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Caracterización de escherichia coli uropatogena aislada en mujeres de 18 a 45 años

Characterization of uropathogenic escherichia coli isolated in women aged 18 to 45 years

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Palabras claves:
Escherichia coli; Epidemiología; Resistencia antimicrobiana; Antibióticos; Salud pública

Resumen

Introducción: Las infecciones del tracto urinario (ITU) son comunes durante la edad fértil, especialmente en mujeres embarazadas, siendo Escherichia coli la causa principal. La resistencia bacteriana, especialmente a antibióticos de primera línea, representa un desafío en el tratamiento. En América Latina, la falta de datos actualizados sobre resistencia antimicrobiana en ITU es un problema. Este estudio se centra en caracterizar Escherichia coli Uropatógena en mujeres de 18 a 45 años en Babahoyo, Ecuador, en 2020. **Objetivo:** Caracterizar Escherichia coli Uropatógena aislada en mujeres de 18 a 45 años en el laboratorio ZHIEL de Babahoyo en 2020. **Metodología:** Se realizó un estudio cuantitativo, empírico y descriptivo, analizando 85 muestras de orina de mujeres de 18 a 45 años obtenidas en el Laboratorio ZHIEL en 2020. Se aplicaron criterios de inclusión y exclusión, y se utilizaron variables como edad, residencia y pruebas de susceptibilidad antimicrobiana. **Resultados:** Hubo un aumento en la identificación de cepas de Escherichia coli en 2021 en comparación con 2020. La mayoría de los casos se encontraron en adultos jóvenes (72.6%). Babahoyo tuvo la mayor prevalencia de casos (58.9%). La resistencia bacteriana fue baja en general, con una mayor resistencia a nitrofurantoina. **Conclusión:** El estudio destaca cambios temporales en la epidemiología de Escherichia coli en Babahoyo, con predominio en adultos jóvenes y baja resistencia antimicrobiana. Estos hallazgos son relevantes para la gestión de infecciones urinarias y la selección de tratamientos adecuados. **Área de estudio:** Microbiología

Keywords:
Escherichia coli; epidemiology; Antimicrobial resistance; antibiotics; public health

Abstract

Introduction: Urinary tract infections (UTIs) are common during the fertile age, especially in pregnant women, with Escherichia coli being the main cause. Bacterial resistance, particularly to first-line antibiotics, poses a challenge in treatment. In Latin America, the lack of updated data on antimicrobial resistance in UTIs is a problem. This study focuses on characterizing Uropathogenic Escherichia coli in women aged 18 to 45 in Babahoyo, Ecuador, in 2020. Objective: To characterize Uropathogenic Escherichia coli

isolated from women aged 18 to 45 at the ZHIEL Laboratory in Babahoyo in 2020. Methodology: A quantitative, Empirical, and descriptive study was conducted, analyzing 85 urine samples from women aged 18 to 45 obtained at the ZHIEL Laboratory in 2020. Inclusion and exclusion criteria were applied, and variables such as age, residence, and antimicrobial susceptibility testing were used. Results: There was an increase in the identification of Escherichia coli strains in 2021 compared to 2020. Most cases were found in young adults (72.6%). Babahoyo had the highest prevalence of cases (58.9%). Bacterial resistance was generally low, with higher resistance to nitrofurantoin. Conclusion: The study highlights temporal changes in the epidemiology of Escherichia coli in Babahoyo, with a predominance in young adults and low antimicrobial resistance. These findings are relevant for the management of urinary infections and the selection of appropriate treatments. Specific area of study: Microbiology.

Introduction

Urinary tract infections (UTIs) are caused by microorganisms that alter the functions of the urinary system such as (kidney, bladder, ureters); during childbearing age, pregnant women are the most vulnerable population to present this type of infections (1). It is estimated that currently there are approximately 10% of pregnant women who present this clinical picture, therefore, it is very important to carry out early detection of the infection and its treatment, because it can be of great risk for the mother and the fetus (2).

Escherichia coli is a Gram-negative bacterium that carries a series of antimicrobial resistance mechanisms, mainly against beta-lactam antibiotics, which are used as first-line therapy in UTIs (3). This resistance can occur through several mechanisms, the most common being enzymatic hydrolysis, which is the production of extended-spectrum beta-lactamases (ESBLs), capable of conferring resistance to first, second, third and even fourth-generation penicillins and cephalosporins (4).

In Cuba, urosepsis due to Escherichia coli was predominant in pregnant women between 19 and 29 years of age, multiparous, with this entity in stages prior to pregnancy. Resistance to nalidixic acid, sulfaprim, amoxicillin + clavulanic acid and cephalexin was present (5). While, in Mexico the positivity rate per trimester was higher for the first

trimester. The lack of treatment occurred mainly because the results of the urine culture were not conclusive (6).

In Latin America, a study in Peru found that antimicrobial resistance in bacteria causing UTI is not included in the epidemiological surveillance system and there is no updated data (7). In 2018, 1455 patients were registered in Peru; of these, 108 (7.4%) had urinary tract infection with positive urine culture, where the most frequently isolated microorganism was Escherichia coli in 70 (63.6%) cases, with resistance to ampicillin (60.8%), ciprofloxacin (34.7%) and (34.7%), and sensitivity to amikacin, nitrofurantoin and cefuroxime. In 13 (11.8%) patients, Escherichia coli and extended-spectrum beta-lactamase-producing enterobacteria resistant to cephalosporins were also identified (8).

In Ecuador, a study was conducted in the population of Zumbahua, Colta and Guamote, where 335 samples were analyzed in a period of 4 months; In the results obtained, there were recommendations not to use ampicillin, trimethoprim/sulfamethoxazole, or quinolones in the area studied as empirical therapy. It is suggested to establish empirical treatment with fosfomycin or nitrofurantoin for uncomplicated UTIs (9). This is why our topic: "Characterization of uropathogenic Escherichia coli isolated in women aged 18 to 45 years" is a relevant and significant topic in the field of public health, since urinary tract infection (UTI) is one of the most common bacterial infections that affects young and adult women worldwide (10).

Escherichia coli (E. coli) is the main cause of urinary tract infections, and understanding its characteristics is essential for the effective diagnosis and treatment of urinary tract infections (11). The characterization of uropathogenic E. coli involves the analysis of its antibiotic resistance profile, the identification of its virulence factors and the evaluation of its capacity to form biofilm, among other aspects (12).

Conducting this research can significantly contribute to improving the understanding of the characteristics of urinary tract infections in young and adult women, which can help develop new strategies to prevent and treat these infections (13). In addition, the results of this research can be very useful for health professionals in choosing the most appropriate treatment and in preventing the emergence of antimicrobial resistance.

Urinary tract infections are one of the most common bacterial infections affecting young and adult women worldwide. Escherichia coli (E. coli) is the main cause of urinary tract infections, and although most of these infections are treatable with antibiotics, the emergence of antimicrobial resistance is complicating the treatment of these infections (14).

Furthermore, the ability of E. coli to form biofilm in the urinary tract and the presence of virulence factors may increase the resistance of this bacteria to conventional treatments

and increase the recurrence of infections (15). In this sense, it is important to characterize the strains of uropathogenic E. coli that affect young and adult women, evaluating their antibiotic resistance profile, identifying their virulence factors and determining their ability to form biofilm. This would allow improving the diagnosis and treatment of urinary tract infections, preventing the emergence of antimicrobial resistance and reducing the recurrence of these infections in young and adult women.

This leads us to the following question: What is the characterization of Uropathogenic Escherichia coli isolated from women of reproductive age, in the ZHIEL laboratory in the city of Babahoyo - Los Ríos Province in the period 2020?

That said, the general objective of this article is: To characterize Uropathogenic Escherichia coli isolated in women aged 18 to 45 years in the ZHIEL laboratory in the city of Babahoyo - Los Ríos Province in the period 2020.

Methodology

This study was based on a quantitative, empirical, descriptive cross-sectional approach. The sample consisted of 85 urine samples from women aged 18 to 45 years. These data were collected from secondary sources entered into the database of the ZHIEL laboratory in the city of Babahoyo, province of Los Ríos in 2020. (As shown in Table 1).

Table 1. Type and level of research

According to its purpose	Basic	By reviewing the results of the isolates, the Escherichia Coli bacteria can be characterized.
According to its scope	Retrospective	Data from the year 2020-2021 will be analyzed
According to its depth	Descriptive	The study aims to describe the frequency and most important characteristics of bacterial infection by Escherichia coli
According to their sources	Mixed	Primary and secondary sources will be used.
According to his character	Quantitative	Quantitative data will be analyzed

Inclusion criteria were applied to women aged 18 to 45 years, with records of patients who have been diagnosed with bacterial infections by Escherichia coli and records of female patients who have undergone urine culture and antibiogram. Regarding exclusion criteria were: records of patients diagnosed with bacterial infections but who did not have bacterial growth > 10,000 CFU/ml.

For the statistical study, the following variables were used: chronological age, age groups, residence, antimicrobial susceptibility tests, health service. On the other hand, 85 urine samples will be collected from pregnant and non-pregnant women aged 18 to 45

diagnosed with bacterial infections by Escherichia coli, the sample was the first urine of the morning, obtained from secondary sources entered into the database of the ZIEHL Laboratory of the city of Babahoyo, province of Los Ríos in the year 2020.

Results

Based on the information collected for the years 2020 and 2021, there is a notable disparity in the distribution of Escherichia coli isolates between the two years. While in 2020 they constituted a relatively small proportion (24.7%), in 2021 they represented the majority (75.3%) of the total population. This suggests that the number of Escherichia coli isolates is increasing over time. (As shown in Table 2).

Table 2. Annual frequency of Escherichia coli isolates analyzed in the Ziehl laboratory, Babahoyo – Ecuador, period 2020-2021.

Year					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	2020	18	24.7%	24.7%	24.7%
	2021	55	75.3%	75.3%	100.0%
	Total	73	100.0%	100.0%	

On the other hand, in the data obtained by age group, it is observed that young adults (18 to 29 years) represent 72.6% of the total population of Escherichia coli isolates, older adults (30 to 45 years) represent 27.4% of the total population of Escherichia coli isolates. (As shown in Table 3).

Table 3. Classification of age groups of patients who come to the Ziehl laboratory in the city of Babahoyo, period 2020-2021.

Age Group					
		Statistics			
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Young adult	53	72.6%	72.6%	72.6%
	Adults	20	27.4%	27.4%	100.0%
	Total	73	100.0%	100.0%	

Regarding Place of Residence, the prevalence in Babahoyo is 58.9% of Escherichia coli isolates. This indicates that Babahoyo has the highest concentration of Escherichia coli cases compared to other locations. It would be relevant to investigate possible reasons behind this higher prevalence, such as specific risk factors or particular environmental conditions.

Jujan accounts for 19.2% of Escherichia coli isolates, although it has a lower percentage compared to Babahoyo, it is still a considerable proportion. It could be investigated

whether there are specific demographic characteristics or risk factors in Jujan that contribute to this moderate presence of Escherichia coli isolates.

Both Montalvo and San Juan have a percentage of Escherichia coli isolates of 4.1%. Although their proportions are lower compared to Babahoyo and Jujan, they still indicate the presence of Escherichia coli in these areas. It would be useful to examine particular factors related to sanitary infrastructure, water quality or access to medical services that could influence these results. (As shown in Table 4).

Table 4. Classification of Place of Residence of Patients Who Visit the Ziehl Laboratory in the City of Babahoyo, Period 2020-2021.

Place of Residence					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Babahoyo	43	58.9%	58.9%	58.9%
	Jujan	14	19.2%	19.2%	78.1%
	Montalvo	13	17.8%	17.8%	95.9%
	Saint John	3	4.1%	4.1%	100.0%
	Total	73	100.0%	100.0%	

At the same time, a comparison was made of the levels of resistance of the isolates to different antibiotics, showing that the Escherichia coli bacteria showed a more pronounced resistance to NIT, reaching 9.14% of the isolates. In addition, a percentage of 8.57% was observed for the isolates evaluated with the antibiotics CFR, CRO and AMP, followed by 6.86% in isolates treated with AMC and PTZ, and 6.29% in those evaluated with CRM and AMI. Likewise, percentages such as 5.71% were recorded for the isolates evaluated with MER, GEN, IMI, CLR, FEP, LEV, and 5.14% for those evaluated with TMS, AZM, CEC, FOX. Other antibiotics showed varied rates, such as 4.57% for CXM, AMX, CTX, PEN, 3.43% for ATM, 2.86% for CAZ, 2.29% for CIP, 1.71% for FD, and finally, 1.14% for CFZ and NAL. (As shown in Figure 1).

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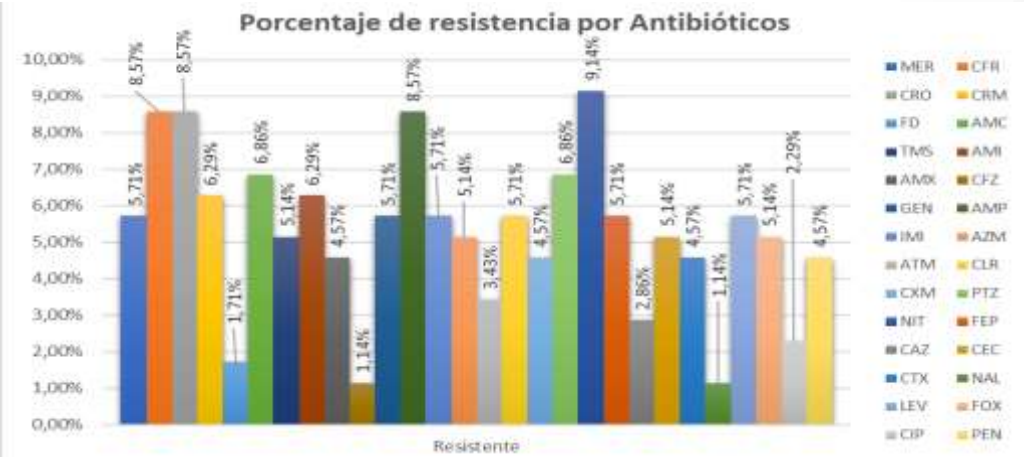

Figure 1. Percentage of antimicrobial resistance of Escherichia coli in isolates from patients who attend the Ziehl Laboratory in the city of Babahoyo, period 2020-2021.

Discussion

The characterization of Escherichia coli strains is of critical importance in the field of public health, it is essential for understanding epidemiology, antibiotic resistance, development of infection prevention and control strategies. This contributes to improving public health and reducing the impact of Escherichia coli infections in the population (16). This specific information on resistance helps health professionals to select the most appropriate treatments and to accurately address the growing threat of bacterial resistance.

The findings indicate a significant increase in the identification of Escherichia coli strains during 2021 compared to data from 2020, indicating possible changes in the epidemiology of this bacteria in the environment of the study. This phenomenon underlines the critical importance of maintaining continuous surveillance and constant monitoring of the prevalence of Escherichia coli. This information not only offers a more complete perspective of the dynamics of the spread of the bacteria, but also highlights the urgent need to adjust and strengthen strategies for the prevention and control of infections associated with Escherichia coli.

Furthermore, disparities in the distribution of isolates according to age groups were evident in this study, where young adults (18 to 29 years) constituted 72.6%, and older adults (30 to 45 years) represented 27.4% of the total population of Escherichia coli isolates. These differences contrast with other studies, such as the one entitled "Phenotypic and molecular characterization of Escherichia coli producing extended-spectrum β-lactamases in outpatients in Lima, Peru". In this study, it was observed that 54.8% of the patients (178/325) were older than 65 years, 25.8% (84/325) belonged to the 45-64 age range, 14.5% (47/325) were between 20-44 years, and 4.9% (16/325) were younger than 20 years.

It is noteworthy to highlight the discrepancies in the distribution by age groups between this study and the one carried out by Galván et al. (17), where a predominance of patients over 65 years of age is evident. In contrast, in this study, the significant presence of young adults is highlighted. These discrepancies can be attributed to the specific characteristics of the populations studied. These demographic and epidemiological differences provide valuable information on the characteristics of Escherichia coli infections in various populations. In addition, they underline the need to take into account the particularities of the population studied when designing public health interventions and policies.

Regarding antimicrobial resistance, a low prevalence of resistance to most of the antimicrobials evaluated in this study was found, compared to other previous studies. However, the drug Nitrofurantoin showed the highest percentage of resistance. This study contrasts with the research led by Lozada et al. (18), during the period 2016-2017 in Galicia, where a significantly lower resistance to NIT (2.4%) and a substantially higher resistance to AMP (49.2%) were observed compared to the results obtained in this current study. These results highlight the importance of the appropriate selection of antimicrobials for the treatment of Escherichia coli infections and the need to continue monitoring and adapting antibiotic prescription guidelines to combat resistance.

It is important to note that this study has some limitations, such as the sample size and representativeness of the population studied. In addition, antimicrobial resistance rates may vary in different geographic contexts and over time. Therefore, continued surveillance and larger studies are required to obtain a more complete picture of the epidemiology and resistance of Escherichia coli in our population.

Conclusions

- In conclusion, this study reveals a marked temporal disparity in Escherichia coli isolations between 2020 and 2021, evidencing significant changes in its epidemiology. The predominant identification of cases in young adults challenges previous trends that pointed to a higher prevalence in older patients. Furthermore, the particularly high geographic concentration in Babahoyo underlines the need to investigate possible risk factors or associated environmental conditions in that region.
- Importantly, Escherichia coli does not present resistance mechanisms or highly resistant phenotypes to first-line antibacterials. The bacteria show increased sensitivity, especially to nitrofurantoin, suggesting that antibiotics commonly used in clinical practice maintain their efficacy against this pathogen. These findings highlight the importance of prudent use of antibiotics to preserve their efficacy over time, thus advocating a comprehensive approach to managing bacterial resistance.

- In a broader context, this study contributes significantly to the knowledge and understanding of Escherichia coli and its antimicrobial resistance. These findings may have substantial implications for public health as well as for the development of effective infection prevention and control strategies.

Conflict of interest

The authors declare that they have no conflict of interest in relation to the submitted article.

Authors' contribution statement

Ana Quijano Robys: was in charge of the research design, data collection, statistical work, analysis of results and critical elaboration of the content, as well as writing the final report.

Jonnathan Ortiz Tejedor: reviewed and approved the research design, participated in the analysis of results and critical review of content, and approved the final report.

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