

DYNAMICS OF EXCRETION OF SULFONAMIDES FROM THE TISSUE OF FATTENING CHICKS

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The aim of this work was to establish the time of excretion of the three sulfonamides: sulfadimidine, sulfanilamide and sulfaguanidine down to the maximum permitted levels remaining in the organism of fattening chicks. Sulfadimidine, sulfanilamide and sulfaguanidine were administered to fattening chicks for a period of six days (from the 30th to 35th days of age in the amount of 100 mg per chick, in capsules) and residues sought in dark and white muscle and in the liver:

- it took six days for sulfadimidine to be eliminated from dark muscle (39.90 ± 0.47 mg/kg found on the first day after the termination of administration) down to the maximum permitted quantity (0.1 mg/kg), five days from white muscle (34.83 ± 0.91 mg/kg), and seven days from the liver (50.41 ± 0.35 mg/kg).

- it took five days for sulfanilamide to be eliminated from dark muscle (from 30.49 ± 0.41 mg/kg on the first day after termination of administration) to the maximum permitted quantity (0.1 mg/kg), five days from white muscle (19.92 ± 0.50), and seven days from the liver (40.43 ± 0.63 mg/kg).

- it took four days for sulfaguanidine to be eliminated from dark muscle (from 2.77 ± 0.21 mg/kg on the first day after the termination of administration), white muscle (1.81 ± 0.12 mg/kg) and the liver (4.38 ± 0.29 mg/kg).

Key words: chicken, dark muscle, white muscle, liver, sulfonamide, maximum permitted level

INTRODUCTION

Feeding of young chicks is intensive from the first day of life until the termination of the fattening period.

In addition to the basic nutritive substances, the feed also contains different and increasingly numerous additives which must not be harmful to animal health. The main role of the additives is to improve the nutritive value and utilization of the feed, stimulate growth, exert therapeutic and prophylactic effects and improve meat quality.

The use of preventive medicinal additives in feed for broilers is aimed at securing their good health and vitality during the fattening period. Without good health of the chicks there can be no satisfactory production of chicken meat,

especially on large chicken farms. Therefore, there are constant attempts to find suitable medicines for the treatment of a large number of chick diseases (Skubic, 1988).

In addition to other disease, one of the major health problems of fattening chicks is coccidiosis. That is why is why coccidiostatics are a regular addition to diets for fattening chicks. The coccidiostatics are often changed because of the larger number of types of Coccidae, irregular effects of coccidiostatics and the development of resistance.

Sulfonamides are employed in the prevention and treatment of coccidiosis. The use of sulfonamides for prophylactic and medicinal purposes in fattening chicks can be in the form of additives to feed mixtures or to drinking water as well as in the form of capsules of a suitable size for direct individual administration per os (Pierce, 1984; Reddy et al., 1988).

The use of sulfonamide medicines in fattening chicks requires great caution and expert responsibility because they can appear in the form of residues in meat and internal edible organs of chicks, which may be harmful for human health.

Therefore, the objective of this paper was to study the time of excretion from the organism down to the maximum permitted quantities remaining of three sulfonamides sulfadimidine, sulfanilamide and sulfaguanidine, which are used in our conditions in the industrial fattening of chicks.

MATERIAL AND METHODS

The experiments were carried out in an experimental facility of the Institute for Animal Husbandry Belgrade, Zemun. Chicks of the Hybro genotype were used for the experiment which lasted 42 days. A total of 180 chicks was included in the experiment, 45 in the control group and 45 in each of the experimental groups. At 30 days of age the first group of chicks were administered 100 mg of sulfadimidine in capsules daily for six days per chick, the second group 100 mg of sulfanilamide daily per chick and the third 100 mg of sulfaguanidine daily per chick. The chicks were sacrificed successively, starting from the 36th day of the fattening period, when sulfonamide administration was terminated, for determination of residue concentrations of sulfadimidine, sulfanilamide and sulfaguanidine in dark and white muscle and in the liver.

A total of 504 samples of dark and white muscle and liver were analyzed for sulfonamide residue content by the method of liquid chromatography under high pressure (HPLC).

RESULTS AND DISCUSSION

In these investigations the concentrations and dynamics of extraction of sulfonamides from the chick organism were different. Nevertheless, the mean concentration of each sulfonamide in dark and white muscle and in the liver of

chicks was the highest on the first day after termination of administration of medicine, and decreased every day during the 7 days research.

Tables 1, 2 and 3 show respectively the descending dynamics in the concentrations of sulfadimidine, sulfanilamide and sulfaguanidine in the dark and white muscle and in the liver.

Table 1. Mean concentrations of sulfadimidine in chick tissues depending on the period after termination of application (mg/kg).

Days	Dark muscle		White muscle		Liver	
	\bar{x}	$\pm Sx$	\bar{x}	$\pm Sx$	\bar{x}	$\pm Sx$
1. day	39.91	0.47	37.83	0.91	50.41	0.35
2. day	19.89	0.83	16.66	0.22	33.77	0.63
3. day	8.89	0.38	6.52	0.17	15.34	0.16
4. day	1.66	0.05	0.87	0.04	4.93	0.27
5. day	0.44	0.02	0.13	0.01	0.89	0.06
6. day	0.08	0.01	0.05	0.01	0.39	0.02
7. day	0.03	0.01	0.00	0.00	0.04	0.02

Table 2. Mean concentrations of sulfanilamide in chick tissues depending on the period after termination of application (mg/kg).

Days	Dark muscle		White muscle		Liver	
	\bar{x}	$\pm Sx$	\bar{x}	$\pm Sx$	\bar{x}	$\pm Sx$
1. day	30.49	0.41	19.92	0.50	40.43	0.61
2. day	10.17	0.54	7.51	0.28	32.77	0.73
3. day	4.40	0.21	3.30	0.22	21.40	0.80
4. day	0.86	0.04	0.61	0.05	9.25	0.42
5. day	0.11	0.01	0.07	0.01	1.82	0.12
6. day	0.03	0.01	0.02	0.01	0.83	0.04
7. day	0.00	0.00	0.00	0.00	0.05	0.01

Table 3. Mean concentrations of sulfaguanidine in chick tissues depending on the period after termination of application (mg/kg).

Days	Dark muscle		White muscle		Liver	
	\bar{x}	$\pm Sx$	\bar{x}	$\pm Sx$	\bar{x}	$\pm Sx$
1. day	2.77	0.21	1.81	0.12	4.38	0.29
2. day	0.95	0.02	0.72	0.03	1.55	0.26
3. day	0.22	0.02	0.15	0.01	0.51	0.04
4. day	0.10	0.01	0.05	0.01	0.13	0.01
5. day	0.02	0.01	0.02	0.01	0.08	0.01
6. day	0.01	0.04	0.00	0.00	0.02	0.01
7. day	0.00	0.00	0.00	0.00	0.00	0.00

It can be seen that at 7 days after termination of treatment residues of sulfadimidine and sulfanilamide were detected in the investigated samples. No sulfaguanidine was found in the investigated samples at 4 days after the termination of treatment.

Statistical analysis indicated that the difference between the concentrations of sulfadimidine, sulfanilamide and sulfaguanidine on the first day were very significant when compared with all other days for all tissues ($P < 0.001$). In the control group no residues of the three investigated sulfonamides were registered.

Many researchers have examined different types and doses of sulfonamides administered to healthy animals in order to determine the withdrawal period (Epstein, and Ashworth 1989; Westheimer, et al. 1971 and others). Thus, Yamamoto et al., (1979) administered therapeutic doses of sulfonamides to chicks in the drinking water for four days and found residues of sulfonamides in the liver after 3 days, in dark and white muscle after 7 days, and in plasma, adipose tissue and kidneys after 10 days.

Moreover, the results of a comparative investigation on three poultry species: 8 week old broilers, hens and ducks, showed some differences. Sulfonamides were given in the drinking water in the concentration of 0.2% for 7 days. Residues up to 0.1 mg/kg were found in the skin of broilers and hens after 8 days, and in the skin of ducks up to 14 days. The presence of residues was also established in other analyzed samples: after 5 days in muscle and in liver of broilers and hens, and after 7 days in liver and in kidneys of ducks (Adamszyk and Chmielowski, 1981).

Thus sulfonamides as a first order chemotherapeutic for the treatment and prevention of certain diseases can be found in different concentrations many tissues and fluids of the animal organism (Booth and McDonald, 1982; Delak, 1983; Yoshiyuki, 1986). An investigation (Dona et al., 1990) in which concentrations of sulfonamides higher than the permitted maximum were found in 40 out of total of 975 samples confirm this. In 7% of the samples the concentration of sulfonamides was below the maximum permitted limit while in 1.5% of samples the registered concentration of sulfonamides was extremely high, namely, above 50 mg/kg.

Concerning the different concentrations of sulfonamides found in the analyzed tissues and organs in fowls by other authors, there is a necessity for systematically monitoring and establishing the dynamics of sulfonamide elimination in every treatment as confirmed by this study.

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DINAMIKA IZLUČIVANJA SULFONAMIDA IZ TKIVA TOVNIH PILIĆA

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SADRŽAJ

Predmet ovog rada je bio da se utvrdi vreme izlučivanja iz organizma tovnih pilića do maksimalno dozvoljene količine tri sulfonamida-sulfadimidina, sulfanilamida i sulfagvanidina.

Na osnovu rezultata ispitivanja koncentracija sulfadimidina, sulfanilamida i sulfagvanidina davanih tovnim pilićima u trajanju od šest dana (od 30. do 35. dana uzrasta u količini od 100 mg u kapsulama po piletu) do maksimalno dozvoljenih količina u tamnijem i svetlijem mesu i jetri utvrđeno je:

- Eliminacija sulfadimidina iz tamnijeg mesa (39.90 ± 0.47 mg/kg prvog dana posle prestanka davanja) do maksimalno dozvoljene količine (0.1 mg/kg) trajala je šest dana, iz svetlijeg (34.83 ± 0.91 mg/kg) pet dana i iz jetre (50.41 ± 0.35 mg/kg) sedam dana.

- Eliminacija sulfanilamida iz tamnijeg mesa (od 30.49 ± 0.41 mg/kg) prvog dana posle prestanka davanja do maksimalno dozvoljene količine (0.1 mg/kg) i iz svetlijeg mesa (19.92 ± 0.50 mg/kg) trajala je pet dana, a iz jetre (40.43 ± 0.63 mg/kg) sedam dana.

- Eliminacija sulfagvanidina iz tamnijeg mesa (od 2.77 ± 0.21 mg/kg) prvog dana posle prestanka davanja, svetlijeg mesa (1.81 ± 0.12 mg/kg) i jetre (od 4.38 ± 0.29 mg/kg) trajala je četiri dana.

