

Salahaddin University-Erbil

**Isolation And Identification Of Bacteria Causing Urinary Tract Infections And Diarrhea In Children In Erbil City**

Research project

Submitted to the department of ( Biology) in partial fulfillment of the requirements for the degree of BSc. in (**Biology** )

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**April-2023**

**Supervisor's recommendation**

I certify that the research (**Isolation And Identification Of Bacteria Causing Urinary Tract Infections And Diarrhea In Children In Erbil City**)

Was under my supervision in the Department of Biology, University of Salahaddin, which is part of the requirements for a bachelor's degree in Microbiology.

Professor Dr. SAWSAN MUHAMMED SORCHEE

**DEDICATION**

I would like to dedicate my paper to my dear family who had helped and supported me in all my life and studies.

**Acknowledgment**

First of all, I wish to express my thanks to the most gracious “ALLAH”, the facilitator in every step of my life and work.

I would like thanks to my supervisors Dr.Sawsan for suggesting this topic and giving me useful instruction throughout studying period as well as appreciation for Staff of the bacteriological laboratory(Rapareen Hospital), represented by Professor Azad and his assistants.

I express my deepest appreciation for this academic staff of biology department, college of Education and Salahaddin University.

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**Abstract**

Urinary tract infection (UTI) is caused by colonization and growth of microorganisms within the urinary system. This study investigates the urinary tract bacterial infection and their sensitivity to antibiotic The results of urinary tract bacteria samples were taken from patients with urinary tract infections( infants and children under fifteen years of age) from Erbil Children's Hospital from 3-1-2022 to 29-12-2022. The bacteria were isolated, cultured and identified by the Bacteriological Laboratories Staff of the Children's Hospital . The incidence was 281 (75%) for females and 91 (25%) for males, as 33% of patients developed a urinary tract infection, and 67% of patients did not have a urinary tract infection, and there are differences between the percentage of infection during year months ,It was found that most cases were in October and December , while January recorded the lowest number of cases of illness. The most common pathogenic bacteria were *Escherichia coli* (64%) and *Staphylococcus sp*. (4%), Klebsiella sp. (10%) *proteus* (6%). *Pseudomonas sp*.(8%) *Streptococcus sp*. (7%) . The causative agents of urinary tract infections and Gram-negative type were the most common (89%) and (11%) Gram-positive. The isolates showed different degrees of sensitivity to different antibiotics.

As well as 40 samples of stool were collected from patients with diarrhea (infants and children under ten years of age) admitted to the Pediatric and Maternity Hospital in Erbil City from 2022 . The information was taken from the laboratory records and installed by specialists in the hospital's laboratory, including bacterial strains that cause diarrhea with months and gender ,All isolated on selective and differential media were identified on the basis of colonial, morphological, Gram stain and Vietic test with sensitivity test, 5 sample were positive including 2(40%) *E.coli* , (60%) *Shigella sp*. (87%) of the samples were non infection. (13%) of the samples had infections. Most cases of diarrhea were in children less than 2 years of age and The male (60%) had more infection rates than the female (40.%). The sensitivity of the bacterial isolates to different antibiotics was performed. There was a variation in the resistance of the isolates ranging from 0-100% whereas other isolates were sensitive.

*Key Word: Urinary tract infections, bacteria Diarrhea*

**Introduction**

The urinary tract consists of various organs of the body involved in the production, storage and excretion of urine. These organs are always at risk of infection by microorganisms, especially bacteria(Lenz.,2000).Urinary tract infection is the most common serious bacterial infection causing illness in infants(Alhai et al.,2020).UTI among children it accounted for 10% of all febrile illnesses in children, which is a major public health problems and second to infection of the respiratory tract among children(Alsammani et al .,2014), During babyhood, 8 percent of girls and 2 percent of boys are in risk of evolving a urinary tract infection (Alhaj et al.,2020).Uncircumcised male infants less than 3 months of age and females less than 12 months of age had the highest baseline prevalence of UTI(Alhaj et al .,2020).

Both anatomic and physiologic factors put children at risk of developing UTI; which is occur more often in girls, because of their urethras are shorter and closer to the anus. This make it easier for bacteria to enter the urethra, urinary obstruction, Vesicoureteral reflux (VUR), neurogenic bladder which is the improper storage of urine in bladder and improper emptying of urine from bladder, and uncircumcised boys (Alper et al .,2005).

Contagions of the urinary tract are divided into two types: lower tract infections that affect the bladder and/or urethra (such as cystitis and urethritis) and upper tract infections that affect the ureters, collecting system, and parenchyma (such as kidney stones) (pyelonephritis) (Heffner et al., 2008).The common bacterial pathogens responsible for urinary tract infections are gram-negative bacteria (90%) like *Escherichia coli, Klebsiella species, Proteus mirabilis, Pseudomonas aeruginosa*, Acinetobacter, and Serratia. while only 10% of the cases are triggered gram positive bacteria which include Enterococcus, Staphylococcus Species mainly S.aurues, and *Streptococcus agalactia*(Alper et al .,2005)

Urinary tract infections may be asymptomatic, acute, chronic, and complicated or uncomplicated, and the clinical manifestations of UTIs depend on the portion of the urinary tract involved, the etiologic organisms, the severity of the infection, and the patient’s ability to mount an immune response to it. Both asymptomatic and symptomatic UTIs pose a serious threat to public health care, hence reducing the quality of life and increase the number of people who are unable to work (Olowe.,2015).A person's age and the region of a urinary tract infect can influence the symptoms of a urinary tract infection (UTI), including as fever, burning feelings while urinating, LAP, itchy genital area, blisters and ulcers, genital and suprapubic discomfort, and pyuria (Odoki et al., 2019).Diagnosis of UTI may in children is simple usually urine analysis and cultures are enough to establish the diagnosis. The most difficult task is to established appropriate therapy. The development of multidrug resistance strains makes treatment issue among the most controversial issues in children(Alsammani et al .,2014).

In the first year of their lives, boys are further probable to get a UTI than girls. After the first year of life, females are further probable than boys to become a urinary tract infection (UTI). (Sykes et al., 2014),Antibiotics are the primary treat for a UTI.Nosocomial urinary tract infections (N-UTIs) are the infection of the urinary tract that occurs after 48 hours of hospital admission (Iacovelli.,2014),About 150 million people suffer from UTIs each year globally which results in greater than 6 billion dollars in direct health care(Stamm.,2001).

The excretion of liquid or loose stools several times in a day (or frequent passage than the normal for an individual) is referred to as diarrhea. The symptom is common to gastrointestinal infection resulting from the intake of many parasite or viruses, bacteria that can be transmitted through the means of food, water, utensils, hands and flies. The three main clinical syndrome of diarrhea include; 1) acute watery diarrhea which lasts for less than 2 weeks; 2) bloody diarrhea and 3) Persistent diarrhea which lasts for at least 2 weeks. Diarrhea leads to loss of electrolyte, dehydration, shock and sometimes death (WHO, 2017).

According to the World Health Organization (WHO) and UNICEF, there are about two billion cases of diarrheal disease worldwide every year, and 1.9 million children younger than 5 years of age perish from diarrhea each year, mostly in developing countries. This amounts to 18% of all the deaths of children under the age of five and means that more than 5000 children are dying every day as a result of diarrheal diseases. Of all child deaths from diarrhea, 78% occur in the African and South-East Asian regions (Farthing et al .,2013).Many cases of diarrhea are due to an infection in the gastrointestinal tract caused by microorganisms such as bacteria, viruses and parasites. This may be present alone or can be together with different symptoms, such as vomiting, abdominal pain, nausea and weight loss (Suleman et al ., 2022).There is a wide spectrum of bacteria that cause diarrhea in children, such as Entero-bacteriaceae as coliform bacteria E. coli, Proteus spp., Salmonella spp., Shigella spp. Citrobacter spp., Yersinia enterocolitica and Klebsiella spp. (Al-Abbas., 2018).Among the bacterial pathogens E. coli plays an important role in causing diarrhea in below five year children. EPEC (Enter pathogenic E. coli): is an important category of diarrhea genic E. coli which has been linked to infant diarrhea in the developing world (Sudershan et al., 2014).Antibiotic resistance has become a major clinical and public health problem during the lifetime of most people. There are many reasons for this problem, one of which is an over use of antibiotics in addition to the chromosomal changes or the exchange of the genetic material via plasmid and transposons which help in transmission and spread of drug resistance among pathogenic bacteria(Al-Sorchee et al., 2013). The aims of this study are determination the bacteria caused diarrheal and UTI in children and the rate of infection in 2022 in male and female with data as well as the rate of monthly infection and the best antibiotic that affects bacteria in Raparin Hospital.

**Material and Methods**

**Sample Collection**

We collected data from patients with urinary tract infections and diarrhea in Raparin hospital in Erbil from 3/1/2022 to 29/12/2022 with months and gender installed, where 1143 samples were collected from UTI and 40 samples were collected from diarrhea.

We collected data from patients with urinary tract infections and diarrhea who were infected with bacteria that numbered 372 children patients with UTI and 5 children patient with dierrhea from 3/1/2022 to 29/12/2022 in Raparin hospital in Erbil with months and gender installed.

**Diagnosis of bacteria**

All isolates were identified on the respective selective and differential media and on the basis of a Gram stain, Gram stain and Vie tic test with a sensitivity test for several antibiotics such as MEM: Meropenem, OFX: Ofloxocin, AZM: Azithromycin, COT: CO-Ttimoxazole, TOB: Tobramycin, AM: Amicacin, L: Lincomycine, DA: Clindamycin, RA: Rifampi, CTX: Cefolaten, AMC: Amoxciline/Clavulanic Acid, E: Erythomycin, CIP: Ciprofloxacin, CAZ: Cefuzipen, IPM: Cefepem, TMP: Trimethprim/Salfamethoxazole (Mandell) et al., 2005 and MacFaddin., 2000).

**Results and Dissection**

A total of (372) samples with urinary tract infection and (5) samples with diarrhea were obtained from Raparin Hospital in Erbil .Where the infection rate with UTI was 281(75%) in females and 91 (25%) in males (Fig. 1) when in diarrhea was 2 (40%) in females and 3 (60%) in males (Fig. 2) .They were admitted to the hospital and performed a general urine examination (GUE) and general stool examination (GSE) test where 33% of the patients were infected with urinary tract infections, 67% of the patients did not contract the infection . (Fig. 3) when Percentage of Infection With diarrhea was (13%) & Non Infection was(87%) (Fig. 4) and its showed that the infection rate in the children less than one years is more common than the other years (Figure5 & Figure 6).

 **Figure: 1 \_Distribution of gender in UTI patient.**



**Figure: 2 \_Distribution of gender in Diarrhea patient.**



**Figure 3 \_Percentage of Infection & Non Infection With UTI .**



 **Figure 4 \_Percentage of Infection & Non Infection With Diarrhea .**



 **Figur 5\_ Incidence rates for UTI patients according to age.**



**Figur 6\_ Incidence rates for diarrhea patients according to age.**

The total number of infected children reached 372 during the months of the year, and we recorded the infection rate from January (14%) to February (22%). and March (27%) and April (33%). (38%) May, (41%) June, (32%) July, August (33), September (31%), October (49%), November (32%), December (49%) found that most cases of The incidence was in October and December, while the lowest number of infections was in January (Fig.7).



 **Figure 7\_ Prevalence of infection during the year months with UTI.**

The most common pathogenic bacteria with UTI were *Escherichia coli* (64%) , *Staphylococcus sp*. (4%), *Klebsiella sp*. (10%) *proteus* (6%). *Pseudomonas sp.* (8%) ,Streptococcus sp. (7%), Figure (8).while with Diarrhea were *Escherichia coli* (40%), *Shigella sp*. (60%), Figure (9).The causative agents of urinary tract infections and Diarrhea are Gram-negative type were the most common (89%) and (11%) Gram-positive. Figure (10) show Percentages of bacterial infection, both negative and positive gram stain (Gve+ & Gve-) with UTI .



 **Figure 8\_ Percentages of bacterial infection with UTI, both negative and positive gram .**

**Figure 9- Percentages of bacterial infection with Diarrhea.**



 **Figure 10- percentage of bacterial isolates from urinary tract infection.**

Table 1 & 2, shows bacterial isolates sensitive and resistant to different antibiotics, And there were differences between the resistance from zero to one hundred, depending on the results.

**Table 1- Percentages of resistance to bacterial isolates to antibiotic in UTI .**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Bacteria isolate** | **M E M** | **O F X** | **A Z M** | **C O T** | **T O B** | **A M** | **L** | **D A** | **R A** | **I P M** | **C T X** | **A M C** | **C I P** | **C A Z** | **E** | **G E N** | **T M P** |
| ***E.coli*** | S | S | R | R | S | S | R | R | R | S | R | S | S | R | R | S | R |
| ***Klebsiella sp.*** | S | S | S | R | S | S | R | R | R | S | R | S | S | R | R | S | S |
| ***Proteus sp.*** | S | I | R | R | R | S | R | R | R | R | R | S | S | R | R | R | R |
| ***Staph sp.*** | S | I | R | R | R | R | S | S | I | S | R | R | R | R | R | R | R |
| ***Strep sp.*** | S | I | R | R | R | R | R | R | R | S | R | S | S | R | R | R | R |
| ***Pseudomonas sp.*** | S | R | R | R | S | S | R | R | R | S | R | S | S | R | R | S | R |
|  **Resistance of Bacteria** | 0 % | 16 % | 83 % | 100 % | 50 % | 33 % | 83 % | 83 % | 83 % | 16 % | 100 % | 16 % | 16 % | 100 % | 100 % | 66 % | 83 % |

**Table 2- Percentages of resistance to bacterial isolates to antibiotic in Diarrhea.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Bacteria isolate** | I PM | MEM | AM | GEN | CIP | TM | CAZ | CFP |
| ***E.coli*** | S | S | S | S | S | S | R | I |
| ***Shigella*** | S | S | S | R | R | R | R | R |
| **Resistance of Bacteria** | 0% | 0% | 0% | 50% | 50% | 50% | 100% | 50% |

**S=Sensitivity R=Resistance I= Intermediate**

Bacterial infection of the urinary tract is one of the common causes for seeking medical attention in the community (Angoti et a.,2016).only (33%)patients were positive for aerobic bacterial infections whereas patients (67%) had no bacterial infection fig. (3) However the percentage of UTI in other studies were (75.42%) and (61%) respectively (Al-Barzinji et al.,2010) In patient (64%) isolate include E. coli was most predominant uropathogen with followed by Ecoli . These results disagree with( Shaaban et al.,2012)

In this study, the prevalence of UTI was in female more than in male (75% female )and(25% male) in another study showed females 63.6% and 36.4% male, it was seen that significantly higher incidence rate of girls than for boys. Another study also showed that urinary tract infection is more common in girls ( Shaaban et al.,2012)

 Antibiotic provide the main basis for the therapy of microbial infection, since the discovery of these antibiotics and their uses as chemotherapeutic agents there was a belief in the medical fraternity that this would lead to the eventual eradication of infectious disease, But worldwide emergence of resistant bacteria has become a major therapeutic problem at the recent time , In addition multidrug resistant strains are also increasingly being isolated from community acquired infections (Fuad et al.,2012).Resistance to antimicrobial agents has been noted since the first use of these agents and is an increasing world-wide problem( Sefton.,2000) Thus, the use of these antibiotics as an empirical treatment for a suspected UTI would be the drugs of choice against most common isolated uropathogens. Similar results were observed by other researcher who found the sensitivity of uropathogen to meropenem and imipenem (Assafi et al., 2015and Polse et al., 2016).

 the prevalence of diarrhea was in male more than in female (40%) female and (60% male), these result disagree with(Hikabe et al., 2016). who found that female (54%) and male (46%), where the highest incidence was amongst less than 2 years of age (0-2) 60%, the sex factor seems to play a role in diarrheal infection in children less than 2 years of age, similar to (Al Abbassi et al., 2005).results where the highest rate was in 15 years under and different from(Sharma et al., 2007).Antibiotics are among the most important drugs currently available to modern medicine and have enabled the treatment of otherwise deadly infectious diseases. For antibiotics to be able to provide these benefits also in the future requires a reduction in the acquisition and spread of antibiotic resistance(Stunnenberg et al., 2016). All isolate was multi drug resistant against antibiotic such as IPM MEM AM GEN CIP TM CAZ CFP…. Resistance of bacteria to antibiotic,GEN(50%) ,CIP(50%), TM(50%), CAZ(100%), CFP(50%). but IPM,AM and MEM sensitive of Bactria .

**Conclusion**

 Early and appropriate diagnosis of urinary tract infection in infants and young children is important as it is marker for urinary tract problems. *Escherichia coli* was the most common organism causing urinary tract infection and diarrhea in children. The most of urinary isolates had high level of resistance to commonly used antibiotics. Bacterial infections are highly common in our community and the mode of transmission plays a

critical role. Therefore, the prevention and control of these infections require a

great social effort and a better performance of the health sector. In conclusion, bacterial infections are still common in our community, the mode of bacterial infection transmission is usually through direct contact (person to person); ingestion of contaminated and non-hygienic food and water, or poorly cooked food. Therefore, this situation requires a great social effort and for the health sector to perform better in terms of prevention and control. Additionally, it is epidemiologically important to pinpoint how often a bacterium generates a health problem in each population individually, which requires further and elongated studies.

**References**

AL ABBASSI, A., AHMED, S. & AL HADITHI, T. 2005. Cholera epidemic in Baghdad during 1999: clinical and bacteriological profile of hospitalized cases. EMHJ-Eastern Mediterranean Health Journal, 11 (1-2), 6-13, 2005.

AL-ABBAS, A. K. J. I. J. P. H. 2018. Etiology of bacterial diarrhea in children under five years in Karbala Province, Iraq. 2, 1.

Al-Barzinji, R., Esmahil, S. E., Sulaiman, S. S., & Raheem, S. G. (2010). Effect of some antimicrobial agents on isolated bacteria from patients with urinary tract infection in Kurdistan Region. Zanco Journal of Medical Sciences (Zanco J Med Sci), 14(2), 61\_67-61\_67.‏

Alhaj, A.M. and Bayoumi, M., 2020. Prevalence of Urinary Tract Infection among Children attending Khartoum State Hospitals.

Alper, B.S. and Curry, S.H., 2005. Urinary tract infection in children. *American Family Physician*, *72*(12), pp.2483-2488.

Alsammani, M.A., Ahmed, M.I. and Abdelatif, N.F., 2014. Bacterial uropathogens isolates and antibiograms in children under 5 years of age. *Medical Archives*, *68*(4), p.239.

Angoti, G., Goudarzi, H., Hajizadeh, M., & Tabatabaii, Z. (2016). Bacteria isolated from urinary tract infection among patients and determination of the antibiotic susceptibility patterns of the gram negative bacteria in Iran. Novelty in Biomedicine, 4(1), 1-4.‏

Assafi, M. S., Ibrahim, N. M., Hussein, N. R., Taha, A. A., & Balatay, A. A. (2015). Urinary bacterial profile and antibiotic susceptibility pattern among patients with urinary tract infection in duhok city, kurdistan region, Iraq. International Journal of Pure and Applied Sciences and Technology, 30(2), 54.‏

AL-SORCHEE, S. M. A., RABAT, A. A. & JUMA, I. M. J. A.-N. J. O. S. 2013. Microbial causatives of diarrhea in children in Erbil city. 16, 19-29.

Farthing, M., Salam, M.A., Lindberg, G., Dite, P., Khalif, I., Salazar-Lindo, E., Ramakrishna, B.S., Goh, K.L., Thomson, A., Khan, A.G. and Krabshuis, J., 2013. Acute diarrhea in adults and children: a global perspective. *Journal of clinical gastroenterology*, *47*(1), pp.12-20.

Fuad, M.M.H.; Ferdowsy, H.; Hossain, M.N. Foysal, M.J. and Rahman, M.M. (2012). In Vitro Antibacterial Activity of Common Antibiotics and Herb Extracts to Clinical Isolates of Escherichia coli Collected from UTI Patient. I J R Pharm. and Bio. Sci. 3(2): 987-992.

Heffner, V.A. and Gorelick, M.H., 2008. Pediatric urinary tract infection. *Clinical Pediatric Emergency Medicine*, *9*(4), pp.233-237.

HIKABE, O., HAMAZAKI, N., NAGAMATSU, G., OBATA, Y., HIRAO, Y., HAMADA, N., SHIMAMOTO, S., IMAMURA, T., NAKASHIMA, K. & SAITOU, M. J. N. 2016. Reconstitution in vitro of the entire cycle of the mouse female germ line. 539, 299-303.

Iacovelli, V., Gaziev, G., Topazio, L., Bove, P., Vespasiani, G. and Agrò, E.F., 2014. Nosocomial urinary tract infections: A review. *Urologia Journal*, *81*(4), pp.222-227.

MacFaddin JF.(2000) Biochemical tests for identification of medical bacteria. 3rd ed. Philadelphia: Lippincott Williams and Wilkins.

Mandell GL, Bennett JE Dolin R. (2005). Principles and practice of infectious diseases. Churchill Livingstone. P.P 881-2.

Odoki, M., Almustapha Aliero, A., Tibyangye, J., Nyabayo Maniga, J., Wampande, E., Drago Kato, C., Agwu, E. and Bazira, J., 2019. Prevalence of bacterial urinary tract infections and associated factors among patients attending hospitals in Bushenyi district, Uganda. *International journal of microbiology*, *2019*.

Olowe, O., Ojo-Johnson, B., Makanjuola, O., Olowe, R. and Mabayoje, V., 2015. Detection of bacteriuria among human immunodeficiency virus seropositive individuals in Osogbo, south-western Nigeria. *European Journal of Microbiology and Immunology*, *5*(1), pp.126-130.

Pennsylvania, Philadelphia; et al) Pediatrics 116: 644–648, 2005 §. *Yearbook of Urology*, *2006*, pp.246-247.

Sefton, A. M. (2000). The impact of resistance on the management of urinary tract infections. International journal of antimicrobial agents, 16(4), 489-491.‏

Shaaban, M. T., Ghozlan, H. A., & El Maghraby, M. M. (2012). Susceptibility of bacteria infecting urinary tract to some antibiotics and essential oils. Journal of Applied Pharmaceutical Science, 2(4), 9.‏

SHARMA, N., MANDAL, P., DHILLON, R. & JAIN, M. 2007. Changing profile of Vibrio cholerae 01, 0139 in Delhi & its periphery (2003-2005). Indian journal of medical research, 125, 633.

Stamm, W.E. and Norrby, S.R., 2001. Urinary tract infections: disease panorama and challenges. *The Journal of infectious diseases*, *183*(Supplement\_1), pp.S1-S4.

STUNNENBERG, H. G., ABRIGNANI, S., ADAMS, D., DE ALMEIDA, M., ALTUCCI, L., AMIN, V., AMIT, I., ANTONARAKIS, S. E., APARICIO, S. & ARIMA, T. J. C. 2016. The International Human Epigenome Consortium: a blueprint for scientific collaboration and discovery. 167, 1145-1149.

SUDERSHAN, R., KUMAR, R. N., KULKARNI, B., KASHINATH, L., BHASKAR, V. & POLASA, K. J. I. J. C. M. A. S. 2014. E. coli pathotypes and their antibiotic resistance in young children with diarrhea in Hyderabad, India. 3, 647-54.

SULEIMAN, K., Kolo, I., Mohammed, S.S.D. and Magaji, Y.G., 2022. Bacterial diarrhea among infants in developing countries: An overview of diarrheagenic Escherichia coli (DEC). *Gadau Journal of Pure and Allied Sciences*, *1*(1), pp.73-81.

Sykes, J.E. and Westropp, J.L., 2014. Bacterial infections of the genitourinary tract. *Canine and feline infectious diseases*, p.871.

World Health Organization. (2017). Diarrheal Disease. WHO Press, Geneva, Switzerland.

Zorc, J.J., Levine, D.A., Platt, S.L., Dayan, P.S., Macias, C.G., Krief, W., Schor, J., Bank, D., Shaw, K.N., Kuppermann, N. and Multicenter RSV-SBI Study Group of the Pediatric Emergency Medicine Collaborative Research Committee of the American Academy of Pediatrics, 2005. Clinical and demographic factors associated with urinary tract infection in young febrile infants. *Pediatrics*, *116*(3), pp.644-648.