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ANTIBIOTIC AND SULPHONAMIDE RESIDUES IN SLAUGHTERED OSTRICH, DUCKS, GEESE AND TURKEYS

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SUMMARY

A total of 120 birds (thirty from each of: ostrich "*Struthio camelus*", ducks "*Anas plathyrhynchus*", geese "*Anser domesticus*" and turkeys "*Meleagris gallopavonis*") were collected from different farms in Egypt and freshly slaughtered except ostrich samples were collected from ostrich slaughter house to detect antibiotic and sulphonamide residues in muscles (breast and thigh muscles), internal organs (liver, kidneys, gizzard) and fat after slaughtering. The samples were examined by microbiological method (Agar diffusion test "inhibition test" by using cork borer) at pH 6.0 for detection of β-lactum, tetracycline and penicillin residues, at pH 8.0 for detection of aminoglycoside residues, and at pH 7.2 was used for detection of sulpha drug residues. Positive samples for antibiotic and sulphonamide residues were reexamined after heat treatment (boiling for 30 minutes). The obtained data proved that the high incidence of antibiotic and sulphonamide residues in slaughtered ostrich, ducks, geese and turkeys were detected in kidneys and liver samples then followed by other tissues. Also, it was found that the highest numbers of positive samples for residues in these birds were observed at pH 6.0, then followed by those at pH 8.0 and 7.2 respectively. After boiling, the incidence of some antibiotic and sulphonamide residues decreased in some samples and completely disappeared in other samples. The judgment of the examined samples as well as the public health hazards of the antibiotic and sulphonamide residues were discussed.

INTRODUCTION

Antibiotics and sulphonamides are still used in a large scale in veterinary field and poultry farms without control. In Egypt, ostrich farms start since

1997 and increased after that to about 55 farms in year 2000 with total populations of 4000 ostrich chicks and layers (Kamel et al., 2001). Sudden death problem is reported in ostrich chicks mainly aging from one day to 4 months old. Therefore administration of different antibiotics is high in these species. The problems of ostrich management and environmental conditions have been reported and also due to bacterial infection (Kamel et al., 2000). Today, interest in the economic importance of the ostrich as a food animal for meat and egg- production makes it necessary to carry out research and expand the available information regarding different medical and management problems related to this bird.

The majority of the ostrich farm owners in Egypt were inexperienced in ostrich diseases. The subtherapeutic use of antimicrobial drugs has played an important role in animal husbandry by controlling diseases, improvement of growth and efficiency of feed conversion. The importance of the withdrawal times of antibiotics as a safe way for avoiding the residues in human foods of animal and poultry origin was stressed by different authors (Anadon et al., 1990 and Mignot et al., 1993). The elimination of anitibiotics from poultry tissues has important public health significance. The ingestion of meat containing antibiotic residues may cause harmful effects such as allergic phenomena, sensitization and antibiotic resistance. (Ionova and Zhecheva, 1977; Grossklaus, 1978 and Daoud and Yanny, 2000). Some antibiotics have residues in poultry tissues and may cause hazardous to human health derived from the consumption of these tissues and organs. Cooking or cold storage may alter the chemotherapeutic residues in the edible tissues (El-Razzaz, 1980; Booth and McDonald, 1988 and Daoud, 1996). Generally antibiotic assay can be conducted either by chemical procedures or by bacteriological techniques.

The bacteriological estimation of antibiotic residues can be carried out either by the diffusion plate assay or by the turbidometric assay method (Daoud and Yanny, 2000). The diffusion plate assays depend upon the diffusion of the antibiotics in tissues containing antibiotic residues from reservoirs on the agar surface. The reservoirs may be holes cut into the agar , metal cylinders (cups) or paper disc (Farid, 1982 and Bridson, 1995). The holes cut in agar were done by Daoud (1991), El-Gamel (1992) and Daoud (1995), while the cork borer method was done by El mossalami et al. (1985); Daoud (1996) and Yassien et al. (1996).

The aim of this work is to detect antibiotic and sulphonamide residues in different tissues and organs of the slaughtered ostrich, ducks, geese and turkeys from Egyptian poultry farms, as well as the effect of heat treatment (boiling) on tissue residues.

MATERIAL AND METHODS

1. Collection of samples:

A total of 120 birds (each thirty from: ostrich, ducks, geese and turkeys) were collected from different poultry farms in Egypt, but ostrich samples were collected from slaughterhouse of ostrich. After slaughtering, each bird was examined for the presence of antibiotic and sulphonamide residues in tissues and organs by microbiological method (Agar diffusion test "inhibition test" by using cork borer according to Levetzow and Weise (1979).

2. Preparation of samples:

Samples were taken from muscles of breast and thigh, internal organs (liver, kidneys and gizzard) and fat from each bird after slaughtering. From each sample a cyclindrical piece (9 mm in diameter and 2 mmthickness) was removed and replaced by a sterile cork borer.

3. Determination of antibiotic residues in slaughtered birds:

3.1 Inhibition test:

The technique recommended by Levetzow and Weise (1979) was applied.

3.2. Preparation of strain suspension:

Bacillus subtilis (BGA) which was obtained from Fedral Health Office, Berlin, Germany, was used for detection of antibiotic and sulphonamide residues. Suspension of the strain was prepared according to Levetzow (1978).

3.3. Media used for detection of antibiotic residues:

Antibiotic media No. 1 was obtained from El-Nasr Pharmaceuticals Chemicals Company, Egypt. It was used for detection of antibiotic and sulphonamide residues. The adopted technique was that recommended by Levetzow and Weise (1979). The media was divided in three portions, the first portion was adjusted at pH 6.0 for detection of β-lactum, tetracycline and penicillin residues. The second portion was adjusted at pH 8.0 for detection of aminoglycoside residues, e.g. tylosin, dihydrostreptomycin, erythromycin and gentamicin. The third portion was adjusted at pH 7.2 for detection of sulpha drug residues. Trimethoprime has been added because it allows the detection of sulphonamides in samples due to trimethoprime sulphonamide synergy. The trimethoprime solution was prepared according to the technique recommended by Levetzow and Weise (1979).

The medium was left to cool to 55 °C, then inoculated with the spore suspension of *Bacillus subtilis* (0.1 ml/100 ml nutrient agar), then the ingredients were poured on leveled flat bottomed petridishes and left till complete solidification.

3.4. Procedure:

Cylindrical pieces measuring 9 mm diameter

and 2 mm thickness were prepared from each sample under examination by means of sterile cork borer, then pieces were put diagonally on the surface of the freshly prepared *B. subtilis* plates: one at pH 6.0, the second at pH 8.0 and the last one at pH 7.2, then all plates incubated at 30°C for 24 hours. Diffusion of any present antibacterial substances will lead to formation of inhibitory zone around the sample in which growth of the test organism was inhibited.

3.5. Heat treatment of positive samples:

Positive samples from each bird were boiled at 100°C for 30 minutes and then examined for the presence of antibiotic residues.

4. Interpretation of the results:

After incubation for 18-24 hours at 30°C, the zones of inhibition concerning antibiotic and sulphonamides were accurately measured and the results were interpreted according to Levetzow and Weise (1979) as follows:

A zone ≥ 2 mm considered positive inhibition.

A zone from 1 to < 2 mm considered suspcious.

A zone < 1 mm considered negative.

Inhibition zones were measured from edge of meat samples to the edge of microbial growth.

5. Statistical analysis:

Statistical analysis were performed according to Petrie and Watson (1999).

RESULTS

Antibiotic and sulphonamide residues (mm) in tissues and organs of slaughtered ostrich before and after boiling were statistically analysed and summarized in table (1), slaughtered ducks were displayed in table (2), slaughtered geese were tabulated in table (3), slaughtered turkeys were illustrated in table (4), while judgment of antibiotic and sulphonamide residues in all examined samples were tabulated in table (5).

Table (1): Antibiotic and sulphonamide residues (mm) in tissues and organs of slaughtered ***Ostrich*** before and after boiling.

Examined tissues	pH 6.0				pH 8.0				pH 7.2			
	Before boiling		After boiling		Before boiling		After boiling		Before boiling		After boiling	
	No. of positive samples	$\overline{X} \pm$ S.E.	No. of positive samples	$\overline{X} \pm$ S.E.	No. of positive samples	$\overline{X} \pm$ S.E.	No. of positive samples	$\overline{X} \pm$ S.E.	No. of positive samples	$\overline{X} \pm$ S.E.	No. of positive samples	$\overline{X} \pm$ S.E.
Breast muscles	7	3.28 ± 0.184	4	2.75 ± 0.250	6	3.16 ± 0.166	3	2.66 ± 0.333	4	2.75 ± 0.478	2	2.50 ± 0.500
Thigh muscles	8	3.50 ± 0.188	4	3.12 ± 0.125	7	3.25 ± 0.250	4	2.76 ± 0.250	4	3.00 ± 0.471	2	2.66 ± 0.333
Liver	10	3.70 ± 0.152	6	3.16 ± 0.307	8	3.28 ± 0.184	4	3.00 ± 0.408	6	3.16 ± 0.307	3	2.75 ± 0.381
Kidneys	11	3.90 ± 0.162	6	3.21 ± 0.083	9	3.55 ± 0.175	5	3.10 ± 0.044	7	3.43 ± 0.297	4	2.85 ± 0.287
Gizzard	5	3.00 ± 0.408	2	2.50 ± 0.500	3	2.66 ± 0.666	0	0	2	2.50 ± 0.500	0	0
Fat	6	2.83 ± 0.307	3	2.33 ± 0.333	4	2.50 ± 0.500	0	0	3	2.33 ± 0.333	0	0

mm. : millimeter (zone of inhibition). No. of examined ostrich = 30 ± S.E.: Standard Error.
Boiling at 100°C for 30 minutes. $\overline{X}$: Mean values in mm.
N.B.: Non Significant varitions between values before and.after treatment by using "T" test.
$P > 0.05$.

Table (2): Antibiotic and sulphonamide residues (mm) in tissues and organs of slaughtered ***ducks*** before and after boiling.

Examined tissues	pH 6.0				pH 8.0				pH 7.2			
	Before boiling		After boiling		Before boiling		After boiling		Before boiling		After boiling	
	No. of positive samples	$\bar{X} \pm$ S.E.	No. of positive samples	$\bar{X} \pm$ S.E.	No. of positive samples	$\bar{X} \pm$ S.E.	No. of positive samples	$\bar{X} \pm$ S.E.	No. of positive samples	$\bar{X} \pm$ S.E.	No. of positive samples	$\bar{X} \pm$ S.E.
Breast muscles	11	3.36 ± 0.472	4	2.75 ± 0.250	8	3.00 ± 0.267	3	2.50 ± 0.288	5	2.50 ± 0.223	3	2.33 ± 0.333
Thigh muscles	13	3.15 ± 0.421	5	2.60 ± 0.244	6	2.83 ± 0.307	2	2.34 ± 0.015	6	2.40 ± 0.200	3	2.16 ± 0.166
Liver	17	4.64 ± 0.561	8	3.62 ± 0.263	9	4.05 ± 0.190	3	3.33 ± 0.333	8	3.37 ± 0.374	4	2.50 ± 0.288
Kidneys	19	5.31 ± 0.592	8	4.25 ± 0.250	10	4.16 ± 0.314	5	3.50 ± 0.500	10	3.75 ± 0.083	4	3.00 ± 0.577
Gizzard	10	3.40 ± 0.163	3	2.86 ± 0.433	7	3.17 ± 0.339	4	2.60 ± 0.355	5	2.60 ± 0.244	3	2.33 ± 0.333
Fat	5	2.80 ± 0.374	2	2.50 ± 0.500	6	2.60 ± 0.408	3	2.23 ± 0.117	4	2.25 ± 0.250	0	0

mm. : millimeter (zone of inhibition). No. of examined ducks = 30 ± S.E.: Standard Error.
Boiling at 100°C for 30 minutes. $\bar{X}$: Mean values in mm.
N.B.: Non Significant varitions between values before and after treatment by using "T" test.
$P > 0.05$.

Table (3): Antibiotic and sulphonamide residues (mm) in tissues and organs of slaughtered ***geese*** before and after boiling.

Examined tissues	pH 6.0				pH 8.0				pH 7.2			
	Before boiling		After boiling		Before boiling		After boiling		Before boiling		After boiling	
	No. of positive samples	$\overline{X} \pm$ S.E.	No. of positive samples	$\overline{X} \pm$ S.E.	No. of positive samples	$\overline{X} \pm$ S.E.	No. of positive samples	$\overline{X} \pm$ S.E.	No. of positive samples	$\overline{X} \pm$ S.E.	No. of positive samples	$\overline{X} \pm$ S.E.
Breast muscles	10	3.80 ± 0.440	4	2.80 ± 0.454	8	3.37 ± 0.421	4	2.50 ± 0.500	6	2.70 ± 0.412	3	2.33 ± 0.333
Thigh muscles	12	3.86 ± 0.445	5	2.90 ± 0.400	10	3.40 ± 0.305	4	2.52 ± 0.250	8	2.75 ± 0.188	3	2.33 ± 0.333
Liver	14	4.35 ± 0.707	5	3.80 ± 0.374	11	4.00 ± 0.233	4	3.25 ± 0.250	9	3.33 ± 0.288	4	2.50 ± 0.288
Kidneys	16	5.31 ± 0.669	7	4.14 ± 0.260	14	4.14 ± 0.293	6	3.30 ± 0.200	11	3.45 ± 0.247	5	3.16 ± 0.307
Gizzard	13	3.60 ± 0.180	4	2.75 ± 0.250	10	3.30 ± 0.152	3	2.50 ± 0,500	7	2.66 ± 0.274	2	2.33 ± 0.333
Fat	9	3.55 ± 0.304	5	2.50 ± 0.288	9	3.22 ± 0,254	4	2.40 ± 0.244	8	2.37 ± 0.182	3	2.27 ± 0.074

mm. : millimeter (zone of inhibition). No. of examined geese = 30 ± S.E.: Standard Error.
Boiling at 100°C for 30 minutes. $\overline{X}$: Mean values in mm.
N.B.: Non Significant varitions between values before and after treatment by using "T" test.
$P > 0.05$.

Table (4): Antibiotic and sulphonamide residues (mm) in tissues and organs of slaughtered ***urkeys*** before and after boiling.

Examined tissues	pH 6.0				pH 8.0				pH 7.2			
	Before boiling		After boiling		Before boiling		After boiling		Before boiling		After boiling	
	No. of positive samples	$\overline{X} \pm$ S.E.	No. of positive samples	$\overline{X} \pm$ S.E.	No. of positive samples	$\overline{X} \pm$ S.E.	No. of positive samples	$\overline{X} \pm$ S.E.	No. of positive samples	$\overline{X} \pm$ S.E.	No. of positive samples	$\overline{X} \pm$ S.E.
Breast muscles	15	4.13 ± 0.515	6	3.66 ± 0.333	13	3.30 ± 0.237	6	2.50 ± 0.223	10	2.90 ± 0.23	5	2.40 ± 0.244
Thigh muscles	12	3.16 ± 0.423	4	3.00 ± 0.408	11	2.72 ± 0.332	4	2.50 ± 0.288	7	2.57 ± 0.202	4	2.25 ± 0.250
Liver	17	4.64 ± 0.663	8	4.44 ± 0.652	15	3.60 ± 0.362	8	3.12 ± 0.295	11	3.26 ± 0.152	6	2.50 ± 0.223
Kidneys	19	5.10 ± 0.561	9	4.50 ± 0.327	16	4.06 ± 0.503	8	3.37 ± 0.182	13	3.69 ± 0.447	6	3.16 ± 0.401
Gizzard	11	3.13 ± 0.270	5	2.80 ± 0.200	9	2.66 ± 0.288	4	2.48 ± 0.205	8	2.37 ± 0.182	4	2.25 ± 0.250
Fat	10	3.10 ± 0.314	3	2.66 ± 0.333	8	2.62 ± 0.263	3	2.46 ± 0.371	7	2.28 ± 0.184	2	2.20 ± 0.500

mm. : millimeter (zone of inhibition). No. of examined turkeys = 30 ± S.E.: Standard Error.
Boiling at 100°C for 30 minutes. $\overline{X}$: Mean values in mm.
N.B.: Non Significant varitions between values before and after treatment by using "T" test.
$P > 0.05$.

Table (5): Judgment on antibiotic residues in examined samples (n=30).

Sample (spp.)	Positive samples												T.C.	
	Breast muscles		Thigh muscles		Liver		Kidneys		Gizzard		Fat			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ostrich "*Struthio camelus*"	7	23.3	8	26.7	10	33.3	11	36.7	5	16.7	6	20.0	8	26.7
Ducks "*Anas platyrhynchus*"	11	36.7	13	43.3	17	56.7	19	63.3	10	33.3	5	16.7	13	43.3
Geese "*Anser domesticus*"	10	33.3	12	40.0	14	46.7	16	53.3	13	43.3	9	30.0	12	40.0
Turkeys "*Meleagris gallopavonis*"	15	50.0	12	40.0	17	56.7	19	63.3	11	36.7	10	33.3	15	50.0

T.C.: Total Condemenation.
N.B.: Judgment on the examined samples was done according to ***Levetzow*** and ***Weise*** (1979).

DISCUSSION

Data presented in table (1) showed that the highest levels of antibiotic and sulphonamide residues in slaughtered ostrich were detected in kidney samples followed by liver, thigh muscles, breast muscles, gizzard and fat samples before and after boiling. The incidence of positive samples for antibiotic and sulphonamide residues in previously mentioned organs and other tissues before and after boiling were 36.66% and 54.54%; 33.33% and 60.00%; 26.66% and 50.00%; 23.33% and 57.14%; 16.66% and 40.00%; 20.00% and 50.00% at pH 6.0; respectively. While at pH 8.0 they were 30.00% and 55.55%; 26.66% and 50.00%; 23.33% and 57.14%; 20.00 and 50.00%; 10.00% and 00.00%; 13.33% and 00.00%; respectively. At pH 7.2, they were 23.33% and 57.14%; 20.00% and 50.00%; 13.23% and 50.00%; 13.33% and 50.00%; 6.66% and 00.00%; 10.00% and 00.00%; respectively.

Concerning the product of the samples after boiling, it was calculated on the positive samples only before heating. From the obtained results it could be concluded that the presence of antibiotic residues in tissues and organs may be due to bad hygienic condition of some ostrich farms which lead to lowering the body resistance and retard the withdrawal time of antibiotics. This held the view reported by Kamel et al. (2001).

From the obtained data in table (2) it was found that the highest mean values for antibiotic and sulphonamide residues in slaughtered ducks before and after boiling were detected in kidney samples followed by liver, gizzard, breast muscles, thigh muscles and fat samples. The percent of positive samples for residues in these organs and tissues before and after boiling were 63.33% and 42.10%; 56.66% and 47.05%; 33.33% and 30.00%; 36.66% and 36.36%; 43.33% and 38.46%; 16.66% and 40.00% respectively at pH 6.0. While at pH 8.0 they were 33.33% and 50.00%; 30.00% and 33.33%; 23.33% and 57.14%; 26.66% and 37.50%; 20.00 and 33.33%; 20.00% and 50.00% respectively. At pH 7.2, they were 33.33% and 40.00%; 26.66% and 50.00%; 16.66% and 60.00%; 16.66% and 60.00%; 20.00% and 50.00%; 13.33% and 00.00% respectively. The obtained data in table (2) were agreed with those obtained by Akulova (1964); Dvorak et al. (1978) and Lashev and Semerdzhiev (1983).

Results in table (3) revealed that kidney and liver samples recorded the highest levels for antibiotic and sulphonamide residues in slaughtered geese before and after boiling, then followed by thigh muscles, breast muscles, gizzard and fat samples. The percent of positive results in the previously mentioned samples before and after boiling were 53.33% and 43.75%; 46.66% and 35.71%; 40.00% and 41.66%; 33.33% and 40.00%; 43.33% and 30.76%; 30.00% and 55.55% respectively at pH 6.0, while at pH 8.0 they were 46.66% and 42.85%; 36.66% and 36.36%;

33.33% and 40.00%; 26.66% and 50.00%; 30.00% and 33.33%; 30.00% and 44.44%; respectively. At pH 7.2 they were 36.66% and 45.45%: 30.00% and 44.44%; 26.66% and 37.50%; 20.00%and 50.00%; 23.33% and 28.57%; 26.66% and 37.50%; respectively.

Data illustrated in table (4) declared that the highest mean values for antibiotic and sulphonamide residues in tissues and organs of slaughtered turkeys before and after boiling were in kidney samples followed by liver, breast muscles, thigh muscles, gizzard and fat samples. The incidence of positive samples for antibiotic and sulphonamide residues in these organs and tissues before and after boiling were 63.33% and 47.36%; 56.66% and 47.05%; 50.00% and 40.00%; 40.00% and 33.33%; 36.66% and 45.45%; 33.33% and 30.00% respectively at pH 6.0. At pH 8.0 they were 53.33% and 50.00%; 50.00% and 53.33%; 43.33% and 46.15%; 36.66% and 36.36%; 30.00% and 44.44%; 26.66% and 37.50%; respectively, while at pH 7.2 they were 43.33% and 46.15%; 36.66% and 54.54% 33.33% and 50.00%; 23.33% and 57.14%; 26.66% and 50.00%; 23.33% and 28.57%; respectively. Antibiotic residues were detected in tissues and organs of slaughtered geese and turkeys by some authores (Rolinski, 1967; Bickford et al., 1973; Dvorak et al. 1978; Ziv et al., 1979; Swezey et al., 1981; Skeels et al., 1985 and Scheer, 1987).

From the achieved results (Table 5) it is evident that ostrich samples 8 (26.7%) should be totally condemned. On the other hand 13 (43.3%) ducks samples recommended to be totally condemned. while 12 (40.0%) geese samples should be totally condemned. In case of turkeys, 15 (50.0%) of the examined birds must be totally condemned. Organs and fat in all examined samples having residues necessitate condemnation.

From the recorded data in tables (1,2,3 and 4), it was observed that the high incidence of antibiotic residues in slaughtered birds were recorded in kidneys and liver samples then followed by other tissues at pH 6.0, 8.0 and 7.2. This may be attributed to the fact that liver is responsible for metabolism and detoxication of the drug by its microsomal enzymes, but kidneys are responsible for filtration and clearance of the blood from any undesirable constituents. These results were greatly in accordance to those detected by Shakaryan et al. (1976); Arichimbault et al. (1978); Nouman et al. (1986); Daoud (1991); Daoud (1995); Hassan (1995); Daoud (1996) and Hassan (1998). It was also detected that the recorded positive cases for antibiotic and sulphonamide residues in tissues and organs were the highest at pH6.0, while they were the lowest at pH 7.2 in fresh and boiled samples. This means that pH 6.0 was the optimum one for the detection of the majority of the applied antibiotics in the Egyptian field. This might be attributed to the fact that every antibiotic has high effect at its suitable pH. These results were nearly in accordance with those recorded by Korkeala et

al. (1982) who stated that the greatest zone of inhibition was given at pH 6.0, then at pH 8.0 and pH 7.2. Data recorded in the present study showed that the antibiotic residues were diminished and decreased in positive samples after boiling for 30 minutes. This means that heat treatment had a destructive effect on some antibiotics. These results were inaccordance with those recorded by Yonova (1971); Scheibner (1972); Jukes (1973); Raseta et al. (1975); Vyhnalek (1975); O'brien et al. (1981); Daoud (1991); Amer et al. (1994); Daoud (1995); Hassan (1995); Daoud (1996); Rose et al. (1996) and Hassan (1998). The variations in antibiotic residues may be due to the differences in species, bread, age of poultry and dose of administration (Daoud, 1995). Different estimates had been made of the propensity of people to allergy in general (Fernston, 1959; Algrid, 1966; Corry et al., 1983 and Saunder, 1988). Residues could therefore be a source from these sites, so the incidence of antibiotic residues in slaughtered animals must be minimized (Nouws and Verdijk, 1991). From the obtained results (tables 1-4), it is concluded that the presence of antibiotic residues in tissues and organs of slaughtered birds may be due to slaughtering of birds without waiting until the withdrawal period of each drug is finished. The presence of antibiotic residues in muscles and organs of poultry indicated that its judgment should be total condemnation since it causes dangerous effects to consumers.

The public health risks due to antibiotic and sulphonamide residues lies in the following: Disorders in the physiological functions of intestinal flora; possible occurrence of strain resistance to antibiotics administrated in human therapy due to administration of cumulative doses of antimicrobial residues via meat; carcinogenic, mutagenic and teratogenic effects and possible occurrence of allergic syndrome e.g: skin rashes and hypersensitivity.

For the control of antibiotic and sulphonamide residues in meat, the following measures were recommended:

1. Testing birds presented for slaughtering for violative concentration of residues and prevent them from entering the food chain.
2. Administration of antibiotics should be done exclusively under veterinarian supervision
3. Meat containing antibiotic and sulphonamide residues can be used for manufacture by increasing time of heat treatment to ensure their destruction.
4. Provide the suitable withdrawal time before birds slaughtering to ensure safety and the complete disappearance of antimicrobial residues from their tissues and organs.

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