rest relied on the continuous anticoccidial administration method as their preferred therapy wherein same drug is used indefinitely until the drug becomes ineffective before they change to another. With regard to mode of administration, all the anticoccidials were administered in water and none in feed. Purpose of usage showed that 37 (43.5%), 21(24.7%) and 27(31.8%) of the respondents used anticoccidials as prophylaxis, chemotherapy, and for both purposes respectively. Duration of anticoccidial application in poultry usually ranges from three to five days with the exception of the guanidines that often requires two days. In this study, 41(48.2%) followed this protocol, 7 (8.2%) used the drugs for up to seven days while 31(36.5%) administered the drug for one or two days. The rest of the farmers, 6 (7.1%) had no defined duration of anticoccidial application.

Discussion

Coccidiosis is the most common enteric parasitic disease of poultry and therefore a major constraint to successful poultry farming in Nigeria and indeed worldwide (Lawal *et al*., 2016). The use of drugs is indispensable in the control of the disease if we are to achieve sustainable poultry production (Kadykalo *et al*., 2018). From the results, the use of ionophores in this environment is none existent. In other words; only synthetic anticoccidials are used in the study

Table 1: Classes and components of anticoccidial usages

Classes of drug	Components	Frequencies	Percentages (%)
Sulphonamides	Sulphaquinoxaline	76	57. 0
	Sulphamrazine	13	9.3
	Sulphadimidine	28	21.0
Thiamine analogue	Amprolium hydrochloride	34	22. 1
Aminopyrimidine	Diaveradine	48	33. 7
Guanidine	Toltrazuril	7	5. 3
	Dicalazuril	8	6.0
Pyrimidine derivative	Trimrthoprine	11	9.1
Nitroimidazole	Metronidazole	6	4. 6

Table 2: Specific anticoccidial presentations, combinations, frequencies and percentages of usage

Drug Composition	Trademark	Frequencies	Percentages %
Toltrazuril	Tolcox®	7	5. 3
Diclazuril	Coczuril®	8	6. 0
Amprolium hydrochloride	Amprol® Coccsol® Amprocare® Amproline–300®	12	9. 0
Metronidazol	Flagyl®	6	4. 6
Amprolium & Vit K	Amprolmix-K®	8	6. 0
Sulphaquinoxaline, Amprolium + Vit A & K	Amprocox®	11	8. 3
Amproluim& Furaltadone	Koksidex®	3	2. 3
Toltrazuril & Enrofloxacin	Coccitreat®	4	3. 0
Toltrazuril& Emosdepside	Procox®	3	2. 3
Sulphadimidine,Sulphaquinoxaline,Diveradine, Vit K & A	Vitacox Plus®	22	16. 5
Sulphaquinoxaline, Diveradine & Vit. K	Embazin-Forte® Coxstop®	26	19. 5
Sulphadimerazine, Sulphaquinoxaline, Pyrimethamine, Furaltadone, Vit. A &K	Pantacox® Agracox®	12	9. 0
Trimetoprime & Sulphadimidine	Diaziprim®	5	3. 8
Trimetoprime & Erythromycin	Ext-mix®	6	4. 6

region. This situation is akin to the findings of Arowolo *et al*. (2012), where the use of none ionosphore anticoccidials were largely patronized in the study region. This could be due to none availability of this class of drug within the region which invariably could be linked to the relatively high cost of this class of anticoccidials. Also, its non-compatibility with sulphonamides (Noack, 2019) which constitutes the bulk of anticoccidial usage in this environment can also be another reason why the drug manufactures are not including them as anticoccidial components. This is against the backdrop that polyether ionophore have been the preferred drug for coccidiosis prevention as they are known to achieve sufficient control despite resistance being common. In addition, they can be used in combination with live virulent vaccines hence ionophore tolerant resistance strain would probably have a wider application of the development of anticoccidial vaccines (Danforth, 2000). Therefore, ionophore will have the advantage of preventing infection during the first 3 – 4 weeks of age when immunity is not developed. Additionally, the antibacterial properties of ionophore can equally reduce the incidence of necrotic enteritis which is oftentimes associated with coccidiosis (Vermeulen *et al*. 2000; Chapman *et al*. 2002). Since ionophores are only used in livestock but not employed for any purpose in human medicine, they are therefore, not included in the WHO list of medically important antimicrobials. Consequently, their use is not an issue for public health (Tang *et al*., 2017; WHO, 2017). It has been advocated therefore that these ionophores continue to play major roles in anticoccidial programs of commercial broilers either alone or in shuttle program with chemical anticoccidial drugs if consistent efficacy and performance are to be maintained (McDougald, 1982; McDougald *et al*., 1990).

From the results, sulfonamide usage accounts for almost 80% of anticoccidial therapy in the region, though, most are in combination. As the first effective anticoccidial agent, sulphonamides have been evaluated extensively. It has been made popular due to its cheapness and affordability within the region where it equally constitutes the bulk of antibiotics in use (Okonkwo & Ogbonna, 2019). However a number of the sulphonamides including the most widely used sulphaquinoxaline has been reported to be associated with marked decrease in weight gain in broilers, severe anemia in chickens, depression in egg production and different pathology of the spleen, liver, bone marrow and thyroid gland (Chapman & Jeffers, 2015; Chapman *et al*, 2016). The use of this class of drug for largely *E. tenella* induced infections may rather be unproductive and economically wasteful because of the acute nature of *E. tenella* infections and the obvious side effects.

The finding in this study revealed that combinations containing vitamin K were the most patronized (Table 2), is not unconnected with the fact that majority of the coccidiosis in the region is caused by *E. tenella* (Okonkwo et. al., 2019), a form associated with severe hemorrhage. This observation can also be attributed to the preference of sulphaquinoxaline, the most consistently used components as shown in Table 2 which has been linked to inhibition of intestinal synthesis of the vitamin K, (Liguoro et. al., 2010) a very important clotting factor.

Shuttle and rotational programs have been employed often to combat the problems of anticoccidial resistance. The use of anticoccidial vaccines in a rotational program with anticoccidial drugs is often used to minimize the risk of anticoccidial drug tolerance or resistance (Chapman, 2002; Chapman *et al*., 2010; Mathis & Broussard, 2005). However, the continuous use of a particular anticoccidial agent practiced by majority of the respondents as against 24.7% who adopted shuttle method will give much room for easy induction of drug tolerance and resistance, a situation that has already been noted in the region (Okonkwo *et al*., 2019).

Although the most widely used method for the control of coccidiosis in poultry is the in-feed application of anticoccidial products (Kadykalo, 2018), the results from this study showed that nearly all the farmers in the study region adopted the water medication. Propriety medicated feeds are readily available in the developed poultry producing countries (Adene & Oluloye, 2004) unlike what obtains in the developing regions. This makes anticoccidial incorporation in those countries easier especially the ionophores as this is the conventional method of its administration (Olejnik *et al*., 2013). This factor may be another reason for the low usage of ionophores within the study region. Water administration which appears to be the only method practiced in this area may be a problem as most coccidial drugs are neither palatable nor very soluble; a situation that can lead to the intake of a subnormal dose of the agent and consequently drug resistance. Prophylactic rather than therapeutic usage has been the more effective method of application of anticoccidials. They are usually in starter rations for meat type broiler raised under the floor-pen management (Kant, 2013). Therefore, the nearly 25%

usage of anticoccidial only for therapy is not a welcome development as the damage might have been done before the drug is introduced.

In conclusion, there is a very high sulphonamide usage spurred by its easy accessibility with its attendant side effects. The use of ionophores is none existent in poultry in this region. This poor drug choice or availability is accompanied with lack of proper anticoccidial programs and drug application dynamics. These may be consequent on lack of awareness, poor information systems and low utilization of professionals. This situation may give rise to a high prevalence of coccidiosis as already being speculated in the area. Thus, the selection and usage of anticoccidials should not be based on its ability to improve weight gain, feed conversion, and suppression of the development of lesions only, but should also ensure that drug resistance is kept at bare.

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