

## EFFICACY OF EXFOLIATIVE CYTOLOGY COMPARED WITH CERVICAL CULTURE FOR THE DETECTION OF CERVICOVAGINAL INFECTIONS

---

*Marisela Aguilar Durán*

Scientific Research Institute, ``Universidad  
Juárez del Estado de Durango``  
Durango - Durango  
ORCID 0000-0002-6788-351X

*Nadia Velázquez Hernández*

Scientific Research Institute, ``Universidad  
Juárez del Estado de Durango``  
Durango - Durango  
ORCID 0000-0002-0976-7086

*Sergio Estrada Martínez*

Scientific Research Institute, ``Universidad  
Juárez del Estado de Durango``  
Durango - Durango  
ORCID 0000-0003-3038-3658

*Mayra Ivonne de la Cruz Hernández*

Scientific Research Institute, ``Universidad  
Juárez del Estado de Durango``  
Durango - Durango

All content in this magazine is licensed under a Creative Commons Attribution License. Attribution-Non-Commercial-Non-Derivatives 4.0 International (CC BY-NC-ND 4.0).



**Abstract:** The vaginal microbiota is a set of microorganisms that inhabit it naturally. An alteration in the resident flora can lead to infection, which is the main cause of gynecological consultation in women of reproductive age. Pap smear cytology, in addition to allowing the detection of cellular abnormalities associated with increased risk of developing cervical cancer, also allows the detection of cervicovaginal infections. In order to find out the concordance of exfoliative cytology by Papanicolaou staining in the detection of cervicovaginal infections compared with cervical culture, 229 sexually active women between the ages of 19 and 67 were voluntarily recruited and informed, after a questionnaire of sociodemographic and gynecologic and obstetric data. sample was taken for Papanicolaou examination and culture of cervicovaginal exudate. An average age of 37.6 years was found, the prevalence of infection by Papanicolaou was 52% and by vaginal culture of 54.6%, in both methods the most frequent infection was bacterial vaginosis due to *Gardnerella vaginalis*. No cases of trichomoniasis were found. The comparison of the diagnostic methods indicates a kappa coefficient of 0.43 ( $p=0.001$ ), which indicates a statistically significant moderate concordance of the methods when diagnosing a cervicovaginal infection.

**Keywords:** infections of the genital system, Papanicolaou test, cervical culture.

## INTRODUCTION

Cervical-vaginal infections are one of the main causes of primary medical care consultation, mainly in women of reproductive age; They are generally diagnosed according to the symptoms, which are characterized by abnormal yellow, greenish, grayish or white vaginal discharge, pruritus, itching, pelvic pain, dysuria and dyspareunia (1). It is important to timely diagnose and treat

these entities through sensitive and specific diagnostic studies for each microorganism, since they can cause serious complications such as infertility, premature births and emotional problems for women and their partners. Sexually transmitted infections have been associated with development of cervical neoplasia (2).

Among the multiple clinical pictures of female infectious diseases, there is a group of entities that includes non-specific or bacterial vaginosis, which is considered the most common form of vaginal infection, followed by vulvovaginitis caused by *Candida* (or candidiasis) and vaginitis caused by *trichomonas vaginalis* (the trichomoniasis). Due to the common symptoms of cervicovaginal infections, it is difficult to distinguish them from each other, therefore it is useful to complement the diagnosis with examination and confirm it by microbiological culture study. It is very difficult to distinguish these infections from one another based on symptomatology alone, and it is absolutely necessary to rely on examination and microbiological study to establish the diagnosis. Through the cytological study, some of these microorganisms can be identified morphologically, which is why it is very useful, on the other hand, exfoliative cytology of the cervix by Papanicolaou staining is the most used technique for the early detection of cervical cancer and diagnosis of infections. genitalia and evaluation of the hormonal level (3).

The standard detection method for vaginal infections is vaginal culture; In the microbiological diagnosis, the presence of the microorganism is evidenced by techniques that allow microscopic observation of the infectious agent or isolation by culture for its identification. The culture media and conditions vary for the different microorganisms, so that the patient's clinical

data are necessary to define the etiological suspicions and confirm the diagnosis (4).

In order to determine the diagnostic utility of Papanicolaou exfoliative cytology compared with the culture of cervicovaginal exudate to detect cervicovaginal infections in women treated at a Family Care Clinic in the city of Durango, the present study was carried out.

## MATERIAL AND METHODS

Descriptive, prospective, cross-sectional study that included voluntarily and informed 229 sexually active women between the ages of 19 and 67 who attended a gynecological consultation in conditions for adequate sample collection: without prior application of ovules, creams, or vaginal douches, without menstruation during the previous five days, without taking antibiotics for the previous ten days and without a history of chronic or autoimmune diseases; After signing the consent for voluntary participation, a sociodemographic and gynecological-obstetric data questionnaire was collected, a cervical sample was taken for a Pap smear and the corresponding samples for culture of cervicovaginal exudate by the clinical laboratory. Measures of central tendency and dispersion were used for quantitative variables and frequencies and percentages for qualitative variables; the concordance of the methods was determined using Cohen's Kappa coefficient,  $p < 0.05$  was considered statistically significant.

## RESULTS

An average age of 37.6 years ( $SD \pm 9.8$ ) was found. Regarding the schooling of the participating women, it was found that less than half of the participants have completed basic education studies (42.8%) despite the fact that all the Participants are from an urban area, the results of this category are shown in

Table 1.

Regarding the occupation of the participants, it was found that 63.8% work, 35.4% are housewives and 0.9% study. The marital status of the participants was mostly married (52.4%), followed by the single group with 23.1%, divorced 17.5%, free union with 5.7% and finally widows with 1.3%.

Table 2 describes the gynecological characteristics of the participants. In the field of contraception, 73% of the participants used some contraceptive method, the most frequent being salpingoclasia with 28%, followed by condoms 15.3% and IUD intrauterine device with 14.4%.

	Median (min-max)
Age of first sexual intercourse	19 (11-39)
Number of sexual partners	3 (1-30)
Number of sexual relations per month	5.5 (0-40)
Number of pregnancies	2 (0-7)
Number of farrowings	1 (0-6)
Number of caesarean sections	0 (0-3)
Number of abortions	0 (0-7)

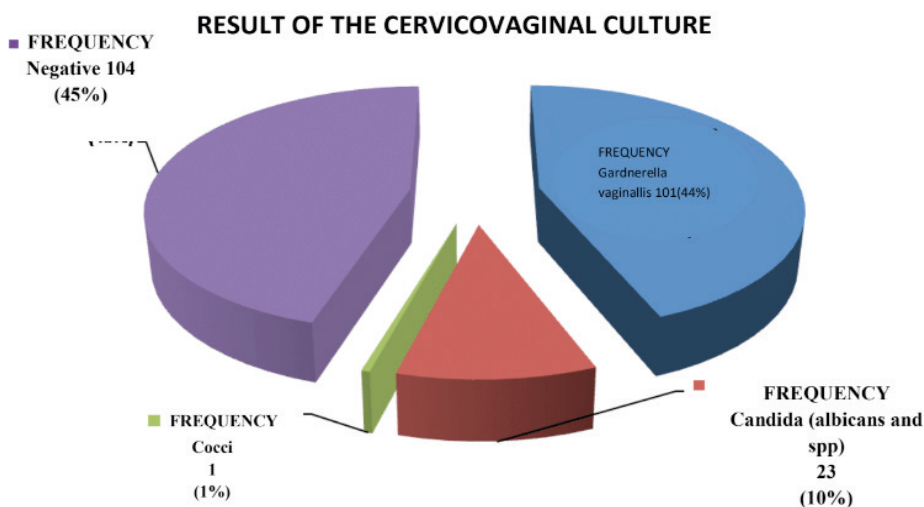
TABLE 2. Gynecological-obstetric characteristics of the participants

The most frequently reported symptoms were irritation with 82.5%, pain during intercourse with 82.1%, pelvic pain with 78.6%, burning with 77.3%, itching with 64.2%, and flow with 48%.

The prevalence of cervicovaginal infection by the Papanicolaou method was 52% and by vaginal culture was 54.6%. Graphs 1 and 2 show the microorganisms causing infection for each diagnostic method; In both methods, the most frequent infection was bacterial vaginosis due to *Gardnerella vaginalis*. No cases of trichomoniasis were found by any of the methods used.

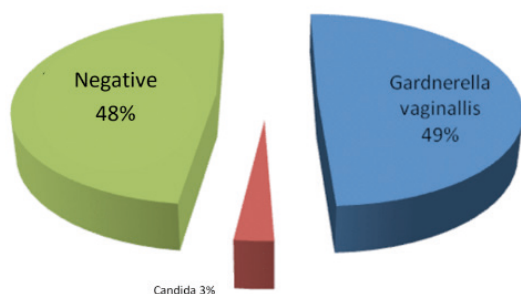
EDUCATION LEVEL	FREQUENCY	PERCENTAGE(%)
No studies	1	0.4
Children's garden	2	0.9
Primary truncates	80	34.9
finished primary	34	14.8
Truncated secondary	14	6.1
Finished high school	14	6.1
<b>Total complete basic education</b>	<b>98</b>	<b>42.8</b>
Truncated baccalauteate	54	23.6
finished high school	13	5.7
Truncated professional	9	3.9
Finished professional	8	3.5
<b>TOTAL</b>	<b>229</b>	<b>100</b>

TABLE 1. Educational level of the participants



Graph 1. Microorganisms reported by cervicovaginal culture

## RESULT BY PAPANICOLAOU



Graph 2. Microorganisms reported by Papanicolaou staining

Comparison of diagnostic methods revealed a statistically significant kappa coefficient of 0.43 ( $p=0.001$ ), indicating moderate agreement of methods when diagnosing cervicovaginal infection.

## DISCUSSION

Cervicovaginal infections are one of the main causes of consultation in first level medical care clinics, especially in women of reproductive age. The normal vaginal ecosystem is recognized as an important host defense mechanism against infections, either by the competitive exclusion of microorganisms, the production of lactic acid by the lactobacilli present, or by the production of bacteriocins and/or hydrogen peroxide. However, a series of factors that can alter the aforementioned ecosystem are also recognized, such as those related to sexual behavior, the use of antimicrobials, natural changes in the menstrual cycle, the application or use of vaginal douches, hygienic habits and others. (1).

It is currently accepted that an alteration of the vaginal flora allows colonization by different bacteria, so it is vitally important to have reliable diagnostic tests to avoid a series of complications derived from these processes. This study compared the usefulness

of Papanicolaou cytology against the culture of cervicovaginal exudate for the detection of cervicovaginal infections in users of the Family Care Clinic of the Scientific Research Institute of the ``Universidad Juárez del Estado de Durango``. The results reveal that no positive cases of *Trichomonas vaginalis* were found (by any of the methods), which is in stark contrast to what has been reported in the literature; in 2013 López et al. (5) reported a prevalence of 23.41% in women from a primary care clinic detected by PCR in urine samples from Veracruz, Mexico. A lower prevalence (14.2%) was found by Casillas in 2016 (6) detecting the parasite by multiplex PCR in women from Jalisco, Mexico. Global global prevalences of 5.3% in women have been estimated (7). High prevalences have been reported by Muñoz (8) and West (9), who estimated 25.7% and 33.6% respectively in female sex workers.

In our study we found that bacterial vaginosis caused by *Gardnerella vaginalis* (GV) is the most common infection, regardless of the diagnostic method used.

The frequency for cervicovaginal culture was 44%, while for Papanicolaou staining it was 49%. Our data contrast with national studies that report lower frequencies of bacterial vaginosis due to GV than ours. In separate studies conducted in Guerrero and Puebla, Cortés (10) and Jiménez (11) found prevalences of 10.4 and 12.7%, respectively, detected by Amsel criteria. In studies carried out in other countries, what was found by Lugo (12) who in 2018 reported a GV-HPV coinfection of 76.9% in a study carried out in Brazil, detected molecularly by PCR.

Regarding vulvovaginal candidiasis caused by *Candida albicans* and *Candida* spp, we found a prevalence of vaginitis by means of culture of vaginal exudate of 10%, which contrasts with that of Papanicolaou which was 3%. Previous studies in healthy non-pregnant women with similar prevalences

in Mexico include the one reported by Solís (13), who reported a prevalence of 12.6% in asymptomatic women. Our results contrast with what was reported by López (14) and Pineda (15) who, using molecular detection by PCR, reported prevalences of 38.8 and 61.7% respectively in populations of Veracruz and Mexico. Similar prevalences have been reported in other countries, such as the study by Damke (16) who reports 13.5% in the Indian population. In that same country, the research carried out by Krishnasamy (17) in 2018 found a prevalence of 56% detected by culture; These figures are similar to those reported by Rabi (18) who reported a 53.7% prevalence of vulvovaginal candidiasis in women from Iraq and through culture.

When comparing the usefulness of Papanicolaou cytology against vaginal exudate culture, we found that its usefulness is moderate and statistically significant, revealed by the kappa coefficient of 0.43 ( $p=0.001$ ). González Pedraza (19) states that Papanicolaou staining has high specificity for detecting bacterial vaginosis, candidiasis and trichomoniasis, but low sensitivity, suggesting that this technique seems to be more suitable for excluding infections than for diagnosing them. For his part, López (20) agrees with our finding of finding significant agreement between both methods, but only for diagnosing candidiasis and, like us, culture was more effective for diagnosing cervicovaginal infection.

## REFERENCES

1. Abdallah M, Augenbraun MH, McCormack W. Vulvovaginitis y cervicitis. En: Bennett JE, Dolin R, Blaser MJ, editores. Mandell, Douglas, Bennett Enfermedades infecciosas Principios y práctica. la Ciudad Condal, España: Elsevier Masson; 2021. p. 1462–76.
2. Filip Jansåker, Xinjun Li, Jenny Dahl Knudsen, Niels Frimodt-Møller, Christer Borgfeldt, Kristina Sundquist. The association between common urogenital infections and cervical neoplasia – A nationwide cohort study of over four million women (2002–2018). The Lancet Regional Health - Europe [Internet]. 2022;17(100378). Disponible en: <https://pubmed.ncbi.nlm.nih.gov/35494213/>
3. Swartz MH, Nentín FG. Genitales femeninos. En: Swartz MH, editor. Tratado de semiología. London, Países Bajos: Elsevier; 2021. p. 404–28.
4. Marco Reverté F, Mensa Pueyo J. Infecciones bacterianas. En: von Domarus A, Farreras P, Rozman C, Cardellach F, Nicolás JM<sup>a</sup>, Cervera R, et al., editores. Farreras Rozman Medicina Interna. la Ciudad Condal, España: Elsevier Masson; 2020. p. 2075–90.
5. López-Monteón, A., Gómez-Figueroa, F.S., Ramos-Poceros, G., Guzmán-Gómez, D., Ramos-Ligonio, A. Codetection of trichomonas vaginalis and Candida albicans by PCR in urine samples in a low-risk population attended in a clinic first level in Central Veracruz, Mexico. BioMed Research International, [Internet]. 2013; 2013. Disponible en: <https://www.scopus.com/inward/record.uri?eid=2-s2.0-84884233935&doi=10.1155%2f2013%2f281892&partnerID=40&km>
6. Casillas-Vega N, Morfín-Otero R, García S, Llaca-Díaz J, Rodríguez-Noriega E, Camacho-Ortiz A, Ayala-Castellanos MM, Mendoza-Olazarán S, Flores-Treviño S, Petersen-Morfín S, Maldonado-Garza HJ, Bosques-Padilla FJ, Garza-González E. Sexually transmitted pathogens, coinfections and risk factors in patients attending obstetrics and gynecology clinics in Jalisco, Mexico. Salud Pública de México. 2016; 58:437–45.
7. Jane Rowley, Stephen Vander Hoorn, Eline Korenromp, Nicola Low, Magnus Unemo, Laith J Abu- Raddad, R Matthew Chico, Alex Smolak, Lori Newman, Sami Gottlieb, Soe Soe Thwin, Nathalie Brouteta Melanie M Taylora. Chlamydia, gonorrhoea, trichomoniasis and syphilis: global prevalence and incidence estimates, 2016. Bull World Health Organ [Internet]. 2019;97:548–62. Disponible en: <http://dx.doi.org/10.2471/BLT.18.228486>

8. Azucena Muñoz-Ramírez, Aracely López-Monteón, Ángel Ramos-Ligonio, Enrique Méndez-Bolaina, Mario R.B. Guapillo-Vargas. Prevalence of *Trichomonas vaginalis* and Human papillomavirus in female sex workers in Central Veracruz, Mexico. *Revista Argentina de Microbiología*. 2018; 351–8.
9. West, B. S., Becerra Ramirez, M., Bristow, C. C., Abramovitz, D. A., Vera, A., Staines, H., Gudelia Rangel, M., Patterson, T. L., Strathdee, S. A., for Proyecto Mujer Mas Segura. Correlates of trichomoniasis among female sex workers who inject drugs in two Mexico-US border cities. *International Journal of STD and AIDS*. 2020;31(9):866–75.
10. Cortés, S.K., Estrada, M.A., Gómez, C.M., Alarcón, R.L., Flores, A.E., Vences, V.A. Prevalence and risk factors associated with bacterial vaginosis in southern Mexico. *Sexually Transmitted Infections*. 2017;93(2):A136
11. Jiménez, F.G., Flores, T.J., Ruiz, T.A., Villagrán, P.C. Evaluación de los métodos utilizados para el diagnóstico de vaginosis bacteriana en el Hospital Regional ISSSTE Puebla. *Ciencia UAT*. 2020;14(2):62–71.
12. Lugo, L., Jacob, C., Machado, A., Almeida, F., Ávila, L., Prata, T., Padovani, C., Ferreira, A., Fernandes, C., Tozetti, I. Human papillomavirus and coinfections with *Chlamydia trachomatis*, *Gardnerella vaginalis*, and *Trichomonas vaginalis* in self-collected samples from female sex workers in the Central-Western region of Brazil. *Jornal Brasileiro de Patologia e Medicina Laboratorial*. 2018;54(1):46–51.
13. Solís, A.M., Moreno, M.M., Dávalos, T.M., Fernández, M.R., Díaz, F.O., Arenas, G.R. Colonización vaginal por *Candida* spp. Frecuencia y descripción de las especies aisladas en mujeres asintomáticas. *Ginecología y obstetricia de México*. 2014;82:1–8.
14. López, M.A., Gómez, F.F., Ramos, P.G., Guzmán, G.D., Ramos, L.A. Codetection of *Trichomonas vaginalis* and *Candida albicans* by PCR in Urine Samples in a Low-Risk Population Attended in a Clinic First Level in Central Veracruz, Mexico. *BioMed Research International* [Internet]. 2013;2013. Disponible en: <http://dx.doi.org/10.1155/2013/281892>
15. Pineda, D.J., Gómez, M.Y., Xoconostle, C.B., García, M.J. Detección de *Candida glabrata* en mujeres mexicanas sanas y con candidiasis vulvovaginal recurrente. *Ginecología y Obstetricia de México*. 2017;85(2):71–9.
16. Damke, S., Chandi, D. Fule, R. Study of Bacterial Vaginosis among Women of Reproductive Age Using Contraceptive Methods in a Tertiary Care Hospital. *Journal of Krishna Institute of Medical Sciences University*. 2020;9(2):22–7.
17. Krishnasamy, L., Krishnakumar, S., Santharam, P., Saikumar, C. Isolation and identification of *Candida* Species in Patients with Vulvovaginal Candidiasis. *Journal of Pure and Applied Microbiology*. 2018;12(4):2269–73.
18. Rabi, S.S., Ali, H.R., Abid, H.S. Prevalence of vulvovaginal Candidiasis and its association with Contraceptives. *Archivos Venezolanos de Farma*. 2021;40(4):373–6.
19. González Pedraza, A.A., Ortiz, Z.C., Topete, B.L., Mota, V.R., Ponce, R.R. ¿Es útil la tinción de Papanicolaou como auxiliar del diagnóstico de algunas infecciones de transmisión sexual? *Atención Primaria*. 2001;27(4):222–6.
20. López OJ. Leucorreas: valores predictivos de la citología cervicovaginal y del cultivo microbiológico para el diagnóstico de la infección vaginal. clínica e investigación en ginecología y obstetricia. 2012;40(5):200–6.