

## Residues of streptomycin antibiotic in commercial layers in Abeokuta and Ibadan metropolis

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### Abstract

*Old layers sold for human consumption in six open markets in Abeokuta and Ibadan metropolis of Ogun and Oyo States of Nigeria were analyzed for the presence of residues of streptomycin antibiotic. One hundred and twenty samples comprising of muscle (thigh and breast), liver and kidney tissues were subjected to microbiological assay technique for the detection of residues of the antibiotic. The assay was done on antibiotic medium 5 agar with Bacillus subtilis (ATCC 6633) organism. Results showed that 34.17% of the sampled birds were positive for the presence of streptomycin antibiotic. The concentration of the residues ranged between 0.18 µg/g and 0.91 µg/g. The mean residue levels recorded among the organs are not significantly different ( $P > 0.05$ ). Some of the muscle samples recorded residue concentration levels higher than the W.H.O recommended maximum residue level for streptomycin antibiotic in muscle tissue of food animals. In view of the importance of antibiotics in the treatment of bacterial diseases in both human and animals, it is advocated that the use of these drugs in food animals be done judiciously.*

**Keywords** Streptomycin, layers

### Introduction

The development of the poultry industry has been described as the fastest way of ameliorating the animal protein deficiency problem in Nigeria, due to the high turn-over rate associated with poultry production and its consequent economic efficiency (Akinokun, 1990).

In the poultry industry, the desire to increase production level necessitated the use of various feed additives as growth promoters, chiefly among which are the antibiotics. Antibiotics are incorporated into poultry feed at sub-therapeutic levels in order to increase growth rate, improve feed utilization and reduce mortality. These

drugs are also used for therapeutic purpose. The antibiotics commonly used in animal husbandry include tetracycline and streptomycin (Brander *et al.*, 1982; Oguntona, 1989; Oyekanle and Owonikoko, 2002; Proudfoot *et al.*, 1982). Feeding antibiotics to food animals can however constitute health hazards to the consumers. This is because residues of these drugs may appear in meat and meat products available for human consumption. These are not mere food contaminants, but that which is injurious to the health of the consumers. The risk posed to health includes allergic reactions in sensitive individuals (Huber, 1986). There is also the danger of increase prevalence of antibiotic-resistant bacteria, which may cause human

resistant bacteria, which may cause human disease (Schothrost *et al.*, 1978). In view of these public health hazards, it is important to investigate food animals for residues of antibiotics. Reports have been made on the presence of tetracycline antibiotic in commercial eggs (Dipeolu *et al.*, 2000) and marketed layers (Dipeolu and Osikalu, 2002). This study thus investigated layers sold for human consumption for the presence of streptomycin antibiotic.

## Materials and Method

### *Sample collection*

Chicken muscles and visceral organs of liver and kidney were used for the study. Live culled layers (30) were purchased from open markets in Abeokuta and Ibadan metropolis in Ogun and Oyo States respectively. The chickens were purchased from three markets from each of the towns of study (five chickens per market). Thereafter (immediately after purchase), the chickens were slaughtered and 120 samples of muscle (from thigh and breast), liver and kidney were aseptically collected from these birds. The samples were carefully labeled and stored at 4°C prior to analysis.

The control samples also comprising of chicken muscles, liver and kidney were collected from old layers produced at the Teaching and Research Farms of the University of Agriculture, Abeokuta (UNAAB). Antibiotics were not administered to the birds three months prior to the study and throughout the study period. The feed given to the birds during this period was also free of antibiotic additive.

### *Analysis of Layers for residues of streptomycin antibiotic*

The samples were analyzed for residues of streptomycin antibiotic using the microbiological assay procedure (agar diffusion method), a modification of the procedure described by Inglis and Katz (1978).

#### *(i) Preparation of plate*

The assay medium is Antibiotic medium 5 (Difco®) agar. 25.5g of the agar was

dissolved in 1L of distilled water. This was thoroughly homogenized with electromagnetic stirrer on a homogenizer (Ika-Combi, MGT RCT). The agar was then sterilized at 124°C for 30min in an autoclave (Prestige® medical series 2100). The sterilized agar was thereafter cooled to a temperature of 60°C and the test organism *Bacillus subtilis* (ATCC 6633) aseptically inoculated and thoroughly mixed. The preparation of the organism was done according to Inglis and Katz (1978), and 5ml of the diluted spore suspension was inoculated into 1L of the agar. The seeded agar was then aseptically poured on sterile petri dishes (Sterilin®, with diameter of 9cm), uniformly mixed and allowed to set on a level surface. Wells of 1.0cm were bored into the hardened agar with micropipette tip. The plate was used within 1hr of hardening.

#### *ii. Preparation of meat sample*

Twenty five grams of meat sample was thoroughly homogenized with 100ml of phosphate buffer (pH 8.0) in a blender. The homogenized meat was then centrifuged at 4000rpm for 10min at room temperature. Thereafter, 1ml of the supernatant was aseptically inoculated into the well bored in the seeded antibiotic medium 5 agar. The plate was thereafter incubated at 37°C overnight and zones of bacteria growth inhibition measured with vernier calipers. The concentration of the residues of streptomycin in the samples was determined by extrapolation from standard curve prepared for streptomycin antibiotic using standard solutions of 0.05µg/ml, 0.75µg/ml, 1.0µg/ml, 1.5µg/ml and 2.0µg/ml of streptomycin (Greenfield International®). The data generated from the study were analyzed statistically using the Analysis of Variance technique (Minitab, 1993).

## Results and Discussion

Residues of streptomycin were recorded in 34.17% of the samples analyzed. This result shows that streptomycin antibiotic is not being judiciously used in poultry production. The occurrence of residues in the samples may be due to incomplete metabolism and excretion of streptomycin from the birds before they were

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slaughtered. Streptomycin residues were also reported in meat (beef, pork and mutton) sold for human consumption in the areas of study (Dipeolu and Alonge 2002). None of the control samples was positive for the presence of residues of streptomycin.

Table 1 shows the residue levels recorded in the layer samples. The concentration of the streptomycin residues in the tissues ranged from 0.18µg/g to 0.91µg/g. While all the chickens sampled from market 2 in Abeokuta were

positive for streptomycin residue, none of the samples from market 6 in Ibadan was positive. The act of medicating birds with antibiotics (popularly known as "capsule") in the markets by the sellers does occur, especially where the hygienic condition is poor. This may be responsible for the higher occurrence of residues observed in birds from Abeokuta. The medication of these birds might also have been done on the farm before they were culled.

**Table 1** *Residue levels of streptomycin antibiotic in layers (µg/g)*

Location	Organs			
	Muscle			
	Breast	Thigh	Liver	Kidney
<u>Abeokuta</u>				
Market 1	0.31	0.91*	-	-
	0.35	0.68*	-	-
	-	-	-	-
	-	-	0.18	-
	-	-	-	-
Market 2	0.26	0.28	0.35	0.35
	-	-	0.33	0.25
	0.35	0.35	0.33	0.38
	0.25	0.26	0.38	0.68
	-	0.31	0.53	0.63
Market 3	-	-	0.31	0.22
	0.31	0.46	-	-
	0.33	0.22	-	0.29
	0.18	0.28	0.41	-
	-	-	-	0.25
<u>Ibadan</u>				
Market 4	0.41	-	0.41	-
	-	-	-	-
	-	-	-	-
	-	-	-	-
Market 5	-	-	-	-
	-	-	0.68	0.25
	-	-	-	-
	0.53*	-	-	0.41
	-	-	-	-
Market 6	-	-	0.31	0.31
	-	-	-	-
	-	-	-	-
	-	-	-	-

\*: streptomycin residue concentration above WHO (1995) recommended MRL

The mean concentration of the residues in one organ is not significantly ( $P>0.05$ ) higher than that of others. Also location of purchase of birds

played no significant role in streptomycin residue deposition in the layer birds (Table 2).

**Table 2** Mean concentrations of streptomycin residues in layers ( $\mu\text{g/g}$ )

	Mean residue levels ( $\mu\text{g/g}$ )	SEM
<b>Organs</b>		
Breast Muscle	0.3350	0.044
Thigh Muscle	0.2825	0.081
Liver	0.3658	0.039
Kidney	0.2069	0.055
<b>Location</b>		
Market 1	0.2856	0.119
Market 2	0.3565	0.031
Market 3	0.3017	0.083
Market 4	0.2050	0.100
Market 5	0.3371	0.082

SEM : Standard error of mean.

The W.H.O. (1995) recommended Maximum Residue Levels (MRLs) (that can be tolerated by the consumers) for streptomycin antibiotic are  $0.5\mu\text{g/g}$  for muscle tissues and  $1.0\mu\text{g/g}$  for liver and kidney tissues. While none of the visceral organs recorded residue levels above the recommended, thigh muscles from market 1 ( $0.91\mu\text{g/g}$  and  $0.68\mu\text{g/g}$ ) and breast muscles from market 5 ( $0.53\mu\text{g/g}$ ) recorded residues at levels above the recommended value (Table 1). This is worrisome since muscle tissues are more important than the visceral organs to the poultry consumers. The implication on public health is that the treatment of ailments with streptomycin antibiotic may be ineffective in the consumers of meat with such high residue levels. While residue levels below the recommended MRLs can be tolerated, zero antibiotic residue level as obtained in Japan (Cronin, 1998) is the most desirable. There is therefore the need for judicious use of antibiotics in poultry production. The use of enzymes for growth promotion can be substituted for sub-therapeutic use of antibiotics.

## References

- Akinokun, J. O. 1990. An evaluation of exotic and indigenous chicken as genetic materials for development of rural poultry production in Africa. *Proceedings of International Workshop on rural poultry development in Africa, held at Obafemi Awolowo University, Ile-Ife, Nigeria.* 13<sup>th</sup> – 16<sup>th</sup> November. 36 – 61.
- Brander, G. C., Pugh, D. M. and Bywater, R. J. 1982. *Veterinary Applied Pharmacology and Therapeutics*. Fourth Edition. The English Language Society and Bailliere Tindall, London. pp 305 – 400.
- Cronin, J. P. 1998. Antibiotic Residues at Muscle injection sites in cattle. Queensland Beef Industry. DPI. Queensland.
- Dipeolu, M. A., Akpan, N. J. and Olutayo, A. 2000. Residues of Tetracycline Antibiotic in turkey and eggs of chicken sold for human consumption. *Nig. Poult. Sci. J.* 1 (1) pp. 4 – 11.

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- Dipeolu, M. A. and Alonge, D. O.** 2002. Residues of Streptomycin Antibiotic in Meat Sold for Human Consumption in some States of SouthWestern Nigeria cattle. *Archivos De Zootecnia* 51 (196) pp. 477 – 480.
- Dipeolu, M. A. and Osikalu, R. O.** 2002. Tetracycline residues in marketed layer birds in Lagos and Ibadan metropolis. In “Contributory Role of Animal Production in National Development.” *Proceedings of the 7<sup>th</sup> Annual Conference, Animal Science Association of Nigeria (ASAN)*. September 16<sup>th</sup> – 20<sup>th</sup> University of Agriculture, Abeokuta Nigeria. A. O. Fanimu and J. A. Olanite (ed.) 55 – 57.
- Huber, W. G.** 1986. Allogenicity of Antibacterial Drug Residues. In “Veterinary Science and Comparative Medicine, A series. Drug Residues in Animals.” Andre, G. R. (ed.) Academy Press Inc. London. pp 33 – 50.
- Inglis, J. M. and Katz, S. E.** 1978. Determination of Streptomycin Residues in Eggs and Stability of Residues after Cooking. *Jour. Offic. Analy. Chem.* 61(8), 1098 – 1102..
- Minitab** 1989. Minitab Standard Version Release 7.1 Minitab Inc.
- Oguntona, T.** 1989. Performance and visceral organ weight of guinea fowl given different antibiotic and growth promotant. *Nig. Jour. Ani. Prod.* 16, 68-71
- Oyekunle, M. A. and Owonikoko, M. O.** 2002. Antimicrobial drug usage for poultry production within a local government area in Ogun State. *Nig. J. Anim. Prod.* 29 (1): 113-120.
- Proudfoot, F. G., Hulan, H. W., Jackson, G. D. and Salisbury, C. D. C.** 1990. Effect of liromycin as a growth promoter for broiler chicks. *Brit. Poult. Sci.* 31: 131-187.
- Schothorst, M., van Leusden, M. van and Neuws, J.F.M.** 1978. Antibiotic residues : regulations, tolerances and detection in the EEC. *J. Assoc. Offic. Analy. Chem.* 61: 1209 - 1213.
- W.H.O.** 1995. Evaluation of Certain Veterinary Drug Residues in Food. W.H.O Technical Report. Forty-third Report of the Joint FAO/WHO Expert Committee on Food Additives. 59

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