



Survey of antimicrobial residue in table EGGS among layer poultry farmers in Maiduguri metropolis, Borno state

Haruna Baba Galadima^{1*}, Yaqub Ahmad Geidam², Bala Usman Shamaki³, Hauwa Ibrahim Abdulrahman⁴, Bulama Ibrahim⁵ and Ali Waziri⁶

¹Dept. of Animal Health and Production, College of Agriculture Gujba, Damaturu, yobe state, Nigeria

²Dept. of Vet. Medicine, Faculty of Veterinary Medicine, University of Maiduguri, Borno state, Nigeria

³Dept. of Vet. Pharmacology and Toxicology, University of Maiduguri, Borno state, Nigeria

⁴Dept. of Vet. Medicine, Faculty of Veterinary Medicine, University of Maiduguri, Borno state, Nigeria

⁵Dept. of Vet. Physiology & Biochemistry, University of Maiduguri, Borno state, Nigeria

⁶Dept. of Vet. Pathology, University of Maiduguri, Borno state, Nigeria

haruna5539@yahoo.com

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Abstract

The objectives of this study is to survey for antimicrobial usage and to assess the antibiotic used pattern among poultry layer farmers in Maiduguri Metropolis Borno state Nigeria. Multistage sampling technique was use together with structured interviewer questionnaire. Coordinates of each farm selected was recorded and map showing spatial distribution of randomly selected farm was constructed. Data were analysed using Statistical package for social science. It was found that majority of the farmers 30 (85.7 %) admitted the use of antibiotic for disease prevention, 29 (82.9 %) of the farmers were not aware of antibiotic residue in table eggs and 34 (97.1 %) of the farmers were not aware of public health effect of antibiotic residue. It was deduce that there is indiscriminate use of most antibiotics in layer farms in Maiduguri Metropolis, There is poor knowledge of drug withdrawal period by farmers and poor awareness on passage of antibiotics from hen to eggs and its public health significance. Prohibited antibiotics for use in food producing animals such as nitrofurans and Chloramphenicol and unapproved antibiotic for use in laying hens such as Sulfonamide, doxycycline, streptomycin, gentamycin and ampicillin are very much in use in the study area. It was recommended that farmer education on the use of antibiotics and its public health implication should be given priority in the study area. Antibiotics being a prescription drug should not be freely sold to farmers over the counter. The established Veterinary Directorate in National Agency for Food and Drug Administration and Control should ensure the control of importation and subsequent use of antibiotics prohibited for use in food animals.

Keywords: Layer poultry farm, antimicrobial, Maiduguri metropolis, survey, questionnaire.

Introduction

Antibiotics are chemical substances derived from biological sources or by chemical synthesis in the laboratory, and they are able to kill or inhibit the growth of microorganisms¹. Antibiotics are administered parentally, orally or topically². Antibiotics are classified according to their effects (bactericidal or bacteriostatic) and also according to their range of efficacy (narrow or broad spectrum) or based on their mode of action (inhibitors of cell wall synthesis, inhibitors of protein synthesis, inhibitors of membrane function, anti-metabolites and inhibitors of nucleic acid synthesis)³. Antibiotics use in poultry farming started over a century for prevention, treatment of bacterial infection and growth promotion^{2,4,5}. In layer hens, antibiotics are only used to treat and prevent bacterial infections⁶. Currently, majority of all food-producing animals receive medication for part or most of their lives^{7,8}. Over the years the problem of antibiotic residue in food producing animals and their effect on human health has been a major concern⁵. The residue in chicken

eggs are of concern because few drugs are label for used in laying hens even though several medications are approved for other classes of poultry production^{9,10}. The overall relationship between antimicrobial used in food animals and resistance have been established¹¹. Self-medication with antibiotics, use of human antibiotics in food animals and non-regulated prescriptions are the most common causes of residue and may have contributed to antibiotic resistance scourge in the poultry industry in Nigeria¹². Geidam *et al.*¹³ reported in Maiduguri that antibiotics are freely marketed without veterinary prescription with tetracycline being the commonly abused antibiotic by poultry farmers.

Layer farming as an entity in Maiduguri Metropolis Borno state of Nigeria have not been surveyed with regards to antibiotic usage. According to codex Alimentarius commission very few drugs are approved for used in laying hens and that strictly prompted the need to assess the pattern of antimicrobial used among layer farmers in Maiduguri Metropolis, Borno state of Nigeria.

Materials and methods

Study area: This study was conducted in Maiduguri Metropolis the capital of Borno state in the North eastern part of Nigeria in the month of January 2016. It is the largest city in the North Eastern part of country¹⁴. The city is bounded in the North by Jere Local Government Area, in the West, south and South-West by Konduga Local Government Area, in the North-West by Mafa Local Government Area (Figure-1)¹⁵. It has an altitude of about 300 meters above sea level. Its geographical coordinates are 11° 50'42" North and 13° 09'36" East. The climate of Maiduguri is characterized by a long dry season with high evaporation rate from October to May and a short Wet season for the remaining part of the year. However the native of the city identify four seasons. Crop production and livestock farming are the predominant occupation of the people¹⁶. Poultry

layer production is a profitable business in Maiduguri Metropolis¹⁶.

Study design: Multi stage sampling method was used in selecting layer farms for questionnaire survey.

Maiduguri metropolis is divided into 4 major areas by Borno state water board namely Bolori, Gwange, Kyarimi Park, and Shehuri North¹⁷. In this study, these areas were taken as the primary sampling units. In each area mention above 50% of sub areas were selected and sampled as secondary sampling units. Fifty percent of laying poultry farms within each secondary sampling unit were randomly sampled and taken as tertiary sampling units. Geographical coordinates of the sampled areas were taken and recorded. A spatial distribution analysis of the layer farm sampled were constructed (Figure-1).

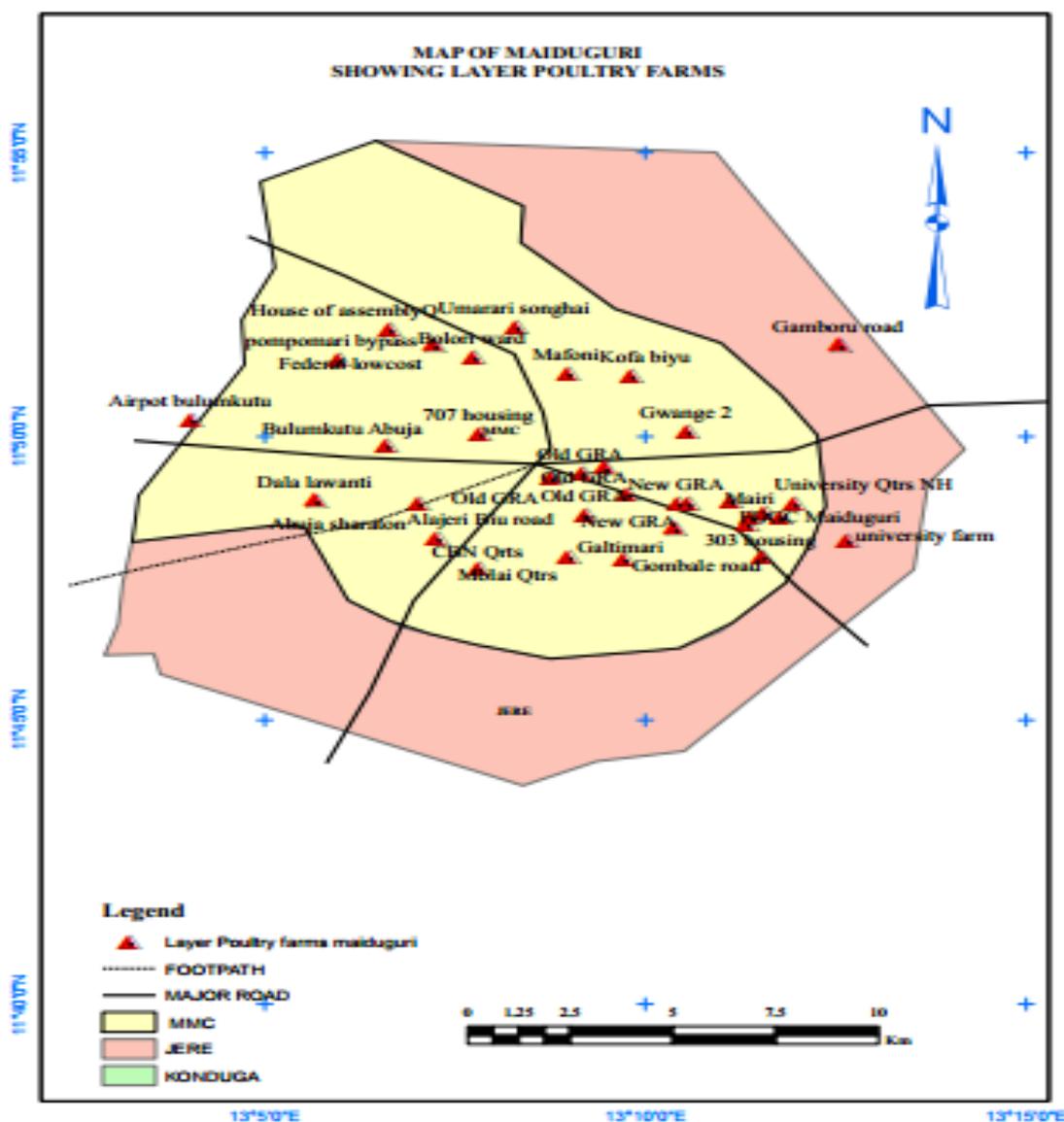


Figure-1: Map Showing Spatial Distribution of Sampled Farms in Maiduguri Metropolis, Nigeria.

Questionnaire survey: Structured interviewer administered questionnaire was designed and administered to 35 randomly selected layer poultry farmers for the purpose of collecting information on the use of antimicrobials, awareness of withdrawal period, awareness of antibiotic residue in table eggs and awareness of any known health effect of antibiotic residue to public health. Empty sachet and bottles of used antimicrobial drugs were collected and recorded.

Statistical analysis: Data were analysed using Statistical package social science Version 21. Descriptive statistic and Chi-square @ 95% confidence interval was used to determine the relationship between variables at P value < 0.005.

Results and discussion

Total of 35 layer poultry farmers were interviewed, 28 (80%) of the respondents have tertiary education, 5 (14.3%) and 2 (5.7%) have secondary and informal education respectively (Table-1). Majority of the farmers are small scale peasants (94.3%) having equal or less than 500 birds in their farms.

Most of the interviewed participants (85.7%) acknowledged that they often apply antibiotics for prevention of diseases. 71.4 % farmers were aware of drug withdrawal period, twenty nine (82.9%) of them were not aware of antibiotic residue in table eggs and 97.1% were not aware of the public health importance of the residue. There is significance (P=0.0004) association between level of education and awareness of public health implication of the residue.

Discussion: Majority (85.7%) of the layer farmers in Maiduguri Metropolis use antibiotic for prevention of disease in their farms. The extensive use of antibiotic by the farmers in the study area might not be unconnected with the lack of knowledge on biosecurity mostly attributed to small scale poultry farmers in the study area. The Same finding was reported by Omeiza *et al.*¹⁸ which state that small scale farmers used drug more often due to frequent experiences of poultry diseases as a result of poor bio-security.

Other investigators in Nigeria, Sudan and Tanzania have findings that are different from the result of this work who attributed the extensive antibiotic usage to large scale layer production farming^{19,20,21}. Flake and Ashitey²² had also noted that poultry farmers adopted antibiotics as preventive medication to compensate for biosecurity measures. High prophylactic use of antibiotic was reported in Nigeria^{18,23}, Sudan²⁴, Tanzania²⁵ and Uganda²⁶.

The study also revealed that despite strict observance of vaccination by majority of the farmers (82.9%), greater percentage of the farms (91.4%) had history of disease outbreaks which might be as a result of vaccine failure and or poor management. Vaccine failure among poultry farmers was reported in Abia State²⁷.

Table-1: Response to questionnaire survey on the use of antibiotics in layer farms in Maiduguri Metropolis, Borno State, Nigeria.

Survey Questions		Respondents (%)
Source of birds	Zartech	15 (42.9)
	Full Hope	1 (2.9)
	Crown Hatchery	2 (5.7)
	B note	2 (5.7)
	Otta farm	9 (25.7)
	ECWA farm	6 (17.1)
Educational qualification	Tertiary education	28 (80)
	Secondary education	5 (14.3)
	Informal education	2 (5.7)
Farm size	≤ 500 birds	33 (94.3)
	≥ 500 birds	2 (5.7)
Breeds of birds	Black Harco	8 (22.9)
	ISSA Brown	24 (68.6)
	More than one breeds	3 (8.6)
Feeds supplements and multivitamins	Multivitamins only	17 (48.6)
	Antibiotic only	2 (5.7)
	Multivitamins and antibiotics	16 (45.7)
Vaccination	Yes	29 (82.9)
	No	6 (17.1)
History of disease outbreak	Yes	32 (91.4)
	No	3 (8.6)
Prophylactic use of antibiotic	Yes	30 (85.7)
	No	5 (14.3)
Awareness of drug withdrawal period	Yes	25 (71.4)
	No	10 (28.6)
Awareness of antibiotic residue in table eggs	Yes	6 (17.1)
	No	29 (82.9)
Awareness of public health effect of antibiotic residue	Yes	1 (2.9)
	No	34 (97.1)

This finding is similar to reports of Sirdar *et al.*²⁰ and Mubito *et al.*²¹ who reported 89% and 100% awareness in Sudan and Tanzania respectively but it is important to note that El-Nasri *et al.*²⁴ reported awareness level of 36% in Sudan. In this study Most farmers (82.9%) do not believe that drugs can pass from chicken to eggs and ninety seven 97% are not aware of any public health problem related to antibiotics residue. This is contrary to the finding of Fagbamila *et al.*¹⁹ who reported 87.1% awareness of antibiotic residue by poultry farmers in Jos which might not be unconnected with large scale layer production an attribute of farming in Jos Plateau state. In a similar finding in Sudan by Sirdar *et al.*²⁰ eighty five (85%) of the farmers are not aware of antibiotic residue and its public health effect on human also the findings of El-Nasri *et al.*²⁴ in Sudan agree with the findings of this research with 94% of the farmers not aware of antibiotic residue in table eggs and its public health effect.

The survey found that tylodox (tylosin and doxycycline) and Neofuramycine plus (furazolidone, chloramphenicol, neomycine, erythromycine, oxytetracycline and streptomycine) are the most commonly used antibiotic by the farmers 51.4% and 34.3% respectively (Table-2 and appendix). This may be attributed to availability of these antibiotics in most of the drug stores in the study area. The finding of Annan-phrah *et al.*²⁸ in Ghana indicated the popularity of Tylodox usage among layer poultry farms. Among the ingredient of Tylodox and Neofuramycine (appendix), doxycycline and streptomycine are unapproved antimicrobials in laying hens while furazolidone and chloramphenicol are prohibited substance in food animals due to their long withdrawal period, carcinogenic and mutagenic effect^{29,30}. The study also showed that tetracycline (68.1%) and aminoglycoside (45%) were the most popular classes of antibiotics used by layer farmers in the study Area. (Figure-2). The popularity of tetracycline and aminoglycoside might be due to their affordable price and availability either as single parent drug or in combinations with different antimicrobial agents, vitamins and minerals. In a similar study by Geidam *et al.*¹³ in Maiduguri showed that tetracycline and aminoglycoside were the most popular classes of Antibiotics used by poultry farmers. Other investigators from different parts of Nigeria have also reported the popularity of tetracycline among layer farmers^{18,19,31-34}.

The popularity of tetracycline in other countries among poultry industry was also reported in Tanzania^{21,35}, In Sudan^{20,24}, In Kenya³⁶, in Kuwait³⁷ and In Saudi Arabia^{38,39}.

The study observed that antimicrobial agents that are prohibited for use in food-producing animals like Nitrofurans (furazolidone, furaltadone, nitrofurazone and nitrofurantoin) and chloramphenicols were used in layer poultry farms in Maiduguri Metropolis which is similar to the report of Geidam *et al.*¹³ which confirmed the use of furazolidone by poultry farmers in Maiduguri, Adebowale *et al.*¹² in Ogun state and Ezenduka *et al.*³² in Enugu State. While the use of chloramphenicol by poultry farmers was reported in Kaduna¹⁸. These antibiotics are

prohibited within European (Commission Regulation 1995), USA, Codex Alimentarius Commission (WHO/FAO) and Nigeria (NAFDAC, 1996)⁴⁰ for administration in food producing animals due to their carcinogenic and mutagenic effects. The study also observed that unapproved Antibiotics in laying hens such as sulfonamides, doxycycline, streptomycin, gentamycin, and ampicillin were widely use in laying farms in the study area. This might not be unconnected with the lack of awareness among farmers and unqualified staff and poor regulation on the use of such agents.

Table-2: Types of antibiotics used and their approval status by Codex Alimentarius Commission (CAC) in laying hens in Maiduguri, Metropolis, Borno State Nigeria.

Antibiotics	No. of Farms Positive (%)	*Regulatory status by CAC	
		Allowed	Not allowed
Keproceryl [®]	2 (5.7)	No	Yes
20% CTC [®]	2 (5.7)	Yes	No
Tylodox [®]	19 (51.4)	No	Yes
Neofuramycin [®]	12 (34.3)	No	Yes
Oxyfuravite [®]	7 (20)	No	Yes
Samoxine [®]	4 (11.4)	Yes	No
Oxywin [®]	1 (2.9)	Yes	No
EST [®]	5 (14.3)	No	Yes
Neotreat [®]	5 (14.3)	Yes	No
Bidox [®]	2 (5.7)	No	Yes
Ancoceryl [®]	2 (5.7)	Yes	No
NCO [®]	7 (20)	No	Yes
Centre-flor [®]	2 (5.7)	No	Yes
Triple powder [®]	1 (2.9)	No	Yes
Tetracin [®]	1 (2.9)	Yes	No
Amoxitin [®]	1 (2.9)	No	Yes
EmbaZine Forte [®]	2 (5.7)	No	Yes
Amprococ [®]	1 (2.9)	No	Yes
Neoceryl [®]	5 (14.3)	Yes	No
Doxy-Gen20/20WSP [®]	2 (5.7)	No	Yes
Admacine [®]	1 (2.9)	No	Yes
Iodoceryl [®]	2 (5.7)	No	Yes
22		7	15

*CAC= Codex Alimentarius Commission.

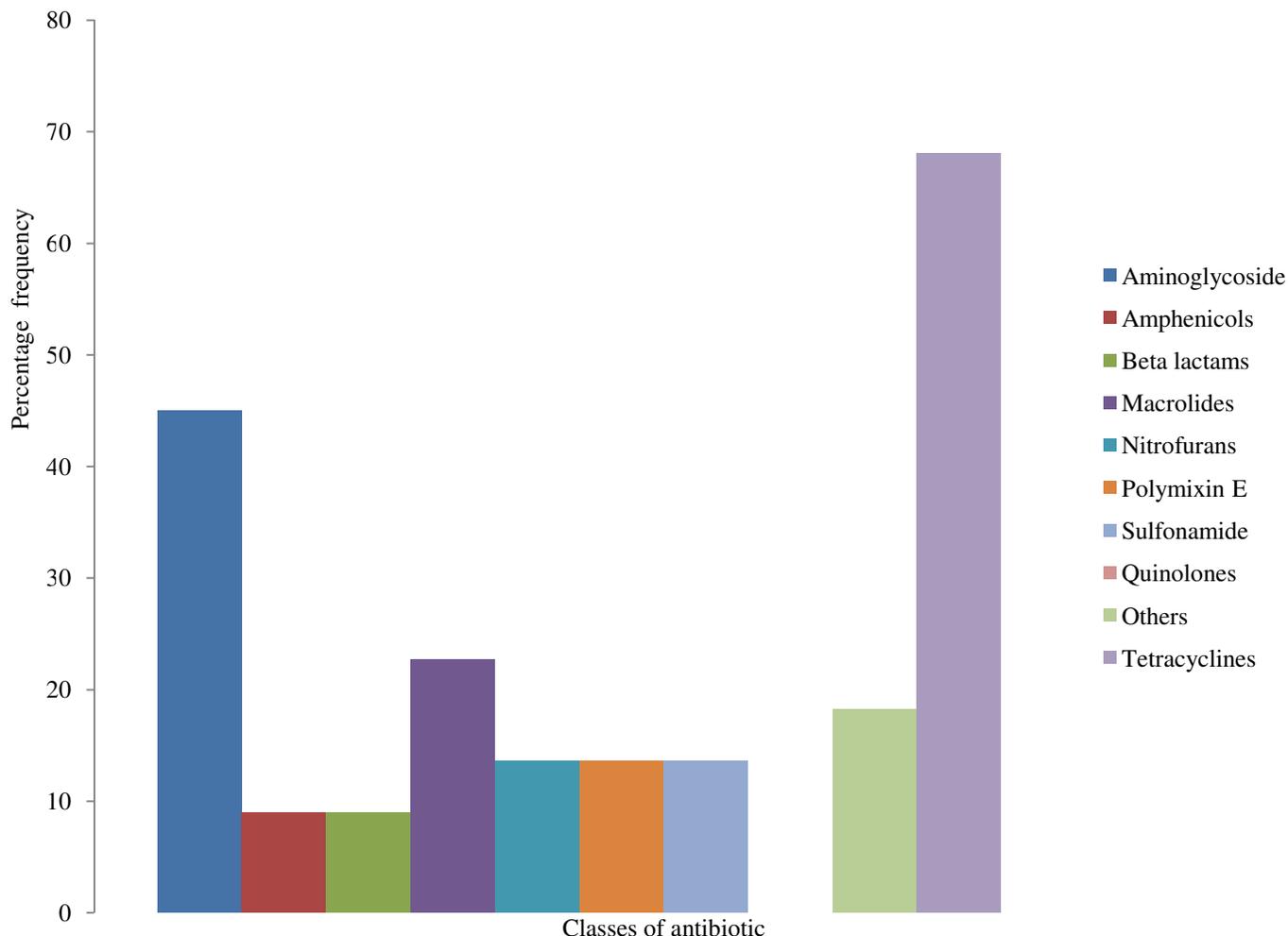


Figure-2: Classes of antibiotics used in layer chicken farms in Maiduguri Metropolis, Borno State Nigeria.

The survey also found that most farmers (71.4%) are aware of drug withdrawal period in food animals but do not observe it in their farms. One possible reason for failure to observe withdrawal period by farmers is lack of knowledge on the public health implications of drug residues in animal by-product and lack of knowledge regarding the passage of drugs from chicken to eggs.

Conclusion

From this study it was concluded that: i. There is small flock size (back yard) farm in Maiduguri with 94.3 % of the farmers holding equal or less than 500 birds in their farms. ii. There is poor knowledge of drug withdrawal by farmers and poor awareness on passage of antibiotics from chicken to eggs and its public health significance. iii. Prohibited antibiotics for use in food producing animals such as nitrofurans and Chloramphenicol and unapproved antibiotic for use in laying hens such as Sulfonamide, doxycycline, streptomycin, gentamycin and ampicillin are very much in use in the study area.

Recommendation: Based on the findings of the study the following recommendation should be put into practice: i. Farmer education on the use of antibiotics and its public health implication. ii. Antibiotics being a prescription drug should not be freely sold to farmers over the counter. iii. The established Veterinary Directorate in NAFDAC should ensure the control of importation and subsequent use of antibiotics prohibited for use in food animals.

Conflict of interest Statement: I affirm that all the authors have seen and agreed to the submission of paper and their inclusion o name as co-authors.

Significance Statement: The study discover that prohibited antibiotics like Nitrofurans and chloramphenicol are patronized by layer poultry farmers in their laying hens and this study will help the researcher to quantify the residue level of Nitrofurans and chloramphenicol and unapproved antibiotics in commercial eggs meant for human consumption.

Appendix: Antibiotics in Use in Maiduguri Metropolis- Trade Names and their Compositions

Drugs (Trade name)	Antibiotics ingredients
Iodosteryl	Active iodine 55mg/100ml
Keproceryl	Colistin sulphate 225000 I.V, Oxytetracycline HCl 50mg, Erythromycine thiocyanate 35mg, Streptomycin sulphate 35mg, Vitamins and Minerals.
20% CTC	Chlortetracycline hydrochloride 20%
Tyloxid Extra WSP	Tylosin tartarate 20g and Doxycycline hyclate 15g
Admacine	Ampiciline Trihydrate 64% and Aluminum magnesium silicate.
Neo- furamycine plus	Furazolidone 6000mg, Neomycine sulphate 200mg, Oxytetracycline 500mg, Streptomycine sulphate 200mg, Erythromycine 3500mg, chloramphenicol 2000mg, vitamins and Minerals.
Oxyfuravite	Oxytetracycline HCl 20000mg, Furaltadone HCl 20000mg and Vitamins.
Samoxine	Oxytetracycline HCl 55mg
Oxywin	Oxytetracycline HCl 55mg
EST	Erythromycine thiocyanate 180mg, sulphadiazine sodium 150mg and trimethoprim 30mg
Neotreat	Oxytetracycline 60mg, Neomycine sulphate 40mg, Vitamins and Minerals.
Bidox	Neomycine sulphate 100mg and Doxycycline hydrochloride 100mg
Ancoceryl	Oxtetracycline HCl 100mg, Neomycine sulphate 20mg, Vitamins and minerals
NCO	Neomycine sulphate, Chloramphenicol and Oxytetracycline HCl
Centre –flor	Florfenicol soluble powder 20%
Amoxy-COL WSP	Amoxicillin trihydrate and Colistin sulphate
Triple powder	Chlortetracycline HCl 100mg, Neomycine sulphate 30mg, and Furaltadone 75mg.
Tetracin	5% Oxytetracycline Hydrochloride
Amoxitin	Amoxicillin trihydrate 114.8mg and Colistin Sulphate 0.25 M.I.U.
Embazin forte	Sulphaquinoxaline 9.4g, Diaveridine 0.98g and Vitamin K 0.053g
Amprococ	Amprolium chlorohydrate 200mg, Sulfaquinoxaline 150mg and Vitamins
Topcoc Forte	Sulphaquinoxaline 9.4g, Diaveridine B.P.V 0.98g and Vitamin K.
Neoceryl plus	Erythromycine thiocyanate 3500mg, Oxytetracycline 5000mg, Stretomycine sulphate 3500mg, Neomycine sulphate 1000mg and Colistin sulphate 2500,000 I.U and Vitamins.
Amprococ	Amprolium 200mg, Sulphadimidine sodium 200mg and Vitamin K 30mg
Tylo 200 WSP	Tylosin tartrate 200mg
Neimycine egg formular	Oxytetracycline HCl 55mg, Vitamin and Minerals
Neo-oxy egg formular WSP	Oxytetracycline HCl 6000mg, Neomycin sulphate 4000mg, and Vitamins and Minerals and Amino Acids

Intergendox	Doxycycline hyclate 100mg and Gentamycine sulphate 50mg
Antibacterial	Chloramphenicol,
Coryl SP	Chlortetracycline 500mg, Erythromycine 3000mg, streptomycine 2000mg, Neomycine sulphate 2000mg, Vitamins and Minerals.
Anidone (CRD)	Erythromycine 200mg, Tylosin tartarate 200mg, Eluesin Extract 200mg, and Excipient
Lay Wright Egg formular	Oxytetracycline HCl 6.5g. Vitamins and Minerals and Excipients
BIO-ETS	Erythromycine thiocyanate 180g, Trimethoprim 33.3g and sulfadiazine sodium 166.6g
Vitaseryl	Colistin sulphate 30,000,000 IU, Oxytetracycline HCl 50,000mg, Erythromycine 25,000mg, Streptomycine sulphate 3400mg, Neomycine sulphate 1000mg, Vitamins and Mineral
Interseryl	Erythromycine thiocyanate 35mg, Oxytetracycline HCl 50mg, Streptomycine sulphate 35mg, colistin sulphate 200,000 I.U, Vitamins and Minetals
Biocox	Amprolium hydrochloride 400mg ascorbic acid 150mg, sulphadimidine Na, Menadion and sodium bisulfide 50mg.
Doxy-Gren 20/20 WSP	Doxycycline 200mg and Gentamycine 200mg.

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