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COMPARATIVE STUDIES ON SOME EPIDEMIOLOGICAL ASPECTS OF EIMERIOSIS IN TURKEYS BETWEEN SOME REGIONS IN BULGARIA AND TURKEY

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Summary

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By means of turkeys' faecal samples flotation with NaCl solution, the species composition of *Eimeria* spp. has been determined in 16 settlements in the Republic of Bulgaria and 4 settlements in the Republic of Turkey. In Bulgaria, the following species were detected: *Eimeria adenoeides*; *E. meleagridis*; *E. meleagrimitis*; *E. gallopavonis*; *E. subrotunda*, as well as *Isospora heisini*, whereas in Turkey − *Eimeria adenoeides*; *E. meleagridis*; *E. meleagrimitis* and *E. subrotunda*. The species *E. subrotunda* was observed for the first time in Bulgaria. The highly pathogenic species *E. adenoeides* was the dominant one in Bulgaria. In Turkey, *E. meleagrimitis* was the most prevailing. From all 1077 turkeys studied in Bulgaria and 161 in Turkey, 586 (54.4%) and 28 (17.4%) were infected with *Eimeria*, respectively. The infection in our country was generally with a low intensity – up to 50 oocysts per gramme faeces − in 371 (63.6%) of affected birds. Only in 5 birds (0.01%) a high-intensity infection was observed with 500 to 8200 oocysts per gramme faeces.

Key words: coccidia, *Eimeria*, epidemiology, protozoa, turkeys

INTRODUCTION

In 1895, Smith described eimeriosis as a new morbidity in turkeys. Nowadays, it is encountered in all countries with developed turkey breeding industry. During the past century, the disease was reported in a number of European countries such as England (Clarkson & Gentles, 1958); France (Yvore *et al.*, 1978); Hungary (Pellerdy, 1974), Turkey (Aydemir, 1985); Russia (Utebaeva, 1972), Bulgaria (Golemanski, 1964; Koinarski, 1987), as well as in America (Moore, 1947). The problems due to the wide distribution of eimeriosis among turkeys are also related to economical losses, due to retarded growth and development of turkey poults, poor feed conversion ratios, and very frequently – with high mortality rates – from 7 to 10% (Koinarski, 2002). Golemanski (1964) informed that the mortality in 20-day-old turkey poults could be as high as 66.6%. According to Froyman *et al.* (2002) eimeriosis in turkeys, if caused by certain species, could be quite serious. Numerous authors indicate *E. adenoeides* as the most pathogenic species (Hein,

1969; Augustine & Danfort, 1989; Hafez, 2000). Its pathogenicity was shown to increase in association with some microbial pathogens such as *Salmonella Enteritidis* (Koinarski *et al.,* 2006).

In Bulgaria, there are reports about the species variety of *Eimeria* and the epidemiology of eimeriosis in turkeys. (Golemanski, 1964; Koinarski & Kamburov, 1984; Koinarski, 1987) but they all refer to periods from more than 20 years ago.

With this connection, it would be interesting to determine the species variety and prevalence of *Eimeria* species among turkeys in Bulgaria and to compare them to data from the neighbouring Turkey. Thus, the purpose of the present study was to investigate some aspects of the epidemiology of eimeriosis in turkeys in different regions of Bulgaria and Turkey.

MATERIALS AND METHODS

By means of the NaCl flotation technique, 1077 faecal samples from turkeys owned by private owners from 16 settlements in the Republic of Bulgaria and 161 samples from 4 settlements in the Republic of Turkey, have been examined. The number of oocysts per gramme faeces was determined by the quantitative ovoscopic method of McMaster. Only sporulated oocysts, observed and measured under a microscope (AXIOSCOP^{TM}, Zeiss, Jena) were used for species identification. Positive coprological samples were put in a thermostat at 28 ± 3 ^{o}C for 72 h, after addition of 2.5% potassium dichromate solution. The dimensions of oocysts and data reported by others (Davies *et al.,* 1963; Pellerdy, 1965; Edgar, 1985; Soulby, 1986) were taken into consideration in the determination of *Eimeria* species.

RESULTS

Data presented in Table 1 evidenced that 586 (54.4%) of the 1077 examined turkeys from Bulgaria were infected with one or more *Eimeria* species. In 365 cases (62.3%) there was a monoinfection and in 221 (37.7%) – mixed infection was present. Two oocysts species were detected in 200 (34.1%) of positive faecal samples and in 21 (3.6%) – 3 species were involved. The most commonly encountered combination was that of *E. adenoeides/E. meleagridis*.

The quantitative ovoscopy showed that in 371 (63.6%) of infected birds, the intensity of infection was low (with up to 50 oocysts per 1 g faeces). High intensity of the infection with 500 to 8200 oocysts per 1 g faeces was established only in 5 (0.01%) turkeys. According to data from Table 1, five *Eimeria* and one *Isospora (I. heisini)* species were detected in our country, the latter being present only in 2 of tested settlements. The prevailing species was *E. adenoeides*, followed by *E. meleagrimitis*. The third in occurrence was *E. meleagridis*. The least prevalent species was *E. subrotunda*.

Table 2 shows the results from the ovoscopy of 161 faecal turkey samples obtained from 4 settlements in the Republic of Turkey. Twenty eight (17.4%) samples were positive for *Eimeria* oocysts. In 20 (71.4%) there was a monoinfection, whereas in 8 (28.6%) – mixed infection with 2 involved *Eimeria* species. The most frequent combination was that between *E. meleagridis* and *E. meleagrimitis*. Three *Eimeria* species were detected, with predominance of *E. meleagrimitis*. The highly pathogenic *E. adenoeides* was observed only in one bird.

Table 1. Species composition of *Eimeria* among turkey population in the Republic of Bulgaria.

Settlement	Number studied	Number (%) infected	E.a.	E. m-dis	E. m-tis	E.g.	E.s.	I.h.	E.a. E.m-dis	E.a. E.m-tis	E.m-dis E.m-tis	E.m-dis E.s.	E.a. E.m-dis E.m-tis	E.m-dis E.m-tis I.h.
1	80	57 (71.2)	25 (43.8)	12 (21.0)	10 (17.6)	–	–	–	5 (8.8)	5 (8.8)	–	–	–	–
2	70	55 (78.6)	18 (32.7)	4 (7.3)	11 (20.0)	1 (1.8)	1 (1.8)	–	5 (9.1)	5 (9.1)	5 (9.1)	–	5 (9.1)	–
3	68	40 (58.8)	15 (37.5)	5 (12.5)	5 (12.5)	1 (2.5)	1 (2.5)	–	5 (12.5)	4 (10.0)	2 (5.0)	–	2 (5.0)	–
4	80	60 (75.0)	20 (33.3)	10 (16.7)	10 (16.7)	–	–	–	5 (8.3)	10 (16.7)	3 (5.0)	–	2 (3.3)	–
5	50	35 (70.0)	10 (28.5)	5 (14.3)	8 (22.9)	–	–	–	5 (14.3)	3 (8.6)	2 (5.7)	–	2 (5.7)	–
6	40	30 (75.0)	8 (26.7)	6 (20.0)	6 (20.0)	–	–	–	3 (10.0)	4 (13.3)	2 (6.7)	–	1 (3.3)	–
7	50	30 (60.0)	7 (23.3)	6 (20.0)	5 (16.7)	–	–	–	5 (16.7)	3 (10.0)	3 (10.0)	–	1 (3.3)	–
8	60	28 (46.6)	5 (17.8)	–	8 (28.6)	1 (3.6)	1 (3.6)	–	5 (17.8)	3 (10.7)	2 (7.2)	–	3 (10.7)	–
9	50	30 (60.0)	5 (16.7)	2 (6.7)	7 (23.2)	–	5 (16.7)	1 (3.3)	3 (10.0)	2 (6.7)	2 (6.7)	–	–	3 (10.0)
10	50	31 (62.2)	5 (16.1)	6 (19.3)	5 (16.1)	–	3 (9.7)	2 (6.5)	2 (6.5)	5 (16.1)	1 (3.2)	–	–	2 (6.5)
11	90	38 (42.2)	5 (13.2)	5 (13.2)	–	–	–	–	13 (34.2)	–	8 (21.0)	7 (18.4)	–	–
12	80	28 (35.0)	8 (28.6)	1 (3.6)	8 (28.6)	3 (10.7)	–	–	–	–	2 (7.1)	6 (21.4)	–	–
13	100	36 (36.0)	7 (19.5)	3 (8.3)	5 (13.9)	4 (11.1)	–	–	9 (25.0)	–	5 (13.9)	3 (8.3)	–	–
14	94	40 (42.6)	2 (5.0)	8 (20.0)	6 (15.0)	4 (10.0)	–	–	6 (15.0)	–	10 (25.0)	4 (10.0)	–	–
15	50	23 (46.0)	8 (34.8)	–	2 (8.7)	3 (13.0)	–	–	4 (17.4)	–	–	6 (16.1)	–	–
16	65	25 (38.5)	5 (20.0)	1 (4.0)	8 (32.0)	3 (12.0)	–	–	4 (16.0)	–	3 (12.0)	1 (4.0)	-	–
Total	1077	586 (54.4)	153 (26.1)	74 (12.6)	104 (17.8)	20 (3.4)	11 (1.9)	3 (0.5)	79 (13.5)	44 (7.5)	50 (8.5)	27 (4.6)	16 (2.7)	5 (0.9)

E.a. = *E. adenoeides*; E.m-dis = *E. meleagridis*; E.m-tis = *E. meleagrimitis*; E.g. = *E. gallopavonis*; E.s. = *E. subrotunda*; I.h. = *Isospora heisini*

Table 2. Species composition of *Eimeria* among turkey population in the Republic of Turkey

	Settlement				Total
	1	2	3	4	
Number studied	33	6	87	35	161
Number (%) infected	5 (15.2)	4 (66.7)	2 (2.3)	17 (48.6)	28 (17.4)
E.adenoeides	–	–	–	1 (5.9)	1 (3.6)
E.meleagridis	2 (40.0)	3 (75.0)	–	–	5 (17.9)
E. meleagrimitis	2 (40.0)	–	1 (50.0)	11 (64.7)	14 (50.0)
E. meleagridis *E. meleagrimitis*	1 (20.0)	1 (25.0)	–	3 (17.6)	5 (17.8)
E. adenoeides *E. meleagrimitis*	–	–	1 (50.0)	1 (5.9)	2 (7.1)
E. meleagrimitis *E. subrotunda*	–	–	–	1 (5.9)	1 (3.6)

DISCUSSION

Pellerdy (1974) has enumerated 7 *Eimeria* species that parasitize on turkeys. In his view, 4 of them (*E. adenoeides*; *E. meleagridis*; *E. meleagrimitis* and *E. gallopavonis*) are pathogenic, and the pathogenicity of one species, namely *E. dispersa,* is questionable. With this regard, 4 of *Eimeria* species detected by us among the turkey population in Bulgaria, are pathogenic. The *E. adenoeides* species, specified by a number of investigators as being the most pathogenic (Pellerdy 1974; Augustine & Danfort, 1989; Hafez, 2000) was the most prevalent. Our results indicated that *Eimeria* organisms were very widely distributed and are detected in spontaneous infections in more than 50% of turkeys in Bulgaria. In over 60% of cases, the infection was with low intensity, i.e. a oocyst carriership was present rather than a clinically manifested infection. This fact should not however be encouraging, as such turkeys are a source and vector of infection for young poults.

Having studied in 1984 the species composition of *Eimeria* among turkeys in Bulgaria, Koinarski & Kamburov confirmed that the most prevalent species was *E. meleagridis*. According to data from the present study, *E. adenoeides* is the dominant species now. In similar studies performed earlier (Golemanski, 1964; Koinarski & Kamburov, 1984, Koinarski, 1987), the species *E. subrotunda* has not been detected. With the present study, this species is established for the first time in Bulgaria. Although it is the least frequent among the five detected *Eimeria* species, the present data showed undoubtedly that the species variety of *Eimeria* was actively changing with time.

Throughout the parallel investigations carried out in the Republic of Turkey, 3 *Eimeria* species have been identified in turkeys. In the country, the highly pathogenic small intestinal species *E. meleagrimitis* was predominating, in spite of the highly pathogenic *E. adenoeides*, encountered in Bulgaria, that is mainly colonizing the caeca. The species observed in Bulgaria *E. gallopavonis*, *E. subrotunda*, and the only *Isospora* spp. in turkeys − *I. heisisni,* were not detected in Turkey. It could not be definitively said

whether these species were not present in this country at all because of the smaller number of examined samples and lack of data from other authors. On the basis only of the present results, it could be suggested that the incidence of *Eimeria* infection in turkeys was lower in Turkey than in Bulgaria. The species variety in the former country was less diverse. The percentage of mixed parasitic infections encountered in Turkey was lower and there was no associated infection with involvement of 3 species of oocysts.

The comparative investigations carried out in Bulgaria and Turkey, did not identify the *Eimeria* species, specific for turkeys, i. e. *E. dispersa* and *E. innocua*.

REFERENCES

Augustine, P. C. & H. D. Danfort, 1989. Chickens repeatedly inoculated with *Eimeria adenoeides* sporozoites develop immunity to *E. tenella* challenge. In: *Proceedings of the 5th International Coccidiosis Conference*, Tours, France, pp. 609−617.

Aydemir, M., 1985. Marmara Bölgesinde hindi coccidiosis'inin Epizootiyolojisi Üserinde Araştırmalar. *Doğa Bilim Dergisi*, Seri D, **9**, 45−58.

Clarkson, M. J. & M. A. Gentles, 1958. Coccidiosis in turkeys. *The Veterinary Record*, **70**, 211−214.

Davies, S. F. M., L. P. Joyner & S. S. Kendall, 1963. Coccidiosis. Oliver & Boyd Ltd., Edinburg.

Edgar, S. A., 1985. Sporulation of oocyst at specific temperatures and notes on the prepatent period of several species of avian coccidian. *Journal of Parasitology*, **41**, 214−216.

Froyman, R., T. Iron & G. Greif, 2002. Recent efficacy data of toltrazuril against turkey coccidiosis in cage and floor pen studies. In: *Proceedings of the 4th International Symposium on Turkey Diseases*, Berlin, Germany, German Veterinary Medical Society, Berlin, Germany, pp. 128−130.

Golemanski, B., 1964. Coccidia of turkeys. *Godishnik na Sofiyskiya universitet*, **6**, 70−85 (BG).

Hafez, H. M., 2000. Enteric diseases of turkeys. In: *Proceedings of International Meeting of the Working Group 10 (Turkey) on Turkey Production in Europe in the New Millenium*, Berlin, Germany, pp. 164−190.

Hein, H., 1969. *Eimeria adenoeides* and *Eimeria meleagrimitis*: Pathogenic effect in turkey poults. *Experimental Parasitology*, **24**, 163−170.

Koinarski, V. & P. Kamburov, 1984. Species variety of *Eimeria* of turkeys in Bulgaria. *Veterinary Science (Sofia)*, **21**, 63−67 (BG).

Koinarski, V., 1987. Survey on turkeys' coccidiosis. Ph.D. Thesis, VIZVM, Stara Zagora (BG).

Koinarski, V., 2002. Anticoccidial efficacy of some ionophore antibiotics in turkey-poults experimentally infected with *Eimeria adenoeides*. In: *Proceedings of the 4th International Symposium on Turkey Diseases*, May 15−18 2002, Berlin, Germany, German Veterinary Medical Society, Berlin, pp. 137−142.

Koinarski, V., M. Lyutskanov & V. Urumova, 2006. Effect of *Eimeria adenoeides* challenge upon the course of an experimental *Salmonella Enteritidis* infection in turkey poults. *Turkish Journal of Veterinary Animal Science*, **30**, 489−495.

Moore, E. N., 1947. Diseases of turkeys in New York. *Cornell Veterinarian*, **37**, 112−120.

Pellerdy, L. P., 1965. Coccidia and Coccidiosis. Publishing House of Hungarian Academy of Sciences, Budapest.

Pellerdy, L. P., 1974. Turkey coccidiosis. In: *Coccidia and Coccidiosis*, 2nd edn, Akademiai Kiado, Budapest, pp. 215−219.

Smith, T., 1895. An infectious disease among turkeys caused by protozoa. *Bulletin of the United States Department of Agriculture*, **8**, 7.

Soulsby, E. S. L., 1986. Helminths, Arthropods and Protozoa of Domesticated Animals. William Clowes Ltd., London.

Utebaeva, M. K., 1972. Coccidia of turkeys in Southern Kazakhstan. *Trudy Instituta zoologii Akademii nauk Kazakhskoy SSR*, **33**, 3−47 (RU).

Yvore, P., H. Berdougo, M. Naciri, A. Bree & J. P. Lafont, 1978. Etude pathogénique de la coccidiose du dindon à *Eimeria adenoeides*. *Annales de Recherches Vétérinaires*, **9**, 531−539.

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