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Original Article

## Prevalence of Asymptomatic Bacteriuria among Pregnant Women At Damietta Governorate, Egypt

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### ABSTRACT

**Background:** Asymptomatic bacteriuria during pregnancy is a main health problem, which is related to an increased risk of maternal and fetal morbidity.

**Aim of the Work:** To estimate incidence of asymptomatic bacteriuria among pregnant females at Damietta Governorate, Egypt.

**Patients and Methods:** Five hundred randomly selected pregnant females attending antenatal care units at Damietta Governorate during the period July, first, 2019 – January 31<sup>st</sup>, 2021. All participants were subjected to full history taking, complete blood count as well as urine culture and bacterial count.

**Result:** A relatively high incidence of asymptomatic bacteriuria [13.8%] was revealed among participants in whom the most causative organism was Escherichia coli. The rate was lower among pregnant women with a high social standard and during the first trimester. Maternal age, parity, education level, or hemoglobin level, on the other hand, had no significant relationship.

**Conclusion:** Screening of asymptomatic bacteriuria in pregnancy must be added to routinely antenatal care investigations and doing another studies on a wider scope are recommended.

**Keywords:** Asymptomatic Bacteriuria; Escherichia Coli; Pregnant Females; Urine Culture; Bacterial Count

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\* Main subject and any subcategories have been classified according to the research topic.

## INTRODUCTION

Asymptomatic bacteriuria in pregnancy is the existence of 100,000 or higher pathogens per millilitre of a clean catch mid-stream urine sample with no genitourinary tract symptoms [1].

Many changes occur in female genito-urinary system, which can induce asymptomatic bacteriuria as renal pelvis and ureters dilation. Additionally, asymptomatic bacteriuria is induced by the bladder being displaced superiorly and anteriorly [2].

Many risk factors are related to asymptomatic bacteriuria during gestation such as low socio-economic stander, depressed immunity, DM, multiparty and anemia. Each of them has two folds increase in the rate of bacteriuria; preterm delivery and perinatal fetal death are the major [3].

Asymptomatic bacteriuria can affect 2–10% of all pregnant females worldwide. Untreated bacteriuria during gestation is related to maternal and fetal hazards [4].

No previous studies from Damietta [Egypt] dealt with the estimation of the prevalence of asymptomatic bacteriuria among pregnant women at Damietta governorate, so we want to estimate it.

## THE AIM OF THE WORK

This study aimed to estimate the incidence of asymptomatic bacteriuria among pregnant women at Damietta Governorate, Egypt.

## PATIENTS AND METHODS

This cross-sectional observational research was conducted during the period July, first, 2019 – January 31<sup>st</sup>, 2021 at the antenatal care units in Damietta Governorate [Egypt].

We included pregnant females [any parity] aged 20-40 years old, who were in their first or second trimester.

On the other side, We excluded any pregnant females with symptoms suggestive of vaginal infection [e.g., vaginal discharge, offensive odors, itching]; symptoms of urinary tract infections [e.g., dysuria, frequency, urgency]; use of antibiotic during last two weeks; known urinary tract malformations or chronic renal diseases; history of fever or chronic diseases [e.g., hypertension, Diabetes Mellitus, renal failure].

The calculated sample size was 384 participants using

the following formula =  $Z^2 * P * [1-P]/D^2$ , in which N denoted number of required subjects, Z for the normal standard deviation [1.96], P equals expected prevalence of asymptomatic bacteria in pregnant females [10%], Q equals [1-P] [The frequency of nonoccurrence of an event] and D for degree of precision [0.03%] [5].

The sample size was increased to 500 participants to increase the study power. " $N = [1.96]^2 * 0.1 * [1-0.1] / [0.03]^2 = 384$ ".

A multistage random sample technique was conducted as the governorate is divided into five health districts. Three health districts were selected by simple random sampling. Within each health district and by simple random sampling, one antenatal care unit was selected giving a total of three antenatal care units.

At the selected antenatal care units, pregnant women were chosen randomly using 1:3:6:9.... etc. All women matching inclusion criteria were recruited until the total target sample size was reached. There has been a relative equal distribution within each center of pregnant women's numbers.

Each participant was subjected to the following:

1. Full history taking including maternal age, social class assessment [by enquiring about the pregnant woman's and husband's occupations, monthly income, crowedness index "number of persons per room" [6]; education level [non-educated, primary school, preparatory school, secondary school, or college]; obstetric history [number of pregnancies, deliveries and abortions]; presence or absence of gestational diabetes.

2. Complete blood count: Two to three milli-liters of venous blood were collected from each pregnant woman into EDTA tubes. The blood sample was drawn from a peripheral vein using a disposable needle. An automated cell counter system was used to analyze the components of blood samples.

3. Urine culture and bacterial count: Urine samples were collected by employing the Midstream Clean Catch Specimens technique. Pregnant females were instructed to clean the urethral area and collected the urine midstream into a clean container. Urine specimens were examined within one hour of collection. CLED [cysteine-, lactose-, and electrolyte-deficient] agar, a differential culture medium was used for isolating and counting bacteria in urine from the suspected cases of urinary tract infection.

Significant bacteriuria was considered if a colony count

≥ 100,000 per mL of urine and colony shape on CLED Agar utilized was as follows: [ *E. Coli*: Colonies that are opaque yellow with a slightly darker yellow core; *Klebsiella species*: Colonies that range in color from yellow to whitish-blue and are very mucoid; *Proteus species*: Colonies of translucent blue; *Pseudomonas aeruginosa*: Colonies with a matted surface and a rough periphery are green; *Enterococci*: Small golden colonies with a diameter of about 0.5mm; *Staphylococcus aureus*: Colonies that are homogeneous in color and deep yellow; Coagulase-negative *Staphylococci*: Colonies that are pale yellow and more opaque than *Enterococcus faecalis*] [7].

**Ethical Consideration:**

The study protocol had been submitted for approval by Institutional Research Board, Damietta Faculty of Medicine, Al-Azhar University [IRB number: ADFM-03062019].

In addition, each participant had signed an informed written consent. Also, confidentiality and personal privacy had been respected through all stages of the study.

**Statistical Analysis:**

The information was analyzed using IBM SPSS version 20. To present quantitative data, the mean, standard deviations, and ranges were used. Qualitative variables, on the other hand, were given as numbers and percentages. When comparing two groups with qualitative data, the Chi-square test was utilized, and the Fisher exact test was used instead of the Chi-square test when the expected count in any cell was less than 5.

For quantitative data having a parametric distribution, the Student's T-test was employed to compare two groups. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant at the level of < 0.05 and highly significant at the level of < 0.01.

**RESULTS**

All 500 pregnant females were tested for ASB in this research.

Table [1] showed that, the mean age of participants was 27.09±5.39 years. 23.6% were primigravida; 15.4% had history of abortion; 87.8% were in the second trimester and 12.2% were in the first trimester; 50.8% completed the secondary school, 20% were completed collage and 12.8% were non-educated.

Of studied females, 51.8% were from moderate social

class, and 26.6% were from high standard. In addition, 3% had gestational diabetes, and 75.6% had regular antenatal care. The mean hemoglobin was 10.31±0.09 gm/dl.

Table [2] showed that 70.8% had sterile urine culture, 13.8% had significant and 9.6% had contamination.

Table [3] demonstrated that 68% had E coli, 18.8% had *staphylococcus aureus* and 8.6% had *Klebsialla* and 4.3% had *Proteus species*.

Table [1] shows the participants' sociodemographic data as well as its relation with positive cultures

Character	Frequency [n=500]	Positive culture [n=69]	P
<b>Age [Mean ±SD]</b>	27.09±5.39	26.33±5.37	0.0202
<b>Gravidity</b>			
Primigravida	118[23.6%]	14[20.3%]	0.712
Gravida two	144[28.8%]	20[29%]	
Gravida three	135[27%]	19[27.5%]	
Gravida four	75[15%]	11[15.9%]	
Gravida five	17[3.4%]	2[2.9%]	
Gravida six	8[1.6%]	3[4.3%]	
Gravida seven	3[0.6%]	0[0%]	
<b>Abortion</b>			
Yes	77[15.4]	56[81.2]	0.116
No	423[84.6]	13[18.2]	
<b>Gestational age</b>			
First trimester	61[12.2%]	19[27.5%]	0.001
Second trimester	439[87.8%]	50[72.5%]	
<b>Educational level</b>			
Non-educated	64[12.8%]	9[13%]	0.133
Primary school	40[8%]	9[13%]	
Preparatory school	42[8.4%]	10[14.5%]	
Secondary school	254[50.8%]	30[43.5%]	
Collage	100[20%]	11[15.9%]	
<b>Socioeconomic level</b>			
High	133[26.6%]	12[17.4%]	0.008
Moderate	259[51.8%]	40[58%]	
Low	108[21.6%]	17[24.6%]	
<b>Gestational diabetes</b>			
Present	15[3%]	4[5.8%]	0.151
Absent	485[97%]	65[94.2%]	
<b>Regular antenatal care</b>			
Yes	378[75.6%]	23[33.3%]	0.05
No	122[24.4%]	46[66.7%]	
<b>Hemoglobin level</b>	10.31±0.09	10.49±0.095	0.175

Table [2]: Results of urine culture

	No	%
Sterile	354	70.8%
Significant	69	13.8%
Contamination	48	9.6%
Insignificant	29	5.8%

Table [3]: Organisms in culture of cases with significant bacteriuria

	No. [n=69]	%
E.coli	47	68%
Staph aureus	13	18.8%
Klebsialla	6	8.6%
Proteus spp	3	4.3%

## DISCUSSION

Asymptomatic bacteriuria in pregnancy is a main health problem, which is related to an increased risk of maternal and fetal morbidity. Routinely screening for asymptomatic bacteriuria during gestation is recommended by most European and North American clinical practice guidelines [8].

The worldwide incidence of asymptomatic bacteriuria during gestation ranges from 2–10% in all pregnant women. However, the incidence estimates markedly vary between studies. A number of socio-demographic risk factors of asymptomatic bacteriuria during gestation have been reported [9]. However, there is a paucity of studies on the incidence and risk factors of asymptomatic bacteriuria in pregnancy in Egypt.

Our work carried out to estimate the frequency and risk factors, particularly sociodemographic, of asymptomatic bacteriuria among pregnant females at Damietta Governorate [Egypt]. Participant's main age in our work was  $27.1 \pm 5.39$  years. This is comparable to the mean age of participants in previous studies [10-14].

However, some studies included participants with higher mean age, such as  $32 \pm 5$  years in Fong *et al.* [15] research while others included participants with lower mean age, such as  $24.3 \pm 4.6$  years in Ayoyi *et al.* [16] research. The variation could be attributed to the differences in the inclusion criteria as well as sociodemographic, geographic, and cultural differences among studies.

The incidence of asymptomatic bacteriuria in our work is 13.8%. Moreover, results of urine culture showed that contamination and insignificant results in 9.6% and 5.8% of cases, respectively. In pregnancy, there are many structural and functional changes in urinary system, which can lead to asymptomatic bacteriuria as renal pelvis and ureters dilation, and the bladder is moved superiorly and anteriorly. The main cause of hydroureter and hydronephrosis is mechanical compression from the enlarged uterus, but progesterone-induced smooth muscle relaxation that can reduce peristalsis of the ureters, urinary stasis and higher bladder capacity. Differential pH and osmolality in the urine, along with glycosuria and aminoaciduria caused by pregnancy, can promote organisms to grow [17, 18].

Our findings are similar to those of a few previous studies. In a cross-sectional study on 1800 pregnant women during the second trimester in Bangladesh, the frequency of asymptomatic bacteriuria was 12% [19].

The incidence was 10.0% in a research on 360 Thai pregnant females [20] and 10.6% by a Nigerian research [21].

In addition, in a recent systematic review and meta-analysis that involved 20 studies and 15108 pregnant women, the all rate of asymptomatic bacteriuria was estimated to be 13% in Iran [22].

In an Egyptian research on 171 pregnant women, 10% had asymptomatic bacteriuria [13].

More recently, in a research on 715 Indonesian pregnant females, 10.2% of them had asymptomatic bacteriuria [8].

However, some other studies found a higher incidence of asymptomatic bacteriuria in pregnancy. In studies from Nigeria, Oli *et al.* [23] study on 357 pregnant women showed that 18.2% had asymptomatic bacteriuria.

In Izuchukwu *et al.* [24] work on 220 Nigerian pregnant females, the incidence of asymptomatic bacteriuria was 29.5%. Another Nigerian research on 473 pregnant females found that 28.8% of them have asymptomatic bacteriuria [25].

Last, Oladeinde *et al.* [26] study, on 2020 pregnant women, reported a high frequency of asymptomatic bacteriuria of 55%.

In Tadesse *et al.* [27] study on 244 Ethiopian pregnant women, the frequency of asymptomatic bacteriuria was 18.8%. Another recent study from Ethiopia on 281 pregnant females showed an incidence of 19.9% [14].

In a Taiwanese study on 1187 pregnant women during the first trimester, the frequency of asymptomatic bacteriuria was 21.3% [28].

A Kenyan study on 1020 pregnant women showed a frequency of asymptomatic bacteriuria of 21.5% [16].

In Rohini *et al.* [29] study on 200 Indian pregnant women, 30.5% of them had asymptomatic bacteriuria. On the other side, some studies reported a lower incidence of asymptomatic bacteriuria among pregnant women than that in our work.

In Aminu and Aliyu [12] study on 200 Nigerian pregnant women, 9% had asymptomatic bacteriuria.

In a study on 600 pregnant females from Nepal, the incidence of asymptomatic bacteriuria was 8.7% [30]. Sujatha and Nawani [31] study on 300 Indian pregnant women revealed an incidence of asymptomatic bacteriuria of 7.3%. A research from Ghana on 220 pregnant women showed that 7.3% of them had asymptomatic bacteriuria [32].

In another study from Ghana on 274 pregnant women,

the incidence of asymptomatic bacteriuria was 5.5% [33].

In a study 4283 pregnant women from Netherland screened between 16 and 22 weeks' gestation, 5.8% had asymptomatic bacteriuria [34].

In a study from Cameroon on 354 pregnant women, 5.7% of them had asymptomatic bacteriuria [35]. In a study from Bangladesh on 4242 pregnant women, the incidence of asymptomatic bacteriuria was 4.5% [36].

The incidence of asymptomatic bacteriuria among 170 pregnant women [during the second and third trimester] from Bruni Darussalam was 4.1% [37]. In an Indian study on 107 pregnant women, asymptomatic bacteriuria was found in 3.2% of them [38].

A study from Hong Kong on 1537 pregnant women [87% were in the first trimester] showed asymptomatic bacteriuria in 2% of cases [15].

Other studies also showed a low incidence of asymptomatic bacteriuria among pregnant females, such as 3.6% reported in Sri Lanka [4], 1.9% in the Philippines [39] and 1.7% in Saudi Arabia [10].

Changes in asymptomatic bacteriuria incidence between and within nations could be due to differences in demographic factors such as age, parity, socioeconomic status, and cultural and religious attitudes linked to personal hygiene and sexual contact.

They could also be attributable to differences in the screening tests used or the study's environment [primary care, community-based, or hospitals] [urine dipstick, microscopy, and culture]. Last, this may be related to the design of studies [prospective or retrospective] [8, 10, 37].

In the present work, the identified etiological microorganisms in urine culture were *Escherichia coli* [68%], *Staphylococcus aureus* [18.8%], *Klebsiella* [8.6%], and *Proteus* [4.3%]. In both pregnant and non-pregnant females, the etiologic factors that cause bacteriuria are the same. The female urethra, which is relatively short is commonly colonized by organisms from the gastrointestinal system. *Escherichia coli* is the most prevalent bacteria that causes bacteriuria, both symptomatic and asymptomatic, which accounts about 70–90% of isolates [13, 17, 35].

Our results are consistent with most previous studies, in which *Escherichia coli* was the most commonly identified etiological factor of asymptomatic bacteriuria during gestation [8, 13, 19, 29, 32]. However, some studies found that is the commonest causative pathogen of asymptomatic

bacteriuria in pregnant women is *Klebsiella* [12, 24, 37, 38].

Other studies found that *Staphylococcus aureus* is the commonest causative pathogen of asymptomatic bacteriuria in pregnancy [27, 40].

The differences could be attributed to the variable settings of collection [e.g., antenatal care units vs. hospitals and possible catheterized patients], presence of predisposing factors, and prevailing microorganisms in different settings.

No significant relationship between age and the prevalence of asymptomatic bacteriuria in our work. Our results agree with some previous studies that showed no significant relationship between the incidence of asymptomatic bacteriuria and age [13, 15, 20, 26, 27, 30, 35]. However, some studies reported a higher incidence of asymptomatic bacteriuria in certain age groups.

In Fong *et al.* [15] study, the highest incidence of asymptomatic bacteriuria was found among pregnant women aged  $\geq 40$  years. Turpin *et al.* [32] reported that the highest age-specific prevalence of asymptomatic bacteriuria is 35-39 year-old.

Labi *et al.* [33] and Izuchukwu *et al.* [24] studies showed a higher incidence of asymptomatic bacteriuria among pregnant women aged 30-34 years. In Kehindo *et al.* [25] and Rohini *et al.* [29] studies, asymptomatic bacteriuria was most common among pregnant women of 25- 30 year's age group.

Another study reported the highest incidence in the age group between 21-30 years [31].

Last, Edae *et al.* [14] reported the highest prevalence in pregnant females between 18-26 years. It has been thought that increasing maternal age is associated with a higher prevalence of asymptomatic bacteriuria during gestation. This could be explained by the fact that when a mother's age increases, so does her parity, which is a risk factor for asymptomatic bacteriuria. However, some studies reported a significant association between a higher incidence of asymptomatic bacteriuria and lower maternal age [41].

In our work, there was no significant association between the incidence of asymptomatic bacteriuria and hemoglobin level. This generally agrees with previous studies [12-14, 20, 24].

The present study demonstrated no significant association between the incidence of asymptomatic bacteriuria and either gravidity or parity.

These results are in accordance with some studies, which showed no significant difference in the incidence of asymptomatic bacteriuria with parity [13-15, 20, 30, 32, 33, 35, 40, 41].

However, other studies reported a significant association between the incidence of asymptomatic bacteriuria and increasing parity [12, 21, 26, 29, 42].

High parity can cause the pelvic organs to descend and the urethral orifice to enlarge, influencing the ascent of microorganisms [21].

This study showed no significant association between the frequencies of asymptomatic bacteriuria and history of previous abortions. This generally agrees with previous studies [10, 11, 25].

Our study showed a statistically significant association between the frequency of asymptomatic bacteriuria and social standard. Pregnant women with high social standards had a lower incidence of asymptomatic bacteriuria. Indeed, the incidence of asymptomatic bacteriuria in pregnancy is closely related to socioeconomic status.

A study has reported that the incidence of asymptomatic bacteriuria was 2% in non-indigent compared to 6.5% of indigent pregnant women [41].

In Aminu & Aliyu [12] study, females with lower socio-economic classes had higher incidence of asymptomatic bacteriuria in pregnancy. However, some studies showed no significant association between the incidence of asymptomatic bacteriuria and socioeconomic level [13].

The current study found no significant association between the frequency of asymptomatic bacteriuria during gestation and education level. This is consistent with findings of some previous studies [13,15,25,30,33,40,41]. However, some other studies reported a significant association between a higher frequency of asymptomatic bacteriuria in gestation and a lower education level [20, 35].

In Oli *et al.* [23] study, women that had only primary education had the highest incidence [27.50%] while those that had tertiary education had the least prevalence [21.10%].

It is believed that improved hygiene that goes with a higher level of education is responsible for the drop in the frequency of bacteriuria in these studies [20, 35].

In this study, 3% of pregnant females had gestational diabetes mellitus [DM]. There was a tendency for a higher incidence of asymptomatic bacteriuria among pregnant

women with gestational DM, although this didn't reach a statistically significant level. It has been traditionally thought that DM is associated with an increased incidence of asymptomatic bacteriuria and urinary tract infection. However, some studies showed no statistically significant difference in the frequency of asymptomatic bacteriuria between pregnant females with and without diabetes mellitus or gestational diabetes mellitus [14,43,44].

The variation could be attributed to the differences in the inclusion criteria as well as gestational age of participants.

Our study showed that the incidence of asymptomatic bacteriuria was significantly higher in the first trimester than the second trimester.

Our results agree with Sujatha and Nawani. [31] Study. The higher incidence of asymptomatic bacteriuria in the first trimester could be a result of underlying asymptomatic urinary infection before pregnancy ensued or at the onset of pregnancy. However, some studies reported a higher incidence of asymptomatic bacteriuria during the second trimester [25,45,46].

Other studies showed that asymptomatic bacteriuria is most common during the third trimester [23,26,29].

Finally, other studies showed no statistically significant relationship between the incidence of asymptomatic bacteriuria and gestational age [11,13-15,20,21,27,33,35,40,41].

The discrepancy among studies could be related to different inclusion criteria. For example, our study included only women in the first and second trimester, while, for example, in Abdel-Aziz *et al.* [13] study, 76 % of participants were in the third trimester. Moreover, other confounding factors may play an important role.

In the present study, there was no significant association between the incidence of asymptomatic bacteriuria and antenatal care, which agrees with Edae *et al.* [14] no significant association. However, other studies showed that the incidence of asymptomatic bacteriuria is higher in pregnant women who had irregular antenatal care. Maternal behaviors related to the risk of urinary infections are more frequent among women with irregular antenatal care [47].

The current study has some limitations. First, this is a single-center study, which included participants from Damietta Governorate; the participants may not be representatives for the entire Egyptian population. Future wider scale and multicenter studies are recommended. Second, the study included pregnant females in only the first and second trimesters; we have no information on the

occurrence of asymptomatic bacteriuria in the third trimester. Third, the present study didn't evaluate some factors that might affect the occurrence of asymptomatic bacteriuria during pregnancy, such as sexual activity, direction of genital washing, history of urinary catheterization, history of urinary tract infections. Fourth, our study didn't study the obstetric and perinatal outcome of asymptomatic bacteriuria and the beneficial effect of treatment. Last, although the sample size was calculated for the occurrence of asymptomatic bacteriuria, it might be inadequate to show a statistically significant difference when comparing groups with smaller numbers.

### Conclusion

A relatively high incidence of asymptomatic bacteriuria [13.8%] was revealed among participants in whom the most causative organism was *Escherichia coli*. The prevalence was lower among pregnant women with a high social standard and during the first trimester. Maternal age, parity, education level, or hemoglobin level, on the other hand, had no significant relationship.

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# International Journal

The background of the cover is a light blue gradient. It features a faint, semi-transparent graphic of a stethoscope on the left side, a globe in the center, and a white ECG (heart rate) line running across the bottom. The overall theme is medical and global.

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