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A review on trichomonas species infection in humans and animals in Iraq

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Abstract

Trichomonas is a common protozoan that causes a sexually transmitted disease in humans called Trichomonosis and venereal and intestinal Trichomonosis in cattle and cats, respectively. This parasite also causes avian Trichomonosis, or canker, in birds' gastrointestinal tract. Three main pathogenic species (*T. vaginalis, T. fetus, and T. gallina*) belonging to this genus are identified and recorded in different parts of the world. However, their presence and epidemiology are still incompletely known in other parts, particularly in *T. fetus* in Iraq. This review aims to update information on this disease based on an electronic search of databases to document the presence and prevalence of *Trichomonas* spp. in humans and some animals in Iraqi cities. The findings show that the infection by *T. vaginalis* and *T. tenax* in humans and *T. gallinae* in birds are identified in Iraq, recording different percentage rates. However, venereal and intestinal Trichomonosis caused by *T. fetus* tends to be slight or absent in cattle and cats. Venereal Trichomonosis is only found in Basra and Nineveh provinces cattle, while intestinal Trichomonosis is not recorded in Iraq yet. *T. hominis* is recorded in central and northern areas of Iraq. In conclusion, less or absence of the infection in cattle or cats may be ascribed to animal breed, climate, less of studies, and/or other unknown factors. Thus, epidemiological and molecular studies are needed to investigate the presence and prevalence of this disease, particularly in cattle and cats of Iraq.

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Introduction

Trichomonas is a genus of flagellate protozoans that are primarily parasites of vertebrates, including humans, cattle, birds, and cats (1,2). Some species belonging to the genus *Trichomonas* are already identified worldwide, which can infect humans and animals. In humans, three *Trichomonas* species (genitourinary *T. vaginalis*, intestinal *T. hominins*, and oral *T. tenax*) are identified in the world, including Iraq (3-6). *T. tenax and T. hominis* are known to be commensalism species that inhabit the oral and intestinal sites of humans, respectively, where they are considered nonpathogenic (7). In contrast, *T. vaginalis* is a well-known pathogenic species that cause sexually transmitted diseases in humans and affects over 150 million people worldwide (8). Another important species is *T. fetus* which commonly causes venereal Trichomonosis in cattle (9). This protozoan is an obligate parasite in cattle and cats' reproductive and gastrointestinal tracts, respectively (10). Interestingly, a study reported for the first time that this species was isolated from the uterus of breeding camels, as well as one preputial washing of a camel bull which showed positive for the infection (11). The disease can cause economic losses in herds due to low pregnancy rates, infertility, endometritis, and abortions in pregnant cows and heifers (12,13). In cattle, the parasite transmission occurs during mating and /or direct contact between infected individuals (14).

In comparison, the fecal-oral route considers a common transmission mode among cats (15,16). In cattle, the parasite is found on the mucosal surfaces of the uterus and vagina of cows, while preputial smegma is considered the favorite place for residue in bulls (17). Vaginitis, cervicitis,

endometritis, and infertility are significant pathogenic signs in infected cows. In addition, placental edema, mild lymphocytic and histiocytic chorionitis, and focal necrosis of trophoblasts are also shown as a result of inflammation of the mucosal surfaces of the reproductive tract (18). However, infected bulls that remain healthy are usually parasite carriers without clinical signs (19). In cats, *T. fetus* has been found in the feces of young cats in the last decades (20), causing diarrhea in domestic cats (15,16,21). Some symptoms can be seen during the infection, including chronic diarrhea associated with blood and mucus, which may be observed as firm or loose in consistency, and suffering from anal irritation and flatulence (22). *T. gallinae* is the only pathogenic species of trichomonads that causes avian Trichomonosis or is called canker in the gastrointestinal tract of birds in particular; Columbiformes, Falconiformes, Strigiformes, and wild Passeriformes (23,24). Previous studies mentioned that outbreaks of avian Trichomonosis were recorded in wild finches, later in Passeriformes, canaries, and psittacines in Europe and North America, as well as identified in other species of birds in the USA, such as; corvids in California (2,25).

Briefly, the wet mount preparation based on urine and vaginal discharge is routinely used to detect *T. vaginalis directly*. However, rapid antigen detection and PCR assays have greater sensitivity and accuracy in diagnosing the infection (26-28). In cattle, microscopic examination of bovine preputial and urogenital washes or scrapings can usually be used to detect the parasite. In addition, subsequent culture is also conducted for propagation and detection of the infection in the laboratory (29). Feline *Tri*chomoniasis can be diagnosed by several techniques, including; direct examination of fresh feces smear, fecal culture using specific media, and histopathological examination of intestinal biopsies. Direct microscopy is used to diagnose avian trichomoniasis based on swabbing the oral cavity during clinical examination or necropsy (23), and cultivation tests are also applicable for detecting the infection in birds (30). Furthermore, PCR amplification is commonly used to diagnose the hosts' infection (15,24,30,31).

Indeed, *Trichomonas* has been documented as a parasite that causes trichomoniasis in mammals and birds for several decades, for instance, in the bovine reproductive tract for about 100 years (32). Interestingly, this parasite has been recently recognized and established in the intestine of cats associated with diarrhea (15,21). Nevertheless, little data is known about the epidemiology and prevalence of this parasite, whether in humans or other animals, including cats in some parts of the world. Thus, this review highlights the distribution and updated prevalence of this parasite in Iraq.

Scientific classification of *Trichomonas*

The taxonomic tree indicates that this protozoan belongs to Kingdom: Protista, Phylum: Protozoa, Subphylum: Sarcomastigophora, Order: Trichomonadida, Family: Trichomonadidae, Genus: *Trichomonas*, Species: *T. vaginalis*, *T. fetus*, *T. gallinae*. These common species cause a disease called trichomoniasis, where *T. vaginalis* resides in the female lower genital tract and the male urethra and prostate of humans (33), and *T. fetus* commonly causes a disease called bovine venereal Trichomonosis in cattle or feline Trichomonosis in cats (19). at the same time, *T. gallinae* causes avian Trichomonosis in the upper gastrointestinal tract of birds (23).

Morphological characteristics of *Trichomonas*

Although species of the genus *Trichomonas* tend to be similar in terms of external appearance, each species has some specific characteristic features, particularly the number and shape of flagella. *T. vaginalis* is oval or pear in shape, measuring 9 × 7 µm, and has five flagella, four anterior, while the fifth flagellum is a recurrent flagellum with an undulating membrane that extends backward of the body (34). Regarding the nonpathogenic *Trichomonas* species, the trophozoite of *T. tenax* measures 5-14 µm long and 6-9 µm wide, which has four anterior flagella and the fifth flagellum that raises an undulating membrane that is two-thirds the length of the body (35). *T. hominins*, this species does not have a cystic stage while it has the trophozoite stage, which is pyriform in shape, measuring 8-20 µm long by 3-14 µm wide and bearing 3-5 anterior flagella (36) While, *whereas T. fetus* only has a trophozoite stage which is about 5-25 µm in length and 3-15 µm in width, this stage is a pear-like shape, one nucleus, three anterior flagella, and a posterior flagellum (37-39). For *T. gallinae*, the trophozoite has an ovoidal to pyriform shape with a size of about 7-11 µm. This trophozoite also has four free anterior flagella and a fifth recurrent one, which does not extend outside the posterior pole (40). The life cycle is a simple asexual cycle without a cyst stage, where trophozoites replicate simply by binary fission (41).

Transmission of *Trichomonas* spp.

T. vaginalis is a species that causes a sexually transmitted disease in humans. Therefore, sexual intercourse is the main route of transmission among humans (42). The oral species, *T. Tenax*, is transmitted via saliva, droplet spray, kissing, and contaminated drinking water (43,44), and the intestinal *T. hominis* can be transmitted via the fecal-oral route (45). In comparison, the transmission of *T. fetus* is one of the primary steps that influence the distribution of the infection among animals. Cow-to-bull or/and bull-to-cow during coitus consider primary routes to transmit the parasite from a host to others, where cows usually get infected by infected bulls through natural or artificial insemination (46,47). Nevertheless, parasites in frozen samples can be killed through drying or high temperatures of the artificial insemination process. Therefore, direct contact between a host and another is a common mode for transmitting the parasite among cattle (48).

In feline trichomoniasis, the parasite is transmitted through the fecal-oral route and can be survived for days in moisture environments, shared litter boxes, and mutual grooming (19). More importantly, this parasite can remain infectious for 24hr in feed containers, dry areas, and water (26). In avian trichomoniasis, the upper digestive tract, including the mouth, pharynx, esophagus, and crop, is the favorite site for *T. gallinae*. Therefore, the most common route to transmit the infection is direct contact via the crop milk from infected parent birds to the nestlings during feeding (49). Additionally, it is believed that this parasite can infect turkeys and chickens through drinking water (50).

***T. vaginalis* in humans**

According to updated global data, 156 million cases per year are infected by *T. vaginalis*, where the prevalence in women between 15-49 years old is 5.3%, while in men is 0.6% (51,52). It is known that the infection in women may be asymptomatic or have vaginal discharge, pruritus, dysuria, vaginitis, and cervicitis (53-55). Infected men are also asymptomatic, although urethritis may be shown in some cases (56). Although the epidemiology of the infection in men is still incompletely known, the severity and epidemiology of it in women rely on some risk factors, including lower socioeconomic status, older age, more sexual partners, and the black race (57,58). The prevalence of infection among women also differs according to geographical areas, where the percentage in Asia is 0.8% compared to 17-20% in Africa (58-60). In Arabic countries, a previous study using clinical and wet-mount examination was conducted to investigate the *Trichomonas* infection in 2,450 women in Benghazi City, Libya, from 2000 to 2001. The findings showed that 29 out of 2450 (1.2%) were infected with symptomatic clinical signs, including vaginitis discharge, burning, vulvar pruritus, dyspareunia, dysuria, and strawberry appearance (61). Another descriptive study was conducted among 430 pregnant women in Gaza, Palestine; its results found that 77 out of 423 women 18.2% were favorable to *T. vaginalis* infection (62).

In Iraq, several studies are already conducted to detect this infection in humans, particularly symptomatic women. This may be an indicator that trichomoniasis considers an endemic disease in Iraqi populations. For instance, A study in Basra province used wet preparation and culture methods to examine 300 females to detect this parasite. The results show that 34 females 11.3% suffering from vaginal discharge were favorable to the infection (63). In 2010, 600 women who attended the gynecological outpatient clinic and hospitals in Sulaimania were examined for *T. vaginalis* infection. The infection rates are 1.66% and 5% based on direct wet mount examination and culture techniques (64). In Dohuk city, 425 vaginal swabs were collected from women with vaginal discharge associated with vaginitis, cervicitis, and pelvic inflammatory disease. The finding appeared that the infection was positive in 10 (2.4%), 15 (3.5%), 17 (4.0%), 23 (5.4%) swabs by wet smear preparation, hematoxylin-eosin-stained smear, Papanicolaou stain, and Diamond modified culture, respectively. This study also found that young women aged 20-25 showed the highest infection rate 7.6% compared to other ages (65). In Babylon province, A study investigated 250 samples of cervical swap for detecting the parasite, and its results appear that the infection rate is 20% by mediated wet swab and 22% by mediated centrifuge (66). Epidemiological research was also carried out for screening for trichomoniasis in 440 women ages (16-60 years old) in Erbil city. The results showed that 14 (3.18%) were positive using the culture technique, while 12 (2.73%) were infected using the direct wet mount technique. Additionally, the age group of 16-26 years recorded the highest infection rate 4% compared to other age groups of 16-26 years and 27-37 years, who recorded 3.3% and 3.1%, respectively (67). A recent study on wet mount and polymerase chain reaction was also conducted to detect the infection in symptomatic women in Babylon city. The results demonstrated that (19.1%) was positive for wet mount and (27.6%) for PCR technique. This study also found that the highest infection rates were recorded in women in the age group 30-40 years (68).

Furthermore, a molecular study using the multilocus sequence typing (MLST) method was conducted to examine 154 Iraqi women in Baghdad province. This study finds that 53 women (34.41%) are positive for *T. vaginalis* infection (69). Recently, a study in the north of Iraq was conducted to assess serum levels of interferon-gamma (IFN-γ), Interleukin 10 (IL-10), C-reactive protein, and antiphospholipid, anticardiolipin antibodies with eosinophil count in response to *T.vaginalis* infection. The observation of this study appeared that serum IFN-γ levels and antiphospholipid immunoglobulin G (IgG) antibodies were significantly increased in infected women (70). A comparative study was carried out to compare ELISA and wet mount preparation for the detection of *T. vaginalis* infection, and its findings reveal that these two techniques recorded 65.5% and 57.2%, respectively (71). More recently, research was conducted on 160 non-pregnant married women who attended private clinics and public hospitals in Baghdad to detect *T. vaginalis* using serological techniques, recording 14.37% as the total infection rate (72). Notably, a serological study based on ELISA examined 240 serum samples collected from 120 couples between 18-43 years old to diagnose this species. The results demonstrate that the infection rates in women are higher than in men, which were 31.7% and 24.2%, respectively (73). Another recent research was done in Baghdad city targeting pro-inflammatory cytokines in the serum of infected women with *T. vaginalis*, showing that this parasite's IL-8 and IL-12 may alter during infection (74). In Al-Diwaniya city, direct wet mount microscopy and culture were used to detect this parasite in vaginal swabs collected from female pregnant patients. The results of this study explain that 12 out of 200 (6%) pregnant women are

favorable to infection (75). A more recent study was conducted in Mosul city to investigate this species in outpatient women (18-45 years) at a Maternity hospital using microscopic and molecular techniques, explaining the high sensitivity of molecular techniques in the detection of the parasite compared to routine methods (76).

To conclude the above data, it is evident that the infection by *T. vaginalis* in Iraq is common and well investigated in most cities, showing the importance of this parasite and its effects on public health. Thus, awareness and advice should always be given to people, particularly women, about the risk of this infection.

***T. tenax and T. hominis* (synonym: *PentaTrichomonas hominis)* in human**

Despite these two species being initially known as nonpathogenic or commensal species in the host (36,77), some recent studies suggest that they are associated with some diseases and symptoms (35,78-81).

In Iraq, some local studies were conducted on humans to investigate the infection by *T. tenax* and *T. hominins*, showing various infection rates. For instance, a study in Basrah, Iraq, examined 100, 104, 110, and 100 samples of the general population, primary school, secondary school, and university students, respectively, during a period of (October-December) based on the direct wet smear method to detect *T. tenax,* the rates of the infection were 11% in the general population, 6.7% in primary school children, 3.6% in secondary school children, 1% in university students (3). *T. tenax* was recorded in patients who attended clinics periodontics in Babylon province. The results demonstrated that 64 out of 310 (20.6 %) patients were positive (40.2% periodontitis, 14.2 % gingivitis) according to wet preparation and Giemsa staining (82). Another study in Babylon province done from September 2011 to May 2012 used the direct smear method and wet preparation method to examine 653 sputum, and 653 saliva samples collected from hospitals, medical centers, and special clinics showed that the total infection rate of *T. tenax* is 1.99 % and 7.81% in sputum and saliva samples, respectively (5). Furthermore, the distribution of oral *T. Tenax* in patients in Karbala city was determined by a random examination of 199 samples taken from 160 patients using PCR, where the parasite was found in 25% out of examined patients (83). Another recent study in Karbala city investigated 383 samples collected from specialized dental centers and some health centers to detect *T. tenax* from September 2017 to May 2018 using the microscopic examination. The findings of this study recorded that the total infection rate is 8.09% (84). A molecular study was conducted in Duhok to detect *T. Tenax* using PCR based on 18s rRNA gene-specific, showing that 8 out of 184 (4.32%) are only positive (85).

Regarding *T. hominins*, little data is found about the presence and epidemiology of this species in Iraqi cities. Nevertheless, a study in Karbala city examined 277 diarrhea cases in children under five, recording the infection rate at 1.1% (86). In the Kurdistan region, particularly in Erbil province, a microscopic study found 2 cases (0.19%) out of 332 children are infected by *T. hominins* (87). Recently, a study was conducted in Ramadi / Iraq from May 2019 to May 2020 to diagnose *T. hominins* in 200 fecal samples based on microscopic examination, where the infection rate is % 2.06 (6). Although some studies suggest that these species can cause host symptoms, their pathological role and effects on hosts are still unclear and /or incompletely understood (6,88). Thus, Further studies can explain more information regarding their epidemiology and pathogenicity.

***T. fetus* in cattle**

In 1932, Trichomonosis was reported for the first time in Pennsylvanian cattle (89). Importantly, it has been shown that the prevalence of infection differs from region to region in the world, where the prevalence of infection is limited in countries that use artificial insemination as the common method of cattle reproduction (19). A study in the northwest USA investigating 450 bulls revealed no infections recorded in these animals (90). However, *T. fetus* was reported in Florida, where 1984 beef bulls in 59 herds were examined, and the overall prevalence was 6.0%, suggesting that the percentage of infection is associated with some bulls factors, such as age, breed, herd, and herd management practices (91). Other studies also reported disease prevalence in different parts of the world. In Argentina and Brazil, the prevalence was 3.5% and 3.7%, respectively (92,93). Another study recorded 18.4% of cows and 7.2% of bulls in Costa Rica (94). In Africa, the prevalence of *T. fetus* infection was 10.4% in the north-western part, while 26.4% was in examined animals of South Africa (95). However, a recent molecular study did not detect *T. fetus* infection in 360 dairy cows in Algeria (96). In Australia, the percentage significantly increased between 1985 and 1986 in the Victoria River district (VDR) of the Northern Territory, where 65.6% of bulls were infected with trichomoniasis, explaining this percentage to the lack of trichomoniasis control measures in the VRD management situation (97). Although the prevalence of Trichomonosis tends to be zero in some European countries due to using control programs, such as artificial insemination, the percentage of 32% was documented in tested bulls of Spain in 2011(98). Recently, two molecular techniques were used to investigate *T. fetus* in 172 pigs, 236 wild boars, and 180 cattle in Poland. The findings showed that pigs were infected with a percentage of 16.28%, while no positive cases in cattle and wild boar (99). Therefore, more research is helpful to understand the epidemiology of this parasite and whether other factors may significantly impact the disease's distribution. In Turkey, cows with various clinical signs were examined to detect *T. fetus* infection. The findings revealed that the percentage of infection was 8.53%, and these cows suffered from vaginal discharge, metritis, and abortion (14). Another study

reported that *T. fetus* was found in aborted fetuses from the Eastern Anatolian Region of Turkey by staining, culture, and PCR methods, suggesting that further investigation is needed to study the epidemiology of the parasite in the region (100).

Furthermore, a study documented for the first time that *T. fetus* was detected in the ileum, cecum, and colon of cats suffering from diarrhea (101). In Iran, the nested PCR technique demonstrated that the parasite is detected in cattle in Isfahan city, where 6 Bulls (8.2%) and 2 Cows (7.4%) isolates are positive (102). It is also reported for the first time in Iran that a cat with chronic diarrhea is found to be infected by *a T. fetus* (103).

As mentioned above, venereal *Tri*chmoniasis is found in various parts of the world, indicating the importance of the disease and its effect on the health of animals, particularly cattle and cats. However, it is still incompletely investigated in some parts of Asia, such as; Iraq. More recently, the parasite was found in the preputial fluid of the bull's penis of Basra, Iraq, showing that 2 out of 100 samples are positive using microscopic examination of slide smear stained with Giemsa stain (104). Furthermore, *T. fetus* is found in the vaginal mucus of infected cows in Nineveh province, Iraq, where the infection percentage is 11 out of 87 cows (12.6 %) using the conventional polymerase chain reaction technique (105). Previous studies explain that the epidemiology of *T. fetus* infection in animals is incompletely studied yet in this region. Thus, it is suggested that priority would be given to investigating the infection in animals to understand whether this disease is endemic or not in Iraq.

T. fetus in cats

In 1996, Trichomonosis in cats was identified for the first time, and it has been considered one of the common gastrointestinal tract disorders in cats globally (106). Some studies carried out in the USA showed positive cases among examined cats. For example, 27out of 68 (39%) of cats suffering from diarrhea were positive for *T. foetus* (107). Another study conducted in the USA demonstrated 31% positive results among 117 cats (20). In addition, the percentage of infection in cats in Australia and New Zealand was 42.4% and 81.8%, respectively (108,109). According to studies conducted on the European cat population, the disease has been recorded in different European countries, where the percentage of infection was about 2-30% (80,110). More recently, *T. fetus* was also found in cats of Poland in a percentage of 20.51% (96). In Asia, the infection percentage was 8.8% in cats found in Japanese hospitals (111), while 86% of the prevalence of the disease was in young cats between 2009 and 2014 in China (112). Undoubtedly, further investigation could provide a further understanding of the epidemiology and prevalence of this disease in cats. According to current research, the infection of *T. fetus* in Iraqi cats is not recorded yet. Thus, survey studies are needed to investigate and understand the epidemiology of this species in cats.

T. gallinae in birds

Since the 19th century, *T. gallinae* has been reported as a significant protozoan parasite that causes avian trichomoniasis in birds worldwide (23). This disease is endemic to columbid (pigeon and dove) species and has recently been an emerging infectious disease (EID) among European birds called fringillid species (113,114). It is mentioned that different strains of this species cause various morbidity and mortality in pigeons, whereas virulent strains can lead to mortality of 50% and 90% in adults and squabs, respectively (115). A recent molecular study documents that genotypic diversity is found among domestic and wild pigeons where a variety of strains are identified in the birds of Saudi Arabia, confirming that infection is significantly higher in domestic pigeons and genotypes of ribotypes A and C are predominant (116). Another recent study confirms this genetic diversity, showing that four strains of *T. gallinae* A, C, II, and KSA11 are recorded in falcon of Saudi Arabia (117). Several epidemiological studies recorded the prevalence of avian trichomoniasis in birds. For instance, a microscopic examination study in India revealed a prevalence of 26.85% of *T. gallinae* in Domestic Pigeon (118). In Iran, a recent wet mount preparation and light microscopy study examined the oropharyngeal cavity, crop/esophagus, droppings/cloaca, and conjunctival swabs of several types of birds belonging to different orders throughout a year. The findings detect that the total positive samples are 23.7%, distributed from the upper gastrointestinal tract to the ophthalmic and respiratory systems (119).

In Iraq, several studies in most Iraqi cities were also conducted to detect avian trichomoniasis, showing various infection rates (120-124). Recently research done in Baghdad from October 2018 to March 2019 found a prevalence of 58 % (106/180) by Giemsa stain microscopy while 85% using PCR product of 370bp of ITS1/1.5.8S./ITS2 rRNA (125). Avain trichomoniasis was also recently recorded in Karbala by a comparative study in the three types of birds (Bird toilet decorations, Bird pigeon, Broiler bath decorations) based on a culture method of oral swabs where the total rate of infection is 14.7% (126). Another study from March 2020 to January 2021 in Samawah, Al-Muthanna province, found that domestic and wild pigeons (*Columba livia*) are infected with *T. gallinae* with a prevalence of 4% and 3.2%, respectively, based on clinical and microscopic examination (127). In summary, it is shown that avian trichomoniasis is widespread among birds of Iraq, considering that veterinarians should frequently give awareness campaigns to owners for knowing this infection and its risk to their birds.

Conclusion

It is demonstrated that the genus *Trichomonas* is one of the common protozoa that infect mammals and birds,

causing a disease called Trichomonosis. This genus has essential species, including (*T. vaginalis* in humans, *T. fetus* in cattle and cats, and *T. gallinae* in birds). The name of the disease differs based on its species and the site of infection inside a host. For instance, *T. vaginalis* causes Trichomonosis, which considers one of the Sexually Transmitted Diseases (STDs) in humans, while *T. fetus* causes venereal Trichomonosis in cattle and intestinal Trichomonosis in cats. In birds, *T. gallinae* infects the upper digestive tract, causing avian trichomoniasis, called canker. According to the survey conducted in this article, all these species are classified as pathogenic, leading to significant health disorders in their hosts. It is shown that many studies are carried out to detect and investigate this disease worldwide, including in Iraq. Data collected from the scientific websites suggested that the prevalence of *T. vaginalis, T. gallinae, and T. tenax* are well investigated, recording different infection rates in most Iraqi cities.

Nevertheless, the observations reveal that the percentage of infection by *T. fetus* tends to be slight or absent. Only two recent studies in Basra and Nineveh provinces recorded venereal Trichomonosis in cattle. In addition, *T. hominis* is only found in the middle and northern parts of Iraq, with a small proportion of infection. Furthermore, current research shows intestinal Trichomonosis has not been recorded in Iraq. These findings raise questions about whether the infection by *T. fetus* is not endemic in this region or the presence of parasite might be limited to other factors, such as the animal breed, climate, or lack of a routine examine. Thus, it is suggested that epidemiological survey studies can be necessary to determine whether the parasite *T. fetus* is present in cats and cattle of other Iraqi cities.

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Conflict of interest

The author declares that there is no conflict of interest regarding the publication of this article.

References

1. Schwebke JR, Burgess D. Trichomoniasis. Clin Microbiol Rev. 2004;17(4):794-803, DOI: 10.1128/CMR.17.4.794-803.2004
2. Amin A, Neubauer C, Liebhart D, Grabensteiner E, Hess M. Axenization and optimization of in vitro growth of clonal cultures of *Tetratrichomonas gallinarum* and *Trichomonas gallinae*. Exp Parasitol. 2010;124(2):202-8. 10.1016/j.exppara.2009.09.014
3. Mahdi NK, al-Saeed AT. *Trichomonas tenax* in Basrah, Iraq. J Pak Med Assoc. 1993;43(12):261-2. [available at]
4. Lewis KL, Doherty DE, Ribes J, Seabolt JP, Bensadoun ES. Empyema caused by Trichomonas. Chest. 2003;123(1):291-292. DOI: 10.1378/chest.123.1.29
5. Al-Quraishi MA, Shaalan NN, Sabeq R. Epidemiology study of pulmonary trichomoniasis in Babylon Province. IJRSB. 2015;3:7-14. [available at]
6. Mohemeed AA, Salih TA, Al-Juboori QK. Investigation of the *Trichomonas hominis* and some other parasites in cases of diarrhea accompanying children arriving at the obstetrics and gynecology hospital in Ramadi, Iraq. SRP. 2020;11(9):1137-1142. DOI: 10.31838/srp.2020.9.164
7. Bennett JE, Dolin R, Blaser MJ. Mandell, Douglas, and Bennett's principles and practice of infectious diseases. 9th ed. NY: Elsevier Sci; 2019. 4176 p.
8. Van der Pol B. *Trichomonas vaginalis* infection:the most prevalent nonviral sexually transmitted infection receives the least public health attention. Clin Infect Dis. 2007;44(1):23-5. DOI: 10.1086/509934
9. Yule A, Skirrow SZ, Bonduran RH. Bovine trichomoniasis. Parasitol Today. 1989;5:373-7. DOI: 10.1016/0169-4758(89)90298-6
10. Yao C, Köster LS. *Trichomonas fetus* infection is a cause of chronic diarrhea in the domestic cat. Vet Res. 2015;46(1):1-6. DOI: 10.1186/s13567-015-0169-0
11. Wernery U. The barren camel with endometritis-isolation of *Trichomonas fetus* and different bacteria. J Vet Med. 1991;38(1-10):523-8. DOI: 10.1111/j.1439-0450.1991.tb00906.x
12. Hayes DC, Anderson RR, Walker RL. Identification of trichomonad protozoa from the bovine preputial cavity by a polymerase chain reaction and restriction fragment length polymorphism typing. J Vet Diagn Invest. 2003;15(4):390-4. DOI: 10.1177/104063870301500417
13. Stockdale H, Rodning S, Givens M, Carpenter D, Lenz S, Spencer J, Dykstra C, Lindsay D, Blagburn B. Experimental infection of cattle with a feline isolate of *Trichomonas foetus*. J Parasitol. 2007;93(6):1429-34. DOI: 10.1645/GE-1305.1
14. Ilker S, Osman SA, Ahmet C, Gunes S. Prevalence of trichomoniasis in dairy cows with some reproductive disorders in Aydin province of Turkey. J Anim Vet Adv. 2010;9:1646-1649. DOI: 10.3923/javaa.2010.1646.1649
15. Gookin JL, Breitschwerdt EB, Levy MG, Gager RB, Benrud JG. Diarrhea associated with Trichomonosis in cats. JAVMA. 1999;215(10):1450-1454. PMID:10579040.
16. Gookin JL, Levy MG, Mac Law J, Papich MG, Poore MF, Breitschwerdt EB. Experimental infection of cats with *Trichomonas fetus*. Am J Vet Res. 2001;62(11):1690-7. DOI: 10.2460/ajvr.2001.62.1690
17. Skirrow S, BonDurant R, Farley J, Correa J. Efficacy of ipronidazole against trichomoniasis in beef bulls. J Am Vet Med Assoc. 1985;187(4):405-7. [available at]
18. Oyhenart J, Martínez F, Ramírez R, Fort M, Breccia JD. Loop mediated isothermal amplification of 5.8 S rDNA for specific detection of *Trichomonas foetus*. Vet. Parasitol. 2013;193(1-3):59-65. DOI: 10.1016/j.vetpar.2012.11.034
19. Dąbrowska J, Karamon J, Kochanowski M, Sroka J, Zdybel J, Cencek T. *Trichomonas foetus* as a causative agent of Trichomonosis in different animal hosts. J Vet Res. 2019;63(4):533. DOI: 10.2478/jvetres-2019-0072
20. Gookin JL, Stebbins ME, Hunt E, Burlone K, Fulton M, Hochel R, Talaat M, Poore M, Levy MG. Prevalence of and risk factors for feline *Trichomonas fetus* and *Giardia* infection. J Clin Microbiol 2004;42(6):2707-10. DOI: 10.1128/JCM.42.6.2707-2710.2004
21. Levy MG, Gookin JL, Poore M, Birkenheuer AJ, Dykstra MJ, Litaker RW. *Trichomonas foetus* and not *PentaTrichomonas hominis* is the etiologic agent of feline trichomonal diarrhea. J Parasitol. 2003;89(1):99-104. DOI: 10.1645/0022-3395(2003)089[0099:TFANPH]2.0.CO;2
22. Stockdale HD, Givens MD, Dykstra CC, Blagburn BL. *Trichomonas fetus* infections in surveyed pet cats. Vet Parasitol. 2009;160(1-2):13-7. DOI: 10.1016/j.vetpar.2008.10.091
23. Amin A, Bilic I, Liebhart D, Hess M. Trichomonads in birds: A review. Parasitol. 2014;141(6):733-47. 10.1017/S0031182013002096
24. Collántes-Fernández E, Fort MC, Ortega-Mora LM, Schares G. Trichomonas. China: Springer; 2018. 313-388 p.

25. Anderson NL, Grahn RA, Van Hoosear K, Bondurant RH. Studies of trichomonad protozoa in free-ranging songbirds: Prevalence of *Trichomonas gallinae* in house finches (*Carpodacus mexicanus*) and corvids and a novel trichomonad in mockingbirds (*Mimus polyglottos*). Vet Parasitol. 2009;161(3-4):178-86. 10.1016/j.vetpar.2009.01.023
26. Huppert JS, Mortensen JE, Reed JL, Kahn JA, Rich KD, Miller WC, Hobbs MM. Rapid antigen testing compares favorably with transcription-mediated amplification assay for detecting *Trichomonas vaginalis* in young women. Clin Infect Dis. 2007;45(2):194-8. DOI: 10.1086/518851
27. Schirm J, Bos PA, Roozeboom IK, Luijt DS, Möller LV. *Trichomonas vaginalis* detection using real-time TaqMan PCR. Journal Microbiol Meth. 2007;68(2):243-7. DOI: 10.1016/j.mimet.2006.08.002
28. Asmah RH, Agyeman RO, Obeng-Nkrumah N. *Trichomonas vaginalis* infection and the diagnostic significance of detection tests among Ghanaian outpatients. BMC Women's Hlth. 2018;18:206. DOI: 10.1186/s12905-018-0699-5
29. Walker RL, Hayes DC, Sawyer SJ, Nordhausen RW, Van Hoosear KA, BonDurant RH. Comparison of the 5.8 S rRNA gene and internal transcribed spacer regions of trichomonad protozoa recovered from the bovine preputial cavity. J Vet Diag. 2003;15(1):14-20. DOI: 10.1177/104063870301500104
30. Gookin JL, Birkenheuer AJ, Breitschwerdt EB, Levy MG. Single-tube nested PCR for detection of *Trichomonas foetus* in feline feces. J Clin Microbiol. 2002;40(11):4126-30. DOI: 10.1128/JCM.40.11.4126-4130.2002
31. Yaeger MJ, Gookin JL. Histologic features associated with *Trichomonas fetus*-induced colitis in domestic cats. Vet Pathol. 2005;42(6):797-804. DOI: 10.1354/vp.42-6-797
32. Ondrak JD. *Trichomonas fetus* prevention and control in cattle. Vet Clin North Am Food Anim Pract. 2016;32(2):411-23. DOI: 10.1016/j.cvfa.2016.01.010
33. Mao M, Liu HL. Genetic diversity of *Trichomonas vaginalis* clinical isolates from Henan province in central China. Pathog Glob Hlth. 2015;109(5):242-6. DOI: 10.1179/2047773215Y.0000000020
34. Chai JY. Ash and Orihel's atlas of human parasitology. 5th ed. Korean J Parasitol. 2007;45(4):311. DOI: 10.3347/kjp.2007.45.4.311
35. Duboucher C, Farto-Bensasson F, Chéron M, Peltier JY, Beaufils F, Périé G. Lymph node infection by *Trichomonas tenax*:report of a case with co-infection by *Mycobacterium tuberculosis*. Hum Pathol. 2000;31(10):1317-21. DOI: 10.1053/hupa.2000.18502
36. Cogswell F. Parasites of non-human primates. China: Blackwell Publishing; 2007. 693-743 p.
37. Taylor MA, Marshall RN, Stack M. Morphological differentiation of *Trichomonas foetus* from other protozoa of the bovine reproductive tract. Br Vet J. 1994;150(1):73-80. DOI: 10.1016/S0007-1935(05)80098-3
38. Wartonaan A, Honigberg BM. Structure of trichomonads as revealed by scanning electron microscopy. J Protozool. 1979;26(1):56-62. DOI: 10.1111/j.1550-7408.1979.tb02732.x
39. Gookin JL, Copple CN, Papich MG, Poore MF, Stauffer SH, Birkenheuer AJ, Twedt DC, Levy MG. Efficacy of ronidazole for treatment of feline *Trichomonas fetus* infection. JVIM. 2006;20(3):536-43. DOI: 10.1892/0891-6640(2006)20[536:eorfto]2.0.co;2
40. Mehlhorn H, Al-Quraishy S, Aziza A, Hess M. Fine structure of the bird parasites *Trichomonas gallinae* and *Tetratrichomonas gallinarum* from cultures. Parasitol Res. 2009;105(3):751-6. 10.1007/s00436-009-1451-8.
41. Beach DH, Holz Jr GG, Singh BN, Lindmark DG. Phospholipid metabolism of cultured *Trichomonas vaginalis* and *Trichomonas foetus*. Mol Biochem Parasitol. 1990;38(2):175-90. DOI: 10.1016/0166-6851(90)90021-d
42. Kandamuthan S, Thambi R, Yeshodharan J. Trichomoniasis: Is it always sexually transmitted? Indian J Sex Transm Dis AIDS. 2014;35(2):166-7. DOI: 10.4103/0253-7184.142422
43. Al-Kobaisi MF. Jawetz, Melnick and Adelberg's Medical Microbiology. 24th ed. Morocco: Sultan Qaboos Univ Med J. 2007;7(3):273-5. [available at]
44. Eslahi AV, Olfatifar M, Abdoli A. The Neglected Role of *Trichomonas tenax* in Oral Diseases: A systematic review and meta-analysis. Acta Parasit. 2021;66:715-732. DOI: 10.1007/s11686-021-00340-4
45. Chomicz L, Zebrowska J, Zawadzki P, Myjak P, Perkowski K, Rebandel H, Kazimierczuk Z. Studies on the susceptibility of *Trichomonas hominis* to some abiotic factors. Wiad. Parazytol. 2004;50(3):405-9. [available at]
46. Yao C, Bardsley KD, Litzman EA, Hall ML, Davidson MR. *Trichomonas fetus* infection in beef bull populations in Wyoming. J Bacteriol Parasitol. 2011;2(5):10-4172. DOI: 10.4172/2155-9597.1000117
47. Yao C. Diagnosis of *Trichomonas fetus*-infected bulls, an ultimate approach to eradicate bovine trichomoniasis in US cattle. J Med Microbiol. 2013;62(1):1-9. DOI: 10.1099/jmm.0.047365-0
48. Islam M, Talukder M, Hossain M, Karim M. Investigation of sexually transmitted protozoan parasite *Trichomonas foetus* in cattle in Bangladesh. JBAU. 2017;15(1):47-54. Retrieved from [available at]
49. El-Khatam AO, AbouLaila MR, Ibrahim M, AbdEl-Gaber MM. *Trichomonas gallinae*:prevalence and molecular characterization from pigeons in Minoufiya governorate, Egypt Exp Parasitol. 2016;170:161-7. DOI: 10.1016/j.exppara.2016.09.016
50. BonDurant RH, Honigberg BM. Trichomonads of veterinary importance. NY: Academic; 1994. 111-88 p.
51. Rowley J, Vander Hoorn S, Korenromp E, Low N, Unemo M, Abu-Raddad LJ, Chico RM, Smolak A, Newman L, Gottlieb S, Thwin SS, Broutet N, Taylor MM. Chlamydia, gonorrhoea, trichomoniasis and syphilis: Global prevalence and incidence estimates, 2016. Bull World Hlth Organ. 2019;97(8):548-562P. DOI: 10.2471/BLT.18.228486
52. Muzny CA, Van Gerwen OT, Kissinger P. Updates in trichomonas treatment including persistent infection and 5-nitroimidazole hypersensitivity. Curr Opin Infect Dis. 2020;33(1):73-77. DOI: 10.1097/QCO.0000000000000618
53. Kusdian G, Gould SB. The biology of *Trichomonas vaginalis* in the light of urogenital tract infection. Mol Biochem Parasitol. 2014;198(2):92-99. 10.1016/j.molbiopara.2015.01.004
54. Meites E, Gaydos CA, Hobbs MM, Kissinger P, Nyirjesy P, Schwebke JR, Secor WE, Sobel JD, Workowski KA. A review of evidence-based care of symptomatic trichomoniasis and asymptomatic *Trichomonas vaginalis* infections. Clin Infect Dis. 2015;61(suppl 8):S837-48. DOI: 10.1093/cid/civ738
55. Mabaso N, Abbai NS. A review on *Trichomonas vaginalis* infections in women from Africa. S Afr J Infect Dis. 2021;36(1). DOI: 10.4102/sajid.v36i1.254
56. Rogers SM, Turner CF, Hobbs M, Miller WC, Tan S, Roman AM, Eggleston E, Villarroel MA, Ganapathi L, Chromy JR, Erbelding E. Epidemiology of undiagnosed trichomoniasis in a probability sample of urban young adults. PLoS One. 2014;9(3):e90548. DOI: 10.1371/journal.pone.0090548
57. Sutton M, Sternberg M, Koumans EH, McQuillan G, Berman S, Markowitz L. The prevalence of *Trichomonas vaginalis* infection among reproductive-age women in the United States, 2001-2004. Clin Infect Dis. 2007;45:1319-26. DOI: 10.1086/522532
58. Muzny CA. Why ىoes *Trichomonas vaginalis* continue to be a neglected sexually transmitted infection? Clin Infect Dis. 2018;67(2):218-220. DOI: 10.1093/cid/ciy085
59. Nguyen M, Le GM, Nguyen HT, Nguyen HD, Klausner JD. Acceptability and feasibility of sexually transmissible infection screening among pregnant women in Hanoi, Vietnam. Sex Hth. 2019;16(2):133-8. DOI: 10.1071/SH18041
60. Joseph Davey DL, Nyemba DC, Gomba Y, Bekker LG, Taleghani S, DiTullio DJ, Shabsovich D, Gorbach PM, Coates TJ, Klausner JD, Myer L. Prevalence and correlates of sexually transmitted infections in pregnancy in HIV-infected and-uninfected women in Cape Town, South Africa. PloS one. 2019;14(7):e0218349. DOI: 10.1371/journal.pone.0218349
61. Kassem HH, Majoud OA. Trichomoniasis among women with vaginal discharge in Benghazi city, Libya. J Egypt Soc Parasitol. 2006;36(3):1007-1016. [available at]

62. Al-Hindi AI, Lubbad AM. *Trichomonas vaginalis* infection among Palestinian women: Prevalence and trends during 2000-2006. Turk J Med Sci. 2006;36(6):371-5. [available at]
63. Mahdi NK. Urogenital trichomoniasis in an Iraqi population. EMHJ.1996;2 (3), 501-505. [available at]
64. Kadir MA, Fattah CO. *Trichomonas vaginalis* among women in Sulaimania governorate-Iraq. Tikrit J Pharm Sci. 2010;6(1):1-9. [available at]
65. Al Saeed WM. Detection of *Trichomonas vaginalis* by different methods in women from Duhok province, Iraq. EMHJ. 2011;17(9), 706-709. [available at]
66. Al-Quraishi MA, Hussian RS, Jabuk SI, Jabuk SI. Relationship between *Trichomonas vaginalis* and malignant cell in the cervix in Babylon city. J Pharm Biol Sci. 2014;9(6):100-2. DOI: 10.9790/3008-0963100102
67. Noureddine AS, Alsakee HM. Prevalence of *Trichomonas vaginalis* infection among women in Erbil governorate, Northern Iraq: An epidemiological approach. ESJ. 2015;11(24):243-255. [available at]
68. Al-Masoudi HK. Polymerase chain reaction compared with wet mount for detection of *Trichomonas vaginalis* in women. Int J Pharmtech Res. 2016;9(3):240-244. [available at]
69. Merdaw MA, Kadhim HS, Abd al Sattar Alriyahee F, Al-Bashier NM, Al-Taie LH. Genetic variation of *Trichomonas vaginalis* isolates from Iraqi Women: Association with fertility and cervical abnormalities. JUBPAS. 2018;26(7):321-38. [available at]
70. Noureddine AS, Alsakee HM. Immunological aspects of *Trichomonas vaginalis* infection in women attending maternity teaching hospital and some public health centers in Erbil governorate, Northern Iraq. CUESJ. 2019;3(1):56-60. DOI: 10.24086/cuesj.v3n1y2019.pp56-60
71. Bedair NH, Ali HZ. Comparison of trichomoniasis diagnosis by microscopic methods and indirect ELISA technique in a sample of Iraqi women. IJS. 2020:742-8. DOI: 10.24996/ijs.2020.61.4.5
72. Jabbar ZR, Al-Warid HS. Some clinical and inflammatory aspects of *Trichomonas vaginalis* infection among women with pelvic inflammatory diseases. IJS. 2021:4649-66. DOI: 10.24996/ijs.2021.62.12.6.
73. Al-Ardi MH. Seroprevalence and risk factors of *Trichomonas vaginalis* among couples in Al-Hamza city-Iraq. Al-Kufa Univ biol. 2021;13(1):33-39. [available at]
74. Ali HZ. Detection of pro-inflammatory IL-8 and IL-12 in Iraqi women infected with trichomoniasis. IJS. 2021:449-54. DOI: 10.24996/ijs.2021.62.2.10
75. Al-Hamzawi SA, Al-Awsi GR. Prevalence of *Trichomonas vaginalis* and its correlation with sociodemographic variables in pregnant women in Al-Diwaniya, Iraq. Mater Proceedings. 2021;90:129-130. DOI: 10.1016/j.matpr.2021.07.399
76. Al-Rubaye FSI, Alkhashab FMB. Genotypes diversity and virulence factor screening of *trichomonas vaginalis* isolated from pregnant women in mosul (north of Iraq). Baghdad Sci J. 2022;19(5):944-950. DOI: 10.21123/bsj.2022.6014
77. Meyer EA. Other intestinal protozoa and *Trichomonas vaginalis*. 4th ed. Galveston (TX): University of Texas Medical Branch at Galveston; 1996. Chapter 80. [available at]
78. Mahittikorn A, Udonsom R, Koompapong K, Chiabchalard R, Sutthikornchai C, Sreepian PM, Mori H, Popruk S. Molecular identification of *PentaTrichomonas hominis* in animals in central and western Thailand. BMC Vet Res. 2021;17(1):203. DOI: 10.1186/s12917-021-02904-y
79. Compaore C, Kemta Lekpa F, Nebie L, Niamba P, Niakara A. *PentaTrichomonas hominis* infection in rheumatoid arthritis treated with adalimumab. Rheumatology. 2013;52:1534-5. DOI: 10.1093/rheumatology/kes385
80. Ribeiro LC, Santos C, Benchimol M. Is *Trichomonas tenax* a parasite or a commensal?. Protist. 2015;166(2):196-210. DOI: 10.1016/j.protis.2015.02.002
81. Doğan N, Tüzemen NÜ. Three *Pentatrichomonas hominins* cases presented with gastrointestinal symptoms. Turkiye Parazitol Derg. 2018;42(2):168. DOI: 10.5152/tpd.2018.4846
82. Al-hamiar AK, Kezar MY, Al-Khafaji YA. Prevalence of oral protozoa in periodontitis and gingivitis patients who's attended to clinics periodontics. Al-Kufa Univ Biol. 2011;3(1):17-20. [available at]
83. Abdulhaleem SH, Sulbi IM, Almammuri AH. Study the Distribution of Oral *Trichomonas tenax* at Almukadissa, Iraq. Indian J Public Health Res Dev. 2018;9(10). DOI: 10.5958/0976-5506.2018.01263.9
84. Mohammed SA, Al-waaly ABM. Prevalence *Trichomonas tenax* in Karbala Governorate. IOP Conf. 2019;1294(6):85-88. DOI: 10.1088/1742-6596/1294/6/062030
85. Jaffer NT, Al-Noori AS, Salih AM, Zuhdi SS. Molecular detection of oral *Trichomonas tenax* among individuals attending dental care units using PCR in Duhok, Iraq. J Duhok Uni. 2019;22(2):195-202. DOI: 10.26682/sjuod.2019.22.2.22
86. Hasan SF. Intestinal parasites in children under five years with diarrhea in Kerbala, Iraq. JUK. 2010;8(1):415-20. [available at]
87. Hama AA, Rahemo ZI. Intestinal parasitosis in relation to hemoglobin concentration among primary schoolchildren in Erbil province, Iraq. Int J Sci. 2014;1(1):96-9. [available at]
88. Govro EJ, Stuart MK. Cytokine response of human THP-1 macrophages to *Trichomonas tenax*. Exp Parasitol. 2016;169:77-80. DOI: 10.1016/j.exppara.2016.07.011
89. Fitzgerald PR. Bovine trichomoniasis. Vet Clin Am Food Anim Pract. 1986;2(2):277-82. DOI: 10.1016/s0749-0720(15)31237-8
90. Fox EW, Hobbs D, Stinson J, Rogers GM. A preliminary survey of North Carolina slaughterhouse bulls for *Trichomonas fetus*. Bov pract. 1995:153-5. DOI: 10.21423/bovine-vol1995no29p153-155
91. Rae DO, Crews JE, Greiner EC, Donovan GA. Epidemiology of *Trichomonas fetus* in beef bull populations in Florida. Theriogenol. 2004;61(4):605-18. DOI: 10.1016/s0093-691x(03)00236-x
92. Mancebo OA, Russo AM, Carabajal LL, Monzon CM. Persistence of *Trichomonas fetus* in naturally infected cows and heifers in Argentina. Vet Parasitol. 1995;59(1):7-11. DOI: 10.1016/0304-4017(94)00734-T
93. Filho RB, Malta KC, Borges JM, Oliveira PR. Prevalence and risk factors associated with *Trichomonas foetus* infection in cattle in the state of Paraíba, Brazil. Acta Parasitol. 2018;63(2):346-353. 10.1515/ap-2018-0039
94. Perez E, Conrad PA, Hird D, Ortuno A, Chacon J, BonDurant R, Noordhuizen J. Prevalence and risk factors for *Trichomonas fetus* infection in cattle in northeastern Costa Rica. Prev Vet Med. 1992;14(3-4):155-65. DOI: 10.1016/0167-5877(92)90013-6
95. Erasmus JA, De Wet JA, Van der Merwe HE, Pienaar GC. Bovine trichomoniasis in the north western Cape Province, western Transvaal and the Orange Free State. J S Afr Vet Assoc. 1989;60(1):51-2. [available at]
96. Derdour SY, Hafsi F, Azzag N, Tennah S, Laamari A, China B, Ghalmi F. Prevalence of the main infectious causes of abortion in dairy cattle in Algeria J Vet Res.2017;61:337-343.DOI:10.1515/jvetres-2017-0044
97. McCool CJ, Townsend MP, Wolfe SG, Simpson MA, Olm TC, Jayawardhana GA, Carney JV. Prevalence of bovine venereal disease in the Victoria River District of the Northern Territory: ikely economic effects and practicable control measures. Aust Vet J. 1988;65(5):153-6. DOI: 10.1111/j.1751-0813.1988.tb14445.x
98. Mendoza-Ibarra JA, Pedraza-Díaz S, García-Peña FJ, Rojo-Montejo S, Ruiz-Santa-Quiteria JA, San Miguel-Ibáñez E, Navarro-Lozano V, Ortega-Mora LM, Osoro K, Collantes-Fernandez E. High prevalence of *Trichomonas foetus* infection in Asturian beef cattle kept in extensive conditions in Northern Spain. Vet J. 2012;193(1):146-51. DOI: 10.1016/j.tvjl.2011.09.020
99. Dąbrowska J, Karamon J, Kochanowski M, Sroka J, Skrzypek K, Zdybel J, Różycki M, Jabłoński A, Cencek T. *Trichomonas foetus*:A study of prevalence in animal hosts in Poland. Pathogens. 2020;9(3):203. DOI: 10.3390/pathogens9030203
100. Guven E, Bastem Z, Avcioglu H, Erdem H. Molecular determination of *Tri*chomonas spp. in aborted bovine fetuses in Eastern Anatolian Region of Turkey. Vet Parasitol. 2013;196(3-4):278-82. DOI: 10.1016/j.vetpar.2013.03.031
101. Yildiz K, Sursal N. The first report of *Trichomonas fetus* in cats from Turkey. Isr J Vet Med. 2019;74:127-33. [available at]

102. Tafazzoli H. Frequency of *Trichomonas fetus* Infection in cows of Isfahan. J Comp Pathol. 2020;17(3):3299-304. [available at]
103. Cheraghi B, Vafaei R, Nassiri SM. The first report of a clinical case of intestinal trichomoniasis caused by *Trichomonas fetus* in a cat with chronic diarrhea in Iran. Iran J Vet Res. 2021;22(3):248-250. DOI: 10.22099/ijvr.2021.39422.5724
104. Hassan BJ. Detection of Trichomonas spp. from penile bulls fluid in Iraq. Asian J Infect Dis. 2020;5(3):29-32. DOI: 10.9734/ajrid/2020/v5i330169
105. Alobaidii WA, Alobaidii QT, Hassan SD. Detection of Trichomoniasis in cattle in Nineveh province. Iraqi J Vet Sci. 2021;35(2):287-90. DOI: 10.33899/ijcs.2020.126790.1380
106. Gookin JL, Hanrahan K, Levy MG. The conundrum of feline Trichomonosis: The more we learn, the 'trickier'it gets. J Feline Med Surg. 2017;19(3):261-74. DOI: 10.1177/1098612X17693499
107. Polak KC, Levy JK, Crawford PC, Leutenegger CM, Moriello KA. Infectious diseases in large-scale cat hoarding investigations. Vet J. 2014;201(2):189-95. DOI: WWW.DOI.ORG/10.1016/j.tvjl.2014.05.020.
108. Bell ET, Gowan RA, Lingard AE, McCoy RJ, Šlapeta J, Malik R. Naturally occurring *Trichomonas fetus* infections in Australian cats:38 cases. J. Feline Med Surg. 2010;12(12):889-98. DOI: 10.1016/j.jfms.2010.06.003
109. Kingsbury DD, Marks SL, Cave NJ, Grahn RA. Identification of *Trichomonas foetus* and Giardia spp. infection in pedigree show cats in New Zealand. N Z Vet J. 2010;58(1):6-10. DOI: 10.1080/00480169.2010.65054
110. Dąbrowska J, Karamon J, Kochanowski M, Jędryczko R, Cencek T. *Trichomonas foetus* infection in cat-first detection in Poland. Acta Parasitol. 2015;60(4):605-8. DOI: 10.1515/ap-2015-0084
111. Doi J, Hirota J, Morita A, Fukushima K, Kamijyo H, Ohta H, Yamasaki M, Takahashi T, Katakura K, Oku Y. Intestinal *Tri*chomonas suis (= T. fetus) infection in Japanese cats. J Vet Med Sci. 2012:74(4):413-7. DOI: 10.1292/jvms.11-0171
112. Köster LS, Chow C, Yao C. Trichomonosis in cats with diarrhea in Hong Kong, China, between 2009 and 2014. JFMS Open Reports. 2015;1(2):2055116915623561. DOI: 10.1177/2055116915623561
113. Robinson RA, Lawson B, Toms MP, Peck KM, Kirkwood JK, Chantrey J, Clatworthy IR, Evans AD, Hughes LA, Hutchinson OC, John SK. Emerging infectious disease leads to rapid population declines of common British birds. PLoS one. 2010;5(8):e12215. DOI: 10.1371/journal.pone.0012215
114. Chi JF, Lawson B, Durrant C, Beckmann K, John S, Alrefaei AF, Kirkbride K, Bell DJ, Cunningham AA, Tyler KM. The finch epidemic strain of *Trichomonas gallinae* is predominant in British non-passerines. Parasitology. 2013;140(10):1234-45. DOI: 10.1017/S0031182013000930
115. McDougald, LR. Other protozoan diseases in the intestinal tract, In Hofstad, MS ed. Diseases of Poultry. 8th ed, Panima Educational Book Agency, New Delhi, India, 1992. pp. 723-725.
116. Albeshr MF, Alrefaei AF. Prevalence and genotyping of *Trichomonas gallinae* in Riyadh, Saudi Arabia. bioRxiv. 2019:675033. DOI: 10.1101/675033
117. Alrefaei AF. Molecular detection and genetic characterization of *Trichomonas gallinae* in falcons in Saudi Arabia. Plos one. 2020;15(10):e0241411. DOI: 10.1371/journal.pone.0241411
118. Saikia M, Bhattacharjee K, Sarmah PC, Deka DK, Upadhyaya TN, Konch P. Prevalence and pathology of *Trichomonas gallinae* in the domestic pigeon (*Columba livia domestica*) of Assam, India. Indian J Anim Res. 2021;55(1):84-9. DOI: 10.18805/IJAR.B-3805
119. Arabkhazaeli F, Madani SA, Ghorbani A. Parasitological and molecular survey of scattered parasitism by trichomonads in some avian species in Iran. Avian Pathol. 2020;49(1):47-55. DOI: 10.1080/03079457.2019.1662369
120. Al-Bakry HS. Prevalence of avian trichomoniasis in different species of pigeons in Mosul. Iraqi J Vet Sci. 2009;23(2):105-109. DOI: 10.33899/ijvs.2009.5731
121. Al-Sadi HI, Hamodi AZ. Prevalence and pathology of trichomoniasis in free-living urban pigeons in the city of Mosul, Iraq. Vet World. 2011;4(1):12-14. [available at]
122. Al-Barwari S, Saeed I. The parasitic communities of the rock pigeon *Columba livia* from Iraq: component and importance. Turkiye Parazitol Derg. 2012;36(4):232. DOI: 10.5152/tpd.2012.56
123. Al-Rammahi HM, H. AL-Hasnawy MH, Abbas AK. Concurrent Infection of Cestodes with Trichomoniasis in Domestic and Wild Columbides Birds in Babylon Province. IJVM. 2013,37, 2;192-198. [available at]
124. Wahhab MA, Abdulrahman NR, Ali SA. A study of oropharyngeal parasite infection in doves and domestic pigeons in some villages of Garmian-Iraqi Kurdistan region. KJAR. 2017;2(1):15-20. DOI: 10.24017/science.2017.1.6
125. Fadhil LT, Faraj AA. Survey of *Trichomonas gallinae* isolates in pigeons by microscopy and PCR. Vet Res. 2019;23:321-9.[available at]
126. Jawad RA, Al-Ali F, Rashid IF, Al-Sabbagh JK, Sulbi IM, Noor MA, Saber WA. Prevalence comparative study of infection with trichomonas spp in the three types of birds at the Kerbala. Indian J Forensic Med Toxicol. 2020;14(3):2655. DOI: 10.37506/ijfmt.v14i3.10839
127. Dakheel Y, Mukdad R, Naji A. A Comparative study of parasitic infections in domestic and wild pigeons in Iraq. Arch Razi Inst. 2022;77(2):709-15. DOI: 10.22092/ARI.2022.357105.1976

مقالة مراجعة عن الإصابة بأنواع طفيلي المشعرات في الإنسان والحيوانات في العراق

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الخلاصة

يعرف طفيلي المشعرة من الأوالي الشائعة التي تسبب مرض ينتقل عن طريق الاتصال الجنسي في الإنسان يدعى داء المشعرات، بالإضافة الى داء المشعرات التناسلي والمعوي في الأبقار والقطط على التوالي. كذلك يسبب هذا الطفيلي داء المشعرات الطيور أو يدعى الأفة في الجهاز الهضمي للطيور. تم تحديد ثلاث أنواع مرضية (مشعرة مهبلية، مشعرة جنينية، مشعرة دواجن) تنتمي الى هذا الجنس حيث سجلت في أماكن مختلفة من العالم، مع ذلك وجودهم ووبائيتهم في أماكن أخرى وبالخصوص المشعرة الجنينية في العراق لاتزال غير معروفة بشكل دقيق. لذلك فان الغرض من هذه المراجعة هو معرفة أحدث المعلومات عن وجود أنواع هذا المرض في الإنسان وبعض الحيوانات في المدن العراقية اعتمادا على البحث الإلكتروني لقاعدة البيانات. أظهرت النتائج أن الإصابة بالمشعرة المهبلية والمشعرة اللاصقة في الإنسان ومشعرة الدواجن في الطيور موثقة في العراق، حيث سجلت نسب إصابة مختلفة لكن الإصابة بالمشعرة الجنينية تكاد أن تكون قليلة أو غير مسجلة في الأبقار والقطط على التوالي، حيث سجلت دراستين فقط الإصابة بالمشعرة الجنينية في الثيران والأبقار في محافظة البصرة ونينوى بينما لم تذكر أي دراسة حول الإصابة بالمشعرة الجنينية المعوية في القطط في عموم مدن العراق الى الإن. إضافة الى ذلك سجلت المشعرة البشرية في وسط وشمال العراق. يستنتج من ذلك أن قلة أو اختفاء الإصابة في الأبقار والقطط في المنطقة من المحتمل يعزى الى سلالة الحيوان، المناخ، قلة الدراسات وعوامل غير معروفة أخرى. لذلك، يتطلب عمل دراسات وبائية وجزيئية لمعرفة وجود وانتشار هذا المرض في العراق وبالخصوص في الأبقار والقطط.