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A BACTERIAL AND IMMUNOLOGICAL STUDY OF SOME CAUSES OF URINARY TRACT INFECTION IN PREGNANT WOMEN IN DHI QAR GOVERNORATE–IRAQ

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By Zahraa Nema Khdair ALSEEDI

August 2022

We certify that we have read this thesis and that in our opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science

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ABSTRACT

A BACTERIAL AND IMMUNOLOGICAL STUDY OF SOME CAUSES OF URINARY TRACT INFECTION IN PREGNANT WOMEN IN DHI QAR GOVERNORATE–IRAQ

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Master of Science in Biology

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August 2022

This study was conducted in the city Dhi Qar/Nasiriyah/Al-Haboubi Hospital in February -2022. The study included 100 urine samples and blood samples from women who visited Al Haboubi Hospital. After captivating Necessary information from all hospital review prepared previously in a questionnaire sheet, women who had usage antibiotics for treatment were excluded. The samples obtained were divided into 3 groups, the first group: 50 non-pregnant women not infaction, the second group: 25 pregnant women with a urinary tract infection (UTI) and the third group: 25 pregnant women without a urinary tract infection (UTI). Microscopical Exam of Urine The method of was followed in the examination, then midstream urine samples were collected usage sterile glass bottles. Area with soap and water, without using sterilizers, with an emphasis on not touching any part of the body to prevent contamination with the natural flora on the skin. After the colonies grew on the culture media of the primary isolate, they were initially diagnosed based on the morphological and cultivar characteristics that included each of sensitivity was tested using seven types of antibiotics used to treat utis for 25 bacterial isolates of utis associated with pregnant women. Most *E. Coli* isolates had a high sensitivity to Amikacin (75%), while 65% of the isolates were sensitive to Norfloxacin and Gentamycin. *E. coli* isolates are resistant to Amoxicillin-Clavulacnic Acid by 35%. The reason may be that the increased resistance of bacterial isolates might be owing to the frequent indiscriminate usage of antibiotic, as well as to the possibility of bacteria acquiring genetic factors that transmit multiple resistance through conjugation

immunology test results Total White blood cells that pregnant women who are NOT infected with UTI have the lowest number of white blood cells, and they are slightly lower numerous than women who are not infected with UTI and who are not pregnant, while the infected pregnant women occupy the highest percentage in this study. The results of immunoglobulin A (IgA) showed that infected pregnant women have the highest percentage of IGA, and the average percentage is healthy women who are not infected with UTI and who are not pregnant, while NOT infected pregnant women have the lowest percentage. The results of immunoglobulin G (IgG) showed that pregnant women infected with UTI have the highest percentage of IGG, while the percentage of non-pregnant women and not infected with UTI is average, while the percentage of pregnant women and not infected with UTI is the lowest. The results of Interleukin–6 showed that women who are not infected with UTI and who are not pregnant have the highest percentage, the percentage is mediated by pregnant without (UTI) women, and the lowest percentage is pregnant women infected with UTI. The results of Interleukin–10 showed that women who are not infected with UTI and who are NOT pregnant have the highest percentage, and the percentage is close to pregnant women without UTI, and the lowest percentage is pregnant women infected with UTI.

2022, 76 pages

Keywords: UTI, Etiology, *Escherichia coli*, *Staphylococcus*, *Streptococcus*, IgG, IgA, Immunology

ÖZET

IRAK DHİ QAR VALİLİĞİ'NDEKİ HAMİLE KADINLARDA İDRAR YOLU ENFEKSİYONUNUN BAZI NEDENLERİNİN BAKTERİYEL VE İMMÜNOLOJİK BIR ÇALIŞMASI

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Bu çalışma, Şubat-2022'de Dhi Qar/Nasiriyah/Al-Haboubi Hastanesi'nde gerçekleştirildi. Çalışma, Al Haboubi Hastanesi'ni ziyaret eden kadınlardan 100 idrar örneği ve kan örneğini içeriyordu. Daha önce bir anket formunda hazırlanan her hastane incelemesinden gerekli bilgiler alındıktan sonra, tedavi için antibiyotik kullanmış olan kadınlar çalışma dışı bırakıldı. Alınan örnekler 3 gruba ayrıldı, birinci grup: 50 gebe olmayan kadın infraksiyon, ikinci grup: idrar yolu (İYE) olan 25 gebe ve üçüncü grup: idrar yolu enfeksiyonu (İYE) olmayan 25 gebe kadın). İdrarın Mikroskobik İncelemesi İncelemede yöntemi izlenmiş, daha sonra steril cam şişeler kullanılarak orta akım idrar örnekleri toplanmıştır. Ciltteki doğal flora ile kontaminasyonu önlemek için vücudun herhangi bir yerine dokunmamaya vurgu yaparak, sterilizatör kullanmadan sabun ve su ile alan. Koloniler, birincil izolatın kültür ortamında büyüdükten sonra, başlangıçta her birini içeren morfolojik ve kültivar özelliklerine göre teşhis edildi. Duyarlılık, hamile kadınlarla ilişkili İYE'lerin 25 bakteri izolatı için İYE'leri tedavi etmek için kullanılan yedi tip antibiyotik kullanılarak test edildi. *E. coli* izolatlarının çoğu Amikasin'e karşı yüksek duyarlılığa sahipken (%75), izolatların %65'i Norfloksasin ve Gentamisine duyarlıydı. *E. coli* izolatları Amoksisilin-Klavülaknik Asit'e %35 oranında dirençlidir. Bunun nedeni, bakteri izolatlarının artan direncinin, antibiyotiklerin sıklıkla gelişigüzel kullanılmasından ve ayrıca bakterilerin konjugasyon yoluyla çoklu direnç ileten genetik faktörleri edinme olasılığından kaynaklanıyor olabilir. İmmünoloji test sonuçları İYE ile enfekte olmayan hamile kadınların en düşük beyaz kan hücre sayısına sahip olduğu ve

İYE ile enfekte olmayan ve hamile olmayan kadınlara göre biraz daha düşük olan toplam beyaz kan hücreleri, enfekte hamile kadınlar ise bu çalışmada en yüksek yüzdeyi işgal etmektedir. İmmünoglobulin A (IgA) sonuçları, enfekte hamile kadınların en yüksek IGA yüzdesine sahip olduğunu ve ortalama yüzdenin, İYE ile enfekte olmayan ve hamile olmayan sağlıklı kadınlar olduğunu, hamile DEĞİL kadınların ise en düşük yüzdeye sahip olduğunu gösterdi. İmmünoglobulin G (IgG) sonuçları, İYE ile enfekte hamile kadınların en yüksek IGG yüzdesine sahip olduğunu, hamile olmayan ve İYE ile enfekte olmayan kadınların yüzdesinin ortalama, İYE ile enfekte olmayan hamile kadınların yüzdesinin ise olduğunu gösterdi. En düşük Interleukin-6'nın sonuçları, İYE ile enfekte olmayan ve hamile olmayan kadınların en yüksek yüzdeye sahip olduğunu, yüzdeye İYE olmayan (İYE) hamile kadınların aracılık ettiğini ve en düşük yüzdenin İYE ile enfekte olan hamile kadınlar olduğunu gösterdi. Interleukin-10'un sonuçları, İYE ile enfekte olmayan ve hamile olmayan kadınların en yüksek yüzdeye sahip olduğunu ve yüzdenin İYE'si olmayan hamile kadınlara yakın olduğunu ve en düşük yüzdenin İYE ile enfekte olan hamile kadınlar olduğunu gösterdi.

2022, 76 sayfa

Anahtar Kelimeler: İYE, Etiyoloji, *Escherichia coli*, *Staphylococcus*, *Streptococcus*, IgG, IgA, İmmünoloji

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My honorable teacher, all reverence and reverence to you, who made me glory, thanks to you I understood the meaning of life, I drew from you sciences, knowledge, and experience, to stand in this world like a lion in his den; Dear and generous, he is not deceived by appearance and crust, but always searches for the essence, thanks to you I found a place in this life, for you did not teach me a single letter, but you taught me everything, I will not be to you, but a slave and voluntary Asst. Prof. Dr. Songül ŞAHİN.
To the owner of excellence and bright ideas, the purest, most beautiful, most beautiful, and kindest greetings, I send them to you with all affection, love, and sincerity, letters cannot write what my heart carries of appreciation and respect, and to describe what filled my heart with praise and admiration, how beautiful it is to be a human being a candle that lights the paths of the perplexed my family.
When I remember all that you have done for me to reach what I have reached in this day, my tongue is unable to say anything, expressions of thanks are few, and words of praise cannot fulfill your right, you are everything at all times, and you are what I meet when I need anything Something in this life, I thank you for what you have done, and you have my best regards and appreciation. my dad and mom
Words cannot express how beautiful and grateful you have given me

Zahraa Nema Khdair ALSEEDI
Çankırı-2022

CONTENTS

LIST OF SYMBOLS

%	Percentage
°C	Degrees celsius
G-ve	Gram negative
mg	Milligram
mL	Milliliter
mm	Millimeter
µL	Microliter

LIST OF ABBREVIATIONS

CAUTI	Catheter-associated urinary tract infections
CFU	Colony forming units
DCS	Dendritic cells
EMA	European medical agency
ICU	In the critical care unit
IgA	Immunoglobulin A
IgG	Immunoglobulin G
LPS	Lipopolysaccharids
MDR	Multiple drug resistant
MHM	Mueller-hinton medium
MIC	Minimum inhibitory concentrations
MMP9	Matrix metalloproteinase 9
MRSA	Methicillin-resistant *S. aureus*
MSA	Mannitol salt agar
RR	Risk ratio
TBE	Tris borate edta buffer
UPEC	Uropathogenic *escherichia coli*
UTI	Urinary tract infection

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1 INTRODUCTION

Escherichia coli are bacillus bacteria belonging to the family of Enterobacteriaceae that can live in aerobic or non-aerobic environment where they live in the intestine of healthy people and warm-blooded animal, and these bacteria are the greatest shared reason of urinary tract infections with an average of 85% of all infections urinary tract, affecting women at a rate of 30 times more than men, and in the normal case the urinary system is protected by urination, which leads to the expulsion of germs suspended in the urethra, but in the event of problems with the urinary flow, *E. coli* can enter the urinary system and multiply in it to develop a tract infection Its polyurethane (Sobel and Kaye 2005).

Urinary tract infection occurs when *Escherichia coli* bacteria from the digestive tract enter the urinary tract, and this can happen easily in women because the anus is located near the urethra, and these germs can move through the urethra to the bladder and even the ureters and kidneys, and cystitis and urethritis are the most infections caused by *E. coli* infection, followed by intra-renal infection (Komala and Kumar 2013).

Antibiotics are the cornerstone of treating any bacterial infection. If the presence of germs is found through a urine test, the doctor is likely to prescribe an antibiotic that helps kill *E. coli*, and if you suffer from repeated urinary tract infections at a rate of more than 4 times in a year, a daily low dose of antibiotics may be needed for a few months. After a urine test that shows the presence of bacteria, your doctor may prescribe Bactrim or ciprofloxacin, the two most usually usage antibiotics to treat UTIs produced by *E. coli* (Dhakal *et al.* 2008).

Diagnosis of *E. coli* in urine urinary tract infection is usually diagnosed after asking about symptoms and analyzing a urine sample in the laboratory to assess the attendance of white and red blood cells and germs in the urine (Mahadeva *et al.* 2014). A number of method are also used to accurately determine the kind of germ producing the infection, and the most important of these include. The following methods are mentioned collecting clean urine: through which the patient is asked to wash the genital area while providing a sample

from the middle of urination to help reduce the chances of contamination of the sample with germs present in the genital area. Diagnostic imaging: This involves using ultrasound, calculated tomography, and magnetic resonance imaging to determine the presence of underlying causes of infection (Pineda *et al.* 2009). Urodynamic test: This test checks how well the urinary tract stores and excretes urine. Cystoscopy: In this procedure, a long tube equipped with a camera is inserted to visually identify problems within the urinary tract.

Aim of Study

Determining the relationship between urinary tract infection and some indicators of immune status and infection in pregnant women in Dhi Qar.

2 LITERATURE REVIEW

2.1 Urinary Tract Infection

An infection of the urinary tract develops in the urinary system. The kidneys, urine tubes, bladder, and urethra make up the urinary system (John *et al.* 2016). Infection can affect any part of the urinary tract, except the lower urinary tract, which comprises the urethra. Inflammation of the bladder is the most common.

Antibiotics are the most common therapy for urinary tract infections, but some simple precautions can help prevent infection and UTIs from the start.

Urinary tract infections affect both men and women, but women are additional vulnerable to them since their urinary tracts are smaller than men's (Barnett and Stephens 1997). To avoid UTIs, women should pay special attention to personal hygiene.

Urinary tract infections have an impact on the kidneys, liver, uterus, and bladder, which are all responsible for eliminating waste from the body. The upper system (kidneys, uterus, fallopian tubes) and then a woman's capacity to become pregnant are all affected if the infection persists or recurs frequently.

Male urinary tract infection can cause infertility because germs move through the prostate gland and other reproductive structures, causing sperm count and motility to drop (Pellati *et al.* 2008). In males, the infection can spread to the testicle, epididymis, and sex glands. Other medical disorders, such as diabetes, can cause a urinary tract infection, which can lead to infertility. However, this issue can be gradually addressed with medication.

2.2 Classification of Urinary Tract Infections

1. Uncomplicated

Cystitis and/or upper urinary tract infection (simple pyelonephritis) in non-pregnant, premenopausal women with no recognized significant anatomical and functional abnormalities within the urinary system or comorbidities

2. Complicated UTIs

A complex UTI should be defined as an infection with a high rate of treatment failure, as it frequently necessitates longer antibiotic sequences and, in some cases, extra treatments. A simple urinary tract infection, or simple cystitis, is an infection of the urinary system produced by suitable susceptible bacteria in a therapeutic setting that is not related with treatment failure or poor results (Najar *et al.* 2009). This is frequently an infection in an immunocompetent non-carrier. Without any symptoms, pyuria and/or bacteriuria is not a urinary tract infection and might not need therapy. A foley catheter or transverse positive urine culture in a non-pregnant female with asymptomatic immunocompetence is an example.

Since the urethra of the female urinary tract is comparatively short, it is predisposed to bacterial sowing at the proximal end (Sabih and Leslie 2017). Infection is more likely as a result of this dissection. Simple cystitis, a single episode of climbing pyelonephritis, and infrequently recurrent cystitis in the correct circumstances can all be classified as simple UTIs if they respond quickly to first-line antibiotics and have no long-term consequences.

A complicated urinary tract infection is defined as one that does not fit the preceding criteria or has a different clinical history (Schmiemann *et al.* 2010). In these situations, protective issues that fail to stop infection or risk issues that contribute to poor sepsis resolution, high morbidity, treatment failure, and re-infection are almost always present.

Examples of a Complicated UTI Include

- Infections caused by structural anomalies, such as obstructions, hydronephrosis, renal tract calculi, or colovesical fistulas, despite the attendance of anatomical preventive measures (complex UTI in males is defined as such).
- Infections caused by a weakened immune system, such as steroid usage, post-chemotherapy, diabetes, the elderly, and HIV)
- UTIs caused by unusual organisms
- Infections that come back despite treatment (multi-drug resistant organisms)
- Infections occur throughout pregnancy (counting asymptomatic bacteriuria)
- Infections after instrumentation, nephrostomy tubes, suprapubic tubes, ureteric stents, or Foley catheters
- Infections in renal transplant patients
- Infections in individuals with compromised renal function

3. Recurrent UTIs

Recurrent urinary tract contagions are clear as two bouts of acute bacterial cystitis with supplementary symptoms in the previous six months or three incidents in the previous year (UTIs) (Flower *et al.* 2014). Recurrent UTIs are far additional shared in women. The price of treating urinary tract infections in the United States alone is over 3.5 billion dollars all year.

A UTI is clear as a urinary tract infection (UTI) with more than 100.000 colony forming units (CFU) per milliliter of urine with symptoms such as dysuria, frequency, urgency, or suprapubic discomfort. A positive predictive value of about 90% for *E. coli* with typical acute urinary symptoms, on the other hand, suggests that a lower CFU threshold might be additional appropriate in detecting simple and recurrent UTIs (Pezzlo 1988).

Risk Factors for Recurrent Infections include

- Atrophic vaginitis
- Chronic diarrhea
- Cystocele
- Any spermicide use in the prior year, particularly if usage with a diaphragm
- First UTI when you were young (prior to 16 years of age)
- Genetic predisposition (often mediated by bacterial/vaginal mucosal adhesion factors)
- Increased post-void residual urine (incomplete bladder emptying)
- Insufficient fluid intake (low urinary volumes)
- New or numerous sexual partners
- Mother with a history of frequent or repeated UTIs
- Urinary incontinence
- Use of spermicide coated condoms

Personal Hygiene Factors

- Not washing hands earlier than wiping vaginal location after voiding
- Taking baths as opposed to showers
- Wiping and washing the vaginal vicinity (incorrectly) from returned to the front
- Not the usage of smooth, gentle washcloths to clean the vaginal location while washing
- Not cleansing the bladder beginning place first while washing
- Failing to usage a gentle, liquid cleaning soap when washing the vaginal region

4 Catheter-associated UTIs

Catheter-associated urinary tract infections (CAUTI) are infections that arise when a person's urinary bladder is catheterize or has been catheterize in the previous 48 hours (Trautner 2010). CAUTIs are the greatest frequent nosocomial infections, with 1 million

cases reported each year in the US. Secondary bloodstream infections are most commonly caused by them. Chronic indwelling catheters are used to manage 3–10% of inhabitants in long-term care institutions. The annual expenditures of CAUTI are projected to be anywhere amid $115 million and $1.82 billion (Umscheid *et al.* 2011). Age, female gender, diabetes, and longer catheterization time are all risk factors for CAUTI. With a daily risk of 3–7%, the length of catheterization is the greatest significant determinant in the growth of bacteriuria. In a research conducted in the United States, 3.2 urinary tract infections per 1000 catheter days were identified in long-term care institutions. CAUTI is 7.78 per 1000 catheter days in the critical care unit (ICU) (Edwards *et al.* 2008), where infection rates are 3–5 times greater than in other hospital patient care parts. CAUTIs in ICUs are linked to longer stays, higher health-care costs, and antibiotic usage.

Both Gram-negative and Gram-positive bacteria, as well as fungi, can reason UTIs. The greatest frequent pathogen for both non-complicate and complex UTIs is uropathogenic *Escherichia coli* (UPEC) (Behzadi *et al.* 2020), which accounts for 75 percent and 65 percent of infections, correspondingly. In complex UTIs, where CAUTIs account for the mainstream of cases, the greatest shared causal organisms after UPEC are *Enterococcus* spp. (11%), *Klebsiella pneumoniae* (8%), Staphylococcus aureus (3%), Candida spp. (7%), *Pseudomonas aeruginosa* (2%), *Proteus mirabilis* (2%), and Group B *Streptococcus* (2%). Antibiotics are the cornerstone of CAUTI treatment. Though, the abiotic surface of the catheter is prone to biofilm formation, making antibiotic penetration difficult. Furthermore, antibiotic treatment is known to cause collateral harm by selecting for resistant bacterial strain and altering the vaginal and gut microbiota, which might offer up new places for resistant organisms to colonize (Tagg and Dierksen 2003). Pili, sticky virulence-associated factors that help bacteria evade antibiotics, may also help bacteria colonize the intracellular environment. Antibiotic resistance is on the rise, with the CDC declaring in 2013 that the human race has entered a "post-antibiotic era," and the World Health Organization warning in 2014 that the situation is getting severe (Ventola 2015). As a result, CAUTI prevention methods and alternatives to antibiotic treatment are urgently required. The molecular pathways related with CAUTI are initially discussed in this paper. The present CAUTI management options, as well as their challenges and future

prospects in terms of prevention, diagnosis, and therapy, will next be examined (Figure 2.1).

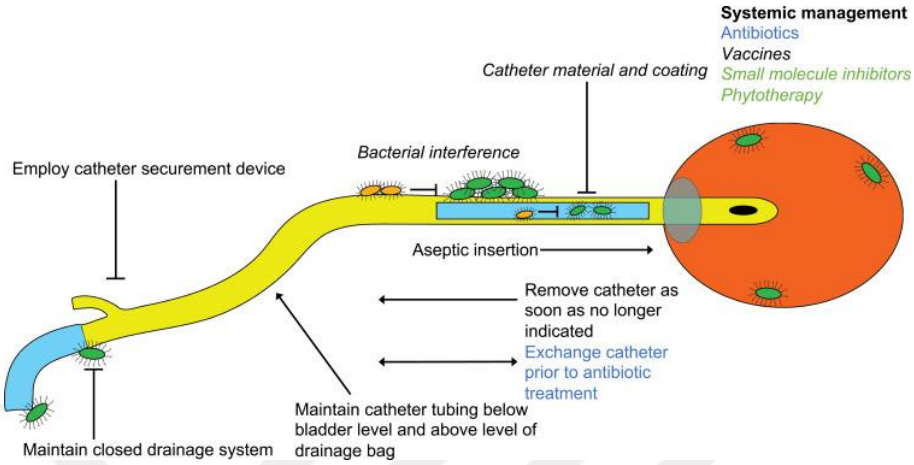

Figure 2.1 Catheter-associated UTIs

Prevention and treatment of catheter-associated urinary tract contagions: current and future treatments. An indwelling urine catheter (yellow) with its proximal end within the urinary bladder is shown schematically (Orange). The catheter drainage hole is black and the balloon is blue. Pathogenic bacteria (green) can build biofilms on the catheter's intraluminal and/or extraluminal surfaces, which can then seed the bladder with infection.

5. Urosepsis

When an infection spreads from the urinary tract to the bloodstream, it is called urosepsis. Bacteria can enter the urinary tract system finished the urethra (the tube that allows urine to exit the body) and cause illness. If an infection stays undiagnosed or untreated, germs can grow and invade the bloodstream, resulting in sepsis, a life-threatening illness (Remington *et al.* 2010). When sepsis affects the structures of the urinary tract, urosepsis develops.

As the body attempts to combat the infection, it might result in a rapid heartbeat, fever, chills, and confusion, as well as organ failure or death. It's crucial to understand the risk factors and recognize early signs.

2.3 Risk Factors for UTI and Asymptomatic Bacteriuria

In older persons, the risk factors for having UTI symptoms differ from those in younger people. Age-related change in immune function (immunosuppression), contact to hospital pathogen (Esme *et al.* 2019), and a advanced number of comorbidities all raise the risk of getting a UTI, but a history of infections is the strongest and greatest persistent risk issue for UTI. Urology affects people of all ages. Individuals who have had previous symptomatic UTIs have a 4-7 times higher chance of acquiring another UTI than those who have never had one.

Adults in institutions have additional comorbidities, functional impairment, and a advanced occurrence of cognitive deficiencies than elderly persons living in the community (Aliberti *et al.* 2019), making them more susceptible to bacteriuria and silent urinary tract infections. A urinary catheter is a substantial risk factor for UTIs in aging people living in institutions. 21 The occurrence of bowel and/or incontinence, functional incapacity, and dementia were substantially linked with tenacious asymptomatic bacteriuria in aging women in institutions without a urinary catheter. Cancer was the lone significant risk issue for prolonged asymptomatic bacteriuria in older men who did not have catheters (Genao and Buhr 2012).

2.4 *Escherichia Coli*

In humans and some animals, it is part of the natural flora of the colon, but it can become pathogenic both inside and outside the digestive tract. The presence of plasmids, coupled phage protists, and pathogenicity are all factors that influence the virulence of *E. coli* strains (Brüssow 2007).

They are anaerobic, gram-negative bacillus that is normally non-pathogenic. *Escherichia coli* possesses fibrils or cilia, which are necessary for adhering to the mucosal surfaces of the host, and strains vary in terms of movement, with some being motile and others not (Proft and Baker 2009).

Although most strains can ferment lactose, gut infections like Salmonella and Shigella cannot. During the fermentation of carbohydrates, *E. coli* produces both acid and gas (Clark 1989). Theodore Escherk was the first to describe it in 1885.

Numerous shared bacterial infections, e.g. cholecystitis, cholangitis, bacteremia, urinary tract infection (UTI), traveler's diarrhea, and other clinical illnesses such neonatal meningitis and pneumonia, are produced by *E. coli* (Rojas-Lopez *et al.* 2018).

Theodor Escherich, who isolated the genus phenotypic, is honored by the name Escherich. Gram-negative bacilli, Escherichia organisms can be found single or in pairs. They are selectively anaerobic, with both a fermentative and respiratory metabolism, and either immobile or motile flagella (Canale-Parola 1977). The bacterium *Escherichia coli* is a prominent endemic of the large intestine.

E. coli has a lot in common with other *E. coli*. All are selective anaerobes that ferment glucose and can use aerobic or anaerobic respiration to generate energy (using nitrate, nitrite, or fumarate as terminal carbon acceptors). They are all deficient in cytochrome C oxidase (that is, they are oxidase negative) (Keightley *et al.* 1996). Differences in three structural antigens, O, H, and K, are used to profile strains. The glycosylated component of the lipopolysaccharide contains O antigens (also known as somatic antigens or cell wall antigens). These antigens are thermostable and may be found in many Enterobacteriaceae species. Many Gram-negative enterococci have O antigens that are routinely utilized for serotyping. Because H antigens are associated to flagella, they are exclusively found in motile (flagella) Enterobacteriaceae like *E. coli*. Within polysaccharide capsules, K antigens are found.

There are numerous different O, H, and K antigens among *E. coli* species, and unique serotypes are linked to specific illnesses (DebRoy *et al.* 2011). A serogroup of *E. coli* with the O157:H7 antigen, for example, causes a severe form of hemorrhagic colitis.

E. coli and collection B *streptococcal* infections reason the great mainstream of newborn meningitis cases (28.5 percent and 34.1 percent overall, respectively). Pregnant women are more susceptible to *E. coli* K1 captive antigen progeny colonization.

This progeny is especially prevalent in neonatal sepsis, which has an 8% death rate and most survivors have neurological or developmental problems later in life (Ornoy and Ergaz 2017). A bad result is predicted by low birth weight and positive CSF transplantation.

Adults can get *E. coli* meningitis after neurosurgical procedures, trauma, or complications from Strongyloides stercoralis hyperinfection of the central nervous system.

E. coli respiratory tract contagions are rare, and they're nearly alway linked to *E. coli* urinary tract infections. This has nothing to do with virulence factors. *E. coli* pneumonia can also be caused by fine aspiration of previously colonized upper airway secretions in highly infected individuals, and is thus a cause of nosocomial pneumonia (Siegel and Weiser 2015). In individuals with underlying diseases e.g. diabetes, alcoholism, chronic disruptive pulmonic disease, and *E. coli* urinary tract infection, *E. coli* pneumonia can also be acquired in the community

E. coli pneumonia typically manifests as bronchopulmonary inflammation in the inferior lobes, with empyema as a consequence (Franquet *et al.* 2000). Bacteremia caused by *E. coli* frequently heads pneumonia and leads to another *E. coli* infection in the urinary or gastrointestinal system.

A routine CBC with distinction must be performed on patients with suspected *E. coli* infection to rule out leukocytosis or the contrary.

The results of Gram staining determine if the organism is Gram-negative, although they are indistinguishable from those of other aerobic Gram-negative bacilli that cause comparable infectious illnesses (Oliveira and Reygaert 2019).

E coli is a Gram-negative bacteria that thrives on ordinary media. On blood agar, it is lactose-fermented and beta-hemolytic. On Gram staining, the majority of *E coli* strains are not colored. *E. coli* bacteria on the McConkey

Specific diagnoses are made by isolating the pathogen from clinical samples in a microbiological laboratory. Blood, urine, sputum, and other fluids such cerebrospinal fluid, bile, and peritoneal cysts can all be used as samples.

Colonization or infection must be determined in the setting of the patient's clinical disorder if the organism was obtained in contaminated settings such as sputum or wounds (Levison and Kaye 1985).

2.5 Antimicrobial Treatment for Symptomatic UTIs

Antimicrobial therapy is suitable for symptomatic UTIs but not for bacteriuria without symptoms. Bacteriuria is a bacterial infection (risk ratio [RR]: 1.33; 95 percent sureness interval.

Fosfomycin, pifmicilinam, or nitrofurantoin are recommended as first-line treatments for simple cystitis in adult women, according to the 2018 EAU Guidelines for Urinary Tract Infections (Levison and Kaye 1985). For the treatment of complex urinary tract infections, a combined antimicrobial therapy with amoxicillin and an aminoglycoside, or second-generation cephalosporins with an aminoglycoside, is advised. Empiric intravenous therapy with third-generation cephalosporins is suggested for the treatment of complex UTIs with systemic symptoms. Although the European Medical Agency (EMA) has prohibited or limited the use of fluoroquinolones owing to impairment and possibly enduring side belongings including muscles, tendons, and joints, as well as the nervous system, according to EAU guidelines. Because of the increased risk of tendon injury in the elderly, the EMA urges caution while using quinolones or fluoroquinolones.

Patients over the age of 65 who have urinary tract contagions are at a advanced risk of developing urine incontinence, especially if they are fragile, require daily help, have dementia, or are bedridden. Antibiotic therapy with broad antimicrobial coverage against all probable causal microorganisms is recommended by guidelines (Karam *et al.* 2016) . Once the culture results are in, antimicrobial medication can be adjusted.

Antimicrobials can be administered as a continuous prophylactic treatment at low dosages for 3-6 months to avoid recurrent UTIs, according to the 2018 EAU guidelines; therapeutic routines comprise nitrofurantoin, cephalexin, fosfomycin, or cefaclor. Antibiotic prophylaxis for recurring UTIs was reported in 19.966 persons (79 percent women) aged 65 years in a big reflective cohort study from the United Kingdom. 14 Medicine annals were usage to settle trimethoprim, cephalexin, or nitrofurantoin prophylaxis for three months. Antibiotic prophylaxis was linked to a lower risk of clinical UTI recurrence (men: HR: 0.49, 95 percent confidence interval: 0.45–0.54; women: HR: 0.57, 95 percent confidence interval: 0.55–0.59) and an acute antibiotic prescription (Men: HR: 0.54, 95 percent confidence interval: 0.51–0.57; Women: HR: 0.61, 95 percent confidence interval: 0.59–0.62), but the writers named for additional investigation to healthier comprehend.

Antimicrobial abuse and misuse have donated to the continuous growth of resistance, which poses a severe public health issue (Cantas *et al.* 2013). 27-29 Methicillin-resistant *Staphylococcus aureus*, for example, is accountable for a variety of difficult-to-treat infections in people. The greatest shared reason of urinary tract infections is *Escherichia coli*, which is shadowed by *Klebsiella pneumoniae*, Proteus mirabilis, *Enterococcus faecalis*, and Drug-resistant *E. coli, Pseudomonas aeruginosa*. *K. pneumoniae*, and *P. mirabilis* isolates have been found to colonize the intestine. UTI pathophysiology, chiefly in recurrent UTI patients. The growth of antimicrobial confrontation was increased during the first month following treatment, according to a meta-analysis of antimicrobials given for bacterial UTIs in primary care (five trials, 14.348 individuals), and the effect could last up to a year. Within one month of antibiotic treatment, the ORs for resistance were 4.40 (95 percent CI: 3.78-5.12) and 1.33 (95 percent CI: 1.2-1.5). Antimicrobial resistance patterns of microorganisms that cause UTIs were analyzed in 32 Norwegian

studies (Abubakar 2009). They discovered no significant difference in resistance rates amid older persons alive in the public and those residing in treatment homes. *Escherichia coli* was the most prevalent urine bacterial isolate, seen in around two-thirds of patient (64 percent in all group).

The experimental antibiotic therapy strategy for UTI symptoms is being challenged by increasing antimicrobial resistance among urinary bacteria, highlighting the need for alternate therapeutic options.

2.6 *Streptococcus*

Viridans streptococci are a diverse collection of Gram-positive cocci that are found in the typical bacterial ecology of the female genital tract, the upper respiratory tract, and the gastrointestinal system, notably the oral cavity. Despite their low virulence, they are a significant source of subacute bacterial endocarditi confusing valvular disease1 and might too be the causal agents in a variety of illnesses affecting neutropenic individuals (Calza *et al.* 2004). Meningitis, pericarditis, pneumonia, upper respiratory tract infection, orodental infection, peritonitis, and endophthalmitis have also been reported.

Traditionally, viridans *streptococci* were thought to be sensitive to beta-lactam antimicrobials, tetracyclines, and macrolides, but antibiotic resistance has become more common in recent years. The identification of a insufficient penicillin-resistant bacteria in patients receiving preventive penicillin treatment started this trend. By the finish of the 1980s, the vast mainstream of these *streptococci* were inhibited by penicillin attentions of 0.12 g/mL, and no strain with a MIC of 4 g/mL had been discovered. In a new investigation in the United States3, the fraction of high-level penicillin resistance (MIC 4 g/mL) in blood strains isolated in 1993 and 1994 reached 13% (Chenoweth *et al.* 2000).

Streptococcus mitis, unique of the species comprised confidential the organization of viridans, is the maximum proof against beta-lactams of the organization. We current a case of urinary tract infection with an exceptionally penicillin-resistant strain of *S. Mitis*

(MIC=32 μg/mL) in an affected person getting cephalexin prophylaxis for urinary infection.

The patient was a 4-year-old girl who had correct Grade II and left Grade III vesicoureteral reflux, as well as two preceding bouts of *E. coli* urinary tract infection. At the age of seven months, the first was given cephalexin (125 mg/6 h) for one week before starting trimethoprim-sulfamethoxazole (32/160 mg/day) prophylaxis. The third, who was 3 years old at the time, required hospitalization and was preserved with cephalexin (250 mg/6 h) (Loening-Baucke *et al.* 1979). Following this occurrence, the prophylactic antibiotic was altered to cephalexin (250 mg/day). She was referred to our hospital when she was 4 years old with a fever of up to 39°C, vomiting, and overall malaise. A urine culture was done, and empiric treatment with amoxicillin-clavulanic acid (125/31.25 mg/8 h) was started. At 48 h afterward initiation of treatment, temperature repaid to usual and symptoms vanished.

The alpha-hemolytic bacterium grew to about 105 colony-forming units/ml on the blood agar plate in the urine culture, but not on MacConkey agar (Meysick 1990). Gram-positive cocci clustered in small chains on the Gram-stained smear. Catalase testing came up negative. With the API 20 Strep® and Rapid ID 32 Strep galleries, the bacterium was identified as S. mitis. The agar dispersal technique unsuccessful to demonstration an inhibitory zone about the disks of penicillin G and ampicillin in an antibiogram. The MICs for penicillin G, 64 g/mL for ampicillin, 32 g/mL for amoxicillin and cefuroxime, 8 g/mL for cefotaxime, and 0.75 g/mL for imipenem were determined using the agar thinning method. During the next two months, no relapse was noted. A switch culture did 1 month advanced was negative.

S. mitis has been concerned as the etiologic agent in urinary infection. A study of 242 strains of streptococci producing urinary tract infection presented that 1.2% fit to this class 5.

Because of structural alterations in the latter, beta-lactam resistance in streptococci of the viridans collection is linked to decreased empathy for penicillin-binding proteins (Grebe

and Hakenbeck 1996). Continued prophylaxis with cephalexin, an antibiotic with low affinity for these germs' penicillin-binding proteins, might have resulted in a constant assortment of strain resistant to penicillin and cephalosporin.

The isolated strain's tall equal of resistance was not clinically meaningful in this case. Despite the high MIC, the high amounts of amoxicillin found in urine (300 to 1300 g/mL) rendered this antibiotic cathartically beneficial. The presence of bacteria with this resistance trait in other infections could cause major therapeutic issues.

The emergence of penicillin-resistant viridans streptococci provides cause for alarm. The increased usage of cephalosporins with low affinity for these bacteria's penicillin-binding proteins would result in an upsurge in the number of strain resistant to both penicillin and cephalosporin, certain of which will probably be complicated in clinically relevant illnesses.

2.7 Innate Immune Responses

In the urinary tract, the innate immune system consists of a variety of local and employed cells that fast a wide variety of pattern recognition receptors (PRRs) e.g. Toll-like receptor 2 (TLR2), TLR4, TLR5, and TLR11, which let initial pathogen credit and transduce this sign to persuade a fast and robust pro-inflammatory immune reply. These signaling proceedings have been thoroughly examined, and will not be discussed here (Griffith *et al.* 1998). Persons with genetic abnormalities in mechanisms of these trails are more susceptible to UTIs, demonstrating the significance of these signaling events. Although these immune responses are vital, they must be strictly managed to maintain the epithelial barrier's retention or speedy recovery. In this unit, we appraisal the chief innate immune cell in the urinary tract. We emphasis on their sole antimicrobial doings and deliberate the controlling devices that switch over-reactive innate immune responses.

2.8 Epithelial Cells

The chief line of defense against pathogens is the epithelial cell that line the urine tract. These cell announcement a wide variety of soluble chemicals, counting pro-inflammatory cytokine and antibiotics. Interleukin-1 (IL-1), IL-6, and IL-8 are the chief cytokines found in urine after infection, and they are critical for phagocyte staffing to ill bladder and kidney tissue (Abraham and Miao 2015). Uromodulin (too recognized as Tamm–Horsfall urinary glycoprotein) is shaped by epithelial cell coating the climbing limb of Henle's loop in kidney nephrons in the urinary system. Uromodulin binds to UPEC and stops bacteria from interrelating with the epithelial cell surface while too producing them to aggregate, letting UPEC to be detached from the urine additional quickly. Uromodulin has too been optional to straight trigger TLR4 and persuade the maturation of certain cells e.g. myeloid dendritic cell (DCs). So, uromodulin might too have an immune-modulatory function.

Certain epithelial cell produced substances restrict bacterial development by removing essential bacterial development issues from the urine. The NGAL protein, which is found in neutrophils, binds bacterial siderophores such enterochelin (Goetz *et al.* 2002). NGAL, which is shaped by -intercalate cell in the kidney, has lately been demonstrated to inhibit the development of UPEC in both human and mouse urinary tracts21. Mice lacking NGAL or -inserted cells were additional vulnerable to infection throughout UPEC infection compared to wild-type mice. Antimicrobial peptides (AMPs) such cathelicidin-relate AMPs (e.g., LL-37 (too recognized as CAMP), -defensin 1 and ribonucleases 7 are concealed to the urine to inhibit bacterial development. AMPs are chief shaped in the urinary tract by bladder epithelial cells (BECs) and -intercalated cells in reply to bacterial infection; afterwards, AMPs are concealed by employed neutrophils. The fact that cathelicidin-deficient animals are very sensitive to both cystitis and pyelonephritissuggests that AMPs have a role in UTI prevention. AMPs can too have immune-modulatory belongings, e.g. boosting neutrophil infiltration and enhancing cytokine production (Abraham and Miao 2015). Pentraxins are a protein family that has evolved over time and can act as soluble PRRs. Pentraxin-related protein 3 (PTX3) levels in urine through UTIs are closely linked to the intensity of symptoms, and genetic variants

in the human PTX3 locus are linked to an elevated risk of acute pyelonephritis. PTX3 is supposed to quandary bacterial surface, which clues to complement-mediate murder and uptake by phagocytes.

2.9 Neutrophils

Following UTIs, neutrophil are the chief immune cell to be attracted to the bladder, and they play a key part in bacterial permission. After activation of PRRs by diverse bacterial products, they reply to CXC-chemokine ligand 1 (CXCL1) and other chemoattractant shaped by insincere bladder epithelial cell, macrophage, and mast cell. Neutrophil can be originate in urine as initial as 2 hour after infection in mice models of UTI, and their levels peak at 6 hours.

The amount of neutrophils in the urinary tract is strongly related to the bacterial burden, and as bacterial number decline, so does the amount of neutrophil.

Neutrophils regulate infection by many pathways after they enter urinary tract tissue, and this is aided by numerous solvable substances in the urine, e.g. pentraxin (Daigo *et al*. 2016). Activated neutrophils, on the other hand, are accountable for significant toxicity to nearby bladder tissue due to the generation of sensitive oxygen class and other cytotoxic chemicals. Extreme neutrophil replies, particularly augmented manufacture of cyclooxygenase 2 (COX2; too recognized as PTGS2), injury bladder tissue and incline the bladder to infection. Activated neutrophils must pass through numerous layers of epithelial cells to spread bacteria in the bladder lumen, counting the usually resistant superficial epithelial cell layer. Seemingly, this action might boundary the cytotoxicity of neutrophil by eliminating them from the bladder tissue to the urine where they can be detached from the body throughout voiding (Abraham and Miao 2015).

2.10 Macrophages

The submucosa of the urinary tract has a large population of macrophage, and additional cells are attracted to these areas after infection. These macrophage create important cytokine and chemokine that impact the timing and strength of inflammatory response throughout UTIs.

The exact recruitment and start of neutrophil response have been demonstrated to be coordinated by crosstalk amid various subset of macrophage in the bladder (Schiwon *et al.* 2014). The majority of LY6C macrophage in the bladder serve as sentinels. These macrophage release the chemokine CXCL1 and macrophage migration inhibitory issue (MIF) to attract neutrophil and CC-chemokine ligand 2 (CCL2) to attract LY6C+ macrophage following infection. Employed neutrophil require local tumour necrosis factor (TNF) signaling to irritated the epithelial basal membrane after extravasation; this obligation was demonstrated in a study that found that transepithelial relocation of neutrophil was inattentive in TNF-deficient pests. Fascinatingly, TNF is produced by newly recruited LY6C+ macrophages, but its effects are not aimed at neutrophils. TNF, on the other hand, causes local LY6C macrophage to emit a second wave of cytokine, primarily CXCL2, which causes neutrophil to impulsively synthesize medium metalloproteinases 9 (MMP9) and begin their transepithelial migration. Therefore, while local LY6C macrophage serve as the primary pro-inflammatory cell, employed LY6C+ macrophage play an important part in maintaining neutrophil near together beforehand attacking the pathogen. Also, because the nearby made TNF has a worldwide triggering effect, the employed LY6C+ macrophage might promote simultaneou start of the nearby microenvironment. Surprisingly, investigations have shown that insightful GR1hiLY6C+ monocyte are not required for bacterial permission in the bladder, implying that our present knowledge is imperfect. Crosstalk amid bladder macrophage, in any case, causes neutrophils to be mobilized into the epithelium and activated with other immune cell. These immune response promote well-organized bacterial permission while simultaneously reducing harmful inflammation (Abraham and Miao 2015).

2.11 Mast Cells

Mast cell are a kind of immune cell that lives beneath the uroepithelium, near to the blood and lymphatic arteries that run through the mucosa. Mast cells can also be seen in large number in the detrusor muscle area of the bladder. Mast cell play an important sentry and immune modulatory function through UTIs, because to their ability to produce a variety of pre-store pro-inflammatory peacekeepers such TNF, histamine, and numerous chemokine when activated. These mediator are kept in cytoplasmic granule, which announcement their payload gradually afterward existence discharged extracellularly. In mice, significant levels of histamine can be detected in the urine as soon as 30 minutes afterward bladder contagion. It's unknown how bladder mast cell develop triggered when the epithelium is still complete, but it's likely that crops of harassed epithelial cell such ATP, LL-37, and IL-33, which are recognized mast cell activators, play a role. Mast cell-deficient animals had reduced neutrophil responses and lower bacterial clearance in response to UPEC infection, indicating that mast cell production an vital part in the initial staffing of neutrophil (Hayes 2018).

During bladder infection, the number of mast cell in the mucosal area of the bladder upsurges dramatically, indicating that these cells play a particularly dynamic role at this site 44.

Mast cells are pro-inflammatory immune cell throughout the initial stages of contagion, nonetheless when the contagion proceeds to a advanced stage, characteristically 6–12 hours post-infection, mast cell begin to crop anti-inflammatory cytokine e.g. IL-10 to overpower inflammatory replies. This flip appears to happen in tandem with the collapse of the epithelial fence, which might aid epithelial renewal. In the bladder, here are two types of mast cell (mucosal and connective tissue kinds), although it's unclear if one or together of these cell kinds play an anti-inflammatory role. Nevertheles, mast cell in the bladder appear to have a double part in immune rule, seemingly to equilibrium the dissimilar wants of host defense and tissue homeostasi.

2.12 Adaptive Immune Responses

While sizeable innate immune response inside the urinary tract are relatively attentive to infection, adaptive immune response, chiefly in the bladder, are normally restrained. Patient with UTIs that travel to the kidney can crop antibodie exact to the infection agent, whilst sufferers with infections constrained to the bladder fail to crop an antibody reaction for unknown reason. This seeming lack of bladder antibody reaction can be an underlying element within the recurrence of UTI, particularly after bladder infection (Wu *et al.* 2020).

This clinical locating became these days replicated in mouse models, in which UTIs severely constrained to the bladder elicited very slight antibody reaction to the invading micro organism, however bladder and kidney infections elicited a considerable antibody response. Augmented local IL-10 manufacture has been related to a failure of the bladder to mount an adaptive response, as IL-10-deficient mice confirmed sizeable antibody response to bladder infection. Mast cells, as stated in advance, are the primary generator of IL-10 inside the bladder after bacterial contamination. Though these secretory cell have an crucial function in beginning a strong immune reaction within the initial stages of bladder contamination, mast cells appear to opposite their interest approximately 6 h after contagion by using swapping to IL-10 manufacture to prevent this reply.

When mast cells produce IL-10, they stop DCs from expressing co-stimulatory molecules, restricting their volume to function as energetic antigen-supplying cells in demanding lymph node. As a result, the bladder's incapability to base an antibody reaction to a bacterial contamination might be a byproduct of its try and block harmful adaptive immune replies to urine fillings, as well as to ease speedy renewal of the bladder epithelium after contamination-precipitated injury, that is constant with the function of mobile-derived IL-10. Obesity impairs the innate immune reaction.

2.13 Immunomodulatory Therapies

As the nature of immune response in the urinary tract develops clearer, this information might be used to design new and real UTI deterrence, treatment, and organization options. Several of these techniques aim to improve innate immune responses, while others focus on adaptive immunological responses (Gardy *et al.* 2009). Adaptive immune replies aimed at specific mechanisms of uropathogen must been demonstrated to be especially defensive in the urinary system when produced elsewhere than the bladder. The effectiveness of these techniques, however, is nearly entirely dependent on statistics from new mice models.

2.14 IgG

IgG is a form of immunoglobulin that contains the most common type of antibodies seen in the bloodstream. IgG is a monomer found primarily in the serum (Sathe and Cusick 2021). It is the greatest shared form of immunoglobulin, secretarial for over 75% of very immunoglobulins. Because IgGs may penetrate the placenta and reach the baby, they are primarily important for newborn protection during the first month of life. IgGs can be found in the blood, lymph, peritoneal fluid, and cerebrospinal fluid in adults. IgGs are produced in a delayed manner, but only in response to a specific antigen. They do, however, break in the body for longer eras of time. Because IgGs in the serum last a long time, they are useful in passive immunization. Foreign antibodies are injected into the body during passive immunization as vaccines (Figure 2.2).

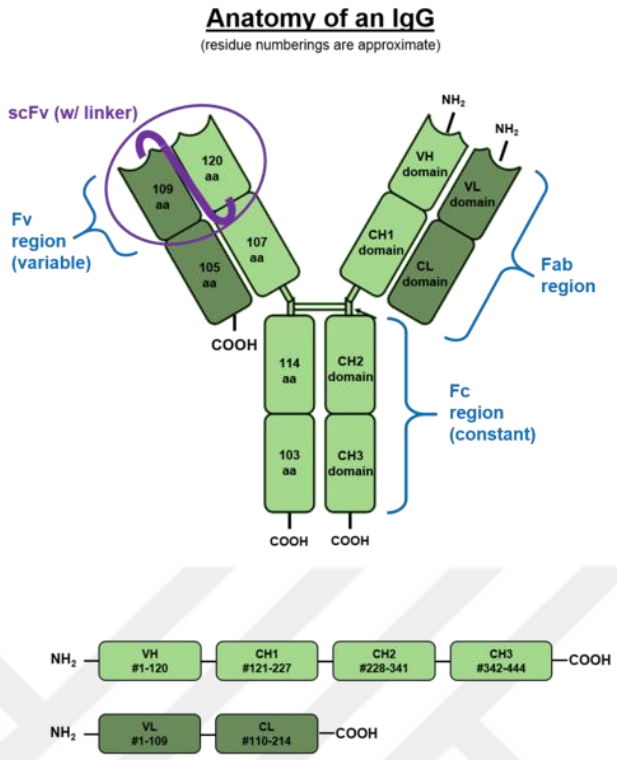

Figure 2.2 Anatomy of an IgG

2.15 IgA

Immunoglobulin A (IgA) is a protein that defends mucosal surface against pathogenic bacteria. Owing to their big surface part and repeated interaction to swallowed and gasped materials, such sites are a important basis of susceptibility. The detail that additional IgA is shaped than altogether other immunoglobulin lessons joint indicates the rank of IgA in fruitful immune protection. IgA is not lone the greatest shared antibody lesson in mucosal sites, but it is too understood in considerable quantities in serum (Woof and Kerr 2006). The IgA heavy chain's unique structural properties allow it to polymerize. In secretions, this results in mostly dimeric procedures with few advanced polymer. Together serum and secretory IgA can neutralize and remove pathogen finished a variety of ways, counting stimulating the IgA Fc receptor recognized as FcRI or CD89 on phagocyte.

The detail that numerous infections have changed methods to prevent IgA-mediate permission highlights the efficacy of these elimination processes

IgA-base monoclonal antibodie are poised to arise as novel and strong therapeutic possibilities as the structure-function linkages underlying the many capabilitie of this immunoglobulin lesson become progressively known, and methods to avoid some characteristic limits are created (De Sousa-Pereira and Woof 2019) (Figure 2.3).

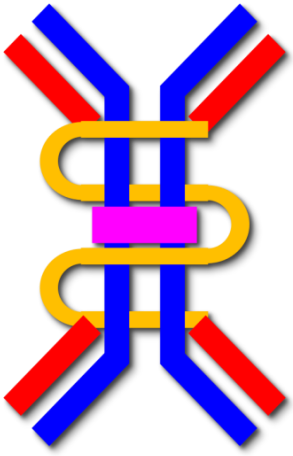

Figure 2.3 Structure of IgA

2.16 Similarities between IgA and IgG

- A secondary immunological response causes both to be created.
- Both are made in reaction to antigens or antigenic markers found in the environment.
- They're both really particular.
- Both polypeptide chains are made up of two heavy chains and two light chains.
- They both take part in the battle against bacterial and viral infections

3 MATERIALS AND METHODS

3.1 Equipment and Materials

Equipment and materials used are shown in Table 3.1

Table 3.1 Equipment and materials used

Origin	Manufacturing company	Equipment
France	Biomerieux	Vitek 2 compact
Germany	Spinreact 3	Auto-Hematology analyzer
England	Gallenkamp	Centrifuge
Switzerland	Butchi	Distillator
England	Gallenghamp	Incubator
England	Gallenghamp	Water bath
Germany	Labcco	Vortex
Japan	Olympus	Light microscope
Germany	Kika-werk VF-2	pH- meter
USA	Difcco	Autoclave
Jordan	AFMA	Petri dish (plastic)
England	Gallenghamp	Magnetic stirrer
Germany	Kika-werk VF-2	Sensitive
Jordan	AFMA	Plastic test tubes
Lebanon	Concord	Refrigerator

3.2 Culture Medium

The culture medium used is shown in Table 3.2

Table 3.2 Culture medium

Manufacturing company	Culture medium
Mast (England)	Blood agar
Oxoid (England)	MacConkey agar
Himedia (India)	Muller-Hinton agar
Oxoid (England)	Eosin methylene blue agar
Himedia (India)	Nutrient agar

3.3 The Antibiotic Discs

Antibiotic discs used in the study are shown in Table 3.3

Table 3.3 Antibiotic discs

Manufacturing company (Origin)	Disc focus	Mg/discs Code	Antibiotic
Bioanalyse (France)	10	AK	Amikacin
Bioanalyse (France)	30	NOR	Norfloxacin
Bioanalyse (France)	30	GN	Gentamycin
Bioanalyse (Turkey)	10	CRO	Ciprofloxacin
Bioanalyse (France)	5	CFM	Cefixime
Bioanalyse (France)	10	DO	Doxycycline
Bioanalyse (France)	30	AMC	Amoxicillin-Clavulacnic Acid

3.4 Methods

3.4.1 Sample collection

This study was conducted in the city of Dhi Qar/Nasiriyah/Al-Haboubi Hospital in February 2022. The study included 100 urine samples and blood samples from women who visited Al Haboubi Hospital. Afterward captivating Essential information from all hospital review ready before in a survey piece, women who had usage antibiotics for treatment were excepted. The tasters obtained were alienated into 3 groups, the first group: 50 non-pregnant women non infection, the second group: 25 pregnant women with a urinary tract infection (UTI) and the third group: 25 pregnant women without a urinary tract infection (UTI).

Microscopical Exam of Urine The method of (Forbes *et al.* 2007) was followed in the examination, then midway urine sample were calm usage sterile glass bottles. area with soap and water, without using sterilizers, with an emphasis on not touching any part of the body to prevent contamination with the natural flora on the skin. He took 5 mL of diuresis, and put the first part of it into the centrifuge (3000 R.P.M) for 5 minutes and

keep the rest in the refrigerator until the transplant date. The filtrate was discarded and a drop was taken from the precipitate and examined below the light microscope to check for the attendance of pus cells, bacterial cells, epithelial cells, red blood cells and other materials such as molds. Casts

3.4.2 Culturing the urine

For the purpose of culturing the urine sample, a loop of vector was used and a drop of it was planted among the blood agar and Maconkey agar, then incubated at 37°C for a period ranging between 18-24 hours, and the plates were inspected to observe any bacterial development.

3.5 Microscopical and Cultural Characteristics

After the colonies grew on the culture media of the primary isolate, they were initially diagnosed based on the morphological and cultivar characteristics that included each of (the size of the colonies).

Its colour, edges and height), and then studying its characteristics under the microscope after staining it with a cream dye (Forbes *et al.* 2007). Identification of Vitek 2 compact:

This device is used to diagnose the types of bacterial isolates and yeasts after confirming them by primary biochemical tests. As the device consists of a case holder and Reagent Cards containing 64 holes, each one signifies the base material or the medium for conducting a test, and plastic tubes, as well as a DensiChek expedient and an information input and output unit, as follows:

1. Preparation of the bacterial suspension: The suspension is prepared according to the instructions of the manufacturer, as follows:

- Prepare sterile plastic tubes.

- Putting 3 mL of saline solution (4.50-5.00% NaCl) into the sterile tube.
- Transfer numerous pure colonies from the culture dish to the tube using a sterile vector loop and mix well pending the solution develops turbid.
- Measuring the turbidity of the suspension using the DensiChek device and rendering to the following Table 3.4:

Table 3.4 Turbidity range

McFarland turbidity range	**Product**
0.63 - 0.50	Gram-negative bacteria = GN
0.63 - 0.50	Gram- positive bacteria = GP
2.20 -1.80	Yeasts = YST

2. Inoculation of the card: Inoculation of the card is carried out according to the next steps:

- Transferring the wedged and the card to the expedient holder and placing them in the places designated for them. Then the card and the stuck are connected through a very thin micro-channel, and the card code is arrived through the scanner.
- Putting the holder in a singular vacuum chamber, as the procedure of vacuuming the air prevents the transmission of microbes to the card as well as their distribution in the holes in it.

3. Card Sealing and Incubation: The delivery channel is cut automatically by the device within 10-15 minutes, and the card is closed, that is, tightly closing the channel harbor to stop any leak, then it is moved to the Carousel incubator and the card are incubate at a temperature of 35.5+1.0°C.

4. Optical System: The optical system in the device projects several bright beam toward the postcard to identify the wavelength of the reactions and interpret them finished color vicissitudes and turbidity as well as the metabolic product.

5. Test Reaction result and Analytical Technique: The expedient works by calculating the result and comparing them with the result stowed in the expedient, which comprises numerous test measurement for a big number of strains that are emerging in dissimilar circumstances and isolate after various places. The expedient shows the result of the test in the form of +, -, (+), (-) and a result in brackets designates that the test is weak.

6. Identification Levels: The level of diagnosis of the object is determined through the map of its test and compared with the taxonomic physiognomies of the expedient. The thing is given a likelihood ratio and a equal of sureness. e.g., if the likelihood ratio is 96-99%, then it is at the level of sureness outstanding.

3.6 Testing the Sensitivity of Bacteria to Antibiotics (Antibiotic Susceptibility Test)

Antibiotic vulnerability testing was performe on Muller-Hinton acar medium Muller-Hinton Agar Using the antibiotic tablets described in paragraph 5-1-3, the bacterial cultures were prepared by transferring one colony to 5 mL of Nutrient broth medium, which was incubate at 37°C for 24 hours. A sterile cotton swab was immerse in the bacterial culture and then feast on the surface of the acre. The plate were allowable to dry at room temperature for 15 minutes, then the antibiotic tablet were transferred with tongs to the surfaces of the agar and incubate at 37°C for 24 h. The result were then read by noting the diameters of the inhibition zones about the antibiotic tablets (Vandepitte *et al.* 2003).

3.7 Statistical Analysis

Data were analyzed through ANOVA, the usage of the General Linear Model of the Statistical Analysis System. Significant variations in remedy have been evaluated the use of Duncan's more than one variety check (Duncan 1955). All significance statements are base on a 0.5 level of likelihood.

3.8 Immunological Examinations

3.8.1 Total white blood cells

The total white cells (CBC) by used Auto-hematology analyzer device (model: SPINAL3)

3.8.2 Immunoglobulin G (IgG)

Procedure

Dilute the standard by small tubes chief, then pipette the volume of 50 µL from every tube to micro plate well, every tube usage two well, total ten well (Figure 3.1).

30 ug/mL	Standard No.1	300 µL Original Standard + 150 µL Standard diluents
20 ug/mL	Standard No.2	300 µL Standard No.1 + 150 µL Standard diluents
10 ug/mL	Standard No.3	150 µL Standard No.2 + 150 µL Standard diluent
5 ug/mL	Standard No.4	150 µL Standard No.3 + 150 µL Standard diluent
2.5 ug/mL	Standard No.5	150 µL Standard No.4 + 150 µL Standard diluent

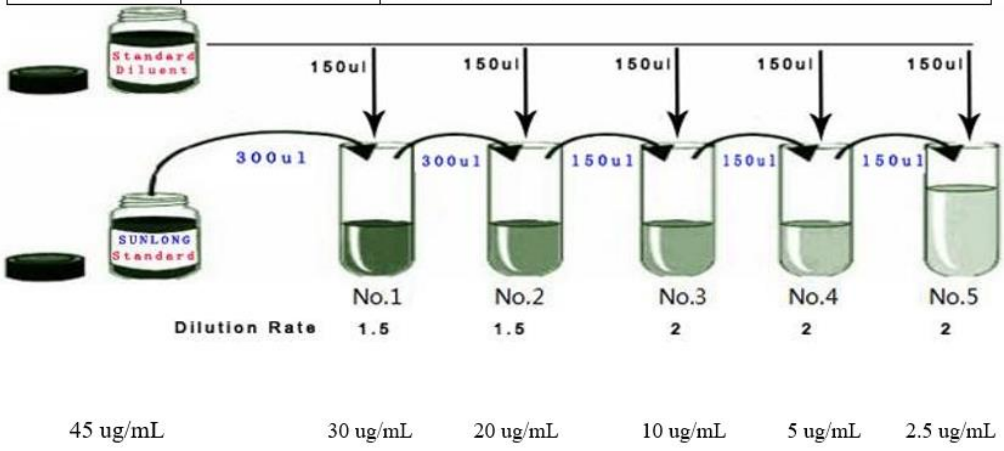

Figure 3.1 Dilution of standards (IgG)

- In the Microelisa mould, depart an empty properly as a blank control. In pattern wells, forty µL pattern buffer and 10 µL pattern (dilution issue five) have been

added. Samples should be loaded downward deprived of moving the properly wall. Mix well with mild shaking.

- Incubation: Incubate half-hour at 37°C after ultimate the membrane plate.
- Dilution: Dilute focused laundry detergent with distilled water (30 instances for 96T and 20 instances for 48T).
- Washing: Carefully peel off the movie of the sealing plate, then pull out and fill up it with the bathing answer. Discard the bathing answer after latent for 30 seconds. Repeat the bathing process five instances.
- Add 50 µL of HRP-Conjugate reagent to every well but for the empty manage nicely.
- Incubation as defined in step 3
- Wash as defined in step 5
- Staining: Add 50 µL of chromogen solution A and 50 µL of chromogen solution B to every well, blend with lightly shaking and incubate at 37°C for 15 min. Please avoid bright even as coloring.
- Termination: Add 50 µL of stop method to all well to terminate the response. The shade of the nicely must change from blue to yellow.
- Read absorbance O.D. At 450 nm the use of a microtiter plate reader. The OD price of the empty manipulate nicely was set as zero. The check must be carried out inside 15 minutes after stopping solution is added.

3.8.3 Immunoglobulin A (IgA)

Procedure

Dilute the standard by small tube chief, then pipette the volume of 50 µL from every tube to micro plate well, each tube usage two well, total ten well (Figure 3.2).

180 ng/mL	Standard No.1	300 µL Original Standard + 150 µL Standard diluents
120 ng/mL	Standard No.2	300 µL Standard No.1 + 150 µL Standard diluents
60 ng/mL	Standard No.3	150 µL Standard No.2 + 150 µL Standard diluent
30 ng/mL	Standard No.4	150 µL Standard No.3 + 150 µL Standard diluent
15 ng/mL	Standard No.5	150 µL Standard No.4 + 150 µL Standard diluent

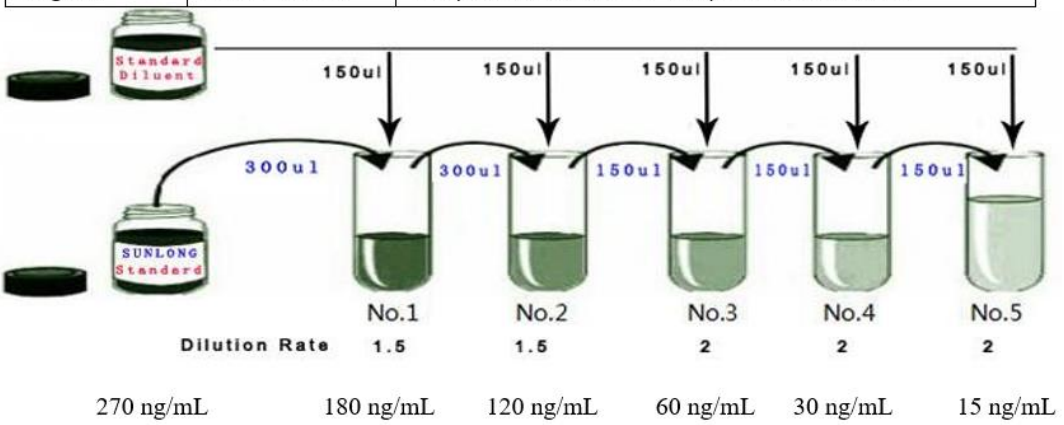

Figure 3.2 Dilution of standards (IgA)

- On the Microelisa plate, depart an empty well along with a blank control. In sample wells, forty µL sample buffer and 10 µL pattern (dilution aspect five) had been delivered. Samples should be loaded downward deprived of moving the properly wall. Mix properly with mild shaking.
- Incubation: Incubate 30 min at 37 after remaining the membrane plate.
- Dilution: Dilute focused laundry detergent with distilled water (30 times for 96T and 20 times for 48T).
- Washing: Carefully peel off the sealing plate film, then pull out and top off with the showering solution. Discard the washing solution after latent for 30 seconds. Repeat the showering system 5 times.
- Add 50 µL of HRP-Conjugate reagent to every nicely besides for the empty manage properly.
- Incubate as defined in step 3.
- Wash as defined in step 5.
- Staining: Add 50 µL of chromogen answer A and 50 µL of chromogen answer B to every well, mix with lightly shaking and incubate at 37 °C for 15 min. Please avoid light whilst coloring.

- Termination: Add 50 µL of the prevent option to every nicely to terminate the response. The color of the well must alternate from blue to yellow.
- Read absorbance O.D. At 450 nm the use of a microtiter plate reader. The OD price of the empty manipulate properly became set as zero. The assess ought to be approved out within 15 mins after stopping answer is delivered.

Notes:

- Store the kit at 4°C upon receipt. The series should be equilibrated to room temperature previous to exam. Eliminate any needless strips from the IgA-coate human frame plate, reseal it with zip lock foil and maintain at 4°C.
- Sediment might additionally appear within the focused wash solution. Please heat the buffer till it melts

Not all sediments will have an effect on the results.

- A satisfactory pipette have to be usage to avoid new blunders. Samples have to be brought to the Microplate in less than five mins. If a massive wide variety of samples are protected, a multichannel pipette is optional.
- A trendy curve must be blanketed in each assay. It is usually optional to copy the wells. If the OD cost of the sample is extra than the primary well of the requirements, satisfy dilute the pattern (number of times) before testing. When scheming the unique IgA concentration, please

Multiply the full dilution element (XnX5).

- In order to keep away from move-infection, the micro-plate seals are one-time usage best.
- Please maintain the substrate absent from light.
- All operations have to be in strict agreement with the producer's instructions. Results determined through Microtiter plate reader.

- All samples, laundries and waste ought to be dealt with as infectious retailers.
- The outcomes from the one-of-a-kind companies must now not be combined.

3.8.4 Interleukin-10

Procedure

Dilute the standard by small tube chief, then pipette the volume of 50 µL from every tube to micro plate well, every tube usage two well, total ten well (Figure 3.3).

90pg/mL	Standard No.1	300µl Original Standard + 150 µL Standard diluents
60pg/mL	Standard No.2	300µl Standard No.1 + 150 µL Standard diluents
30pg/mL	Standard No.3	150µl Standard No.2 + 150 µL Standard diluents
15pg/mL	Standard No.4	150µl Standard No.3 + 150 µL Standard diluents
7.5pg/mL	Standard No.5	150µl Standard No.4 + 150 µL Standard diluents

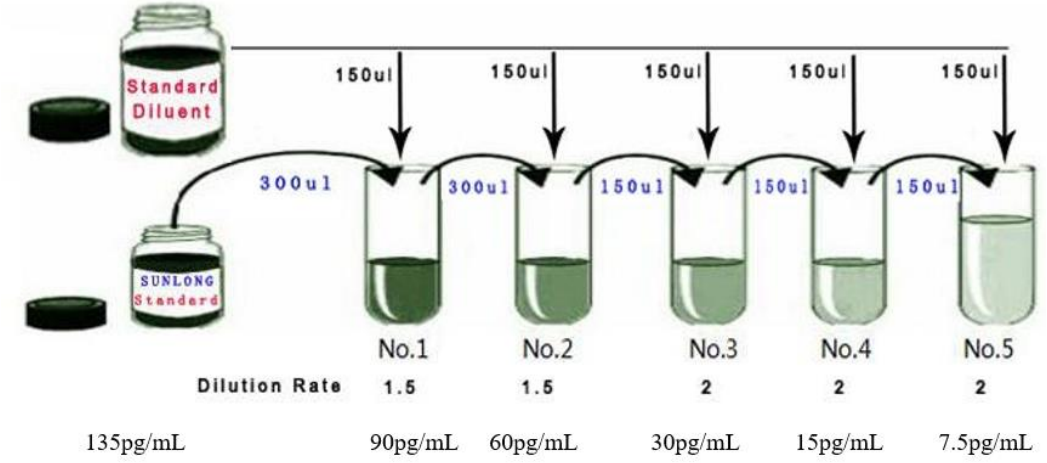

Figure 3.3 Dilution of standards Interleukin-10

- In the Microelisa mildew, depart an empty nicely as a clean manipulate. In sample wells, 40 µL. Sample dilution buffer and 10 µL sample (dilution thing five) have been delivered. Samples ought to be loaded downward without moving the nicely wall. Mix nicely with gentle shaking.
- Incubation: Incubate half-hour at 37°C after closing the membrane plate.
- Dilution: Dilute focused laundry detergent with distilled water (30 times for 96T and 20 times for 48T).

- Washing: Carefully peel off the movie of the sealing plate, then pull out and top off it with the washing answer. Discard the showering answer after latent for 30 seconds. Recurrence the washing method 5 instances.
- Add 50 μL of HRP-Conjugate reagent to every well besides for the empty manage properly.
- Incubation as defined in step 3.
- Wash as described in step 5.
- Staining: Add 50 μL of chromogen solution A and 50 μL of chromogen solution B to all nicely, mix with mildly shaking and incubate at 37°C for 15 min. Please keep away from light even as coloring.
- Termination: Add 50 μL of prevent technique to every well to terminate the reaction. The colour of the well need to alternate from blue to yellow.
- Read absorbance O.D. At 450 nm the use of a microtiter plate reader. The OD value of the empty manage nicely changed into set as zero. The take a look at need to be performed within 15 minutes after preventing answer is added.

3.8.5 Interleukin-6

Procedure

Dilute the standard by small tube first, then pipette the volume of 50 μL from every tube to micro plate well, every tube usage two well, total ten well (Figure 3.4).

180 pg/mL	Standard No.1	300µl Original Standard + 150 µL Standard diluents
120 pg/mL	Standard No.2	300µl Standard No.1 + 150 µL Standard diluents
60 pg/mL	Standard No.3	150µl Standard No.2 + 150 µL Standard diluents
30 pg/mL	Standard No.4	150µl Standard No.3 + 150 µL Standard diluents
15 pg/mL	Standard No.5	150µl Standard No.4 + 150 µL Standard diluents

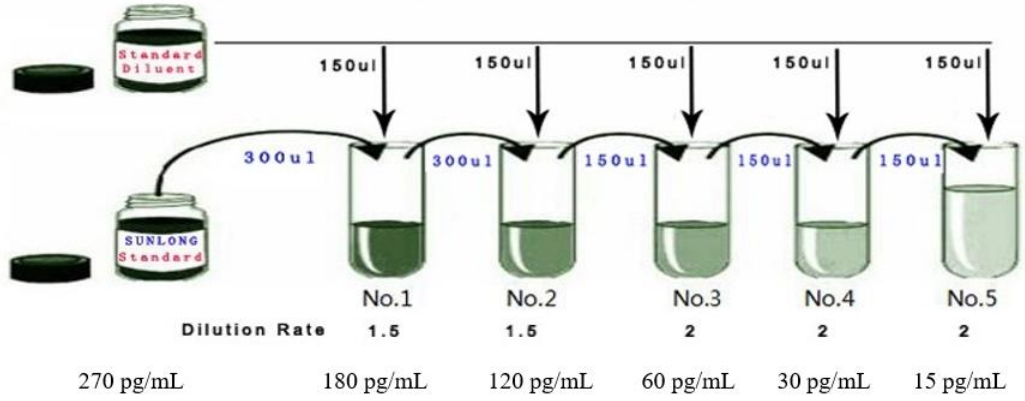

Figure 3.4 Dilution of standards Interleukin-6

- In the Microelisa mold, go away an empty well as a blank manage. In pattern wells, 40 µL pattern buffer and 10 µL pattern (dilution aspect 5) have been added. Samples have to be loaded downward deprived of moving the properly wall. Mix nicely with mild shaking.
- Incubation: Incubate 30 minutes at 37°C after closing the membrane plate.
- Dilution: Dilute concentrate laundry detergent with distilled water (30 instances for 96T and 20 instances for 48T).
- Washing: Carefully peel off the film of the sealing plate, then pull out and top off it with the washing solution. Discard the showering answer after resting for 30 seconds. Recurrence the bathing system 5 times.
- Add 50 µL of HRP-Conjugate reagent to each nicely but for the empty manage well.
- Incubation as defined in step 3.
- Wash as defined in step five.
- Staining: Add 50 µL of chromogen solution A and 50 µL of chromogen solution B to every well, blend with gently shaking and incubate at 37°C for 15 min. Please keep absent from mild whilst coloring.

- Termination: Add 50 μL of prevent option to every nicely to terminate the response. The colour of the nicely ought to alternate from blue to yellow.
- Read absorbance O.D. At 450 nm the use of a microtiter plate reader. The OD price of the empty control well became set as zero. The assays have to be done inside 15 mins after preventing answer is introduced.

Notes:

- Store the package at 4°C upon receipt. The series need to be equilibrated to room temperature previous to examination. Eliminate any pointless strips from the human anti-IL-6 antibody-lined plate, re-seal them with zip lock foil and keep at 4°C.
- Sediment may additionally appear in the focused wash answer. Please heat the buffer until it melts

Not all sediments will have an effect on the consequences.

- A nice pipette must be used to keep away from experimental blunders. Samples must be delivered to the Microplate in much less than five minutes. If a big variety of samples are comprised, a multichannel pipette is suggested.
- A trendy curve ought to be protected in each assay. It is usually optional to copy the wells. If the OD value of the taster is more than the primary well of the standards, satisfy dilute the taster (number of instances) earlier than checking out. When calculating the authentic IL-6 awareness, please

Multiply the entire dilution component (XnX5).

- In order to avoid pass-contamination, the micro-plate seals are one-time usage simplest.
- Please preserve the substrate far from light.

- All operations must be in strict agreement with the manufacturer's commands. Result determined by means of Microtiter plate reader.
- All sample, laundries and waste must be handled as infectious marketers.
- The outcomes from the one-of-a-kind corporations have to not be blended.

4 RESULTS AND DISCUSSION

4.1 Study Samples

Table 4.1 results showed that 25 (100%) of pregnant women (positive) suffer from urinary tract infection and have bacterial growth, while 25 (33.34%)of pregnant women did not get bacterial growth and were considered (negative), while non-pregnant women showed 50 (66.66%) no Bacterial growth (negative)

Table 4.1 Results of bacterial culture of the samples under study

Pregnant with out UTI	Pregnant with UTI	non-pregnant	Number	Bacterial Culture
0 (0%)	25 (100%)	0 (0%)	25	Growth
25 (33.34%)	0 (0%)	50 (66.66%)	75	No growth
100 (100%)			100	Total

Urinary tract infections (UTIs) are frequently encountered in pregnant women. Pyelonephritis is the most common serious medical condition seen in pregnancy. Thus, it is crucial for providers of obstetric care to be knowledgeable about normal findings of the urinary tract, evaluation of abnormalities, and treatment of disease. Fortunately, UTIs in pregnancy are most often easily treated with excellent outcomes. Rarely, pregnancies complicated by pyelonephritis will lead to significant maternal and fetal morbidity. Changes of the urinary tract and immunologic changes of pregnancy predispose women to urinary tract infection. Physiologic changes of the urinary tract include dilation of the ureter and renal calyces; this occurs due to progesterone-related smooth muscle relaxation and ureteral compression from the gravid uterus. Ureteral dilation may be marked. Decreased bladder capacity commonly results in urinary frequency. Vesicoureteral reflux may be seen. These changes increase the risk of urinary tract infections (Johnson *et al.* 2021).

The pathogenic bacteria that responsible for pregnant women infections are similar to those present in the general population. Most bacteria infect UT among pregnant women

belong to the family of *Enterobacteriaceae* that commonly present normally in the gastrointestinal tract. Previous study showed *Escherichia coli* was (63–85%) the most responsible bacteria for UTI followed by coagulase-negative *Staphylococcus* (>15%), *Klebsiella pneumoniae* (~8%), S. aureus (>8%), and group B *streptococci* (2–7%) (Ghaima *et al.* 2018).

Recent study showed the urine microscopy of pregnant women with UTIs appeared *Escherichia coli* (*E. coli*) was the commonest bacterial isolate (49.9%), and other microorganisms isolated included *Klebsiella* species (14.4%), *Enterococcus faecalis* (12.9%) and coagulase-negative *staphylococci* (CoNS); (8.9%) (Orji *et al.* 2022).

Another study showed the bacterial growth in pregnant with UTIs was (35%). Gram-negative bacteria were more prevalent (73%): *Klebsiella pneumoniae* 52(37.41%), *Escherichia coli* 40(28.78%), *Pseudomonas aeruginosa* and *Proteus mirabilis* 7(5.04% each), *Citrobacter freundii* 1(1%). *Staphylococcus aureus* 33(23.57%) was the only gram-positive isolate (Johnson *et al.* 2021).

However, sexual intercourse, urination after sex, diaphragm use, the indwelling of a urinary catheter, earlier surgical procedure, presence of stones in the kidney, intrauterine device, poor sanitary condition, malnutrition, and low-socioeconomic status especially in the rural areas represent the major risk factors that involved in the UTIs development (Oladeinde *et al.* 2015).

4.2 Diagnostics of the Samples Under Study

4.2.1 *E. coli*

The results showed in Figure 4.1 that the bacteria were fermenting the sugar lactose, which gave pink, smooth and shiny colonies with a sharp edge on the center of the differential component, which contains yellow salts and crystal violet dye, which allows the development of gram-negative bacteria, including the intestinal family, and inhibits

the growth of positive bacteria. For Gram stain, the isolates gave small gray colony colonies on medium (blood agar).

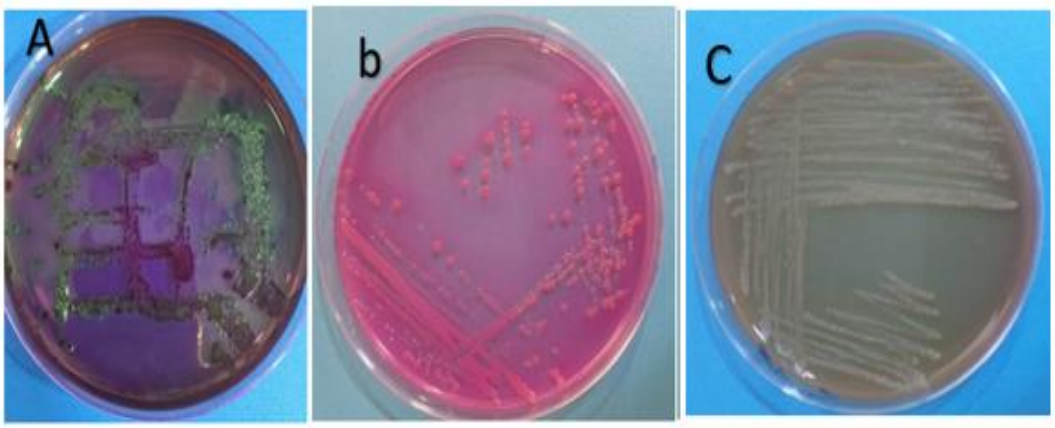

Figure 4.1 Morphological figure of *E. coli* colonies on: **a)** Eosin methylene blue agar, **b)** MacConkey agar, **c)** blood agar

4.2.2 *Klebsiella pneumonia*

The results of Figure 4.2 showed the growth on MacConkey agar medium that fermented lactose sugar and formed bright pink colonies with a mucous texture, which is a distinctive feature of this bacteria.

Figure 4.2 Klebsiella pneumonia growth on MacConkey

4.3 Bacterial Growth of Isolates

Results of Table 4.2 showed the *Escherichia coli* scored highest percentage 20 (100%) (positive) in pregnant with UTI, while it scored 0 (0%) (negative) in non pregnant and pregnant without UTIs. Also, *Klebsiella pneumoniae* scored highest percentage 5 (100%) (positive) in pregnant with UTI, while it scored 0 (0%) number (negative) in non pregnant and pregnant without UTIs.

Table 4.2 Types of bacterial isolates that cause UTIs and the isolates under study

pregnant with out UTI	pregnant with UTI	non-pregnant	N	Bacteria
0 (0%)	20 (100%)	0 (0%)	20	*Escherichia coli*
0 (0%)	5 (100%)	0 (0%)	5	*Klebsiella pneumoniae*
25 (100%)			25	Total

Previous results revealed that the urinary tract infection caused by *K. pneumoniae* and *E. coli* are more prevalence in female than male. The percentage of *K. pneumoniae* isolates was in 88% in female while in male was 25% (Shakya *et al.* 2017). This is understandable due to the anatomy and it is in agreement with trend worldwide. The study is compatible with (Jadhav *et al.* 2011) and also because bacteria can reach more easily the bladder in women, partially due to the short and wider urethra of female, and its proximity to the anus (Turay *et al.* 2014). Scientific information indicates that bacteria easily move up to the urethra from the rectum and thereby it causes infection (Rizwan *et al.* 2018). The ages of patients were from 2 months to 72 years, among these elderly patients are likely predisposed to conditions such as obstruction of urinary tract, poor bladder emptying and diabetes mellitus, etc. These factors favor colonization of bacteria and play an important role in UTI (Han *et al.* 2015).

(Eghbalpour *et al.* 2022) showed 36% of *E. coli* in pregnant women with UTIs, and these results were lowest than present results that showed 100% of *E. coli* in pregnant women with UTIs. Additionally, (Bizuwork *et al.* 2021) showed 30% of *E. coli* in pregnant women with UTIs, and these results were lowest than present study that scored 100%. In

contrast, (Banda *et al.* 2020) showed 71.5% of *E. coli* in pregnant women with UTIs, and these results were nearly to present study. The possible reason for such difference could be due to variation in care during urine collection, difference in socioeconomic status, and genital hygienic practices among pregnant women from different backgrounds (Enayat *et al.* 2008). Presence of high load of bacteria in the urine of pregnant women is reported to lead to complications like pyelonephritis and septicemia and may also result in low birth weight and still birth (Sheiner *et al.* 2009). Among *E. coli* strains isolated from patients with UTIs, different features phylogroups, with special virulence factors, could cause severe infection. Awareness about the virulence patterns distribution among phylogenetic groups of UPEC could greatly aid in confine and prevent the development of lethal infection caused by these strains (Eghbalpour *et al.* 2022).

In pregnant women, the odds of acquiring urinary tract infections (UTI) from untreated bacteriuria is high, with consequent risk for preterm labour. Pregnant woman diagnosed with bacteriuria are thus offered antibiotics to prevent complications. The extraintestinal pathogenic *E. coli* (ExPEC) are a major cause of UTI in pregnancy. The ExPEC harbour diverse but specific virulence factors (VFs) with the potential to colonize highly specialized ecological niches, such as the urogenital tract (Forson *et al.* 2018). Previous study showed the number one admission diagnosis in women with UTI due to *E. coli* was threatened preterm labor, and fever and threatened abortion (Dautt-Leyva *et al.* 2018).

High risk of acquiring *E. coli* urinary tract infection could be due to the anatomical and the physiological changes that occur during pregnancy and the fact anatomical proximity of the anal and urogenital opening in females makes it possible for fecal contamination of the urinary tract from commensals of the bowel of which *E. coli* is a typical example and since most *E. coli* strains and other bacteria prefer that environment, they are able to persist and cause UTI (Banda *et al.* 2020).

UTI affects all age groups particularly in females that are observed more prevalent than in males. It was reported from 50 to 70% of all women during her lifetime particularly pregnant women will acquire one UTI at least. In pregnant women, increasing of UTI infection during the pregnancy stage due to the physiological, immune system, and

anatomical changes in UT. Also, old age, diabetes mellitus, sickle cell anemia, parity, UTI history, disorders of the UT, and the increase in the risk of UTI among pregnant women may be resulting from immune deficiency (Uddin and Khan 2016).

Among seven identified Gram negative bacterial species, *E. coli* (57.8%), was the predominant followed by *Klebsiella* spp. (31.4%) in children with UTIs (Ganesh *et al.* 2019).UTI occurs when *E. coli* and/or other gastrointestinal tract flora enters urinary tract (McLellan and Hunstad 2016). Previous study mentioned the UTI was seen more frequently in girls than in boys, and that may be attributed to shorter female urethra and other additional factors (Giri *et al.* 2020). The prevalence of UTI is higher in males than females in the first three months of life, however after the first year of life it is higher in females (Shaaban *et al.* 2021).

A study by (Ahmed 2021) in Egypt explains that *E. coli* was present with the highest frequency in pregnant women in the age group of 21–30 years, the higher presence in this age group could be due to the fact that women are more sexually active and intensive intercourse could lead to minor urethral damage and also transfer bacteria from the perineum to the urethra and bladder which made them more susceptible to UTIs (Derese *et al.* 2016).

A study done by (Almukhtar 2018) in Kirkuk, Iraq from 450 urine samples found that *E. coli* accounted for 11.7% for pregnant women while it accounted for 21% and 44% for married and single women, respectively. Another study done by (Al-Nasrawi and Al-Hashimy 2020) in Al-Najaf, Iraq from 500 urine samples, 27.82% of it define as *E. coli*. (El-Kashif 2019) detected in a study in Saudi Arabia on 303 pregnant women, *E. coli* accounted for 37% while (Azami *et al.* 2019) in Iran found that *E. coli* was present in 63.3% in pregnant women.

It is apparent from the studies mentioned above and this study that *E. coli*'s presence in pregnant women is high and this could be due to physiological reasons, pregnancy's effects on the woman's body which could make her more susceptible to infectious microorganisms, or the high presence of albumin and other amino acids in a pregnant

woman's body which makes her a suitable environment for microorganisms capable of causing UTI (Almukhtar 2018). The weakening of the immune system and the incapability of a pregnant woman to take antibiotics during the first trimester increase a pregnant woman's risk of getting a UTI (Almukhtar 2018).

On the other hand, (Odongo *et al.* 2020) in Uganda noticed that *E. coli* was found in 10% of their samples, and that 52% of these *E. coli* samples were isolated from women compared to 48% men. The reason for these difference in *E. coli*'s prevalence could be due to geographical, health reasons, social habits and economic state of the community, awareness and hygiene, period when samples were collected and their amount in addition to taking antibiotics before sample collection (Almukhar 2018). *E. coli*'s higher presence in women than men could be caused by the close proximity of the anus to the urethral tube. Also, the urethral tube of the female body is shorter than that of men which shortens the distance microorganisms have to travel to get to the bladder (Odongo *et al.* 2020). *E. coli*'s presence might be contributed to the microorganism's adaptation to the harsh environment of the urinary tract. The high number of virulence factors help the bacteria not only to survive but also cause infection and disease, and the capability of the bacteria to travel from the anus, which is its natural habitat, to the urethral tube due to the short distance these two are from each other could be one of the most important reasons for UTIs (Raeispour and Ranjbar 2018).

The present study showed 100% of *K. pneumonia*e isolates were present in pregnant with UTIs. The reason for the appearance of *K. pneumonia*e in the urine at a higher rate is using catheters for a long period of time, especially in patients stay-ing in hospitals beside causing UTIs in older women (Petrosillo *et al*. 2019). Recently *K. pneumoniae* was reported as one of the most important clinical organisms that has acquired much public health concern. *K. pneumoniae* is a worldwide and ubiquitously Enterobacteriaceae, it is considered as one of the opportunistic pathogens causing broad spectra of dis-eases and shows the acquisition of resistance to antibiotics (Effah *et al.* 2020, Jean *et al.* 2020).

Recent studty showed the overall occurrence of *Klebsiella* spp. and *K. pneumoniae* was found to be 23.2% and 16.8% respectively in pregnant women with UTIs (Bobbadi *et al.* 2021).

4.4 Testing the Sensitivity and Resistance of the Bacteria Under Study to Antibiotics

Sensitivity was tested using 7 types of antibiotics used to treat UTIs for 25 bacterial isolates of UTIs associated with pregnant women. For *E. coli*, the isolate was most sensitive to Amikacin (75%), Norfloxacin (65%) and Gentamycin (65%). On the other hand, these isolates resist Amoxicillin-Clavulacnic Acid (35%) and Doxycycline (30%) (Table 4.3).

Table 4.3 Results of the sensitivity test for the antibiotics of the isolates type *Escherichia coli*

Resistant isolates (R) (%)	Medium Sensitive isolates (MS) (%)	Sensitive isolates (S) (%)	Antibiotic
2 (10)	3 (15)	15 (75)	Amikacin
4 (20)	3 (15)	13 (65)	Norfloxacin
3 (15)	4 (20)	13 (65)	Gentamycin
5 (25)	5 (25)	10 (50)	Ciprofloxacin
5 (25)	6 (30)	9 (45)	Cefixime
6 (30)	4 (20)	10 (50)	Doxycycline
7 (35)	6 (30)	7 (35)	Amoxicillin-Clavulacnic Acid

(Jakobsen *et al.* 2007) showed 77% of *E. coli* isolates are sensitive to gentamicin, and these results nearly to present results that showed 65% of *E. coli* isolates are sensitive to gentamicin. Antimicrobial resistance in *E. coli* has been reported worldwide and increasing rates of resistance among *E. coli* is a growing concern in both developed and developing countries (El Kholy *et al.* 2003). A rise in bacterial resistance to antibiotics complicates treatment of infections. In general, up to 95 % of cases with severe symptoms are treated without bacteriological investigation (Dromigny *et al.* 2005). Occurrence and susceptibility profiles of *E. coli* show substantial geographic variations as well as significant differences in various populations and environments.

(Kibret and Abera 2011) showed the *E. coli* isolates showed high rates of resistance to erythromycin, Amoxicillin-Clavulacnic Acid and tetracycline, and these results matched with present study that showed *E. coli* isolates was resisit to Amoxicillin-Clavulacnic Acid.

Previous study showed the use of fosfomycin in combination with gentamicin seems to be a promising therapeutic approach against *E. coli* biofilm related infections. Nevertheless, against both Gram-negative species, combination of gentamicin with ciprofloxacin represents the most optimal treatment option (Wang *et al.* 2019). Further in vivo and clinical studies are essential to define the potential treatment regimen based on the combination of these two antibiotics.

(Daoud *et al.* 2020) showed the most common antibiotic resistance rate in *E. coli* was observed for ampicillin and amikacin, and these results were contrast to present study that showed gentamicin and amikacin have no activity in treating *E. coli*. These high levels of *E. coli* resistance to ampicillin may be a consequence of frequent and inappropriate use of this antibiotic in empirical therapy. That's why, ampicillin is no longer recommended for empirical treatment of UTIs (Yılmaz *et al.* 2016). Activity of amikacin against uropathogen *E. coli* evolved in a 2-phase pattern during the study period with an increase since 2015; the change in interpretation criteria might be behind this evolutio (Daoud *et al.* 2020).

Authors observed that amikacin could be an excellent empirical UTI treatment option in these patients infecting with *E. coli* (Salas-Mera *et al*. 2016). Other authors have already proposed the use of amikacin in this population, given its adequate coverage for other common uropathogens and its excellent diffusion to the renal parenchyma (Rezaee and Abdinia 2015).

(Choe *et al.* 2018) showed the amikacin outpatient parenteral antibiotic therapy (OPAT) represents a feasible therapeutic option for non-bacteremic urinary tract infections (UTIs) caused by extended-spectrum β-lactamase-producing *Escherichia coli* (ESBL-EC) in settings with limited resources. Amikacin displayed similar, if not better, susceptibility

rates versus the majority of available antibiotics, particularly against the *E. coli*, *K. pneumoniae*, and *P. aeruginosa* populations (Kuti *et al.* 2018).

Previous data highlight the continued potency of amikacin and suggest that the achievable lung concentrations of approximately 5000 mg/L with the administration of the amikacin by inhalation (Amikacin Inhale, BAY41-6551) will exceed the MICs typically observed for *P. aeruginosa*, *E. coli* and *K. pneumoniae* in the hospital setting (Sutherland *et al.* 2016).

Previous study showed all gentamicin-resistant *E. coli* strains were amikacin-sensitive. The presence of chronic conditions and antibiotic prophylaxis could be potential risk factors for gentamicin-resistant *E. coli* community-acquired urinary tract infection (CA-UTI) in children (Roldan-Masedo *et al.* 2019).

Authors confirmed that the combination of nitrofurantoin and amikacin possesses a significantly synergistic effect on MDR UPEC in vitro. In addition, Authors demonstrated for the first time that this drug combination was significantly synergistic effect on MDR UPEC in the *G. mellonella* model. Study findings constitute an alternative and promising therapeutic option for the treatment of UTIs caused by MDR UPEC (Zhong *et al.* 2020)

Previous study showed the antimicrobial resistance pattern of *E. coli* was high for commonly antimicrobial agents used inoutpatients; especially quinolone, cotrimoxazole and cephalosporin. However, due to low resistance levels, fosfomycinand amikacin could be considered as effective treatment options for community acquired UTIs (Sangsuwan *et al.* 2021).

Sensitivity was tested using 7 types of antibiotics used to treat UTIs for 25 bacterial isolates of UTIs associated with pregnant women. For *Klebsiella pneumoniae*, the isolate was most sensitive to Amikacin (60%), Norfloxacin (40%) ,Gentamycin (40%), and Cefixime (40%). On the other hand, these isolates resist Amoxicillin-Clavulacnic Acid (60%) and Gentamycin (40%), and Cefixime (40%) (Table 4.4).

Table 4.4 Result of the sensitivity test for the antibiotics of the isolates type *Klebsiella pneumoniae*

Resistant isolates (R) (%)	Medium Sensitive isolates (MS) (%)	Sensitive isolates (S) (%)	Antibiotic
0(0)	2(40)	3(60)	Amikacin
1(20)	2(40)	2(40)	Norfloxacin
2(40)	1(20)	2(40)	Gentamycin
2(20)	3(60)	1(20)	Ciprofloxacin
2(40)	1(20)	2(40)	Cefixime
1(20)	3(60)	1(20)	Doxycycline
3(60)	1(20)	1(20)	Amoxicillin-Clavulacnic Acid

(Shakya *et al.* 2017) showed the obtained results indicate that the isolates of *K. pneumoniae* were highly resistant in term multi-drug resistant pathogen, especially against cephalosporines and pencillins, as well as increased resistance percentage to gentamycin, trimethoprim/sulfamethoxazole and amikacin was found, and these results similar to present study that showed the isolates of *K. pneumonia* was resist to gentamicin.

(Jalil and Al Atbee 2022) showed the *E. coli* isolates showed a variable levels of resistance to to Gentamicin (31%) and Amikacin (17%), which belongs to aminoglycoside antibiotics, and these results nearly to present study that showed the *E. coli* isolates was resisit to Gentamicin (40%).

The emergence of resistant *K. pneumoniae* bacteria is considered as an evidence of development of resistance, due to the possess mechanisms of resistance to carbapenems include production of lactamases and mutations that alter the expression and/or function of porins and PBPs (Bleriot *et al*. 2020). Combinations of these mechanisms can cause high levels of resistance to carbapenems in *K. pneumoniae* (Ugakli and Dogan 2020). It is very important for public healthcare departments to monitor and report the changes in antimicrobial resistant isolates (Effah *et al*. 2020).

In his local study, (Al-Mauwasi 2018) illustrated that the resistance rate of *K. pneumoniae* clinical isolates was 81.42% resistant to Cefotaxime, 74.28% to Augmentin, 62.85% for

Amikacin, 55.71% for Gentamycin, 55.71% for Tetracycline, 45.71% for Ciprofloxacin, 42.85% for Impenem and 38.57% for Piperacillin.

In another recent local study done by (Al-Rubyaie 2021) showed that the percentage of Tetracycline and Augmentin were about 100% against *K. pneumoniae* isolates, while the percentage of resistance of Cefotaxime was 80.0%, and the percentage of resistance to Ciprofloxacin was 36.0%, the percentage of resistance to Piperacillin was 28.28% followed by 16.0% to both of Impenem and Amikacin.

A study by (Nirwati *et al*. 2019) showed that *K. pneumoniae* isolates were 100% sensitive to Amikacin. Ciprofloxacin and Amoxicillin-Clavu-lanic acid showed resistance of rate 38.75% and 36.69%, respectively. An other study done by (Cepas *et al*. 2019), showed that 40% of *K. pneu-moniae* strains were resistant to Ciprofloxacin and Amoxicillin-Clavulanic acid. The relative variation in the patterns of resistance of *K. pneumoniae* towards the antibiotics occurs due to many reasons like size of studied sam-ples, geographical differences, source of specimens, site of infection, and predisposition patient, but it is generally seen from the general context of the antibiogram that the *K. pneumoniae* were multi-drug resistant patho-gens and they have a relatively high level of resistance to Cephalosporins (Abdel-Rhman 2020).

A recent local study by (Kareem *et al.* 2021) revealed the emergence of efflux pump-mediated drug resistance in MDR *K. pneumoniae* bacteria in Iraq. Another recent study for a total (107) clinical *K. pneumoniae* isolates showed that all isolates were MDR to minimum 6 and maximum 14 anti-biotics out of 17 (Fatima *et al*. 2021).

However, the current results have shown consistent with many other studies such as (Hussein 2018) which showed variable levels of resistance in urinary *K. pneumoniae* isolates which have, in general, high rates of resistance to the most commonly used antimicrobial agents. It is necessary to follow proper infection control practices and physicians should be aware of the patients with such risk factors.

4.5 Total White Blood Cells

The results of Figure 4.3 showed the WBCs scored least level at pregnant women without UTIs (7100) compared to pregnant women with UTIs that scored highest levels of WBCs (8800) wıth sıgnıfıcant dıfferences ($p<0.05$) among three groups.

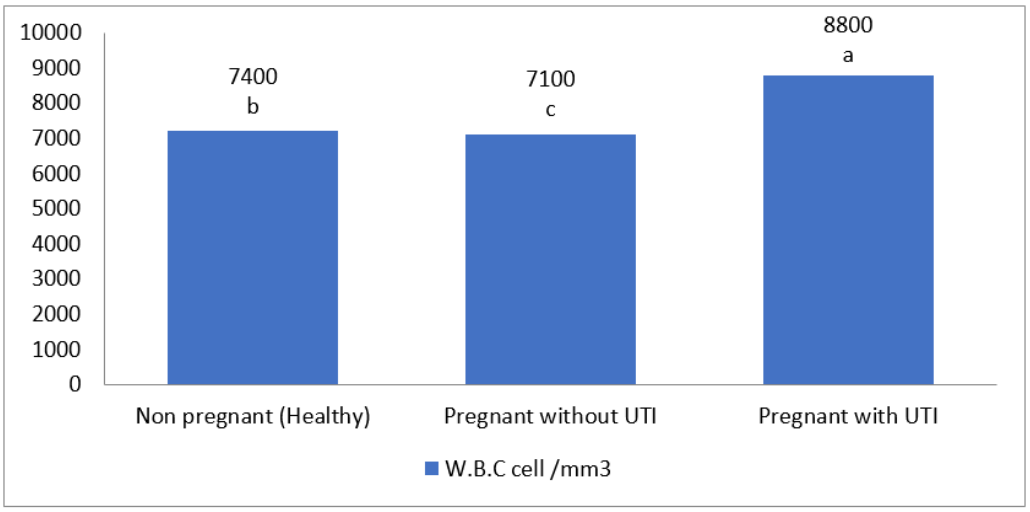

Figure 4.3 Total white blood cells in non-pregnant, pregnant with UTI and pregnant with out UTI women

The present study showed low levels of WBCs in pregnant without UTIs and high levels of WBCs in pregnants with UTIs due to impaired immune status in pregnat women and increase immune response to microbial infection in patients with UTIs. In many labs, the presence of nitrites or leukocyte esterase will automatically trigger a microscopic evaluation of the urine for bacteria, WBCs, and RBCs. On microscopy, there should be no visible bacteria in uninfected urine, so any bacteria on Gram-stained urine under high field microscopy is highly correlated to bacteriuria and UTIs. A good urine sample with greater than 10 WBC/HPF is abnormal and highly suggestive of a UTI in symptomatic patients (Byron 2019). Study findings showed that ESR and differential leukocyte count are two valuable tests in febrile UTI and may be useful for localization of UTI level, but the total leukocyte count and CRP level as in qualitative methods are not useful, and many patients with febrile UTI do not have leukocytosis (Naseri 2008). Recent study showed the probability of UTI in young children significantly increases with WBCs, and/or many

or greater bacteria on urinalysis. Therefore, these findings can be used to more accurately predict the probability of true UTI in children (Liang *et al.* 2021).

There are marked changes in WBC in pregnancy, with substantial differences between cell subtypes. WBC are measured frequently in pregnant women in obstetric and non-obstetric settings, and results should be interpreted using a pregnancy-specific reference intervals (RI) until delivery, and between days 7-21 after childbirth (Dockree *et al.* 2021).

Total WBC was persistently elevated between 8-40 weeks of gestational age (5.7-15.0×109/L) (Chandra *et al.* 2012). This is primarily driven by increased neutrophils (3.7-11.6×109/L), which remained stable throughout pregnancy, consistent with previous studies (Pramanik *et al.* 2007). This confirms the need for a pregnancy-specific RI, but refutes the need for partitioned, gestational-age specific limits. This demonstrates a similar pattern to CRP, the other main inflammatory marker used in pregnancy, which is persistently raised from the first trimester, and which is most accurately interpreted using a single pregnancy-specific RI at any stage of pregnancy (Dockree *et al.* 2021).

Small studies have investigated the value of a raised neutrophil count for diagnosing infection in pregnancy when using this upper threshold (15×109/L) and, while the sensitivity and specificity of using this a standalone tool were limited (53% and 73%, respectively), (Oludag *et al.* 2014) this was an overall improvement on studies that used lower limits (Sabogal *et al.* 2018). While neutropenia is technically anything below the lower reference limit, the threshold for treatment for febrile neutropenia is substantially lower (0.5-1.0×109/L). Importantly, a severe neutropenia has been reported in several cases of maternal COVID-19, and clinicians should remain vigilant for a very low neutrophil count in pregnant women (Dockree *et al.* 2021).

4.6 Immunoglobulin A (IgA)

The results of Figure 4.4 showed the IgA scored least level at pregnant women without UTIs (130) compared to pregnant women with UTIs that scored highest levels of IgA (167) wıth sıgnıficant dıfferences ($p<0.05$) among three groups

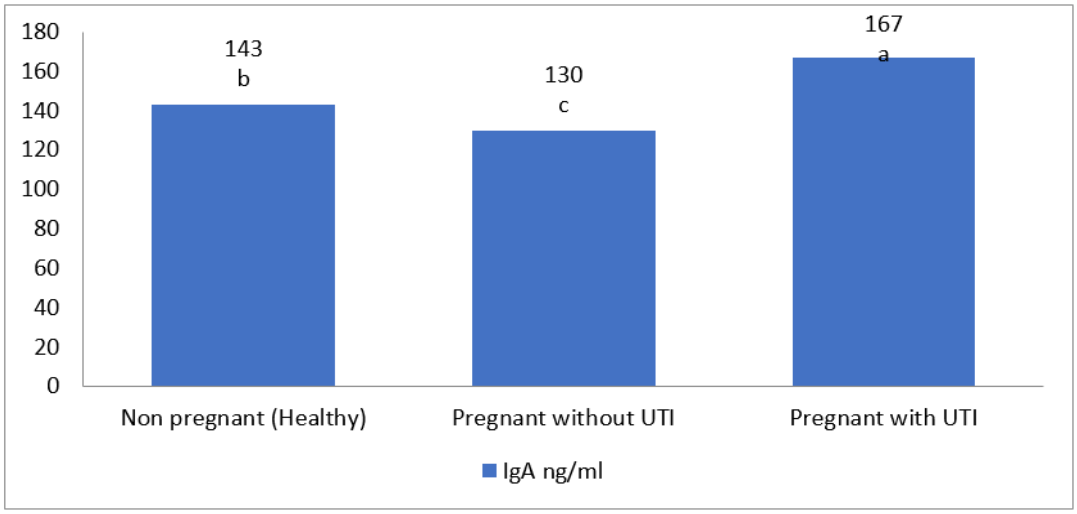

Figure 4.4 Immunoglobulin A (IgA) in non-pregnant, pregnant with UTI and pregnant with out UTI women

4.7 Immunoglobulin G (IgG)

The results of Figure 4.5 showed the IgG scored least level at pregnant women without UTIs (43) compared to pregnant women with UTIs that scored highest levels of IgG (80) wıth sıgnıficant dıfferences ($p<0.05$) among three groups.

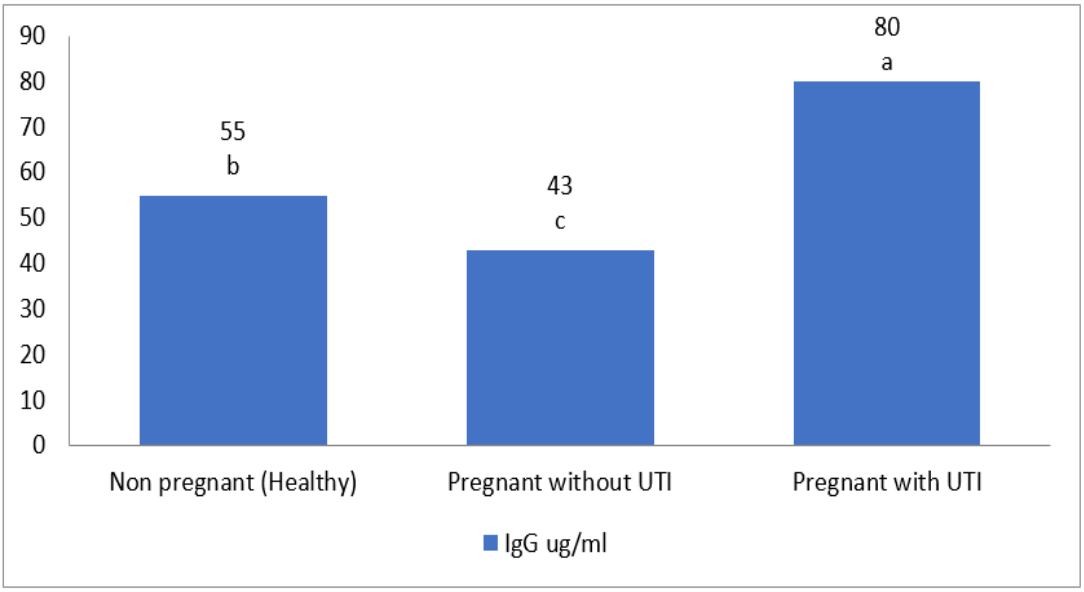

Figure 4.5 Immunoglobulin G (IgG) in non-pregnant, pregnant with UTI and pregnant with out UTI women

IgA and IgG

The present study showed low levels of IgA and IgG in pregnant without UTIs and high levels of IgA and IgG in pregnants with UTIs due to impaired immune status in pregnant women and increase immune response to microbial infections in patients with UTIs. Al (Al Otraqchi *et al.* 2021) showed high levels of IgA and IgG in patients with UTIs than healthy and these results matched with present study.

Secretory IgA was found to be locally produced in the bladder. It is suggested that IgA(s) levels reflect an antibody response to infection (Kaufman *et al.* 1970). Elderly individuals with asymptomatic bacteriuria had significantly elevated antibody levels (IgA and IgG) relative to controls. When followed up to 12 months with persistent bacteriuria, antibody levels tended to persist but were variable. In elderly women with elevated urinary antibody titers, site of infection tended to be localized to the kidney, but antibody levels within the control range occurred as frequently as elevated antibody levels for renal infection. Subjects with invasive urinary infection had significantly elevated antibody levels at onset of symptoms, with levels increased or decreased when repeated 2–4 weeks later (Nicolle and Brunka 1990). The results show that IgM chronologically is the first

antibody to appear in increased amounts in the serum and urine, followed by IgG. The data also suggests a relationship exists between total serum IgG and total urine IgG which may affect the host's ability to eliminate urinary infection (Davis *et al.* 1987).

The systemic T helper 1/T helper 2 (Th1/Th2) cytokine balance during normal human pregnancy is controversial, and observations about the balance in the postpartum period have only been reported for up to 3 months. So decreased cytokine and immunoglobulin production during pregnancy may explain why pregnant women are more prone to develop UTI (Mousa and Qasim 2015).

(Elbagir *et al.* 2020) showed hıgh levels of IgA ın pregnants without UTIs than healthy and these results contrast to present study that showed low levels of IgA ın pregnants without UTIs than healthy. The decrease levels of IgA and IgG during pregnant due to inflammatory process, lifestyle, and malnutrition,

4.8 Interleukin-6

The results of Figure 4.6 showed the ınterleukın 6 scored least level at pregnant women with UTIs (60.4) compared to healthy women that scored highest levels of ınterleukın 6 (103.5) wıth sıgnıficant dıfferences ($p<0.05$) among three groups.

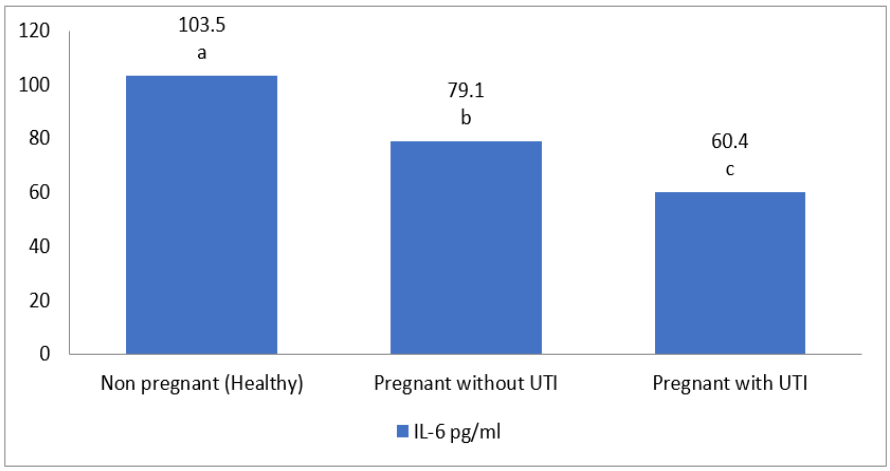

Figure 4.6 Interleukin-6 in non-pregnant, pregnant with UTI and pregnant with out UTI women

(Al Rushood and Amal 2020) indicate the IL-6 levels are elevated in patients with UTI than controls and these results not compatible to present results. Systemic release of various mediators contributes to the clinical expression of acute pyelonephritis while in lower UTIs, cytokines are secreted mainly in the urine, explaining the absence of systemic toxicity symptoms in acute cystitis (Krzemień *et al.* 2016). It has been reported that host response to the presence of bacteria in the urinary tract might be genetically determined. It has been suggested that the genetic polymorphisms of cytokines may influence the type of host response during an infection. People who are lower cytokine responders may not have systemic symptoms despite the presence of bacteria in their urine (Yun *et al.* 2014).

(Mousa and Qasim 2015) mention the low levels of IL-6 in with UTI than controls and theses results compatible to present results. The systemic T helper 1/T helper 2 (Th1/Th2) cytokine balance during normal human pregnancy is controversial, and observations about the balance in the postpartum period have only been reported for up to 3 months. So decreased cytokine and immunoglobulin production during pregnancy may explain why pregnant women are more prone to develop UTI (Mousa and Qasim 2015). (Mohammed Ali and Alrifai 2021) show high levels of IL-6 and IL-8 in with UTI than controls and they discovered that IL-8 is a good biomarker for urinary tract infection, while IL-6 is not.

(Engelsöy *et al.* 2019) show high levels of IL-6 in patients with Uropathogenic *Escherichia coli* (UPEC) and show that proinflammatory cytokines have the ability to alter the virulence traits of UPEC. CRP and IL-6 are applicable to the differential diagnosis of sepsis and differentiating the sepsis induced by Gram-negative bacteria from Gram-positive bacteria. Appropriate combinations of these indicators are capable of increasing differential diagnosis efficiency. These indicators can be used as markers of antibiotics usage, but whether they can be used as markers to withdraw antibiotics is still needed to be observed (Shao *et al.* 2018).

Intravesical inoculation of patients with *Escherichia coli* provided an opportunity to examine the interleukin-6 (IL-6) response to a gram-negative bacterial urinary tract infection in humans (Al-Kaabi and Al-Khalidi 2020). All patients secreted IL-6 as a result

of infection. Urinary IL-6 was not continuously secreted but appeared as a series of similar peaks during the first 48 h after infection (Hedges *et al.* 1991).

Physiologic and pathologic concentrations of IL-6 did not cause amnion cell aging, cell death, cellular transitions, or inflammation. IL-6 may function to maintain cellular homeostasis throughout gestation in fetal membrane cells. Although IL-6 is a good biomarker for adverse pregnancies, it is not an indicator of an underlying pathological mechanism in membrane cells (Omere *et al.* 2020).

The decreased leveks of IL-6 in pregnant with and without UTIs than healthy due to serve as pro and ani-inflammatry cytokine as well as to weak immune status in pregnant women during pregnancy and due to microbial infection that lead to impaired immune response.

4.9 Interleukin-10

The results of Figure 4.7 showed the ınterleukın 10 scored least level at pregnant women with UTIs (49) compared to healthy women that scored highest levels of ınterleukın 10 (90) wıth sıgnıfıcant dıfferences ($p<0.05$) among three groups.

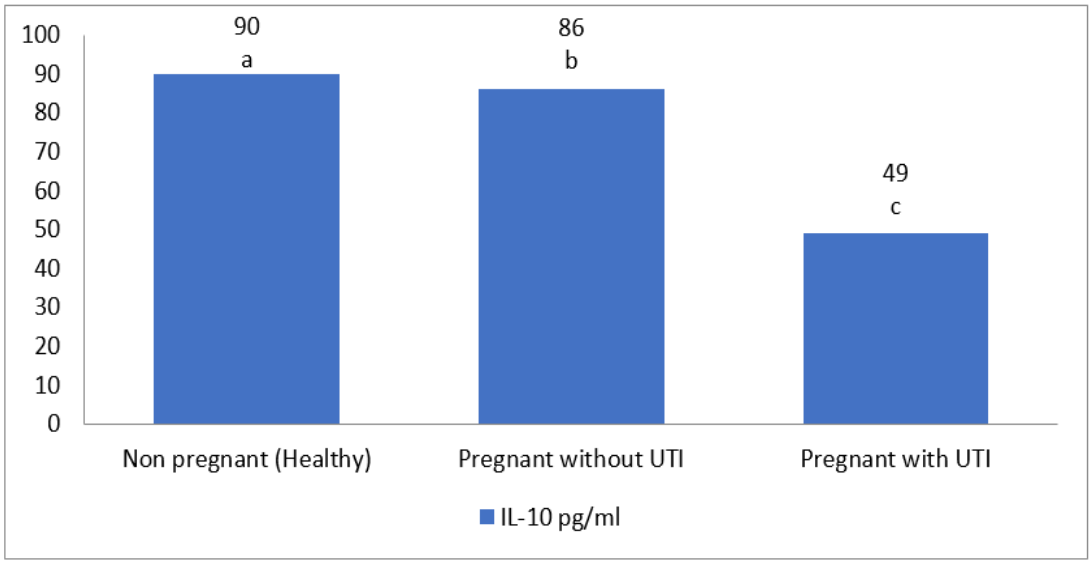

Figure 4.7 Interleukin-10 in non-pregnant, pregnant with UTI and pregnant with out UTI women

(Nath *et al.* 2020) showed low levels of IL-10 in pregnant women than healthy, and these results contrast to present study. In contrast, (Yang *et al.* 2018) mentioned the early pregnancy induced a lower Th1 immunity (IFN-γ) and a higher Th2 immunity (IL-4 and IL-10) in the peripheral blood mononuclear cells, which may be related to interferon-tau and P4, thereby contributing to successful pregnancy. The anti-inflammatory potential of a pregnant woman's diet increases slightly with pregnancy development; however, its value has no permanent significant association with the level of CRP, IL-6, and IL-10 (Pieczyńska *et al.* 2020).

Previous data suggest that IL-10 functions as an important protective agent contributing to the regulation of maternal immune tolerance during pregnancy (Cheng and Sharma 2015). Another study showed that serum levels of IL-10 play a significant role in the incidence of preeclampsia among pregnant mothers. Therefore, IL-10 can be used for diagnostic and therapeutic purposes (Khazaei-Koohpar and Alavi 2019). Additionally, study findings support the role of decreased IL-10 levels in the pathophysiology of preeclampsia (Nath *et al.* 2020).

The present study revealed low levels of IL-10 in patients with this than healthy and these results contrast to results (Drage *et al.* 2019) that showed high levels of IL-10 in patients with UTIs than healthy. Study findings suggest that bacteriuria, characteristic of older recurrent urinary tract (rUTI) patients, is associated with an immune homeostasis in the urinary tract involving the synthesis and activities of the pro and anti-inflammatory cytokines IL-1, IL-5, IL-8 and IL-10. Data also suggests a role for IL-10 in regulating bacterial persistence (Drage *et al.* 2019).

The decreased leveks of IL-10 in pregnant with and without UTIs than healthy due to this intrleukin is anti-inflammatory cytokine as well as the weak immune status in pregnant women during pregnancy and due to microbial infection that lead to impaired immune response.

5 CONCLUSIONS AND RECOMMENDATION

5.1 Conclusions

- *E. coli* can easily pass from one person to another, especially when infecte adults and children do not wash their hands correctly. Family member of young children infected with *E. coli* are at high risk of contracting this infection. Outbreak have too occurre amongst children visiting zoos and animal pens at county fair.
- Weakened immune systems. People with a weakened immune system because of HIV infection (AIDS), cancer medications, or drugs used to prevent the body from rejecting organ transplants are more likely to get *E. coli*.
- *Escherichia coli* is unique of the greatest significant kinds of bacteria that live in the intestine of mammal, and it is also known as the large intestine germ, and it lives in it permanently and is exposed to some causes that make it cause symptoms.
- There is no direct treatment for it, but the treatment is to treat the symptoms, and often the infection can be resisted and it takes a number of days to get rid of it. Only you can drink fluids to compensate for the shortage and stop eating until you feel better

5.2 Recommendations

Pregnant women are at risk of urinary tract infections and this should be taken into account when following up. Urinary tract infections (UTIs) are frequently encountered in pregnant women. Pyelonephritis is the most serious medical condition during pregnancy. Thus, it is essential for obstetric care providers to be aware of normal urological findings, assessment of abnormalities, and treatment of disease.

Urinary tract changes and immune changes of pregnancy should be taken into consideration and caution should be taken of women's exposure to urinary tract infection. Physiological changes in the urinary tract include dilation of the ureter and nephrosis. This is caused by the relaxation of smooth muscle associated with progesterone and the pressure of the ureter from the gestational uterus. Ureteral dilatation may be marked.

Decreased bladder capacity usually causes frequent urination. Vesicoureteral reflux can be seen. These changes increase the risk of UTIs.

However, sexual intercourse, urination after sex, diaphragm use, urinary catheterization, early surgical procedure, presence of kidney stones, intrauterine device, poor health, malnutrition, and low socioeconomic status especially in rural areas. The main risk factors that are involved in the development of UTIs, these should be taken care of and minimized.

Therefore, all these things must be taken into account and taken into account to reduce bacterial infections that cause urinary tract infectionin pregnant women.

- Healthy adult often recover from an *E. coli* infection within a week. But certain people, especially children and the elderly, may be at risk of developing a serious type of kidney failure known as hemolytic uremic syndrome, which is a life-threatening syndrome
- There is no vaccine or drug that can protect you from any disease related to *E. coli*, although researchers are working to investigate the effectiveness of some potential vaccines. To reduce your chances of exposure to *E. coli* bacteria, don't drink lake or pond water, wash your hands often, avoid junk foods, and beware of cross-contaminants.
- Mayo Clinic Minute: Avoid summertime *E. coli* infection

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