



Investigation of Bacterial and Fungal Spp. Causing Vaginal Infection in Married Libyan Women Attending Gynecology Clinics in Aljmail City

Rumadhanah Abraheem Mohammed ¹, Zakeeyah Saliem Mohammed Qajjam ^{2*}, Kareemah Murajia Mohammed ³

¹ Lecturer, Botany Department, University of Zawia, Al-Ajalat, Libya

² Lecturer, Botany (Microbiology) Department, University of Zawia, Al-Ajalat, Libya

³ Assistant lecturer, Botany Department, University of Zawia, Al-Ajalat, Libya

*Corresponding author: z.qajjam@zu.edu.ly

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Abstract:

Because the vaginal microbiome changes and is susceptible to a variety of pathogenic bacteria, treating vaginal infections in married women seeking gynecological treatment is difficult. These infections, mostly bacterial and fungal, cause significant pain and damage women's health and quality of life. This study examines sociodemographic characteristics, pregnancy status, medical conditions, vaginal hygiene behaviors, and bacterial and fungal species to better understand their effects on vaginal health. Understanding these traits is essential to developing effective therapy and prevention measures for these diseases. This cross-sectional study examined married women attending gynecological clinics in Al-Ajmal, Libya. Social demographics, pregnancy status, medical issues, and vaginal cleaning practices were collected using structured questionnaires. Standard laboratory techniques were used to test vaginal samples for bacteria and fungi. Then, the data was evaluated to determine the prevalence of microorganisms and sociodemographic features in participant women. The study findings indicated that there was a greater percentage of older women, residing in rural areas, and had lower levels of education and income who sought gynecological care. Diverse instances of bacterial and fungal species, specifically *Escherichia coli* and *Candida albicans*, were detected, hence emphasizing their involvement in vaginal infections. Variations in the frequencies of vaginal wash behaviors were noted among the subjects. This study shows the various aspects that affect vaginal health in married women. Customized interventions targeting sociodemographic gaps, hygiene practices, and medical conditions are needed to manage and prevent vaginal bacterial and fungal infections. Understanding this topic is crucial to improving women's vaginal health.

Keywords: Bacteria, *Candida* spp., GBS, reproductive health, Vaginal infection.

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دراسة البكتيريا والفطريات المسببة للعدوى المهبلية عند النساء اللبيات المتزوجات واللاتي يترددن على العيادات النسائية

رمضانة ابراهيم محمد النقا^{1*}، زكية سالم محمد قجام²، كريمة مراجع محمد مراجع³

¹ محاضر، قسم النبات، جامعة الزاوية، العجيلات، ليبيا

² محاضر، قسم النبات (الأحياء الدقيقة)، جامعة الزاوية، العجيلات، ليبيا

³ محاضر مساعد، قسم النبات، جامعة الزاوية، العجيلات، ليبيا

الملخص

إن عملية إدارة العدوى المهبلية للنساء المتزوجات اللاتي يطلبن الرعاية في عيادات النساء يعتبر تحديًا معقدًا، وذلك بسبب التغيرات في تكوين البكتيريا في المهبل وتعرضها لمجموعة من الكائنات المجهرية الممرضة. تسهم هذه العدوى، التي يعزى سببها الأساسي إلى البكتيريا والفطريات، بشكل كبير في الإحساس بالألم، مما يؤثر على الصحة العامة وجودة الحياة للنساء. يهدف هذا البحث إلى استكشاف العوامل الاجتماعية الديموغرافية، وحالة الحمل، والحالات الطبية، وممارسات النظافة الشخصية في المنطقة الرحمية، ووجود البكتيريا والفطريات لفهم تأثيرها على الصحة الجنسية والتناسلية. فهم هذه الخصائص يعد أمرًا بالغ الأهمية في تطوير استراتيجيات فعالة لإدارة والوقاية من هذه الأمراض. في هذه الدراسة، تم تنفيذ دراسة ذات طابع عرضي عابر لفحص النساء المتزوجات اللاتي يطلبن الرعاية في عيادات النساء في مدينة الجميل الليبية. تم استخدام استبيانات منظمة لجمع البيانات الاجتماعية وحالة الحمل والمشاكل الطبية ومعلومات عن عادات غسل المنطقة الرحمية. تم تطبيق بروتوكولات مختبرية قياسية لفحص عينات المنطقة المهبلية للكشف عن وجود البكتيريا والفطريات ثم عمل تحليل للبيانات وحساب للنسب المئوية.

توضح نتائج الدراسة وجود نسبة أعلى من النساء اللواتي يتقدمن في السن ويعيشن في المناطق الريفية ويحملن مستويات تعليمية ودخل منخفضة ويبحثن عن الرعاية النسائية. تم اكتشاف حالات مختلفة من البكتيريا والفطريات، وخاصة بكتيريا إيشيريشيا كولاي وكانديدا ألبيكانس، مما يؤكد دورها في الإصابة بالعدوى الرحمية. لاحظت تباينات في تكرار سلوكيات غسل المنطقة الرحمية بين المشاركين. بناءً على ذلك، يتضح من هذه الدراسة أن هناك مجموعة متنوعة من العوامل التي تؤثر في صحة المنطقة الرحمية بين النساء المتزوجات اللواتي يطلبن الرعاية في عيادات النساء. لذا، يجب تنفيذ تدخلات مستهدفة تستهدف بشكل خاص الفروق الاجتماعية الديموغرافية وعادات النظافة الشخصية والحالات الطبية للتحكم في والوقاية من العدوى البكتيرية والفطرية في منطقة الرحم بشكل فعال. يعد فهم هذا الموضوع بشكل شامل ضروريًا لتحسين الصحة والرفاهية العامة للنساء فيما يتعلق بمنطقتهم الرحمية.

الكلمات المفتاحية: بكتيريا، فطر الكانديدا، بكتيريا GBS، العدوى المهبلية، الصحة الإنجابية.

Introduction

Vaginal infections in married women pose a substantial health issue, exerting adverse effects on their overall well-being and reproductive health. The vaginal microbiota is vulnerable to a range of pathogenic microorganisms, primarily consisting of bacterial and fungal species. Frequently, these infections present themselves as vaginitis, which is characterized by inflammation, discharge, pain, and itching [1, 2].

Bacterial and fungal species play a crucial role in causing vaginal infections among women, significantly impacting vaginal health. The most common bacterial species associated with vaginal infections include *Escherichia coli*, *Streptococcus agalactiae*, and *Staphylococcus aureus*, and various species of *Lactobacilli*, where an imbalance in the normal vaginal flora can lead to conditions like bacterial vaginosis. This imbalance often results in a decrease in the beneficial *Lactobacilli* and an increase in harmful bacteria, leading to symptoms such as unusual discharge, odor, and discomfort [3, 4].

Fungal species, notably *Candida albicans*, are responsible for causing most cases of vaginal yeast infections or candidiasis. Changes in the vaginal environment, such as hormonal fluctuations, antibiotic use, or compromised immunity, can trigger overgrowth of *Candida species* [5].

The global healthcare community is significantly concerned about the frequency and incidence rates of vaginal infections among married women. Numerous epidemiological studies have documented diverse prevalence rates, hence highlighting the extensive distribution of these infection. Based on the available literature, it has been observed that the prevalence rates of the condition in question vary between about 20% and 50% among women who seek gynecological consultations [6]. Moreover, the incidence rates of this condition exhibit oscillations depending on factors such as geographical region, age, sexual activity, and other demographic variables. Furthermore, there is a notable rise in both the prevalence and incidence rates within specific age

groups, with a particular peak observed during the reproductive phase [7, 8]. Hormonal fluctuations, commonly observed during menstruation, pregnancy, menopause, or as a result of contraceptive utilization, also impact the vaginal milieu, rendering it more susceptible to infections [9].

Hygiene procedures, such as the utilization of abrasive soaps, douching, or the application of irritating feminine products, have the potential to disturb the inherent pH equilibrium, hence establishing a conducive environment for the occurrence of infections [10]. Health diseases such as diabetes or immunosuppressive illnesses weaken the body's immune response, hence diminishing its capacity to effectively combat infections. In addition, the utilization of antibiotics has the potential to disrupt the inherent equilibrium of microorganisms present in the vaginal region, so facilitating the proliferation of detrimental bacteria or fungus [8, 11]

Vaginal infections have a substantial impact on the sexual and reproductive health of women. These infections frequently result in discomfort, pain, and changes in vaginal discharge, which can contribute to diminished sexual desire and discomfort during sexual intercourse [12, 13]. The presence of physical symptoms, such as pruritus, erythema, and atypical excretions, can have an impact on the level of sexual intimacy experienced by individuals, potentially leading to emotional distress and placing strain on interpersonal relationships. In addition, the occurrence of repeated infections might potentially contribute to the avoidance of sexual activity, leading to a decline in sexual satisfaction and less closeness within interpersonal relationships [14, 15].

Insufficient study has been conducted to thoroughly investigate the prevalence, diversity of strains, and underlying determinants that contribute to the occurrence of these diseases among Libyan married women. This study aims to address the existing knowledge gap by examining the many bacterial and fungal species responsible for vaginal infections in this particular population.

The objective of this study is to ascertain the frequency, characteristics, and probable factors that may influence them. Additionally, the objective of this study is to identify the predominant strains that are commonly found among this particular community.

Material and methods

The present study employed a cross-sectional research methodology to assess the frequency and attributes of bacterial and fungal infections linked to vaginosis. The research was centered on 55 of married women who were receiving care at gynecological clinics located in different healthcare facilities in Ajmal city, Libya. The study was conducted over a period of two months, starting on June 1, 2023, and ending on July 31, 2023.

Inclusion and exclusion criteria: The criteria for participant selection covered married women who were attending gynecological clinics within the authorized healthcare institutions during the stated study period. The participation of these ladies in the study necessitated their provision of informed consent and willingness to engage in the research. The inclusion criteria for the study encompassed women of various age groups who were actively seeking gynecological treatment and demonstrated a willingness to participate in the research by providing pertinent details regarding their medical history and vaginal hygiene routines.

In contrast, the exclusion criteria encompassed unmarried women, individuals who had received antibiotic or antifungal treatments during the designated time period before the commencement of the trial, and individuals who declined to provide informed permission. The rationale behind the exclusion of unmarried women from the study can be attributed to the study's specific objective of examining bacterial and fungal diseases related to vaginosis within the specific population of married women seeking care at gynecological clinics. The purpose of this criterion was to ensure the preservation of a cohesive demographic group to analyze and interpret the results. Furthermore, the decision to exclude participants who had recently received antibiotic or antifungal treatments was made to minimize any potential confounding factors that could affect the assessment of the prevalence of bacterial and fungal infections associated with vaginosis.

Data Collection: The process of data collection consisted of utilizing a well-organized questionnaire that was administered through in-person interviews performed by staff who had received appropriate training. The survey consisted of many sections that focused on demographic information, including age, residential location (urban or rural), level of education, income level, pregnancy status, and medical history, which encompassed conditions such as diabetes, hypertension, and other pertinent health issues. Furthermore, the questionnaire explored questions about practices of vaginal cleanliness and symptoms correlated with possible vaginal infections.

Laboratory Analysis:

Vaginal swab samples were taken from the participants in a sterile manner during their clinic visit and later transferred to the laboratory for comprehensive analysis. Microbiological examinations were undertaken to ascertain the presence and isolate pathogenic bacteria and fungi within the samples. Various techniques such as specialized staining, culture and biochemical tests were utilized in order to precisely ascertain and define bacterial and fungal species.

In order to isolate and identify bacteria, swab samples are obtained from the vaginal region and subsequently streaked onto specialized media to promote the growth of diverse bacterial strains. The experimental procedure involved the utilization of nutrient agar, MacConkey agar, and blood agar for the purpose of isolating and cultivating microorganisms. After the incubation period, researchers detect various colonies and choose them for subsequent analysis. In order to ascertain the precise bacterial strains, a range of biochemical tests are conducted to describe and distinguish between different bacterial species.

In the case of fungi, swab samples collected from the vaginal region are streaked onto specialized media in order to promote the proliferation of fungal species. The SDA medium creates a favorable environment that promotes the growth of fungi. The utilization of chromogenic agar, which exhibits discernible alterations in color, facilitates the differentiation of *Candida species* using distinctive variations in colony pigmentation. After the incubation period, researchers observe the presence of clearly distinguishable colonies and proceed to choose specific ones for subsequent study. Biochemical techniques, such as microscopic inspection of lactophenol cotton blue, are employed for the precise identification and discrimination of *Candida species*.

Data Analysis:

The data that was obtained underwent a thorough analysis. Descriptive statistical techniques were employed to illustrate the demographic attributes, prevalence rates of various bacterial and fungal species, and factors linked to the occurrence of infections connected to vaginal infection.

Results and discussion

Sociodemographic and socioeconomic characteristics distribution among participant women:

The sociodemographic factors delineated provide insight into the heterogeneous demographic makeup of the study individuals as demonstrated in Table 1.

The analysis of the distribution among various age groups indicates that there is a somewhat higher proportion of women aged 40 years and above (45.46%). This finding suggests that there is a notable presence of older individuals who are seeking gynecological care. Furthermore, it is worth noting that a significant proportion of the participants (67.27%) in this study originate from urban areas. When examining the educational backgrounds of women, it is evident that a significant proportion (43.63%) hold only a primary level of education. This factor may have implications for their degree of health awareness and their propensity to seek healthcare services about vaginal health. Moreover, the distribution of income levels reveals that a significant fraction of the participants can be classified as belonging to the 'poor' category (45.46%).

Table 1: Distribution of Sociodemographic and Socioeconomic Characteristics.

		No.	%
Age	21-30	12	21.82%
	31-40	18	32.72%
	>40	25	45.46%
	Mean 35.33 SD \pm 7.153		
Residence	Rural	37	67.27%
	Urban	18	32.73%
Education	Primary	24	43.63%
	Secondary	18	32.72%
	University	13	23.65%
Income level	Poor	25	45.46%
	Moderate	20	36.36%
	High	10	18.18%

Pregnancy existence among participant women:

Table 2 and Figure 1 show that findings of the study indicate that a minority, specifically 33.33% of the participants, were identified as non-pregnant, while the majority, comprising 66.67%, were classified as

pregnant. It is vital to comprehend the differentiation in pregnancy status among the participants of the study, as it facilitates a comparative examination between women who are pregnant and those who are not pregnant, about their vulnerability to bacterial and fungal infections associated with vaginosis.

Table 2: Distribution of pregnancy existence.

	No.	%
pregnant	30	66.67%
Non-pregnant	15	33.33%
	55	100.0

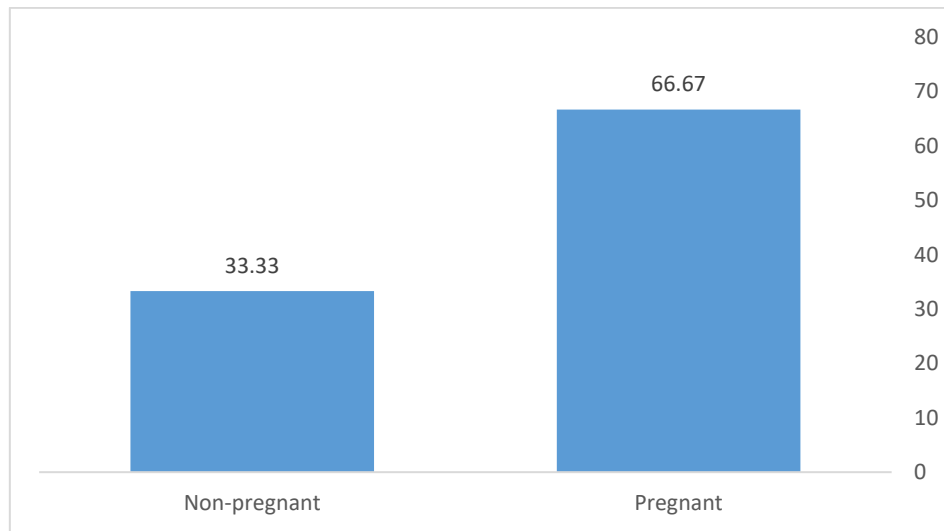


Figure 1: Existence of pregnancy among participating women.

Different Medical conditions distribution between women:

The study results shown in Table 3 are shedding light on the distribution of medical conditions within this specific population. A significant proportion of the participants (58.18%) indicated that they did not have any specific medical issues. Within the subset of individuals who disclosed their medical conditions, it was seen that diabetes was present in 20% of the subjects, thereby establishing itself as the most predominant specific health ailment within this particular group. Coronary Heart Disease (CHD) was found to be present in 7.27% of the patients, while hypertension was documented in 14.55% of the cohort.

Table 3: Prevalence of medical conditions among participating women.

	No.	%
No medical conditions	32	58.18%
Diabetes	11	20%
CHD	4	7.27%
Hypertension	8	14.55%
	55	100.0

Vaginal douching practice frequency:

Regarding vaginal wash practices demonstrates a range of frequency at which individuals within the demographic engage in this practice as shown in Table 4. A minority of the participants (12.72%) indicated a lack of usage of vaginal wash. Within the group of individuals who engaged in the vaginal wash, approximately half of the participants (50.90%) reported engaging in this activity daily, but a substantial proportion reported engaging in the vaginal wash every week (21.38%) or infrequently (18%).

Table 4: Frequency of Vaginal douching practices.

	No.	%
Never	7	12.72%
Rarely	9	18%
weekly	12	21.38%
Daily	28	50.90%
	55	100.0

It is crucial to comprehend these behaviors, since they have a profound influence on the vaginal microbiota and, consequently, the susceptibility to bacterial and fungal illnesses linked to vaginosis. The potential impact of vaginal wash frequency and procedure on the vaginal pH and flora, and consequently the vulnerability to infections, warrants consideration.

Bacterial spp. causing infection distribution:

Table 5 and Figure 2 reveal the occurrence of harmful bacteria among this population. The findings shed light on the diverse range of bacterial species that are frequently detected in vaginal samples. *Escherichia coli* (*E.coli*) emerges as the predominant bacterium among those that have been identified, constituting 32.73% of the reported instances. *Streptococcus agalactiae*, often known as *Group B Streptococcus* (*GBS*), accounts for 23.63% of the cases. *Staphylococcus hemolyticus* and *Klebsiella pneumoniae* make for 18% and 12.72% of the cases, respectively. The prevalence of *Staphylococcus epidermidis* was found to be 10.90% in the cases examined, whereas *Diphtheroid species* (*SPP*) exhibited the lowest prevalence at 3.62%.

Table 5: Distribution of bacterial spp. in vagina.

	No.	%
E.coli	18	32.73%
Staphylococcus epidermidis	6	10.90%
Streptococcus agalactiae (GBS)	13	23.63%
Klebsiella pneumonia	7	12.72%
Staphylococcus hemolyticus	9	18%
Diphtheroid SPP.	2	3.62%
	55	100.0

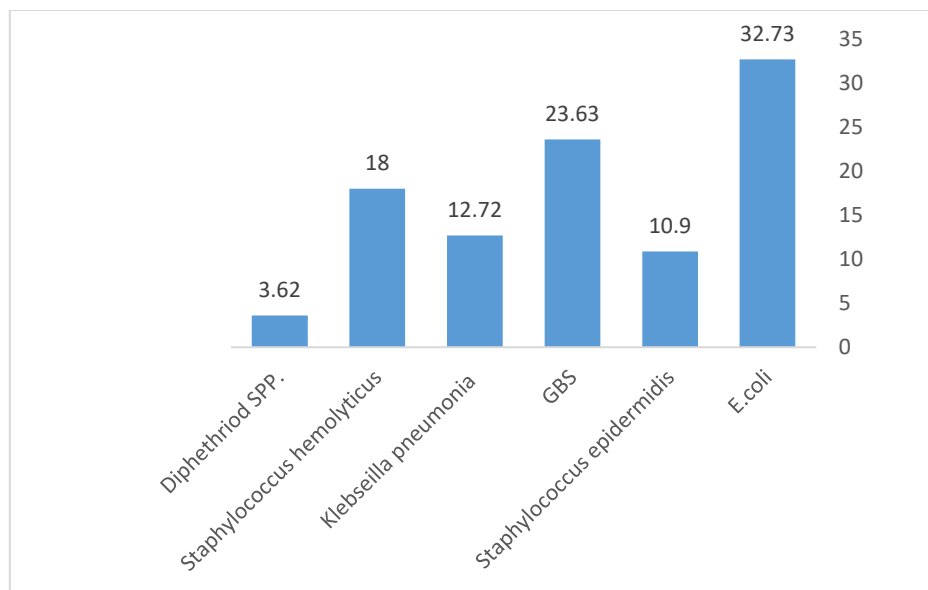


Figure 2: Different bacterial spp. prevalence in vaginal swabs.

Fungal spp. distribution and prevalence.

Table 6 and Figure 3 indicate the occurrence of harmful fungus among the female participants. The analysis of vaginal samples indicates the existence of various fungal species. *Candida albicans* is widely recognized as the most predominant species, constituting 58.18% of the reported cases. *Candida tropicalis* accounts for 10.90% of the observed cases, but a substantial proportion (30.92%) exhibited no discernible indications of fungal infection.

Table 6: Prevalence of different fungal spp.

	No.	%
Candida albicans	32	58.18%
Candida tropicalis	6	10.90%
No fungal infection	17	30.92%
	55	100.0

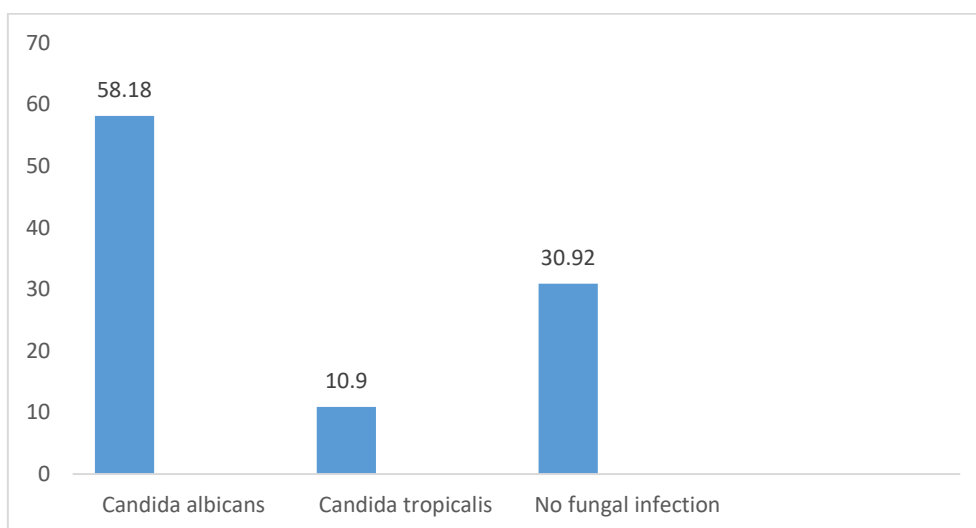


Figure 3: prevalence of fungal infection and fungal spp. distribution.

Discussion:

The present study involves a comprehensive examination of the sociodemographic features of married Libyan women attending gynecological clinics in Aljmail City, with a focus on the bacterial and fungal species associated with vaginal infections. An in-depth comprehension of the demographic profile is essential to contextualize the prevalence and related risk factors of these illnesses. This discourse thoroughly analyzes multiple facets, including age distribution, residential background, educational attainment, income levels, and the urban-rural dichotomy. The examination's insights are enhanced by employing a comparative approach, which involves drawing connections with foreign studies conducted in Ecuador, Iraq, Vietnam, China, Egypt, and Iran. Moreover, the discourse expands to encompass the examination of pregnancy, vaginal douching practices, and the wide range of bacterial and fungal species, creating associations and discrepancies using comparisons with varied investigations.

The findings of our study on married Libyan women seeking gynecological care in Aljmail City indicate a significant change in the age distribution. Specifically, 45.46% of the participants were found to be 40 years old or older.

The demographic composition of our study distinguishes it from previous investigations conducted in Ecuador, as the majority (61.8%) of participants in those studies belong to the 21-30 age group [16]. The presence of age discrepancies may suggest differences in life phases and the corresponding risk factors, which can impact the occurrence of vaginal infections. The study conducted in Vietnam presented a categorization of patients into two groups: pre-menopausal (35%) and post-menopausal (65%) [17]. This classification highlighted a potential association between hormonal factors and the prevalence of infection.

The findings of the Iraqi study are consistent with our research since they also indicate a higher prevalence of infection among individuals from rural areas [18]. This aligns with our study, which included a substantial number of rural respondents, accounting for 67.27% of the total sample. This finding implies that the presence of environmental and lifestyle factors in rural areas may be associated with an increased susceptibility to vaginal infections.

Furthermore, the differential between urban (52%) and rural (48%) settings in Vietnam underscores the influence of geographical positioning on the prevalence of infection [17]. In contrast, the findings of the Egyptian study indicate a distinct urban-rural dynamic, wherein urban women have a notably greater prevalence of infections [19].

The study examines the socio-economic features of participants to get valuable insights into the potential factors influencing vaginal infections among married women in Aljmail city, Libya. The conclusion of note is that 43.63% of the participants possess solely a primary level of education. This finding is consistent with previous research conducted in Iran, which revealed a statistically significant link between lower levels of education and a heightened vulnerability to vaginal infections ($p < 0.025$) [20]. Likewise, research conducted in China has provided support for the idea that lower levels of education are associated with an increased risk of vaginal

infections [21]. This suggests that educational achievement is a significant component in determining susceptibility to these types of diseases.

On the other hand, the educational environment in Ecuador presents a distinct scenario, wherein around 79.7% of the individuals included in the study had attained a secondary level of education, commonly known as high school education [16].

Moreover, the study's analysis of income distribution reveals that 45.46% of participants can be categorized as belonging to the 'poor' group, aligning with a larger global trend. There is a significant correlation between low-income levels and a higher prevalence of vaginal infection, as well as a lack of understanding regarding this condition ($p < 0.001$). Based on a recent study conducted in 2023 [22].

The findings of a separate investigation highlight a significant correlation between low socioeconomic level, as well as additional characteristics such as low literacy and age over 35, and the prevalence of vaginal infections among married women [23].

The identification of a notable discovery in our study reveals that 66.67% of the female participants are now pregnant, which holds special significance when juxtaposed with the findings of a separate study wherein 60.1% of participants were pregnant and 39.9% were not pregnant [23]. In contrast to our research findings, the alternative study indicates that there is no statistically significant disparity in the occurrence of vaginal infections between women who are pregnant and those who are not [24]. This phenomenon presents a compelling juxtaposition, indicating that the physiological alterations experienced during pregnancy, which are acknowledged to impact the composition of the vaginal microbiota, may not inevitably lead to heightened vulnerability to infections.

The accurate identification of medical disorders among the participants in our study is a crucial component in comprehending the wider health context that impacts the occurrence of vaginal infections. Significantly, a considerable percentage (58.18%) of participants indicated the lack of any particular medical conditions. This finding is in contrast to the results of a separate study, which demonstrated a notable correlation between Type 2 Diabetes Mellitus (T2DM) and an increased occurrence of vaginal infections. The study indicated that individuals with T2DM had a 2.3-fold higher likelihood of experiencing vaginal infections compared to individuals without diabetes [25].

The association between diabetes and an elevated susceptibility to vaginal infections has been extensively established, and our research findings are consistent with this observed pattern. Potential underlying mechanisms may encompass modifications in immunological responses, alterations in the vaginal microenvironment, and heightened blood glucose levels, so creating a conducive milieu for microbial proliferation.

Remarkably, a recent investigation brought attention to the fact that, with the exception of vulvovaginal candidiasis infections, there exists no substantial association between bacterial vaginal infections and either gestational diabetes or overall health status [26]. This subtle discovery implies that there may be variations in the association between diabetes and certain types of vaginal infections. Vulvovaginal candidiasis, which is frequently linked to alterations in the vaginal flora, hormonal variations, and diabetes, presents itself as a notable anomaly.

The investigation of vaginal douching behaviors among the participants in our study has unveiled a significant trend, wherein over half (50.90%) of the individuals partake in daily douching, while 12.72% choose not to engage in this activity. The aforementioned observation elicits a need for more investigation, particularly considering the contradictory results reported in previous research projects. According to a study, there are no statistically significant disparities observed in regard to vaginal flora and infection rates between women who engage in douching and those who do not [27]. This finding suggests that the association between douching practices and vaginal health is intricate in nature.

In contrast, a study conducted at Zagazig University in Egypt offers a divergent viewpoint, highlighting vaginal douching as a significant factor associated with risk. Within this particular context, it was observed that a significant proportion of women, specifically 92.2%, who encountered vaginal infections engaged in the practice of vaginal douching [1]. The significant disparity highlights the potential impact of geographical and cultural variables on the effects of douching techniques. This inquiry encourages contemplation regarding the

distinctive characteristics of douching solutions, the frequency at which they are used, and the microbial composition of the vaginal flora.

The variability in results observed among different studies can be attributed to differences in the characteristics of study participants, research methodology employed, and cultural standards pertaining to vaginal cleanliness. In order to enhance our understanding of the observed consequences, it is crucial to consider the precise constituents of douching solutions, the cultural factors that drive this practice, and the microbiological alterations that result from douching.

The present study provides valuable insights into the microbial composition associated with vaginal infections among married women in Libya, by the identification of distinct bacterial species. *E.coli* is observed to be the prevailing bacterium, accounting for 32.73% of the documented occurrences. *Streptococcus agalactiae* constitutes 23.63% of the total, with *Staphylococcus hemolyticus* comprising 18%, *Klebsiella pneumoniae* accounting for 12.72%, and *Staphylococcus epidermidis* representing 10.90%. *Diphtheroid species (Spp.)* demonstrate a notably low occurrence rate of 3.62%.

The findings of a study conducted in Iraq provide comparative insights into the prevalence of *Staphylococcus haemolyticus* (25.92%) and *Staphylococcus epidermidis* (23.45%) as dominant bacterial species, hence demonstrating regional variations in microbial makeup [28]. Our data corroborate the significance of *Staphylococcus haemolyticus*, highlighting the necessity of accounting for regional disparities when comprehending the prevalence of bacterial infections in the vaginal region.

The interconnection of microbial communities in various anatomical sites is shown by the significant presence of *Escherichia coli* in the vaginal microbiome of women suffering from urinary tract infections, as evidenced by a separate study [29]. This highlights the significance of taking into account systemic variables and potential microbial reservoirs outside of the vaginal environment when evaluating the occurrence of particular bacterial species.

The identification of probable bacterial vaginal pathogens, including *Staphylococcus aureus*, *Group B streptococci*, and *Escherichia coli*, in a distinct investigation [30] corresponds with our research outcomes and underscores the importance of these bacteria in relation to vaginal health and infections.

Moreover, the prevalence of colonization by *Group B streptococcus* and *Escherichia coli* in pregnant women, as emphasized in a study conducted in 2019 [31], underscores the importance of comprehending the dynamics of microorganisms during pregnancy, given the potential consequences for the health of both the mother and the fetus.

The examination of fungal species in our research provides significant insights on the incidence of fungal infections. *Candida albicans* is identified as the prevailing species, accounting for a significant proportion of 58.18% in the documented cases. *Candida tropicalis* was observed in 10.90% of the cases, although a significant proportion (30.92%) had no apparent signs of fungal infection.

The prevalence of *Candida albicans* as a prominent fungal isolate is supported by comparative findings from several research. According to a study, *Candida albicans* was identified as the most prevalent species, whereas *Candida glabrata* and *Candida tropicalis* were shown to occur with lesser frequency [32]. This observation is in line with our findings, highlighting the widespread identification of *Candida albicans* as a prominent fungal pathogen.

The findings of a recent study conducted in 2023 offer additional contextual information, indicating that *Candida albicans* accounted for 28.57% of the observed cases, followed by *Candida glabrata* at the same percentage, and *Candida tropicalis* at 7.14% [33]. These observations were made among a cohort of healthy women who participated in the study. This study mostly examines individuals who are in good health, yet it makes a valuable contribution to the overall comprehension of the initial occurrence of *Candida* species in the vaginal microbiota.

Significantly, a study in 2021 highlights the link between *Escherichia coli* and the virulence characteristics of *Candida albicans*, emphasizing the potential interaction between bacterial and fungal diseases [34]. This interaction has the potential to impact the overall pathogenicity and severity of infections, underscoring the significance of taking into account polymicrobial dynamics within the framework of vaginal health.

Furthermore, the study conducted in 2019 highlights the substantial prevalence of *Candida albicans* (46%) among women suffering from vaginal infections [35], hence emphasizing the importance of this particular species in the realm of fungal-related vaginal infection.

Conclusion

The thorough evaluation of sociodemographic parameters, pregnancy status, medical conditions, hygiene behaviors, and the incidence of bacterial and fungal species among female individuals seeking care at gynecological clinics offers a nuanced comprehension of the various elements that influence vaginal health. This study emphasizes the predominance of older women residing in rural areas who have limited educational attainment and income, which may have an impact on their access to healthcare services and level of health awareness. The presence of many bacterial and fungal species, including *Escherichia coli* and *Candida albicans*, indicates their involvement in vaginal infections. In order to effectively manage and prevent bacterial and fungal vaginal infections, it is crucial to implement targeted treatments that specifically address sociodemographic gaps and hygiene practices. This study highlights the importance of employing a comprehensive strategy to enhance women's vaginal health and overall well-being.

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