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Bacteriological study of the bacteria isolated from alkaline urine in women and their susceptibility to antimicrobial agents

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ABSTRACT

According to the findings, the typical level of (alkaline urine) found in patients suffering from an infection of the urinary tract was 10.6 percent. It was significantly higher in women who were not pregnant compared to women who weren't pregnant (62.5% vs. 37.5%) at a probability levelP = 0.0001. Most patients were in the age category of less than 25 years. All of the patients showed evidence of positive bacterial growth, and E. coli was shown to be the most prevalent bacteria (22.5%, P 0.05). Additionally, 46.8% of these samples included urease-producing bacteria. (Gentamycin), (Nalidixic acid and Phosphomycin 0 percent), and fractionally resistant to (Ciprofloxacin 50 percent efficacy), and (Azithromycine 60 percent). The only antibiotic that was effective against all of the bacterial samples was 100% for Amoxacillin .

Keywords: *Alkaline urine, Urine pH*

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INTRODUCTION

Commonly known as cystitis or lower urinary tract infections, urinary tract infections are bacterial infections that affect the bladder and the structures that surround it. Urinary tract infections can also be referred to simply as UTIs (Michael and Wanda, 2020). One of the most common infections that affects women, a urinary tract infection (UTI) strikes forty percent of all women at some point in their lives. UTIs are not very prevalent in males who have had their circumcisions done, and by definition, any male UTI is regarded to be difficult. Even though many cases of mild UTI can clear up on their own without the need for medication, a significant number of people will still seek therapy for the symptoms they are experiencing. The purpose of the treatment is to prevent the infection from spreading to the kidneys or developing into upper tract disease or pyelonephritis, both of which have the potential to induce hypertension and harm the delicate structures that are found in the nephrons (Long and Koyfman, 2018 ; Tang et al. 2019). Microorganisms that cause disease can enter the body through the perineum and create a urinary tract infection (UTI). Escherichia coli is by far and away the most common bacteria that cause uncomplicated UTIs (Yamaji et al. 2018). Urine is an excellent medium for the formation of bacteria; nevertheless, there are a number of factors that make urine unfavorable for the growth of bacteria, including a pH that is lower than 5, the presence of organic acids, and significant quantities of urea. Urinating on a consistent basis has also been demonstrated to lower the risk of developing a urinary tract infection (commonly known as a UTI) (Araujo da Silva et al. 2018; Richards et al. 2019). Urine that is healthy has a pH that is somewhat acidic, with values averaging between 6.0 and 7.5; nevertheless, the usual range for urine pH is between 4.5 and 8.0. Urine with a pH of 8.5 or 9.0 typically contains a microorganism capable of breaking down urea, such as Proteus or Klebsiella. An alkaline pH can be present in struvite kidney stones, which are sometimes sometimes referred to as "infection stones" (Ganzeboom et al. 2018; Ditkoff et al. 2018; O'Grady et al. 2019).

Urine with a high pH and an abundance of bacteria capable of breaking down urea when it has been stored for an extended period of time. However, a high urine pH can be induced by a vegetarian diet, diuretic therapy, vomiting, stomach suction, or alkali therapy (Michael et al. 2011). Other possible causes include stomach suction and alkali therapy. Urine that is infected will experience a gradual shift in pH as a result of the production of NH_4^+ by microorganisms that break down urea. It is usual practice to calculate the quantity of NH_4^+ in the urine by subtracting the concentrations of the two most abundant cations, Na^+ and K^+, from the concentrations of the most abundant anion, Cl (Mark and Jardine, 2013). Changing the pH of urine while keeping the same amount of fluid passing through the kidneys is one way to increase renal clearance of drugs that are considered to have weak electrolytes. If the urine pH is altered in order to increase the degree to which the drug is ionized, there will be less reabsorption from the renal tubule (Derek et al. 2018). When the pH of the urine is greater than 6.5 and certain (aryl) metabolites are present, the human germicidal protein siderocalin is no longer able to withstand the iron procuration molecule enterobactin produced by the bacterium. This occurs when the urine has a pH that is greater than 6.5. Enterobactin was able to boost the growth of new bacterial pathogens by removing iron from siderocalin, which allowed for more iron to be available for bacterial growth (Robin, 2015).

Before the laboratory finding of urine checking or culture, experimental germicidal handling is training in (UTIs). Several studies have found that when alkaline urine was used, the curative efficiency of germicidal was reduced or the recovery period was prolonged (Cunha et al., 2016). Overall inhibitory activity was shown to be influenced by pH. Several medicines only had pH-dependent effects against select uropathogens, despite the fact that most drugs reacted similarly across most or all of the uropathogens examined. Fluoroquinolones, co-trimoxazole, aminoglycosides, and macrolides all performed best at an alkaline pH, whereas tetracyclines, nitrofurantoin, and several of the -lactams examined performed best at an acidic pH. Fluoroquinolones, co-trimoxazole, aminoglycosides, and macrolides all performed

best at an alkaline pH. Sulfamethoxazole, oxacillin, amoxicillin and clavulanic acid, vancomycin, imipenem, and clindamycin were resistant to the effects of pH. Vancomycin and imipenem were also resistant (Luo et al. 2014). When the urine's pH is lower than 6, the antibiotics trimethoprim, fosfomycin, amikacin, and ertapenem are less effective at killing the five different bacterial species (Burian et al., 2012).

MATERIALS AND METHODS

Patients ranged in age from 10 to 45 years old (age SD: 21.78 12.39 years). There were 160 (10.6 percent) pregnant women, 60 (37.5 percent) non-pregnant women, and 100 (62.5 percent) non-pregnant women. Urine samples were collected and stored in sterile containers. Urine reaction and pH were measured immediately as part of a general urine examination. A total of 1500 urine samples were tested for pH, and 95 of them showed an alkaline reaction. Blood and MacConkey agar was used for culture, incubated at 37C for 24 hours. Bacterial growth was evaluated using cultural, microscopical, and biochemical methods. According to the (CLSI), 2012, the disk diffusion technique on (Mullar-Hinton agar) was used to test bacterial sensitivity to antibiotics.

The Statistical Package for Social Science (SPSS) Version 21 was used for statistical analysis, and P values less than 0.05 were considered significant.

RESULTS

The results in table 1 show that alkaline urine was found in 10.6% (160/1500) of individuals with UTIs. Most patients were in the 25yearold, according to the age distribution.

TABLE 1: Age distribution of female patients in the study

Sex	Age (Years)			Total
	< 25	25-40	>40	
Female	83(51.8%)	64 (40%)	13(8%)	160 (100%)
P value= 0.0001 Pearson Chi-Square = 49.162				

Table 2 shows the distribution of bacterial kinds of specimens by pregnancy case, with a considerably higher percentage in non-pregnant women (37.5 % vs 62.5 %, P 0.05).

TABLE 2: allocation of bacterial specimen according to pregnancy

Bacterial type	Pregnant (%)	Non-pregnant (%)	Total (%)
Escherichia coli	10(6.2)	26 (16.2)	36 (22.5)
Proteus mirabilis	11 (6.8)	22(13.7)	33(20.6)
Enterococcus faecalis	9(5.6)	10(6.2)	19(11.8)
Pseudomonas aeruginosa	6 (3.7)	12(7.5)	18(11.2)
Klebsiellapneumoniae	8(5)	4 (2.5)	12 (7.5)
Staphylococcus aureus	6 (3.7)	14 (8.7)	20(12.5)
Streptococcus pyogenes	10(6.25)	12 (7.5)	22(13.7)
Total	60 (37.5)	100 (62.5)	160 (100)
p < 0.05 [S] Chi-Square=8.013			

From where certain properties of bacteria isolates, the returns found that 46.8% were urease producers, table (3).

TABLE 3: Urease production rate of bacterial isolates

Bacterial type	Urease production		
	+ve	-ve	Total
Escherichia coli	3	33	36
Proteus mirabilis	33	0	33
Enterococcus faecalis	1	18	19
Pseudomonas aeruginosa	10	8	18
Staphylococcus aureus	18	2	20
Streptococcus pyogenes	0	22	22
Klebsiellapneumoniae	10	2	12
Total (%)	75 (46.8)	85 (53.1)	160 (100)
$p < 0.05$ [S] Chi-Square=118.561			

All bacterial specimens were resistant (0 percent efficiency) to the germicidal susceptibility test (Gentamycin, Nalidixic acid and Phosphomycin). All specimens, on the other hand, were susceptible to (Amoxacillin 100 percent efficacy). Except for those of (Ciprofloxacin), all specimens are sensitive to it (E. coli and Ps. aeruginosa ,50 percent efficacy). Similarly, all specimens except those of S. aureus were responsive to (Azithromycine) (60 percent efficacy). For all bacterial specimens, the (Minimum Inhibitory Concentration) MIC of (Azithromycin) was between (64-1024) g/ml, while the MIC of (Ciprofloxacin) was between (4-28) g/ml.

DISCUSSION

Urinary tract infections, sometimes known as UTIs, are one of the most prevalent types of bacterial infections that affect women. They typically strike between the ages of 16 and 35, with 10 percent of women contracting the infection each year and more than 40 percent to 60 percent contracting it at least once in their lives. In men, they strike between the ages of 15 and 45. There is a high risk of recurrence; in fact, within one year of their initial infection, approximately half of those infected will have a second infection (Sakamoto et al., 2019; Alperin et al., 2019). Numerous factors, including pH, influence antibiotic efficacy in the urinary system; therefore, while treating urinary tract infections, especially severe infections, it is important to consider the patients' urine pH. Clinical testing of urine pH and antibiotic efficacy may lead to lower antibiotic dosages and shorter regimen durations, potentially reducing antibiotic resistance (Yang et al. 2014). Alkaline urine could be a sign of urease-splitting organisms and the production of calculi. More extensive imaging may be able to detect stones, allowing for urologic management and avoiding antibiotic courses and multiple visits to the doctor. (2019, Bethany et al.) The average percentage of alkaline urine in patients with (UTI) was 10.6 percent in the current study. Despite the fact that this range was substantially lower than that of acidic urine, it should not be discounted.

The findings also show that non-pregnant women with alkaline urine had much greater levels than pregnant women, and that all of the patients were under the age of 25. Microorganisms that cause disease can enter the body through the perineum and create a urinary tract infection (UTI). Because women's urethras are typically shorter than men's, they are more likely to suffer from urinary tract infections (UTIs) (Yamaji et al., 2018). Hormonal variations, especially during pregnancy, can drastically affect the vaginal environment's pH balance. However, the pH equilibrium acts as a natural barrier against hazardous germs (EFCNI, 2020). Other predicted outcomes include the dominance of (E. coli). E. colias well as othergram-negative enterobacteriaceae are the primary pathogens of UTI, according to all studies related to UTI.

For a proper beginning treatment, it is critical to be informed of local epidemiological data (Akhtar et al., 2014; Zuleica et al., 2019). The hypothesis that E. coli, which is responsible for the vast majority of enterobacteriaceae found in the gastrointestinal tract (GIT), is the primary source of the bacteria that cause UTIs is the one with the highest probability of being correct (Kumar et al., 2015).

Most previous investigations found that non-pregnant women had a greater rate of bacterial specimen than pregnant women (Szweda and Jozwik, 2016). The current conclusion could be attributable to an uneven distribution of study specimens, as those under the age of 15 dominated (all were non-pregnant). It is widely documented that (UTIs) caused by uropathogens meticulously cultivating urea-splitting uropathogens changed urine pH toward alkalinity, a medium that promotes pathogen growth (Robin, 2015). In this investigation, urease manufacturers made up nearly half of the bacterial isolates. This is supported by the majority of studies on alkaline urine (Carlini and Ligabue-Braun, 2016).

All bacterial isolates were 100% resistant to Gentamycin, Nalidixic acid, and Phosphomycin and partially resistant to (Ciprofloxacin 50%), (Azithromycine 60%), with the exception of (Amoxacillin 100%). In general, these findings are in line with earlier publications (So et al., 2015; Cunha et al., 2016). Under alkaline pH, the most likely mechanism behind these results is the production of enterobactin, a bacterial iron acquisition molecule that was able to take iron away from siderocalin, a human cell antimicrobial protein, and increase bacterial growth (Robin, 2015). Furthermore, in alkaline urine, the concentration of some antimicrobials in the urine was much lower (Loose et al., 2018). As a result, practitioners should take the pH of their patients' urine into account when treating urinary tract infections (Yang et al., 2014).

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