

Fluor Albus Characteristics Associated with Sexually Transmitted Infection (STI) in Makassar Pregnant Women

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DOI: 10.24252/al-sihah.v15i2.38797

Received: 22 June 2023 / In Reviewed: 2 October 2023 / Accepted: 20 December 2023 / Available online: 29 December 2023
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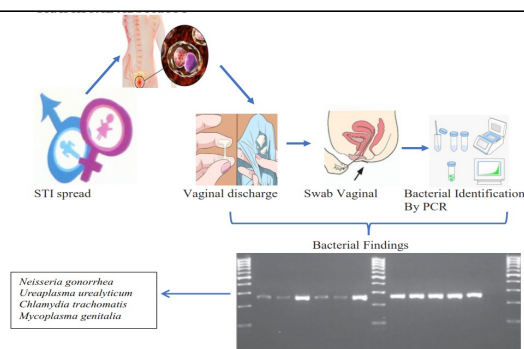
ABSTRACT

Sexually Transmitted Infection (STI) is a common condition with increased prevalence among pregnant women and can negatively affect the fetus. According to WHO, a total of 374 million new cases of STI are projected to occur in 2020, including gonorrhea (82 million), syphilis (7.1 million), and trichomoniasis (156 million). Therefore, this study aimed to determine the relationship between the characteristics of vaginal discharge (fluor albus) in pregnant women and STI. The descriptive method was used with a cross-sectional design, and the procedures were conducted in May 2023. The sample population comprised all pregnant women with ANC in Makassar during the study period. Vaginal swabs were obtained from 127 pregnant women who were willing to participate and had vaginal discharge. The results showed that 53 participants reported having physiological fluor albus, while 74 had pathological symptoms. Itching and odor were reported to be the most common clinical signs associated with patients' abnormal vaginal discharge, followed by itching, pain, and odor. Furthermore, a significantly high prevalence of the condition was observed among pregnant women aged 20-30 years. Based on the results, the predominant symptom of fluor albus was itching and odor when combined with microorganisms that caused STI. Several pregnant women with clinical complaints also had microorganisms apart from those associated with STI. These results indicated the pressing need to develop additional testing in pregnant women with fluor albus, particularly those with concomitant symptoms.

ABSTRAK

Infeksi Menular Seksual (IMS) adalah kondisi umum dengan prevalensi yang meningkat pada wanita hamil dan dapat berdampak buruk pada janin. Menurut WHO, total 374 juta kasus baru IMS diperkirakan terjadi pada tahun 2020, termasuk gonore (82 juta), sifilis (7,1 juta), dan trikomoniasis (156 juta). Oleh karena itu, penelitian ini bertujuan untuk mengetahui hubungan karakteristik keputihan (fluor albus) pada ibu hamil dengan IMS. Metode yang digunakan adalah deskriptif dengan desain cross-sectional dan prosedur dilakukan pada bulan Mei 2023. Populasi sampel adalah seluruh ibu hamil yang melakukan ANC di Makassar selama masa penelitian. Swab vagina diperoleh dari 127 ibu hamil yang bersedia ikut dan mengalami keputihan. Hasil penelitian menunjukkan 53 partisipan dilaporkan mengalami fluor albus fisiologis, sedangkan 74 partisipan mengalami gejala patologis. Gatal dan bau dilaporkan menjadi tanda klinis paling umum yang terkait dengan keputihan pasien yang tidak normal, diikuti rasa gatal, nyeri, dan bau. Selain itu, prevalensi penyakit ini juga sangat tinggi pada wanita hamil berusia 20-30 tahun. Berdasarkan hasil, gejala fluor albus yang dominan adalah gatal dan berbau bila dikombinasikan dengan mikroorganisme penyebab IMS. Beberapa ibu hamil dengan keluhan klinis juga mempunyai mikroorganisme selain yang berhubungan dengan IMS. Hasil ini menunjukkan adanya kebutuhan mendesak untuk mengembangkan pengujian tambahan pada wanita hamil dengan fluor albus, khususnya mereka yang memiliki gejala penyerta.

GRAPHICAL ABSTRACT



Keyword

odorants
pregnant women
pruritus
sexually transmitted diseases
vaginal discharge

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INTRODUCTION

Sexually Transmitted Infection (STI) is a highly prevalent condition, which exerts a disproportionate impact on women, posing a significant threat to public health. Recent systematic studies have also shown that pregnant women in low- and middle-income nations have a high prevalence of curable STI (Almubarak et al, 2020; Tanwar et al., 2022). In the context of Indonesia, the high prevalence of the condition among sexually active individuals has created significant public health concerns. Furthermore, the Ministry of Health reported a substantial 37% increase in STI transmission rate between 2014 and 2018 (Kementerian Kesehatan, 2020).

Vaginal discharge, also known as fluor albus, is a common symptom of several STI among women (Amare, 2021; Bosaeus et al, 2020; Centers for Disease Control and Prevention [CDC], 2023). This symptom is characterized by discharge from the genital organs without blood and can either be a normal (physiological) condition or a pathological sign of an underlying disease. Normal fluor albus typically exhibits a clear to whitish appearance, is odorless, and poses no significant issue. Meanwhile, pathological fluor albus typically has a yellowish, greenish, or greyish color, a fishy or foul smell, and produces large amounts of secretions (CDC, 2022; Contini et al., 2019). The abnormal discharge is associated with a range of discomforts, including pruritus, erythema, edema, burning in the genital area, pain during coitus (dyspareunia), and pain during micturition (dysuria) (Amare, 2021; Bosaeus et al, 2020; Centers for Disease Control and Prevention, 2023).

World Health Organization (WHO) showed the severity of poor female reproductive health, estimating that it constituted 33% of the total disease burden affecting women globally (World Health Organization [WHO], 2021).

This concern is supported by the Health Department of Indonesia stating that vaginal discharge is a frequently encountered symptom among women. Several studies showed that the condition, also known as fluor albus and leucorrhoea, was characterized by the discharge of fluid from the genitalia of women without blood.

Accurate diagnosis of vaginal discharge necessitates a comprehensive method, incorporating both laboratory testing and clinical assessment (CDC, 2022; CDC, 2023). Leucorrhoea, an alternative term for normal vaginal discharge, is characterized by a thin, clear, or milky white fluid with a faint smell. Furthermore, it serves as one of the initial symptoms of pregnancy, progressively increasing in volume and persisting throughout the entire gestation period. Compared to leucorrhoea, pathological vaginal discharge (PVD) can exhibit an unpleasant odor and vary in color from dirty white to yellowish green. Vaginal infections, such as *Trichomonas vaginalis*, bacterial vaginosis, and vaginal candidiasis (candidial vaginitis or vulvovaginal candidiasis) are frequently the cause of PVD (Aduloju et al., 2019; Whelan et al., 2021; Warr et al., 2019).

Cervical discharge typically arises from an infection with *Neisseria gonorrhoeae* and *Chlamydia trachomatis*, while vaginal discharge is often caused by *Trichomonas vaginalis*, *Candida species*, or bacterial vaginosis. Previous studies showed a higher microbial presence in pregnant women compared to non-pregnant individuals. Furthermore, increased glycogen content in the vagina can cause glycosuria in acidic conditions, leading to a heightened incidence rate of *Candida albicans* in pregnant women compared to non-pregnant individuals (Aduloju et al., 2019).

According to epidemiological studies, pathogenic fluoride-associated diarrhea (PVD) can affect women at any stage of life, including early childhood, old age, senescence, low socio-

economic status, and low education. A significant 76% of Asians facing reproductive health issues have issues related to vaginal discharge (Gupta & Bowman, 2012; Khaskheli et al., 2021; Kokkayil & Dhawan, 2015; Sawant, 2017). A previous report stated that approximately 90% of young women in Indonesia had the potential to experience the condition. This can be attributed to the country's tropical climate, which facilitates the growth and development of bacteria, viruses, and fungi, leading to a high number of fluor albus cases (Kementerian Kesehatan, 2020).

Fluor albus can affect women across all age groups, ranging from young adulthood to old age, and it does not consider socioeconomic status but is more prevalent in women with poor socioeconomic and educational levels (Isara & Baldeh, 2021; Lee et al., 2007; Jonduo et al., 2022). A significant number of women experience increased levels of the condition during a typical pregnancy, often attributed to an infection when accompanied by symptoms, such as itching, soreness, or an unpleasant odor. The infection can lead to complications, including premature birth, poor birth weight, and miscarriage during pregnancy when left untreated (Garcia et al., 2023; Olaleye et al., 2020).

Aduloju et al. (2019) stated that 16.6% of pregnant women with abnormal vaginal discharge also had BV. Furthermore, higher education, multiparity, and the 25–34-year age group were all substantially correlated with BV ($p < 0.05$). Lower abdominal pain, dyspareunia, vulvar itching, and vaginal discharge characteristics, including color and consistency, have been reported to be correlated. Another study by Khaskheli et al. (2021) explained that PVD during pregnancy was more frequent and associated with adverse maternal and perinatal outcomes.

Pregnant women who exhibit symp-

toms, specifically pathological, must contact a doctor immediately to acquire a proper diagnosis and treatment. Furthermore, understanding the cause of less frequent vaginal discharge has been reported to be essential (Gupta & Bowman, 2012; Khaskheli et al., 2021; Kokkayil & Dhawan, 2015; Sawant, 2017). Although certain infections have no symptoms, severe complications can develop when left untreated, particularly during pregnancy, which could have an impact on the unborn child (Isara & Baldeh, 2021).

Topical and oral medications recognized as safe for use during gestation are often employed in treating vaginitis during this critical period. Several studies also showed that it was imperative to comprehend the significance of proper genital care, as it played an essential role in maintaining the cleanliness and health of the female reproductive system. Insufficient awareness regarding the importance of maintaining the health and hygiene of reproductive organs can elevate the risk of developing pathological fluor albus, as intimate areas are not adequately maintained.

Based on the results, further investigation into fluor albus in pregnant women with STI is crucial, particularly for individuals from lower socioeconomic backgrounds and residing in lower- and middle-income nations, such as South Sulawesi, Indonesia. Previous reports also showed that cases of pregnancy-related fluor albus in this area had not been extensively documented. Therefore, this study aims to determine the relationship between the physiological and pathological characteristics of fluor albus in mothers and the prevalence during pregnancy.

METHODS

This study was conducted in May 2023 using the descriptive-observative method. The sample population comprised all women with

Table 1
The Primer for PCR

Microorganism	Gene Target	Primer	Size (bp)
<i>Chlamydia trachomatis</i>	Orf8	f5'-CTAGGCGTTTGTACTCCGTCA r5'-TCCTCAGGAGTTTATGCACT	200
<i>Neisseria gonorrhoea</i>	16s RNA	f5'-ACTGCGTTCTGAACTGGGTG r5'-GGCGGTCAATTCACGCG	281
<i>Ureaplasma urealyticum</i>	ureA-B	f5'-GAAACGACGTCCATAAGCAACT r5'-GCAATCTGCTCGTGAAGTATTAC	423
<i>Mycoplasma genitalium</i>	mpga	f5'-AGTTGATGAAACCTTAACCCCTTG r5'-CATTACCAGTTAAACCAAAGCCT	346

Note: The primer gen that used to identify the causative agent of fluor albus identify *Chlamydia trachomatis* (gene Orf 8), *Neisseria gonorrhoea* (16s RNA), *Ureaplasma urealyticum* (ureA-B) and *Mycoplasma genitalium* (mpga)

flour albus who came for prenatal medical check-ups at RS Tajuddin Chalid Makassar and RS Sitti Khadijah Makassar, as well as several primary health cares, such as Kassi-kassi, Tamangapa, Minasa Upa dan Jongaya primary health care during the study period. Individuals who agreed to participate in the study were given information about the methods to be used and asked for informed consent. Vaginal swabs from 127 pregnant women were then taken and transported using transport media to the laboratory in 2 hours.

The samples obtained were immediately vortexed after being collected into sterile, 50 ml conical tubes. Furthermore, the pellets were centrifuged once more at 2,000 rpm for 10 minutes after being separated at 3,000 rpm for 20 minutes, followed by rinsing in 5 milliliters of sterile water. After 3 rounds of resuspension in 30% polyethylene glycol (PEG 8,000, Sigma) and 3 mM NaCl, the pellets' DNA was extracted. Subsequently, the mixture was incubated on ice for 30 minutes, and centrifuged for 5 minutes at 15,000 rpm and room temperature. The process was then continued with the freezing of the last pellet at -20°C.

An initial 16S rDNA consensus primer from the causative bacteria in all specimens was examined using PCR and automated sequencing analysis to confirm the pathogenic bacterial infection. GenoTech Corp (Korea) successfully

sequenced the amplified products' DNA by using individual synthetic primers on an Applied Biosystems 3730 xi DNA analyzer in line with the manufacturer's instructions. Using the BLAST search engine, the resultant sequences were compared with reported sequences in the NIH-GeneBank database.

A total of 6 target organisms were amplified using particular primers that were synthesized by GenoTech Corp (Korea) and were listed in Table 1 as follows. A 200 bp fragment from the *C. trachomatis* orf 8 gene was amplified by the CT primer, a 281 bp fragment from the *N. gonorrhoeae* 16S rRNA gene was amplified by the NG primer, a 423 bp fragment from the *U. urealyticum* ureA-B gene was amplified by the UU primer, and a 346 bp fragment from the *M. genitalium* mpga gene was amplified by the MG primer.

The variables observed in this study included age, marital status, history of pregnancy, parity, education, clinical symptoms collected from the questionnaire, and the bacterial results through the PCR result. After data collection, the statistical package for the social sciences (SPSS) application version 20.0 was used to process the data. This study was approved by the Health Research Ethics Committee of the Faculty of Medicine at Hasanuddin University with approval number UH232010107.

Table 2
Distribution of Characteristics of Participants

Characteristics	Number	Percent
Age Group		
< 20 years	8	6,3
20-30 years	83	65,4
> 30-40 years	34	34
> 40 years	2	1,6
Parity		
Nullipara	2	1,6
Primipara	54	54
Multiparous	60	60
Grande Multipara	11	8,7
Gestational Age		
0-12 mgg	13	10,2
>12-24 weeks	56	44,1
>24-36 weeks	46	46
>36 weeks	12	12
Flour Albus Experienced		
Physiological	53	43,3
Pathological	74	56,7
Marital Status		
Married 1x	121	95,3
Married >1 x	6	4,7
Education		
Junior High School	115	90,6
Senior High School	10	7,9
College	2	1,6
Healthy Behavior		
Good	19	15
Enough	46	36,2
Less	62	48,8
Clinical Symptoms		
Itchy	15	11,81
Pain	10	7,87
Odor	12	9,44
Itching and Odor	10	7,87
Itching and Pain	9	7,08
Pain and Odor	8	6,29
Itching, Pain and Odor	10	7,87
No Symptoms	53	43,3
Vaginal Secret Color		
Clear	53	43,3
White	74	56,7

RESULTS

In May 2023, a total of 127 women out of 435 came for prenatal care organized for fluor albus patients. Based on the data collected, the dominant age group was 20-30 years with 83 people (65.2 (4%), while the least was > 40 years, as shown in Table 2. Furthermore, the majority of participants Most of were multipara with 60 individuals (60%), followed by primipara accounting for 54 people (54%), while the least was nullipara with 2 individuals.

For gestational age, the results showed that the gestational age of most participants was >12-24 weeks, totaling 56 people (44.1%) followed by >24-36 weeks.

In this study, 74 participants experienced physiological vaginal discharge, while 53 had pathological vaginal discharge (43.3%). A total of 121 participants were married mothers (95.3%), while 6 individuals (4.7%) were married more than 1 time. Based on the 127 vaginal swabs performed on pregnant women, the most identified bacteria was *Ureaplasma*

Table 3
Distribution of Bacteria Causing STI From Vaginal Swab Samples

Types of Bacteria	Identification of Bacteria by <i>Multiplex PCR</i> (n=127)			
	Positive	Percentage	Negative	Percentage
<i>Chlamydia trachomatis</i>	11	8,7	116	91,3
<i>Neisseria gonorrhoea</i>	18	14,2	109	85,8
<i>Ureaplasma urealyticum</i>	58	45,7	69	54,3
<i>Mycoplasma genitalia</i>	1	0,8	126	99,2

urealyticum in 58 participants (45.7%), while the least identified was *Mycoplasma genitalia* in 1 patient (0.8%), as shown in Table 3. For the distribution of bacteria that caused STI in pregnant women, *Neisseria gonorrhoea* was found in 18 participants (14.2%), while *Chlamydia trachomatis* was observed in 11 (8.7%).

DISCUSSION

This study used mPCR to detect the presence of bacteria in vaginal discharge and to characterize the characteristics of fluor albus in pregnant women. The 127 vaginal swab specimens obtained were subjected to mPCR assay testing. The aforementioned observations firmly implied that mPCR testing enhanced the comprehension of STI epidemiology during pregnancy. Based on the data collected, the dominant age group was 20-30 years, comprising 83 people (65.2 (4%), while the least was > 40 years. Furthermore, the majority of participants were multipara totaling 60 individuals (60%), followed by primipara with 54 individuals (54%), while the least was nullipara, with 2 participants.

For gestational age, the results showed that the dominant group was >12-24 weeks, comprising 56 individuals (44.1%), followed by >24-36 weeks. The results were in line with Khaskheli et al (2021) in Pakistan, which obtained similar characteristics in terms of participants' demographics and gestation among 85 pregnant women aged 20-37 years old (mean age = 27.4 ±4.7 years). The majority of partici-

pants were aged 26–31 years old (n = 34, 40%), 28–35 weeks pregnant (n = 29 34%), and primigravida (n = 35, 41%). The results were consistent with the stated theory by Abu-Raya et al. (2020). Several studies showed that it was common to experience increased vaginal discharge during pregnancy. This aided in preventing infections from entering the womb through vagina. The volume of discharge tended to increase toward the end of the gestation period and was often characterized by streaks of sticky, jelly-like pink mucus in the final week (Tuddenham et al., 2022; Zenebe et al., 2021).

Among the 73 cases of fluor albus pathology in this study, the dominant complaint was itching (11.81%), followed by odor (9.44%) pain, itchy and odor, as well as itchy, odor and pain (7.87%), while 53 mothers with physiological vaginal discharge had no complaint. According to Prasad et al. (2021), dysuria (32.5%) was the most common symptom, followed by itching (27.5%), redness (25%), swelling (17.5%), UTI (10%), and lower abdominal pain (9%). Almubarak et al. (2020) in Saudi Arabia reported that itching (49.2%) was the most common sign, followed by redness (48.4%), dysuria (36%), and swelling (4.5%). Furthermore, this current investigation showed a significant correlation between variable discharge and UTI (P<0.001).

The majority of participants in this study were pregnant women with a low level of education (90.6%) and low hygiene behavior (48.8%). This was in line with Khaskheli et al.

(2021), where Pakistani women were less aware and less likely to practice good hygiene and healthcare during the periods, pregnancies, deliveries, and the postpartum phase. Due to social, economic, and cultural factors, participants in rural areas were less likely to seek medical attention during pregnancy.

Several studies proved that numerous women lacked knowledge about proper vaginal care and the bacterial infections vulvovaginitis being responsible for various vaginal discharge cases. The primary method for preventing vaginal discharge was to practice good personal hygiene, particularly in vaginal area. According to epidemiological studies, pathological leucorrhoea could affect women of any age, including young girls, pregnant women in good health, and older individuals who were unaware of their socioeconomic situation, educational background, and cultural background. However, women with low levels of education and socioeconomic status were more likely to experience this situation (Tanwar et al., 2022; Pillay et al., 2018; Smith, 2021).

Some individuals who experienced an excessive amount of stress could experience vaginal discharge. According to some specialists, pregnancy was a component of the condition that caused vaginal discharge in working women, which was due to an increase in the production of stress hormones. Efforts that could be used to prevent the occurrence of the condition included cleaning intimate organs with a cleanser that did not interfere with the stability of the surrounding pH. An example of this cleanser was cleaning products made from milk-based ingredients that could maintain pH balance while increasing normal flora growth and suppressing the growth of hostile bacteria. The use of powder on female organs was often carried out to keep the vagina fragrant and dry all the time (Liu et al., 2022; Wynn et al., 2020; Zenebe et al., 2021).

Among the microorganisms examined in this study from 127 swab samples, 18 were found to be positive for *Neisseria gonorrhoea*. From these positive results, general positive cases were found in mothers with poor health behavior and a history of pathological flour albus. Meanwhile, when studied based on age group, parity, and gestational age, several cases were found in the 20-30 year age group, primiparous and multiparous groups, and in the 12-36 week age group, respectively.

The most frequently identified bacteria was *Ureaplasma urealyticum* in 58 individuals (45.7%), while the least identified was *Mycoplasma genitalia* in 1 patient (0.8%). Based on the distribution of bacteria that caused STI in pregnant women, *Neisseria gonorrhoea* was found in 18 individuals (14.2%), while *Chlamydia trachomatis* was in 11 people (8.7%). The results were in line with Liu et al. (2022) which found *Ureaplasma urealyticum* as the most common microorganism found in patients divided into infertile and fertile groups. Among the 65 vaginal swab specimens, the prevalence of *U. urealyticum*, *M. genitalium*, *C. trachomatis*, and *N. gonorrhoeae* in the infertile group was 15 (23.1%), 11 (16.9%), 9 (13.8%), and 4 respectively. However, these rates in the fertile group were 6 (11.1%), 3 (5.5%), 5 (9.2%), and 1 (1.8%), respectively.

Bacterial infections were higher in the infertile group, and the causal bacteria could be associated with female infertility (Olaleye et al., 2020; Olcu et al., 2022). Timely control and treatment of infections caused by these organisms, along with other factors, could be important in the prevention and treatment of female infertility, thereby positively impacting public health. The results were inconsistent with Prasad's study, where the most frequent reason for the pathological vaginal discharge was candidiasis. Furthermore, this was in line with a cross-sectional study carried out at a

hospital in Western India, where 183 pregnant women (78.54%) had vaginal discharge, with *Candida albicans* being the most common clinical diagnosis (Liu et al., 2022; Luján et al., 2016; Smith, 2021).

Pregnant women were highly likely to contract STI, which was well-known to be associated with a higher risk of adverse outcomes for both the mother and the newborn. The infection was extremely common in pregnant women and frequently present with no symptoms.

The lack of study on fluor albus to identify the bacteria present in pregnant women's vaginal discharge was a problem, particularly in Makassar, where there was a perception that vaginal discharge was normal during pregnancy. This showed the need for more studies because vaginal discharge often affected the fetus. The results did not describe the birth outcomes of mothers with complaints of fluor albus, both physiological and pathological, but focused on microorganisms that caused STI from vaginal swab of mothers who had undergone STI screening with triple elimination. The literature gap could be a basis for the development of future studies.

CONCLUSIONS

In conclusion, this study presented cross-sectional data showing the characteristics of fluor albus characteristic during pregnancy. Although participants had already taken the triple elimination, the positive results of microorganisms in this case provided a recommendation for the need for periodic screening of mothers with fluor albus for advanced STI detection, specifically those with vaginal discharge during pregnancy.

ACKNOWLEDGEMENT

We thank the women who agreed to be participants in this study and we also thank the laboratory assistants who helped complete this research.

FUNDING

The author(s) reported there is no funding associated with the work featured in this article.

AUTHORS' CONTRIBUTIONS

Nadyah Haruna designed the study, wrote and revised the manuscript, enrolled participant, collected and analyzed the data. Mochammad Hatta formulated the concept, reviewed and revised manuscript. Firdaus Hamid formulated the concept, reviewed and revised manuscript, analyzed the data. Baedah Madjid formulated the concept, reviewed and revised manuscript. Ilhamjaya Patellongi acquired and analyzed the data. Monika F. Farid enrolled participants. All authors approved the final manuscript

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COMPETING INTERESTS

The authors confirm that all of the text, figures, and tables in the submitted manuscript work are original work created by the authors and that there are no competing professional, financial, or personal interests from other parties.

REFERENCES

- Abu-Raya, B., Michalski, C., Sadarangani, M., & Lavoie, P. M. (2020). Maternal Immunological Adaptation During Normal Pregnancy. *Frontiers in Immunology*, *11*. <https://doi.org/10.3389/fimmu.2020.575197>
- Aduloju, O. P., Akintayo, A. A., & Aduloju, T. (2019). Prevalence of bacterial vaginosis in pregnancy in a tertiary health institution, south western Nigeria. *The Pan African Medical Journal*, *33*. <https://doi.org/10.11604/2Fpamj.2019.33.9.17926>
- Almubarak, S. S., Alsofyani, A. H., Alhbabi, Z., Almahboob, G. S., Alodail, M., Alaswad, F., & Alfayez, M. (2020). Increased vaginal discharge during pregnancy: prevalence, causes, and associated symptoms. *Age*, *21*(46), 4-5. <http://dx.doi.org/10.24911/IJMDC.51-1578948957>
- Amare. (2021). 2020 STD Prevention Conference September 14–24, 2020: Erratum. *Sexually Transmitted Diseases*, *48*(2), e34–e34. <https://doi.org/10.1097/OLQ.0000000000001346>
- Bosaeus, M., Andersson-Hall, U., Andersson, L., Karlsson, T., Ellegård, L., & Holmång, A. (2020). Body Composition During Pregnancy: Longitudinal Changes and

- Method Comparisons. *Reproductive Sciences*, 27(7), 1477–1489. <https://doi.org/10.1007/s43032-020-00141-6>
- Centers for Disease Control and Prevention (2022). STD Facts - STDs & Pregnancy. <https://www.cdc.gov/std/pregnancy/stdfact-pregnancy.htm>
- Centers for Disease Control and Prevention (2023). STDs & Infertility. <https://www.cdc.gov/std/infertility/default.htm>
- Contini, C., Rotondo, J. C., Magagnoli, F., Maritati, M., Seraceni, S., Graziano, A., Poggi, A., Capucci, R., Vesce, F., Tognon, M., & Martini, F. (2019). Investigation on silent bacterial infections in specimens from pregnant women affected by spontaneous miscarriage. *Journal of Cellular Physiology*, 234(1), 100–107. <https://doi.org/10.1002/jcp.26952>
- Garcia, M. R., Leslie, S. W., & Wray, A. A. (2023). Sexually transmitted infections. In StatPearls [Internet]. *StatPearls Publishing*. <https://www.ncbi.nlm.nih.gov/books/NBK560808/>
- Gupta, N. K., & Bowman, C. A. (2012). Managing Sexually Transmitted Infections in Pregnant Women. *Women's Health*, 8(3), 313–321. <https://doi.org/10.2217/WHE.12.16>
- Isara, A., & Baldeh, A. K. (2021). Prevalence of sexually transmitted infections among pregnant women attending antenatal clinics in West Coast Region of The Gambia. *African Health Sciences*, 21(2), 585–592. <https://doi.org/10.4314/ahs.v21i2.13>
- Jonduo, M. E., Vallely, L. M., Wand, H., Sweeney, E. L., Egli-Gany, D., Kaldor, J., Vallely, A. J., & Low, N. (2022). Adverse pregnancy and birth outcomes associated with *Mycoplasma hominis*, *Ureaplasma urealyticum* and *Ureaplasma parvum*: a systematic review and meta-analysis. *BMJ Open*, 12(8), e062990. <https://doi.org/10.1136/bmjopen-2022-062990>
- Kementerian Kesehatan (2020). Laporan Perkembangan HIV/AIDS & Penyakit Infeksi Menular Seksual (PIMS) Triwulan III Tahun 2020. <https://siha.kemkes.go.id/>
- Khaskheli, M., Baloch, S., Baloch, A. S., & Shah, S. G. S. (2021). Vaginal discharge during pregnancy and associated adverse maternal and perinatal outcomes. *Pakistan journal of medical sciences*, 37(5), 1302. <https://doi.org/10.12669%2Fpjms.37.5.4187>
- Kokkayil, P., & Dhawan, B. (2015). Ureaplasma: Current perspectives. *Indian Journal of Medical Microbiology*, 33(2), 205–214. <https://doi.org/10.4103/0255-0857.154850>
- Lee, S. R., Chung, J. M., & Kim, Y. G. (2007). Rapid One Step Detection of Pathogenic Bacteria in Urine with Sexually Transmitted Disease (STD) and Prostatitis Patient by Multiplex PCR Assay (mPCR). In *The Microbiological Society of Korea* (Vol. 45, Issue 5). <http://ncbi.nlm.nih.gov/BLAST>
- Liu, T., Lai, S. Y., Zhou, W., Liu, Y. L., Chen, S. S., & Jiang, Y. M. (2022). Analysis of *Ureaplasma urealyticum*, *Chlamydia trachomatis*, *Mycoplasma genitalium* and *Neisseria gonorrhoeae* infections among obstetrics and gynecological outpatients in southwest China: a retrospective study. *BMC Infectious Diseases*, 22(1), 283. <https://doi.org/10.1186/s12879-021-06966-z>
- Luján, A., Fili, S., & Damiani, M. T. (2016). Female Infertility Associated to *Chlamydia trachomatis* Infection. In *Genital Infections and Infertility. InTech*. <https://doi.org/10.5772/62462>
- Olaleye, A. O., Babah, O. A., Osuagwu, C. S., Ogunsola, F. T., & Afolabi, B. B. (2020). Sexually transmitted infections in pregnancy – An update on *Chlamydia trachomatis* and *Neisseria gonorrhoeae*. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 255, 1–12. <https://doi.org/10.1016/j.ejogrb.2020.10.002>
- Olcu, M., Atalay, M. A., & Percin Renders, D. (2022). Development of multiplex PCR panel for detection of anaerobic bacteria in clinical samples. *Anaerobe*, 76, 102611. <https://doi.org/10.1016/j.anaerobe.2022.102611>
- Pillay, J., Moore, A., Rahman, P., Lewin, G., Reynolds, D., Riva, J., Thériault, G., Thombs, B., Wilson, B., Robinson, J., Ramdyal, A., Cadieux, G., Featherstone, R., Burchell, A. N., Dillon, J.-A., Singh, A., Wong, T., Doull, M., Traversy, G., Hartling, L. (2018). Screening for chlamydia and/or gonorrhoea in primary health care: protocol for systematic review. *Systematic Reviews*, 7(1), 248. <https://doi.org/10.1186/s13643-018-0904-5>
- Prasad, D., Parween, S., Kumari, K., & Singh, N. (2021). Prevalence, Etiology, and Associated Symptoms of Vaginal Discharge During Pregnancy in Women Seen in a Tertiary Care Hospital in Bihar. *Cureus*, 13(1), e12700-e12700. <https://doi.org/10.7759/cureus.12700>
- Sawant, L. D. (2017). Sexually Transmitted Infections in Pregnancy. *International Journal of Pregnancy & Child Birth*, 2(6). <https://doi.org/10.15406/ipcb.2017.02.00044>
- Smith, M. (2021). Validating Real-Time Polymerase Chain Reaction (PCR) Assays. *Encyclopedia of Virology*, 35–44. <https://doi.org/10.1016/b978-0-12-814515-9.00053-9>
- Tanwar, R., Sarda, S., Agarwal, S., & Dubey, S. (2022). Prevalence of Sexually Transmitted Infection in Pregnancy at a Tertiary Care Center of Central India: An Observational Study. *Journal of South Asian Federation of Obstetrics and Gynaecology*, 14(2), 128–131. <https://doi.org/10.5005/jp-journals-10006-2039>
- Tuddenham, S., Hamill, M. M., & Ghanem, K. G. (2022). Diagnosis and Treatment of Sexually Transmitted Infections. *JAMA*, 327(2), 161. <https://doi.org/10.1001/jama.2021.23487>
- Warr, A. J., Pintye, J., Kinuthia, J., Drake, A. L., Unger, J. A., McClelland, R. S., Matemo, D., Osborn, L., & John-Stewart, G. (2019). Sexually transmitted infections during pregnancy and subsequent risk of stillbirth and infant mortality in Kenya: a prospective study. *Sexually Transmitted Infections*, 95(1), 60–66. <https://doi.org/10.1136/sextrans-2018-053597>
- Whelan, J., Eeuwijk, J., Bunge, E., & Beck, E. (2021). Systematic Literature Review and Quantitative Analysis of Health Problems Associated with Sexually Transmitted *Neisseria gonorrhoeae* Infection. *Infectious Diseases and Therapy*, 10(4), 1887–1905. <https://doi.org/10.1007/s40121-021-00481-z>
- World Health Organization (2021). Guidelines for the management of symptomatic sexually transmitted infections. <https://www.who.int/publications/i/item/9789240024168>
- Wynn, A., Bristow, C. C., Cristillo, A. D., Murphy, S. M., van den Broek, N., Muzny, C., Kallapur, S., Cohen, C.,

- Ingalls, R. R., Wiesenfeld, H., Litch, J. A., Morris, S. R., & Klausner, J. D. (2020). Sexually Transmitted Infections in Pregnancy and Reproductive Health: Proceedings of the STAR Sexually Transmitted Infection Clinical Trial Group Programmatic Meeting. *Sexually Transmitted Diseases*, *47*(1), 5–11. <https://doi.org/10.1097/OLQ.0000000000001075>
- Zenebe, M. H., Mekonnen, Z., Loha, E., & Padalko, E. (2021). Prevalence, risk factors and association with delivery outcome of curable sexually transmitted infections among pregnant women in Southern Ethiopia. *PLOS ONE*, *16*(3), e0248958. <https://doi.org/10.1371/journal.pone.0248958>