

RETROSPECTIVE ANALYSIS OF TAENIASIS IN BULGARIA CAUSED BY THE BEEF TAPEWORM FOR THE PERIOD 2008-2017

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ABSTRACT

The aim of the present study is to analyse the dynamics of the distribution of taeniasis caused by the beef tapeworm (*Taeniarhynchus saginatus*) among the population of Bulgaria for the period 2008-2017.

Material and methods. The analysis is based on laboratory and clinical data on patients diagnosed with taeniarhynchosis in DPTM at NCIPD, as well as data from epidemiological studies carried out by RHIs in accordance with the current legislation in the country.

Results. For the studied period, cases of human taeniarhynchosis were reported from 21 districts of the country, with 246 infected persons. The areas with the highest number of cases during the whole period were Shumen – 14.6%, Plovdiv – 13.8%, Targovishte – 10.9 and Sofia – 10.6%. Annual morbidity ranges from 0.63 per 100 000 (2008) to 0.23 per 100 000 (2017), with average morbidity of 0.37‰. The prevalence was higher among female subjects (61%), and the distribution by age showed a significantly higher incidence in adults (88%) compared to the group of children and adolescents (22%). The most affected were the age groups 35-39 (11.79%) and 55-59 (11.38%) years. Patients of

different ethnic origin represent 54% of cases.

Conclusion. Data from our study shows that cases of taeniarhynchosis, even though sporadic, are reported annually in the country. The distribution is highest in regions with well-developed private livestock farming and high rate of home meat production without veterinary control. Poor health literacy of the population resulting in environmental contamination with human excreta and the possibility of infection of intermediate hosts, as well as consumption of uncooked homemade products and insufficient veterinary health control mainly contribute to the endemic spread of taeniarhynchosis in the country.

KEYWORDS:

taeniasis, beef tapeworm, incidence

INTRODUCTION

Taeniasis caused by the beef tapeworm (taeniarhynchosis) is a parasitic food-borne disease the source of which is the infected person and cattle being the intermediate hosts (1). The causative agent of the disease is the beef tapeworm *Taeniarhynchus saginatus* (*Taenia saginata*) belonging to class Cestoda. *T. saginatus* is a flat, hermaphroditic parasite composed of 1000 to 2000 proglottids and reaches 4 to 10 metres in length. One proglottid may contain between 50 000 and 80 000 eggs (2, 3). There are four suckers, a spherical scolex and a rostellum without hooks. The large number of bilateral branches of the uterus is the main element used in species identification of the helminth (Fig. 1) (4). The eggs of the beef tapeworm are spherical with a thick dark brown cross-furrowed shell and an oncosphere with a 6-hooked embryo (1).

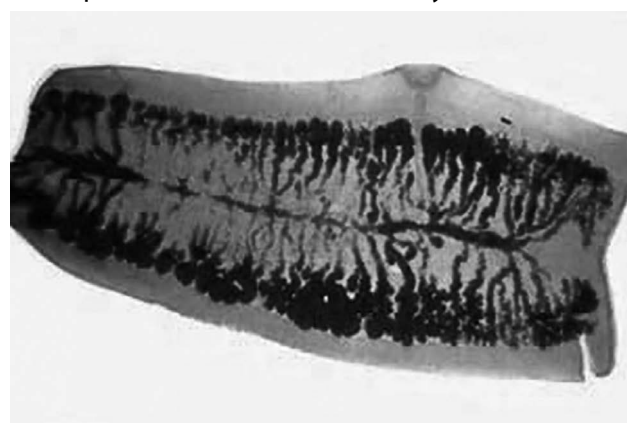


Fig. 1. Proglottid of *T. saginata* (Source: Kurdova, R (Ed.). Laboratory diagnosis of parasitoses in humans. Sofia, ARSO, 2009, 254 p.).

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T. saginatus has a typical life cycle. Human is the ultimate host where the tapeworm develops into a sexually mature parasite in the small intestine. Mature proglottids actively exit the anus of the infected person, the uterus ruptures and the eggs fall in the external environment where they remain invasive for 2-3 months. Oncospheres are released from the swallowed eggs in the bovine intestines, penetrate the intestinal wall and spread throughout the body. The cysticercus that develops from them reaches invasive stages after 4 months. The larval form of *T. saginatus* is called *Cysticercus bovis* and develops in the chewing muscles and heart of the cattle. People become infected after consumption of uncooked beef or veal. Animals are infected when feeding in areas contaminated with human faeces containing *T. saginatus* eggs (1-4).

The incubation period of the disease is about 3 months. The complaints can start before releasing of proglottids and continue for a long time afterwards with loss of appetite, nausea and navel pain. During the later stages of the disease fatigue, headache, dizziness, itching in the anal area is observed as well as urticaria. In most cases, the clinical symptoms are either mild or absent. The proglottids are released during the day, actively crawling through the anal opening (1, 2).

In Bulgaria the disease is widespread throughout the country. During the 1950s, 750-1000 patients were registered annually (1). The disease is widespread in Central and South America, South Asia, the Philippines, China and Africa, and has been reported in Europe (1).

In Bulgaria taeniasis caused by the beef tapeworm and bovine cysticercosis is a subject to mandatory registration and notification.

The aim of the present study is to analyse the dynamics of the distribution of taeniasis caused by the beef tapeworm among Bulgarian population for the period 2008-2017.

MATERIAL AND METHODS

The analysis is based on laboratory and clinical data on patients diagnosed with taeniarhynchosis in the Department of Parasitology and Tropical Medicine (DPTM) at the National Centre of Infectious and Parasitic Diseases (NCIPD), as well as data from epidemiological studies carried out by the Regional Health Inspectorates (RHIs) in accordance with the current legislation in the country, and the annual analyses of parasitic diseases in the country performed by DPTM.

Mean values, standard deviation and confidence interval were determined with statistical software. We used Student's t-test to determine if the means of two data sets differ significantly at $p < 0.05$.

RESULTS

For the studied period, cases of human taeniarhynchosis were reported from 21 districts of the country with 246 infected persons. The areas with the highest number of cases during the whole period were Shumen – 14.6%, Plovdiv – 13.8%, Targovishte – 10.9 and Sofia – 10.6% (Fig. 2).

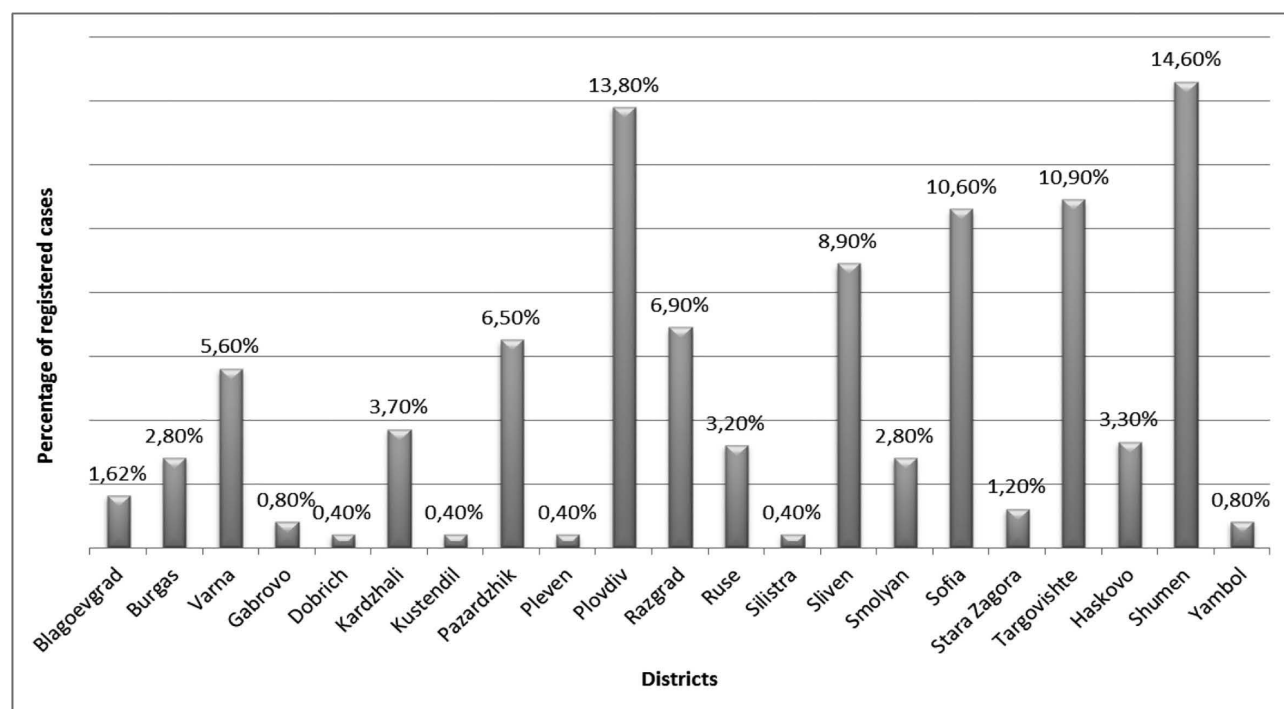


Fig. 2. Percentage of registered taeniosis cases caused by *T. saginata* by district.

Annual morbidity ranges from 0.63 per 100 000 (2008) to 0.23 per 100 000 (2017) with average morbidity of 0.37%₀₀₀ (Fig. 3). The prevalence was higher among female subjects (61%) (Fig. 4). The distribution by age showed a significantly higher incidence in adults (88%) compared to the group of children and adolescents (22%) (Fig. 5). The most affected were the age groups 35-39 (11.79%) and 55-59 (11.38%) years (Table 1). Patients of different ethnic origin represent 54% of cases.

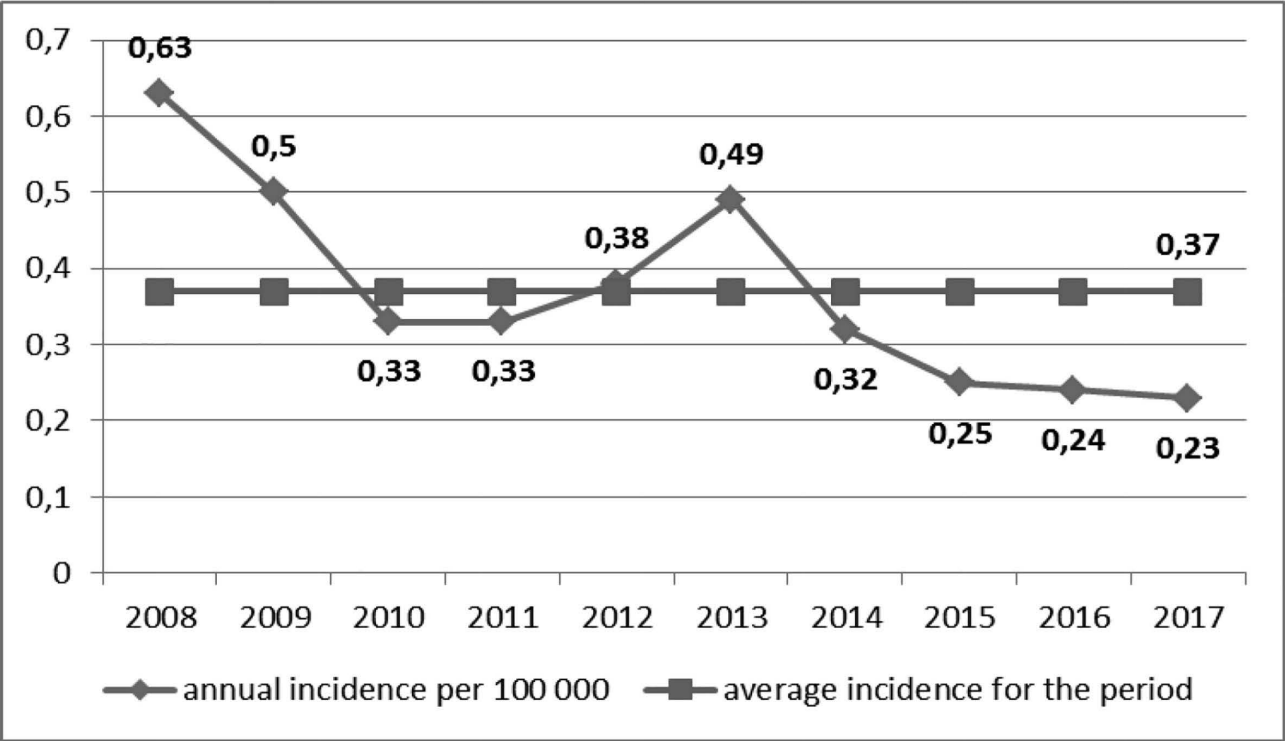


Fig. 3. Incidence of taeniosis caused by *T. saginata* by year (2008-2017).

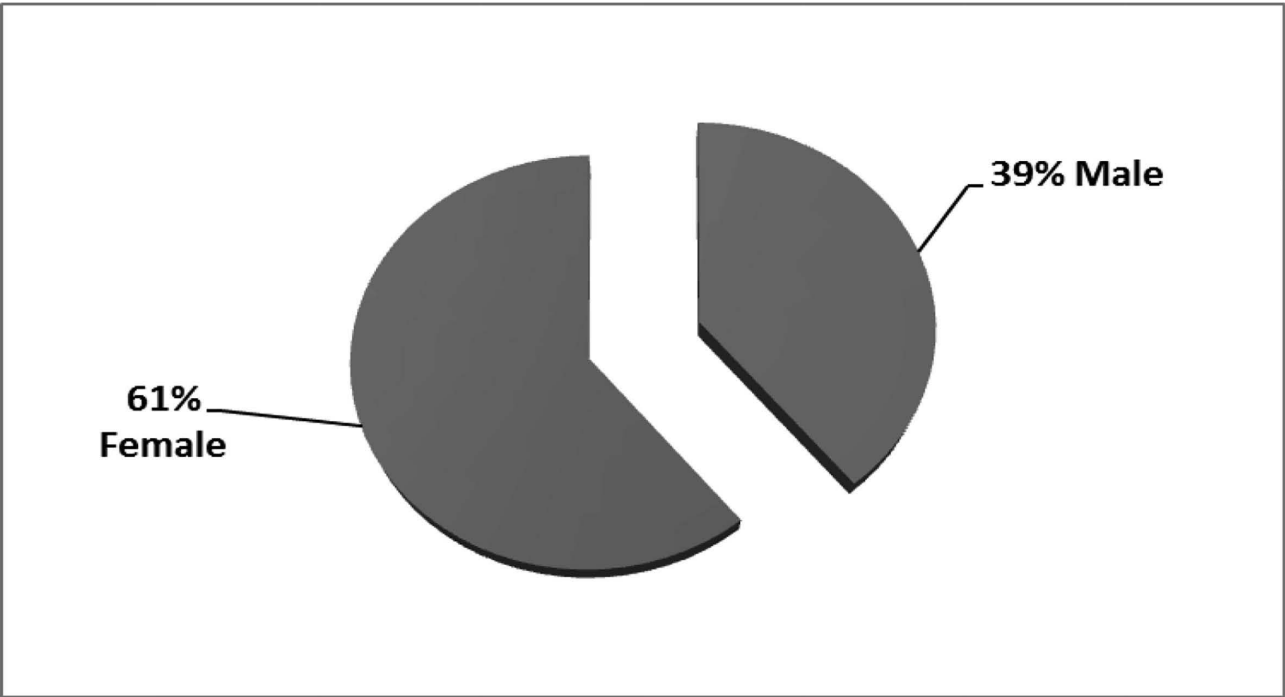


Fig. 4. Gender distribution of taeniosis cases.

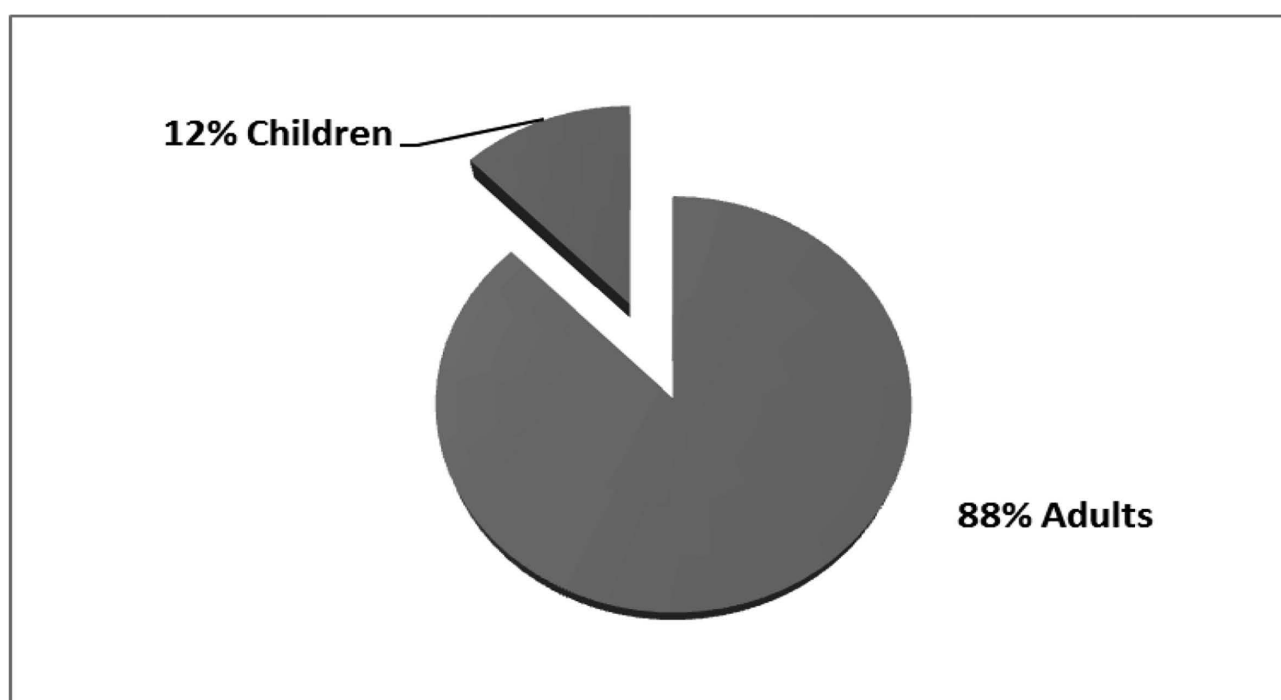


Fig. 5. Distribution of taeniosis cases among children and adults.

Table 1. Distribution of taeniosis cases by age group.

Age group/ Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
0 - 4	2	1	1	–	–	–	–	–	–	1
5 - 9	2	1	–	–	2	1	–	1	–	1
10 - 14	3	–	2	–	1	1	1	2	2	1
15 - 19	3	4	–	1	–	–	3	–	2	1
20 - 24	5	1	–	–	1	–	3	–	2	1
25 - 29	3	2	1	1	2	3	1	1	4	1
30 - 34	4	2	3	1	1	5	3	–	1	1
35 - 39	3	6	3	4	2	3	2	2	1	3
40 - 44	4	2	1	4	2	6	1	1	1	1
45 - 49	4	2	1	2	–	2	3	4	1	1
50 - 54	3	4	3	3	1	3	–	–	–	2
55 - 59	8	4	3	1	4	1	2	2	1	2
60 - 64	3	1	2	1	2	–	1	3	–	1
> 65	1	3	3	–	2	5	2	1	1	2
Mean	3.43	2.36	1.64	1.29	1.43	2.14	1.57	1.21	1.14	1,36
Standard Deviation	1.65	1.65	1.22	1.44	1.09	2.07	1.16	1.25	1.10	0.63
Confidence Level (95.0%)	0.953	0.950	0.702	0.830	0.629	1.195	0.669	0.723	0.635	0.366
Total	48	33	23	18	20	30	22	17	16	19
Percentage	19.51	13.41	9.35	7.32	8.13	12.20	8.94	6.91	6.50	7.72

DISCUSSION

Taeniarhynchosis is a disease with a cosmopolitan spread. *Taenia saginata* is thought to be more widespread in developing countries where hygiene and sanitary standards are below average and routine meat inspections are not always performed. However, in countries where standards of hygiene and sanitation are considered high and routine meat inspection is in place, for example in Europe, bovine cysticercosis is still widespread and the prevalence of the disease in humans ranges from 0.01% to 10% (3, 5). Data on the prevalence of taeniarhynchosis in the New World countries shows similar results with prevalence of 0.04% to 8.8% (5).

Data from our study shows that cases of taeniarhynchosis, even though sporadic, are reported annually in Bulgaria. During the study period 246 cases of taeniarhynchosis were registered in the country which exceeds more than 3 times the number of cases registered in the ten-year period 1991-2000 (6). Similar data is available for the spread of the disease in Croatia where 124 cases of taeniarhynchosis were recorded in 2004-2013. In Serbia and Romania 212 (1997-2004) and 3129 (2007-2014) cases of taeniasis caused by *Taenia* spp. were recorded, respectively, which are not identified to the species level (7). It is worth pointing out that the *Taenia* eggs found with helminthovoscopy are not species-specific and the species can be determined by microscopic examination of the tapeworm proglottids and /or by PCR (1).

The proportion of female patients exceeds that of male persons but there is no statistically significant difference (Student's t-test: $t = -2.0275 < 2.101$). The distribution by age shows a statistically significant difference between the infected adults compared to the group of infected children and adolescents (Student's t-test: $t = 6.2923 > 2.101$). The higher percentage of infected persons of different ethnic origin is explained by the fact that for religious reasons they consume more veal and beef, most of them are engaged in farming and meat production for personal consumption and home trade. In most cases the meat or meat products do not pass veterinary control.

Taeniarhynchosis distribution is highest in regions with well-developed private livestock farming (Shumen, Plovdiv, Targovishte) and high rate of home meat production without veterinary control.

The high number of cases registered in Sofia is attributed to the close connection of the residents of the capital with the province. They often travel to the countryside to visit parents and close relatives and for supplying home-produced food, including meat and sausages.

In our opinion, the endemic spread of taeniarhynchosis in the country is mainly due to the poor health literacy of the population regarding the mechanisms of infection with bovine tapeworm, poor sanitation, especially in smaller settlements, which contributes to the contamination of the environment with human excreta and the possibility of infecting intermediate hosts, consumption of poorly-cooked meat products produced at home and insufficient veterinary control.

There are no significant problems regarding the diagnosis of the disease in humans. The eggs of *Taenia* spp. have a characteristic morphology and their detection in faecal samples is not difficult. Species differentiation of the parasite is also not a problem if proglottids are present in the samples. The characteristic uterine branches enable the differentiation of *T. saginata* from *T. solium* (8). There is a problem with the treatment of infected persons due to the lack of first-line drugs of choice in pharmacies (Praziquantel, Niclozamide). In some cases, this may delay the etiological treatment. During this period the infected person is a source of invasive helminth eggs and can contaminate the environment thus leading to infection of the intermediate hosts and the continuation of the epidemic process.

CONCLUSION

Overall, taeniarhynchosis in Bulgaria is not a serious problem for the public health system. However, the annual registration of cases, even though sporadic, requires greater efforts in control measures. On the part of human medicine efforts should be directed towards health promotion measures among the population, and on the part of veterinary medicine – towards improvement of control measures in the field of meat production, especially in small private farms.

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