Comparison of Histoplasmin Sensitivity Rates Among Human Beings and Animals in Boone County, Missouri

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VARIOUS workers, in an attempt to explain the epidemiology of histoplasmosis, have suggested that certain animals might be reservoirs of the infection. DeMonbreun[1] and later Prior and Cole[2] have suggested dogs as a possible reservoir. Emmons[3] has suggested wild rodents, in particular, rats. Ruhe and Cazier[4] reported that reactions to histoplasmin occurred among cattle and the frequency of reactors in Kansas decreased from east to west just as Palmer[5] showed that the frequency of reactors in human beings decreased in this state.

Furcolow and Ruhe[6] compared the human and cattle rates in Shawnee County, Kansas. They found that the age-specific rates were quite similar in human beings and cattle.

Recently more extensive work has been done among children and animals in Boone County, Missouri. The entire rural school population has been skin tested in this county. The method of skin testing the children has been reported[7] and consisted in the intracutaneous injection of 1/10th ml. of histoplasmin Lot H-40, diluted 3:1,000. The reactions were read at 48 hours and measurements were made of both erythema and induration. A positive test was considered to be one in which the induration measured 5 mm. or more in diameter. An analysis of the effect of residence, rainfall, and other factors on the reaction rates among children has been made.[7]

Animals on farms throughout the county were tested (for location see[8]). An analysis of the histoplasmin rates among these animals has been previously presented.[8] In the present paper these data have been revised to include only lifetime residents, and data obtained after testing 3 additional herds of cattle have been added. The method used to skin test the various animals has been reported.[9] In brief, it consisted of the intradermal injection in the cervical region of 1/10th ml. of histoplasmin Lot H-3 and 4, undiluted. Measurement of the induration was made at 48 hours and the reaction was considered positive if the induration measured 5 mm. or more in diameter at this time.

The present paper is concerned primarily with the comparison of human and animal rates in Boone County, Missouri.

The human and animal histoplasmin sensitivity rates according to age in Boone County are presented in Table 1. These data are presented graphically in Figure 1. It should be noted that the rates for animals and human beings increase with age, although the animal rates are lower. The human rates are extremely high. In fact, they represent

TABLE 1

Human and Animal Histoplasmin Sensitivity Rates Among Lifetime Residents According to Age in Boone County, Missouri

		Age in Years (Last Birthday)						
		Under 2	*2 and 3*	*4 and 5*	*6 and 7*	*8 and 9*	*10 and 11*	*Total*
Children	No. Tested	13	73	113	299	287	262	1,047
	No. Pos.	2	30	70	250	248	241	841
	% Pos.	15	41	62	84	86	92	80
						8 and over		
Horses	No. Tested	2	3	4	11	24		44
	No. Pos.	0	3	1	8	20		32
	% Pos.	0	100	25	73	83		73
Sheep	No. Tested	66	22	21	46	7		162
	No. Pos.	1	4	5	23	4		37
	% Pos.	2	18	24	50	57		23
Cattle	No. Tested	195	198	65	41	23		522
	No. Pos.	5	27	11	13	12		68
	% Pos.	3	14	17	32	52		13
Swine	No. Tested	127	2	0	0	0		129
	No. Pos.	2	0	0	0	0		2
	% Pos.	2	0	0	0	0		1
Chicken	No. Tested	83	10	4	1	0		98
	No. Pos.	1	0	0	0	0		1
	% Pos.	1	0	0	0	0		1
Turkey	No. Tested	25	0	0	0	0		25
	No. Pos.	0	0	0	0	0		0
	% Pos.	0	0	0	0	0		0

the highest rates as yet reported in the literature. It is seen that 84 per cent of the children are positive to histoplasmin by the time they are 7 years of age. Indeed, it has been estimated that an annual conversion rate of 20 per cent per year must be operative to yield the observed rates of reaction among these children. Among the animals, the horses show the highest rate, which approaches closely the human rate. The rates among sheep and cattle are quite similar, with sheep having slightly higher rates than cattle. However, even for cattle over half (52.4 per cent) of those tested who were 8 years of age or over were positive.

Tests were also conducted among chickens and swine and a few reactors were found. Since animals older than 2 years of age were not available in these species, no age-specific rates could be determined. No reactors were found among 25 turkeys, age 5 months.

It is of interest to mention that following the extensive testing program in Boone County, human, canine, and bovine cases of histoplasmosis were found.[10] In the vicinity of the bovine case an extensive skin testing survey with histoplasmin was conducted on farms within a half-mile radius. In this area 258 cattle were tested. In Table 2 the histoplasmin skin test results among

FIGURE 1—Per cent of Positive Reactors to Histoplasmin by Age Among Children Compared to Horses, Cattle, and Sheep, all Lifetime Residents of Boone County, Missouri.

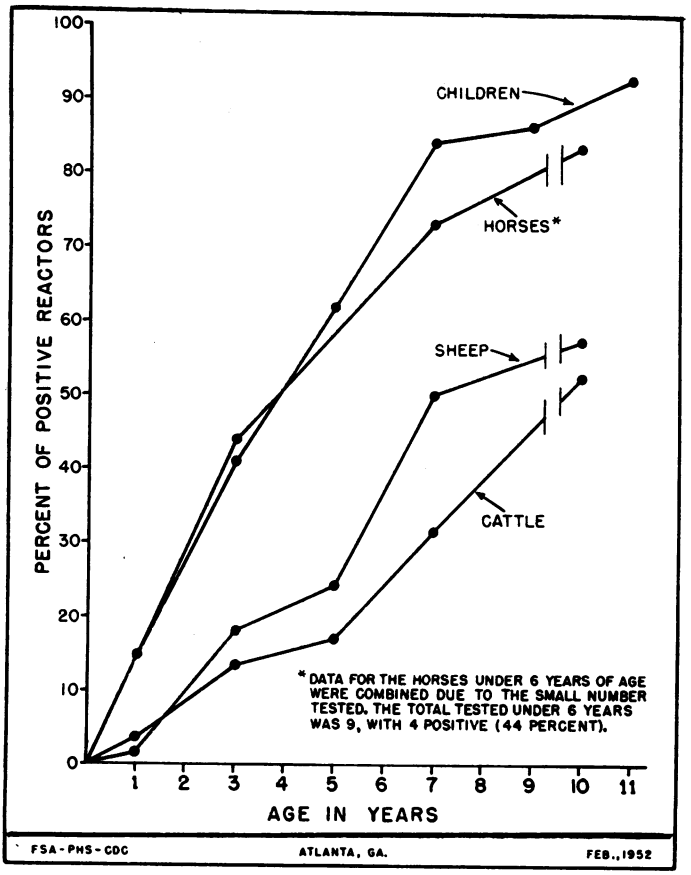

TABLE 2

Histoplasmin Sensitivity Rates Among Cattle and School Children, Lifetime Residents of the Vicinity of a Bovine Case of Histoplasmosis in Missouri

	Age in Years (Last Birthday)					
	Under 2	*2 and 3*	*4 and 5*	*6 and 7*	*8 and over*	*Total*
			Cattle			
Number Tested	124	58	44	21	11	258
Positive	3	14	6	8	5	36
Per cent Positive	2	26	14	38	46	14
			Children			
Number Tested	0	15	29	67	89	200
Positive	0	5	8	43	60	116
Per cent Positive	0	33	28	64	67	58

these cattle are compared to the skin test results obtained on testing 200 school children who attended rural schools within three miles of the farm on which the bovine case of histoplasmosis was found. The rates in cattle and children both increased with age, although the rates in children were higher.

It is interesting to note that the cattle

in the vicinity of a case have somewhat higher rates than the rates for cattle for the county as a whole, while the children from the schools in the vicinity of the bovine case have somewhat lower rates than the county as a whole. In general, among cattle and children, the rates, therefore, are more nearly alike than the rates for the county as a whole.

The similarity of the histoplasmin rates among animals and human beings indicates that both may have been infected from some common source. In view of the increasing number of reports concerning the isolation of *Histoplasma capsulatum* from soil, Emmons,[11, 12] Ajello and Zeidberg,[13] Grayston, *et al.*,[14] as well as ourselves,[15] it seems possible that the common source may be soil which contains spores of the fungus.

SUMMARY

1. A comparison of the rates of reaction to histoplasmin among animals and children in Boone County, Missouri, is presented.

2. Similar but slightly lower rates prevail among horses than among human beings.

3. The rates among sheep and cattle are similar, with the cattle rates being somewhat lower.

4. Reactions also occur among swine and chickens but age-specific rates could not be determined.

5. From analysis of the rates of reaction of cattle and children in the vicinity of a case of bovine histoplasmosis, it appears that the bovine rates were higher and the human rates lower among these groups than among the cattle and human beings in the county as a whole.

6. In general, the most striking finding of this comparison of the histoplasmin sensitivity rates between human beings and animals is increasing rates of reaction with age in all species. This can be interpreted as evidence of a common source of infection rather than one species infecting the other.

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ADDENDUM—Since this article was written *Histoplasma capsulatum* has been isolated from soil and bark obtained from two farms in Boone County, Missouri.