Tissue Residue Depletion of Sulfaquinoxaline in Turkey Poults

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Sulfaquinoxaline was administered in the drinking water to turkey poults, 11–12 weeks old, at a prophylactic (0.0175%) or therapeutic (0.1%) dose for 7 days. Sulfonamide residues were determined in breast muscle, liver, kidney, skin, and blood serum at 0 (the morning following the last day of medication), 3, 5, 7, and 10 days posttreatment. Residue depletion was rapid although incomplete between 0 and 3 days withdrawal in all tissues. The most rapid depletion occurred in muscle tissues; residues persisted longer in liver, renal, and skin tissues. A withdrawal period in excess of 10 days is indicated for turkeys given sulfaquinoxaline at these dosages under the conditions of this study.

Sulfaquinoxaline is useful for the treatment of coccidiosis in chickens and for the prevention and treatment of this disease in turkeys (Merck Veterinary Manual, 1967). Losses due to fowl typhoid in turkeys can often be reduced by giving sulfaquinoxaline in the drinking water. Administration of this drug at 0.1 or 0.05% in the feed was shown to offer possibilities in the prevention of enzootic *Pasteurella* infections in chickens, although no recognizable curative properties were indicated (Delaplane, 1945). Sulfaquinoxaline, sulfamethazine, and sulfamerazine were markedly effective in the prophylaxis of experimental fowl cholera in turkeys; sulfaquinoxaline was the most effective at low intake levels (0.01%) (Peterson, 1948). Administration of sulfaquinoxaline at 1.5 g/10 lb of feed or 1.5 oz/gal of water protected 12-week-old turkeys against heavy inoculation of *Pasteurella multocida* organisms when given at the time of or before infection (Richey and Morgan, 1957).

Sulfaquinoxaline is preferred over the more common sulfonamides because of its greater accumulation and longer retention time in the blood (Schlenker and Simmons, 1950; Smith and Robinson, 1944). The high degree of binding to plasma proteins is believed to be related to the blood concentrations attained in chickens, as well as its ready penetration into the egg (Bankowski and Johnson, 1949).

Sulfonamide residues in tissues and eggs of chickens administered sulfaquinoxaline at therapeutic and prophylactic doses have been determined (Righter *et al.*, 1970). Residue depletion was most rapid in muscle and fat; residues persisted tor the longest time in renal tissues. Concentrations in egg yolks were high (greater than 0.1 ppm) at the tenth day after withdrawal.

Tissue residue levels of sulfonamides in turkeys are either obscure or lacking. This study was undertaken in order to determine the amount and duration of tissue residues of sulfaquinoxaline in turkey poults.

MATERIALS AND METHODS

Sixty turkey poults (11–12 weeks of age) were divided equally into three groups and housed in chicken houses. The sodium salt of sulfaquinoxaline was given in the drinking water to 20 birds at a recommended prophylactic dosage of 0.0175% for 7 days and to 20 birds at a therapeutic dosage of 0.1% for 3 days. Twenty birds served as controls and received no medication. All birds were fed a standard growing chick mash prior to and throughout the experimental period. The medicated water was administered daily to reduce fecal contamination and ensure normal intake. Four turkeys from each of the test regimens were sacrificed by immediate decapitation at 0 (the morning following the last day of medication), 3, 5, 7, and 10 days posttreatment. The control birds were sacrificed at a comparable time in the experimental period.

The tissues analyzed for sulfonamide residues were breast muscle, liver, kidney, and skin. A sample was composed of tissues from two birds in order to ensure an adequate amount of tissue (50 g or more) for analysis.

Blood samples were taken from three birds in each experimental group at 0, 3, 5, 7, and 10 days posttreatment. Blood was taken from the wing vein by cutting the vein and drawing the blood up in a syringe as it pooled on the wing. Serum was separated by centrifugation and kept frozen until analyzed for sulfaquinoxaline by a method developed by Szalkowski (1972). The method consisted of dissolving the serum in dilute NaOH and extracting the aromatic amines with chloroform, precipitating the proteins with HCl, and converting bound sulfaquinoxaline to the free drug by acid hydrolysis. The Bratton–Marshall reaction was used for color development. The colored compound was then extracted into 1-butanol and the absorbance was read at 545 nm. With this method, 0.5 μg of sulfaquinoxaline can be determined quantitatively.

Tissue samples were analyzed for free sulfonamides by the method of Tishler *et al.* (1968), and drinking water samples were analyzed by using the color development step of the same method.

RESULTS

The residue depletion rates of the various tissues and serum are shown in Table I. Residues were depleted by 94–100% at the third day after withdrawal in all tissues of turkeys given either the prophylactic or therapeutic dosage level. In both experimental groups, residue concentrations were highest in kidney at day 0 and were depleted from muscle tissues by day 5 after withdrawal. The sulfonamide concentration in liver and renal tissues at day 7 was 0.1 ppm, the level of method sensitivity; this concentration persisted through day 10 of withdrawal in turkeys given the therapeutic dose. Residues also persisted in skin tissues of both groups at day 10 and were well above the level of method sensitivity in skin tissues of birds given the therapeutic dose.

Concentrations of sulfonamide in blood serum were reduced by 98–99% at day 3 of withdrawal in both experimental groups.

DISCUSSION

Sulfaquinoxaline residues persisted more in skin, kidney, and liver tissues than those in muscle tissue, and appeared to be especially difficult to eliminate from the skin tissue of turkeys given the therapeutic dosage level. These results are similar to those observed in chickens (Righter *et al.*, 1970). At day 0, the sulfaquinoxaline concentration in the serum of birds given the therapeutic dose was not much higher than that of birds given the prophylactic

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Table I. Sulfonamide Residues in Tissues and Serum of Turkey Poults Administered Sulfaquinoxaline in the Drinking Water at Therapeutic or Prophylactic Dose Concentrations

Posttreatment withdrawal day	Residues, ppm[a]				
	Muscle	Liver	Kidney	Skin	Serum
			Prophylactic dose (0.0175%)		
0	6.0	14.5	25.0	16.9	41.8
3	0.2	0.4	1.4	0.4	1.0
5	0.0	0.2	0.2	0.2	0.0
7	0.0	0.1	0.1	0.1	0.0
10	0.0	0.0	0.0	0.1	0.0
			Therapeutic dose (0.1%)		
0	26.0	18.2	42.7	34.4	48.0
3	0.1	0.2	0.5	0.4	0.0
5	0.0	0.2	0.2	0.2	0.1
7	0.0	0.1	0.1	0.2	0.2
10	0.0	0.1	0.1	0.2	0.1
Controls	0.0	0.0	0.1	0.0	0.3

[a] Data for tissues represent the means of two composite samples from two birds, and for serum, the means of three birds. Values are corrected for mean control values which are included in the table.

dose, which might indicate that drug intake was reduced in the therapeutically treated birds; however, this is only speculative, since the water intake was not measured. Similar results were observed in tissues of chickens given sulfaquinoxaline in the feed at prophylactic and therapeutic dosage levels (Righter *et al.*, 1970).

Although skin tissues appear to be the limiting factor in establishing withdrawal times, residue concentrations below 0.1 ppm were not attained until 10 days after drug withdrawal in liver and kidney tissues of the turkeys given the low dosage level. Residue concentrations in skin tissues remained at 0.1 ppm at 10 days after withdrawal. In birds given the therapeutic dosage level, residue concentrations of 0.1 ppm or greater persisted in liver, kidney, and skin at the tenth day after withdrawal.

The results of this study indicate the necessity of a withdrawal period in excess of 10 days for turkeys given sulfaquinoxaline at these dosage levels and under the conditions of this study.

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