



Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/17747
DOI URL: <http://dx.doi.org/10.21474/IJAR01/17747>



RESEARCH ARTICLE

REVIEW OF TRICHOMONAS VAGINALIS INFECTION FROM (2013-2023) IN GOVERNORATES OF IRAQ

Rawaa Abdulkhaleq Hussein and Mohammed Jasim Shaker

Department of Microbiology, College of Medicine, University of Diyala, Diyala, Iraq.

Manuscript Info

Manuscript History

Received: 25 August 2023

Final Accepted: 27 September 2023

Published: October 2023

Key words:-

Trichomoniasis, Trichomonas Vaginalis, Epidemiological Study

Abstract

Trichomoniasis is one of the most common sexually transmitted diseases (STD) in the countries, mostly for females, caused by a protozoan parasitic infection called *Trichomonas vaginalis* (*T. vaginalis*) and causes vaginal discharge for females and irritation of dysuria. Humans are the only recognized infected with this parasite transmitted via vaginal sexual intercourse. People who are infected with this parasite can transmit the trichomoniasis to other people. The infection with trichomoniasis greatly damages the reproductive system. Trichomoniasis has important medical, social, and economical implications. It is reported to be more than 280 million annual cases globally. *T. vaginalis* holds the distinction of being the only parasite infection transmitted sexually in humans. It is a highly effective disease. The present study aims to throw more light on the epidemiological of *T. vaginalis* infection. Where, this study article related to the prevalence of *T. vaginalis* among Iraqi people in the period from (2013-2023) were studied in different governorates of Iraq. These types of epidemiological studies are recommended to assess the epidemiological situation of trichomoniasis in the way to implement appropriate control measures where needed. Results of data analysis reveal different rates of infection by this parasite in Iraqi governorates. It concludes the variation in parasitic infection rates among studies can be interpreted on the basis of geographical location of Iraqi governorates, size of population, tourist cities, industrial cities, rate of female/male in population, personal hygiene, education levels. In addition, various sampling techniques and research methodologies, all consider markers could demonstrate the causes for the variation in the data of parasitic infection in different researches.

Copy Right, IJAR, 2023., All rights reserved.

Introduction:-

Historical Background

Presently, our community is contaminated with diseases related to different kinds containing inherited microbes, risk infectious with physiologic diseases. Any disease having its specific methods of human infection. Information about the infections prevalence and reviewing data analysis helps us in controlling methods. Review study is useful for infections control, outbreak investigation, and survey studies are used to direct over research investigation and to perform infection control measures (1).

Corresponding Author:- Rawaa Abdulkhaleq Hussein

Address:- Department of Microbiology, College of Medicine, University of Diyala, Diyala, Iraq.

Trichomonas vaginalis infection is the extrememost common sexually transmitted disease in the countries, , caused by a move protozoa parasitic infection called *T. vaginalis*, could cause the urogenital tract of males and females infections. New cases about 250 million of *T. vaginalis* Infection are detectedin different countriessvery year (2). The disease is commonly acquired via sexual connect and also through non-sexual connect, included fomites. *Trichomonas vaginalis*infectionusuallycauses to vaginitis in females and urethritis and prostatitis in males (3).

Trichomonas vaginalis infection is also considered as a biological marker triggers an evaluation for other STD. Potential squeal of this STD in women include tubal factor infertility, and cytological abnormalities of the cervix (4). The public health importance of the problem is underscored by the fact that the trichomoniasis is distribute in reproductive age females with danger adverse. . reproductive outcomes (5). The outcome of trichomoniasisdiffer depending on vary factors like the host immune response and genetic variability of the isolates (6).

Newly, trichomoniasismayberelated to risk risewith the presence of HIV and cancer. During pregnancy severe infectionscouldbelinked with premature disrupt of membranes, preterm delivery, and low birth weight [7]. Vary markerscanimpact the distribution of *Trichomonas vaginalis* infection including residence, education,maritalstateandthekindofcontraceptionmodeused,sociocultural level, age, the used drug,kind of vaginal discharge, and presenceof other STD(8 –9). The examination by direct microscopic of the wet mount of vagina is the most common mode used to exam vaginal trichomoniasis, which appears high specificity of fresh vaginal sample(10).

The inflammatory reaction of parasitic sites is considers the major pathogenic pathway of *T. vaginalis*causes, and the refined inflammation canstimulate carcinogenesis. It was register that trichomoniasismay cause cervical precancerous lesions and neoplastic lesions (11). *T. vaginalis* infection increase risk for causes of cervical cancer (12), also itcan damaging prostate epithelial cellswhich results in prostate cancer . As well as,trichomoniasis was connected with hrHPV, the causes in most cervical cancers (13).Few indexreported the role of immune responses in stimulating protection in human trichomoniasis is available. Specific antibody responses to *T. vaginalis* antigens in serum have been recorded; as well as, the circulating antibody levels also vary and presence to have no function in helping the host to treat the infection and a cell mediated immune response is also trigger. T-cell subsets and cytokines do a main function as key markers in the regulation of mucosal responses in differentprotozoan infections (13). As well as, recent treatment is effective the disease is remain poorly measured and there are concerns about rising levels of drug resistance (14). In Iraq, studies are recommended to assess the epidemiological situation of this disease in the way to implement appropriate control measures where needed. The present study aim to throw more light on the epidemiological of *T. vaginalis* infection in Iraqi governance.

Search Strategy

The present study that recorded *T. vaginalis* infection in patients, from 2013 to 2023.

Taxnomic and Classification

T. vaginalis belong to Kingdom: Animalia, Phylum: Metamonada, Class: Parabasilina, Family: Trichomonadida (15).

Morphology,Life cycle and Modes of Transmission

The main researches of trichomoniasis have recorded only the trophozoite stage as the motile,infectionstage of the protozoan which is STD of humans,whichcontact with epithelial cells from vagina, cervix, and prostate (16).The trophozoite of *T. vaginalis* is oval and flagellated. It is measure about 9 X 7 µm. Near the cytostomeFive flagella arise ; four of them immediately expand outside together, while the fifth flagellum wraps backwards along the surface of the parasite. Although , a conspicuous barb-like axostyle projects obverse the four-flagella bundle; the axostyle could be used for connect to surfaces and could cause the tissue disruptseen in *T. vaginalis*infections. .Trichomoniasisremains in the lower genital tract of women and the prostate andurethra of men, whichtheparasitemultiply by binary fission. Thisprotozoanhasn'tpresence to have resistant phaseand not livegood in the outer condition.Another studies have recorded formation about pseudocysts (17), ovalphase, non-motile without a true cyst wall (18). Pseudocyst was recorded to be stimulate by different temperatureandirondeficiencyinthediaof*T. vaginalis*. *T. vaginalis* trophozoite (diagnostic stage) during sexual intercourse, when found in vagina or orifice of urethra became infective stages (19).

Different study in the area has concentrated on the relationship of non-sexual methods of prevalence of the protozoan from swimming pools contaminated toilet seats, and douche nozzle (20).

Chemical Structures

The chemical structure of *T. vaginalis* the surface lipoglycane play an important role in the binding epithelial cell galactin-1. They also analyzed that the structure of this lipoglycane which noticed the constitution of rhamnose, N-acetylglucose amine, galactose, xylose, N-acetylglactosamine and glucose. Similar description was noticed by Singh et al. (21) with few exceptions including presenting of oligosaccharide and investigation of CPI glycan core and they mentioned that its chemical composition were used in the antigen isolation and diagnostic kit preparation.

Pathogenesis and Clinical Signs

Trichomonas vaginalis is a flagellated parasitic protozoan, naturally pear but generally amoeboid in form, anaerobic life status (22). *T. vaginalis* has a large genome (strain G3, 176,441,227 bp) with ~60,000 protein coding genes regular into 6 chromosomes (23). It is an obligate protozoan that phagocytoses erythrocytes, vaginal epithelial cells and bacteria as well as, *T. vaginalis* ingested by macrophages and uses carbohydrates as its major energy source through fermentative metabolism under anaerobic and aerobic environment. It mainly hit the squamous epithelium of the genital tract. Incubation time is communally about four to twenty eight day. *T. vaginalis* found in the women lower genital tract and the man prostate and urethra, it is transmitted only in people, primarily by sexual intercourse. Infection could remain between months or even years, in females but generally remain less than ten days in males. *T. vaginalis* may be infected with double-stranded RNA (dsRNA) viruses that could have serious implications for disease pathogenesis and virulence of trichomonas (24).

Trichomoniasis are transmitted from one person to another through vaginal, or anal sex and oral (25). There are 30 microorganisms (bacteria, parasites and viruses,) which are transmitted by sexual intercourse, 8 of these microorganisms account for the vast majority of sexually transmitted disease in the world.

4 of these infections are curable at present (chlamydia, syphilis, gonorrhoea and trichomoniasis) and responsible for infecting about 374 million individuals in 2020 (26-27). The other 4 microorganisms are incurable and caused by viruses [herpes, hepatitis B, and herpes simplex virus (HSV), (HIV) and (HPV)] (26). These infections can cause many physical complications which can be cause death of the humans (28).

T. vaginalis causes vary clinical symptoms in males and females, in women the trichomoniasis can appear as vaginal inflammation, an acute or chronic urethritis, vulvovaginitis. The present of signs mainly happens during or few times after menstruation. The main complaint related to trichomoniasis a vaginal inflammation connected with a foul-smelling discharge, copious, that is usually connected with itching and burning. The discharge is usually gray, or green, yellow and is commonly blood tinged or frothy. The discharge decrease as the disease becomes more chronic. Most of females present with difficult coitus or painful. Urethral happiness in many of infections and is described by frequent urination and dysuria (painful urination).

The epithelia of vagina is the main site of disease, which lead to the vaginal walls are commonly red and can appear petechial hemorrhages. Punctate hemorrhages of the cervix, known strawberry cervix, are presented in about (2% of patients) (8). (50-90%) of Men infection with no symptomatic and the disease could be self-limiting. The prostate and urethra are the major locations of disease. The main signs involve: dysuria, urethral discharge, and urethral pruritus (itching).

Epidemiology and Prevalence of Trichomoniasis

In recent study, trichomoniasis was found to be considerable connected with lower socioeconomic status, lower educational level, age, and containing more than one sexual partners in the previous year (29). Trichomoniasis distribution in United States is higher, may be due to a function of the lack of public health consideration it takes (30). The people who screening for trichomoniasis tests is recently in the U.S. is HIV-infected females (31). Also without signs, *T. vaginalis* in this people can be connected with high rates of symptoms like pelvic inflammatory disease (PID) and poor birth outcomes. Different current studies have found high trichomoniasis distributed (17.4–20%) among HIV infected females (32). Like to HIV-uninfected males, in HIV-infected males with *T. vaginalis* is less common. Although, trichomoniasis could be connected with adverse birth results, it is important to consider trichomoniasis effect on pregnant females (33). Recently, in asymptomatic pregnant females there are no recommendations for examining for trichomoniasis (34).

This review offers useful data on the epidemiology of trichomoniasis in Iraqi governance to be considered for control initiatives. results of a higher infection with the parasite by the method of direct examination, including the findings of the study in Baghdad 15.38% (35), Diyala (24.60%) (36) and in Muthanna (26.00%) (37). While the highest infection rates were recorded in Iraq with a recent study in Maysan with a direct examination was (75.22%) (38). Other studies found the distribution of trichomoniasis presented 53% and 57.85% for Al-Nashwa and Al-Mashab marsh villages of Basrah, respectively in 2013 (39), in Baghdad at 2017 (17%) (40), and the overall percentage of *T. vaginalis* was 41.6% in diyalia 2015 (41), while in Basra Maternity Hospital, recorded rate of trichomoniasis was (38.5%), (65.4%), (69.2%), (80.8%) and (96.2%) using wet mount, Giemsa stain, AO, culture and in pouch system, respectively at 2022 (42), other study in Erbil found 14 (3.18%) and 12 (2.73%) positive results for *T. vaginalis* infection using culture technique and direct wet mount, respectively at 2014 (43), other results showed the infection rate was (8.62%) with *T. vaginalis*, in Holy Karbala Governorate 2021 (44), high incidence (20%) of *T. vaginalis* in Kut 2014 (45), 1.6% women were infected in Basrah 2020 (46), The infection rate 14.37% in Baghdad 2021 (47), while in 2022 (2.3%) the results with vaginitis in Mosul city (48) and 6% in Diywaniya at 2023 (49).

These prevalence appear to be varies when compared to those reported in other countries, trichomoniasis 1.4% in Japanese men have urethritis and 1.0% in male without symptoms (50). Other study (51) detected that trichomoniasis rate 4% in Korean males, 2.4%–8.2% in Croatian males have urethritis, and 1% in males without symptoms of *T. vaginalis* infection (52). Although, different researches have presented the distribution of *T. vaginalis* infection is between 2% and 8% and may extent more than 30% related to different factors (53).

Different danger markers may impact the distribution of *T. vaginalis* infection including age, residence, education, sociocultural level, marital state and the kind of contraception method used, vaginal secretion, the types of drug used, and the presence of other sexually prevalence diseases (9).

Advances in understanding *T. vaginalis* epidemiology:

This term involve the molecular prevalence of trichomoniasis, the development of highly sensitive diagnostic methods, and improved features of the prevalence, incidence and clinical features of *T. vaginalis* infection in males.

Molecular prevalence of trichomoniasis Publication of the complete. *vaginalis* genome in 2007 has fostered significant advances in present understanding for microorganism natural history. (54) As well as, the current development of *T. vaginalis*-specific microsatellite and single nucleotide polymorphism genotyping analysis w6 has detected present understanding of *T. vaginalis* genetics. When these technologies used by investigators currently identified 2 different genome structure kinds connected with clinically present unique phenotypes. These results improved previously inconclusive detecting that suggest a two-kind population structure of *T. vaginalis* using less sensitive tests. w7 (55) kind 1 *T. vaginalis* isolates have a higher prevalence of infection with *T. vaginalis* virus (TVV). These viruses are present in about 50% of isolates. (56) The detect of TVV-infected trichomonads stimulates mucosal inflammatory responses and could play a role in mediating susceptibility to and the clinical presentation of other STIs. kind 2 *T. vaginalis* isolates are found having a more distribution of resistance to metronidazole (57).

Genetic Variation

In spite of the people health serious and prevalence of *T. vaginalis* infection, there are remain various questions not answered according to different features of the trichomoniasis. Knowing the genome features of this parasite is very important to control and prevention trichomoniasis of human (58). Recently, many of diagnostic tests has advanced to known the gene polymorphism of this parasites, which involve internal transcribed spacer (ITS) typing and microsatellite (MS) genotyping, multilocus sequence typing (MLST), (59). Phylogenies contain witnessed applications in different fields, like epidemiology (60), function of protein and gene prediction (61), and multiple sequence alignment (62). Homology study of genomic structure and sequence could be use to demonstrate phylogenetic trees to detect the genetic variation and development connection of this parasite (63,64,64).

Molecular kiding can give information of the genome variation, population structure, and prevalence association of trichomoniasis in the humans (65-66). As well as, the researches about genome variation uses to known the drug resistance source, pathogenicity and relapse of infection with this protozoan (67-68). PCR-RFLP depend on the actin, which more study for the genotyping strains of *T. vaginalis*. The mostly of *T. vaginalis* isolates were the actin genotype E (45%), the other isolates were genotype N (1.5%), G (7.5%), and genotype H (1.5%), two of them were mixed genotypes E and H (10%) found in Turkey (69). While in Kenya, 5 actin genotypes were

detected by RFLP test, and the researchers used the last test to detect 5 genotypes: I (4.5%), N (27.3%), E (50%), G (13.6%), and P (4.5%) (70).

TV and carcinogenesis

Currently, trichomoniasis was detected to be highly connected with human papilloma virus (HPV) infections and cervical cytological abnormalities such as cervical neoplasia, metaplasia and carcinoma in situ (71). It could be in indirect relationship of both *T. vaginalis* and cervical neoplasia. Different study by Zhang and Begg (72) detected that *T. vaginalis* was connected with increase happened of cervical neoplasia. Several studies in developed countries as Finnish, Dutch, Belgian and Chinese documented elevated odds ratios (1.4–2.0) of cervical neoplasia in females who have trichomoniasis (73–74). Although, one study presented relationship between prostate cancer and *T. vaginalis*, they concluded an association between prostatic adenocarcinoma, neoplasia, metaplasia and *T. vaginalis* proctitis (75–76).

Conclusion:-

Data analysis reveals different rate of infection by this parasite in Iraqi governance from 2013–2023. It concludes the variation in parasitic infection rates among studies can be interpreted on the basis of geographical location of Iraqi governorates, size of population, Tourist cities, industrial cities, rate of female/male in population, personal hygiene, education levels. In addition, various sampling techniques and research methodologies, all these markers may be presented the causes for the variations the prevalence of *T. vaginalis* in different researches. In present study suggest further studies on trichomoniasis. Related to the increase distribution and health consideration connected with *T. vaginalis*, there is a requirement for implicated examination protocols in Iraq. The soon diagnosis of infections without symptoms and treatment regimens are necessary.

References:-

- 1- Karwan S. Najm Al-Marjan1, Hawri H. Mohammed Jabbar, Liza J. Yousif, Fouad H. Kamil, Najat J. Ahmed, Suzan S. Ali1, Layla A. Kareem, Ahmed A. Ab.Jabar, Awat M. Mustafa, Kalthum Kh. Ahmed. A Systematic Review and Meta-analysis of Most Endoparasites and Ectoparasites during Past Decade in Iraq. *Polytechnic Journal* Vol 11 No 2 2021
- 2 Kashan, Z., Arbabi, M., Delavari, M., Hooshyar, H., Taghizadeh, M., & Joneydy, Z. (2015). Effect of *Verbascum thapsus* Ethanol Extract on Induction of Apoptosis in *Trichomonas vaginalis* in vitro. *Infectious Disorders-Drug Targets (Formerly Current Drug Targets-Infectious Disorders)*, 15(2), 125–130. 3
- 3-Muntaha A. H. Nasir, AL-Idreesi S.R, Wasfi A. AL-Masoudi. (2022). Comparison of Different Techniques for the Diagnosis of *Trichomonas Vaginalis* Infection in Females at Reproductive Age. *P J M H S* Vol. 16, No. 07, July 451.
4. Donders, G. G.; Depuydt, C. E. and Bogers, J. (2013). Association of *Trichomonas vaginalis* and Cytological Abnormalities of the Cervix in Low Risk Women. *PLoS One*.
- 5-McClelland, R. S. (2008). *Trichomonas vaginalis* infection: can we afford to do nothing? *J Infect. Dis.*, 197:487–9.
- 6-Maysoon Abdul-zahra Merdaw, Lazim Hameed Al-Taei, Nada Taha Al-Bashier and Qasim Sharhan AlMayah. (2014). Epidemiological Study of *Trichomonas vaginalis* Infection among Iraqi Women. *International Journal of Advanced Research*, Volume 2, Issue 9, 920–925.
- 7- B. van der Pol, (2018) “Clinical and laboratory testing for *Trichomonas vaginalis* infection,” *Journal of Clinical Microbiology*, vol. 54, no. 1, pp. 7–12,
- 8- P. A. 8-T. Nu, V. Q. H. Nguyen, N. T. Cao, D. Dessì, P. Rappelli, and P.L. Fiori, (2015) “Prevalence of *Trichomonas vaginalis* infection in symptomatic and asymptomatic women in Central Vietnam,” *Journal of Infection in Developing Countries*, vol. 9, no. 6, pp. 655–660,
- 9-Marwa M. I. Ghallab, Doaa Alaa, and Salwa M. Morsy. (2021). Multiattribute Analysis of *Trichomonas vaginalis* Diagnostics and Its Correlation with Clinical Complaints and Contraceptive Methods in a Symptomatic Egyptian Cohort. *Infectious Diseases in Obstetrics and Gynecology*.
- 10-Al-Mamoori, Z. Z. M., Alhisnawi, A. A. A., & Yousif, J. J. (2020). prediction of trichomoniasis in women complaining vaginal discharge by different methods and determine some immunological markers. *plant archives*, 20(1), 3653–3658.
- 11- Ghosh I, Mandal R, Kundu P, Biswas J. (2016) Association of genital infections other than human papillomavirus with pre-invasive and invasive cervical neoplasia. *J Clin Diagn Res*. 10:XE01–6

- 12-Zhenchao Zhang, Dongxian Li , Yuhua Li, Rui Zhang, Xianghuan Xie, Yi Yao, Linfei Zhao, Xiaowei Tian, Zhenke Yang, Shuai Wang, Xuejing Yue and Xuefang Mei1.,(2023) The correlation between Trichomonas vaginalis infection and reproductive system cancer: a systematic review and meta-analysis.. Infectious Agents and Cancer 18:15
- 13-Mohammed Jasim Shaker, Rawaa Abdulkhaleq Hussein.(2014). Immunological Study of Women Infected with Trichomonas vaginalis Parasite in Baghdad city .International Journal of Science and Research (IJSR).Volume 3 Issue 9, September
- 14-Abdulsadah A. Rahi, Russul W. Kadhim, Hanan Sajad.(2014) Prospective Study of Trichomonas vaginalis Infection.Sch. J. App. Med. Sci., 2(1D):456-460
15. Brooks G, Melvin A, Jawetz Melnic and Aldelberg's Medical Microbiology. 22nd edn John. Wiley and Son London; 2001.
- 16-Hirt,R.P.(2013).Trichomonas vaginalisvirulencefactors:anintegrative overview. Sex. Transm. Infect. 89, 439–443.
- 17-Pereira-Neves, A., Ribeiro, K. C., and Benchimol, M. (2003). Pseudocysts in trichomonads–new insights. Protist 154, 313–329.
- 18-Dias-Lopes, G., Saboia-Vahia, L., Margotti, E. T., Fernandes, N. S., Castro, C. L. F., Oliveira, F. O., et al. (2017). Morphologic study of the effect of iron on pseudocyst formation in Trichomonas vaginalis and its interaction with human epithelial cells. Mem. Inst. Oswaldo Cruz 112, 664–673.
- 19- CDC. 2022. Trichomoniasis, parasite biology, life cycle. <https://www.cdc.gov/dpdx/trichomoniasis/index.html>.2022.
- 20-Pereira-Neves, A., and Benchimol, M. (2008). Trichomonas vaginalis: in vitro survival in swimming pool water samples. Exp. Parasitol. 118, 438–441.
- 21- Ryan CM, Mehlert A, Richardson JM, Ferguson MA, Johnson PJ. Chemical structure of Trichomonas vaginalis surface lipoglycan: a role for short galactose (β 1-4/3) Nacetylglucosamine repeats in host cell interaction. J Biol Chem. 2011 Nov 25;286(47):40494-508.
- 22- Harp DF, Chowdhury I. (2011). Trichomoniasis: evaluation to execution. Eur J ObstetGynecolReprod Biol. 157(1):3–9.
- 23- Carlton JM, et al. (2007).Draft genome sequence of the sexually transmitted pathogen Trichomonas vaginalis . Science. 315(5809):207–12.
- 24-Patricia Kissinger.(2015).Epidemiology and Treatment of Trichomoniasis.Curr Infect Dis Rep . 17(6): 484. doi:10.1007/s11908-015-0484-7.
- 25-Fasciana, T., Capra, G., Lipari, D., Firenze, A., & Giammanco, A. (2022). Sexually transmitted diseases: Diagnosis and control. International Journal of Environmental Research and Public Health, 19(9), 5293.
- 26-U.S. National Library of Medicine. (2022). Sexually transmitted diseases | STD | venereal disease. MedlinePlus.
- 27-World Health Organization. (2021.). Sexually transmitted infections. World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/sexually-transmitted-infections> .
- 28-Drago, F., Ciccamese, G., Zangrillo, F., Gasparini, G., Cogorno, L., Riva, S., Javor, S., Cozzani, E., Broccolo, F., Esposito, S., & Parodi, A. (2016). A survey of current knowledge on sexually transmitted diseases and sexual behaviour in Italian adolescents. International Journal of Environmental Research and Public Health, 13(4), 422.
- 29-Mohammed Qassim Baktash1, Abdul-Aziz Ahmed Aziz1.(2023). Women's Knowledge of Sexually Transmitted Diseases in Telafer City, Iraq.Nurse Media Journal of Nursing, 13(1), 13
- 30- PatelEU, Gaydos CA, Packman ZR, et al.:(2018) Prevalence and Correlates of Trichomonas vaginalis Infection Among Men and Women in the United States. Clin Infect Dis. 67(2): 211–7.
- 31- Field N, Clifton S, Alexander S, et al.:(2018) Trichomonas vaginalis infection is uncommon in the British general population: implications for clinical testing and public health screening. Sex Transm Infect. 94(3): 226–9.
- 32-Workowski KA, Bolan GA, (2015). Centers for Disease Control and Prevention: Sexually transmitted diseases treatment guidelines, MMWR Recomm Rep. 2015; 64(RR-03): 1–137.
- 33-Muzny CA, Tamhane AR, Eaton EF, et al.: Incidence and predictors of reinfection with trichomoniasis based on nucleic acid amplification testing results in HIV-infected patients. Int J STD AIDS. 2019; 30(4): 344–52.
- 34-Floosearch-Olivia T. Van Gerwen ,Christina A. Muzny.REVIEW Recent advances in the epidemiology, diagnosis, and management of infectionTrichomonas vaginalis [version 1; peer review: 2 approved].F1000Research 2019, 8(F1000 Faculty Rev)

- 35- Al-Marsomy, H. D. (2020). Association between *Trichomonas vaginalis* and vaginal bacterial community composition in Human vagina. *Research Journal of Pharmacy and Technology*, 13(6), 2925- 2931.
- 36-Al-Hussuny, E. M. (2015). An epidemiological study of *Trichomonas vaginalis* in among women living in Baquba City, Diyala Province, Iraq. *Diyala Journal for Pure Science*, 11(3) .(
- 37- Al-Khalidy, K. A. H., & Al-abodi, H. R. (2020). Effect of Vaginal Trichomoniasis on Women who Suffer from Delayed Pregnancy. *European Journal of Molecular & Clinical Medicine*, 7(1), 45-50.
- 38- Khudair N. and Al-Saad H. A. M. (2020).The Prevalence of *Trichomonas Vaginalis* Parasite Among Women in Some Rgions of Maysan Province, *American Society Gene & Cell Therapy*.
- 39-Hind M. Jarallah. (2013)*Trichomonas vaginalis* infections among women in basrah marshes villages south IRAQ.Egypt. *J. Exp. Biol. (Zool.)*, 9(1): 71 – 74.
- 40-Mariam K. Ali1 MSc, Huda D. Hatha12 PhD, Hala A. Almoayed.(2013). Prevalence and Diagnosis of sexually Transmitted Pathogens in A Sample of Iraqi Women: A Molecular Study .*Iraqi JMS Vol. 15(4)*
- 41-Entsar M. Al-Hussuny .(2015). An epidemiological study of *Trichomonas vaginalis* in among women living in Baquba City, Diyala Province, Iraq. *Diyala journal of pure science Vol: 11 No: 3*.
- 42- Muntaha A. H. Nasir1, AL-Idreesi S.R2, Wasfi A. AL-Masoudi(2022). Comparison of Different Techniques for the Diagnosis of *Trichomonas Vaginalis* Infection in Females at Reproductive Age. *P J M H S Vol. 16, No. 07, 451*
- 43-Avreen S. Nouraddin, M.Sc. Public Health Laboratory, General Health Directorate, Erbil, Iraq Hadi M. Alsakee, M.Sc., PhD. -Prevalence of *Trichomonas vaginalis* infection among women in Erbil governorate, northern Iraq: an epidemiological approach
European Scientific Journal August 2015 edition vol.11, No.24 ISSN: 1857 – 7881
-
- 44-Zainab Abdulhasan Alhusseini1*, Mahir Ali Alquraishi2. Volume 44, Issue 06,.Z. A. Alhusseini and M. A. Alquraishi, 2021 Epidemiological Study and Detection of *Trichomonas Vaginalis* Parasite in Holy Karbala Governorate
Teikyo Medical Journal.-Scholars Journal of Applied Medical Sciences (SJAMS)
- 45-Abdulsadah A. Rahi*, Russul W. Kadhim, Hanan Sajad Department of Biology, College of Science, Wasit University, Kut, Iraq. 2022.Prospective Study of *Trichomonas vaginalis* Infection.-*International Journal of Applied Sciences and Technology*
- 46-Nadia Jaffer Kadhum, Sabeeh h. Al-mayah, Shaymaa Jabbar Raisan. 2020 Epidemiological study on trichomonas vaginalis among the women who attended the hospitals of Basra Province.*Journal of Basrah Researches ((Sciences)) Vol. (4 6). No. 2*.
- 47-Zainab rashedabdul-jabbar. Harith saeed al-warid 2021.Some clinical inflammatory aspect of *Trichomonas vaginalis* infection among women with pelvic inflammatory disease.iraqi journal science v62.no.12.
- 48-Khansaa Azeezyonis AL-Taei. detection of trichomonas vaginalis in women with vaginitis in Mosul city
- 49-Shiren ali Al-hamzawi.Ghaidaa Raheem Lateef Al-Awsi. (2023). prevalence of *Trichomonas vaginalis* and its correlation with socio-demographic variables in pregnant women in al-diwaniya,Iraq.materials today.v.80.part 3.2023.
- 50- Seike, S.-I. Maeda, Y. Kubota, M. Tamaki, M. Yasuda, and T. Deguchi, “Prevalence and morbidity of urethral *Trichomonas vaginalis* in Japanese men with or without urethritis,” *Sexually Transmitted Infections*, vol. 89, no. 6, pp. 528–530, 2013.
- 51- Seo, H. W. Yang, S. Y. Joo et al., “Prevalence of *Trichomonas vaginalis* by PCR in men attending a primary care urology clinic in South Korea,” *Korean Journal of Parasitology*, vol. 52, no. 5, pp. 551–555, 2014.
- 52-Zhang, L. Kang, W. Wang et al., “Prevalence and genetic diversity of *Trichomonas vaginalis* clinical isolates in a targeted population in Xinxiang City, Henan Province, China,” *Parasites and Vectors*, vol. 11, no. 1, p. 124, 2018.
- 53- Momeni, J. Sadraei, B. Kazemi, and A. Dalimi, “Molecular typing of the actin gene of *Trichomonas vaginalis* isolates by PCR-RFLP in Iran,” *Experimental Parasitology*, vol. 159, pp. 259–263, 2015.
- 54- Carlton JM, Hirt RP, Silva JC, et al. Draft genome sequence of the sexually transmitted pathogen *Trichomonas vaginalis*. *Science* 2007;315:207–12.
- 55- Snipes LJ, Gamard PM, Narcisi EM, et al. Molecular epidemiology of metronidazole resistance in a population of *Trichomonas vaginalis* clinical isolates. *J Clin Microbiol* 2000;38:3004–9.
- 56- Goodman RP, Ghabrial SA, Fichorova RN, et al. *Trichomonasvirus*: a new genus of protozoan viruses in the family Totiviridae. *Arch Virol* 2011;156:171–9.
- 57- Conrad MD, Gorman AW, Schillinger JA, et al. Extensive genetic diversity, unique population structure and evidence of genetic exchange in the sexually transmitted parasite *Trichomonas vaginalis*. *PLoS Negl Trop Dis* 2012;6:e1573.

- 58-M. D. Conrad, A. W. Gorman, J. A. Schillinger et al., "Extensive genetic diversity, unique population structure and evidence of genetic exchange in the sexually transmitted parasite *Trichomonas vaginalis*," *PLoS Neglected Tropical Diseases*, vol. 6, no. 3, Article ID e1573, 2012.
- 59-Carrillo-Avila, M.L. Serrano-Garcia, J. Fernandez-Parra et al., "Prevalence and genetic diversity of *Trichomonas vaginalis* in the general population of Granada and coinfections with *Gardnerella vaginalis* and *Candida* species," *Journal of Medical Microbiology*, vol. 66, no. 10, pp. 1436–1442, 2017.
- 60- Conrad, Z. Zubacova, L. A. Dunn et al., "Microsatellite polymorphism in the sexually transmitted human pathogen *Trichomonas vaginalis* indicates a genetically diverse parasite," *Molecular and Biochemical Parasitology*, vol. 175, no. 1, pp. 30–38, 2011.
- 61- Ciccozzi, A. Lai, G. Zehender et al., "The phylogenetic approach for viral infectious disease evolution and epidemiology: an updating review," *Journal of Medical Virology*, vol. 91, no. 10, pp. 1707–1724, 2019.
- 62-Chowdhury and G. Garai, "A review on multiple sequence alignment from the perspective of genetic algorithm," *Genomics*, vol. 109, no. 5-6, pp. 419–431, 2017.
- 63- Atas, N. Tuncbag, and T. Doğan, "Phylogenetic and other conservation-based approaches to predict protein functional sites," *Methods in Molecular Biology*, vol. 1762, pp. 51–69, 2018.
- 64- Feuermann, P. Gaudet, H. Mi, S. E. Lewis, and P.D. Thomas, "Large-scale inference of gene function through phylogenetic annotation of Gene Ontology terms: case study of the apoptosis and autophagy cellular processes," *Database*, vol. 2016, Article ID baw155, 2016.
- 65-Cornelius, D.A. Robinson, C.A. Muzny et al., "Genetic characterization of *Trichomonas vaginalis* isolates by use of Mtilocus sequence typing," *Journal of Clinical Microbiology*, vol. 50, no. 10, pp. 3293–3300, 2012.
- 66- Upcroft, M. G. Delgadillo-Correa, R. L. Dunne, A. W. Sturm, P. J. Johnson, and P. Upcroft, "Genotyping *trichomonas vaginalis*," *International Journal for Parasitology*, vol. 36, no. 7, pp. 821–828, 2006.
- 67- Conrad, P. Kissinger, N. Schmidt, D. H. Martin, and J. M. Carlton, "Genetic diversity of *Trichomonas vaginalis* reinfection in HIV-positive women," *Sexually Transmitted Infections*, vol. 89, no. 6, pp. 473–478, 2013.
- 68- Gerhold, A. B. Allison, H. Sellers, E. Linnemann, T. H. Chang, and J. F. Alderete, "Examination for double stranded RNA viruses in *Trichomonas gallinae* and identification of a novel sequence of a *Trichomonas vaginalis* virus," *Parasitology Research*, vol. 105, no. 3, pp. 775–779, 2009.
- 69- Demirag, E. Malatyali, S. Ertug, and H. Ertabaklar, "Determination of *trichomonas vaginalis* genotypes using PCR restriction fragment length polymorphism (RFLP)," *Turkiye Parazitoloji Dergisi*, vol. 41, no. 4, pp. 188–191, 2018.
- 70- Masha, P. Cools, T. Crucitti, E. J. Sanders, and M. Vaneechoutte, "Molecular typing of *Trichomonas vaginalis* isolates by actin gene sequence analysis and carriage of *T. vaginalis* viruses," *Parasites and Vectors*, vol. 10, no. 1, p. 537, 2017.
- 71-Donders G.G.G., Depuydt C.E., Bogers J.P., Vereecken A.J. 2013. Association of *Trichomonas vaginalis* and cytological abnormalities of the cervix in low risk women. *PLoS One* 8(12)
- 72- Zhang Z.F., Begg C.B. 1994. Is *Trichomonas vaginalis* a cause of cervical neoplasia? Results from a combined analysis of 24 studies. *International Journal of Epidemiology* 23(4)
- 73 - Depuydt C.E., Leuridan E., Van Damme P., Bogers J., Vereecken A.J., Donders G.G. 2010. Epidemiology of *Trichomonas vaginalis* and human papillomavirus infection detected by real-time PCR in Flanders. *Gynecologic and Obstetric Investigation* 70(4): 273–280.
- 74- Roeters A.M., Boon M.E., van Haften M., Vernooij F., Bontekoe T.R., Heintz A.P. 2010. Inflammatory events as detected in cervical smears and squamous intraepithelial lesions. *Diagnostic Cytopathology* 38(2): 85–93.
- 75- Sutcliffe S., Alderete J.F., Till C., Goodman P.J., Hsing A.W., Zenilman J.M., De Marzo A.M., Platz E.A. 2009. Trichomonosis and subsequent risk of prostate cancer in the Prostate Cancer Prevention Trial. *International Journal of Cancer* 124(9): 2082–2087.
- 76- Sutcliffe S., Giovannucci E., Alderete J.F., Chang T.H., Gaydos C.A., Zenilman J.M., De Marzo A.M., Willett W.C., Platz E.A. 2006. Plasma antibodies against *Trichomonas vaginalis* and subsequent risk of prostate cancer. *Cancer Epidemiology Biomarkers and Prevention* 15(5): 939–945.