

OBOLJEVANJE OD ENTEROBIJAZE U CRNOJ GORI U PERIODU 2010-2019. GODINE

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SAŽETAK

Uvod/Cilj: Procjenjuje se da više od milijardu ljudi u svijetu godišnje oboli od enterobijaze. Enterobijaza predstavlja najčešću helmintozu u razvijenim zemljama sveta kao što su severo-zapadna Evropa i Sjeverna Amerika. Cilj ove deskriptivne studije je da se analizira kretanje obolevanja od enterobijaze u Republici Crnoj Gori za period od 2010. do 2019. godine.

Metode: Podaci o obolijevanju od enterobijaze su preuzeti iz Godišnjeg izvještaja o zaraznim bolestima na teritoriji Crne Gore, Instituta za javno zdravlje Crne Gore. Podaci o broju stanovnika Crne Gore za 2011. godinu su iz popisa stanovništva, a za ostale godine korišćen je procenjen broj stanovnika iz publikacija Republičkog zavoda za statistiku. U analizi podataka primenjene su sirove, uzrasno-specifične i standardizovane stope incidencije.

Rezultati: U periodu od 2010. do 2019. godine u Crnoj Gori je prijavljeno 1308 osoba oboljelih od enterobijaze. Odnos oboljelih muškaraca i žena iznosio je 1:1,3. Smrtni ishodi od ove bolesti nisu registrovani. Najviše sirove stope incidencije za oba pola su u uzrasnoj grupi 0-4 godine i iznose 172,9/100.000 za muškarce i 175/100.000 za žene. Prosječna godišnja sirova stopa incidencije enterobijaze za ovaj desetogodišnji period je iznosila 21,1/100.000 stanovnika (21,1/100.000 za žene i 21,0/100.000 za muškarce), a standardizovana (prema populaciji Evrope) 29,3/100.000 (30,7/100.000 za žene i 27,9/100.000 za muškarce). Trend sirovih stopa incidencije pokazuje blagu tendenciju porasta, ali bez statističke značajnosti.

Zaključak: Higijena ruku je najbolja mjera prevencije enterobijaze. U domaćinstvima gde je zaraženo više od jednog člana ili se ponavljaju simptomatske infekcije, preporučuje se da se svi članovi domaćinstva liječe istovremeno, bez obzira da li imaju simptome ili ne. Neohodno je ponoviti liječenje kroz dvije nedjelje jer antihelmintici djeluju samo na odrasle parazite, a ne i na jaja/larve iz kojih se razvijaju nove jedinice.

Ključne reči: enterobijaza, incidencija, trend obolevanja

Uvod

Enterobijaza je parazitaro oboljenje intestinalnog trakta čovjeka, prvenstveno djece. Uzrokuje ga nematoda *Enterobius vermicularis*, u narodu poznata kao „mala dječja glista“ ili pundravac (1,2). *Enterobius vermicularis* je po izgledu mala, tanka, obla glista, bijele boje (3). Pripada klasi nematoda (valjkasti crvi). Odvojenih je polova i ženke su veće od mužjaka (3).

Enterobijaza je kosmopolitska infekcija. Za razliku od drugih crijevnih nematoda, predstavlja najčešću helmintozu u razvijenim zemljama (severo-zapadna Evropa i Sjeverna Amerika) (4). Češće se sreće u zemljama sa kontinentalnom i hladnom klimom, za razliku od ostalih parazita, koje češće

srećemo u tropskim krajevima (5). Procjenjuje se da više od milijardu ljudi u svijetu godišnje oboli od enterobijaze (1,2).

U tankom crijevu se iz jaja oslobađaju larve (3,6). Larve sazrijevaju u duodenumu, dok odrastao parazit sazrijeva u cekumu i gornjim dijelovima kolona, gdje se dešava i oplodnja (3,7). Nakon parenja, mužjak uginu (6). Oplodjene ženke noću migriraju iz debelog crijeva do perianalnih i perinealnih kožnih nabora, i tu na granici kože i sluzokože, polože 15-20.000 jaja, nakon čega uginu. Vremenski interval od gutanja infektivnih jaja do ovipozicije od strane odraslih ženki je oko mjesec dana (2-6 nedelja) (6,8). Životni vijek odraslih paraz-

INCIDENCE OF ENTEROBIASIS IN MONTENEGRO IN THE PERIOD 2010-2019

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SUMMARY

Introduction / Aim: It is estimated that more than one billion people worldwide suffer from enterobiasis each year. Enterobiasis is the most common helminthiasis in developed countries such as northwestern Europe and North America. The aim of this descriptive study is to analyze the trends in enterobiasis in the Republic of Montenegro for the period from 2010 to 2019.

Methods: Data on enterobiasis were taken from the Annual Report on Infectious Diseases in Montenegro, the Institute of Public Health of Montenegro. Data on the number of inhabitants of Montenegro for 2011 were taken from the census, and for other years the estimated number of inhabitants from the publications of the Republic Statistical Office was used. Crude, age-specific and standardized incidence rates were applied in the data analysis.

Results: In the period from 2010 to 2019, 1308 people with enterobiasis were reported in Montenegro. The ratio of affected men and women was 1: 1.3. No deaths from this disease have been reported. The highest crude incidence rates for both sexes are in the 0-4 age group and are 172.9/100,000 for men and 175/100,000 for women. The average annual crude incidence rate of enterobiasis for this ten-year period was 21.1/100,000 inhabitants (21.1/100,000 for women and 21.0/100,000 for men), and the standardized (according to the population of Europe) 29.3/100,000 (30.7/100,000 for women and 27.9 / 100,000 for men). The trend of crude incidence rates shows a slight upward trend, but without statistical significance.

Conclusion: Hand hygiene is the best measure to prevent enterobiasis. In households where more than one member is infected or symptomatic infections recur, it is recommended that all household members should be treated at the same time, regardless of whether they have symptoms or not. It is necessary to repeat the treatment in two weeks, because anthelmintics act only on adult parasites, and not on eggs / larvae from which new individuals develop.

Key words: enterobiasis, incidence, trend of incidence

Introduction

Enterobiasis is a parasitic disease of human intestinal tract, which primarily occurs in children. It is caused by a nematode *Enterobius vermicularis* that is known as a pinworm or "seatworm" (1,2). *Enterobius vermicularis* is a small, thin, white roundworm (3). It belongs to the class of nematodes (roundworms). It can be male or female, while the female nematode is bigger than the male (3).

Enterobiasis is a cosmopolitan infection. In contrast to other intestinal nematodes, it represents the most common helminthiasis in developed countries (Northwestern Europe and North America) (4). It is encountered more frequently in countries

with continental and cold climate, in contrast to other parasites, which are met more frequently in tropical climates (5). It has been estimated that more than a billion people worldwide is affected by enterobiasis annually (1,2).

Larvae are released from eggs in the small intestine (3,6). Larvae mature in the duodenum, while the adult parasite matures in the cecum and in upper parts of the colon, where fertilization happens (3,7). After copulation, the male pinworm dies (6). Gravid females migrate at night from the anus to perianal and perineal folds, and there, on the border of skin and mucosa they lay 15-20.000 eggs, and after that they die. The time interval

ita je oko dva mjeseca (ženke prežive 37-93, a mušjaci oko 50 dana) (6,9). Jaja postaju zarazna nekoliko sati nakon polaganja, a izvan domaćina preživljavaju oko dvije nedjelje. Gravidne ženke obično aktivno migriraju iz rektuma i mogu da pređu u bliske otvore i tako izazovu komplikacije (10).

Kod oko 40% osoba infekcija je asimptomatska (11). Od simptoma su najčešći perianalni ili perinealni pruritus, koji se pogotovo intenzivira noću (9). Smatra se da su migratorni pokreti ženke i ljepljiva supstanca u koju polažu svoja jaja, odgovorni za pojavu svraba (3,9). Istraživanja pokazuju da se svrab češće javlja kod onih koji već pate od nekog kožnog oboljenja (atopijskog dermatitisa, psorijaze, kontaktnog dermatitisa, seboroičnog dermatitisa, neurodermatitisa) (12). Usled češanja, mogu nastati perianalni eritem i sekundarna bakterijska infekcija i folikulitis (9). Ostali simptomi uključuju nesanicu (zbog isprekidanog sna usled svraba i češanja), nemir i umor. Djeca mogu postati anoreksična, izgubiti na težini (pogotovo kod prisustva velikog broja parazita u crijevima) ili patiti od oslabljene koncentracije, razdražljivosti i emocionalne nestabilnosti (3,9,10,13). Može se javiti i enureza, bruksizam, pa čak i konvulzije.

Ponekad, ženke mogu ektopično migrirati i ući u ženski genito-urinarne trakt, a kod djevojčica mogu i da polažu jaja na sluznicu vagine i usmina i tako dovedu do zapaljenskih promjena tih regija (urinarnih infekcija, kolpitis, vulvovaginitisa) (14,15,16). U uterusu i adneksima, paraziti mogu da se inakapsuliraju i daju simptome salpingitisa, a veoma rijetko tim putem mogu da dospiju i u peritonealnu šupljinu i dovedu do stvaranja eozinofilnih granuloma i hroničnog pelvičnog peritonitisa. Mogući su i granulomi jetre (17). Za stvaranje granuloma su odgovorne mrtve odrasle jedinke i jaja deponovana na ektopičnim mjestima. Rijetko, enterobijus može da izazove apendicitis tako što blokira lumen apendiksa ili dovede do upalnog procesa oko njega (18,19). Moguće su i intestinalne opstrukcije, perforacija crijeva, enterokolitis koji oponaša Kronovu bolest i pojava eozinofilnog ileokolitisa (20,21).

Infekcija se prenosi najčešće prljavim rukama, ali može da se prenese putem kontaminiranih predmeta, hranom i rjeđe vodom (22). Jaja se, iako rijetko, mogu i udahnuti (udisanjem prašine u kojoj se ona nalaze), a zatim progutati (6). Ovo se dešava kod npr. rastresanja posteljine, odjeće ili u jako kontaminiranim domaćinstvima i institucijama (9,11).

Osjetljivost na ovu infekciju je opšta (10). Najčešće obolijevaju mlađa školska i predškolska djeca, uzrasta 5-10 godina, osobe koje borave u institucijama (vrtići, domovi, kampovi i sl.), kolektivima, porodice sa školskom djecom i oni koji brinu o zaraženoj djeci (3,9,23). U ovim grupama prevalencija može biti 50% (6). Česta je pojava infekcije kod većeg broja članova istog domaćinstva (10,24). Prevalencija je najniža kod odraslih, izuzev majki zaražene djece (10). Veća prevalencija obolijevanja je zabilježena kod muškaraca koji imaju seksualne odnose sa muškarcima. Ne postoje podaci koji sugerišu da je ovo „oportunistička“ infekcija kod HIV-om inficiranih osoba (9). Pošto se imunitet ne razvija, moguće je da dođe do infekcije više puta u toku života (10).

Cilj ove deskriptivne studije je da se analizira kretanje obolevanja od enterobijaze u Republici Crnoj Gori za period od 2010. do 2019. godine.

Metode

U okviru ove deskriptivne studije analizirano je kretanje učestalosti obolevanja od enterobijaze u Crnoj Gori za period 2010-2019. godine. Istraživanjem su obuhvaćeni svi prijavljeni slučajevi obolijevanja od enterobijaze na području Crne Gore u vremenskom intervalu od 2010. do 2019. godine. Podaci o obolelima od enterobijaze preuzeti su iz Godišnjih izvještaja o zaraznim bolestima na teritoriji Crne Gore, Instituta za javno zdravlje Crne Gore, po kalendarskim godinama od 2010. do 2019. godine.

U radu su prikazane opšte, specifične i standardizovane stope incidencije, trend stopa incidencije, procentualni udio enterobijaze u ukupnoj strukturi obolijevanja od parazitarnih bolesti, kao i topografska raspodjela oboljelih po regionima. Specifične stope incidencije izračunate su po polu i uzrastu, a standardizovane stope su računete metodom direktne standardizacije, u odnosu na evropsku populaciju (25).

Brojilac za izračunavanje stopa incidencije enterobijaze činile su obolele osobe, a imenilac broj stanovnika Crne Gore. Za 2011. godinu broj stanovnika je dobijen iz popisa stanovništva, a za ostale godine korišćen je procenjen broj stanovnika Crne Gore, preuzet iz publikacija Republičkog zavoda za statistiku (Monstat) (26).

Za izračunavanje specifičnih stopa incidencije po uzrastu, formirano je devet uzrasnih grupa. Za prve četiri uzrasne grupe interval je iznosio pet

from the ingestion of infective eggs to oviposition by the adult females is about one month (2-6 weeks) (6,8). The adult life span is about two months (females survive for 37-93, while males survive for about 50 days) (6,9). The eggs become infective a few hours after being laid, and they survive for about two weeks outside their host. Gravid females usually migrate actively from the rectum, and they can pass into other close areas and cause complications (10).

In about 40% of persons, the infection is asymptomatic (11). The most common symptoms are perianal and perineal pruritus, especially at night (9). It is believed that the migratory movements of females and the adhesive substance, where they lay their eggs, are responsible for the appearance of pruritus (3,9). Studies have shown that pruritus is more common in those people who already suffer from some skin diseases (atopic dermatitis, psoriasis, contact dermatitis, seborrheic dermatitis, neurodermatitis) (12). Perianal erythema, secondary bacterial infection, and folliculitis can be caused by scratching (9). The other symptoms include insomnia (due to sleep disturbance caused by itching and scratching), restlessness, and fatigue. Children may become anorexic, lose weight (especially due to a large number of parasites in their intestines) or suffer from poor concentration, irritability and emotional instability (3,9,10,13). Enuresis, bruxism and even convulsions may appear.

Females may sometimes migrate ectopically into genitourinary tract, while in girls they can sometimes lay their eggs on vaginal mucosa and vulva, and cause inflammatory changes of that area (urinary infections, colpitis, vulvovaginitis) (14,15,16). Parasites can encapsulate in the uterus and the adnexa and give the symptoms of salpingitis, and very rarely they can reach the peritoneal cavity and lead to the appearance of eosinophilic granulomas and chronic pelvic peritonitis. Hepatic granulomas are also possible (17). Dead adult parasites and eggs deposited on the ectopic places are responsible for the appearance of granulomas. Enterobius may rarely cause appendicitis by blocking the appendiceal lumen or lead to the inflammatory process around it (18,19). Intestinal obstructions are also possible, perforation of intestines, enterocolitis, Crohn's disease and the appearance of eosinophilic ileocolitis (20,21).

The infection is usually transmitted via dirty hands, but also via contaminated things, food and water (22). Eggs can be, but very rarely, inhaled (by inhaling the dust in which they exist), and then ingested (6). This happens after shaking bedding and clothes or in very contaminated households and institutions (9,11).

Susceptibility to this infection is general (10). Younger pre-school and school children aged 5-10 are most commonly affected, as well as persons who stay at institutions (kindergartens, dormitories, camps, etc.), in collective settings, in families with school children and in those who take care about the infected persons (3,9,23). In these groups, prevalence can be 50% (6). It often happens that more members of the same household get this infection (10,24). The prevalence is the lowest in adults, except in case of mothers of infected children (10). Higher prevalence is noted in men who have sexual relationships with men. There are no data that suggest that this is an "opportunistic infection" in HIV positive persons (9). Since immunity does not develop, this infection can recur several times during lifetime (10).

The aim of this descriptive study was to analyze the trends in enterobiasis in the Republic of Montenegro during the period 2010 to 2019.

Methods

Within this descriptive study, the trends in the incidence of enterobiasis in Montenegro from 2010 to 2019 were analyzed. The study included all reported cases of enterobiasis in the territory of Montenegro during the time period 2010 to 2019. Data on enterobiasis were taken from the Annual Report on Infectious Diseases in Montenegro, the Institute of Public Health of Montenegro per each year from 2010 to 2019.

General, specific and standardized incidence rates, the trends in incidence rates, the percentage share of enterobiasis in the whole structure of incidence of parasitic diseases, as well as the topographic share of affected persons according to different regions were presented in this study. Specific incidence rates were calculated according to sex and age, while standardized rates were calculated with the help of direct standardization method, in relation to the European population (25).

The numerator for the calculation of incidence rates of enterobiasis included affected persons,

godina (0-4, 5-9, 10-14, 15-19 godina), za sledeće četiri 10 godina (20-29, 30-39, 40-49, 50-59 godina), a poslednja uzrasna grupa obuhvatila je osobe starije od 60 godina.

Pri analizi kretanja stopa incidencije, u posmatranom vremenskom periodu, korišćena je jednačina linearnog trenda.

Rezultati

U periodu od 2010. do 2019. godine u Crnoj Gori je prijavljeno 1308 osoba oboljelih od enterobijaze. Najveći broj obolelih (197) je zabežen 2012. godine, a najmanji 2010. godine (Tabela 1). Prosječan godišnji broj oboljelih za dati desetogodišnji period iznosi 131. Najveća stopa incidencije enterobijaze (31,8/100.000 stanovnika), zabilježena je 2012. godine, a najmanja 2011. godine (5,2/100.000) (Grafikon 2). Prosječna godišnja stopa incidencije za ovaj period je iznosila 21,1/100.000 stanovnika. Trend opštih stopa incidencije pokazuje blagu tendenciju porasta, ali bez statističke značajnosti ($y = 1,7048x + 11,673$; $p = 0,3015$). Najveće učešće enterobijaze u obolijevanju od svih parazitarne bolesti, koje se obavezno prijavljuju u Crnoj Gori, bilježi se 2018. godine, gdje čini više od četvrtinu obolijevanja od svih

parazitarne bolesti, odnosno 25,4%. Najmanje učešće enterobijaze registruje se 2013. godine, gdje čini 11,1% u strukturi obolijevanja od parazitarne bolesti. Inače, prosječno godišnje učešće enterobijaze u obolijevanju od parazitarne bolesti u Crnoj Gori u periodu 2010-2019. godine iznosi 18,5%.

Najveća stopa incidencije za oba pola registrovana je 2012. godine i iznosila je 33,3/100.000 muškaraca i 30,3/100.000 žena. Najmanje stope incidencije su zabilježene 2011. godine (za muškarce 4,2/100.000, a za žene 6,1/100.000). Najveća razlika u obolijevanju među polovima je bila u 2015. godini sa dominacijom muškog pola (32,2/100.000 za muškarce i 24,5/100.000 za žene). Prosječna godišnja stopa incidencije u desetogodišnjem periodu je bila 21,1/100.000 za žene i 21/100.000 za muškarce. Trendovi stopa incidencije i kod žena i kod muškaraca pokazuju blagu tendenciju porasta, koji nisu statistički značajni (muškarci: $y = 1,5721x + 12,373$; $p = 0,2255$; žene: $y = 1,8267x + 11,013$, $p = 0,3739$).

Najveća prosječna uzrasno-specifična stopa incidencije od enterobijaze je zabilježena u uzrasnoj grupi 0-4 godine (173,9/100.000), a najmanja u uzrasnoj grupi 60 i više godina (1/100.000) (Grafikon 2).

Tabela 1. Ukupan broj oboljelih i opšte stope incidencije obolijevanja od parazitarne bolesti i enterobijaze na 100.000 stanovnika i procentualni udio enterobijaze u parazitarne bolestima u Crnoj Gori po kalendarskim godinama 2010-2019. godine

Godina	Parazitarne bolesti		Enterobijaza		Udio obolelih od enterobijaze među obolelima od parazitarne bolesti
	Br. oboljelih	Incidencija/100.000	Br. oboljelih	Incidencija/100.000	%
2010	270	43,6	46	7,4	17,0%
2011	222	35,8	32	5,2	14,4%
2012	942	151,8	197	31,8	20,9%
2013	666	107,2	74	11,9	11,1%
2014	825	132,7	171	27,5	20,7%
2015	1093	175,7	176	28,3	16,1%
2016	1073	172,4	158	25,4	14,7%
2017	769	123,6	161	25,9	20,9%
2018	629	101,1	160	25,7	25,4%
2019	574	92,3	133	21,4	23,3%
Prosjek	706,3	113,6	130,8	21,1	18,5%

while the denominator was the population of Montenegro. Data on the number of inhabitants were taken from the census for 2011, while for other years the estimated number of inhabitants of Montenegro was taken from the publications of the Republic Statistical Office (Monstat) (26).

Nine age groups were formed in order to calculate the specific incidence rates. The interval amounted to five years for the first four groups (0-4, 5-9, 10-14, 15-19), while for the next for groups it was 10 years (20-29, 30-39, 40-49, 50-59 years), and the last group included people older than 60 years.

The equation of linear trend was used for the analysis of trends in incidence rates during the observed time period.

Results

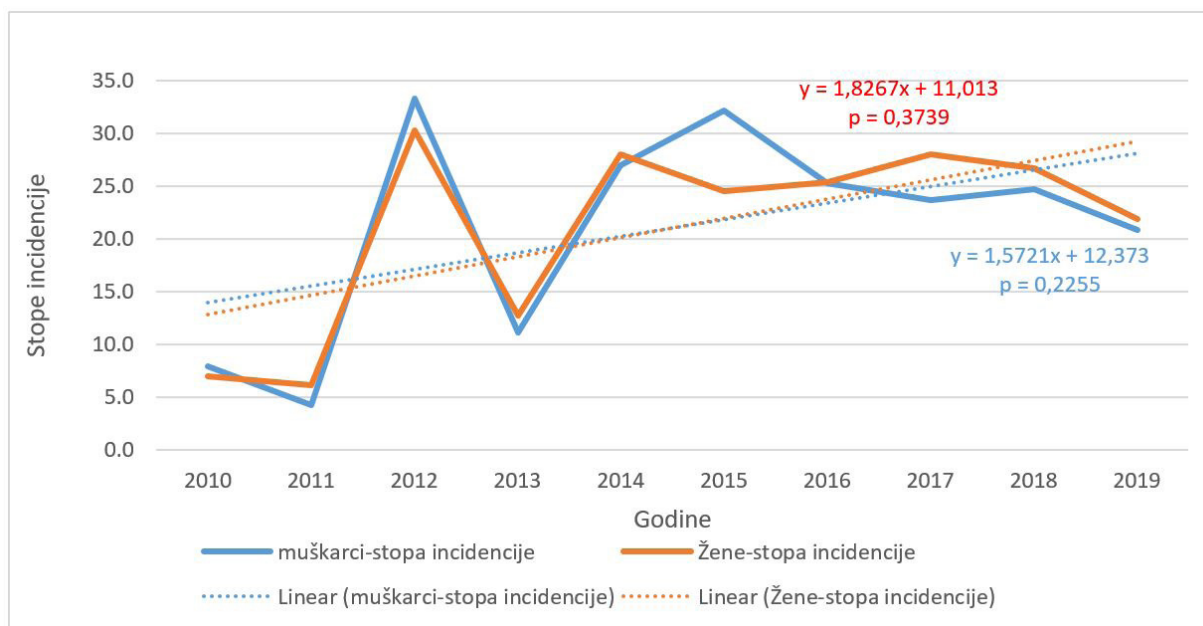
In the period 2010-2019, 1308 people with enterobiasis were reported in Montenegro. The largest number of people with enterobiasis (197) was noted in 2012, while the smallest number in 2010 (Table 1). The average annual number of affected people for the ten-year period amounted to 131. The highest incidence rate (31.8/100,000) was noted in 2012, while the lowest incidence rate was noted in 2011 (5.2/100,000) (Figure

2). The average annual incidence rate for this period amounted to 21.1/100,000 inhabitants. The trend in general incidence rates showed a slight tendency of rise, but with no statistical significance ($y = 1.7048x + 11.673$; $p = 0.3015$). The largest share of enterobiasis in the incidence of all parasitic diseases, which are necessarily reported in Montenegro, was noted in 2018, when that share was 25.4%, that is, one fourth of all parasitic diseases. The smallest share of enterobiasis was registered in 2013, with the share of 11.1% in the structure of parasitic diseases incidence. However, the average annual share of enterobiasis in the incidence of parasitic diseases in Montenegro amounted to 18.5% from 2010 to 2019.

The highest incidence rate for both males and females was registered in 2012 and it amounted to 33.3/100,000 men and 30.3/100,000 women. The lowest incidence rates were registered in 2011 (for men 4.2/100,000, and for women 6.1/100,000). The biggest difference in incidence among men and women was in 2015, when men were dominant (32.2/100,000 for men and 24.5/100,000 for women). The average annual incidence rate in the ten-year period was 21.1/100,000 for women and 21/100,000 for men. Incidence rates showed a slight upward trend in both men and women,

Table 1. Total number of cases and incidence rates of parasitic diseases and enterobiasis per 100,000 inhabitants and the percentage of enterobiasis in all parasitic diseases in Montenegro by calendar years from 2010 till 2019

Years	Parasitic diseases		Enterobiasis		The percentage of enterobiasis in all parasitic diseases
	No of cases	Incidence rate per 100,000	No of cases	Incidence rate per 100,000	%
2010	270	43.6	46	7.4	17.0%
2011	222	35.8	32	5.2	14.4%
2012	942	151.8	197	31.8	20.9%
2013	666	107.2	74	11.9	11.1%
2014	825	132.7	171	27.5	20.7%
2015	1093	175.7	176	28.3	16.1%
2016	1073	172.4	158	25.4	14.7%
2017	769	123.6	161	25.9	20.9%
2018	629	101.1	160	25.7	25.4%
2019	574	92.3	133	21.4	23.3%
Average	706.3	113.6	130.8	21.1	18.5%

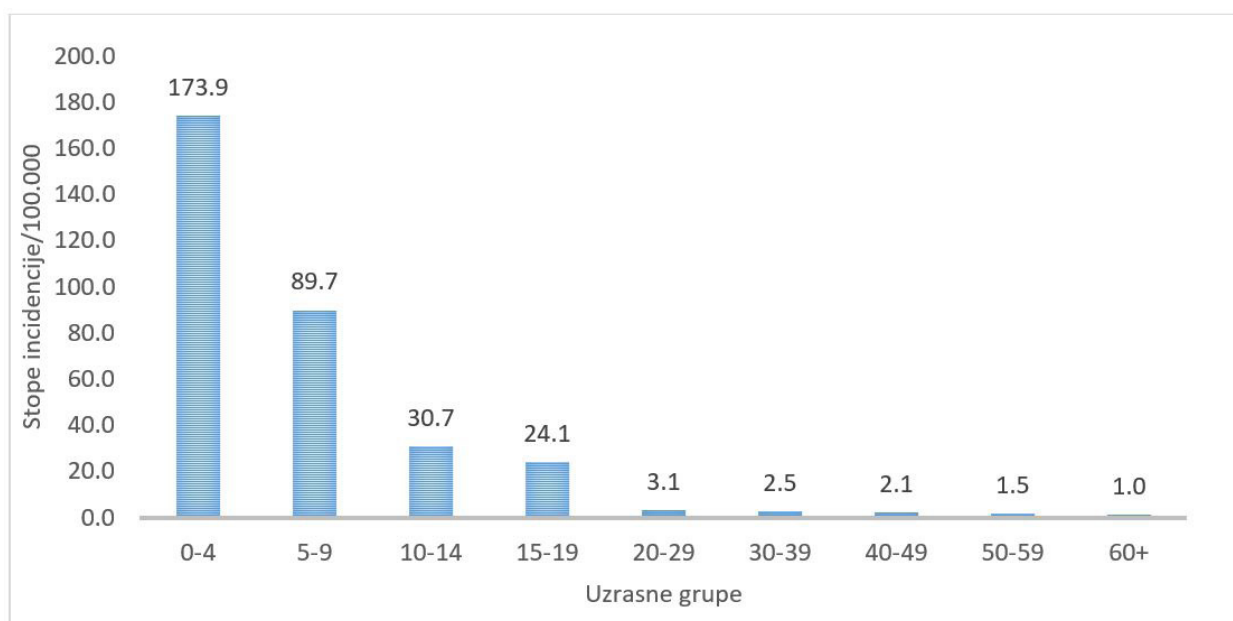


Grafikon 1. Specifične stope incidencije (na 100.000 stanovnika) od enterobijaze i trend stopa incidencija po polu, Crna Gora 2010-2019. godine

Najviša prosječna stopa incidencije od enterobijaze kod muškaraca je bila 172,9/100.000 u uzrastu 0-4 godine, dok je kod osoba ženskog pola 175/100.000 u istom uzrastu (Grafikon 3). Najmanja stopa incidencije od enterobijaze je bila kod muškaraca u uzrastu 30-39 godina (1,1/100.000), a kod žena u uzrastu 60 i više godina (0,9/100.000).

Prosečna standardizovana stopa incidencije enterobijaze prema evropskoj populaciji iznosi 18,1/100.000 stanovnika, a prema svjetskoj populaciji 29,3/100.000 stanovnika. Kod muškaraca najviša standardizovna stopa incidencije (dobijena

korišćenjem evropske standardne populacije) registrovana je 2015. godine i iznosila je 27,2/100.000, a kod žena 2012. godine i iznosila je 26,8/100.000 (Grafikon 4). Najniža standardizovana stopa incidencije je bila 2011. godine (3,3/100.000 za muškarce i 5,3/100.000 za žene). Trend stopa incidencije kod oba pola pokazuje tendenciju porasta, ali bez statističke značajnosti (za muškarce $y = 1,3939x - 2790,9$; $p = 0,2604$; za žene $y = 1,7364x - 3478,8$; $p = 0,4108$). Prosječna stopa incidencije kod muškaraca je bila 17,2/100.000, a kod žena 19,1/100.000.



Grafikon 2. Prosječne uzrasno-specifične stope incidencije (na 100.000) od enterobijaze, Crna Gora, 2010-2019. godine



Figure 1. Sex-specific incidence rates (per 100,000) and trend in incidence of enterobiasis by gender, Montenegro 2010-2019

but they were not statistically significant (men: $y = 1.572x + 12.373$; $p = 0.2255$; women: $y = 1.8267x + 11.013$, $p = 0.3739$).

The highest average age-specific incidence rate of enterobiasis was registered in the age group 0-4 years (173.9/100,000), while the lowest was in the age group 60 years and older (1/100,000) (Figure 2).

The highest average incidence rate of enterobiasis in men was 172.9/100,000 in the age group 0-4 years, while in women it was 175/100,000 in the same age group (Figure 3).

The lowest incidence rate was in men aged 30-39 (1.1/100,000), while in women it was in the age group 60 years and older (0.9/100,000).

The average standardized incidence rate of enterobiasis in the European population amounts to 18.1/100,000, while in the world population this rate amounts to 29.3/100,000. In men, the highest standardized incidence rate (obtained using the European standard population) was registered in 2015 and it amounted to 27.2/100,000, while in women, the highest standardized incidence rate was registered in 2012 and it amounted to

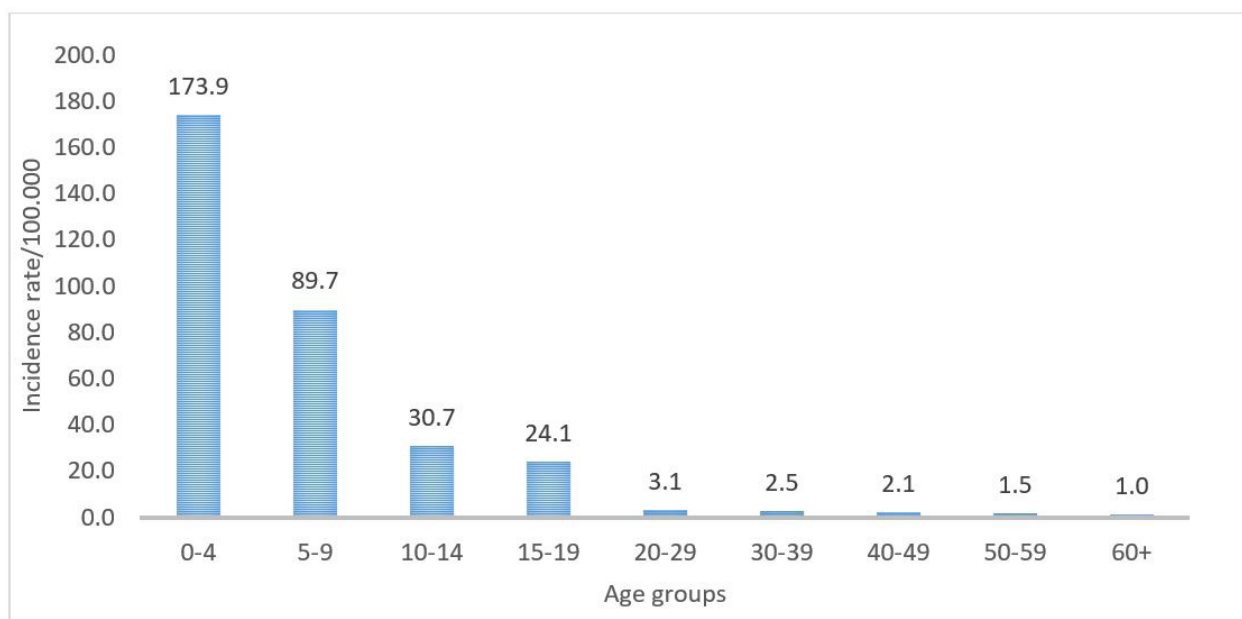
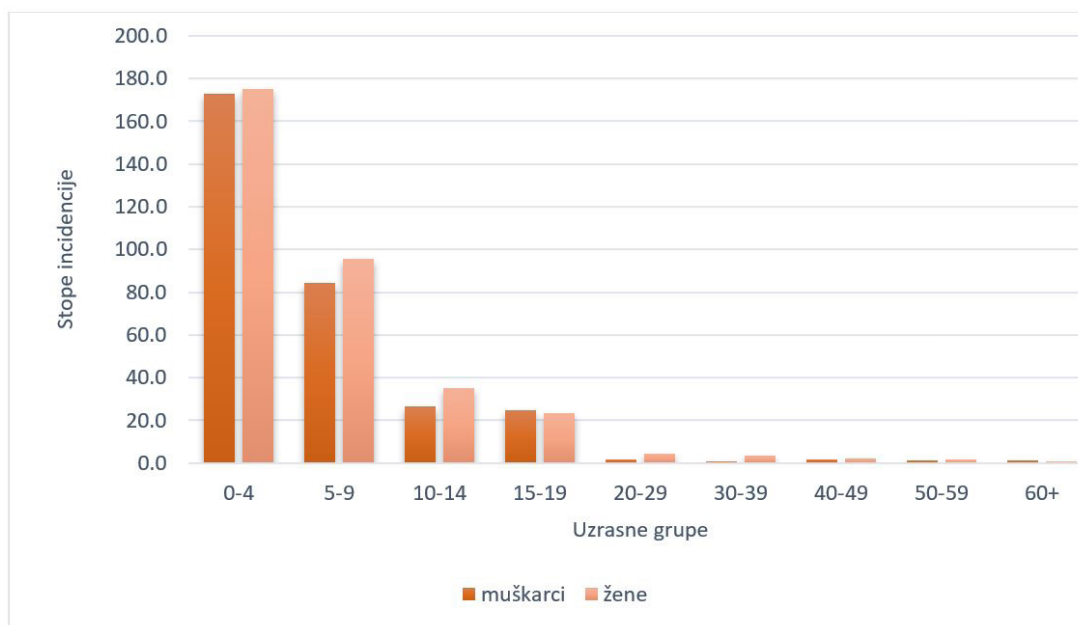


Figure 2. Average age-specific incidence rates of enterobiasis (per 100,000), Montenegro 2010-2019



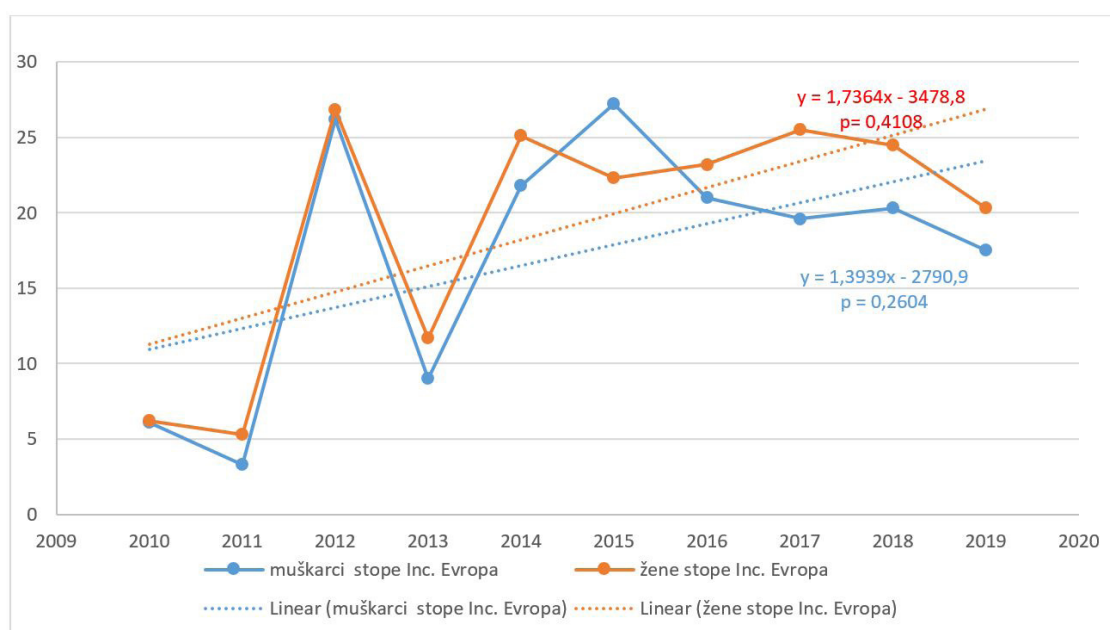
Grafikon 3. Prosječne uzrasno-specifične stope incidencije od enterobijaze u odnosu na pol, Crna Gora, 2010-2019. godine

U navedenom periodu više od 2/3 (tačnije 69%) registrovanih slučajeva, prijavljeno je u Primorskom regionu, 23% u Središnjem, a najmanji broj slučajeva u Sjevernom regionu (8%) (Grafikon 5). Odnos oboljelih od enterobijaze u Primorskom, Središnjem i Sjevernom regionu je bio 8,6: 2,9: 1.

Diskusija

Enterobijaza je helmintijaza koja se javlja širom svijeta, i za razliku od drugih iz ove grupe bolesti, javlja se podjednako i u razvijenim i u zemljama

u razvoju. Češće se javlja u zemljama umjerenog pojasa, što je još jedna njena osobenost (1,2,5). U većini slučajeva infekcija protiče asimptomatski, tako da se samo mali broj dijagnostikuje, što predstavlja tzv. vrh ledenog brijega. Osim toga, ova parazitarna bolest u većini zemalja Evrope, Amerike i svijeta ne podliježe obaveznom prijavljivanju, tako da ostajemo uskraćeni za podatke o njejoj incidenciji i kretanju tokom vremena. Enterobijaza se ne prijavljuje ni u Republici Srbiji.



Grafikon 4. Standardizovane stope incidencije (prema Evropskoj populaciji, na 100.000) po polu, kao i trend stopa incidencije, Crna Gora, 2010-2019. godine

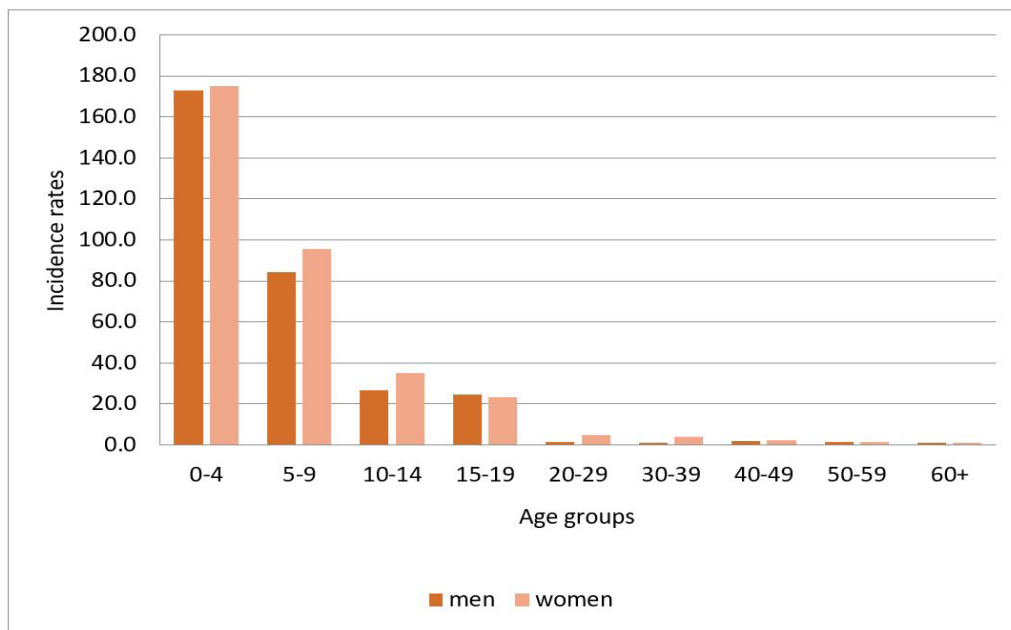


Figure 3. Average age-specific incidence rates of enterobiasis (per 100,000) in relation to gender, Montenegro, 2010-2019

26.8/100,000 (Figure 4). The lowest standardized incidence rate was in 2011 (3.3/100,000 in men, and 5.3/100,000 in women). The incidence rates showed an upward trend in both females and males, but without statistical significance (for men $y = 1.3939x - 2790.9$; $p = 0.2604$; for women $y = 1.7364x - 3478.8$; $p = 0.4108$). The average incidence rate in men was 17.2/100,000, while in women, it was 19.1/100,000.

In the given time period, more than 2/3 (more precisely 69%) of registered cases were reported in

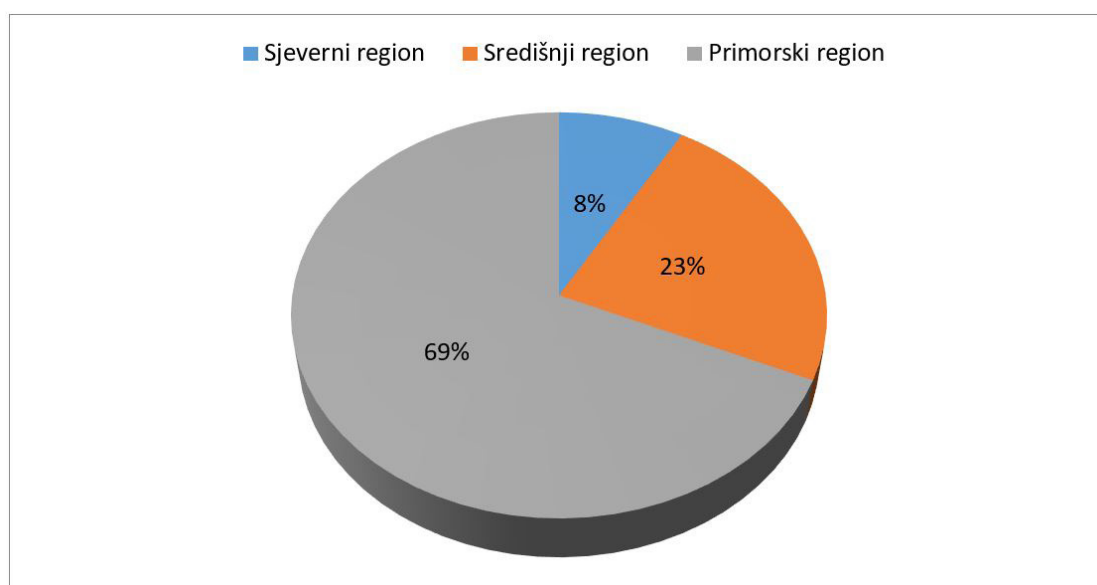
the coastal region, 23% in the central region, while the smallest number of cases was in the northern region (8%) (Figure 5). The ratio of people with enterobiasis in the coastal, central and northern region was 8.6: 2.9: 1.

Discussion

Enterobiasis is a helminthiasis that occurs worldwide, and in contrast to other diseases from this group of diseases, it occurs equally in developed, as well as in developing countries. It appears more frequently in countries



Figure 4. Standardized incidence rates (per 100,000) of enterobiasis (according to the population of Europe) and trend in incidence rate, by gender, Montenegro 2010-2019



Grafikon 5. Distribucija oboljelih od enterobijaze po regionima u Republici Crnoj Gori za period 2010-2019. godine

Ipak, u mnogim zemljama Evrope i u Sjedinjenih Američkih Država ispitivala se učestalost ovog oboljenja (prevalencija) kroz različita sprovedena istraživanja. Tako se u radu iz 2018. godine, u Istočnoj Slovačkoj ispitivala učestalost ove helmintijaze kod predškolske i školske djece (27). Uzorak je obuhvatao 390 djece, (tačnije 218 djevojčica i 172 dječaka), a prevalencija *E. vermicularis* je iznosila 3,59%. Nešto je bila viša kod dječaka (4,07%) nego kod djevojčica (3,21%) (14). Jaja *E. vermicularis*-a su najčešće izolovana u grupi djece uzrasta od 3 do 6 godina, a među njima najviše je bilo oboljelih u uzrastu između 4 i 5 godina.

Slični su bili rezultati epidemiološke studije kod djece i adolescenata iz sjeveroistočnog regiona Poljske sprovedene u periodu 2008-2009., koji su pokazali prevalenciju enterobijaze od 3%, a istraživanje sprovedeno par godina kasnije ukazalo je da je ukupna prevalencija ove helmintijaze u Poljskoj 10,1% (28). U studiji u Italiji, jaja *E. vermicularis* pronađena su kod 13,4% dece (29). Prevalencija među djecom u nekim zajednicama ide i do 61% u Indiji, 50% u Engleskoj, 39% na Tajlandu, 37% u Švedskoj i 29% u Danskoj (30). Učestalost ove parazitoze u Turskoj kod djece koja pohađaju osnovne škole varira između 5,4% i 67% (31).

Što se tiče istraživanja iz Sjedinjenih Američkih Država, ona ukazuju da je i kod njih *E. vermicularis* najčešća helmintijaza sa opštom prevalencijom kod djece 0,2-20%, dok se kod onih koje žive u institucijama prevalencija kreće 50-100% (6,32). Od svih starosnih grupa, djeca školskog uzrasta su na-

jviše izložena riziku od infekcije. Kod odraslih, enterobijaza je najčešća kod roditelja (starih 30-39 godina) djece uzrasta 5-9 godina (6,32). Generalno, kod njih se pokazalo da muškarci obolijevaju dvostruko češće nego žene, osim kod osoba starih od 5 do 14 godina, gdje su uglavnom obolijevale žene (6,32).

U malom broju Izvještaja o zaraznim bolestima u Republici Hrvatskoj, koji su dostupni na sajtu hrvatskog Zavoda za javno zdravstvo, uočavamo da se ni u ovoj zemlji, enterobijaza ne prijavljuje kao posebno oboljenje, već od skora u sklopu helmintijaza (33). Međutim, kako navode, poslednjih godina u njihovom informacionom sistemu postoji mogućnost uvida u uzročnike iste, tako da je 2016. godine od svih helmintijaza, enterobijaza učestvovala sa 46%, a u 2017. godini (poslednjoj objavljenoj na sajtu) sa čak 70% (19). Ovdje moramo dati napomenu da je u 2016. godini u Hrvatskoj čak 37% helmintijaza prijavljeno kao nedefinisano, a 10% kao nespecifično (33), te se vjerovatno u ovome dobrim dijelom krije objašnjenje zbog čega je ovolika razlika u učešću enterobijaze. Može se zaključiti da je u Hrvatskoj *E. vermicularis* najčešći iz grupe svih helminata, bar što se tiče navedenih godina. Ako ove dvije godine uporedimo sa našim, u Crnoj Gori je u 2016. godini enterobijaza činila 84%, a 2017. godine 85% svih helmintijaza i 21% svih parazitarnih bolesti koje se obavezno prijavljuju. U izvještaju hrvatskog Zavoda za javno zdravstvo iz 2017. godine, jasno se uočava porast broja prijavljenih slučajeva helmintijaze u

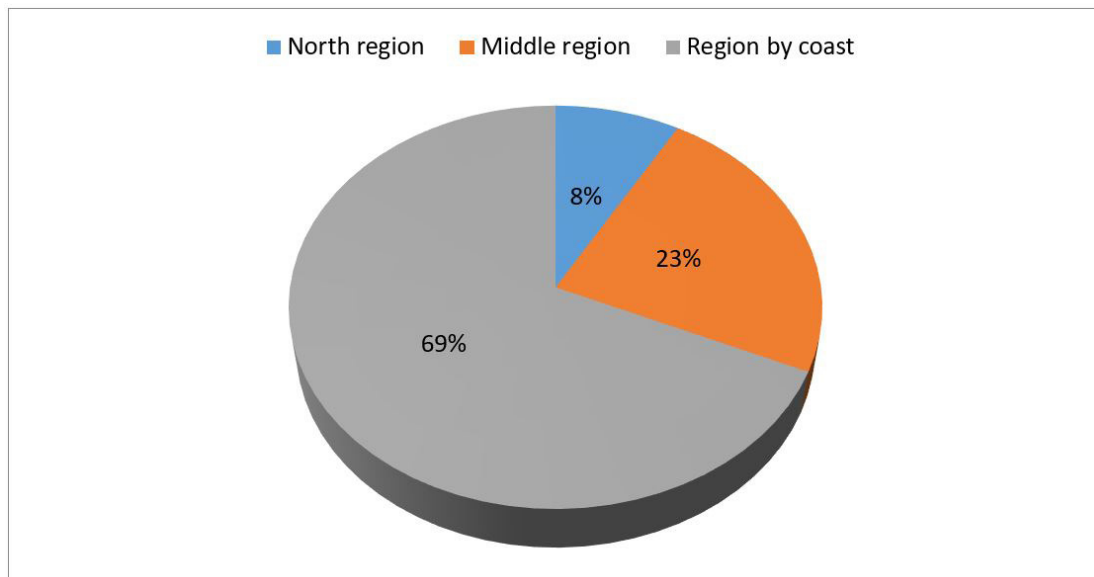


Figure 5. Distribution of enterobiasis patients by regions, Montenegro , 2010-2019

with moderate climate, which is one of its characteristics (1,2,5). In most cases, the infection passes as an asymptomatic infection, and only the small number is diagnosed, which represents the tip of the iceberg. In addition, this parasitic disease is not subject to mandatory registration in many European, American countries and across the world. Therefore, we remain deprived of data about its incidence and trends over time. Enterobiasis is not reported in the Republic of Serbia, as well.

However, in many countries of Europe and United States of America, the frequency of this disease (prevalence) has been examined in different studies. Thus, in a study from 2008, conducted in Eastern Slovakia, the prevalence of this helminthiasis was examined in pre-school and school children (27). The sample included 390 children, that is, 218 girls and 72 boys, while the prevalence of *E. vermicularis* amounted to 3.59%. It was slightly higher in boys (4.07%) than in girls (3.21%) (14). The eggs of *E. vermicularis* were most frequently isolated in the group of children aged 3 to 6 years, while the majority of children with this disease were in the age group 4 to 5 years.

Similar results were obtained in the epidemiological study that was conducted in 2008-2009 and that included children and adolescents from the northeastern region of Poland. The results showed the prevalence of enterobiasis of 3%, while one study that was conducted a few years later indicated that the prevalence of this helminthiasis was 10.1% in Poland (28). In one study conducted

in Italy, the eggs of *E. vermicularis* were found in 13.4% of children (29). The prevalence among children in some communities amounts to 61% in India, 50% in England, 39% in Thailand, 37% in Sweden, 29% in Denmark (30). The prevalence of this parasitic disease in primary school children in Turkey varies between 5.4% and 67% (31).

As far as studies from the United States of America are concerned, they point to the fact that *E. vermicularis* is the most common helminthiasis in their population, with the general prevalence in children from 0.2-20%, while the prevalence varies from 50-100% in people living in institutions (6,32). Of all age groups, school children are most exposed to the risk of this infection. In adults, enterobiasis is most frequent in parents (aged 30-39 years) of children aged 5 to 9 years (6,32). Generally, it was shown that men got this disease two times more frequently than women, except in case of persons aged 5 to 14 years, where females usually got the disease (6,32).

In a small number of reports on infectious diseases in the Republic of Croatia, which are available on the website of the Public Health Institute, we notice that in this country, enterobiasis is not reported as a separate disease, as well, but as a share within helminthiasis (33). However, as they claim, in their information system, the cause of disease could be seen during the last few years, so in 2016, the share of enterobiasis was 46% of all helminthic diseases, while in 2017 (the last year published on the site), this share was even 70% (19). We have to note that in Croatia in 2016, even

periodu 2010-2017. godine (33). U 2017. godini, malo više od polovine oboljelih (52%) su osobe ženskog pola, dok su u Crnoj Gori, u tom periodu, žene činile 56% registrovanih. Među oboljelima u Hrvatskoj, najviše je bilo djece: više od polovine činila su djeca uzrasta 0-7 godina, (podaci za 2016. i 2017. godinu) sa najvećom učestalošću kod djece 4-6 godina (19). Podaci za Crnu Goru u ovom periodu nam govore da je i u 2016. i 2017. godini više od polovine oboljele djece od svih helmintijaza u uzrastu do 4. godine (52%), a od 74-78% u dobnoj grupi 0-9 godina. Incidencija helmintijaza u Hrvatskoj 2017. godine iznosi 45,4 na 100.000 stanovnika (33), dok u istoj godini u Crnoj Gori iznosila 30,4/100.000.

Što se našeg istraživanja tiče, prosječno učešće enterobijaze u grupi parazitarnih bolesti, koje se obavezno prijavljuju u Crnoj Gori, u periodu 2010-2019. godine iznosi 18,5%; najčešća bolest iz ove grupe je definitivno šuga. Najveći udio enterobijaze u parazitarnim bolestima zabilježen je 2018. godine gdje je činila četvrtinu, a najmanji 2013. godine sa učešćem od 11,1%. Najveća incidencija enterobijaze zabilježena je 2012. (31,8/100.000) i 2015. godine (28,3/100.000), a najmanja 2011. godine (5,2/100.000). Udio enterobijaze u ukupnim helmintijazama koje se prijavljuju u Crnoj Gori u ovom periodu prelazi 80%, tako da i u našem slučaju opravdava naziv „najčešća helmintijaza“.

Enterobijazu odlikuje visoka kontagioznost, što posebno dolazi do izražaja u gusto naseljenim objektima/ustanovama. Osjetljivost na ovu bolest je opšta, ali je zbog ekspozicije ona najčešća među predškolskom i školskom djecom (1,2,5). Takođe, lična i higijena prostora igraju bitnu ulogu u nastanku bolesti, te se iz ovoga može naslutiti zašto se ova parazitoza najčešće javlja među ovom populacijom. U našem periodu posmatranja, djeca do 9. godine starosti činila su čak preko 80% svih prijavljenih slučajeva obolijevanja. Među njima, najčešće su oboljevala ona uzrasta 0-4 godine (stopa incidencije 173,9/100.000 ili ukupno 53% registrovanih), dok su ona 5-9 godina sa stopom incidencije 89,7/100.000, skoro dvostruko rjeđe bila inficirana (činila su 27,3% ukupno prijavljenih osoba). Rezultati koje smo dobili, a koji se slaže da podacima drugih istraživanja, mogu se objasniti navikama i ponašanjem djece određenog uzrasta. Mala djeca, predškolskog uzrasta, često stavljaju prste u usta, kao i kontaminirane predmete (igračke), sisaju

palac, nemaju izgrađene higijenske navike u vidu čestog i pravilnog pranja ruku, pogotovo prije jela i nakon upotrebe toaleta. Dalje, najčešće borave u kolektivu (vrtići i druge predškolske ustanove), što značajno povećava rizik obolijevanja, olakšavajući transmisiju. Školska djeca, iako i ona veliki dio vremena borave u kolektivima, što su starija, praktikuju bolju higijenu ruku i imaju drugačije navike i aktivnosti.

Što se odraslih osoba tiče, (ako uzmemo da su odrasle osobe one iznad 18 godina) u našem istraživanju, najčešće su oboljevale osobe uzrasne grupe 20-29 (stopa incidencije 3,1/100.000), odnosno činile su 0,9% svih oboljelih od enterobijaze. Odmah iza njih su obolevale osobe 30-39 godina (sa 0,8% učešća), a najmanje osobe uzrasta 60 i više godina (0,3% učešća među ukupno registrovanim slučajevima obolelim od enterobijaze u Crnoj Gori u desetogodišnjem periodu praćenja). Podaci iz literature nam kazuju da od odraslih osoba najčešće oboljevaju oni koji se nalaze u ustanovama kolektivnog smještaja ili se brinu o zaraženima (roditelji, staratelji, vaspitačice, njegovateljice).

Kao što je već navedeno, osjetljivost na ovu infekciju je opšta, tako da ni polne predilekcije nema. To nam potvrđuje i prosječna stopa incidencije u posmatranom periodu koja iznosi 21/100.000 za muškarce i 21,1/100.000 za žene. Ipak, prosječne specifične stope incidencije u odnosu na uzrast i pol, bile su veće kod žena u skoro svim starosnim grupama, izuzev u onoj 15-19 i 60 i više godina, gdje su češće oboljevali muškarci.

Što se teritorijalne distribucije tiče, više od 2/3 slučajeva (69%) je prijavljeno u primorskom regionu. Zabilježeno je, npr. i u susjednoj Hrvatskoj, da je najveća učestalost enterobijaze u županijama južnijeg dijela ove zemlje (19). Najmanje slučajeva u Crnoj Gori, registrovano je u sjevernom regionu (8%).

U cilju prevencije ove bolesti treba naglasiti da ne postoje specifične mjere. Od opštih mjera najvažnija je higijena ruku. Takođe, neophodno je edukovati stanovništvo o neophodnosti održavanja lične higijene, posebno o važnosti redovnog pranja ruku, naročito nakon toaleta, prije jela ili pripreme hrane, nakon mijenjanja pelena (6,10).

Zaključak

Higijena ruku je najbolja mjera prevencije eneterobijaze. Lična higijena i higijena prostora, takođe igraju bitnu ulogu. U domaćinstvima gde

37% of helminthiasis were reported as undefined, while 10% were reported as non-specific (33), and therefore, the difference in the share of enterobiasis can be explained by this fact. It can be concluded that in Croatia *E. vermicularis* is the most common form the group of all helminthes, as far as the above mentioned years are concerned. If we compare these two years with ours, in Montenegro in 2016, enterobiasis made 84%, while in 2017, 85% of all helminthiasis, and 21% of all parasitic diseases that are necessarily reported. In the Report of the Institute of Public Health of Croatia from 2107, the rise in the number of reported cases of helminthiasis was noticed in the period 2010-2017 (33). In 2017, slightly more than a half of infected persons (52%) were females, while in Montenegro, in the same period, women made 56% of all registered persons. The majority of persons with enterobiasis in Croatia were children: more than a half were children aged 0-7 years (data for 2016 and 2017) with the highest prevalence in children aged 4-6 years (19). Data for Montenegro in this period indicate that in 2016 and 2017, more than a half of children with all helminthic diseases were in the age group 0 to 4 years (52%), while 74-78% in the age group 0-9 years. The incidence of helminthiasis in Croatia in 2017 amounted to 45.4 per 100,000 inhabitants (33), while in the same year in Montenegro it amounted to 30.4/100,000.

As far as our study is concerned, the average share of enterobiasis in the group of parasitic diseases, which are mandatorily reported in Montenegro, in the period 2010-2019, amounted to 18.5%. The most common disease in this group is scabies. The largest share of enterobiasis in parasitic diseases was registered in 2018, when it made one fourth, while the smallest was in 2013 with the share of 11.1%. The highest incidence of enterobiasis was registered in 2012 (31.8/100,000) and in 2015 (28.3/100,000), while the smallest was in 2011 (5.2/100,000). The share of enterobiasis in all helminthic diseases that are reported in Montenegro in this period was more than 80%, and therefore, it is also "the most common helminthiasis".

Enterobiasis is characterized by high contagiousness, which is particularly pronounced in densely populated settings/institutions. The susceptibility to this disease is general, but due to exposure it is most common in pre-school and school children (1,2,5). Also, personal hygiene and

room hygiene have an important role in disease occurrence, and therefore, one may conclude why this parasitosis occurs in this population. In the period of our observation, children aged 0-9 years made 80% of all reported cases. Among them, the incidence was the highest in the age group 0-4 years (incidence rate 173.9/100,000 or 53% of registered persons), while the incidence was 89.7/100,000 in children aged 5-9 years, who were two times more rarely infected (27.3% of all registered persons). The obtained results, which are in accordance with the data from other studies, may be explained by children's behavior and habits in specific age groups. Younger, pre-school children often put their fingers into their mouths, as well as contaminated items (toys), they suck the thumb, do not have developed hygiene habits regarding regular and proper handwashing, especially before eating and after going to the toilet. Furthermore, they often stay in collective settings (kindergartens and other pre-school institutions), which significantly increases the risk of getting the disease, which can be transmitted more easily. Although school children spend a lot of time in collectives, when they get older, they practice better hand hygiene and have different habits and activities.

As far as adults are concerned (persons older than 18), in our study, persons aged 20-29 got the disease most frequently (incidence rate was 3.1/100,000), that is, they made 0.9 of all persons with enterobiasis. Soon after them were persons aged 30-30 (with 0.8% share), while the smallest share was in persons older than 60 (0.3% share among all registered cases of enterobiasis in Montenegro in the ten-year observation period). Literature data indicate that persons who are accommodated at collective institutions or who take care of infected persons (parents, guardians, pre-school teachers, care providers) get this disease most frequently.

As it has already been mentioned, susceptibility to this infection is general, and therefore, there is no sex predilection. It is confirmed by the average incidence rate in the observed period which amounted to 21/100,000 for men and 21.1/100,000 for women. However, average specific incidence rates regarding sex and age were higher in females in almost all age groups, except in the age groups 15-19 and 60 and older, where men were affected more frequently.

je zaraženo više od jednog člana ili se ponavljaju simptomatske infekcije, preporučuje se da se svi članovi domaćinstva liječe istovremeno, bez obzira da li imaju simptome ili ne. Neohodno je ponoviti liječenje kroz dvije nedjelje, jer antihelmintici djeluju samo na odrasle parazite, a ne i na jaja/larve iz kojih se razvijaju nove jedinice. Potrebno je pružiti dodatnu edukaciju i kontrolisati sprovođenje prije svega higijene ruku, djeci predškolskog i školskog uzrasta, kao i svim osobama koje žive i rade u ustanovama kolektivnog smještaja, budući da su oni u povećanom riziku od infekcije uzrokovane *Enterobius Vermicularis*-om.

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As far as territorial distribution is concerned, more than 2/3 of cases (69%) were registered in the coastal region. It was registered in the neighboring Croatia that the highest incidence of enterobiasis was in the southern counties of this country (19). The smallest number of cases in Montenegro was registered in the northern region (8%).

Aimed at disease prevention, it should be emphasized that there are no specific measures. Hand hygiene is the most important measure of all general measures. Also, the population should be educated about the necessity of maintaining personal hygiene, especially about the importance of regular hand washing, especially after going to the toilet, before eating and food preparation, after changing diapers (6,10).

Conclusion

Hand hygiene is the best prevention measure regarding enterobiasis. Personal hygiene and room hygiene also have an important role. In households, where more than one family member is infected or symptomatic infections recur, it is recommended that all household members should be treated, no matter whether they have symptoms or not. It is necessary to repeat the treatment in two weeks, because antihelminthics have effect only on adult parasites, but not on eggs/larvae, from which new individuals develop. It is necessary to provide additional education and control prevention measures, primarily hand hygiene in pre-school and school children, as well as in all persons who live and work in institutions of collective accommodation because they are at higher risk of infection caused by *Enterobius Vermicularis*.

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