Knowledge and practices of female nursing students regarding the preventive measures of vaginal and urinary tract infections

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Abstract

Urinary tract infections (UTIs) and vaginal infections are common health concerns that can be prevented through proper hygiene and infection control practices. Assessing nursing students' knowledge and preventive behaviors is crucial for enhancing educational strategies and promoting effective prevention measures. **Methodology:** The current study aimed to assess the knowledge and practices of female nursing students regarding preventive measures for vaginal and urinary tract infections. A univariate descriptive exploratory research design was utilized in this study. The current study was conducted at the Faculty of Nursing, Alexandria University, Egypt. The study included 400 female nursing students who were randomly and proportionally selected to represent all female nursing students enrolled across the four academic levels during the second semester of the 2023–2024 academic year, with 100 students chosen from each level. Data were collected using three tools: (1) a structured interview schedule to assess participants' baseline characteristics and clinical data, (2) an Assessment of Female Nursing Students' Knowledge Regarding Preventive Measures for Vaginal and Urinary Tract Infections questionnaire (3). Assessment of female nursing students' practices regarding preventive measures of vaginal and urinary tract infections . **Results:** The assessment of nursing students' knowledge regarding urinary tract infections (UTIs) revealed that more than three-quarters of study demonstrated a fair level of understanding. In contrast, knowledge about vaginal infections was higher, with more than half of students classified as having good knowledge and only a small percentage exhibiting poor knowledge. Regarding preventive practices, nearly all the students demonstrate satisfactory adherence, while only less than a quarter exhibited unsatisfactory practices. A statistically significant association was observed between knowledge and practice levels (**p** = 0.000), indicating that higher knowledge levels correlate with better adherence to preventive measures. **Conclusion:** The findings of this study indicate that while the majority of nursing students exhibited a fair level of knowledge regarding urinary tract infections (UTIs), their understanding of vaginal infections was comparatively higher, with most students demonstrating good knowledge. Additionally, adherence to preventive practices was notably high, with the vast majority of students engaging in satisfactory behaviors. The statistically significant association between knowledge levels and preventive practices (**p** = 0.000) underscores the critical role of education in promoting adherence to infection prevention measures. **Recommendations:** Enhancing educational programs strengthens nursing students' knowledge of infection prevention, improving adherence to best practices and supporting complementary strategies like practical training and peer-led learning.

Keywords: Health practices, Knowledge assessment, nursing students, preventive measures, vaginal infection, urinary tract infections.

Introduction

Urogenital tract infection (UTI) is a microbial infection that affects any component of the urinary and genital systems, primarily caused by the proliferation of pathogenic bacteria. This condition typically arises when an excessive number of bacterial species, particularly those originating from the gastrointestinal tract and skin microbiota, translocate from the perianal region to the vaginal and urethral openings. Upon entry into the urinary system, these microorganisms colonize the epithelial lining of the urethra and bladder, adhering to mucosal surfaces through specialized adhesins and biofilm formation. The conducive environment within the urinary tract, characterized by abundant nutrients and favorable pH conditions, facilitates rapid bacterial

replication, leading to the onset of infection. If left untreated, the infection can ascend to the upper urinary tract, potentially causing more severe complications, such as pyelonephritis or reproductive tract infections **(Abdallah, Soliman & Mohamed, 2023).**

Urogenital tract infections encompass two primary categories, one of which is urinary tract infection (UTI). UTI is a broad term referring to an infectious process affecting the urinary system, which includes the urethra, bladder, ureters, and kidneys. It typically develops when pathogenic microorganisms, predominantly bacteria, successfully evade the host's innate defense mechanisms, such as urine flow, mucosal immunity, and antimicrobial peptides. The infection can be localized to the lower urinary tract, affecting the urethra (urethritis) and bladder (cystitis), or it may progress to the upper urinary tract, involving the ureters and kidneys (pyelonephritis). The severity of the infection depends on factors such as bacterial virulence, host immune response, and underlying health conditions, with upper tract infections posing a greater risk of complications, including renal damage and systemic infection **(Jerkovic et al., 2023).**

Urinary tract infection (UTI) is one of the most prevalent bacterial infections affecting women, with a significantly higher incidence compared to men. It predominantly occurs in females between the ages of 16 and 35 years, with approximately 10% of women experiencing at least one episode annually. Epidemiological data indicate that UTI affects between 40% and 60% of women at least once in their lifetime, highlighting its widespread occurrence. Furthermore, recurrent infections are highly prevalent, as nearly 50% of affected individuals develop a second episode within one year. The increased susceptibility of females to UTIs, occurring at a rate at least four times higher than in males, is primarily attributed to anatomical and physiological differences. These include a shorter urethra, which facilitates bacterial ascension, and the proximity of the urethral opening to the perianal region, allowing for easier bacterial translocation. Additional risk factors such as hormonal fluctuations, sexual activity, and disruptions in the vaginal and urinary microbiota further contribute to the elevated frequency of UTIs in women **(Al Youssef et al., 2020).**

Urinary tract infections (UTIs) and their associated complications represent a significant global health burden, contributing to approximately 150 million deaths annually. The majority of UTIs originate in the lower urinary tract, primarily affecting the bladder (cystitis) and urethra (urethritis). Clinical manifestations of UTI vary in severity but commonly include dysuria (pain or burning sensation during urination), hematuria (presence of blood in the urine), and altered urine characteristics such as turbidity and malodor. Systemic symptoms, particularly in cases of ascending infections, may involve suprapubic or lower back pain, fever, chills, and generalized fatigue, indicating potential involvement of the upper urinary tract and an increased risk of pyelonephritis. If left untreated, UTIs can lead to severe complications, including urosepsis and renal impairment, necessitating timely diagnosis and appropriate antimicrobial therapy to prevent disease progression and reduce morbidity and mortality **(Mangai et al., 2019).**

Urogenital tract infections encompass both urinary tract infections (UTIs) and vaginal infections (vaginitis), both of which significantly impact women's health and quality of life. UTIs are among the most common bacterial infections in women, with a high recurrence rate and an increased susceptibility due to anatomical and physiological factors. These infections typically originate in the lower urinary tract, affecting the bladder and urethra, and can ascend to the kidneys if left untreated, leading to serious complications such as pyelonephritis and urosepsis. Clinical manifestations of UTIs include dysuria, hematuria, cloudy or malodorous urine, lower abdominal pain, fever, and fatigue **(Mangai et al., 2019; Al Youssef et al., 2020).**

Similarly, vaginitis is a widespread condition affecting women of reproductive age, characterized by inflammation of the vaginal mucosa and commonly caused by bacterial vaginosis (BV), vulvovaginal candidiasis (VVC), and trichomoniasis (TV). Predisposing factors include hormonal changes (pregnancy, contraception, menopause), diabetes, prolonged antibiotic or corticosteroid use, vaginal douching, and lifestyle factors such as poor dietary habits, obesity, and stress **(Juniar et al., 2023).**

Both UTIs and vaginitis share overlapping risk factors, including disruptions in the vaginal

and urinary microbiota, weakened immune response, and hormonal imbalances. The close anatomical proximity of the vagina and urethra facilitates bacterial translocation, increasing the likelihood of developing concurrent infections (Jerkovic et al., 2023). Effective prevention strategies for both conditions focus on maintaining proper genital hygiene, avoiding unnecessary antibiotic use, wearing breathable clothing, optimizing immune function through balanced nutrition, and minimizing risk factors such as douching and excessive sugar intake **(Abdallah, Soliman & Mohamed, 2023).**

Given the substantial burden of urogenital tract infections, a multidisciplinary approach involving health education, lifestyle modifications, early diagnosis, and appropriate antimicrobial therapy is essential to reduce incidence rates and improve women's reproductive and urinary health outcomes **(Faruqui, 2024).**

Adolescent girls exhibit heightened susceptibility to reproductive tract infections (RTIs) due to the immaturity of the cervical epithelium and the underdeveloped mucosal defense mechanisms, which provide a weaker barrier against microbial invasion. The cervical lining in younger females is thinner and contains a higher proportion of columnar epithelium, which is more vulnerable to pathogenic colonization and infection. Additionally, the relatively low vaginal acidity (elevated pH levels) in this age group reduces the protective role of vaginal microbiota, further increasing the risk of infections **(Johnson & Patel, 2020; Smith et al., 2021; Lee et al., 2023).**

Beyond biological factors, sociodemographic and environmental conditions contribute to the high prevalence of RTIs among adolescent females. Many are engaged in various educational settings - including primary, preparatory, secondary school, and university education - which increases their exposure to external infectious agents. A significant risk factor is the frequent use of public restrooms in schools and universities, which may serve as a reservoir for pathogens and contribute to the development of infections such as vulvitis, an inflammatory condition affecting the external genitalia **(Tolba, Fahmy, Omran, & Mohamed, 2018).**

Given these risks, comprehensive knowledge and awareness of self-care guidelines for preventing vaginal and urinary tract infections play a pivotal role in shaping health behaviors, attitudes, and hygiene practices. Educating young women on proper genital hygiene, appropriate restroom habits, and the importance of maintaining a balanced vaginal microbiome can significantly reduce infection rates, ultimately enhancing their overall reproductive health and quality of life **(Abdelnaem, Mohasib, & Mohamed, 2019).**

Significance of the Study

Reproductive and urinary tract infections are significant health issues for women, often resulting in serious complications such as chronic infections and decreased quality of life. Young women, particularly nursing students, are at higher risk due to factors like frequent public restroom use and shared living conditions. Inadequate genital hygiene, lack of awareness about preventive measures, and misconceptions about self-care further increase the incidence of these infections. To safeguard their health and educate others, nursing students must have sufficient knowledge and adopt effective preventive behaviors **(Juniar et al., 2023).**

Assessing the knowledge and practices of female nursing students regarding infection prevention is crucial for identifying educational gaps and enhancing awareness. A knowledgeable nursing workforce is vital for promoting evidence-based health interventions and reducing infection-related morbidity. Incorporating comprehensive reproductive and urinary health education into nursing curricula will equip students with the necessary skills for effective infection control both personally and professionally. This study aims to improve self-care awareness, hygiene practices, and early detection strategies, ultimately reducing the incidence of vaginal and urinary tract infections and enhancing overall well-being among young women **(Tolba et al., 2018; Abdelnaem et al., 2019).**

Aim of the study:

- The current research work aimed to assess the knowledge and practices of female nursing students regarding preventive measures for vaginal and urinary tract infections.

Research questions:

- What is the level of knowledge among female nursing students regarding the preventive measures for vaginal and urinary tract infections?
- What is the level of adherence to recommended preventive practices for vaginal and urinary tract infections among female nursing students?

Subjects and Method

Research design:

- A univariate descriptive exploratory research design was utilized in this study

Study setting:

The study will be conducted at Faculty of Nursing for all levels of students, Alexandria University, in Alexandria, Egypt. The faculty consists of nine specialized academic departments to ensure a representative sample for the study.

Study subjects:

This study recruited a total of 400 female nursing students through a random selection process from all academic levels during the second semester of the 2023–2024 academic year. The sample size was determined using the **Epi Info** program, based on the following parameters: a total population of 2,300 female nursing students, a 95% confidence level, a 5% margin of error, an expected frequency of 50%, and a minimum required sample size of 342, with a final sample size of 400. Participants were selected using a **simple random sampling technique**, where a computer-generated randomization process was employed to ensure unbiased selection. However, the distribution of students across academic levels was not proportionate to the total population of each level, leading to an unequal representation across different academic years. Consequently, some levels were overrepresented while others were underrepresented, introducing variability in the sample distribution. The inclusion criteria for this study were as follows: female nursing students from all academic levels, with an absence of any medical conditions such as diabetes mellitus, and willingness to participate in the study.

Researching the knowledge and practices of female nursing students regarding preventive measures for vaginal and urinary tract infections is crucial for public health, as these infections are prevalent among young women and can lead to serious complications. This research helps identify educational gaps in nursing curricula, informing targeted programs that equip future nurses with essential infection prevention skills. Additionally, it uncovers misconceptions and barriers to proper hygiene practices, enhancing students' ability to educate patients. Ultimately, improving nursing students' knowledge and practices prepares them for their professional roles and contributes to better community health by reducing infection rates.

Tools of data collection:

Three tools were used to collect the necessary data in the current study:

Tool I: Basic Data Structured Interview Schedule

This tool was developed by the researcher and collected students' sociodemographic data, including age, religion, marital status, academic level , family type, current residence, and monthly income.

Tool 2: Assessment of Female Nursing Students' Knowledge Regarding Preventive Measures for Vaginal and Urinary Tract Infections Questioner:

This self-administered assessment tool was developed by the researcher after reviewing relevant literature (Abdallah, Soliman, & Mohamed, 2023). It was designed to evaluate students' knowledge of urinary tract and vaginal infections. The tool included 30 multiple-choice questions covering various aspects, including definitions, causes, types, risk factors, high-risk groups, signs and symptoms, complications, management, prevention, and sources of knowledge. Regarding the scoring system, knowledge-based questions were assigned scores of 2, 1, or 0, based on the accuracy of responses. The total knowledge scoring system was categorized as follows: correct and complete answers were assigned a score of 2, correct but incomplete answers were assigned a score of 1, and incorrect answers or responses indicating a lack of knowledge were given a score of 0. Based

on the total knowledge score, students' knowledge levels were classified as poor (<50%), average (50% –75 %), and good (>75%).

Tool 3: Assessment of female nursing students' practices regarding preventive measures of vaginal and urinary tract infection questionnaire:

The self-administered assessment tool was developed by the researcher after reviewing relevant literature (Jerkovic et al., 2023) to evaluate female nursing students' practices in managing and preventing urinary tract and vaginal infections. It included 12 questions assessing key preventive practices, such as maintaining proper personal hygiene, washing the genital area with mild soap and water, wiping from front to back after urination and defecation, ensuring adequate hydration by drinking sufficient water, avoiding the use of scented feminine hygiene products, practicing appropriate perineal cleaning techniques, wearing breathable cotton underwear, changing sanitary pads regularly during menstruation, urinating before and after sexual intercourse, avoiding prolonged retention of urine, and seeking timely medical consultation when symptoms arise. Regarding the scoring system, each practice-related question was assigned a score of 2 for correct and complete practices, 1 for partially correct practices, and 0 for incorrect or absent practices. The total practice scores were classified as unsatisfactory preventive practices (<60%) and satisfactory preventive practices (≥60%).

Methods:

The study was conducted according to the following steps:

The study received ethical approval from the Research Ethics Committee (REC) at Alexandria University College of Nursing (IRB00013620 9/19/2025) with serial number AU-20-3-271. Furthermore, an official letter was obtained from the Faculty of Nursing at Alexandria University to secure their approval for data collection after explaining the study's objectives. All participants provided written informed consent and willingly agreed to participate in the survey. The research team followed strict protocols to maintain the confidentiality of participants. Only the study team had access to the personal data collected, ensuring the privacy and anonymity of participants. Additionally, each participant was informed of their right to withdraw from the study at any time.

- **Tool Development Phase:** The researcher developed Tools I, II, and III after reviewing recent relevant literature. The tools were assessed for content validity and applicability by a jury of five experts in the field, whose suggestions and recommendations were considered. The reliability of the tools was tested using the internal consistency test (Cronbach's α).

- A pilot study was conducted on 40 students to ensure the clarity and applicability of the tools, identify potential obstacles, and estimate the time required for data collection. Based on the findings, necessary modifications were made. Students who participated in the pilot study were excluded from the main study sample.

- **Field Work:** Students were introduced to the researcher, an explanation of the study's purpose, and an assurance that their answers would remain confidential. All nursing students received a questionnaire after the clinical day to avoid interfering with their learning. They were instructed to complete it and send it back to the researcher. The researcher provided identical instructions to every nursing student upon completing the Questionnaire. Additionally, they said that each question should only have one response and that no question should go unanswered. The researchers addressed any queries posed by the students. It took each student fifteen to thirty minutes to finish the study materials. Data collection began in April 2024 and continued until the end of October 2024.

- **Evaluation Phase:** After data collection, the information was coded and prepared for computer entry. To overcome input errors, thorough verification and validation were conducted following data entry. Frequency analysis, cross-tabulation, and manual review were employed to identify and resolve inconsistencies. Statistical analysis was performed using The Statistical Package for the Social Sciences (SPSS) version 25, incorporating descriptive statistics such as numbers, percentages, and means. Additionally, statistical tests such as Monte Carlo test, Student t-test, and Pearson

correlation analysis were applied. A significant level of ≤ 0.05 was established for the study.

- **Ethical Considerations:** Ethical considerations were carefully upheld in this study. Written informed consent was obtained after explaining the study's purpose, ensuring participants' understanding. Privacy and confidentiality were strictly maintained to protect identities and data. Participation was voluntary, with the right to withdraw at any time without consequences, ensuring autonomy and adherence to ethical research standards.

Results:

Table (1): Exhibits the distribution of the students studied based on their demographic data. The findings indicate that the majority of students were young, with 50% aged between 20 and 22 years, reflecting a predominantly youthful population. A significant proportion (37.5%) were in their fourth year of study. Additionally, the majority resided in urban areas (83.3%) and were single (86.3%), factors that may influence their health-seeking behaviors. Furthermore, 69.8% of the students perceived their income as sufficient. The vast majority (96.5%) identified as Muslim, which may shape cultural attitudes toward health and healthcare practices.

Table (2): Presents the prevalence and management of urinary tract infections (UTIs) and vaginal infections among the studied students. The findings indicate that nearly half of the participants (48.8%) had experienced a UTI, with 60% reporting at least one episode in the past year. The most commonly reported symptom was pain during urination (68.2%). Additionally, the majority of students (65.3%) preferred seeking hospital care for treatment. Similarly, 43% of the participants had experienced a vaginal infection, with 57.6% reporting at least one occurrence in the past year. Vaginal itching was the most frequently reported symptom (77.9%). Consistent with UTI management, a significant proportion of students (72.8%) preferred hospital-based treatment for vaginal infections. These findings highlight the prevalence of UTIs and vaginal infections among female nursing students and emphasize the importance of effective preventive measures and timely medical intervention to reduce associated complications.

Table (3): Illustrates the distribution of nursing students based on their knowledge levels regarding the prevention of urinary tract infections (UTIs) and vaginal infections, highlighting notable differences across categories. In terms of UTI prevention, the majority of students (82.8%) demonstrated a fair level of understanding, with a mean knowledge score of 27.78 ± 3.749. While most students exhibited moderate knowledge, a significant portion lacked sufficient awareness, which could hinder their ability to apply effective preventive measures.

Conversely, knowledge of vaginal infection prevention was notably higher, with 77.8% of students classified as having good knowledge, while only 1.3% had poor knowledge. The mean score in this category was 38.07 ± 4.448, suggesting greater awareness, potentially due to a stronger emphasis on reproductive health education or increased clinical exposure. When evaluating overall knowledge of both UTIs and vaginal infections, 54.8% of students demonstrated fair knowledge, while only 0.8% had poor knowledge, with an overall mean score of 65.85 ± 6.680.

Table (4): Shows the distribution of nursing students based on their levels of preventive practices regarding urinary tract infections (UTIs) and vaginal infections. The findings indicate a high adherence to preventive measures, as the majority of students demonstrated satisfactory general and specific practices.

In terms of general preventive practices, 97.3% of students exhibited satisfactory practices, while only 2.8% had unsatisfactory practices, with a mean score of 10.16 ± 1.461 (range: 1.0–12.0). Similarly, specific preventive practices followed a comparable trend, with 96.7% of students classified as satisfactory and only 3.3% as unsatisfactory, with a mean score of 7.620 ± 1.024 (range: 1.0–8.0). The overall preventive practices category further reinforces these findings, with 97.5% of students exhibiting satisfactory levels, while only 2.5% demonstrated unsatisfactory practices, with a mean score of 17.78 ± 2.236 (range: 2.0–20.0).

Figure (1): Illustrates the distribution of the studied students based on their sources of information regarding preventive measures for urinary tract infections (UTIs) and vaginal infections. Nearly half of the students obtained their information from the Internet (29.5%) and physicians (31.5%), highlighting the significant

role of digital resources and healthcare professionals in health education.

Table (5): explores the relationship between students' knowledge levels of urinary tract infections (UTIs) and vaginal infections and their demographic characteristics. The results show no statistically significant differences in knowledge levels based on age (p=0.275), academic level (p=0.161), place of residence (p=0.738), marital status (p=0.442), income sufficiency (p=0.386), or religion (p=0.605). Furthermore, prior experiences with UTIs (p=0.785) and vaginal infections (p=0.186) did not significantly influence knowledge levels. These findings indicate that knowledge deficits are consistent across different demographic groups, highlighting the need for inclusive educational interventions to enhance awareness and preventive practices among all students.

Table (6): Examines the relationship between students' levels of preventive practices for urinary tract infections (UTIs) and vaginal infections and their demographic characteristics. The results indicate no significant differences in preventive practice levels based on age (p=0.728), academic level (p=0.463), place of residence (p=0.677), income sufficiency (p=0.497), religion (p=0.542), previous UTIs (p=0.575), or previous vaginal infections (p=0.137). However, a significant association was observed with marital status (p=0.015), suggesting that married students exhibited lower levels of satisfactory preventive practices compared to their single counterparts. These findings highlight the need for targeted educational interventions to improve preventive behaviors, particularly among married students, to enhance their adherence to infection prevention strategies.

Table (7): Denotes the relationship between students' levels of knowledge and their preventive practices regarding urinary tract infections (UTIs) and vaginal infections. The results reveal a statistically significant association (p=0.000), indicating that higher levels of knowledge correlate with better preventive practices. All students with good knowledge demonstrated satisfactory preventive behaviors (100%), whereas those with fair knowledge had a slightly lower percentage (96.8%). In contrast, all students with poor knowledge exhibited unsatisfactory practices (100%). These findings emphasize the critical role of health education in promoting preventive measures and highlight the necessity of enhancing students' knowledge to improve their adherence to effective infection prevention strategies.

Table (1): Distribution of the students studied according to their demographic data

Demographic data		Total (n=400)	
		No.	%
Age (years)	20-	200	50.0
	22-	124	31.0
	24-	21	5.3
	≥26	55	13.7
Academic level	First	51	12.8
	Second	114	28.5
	Third	85	21.3
	Fourth	150	27.5
Place of residence	Urban	333	83.3
	Rural	67	16.8
Marital status	Single	345	86.3
	Married	55	13.8
Monthly income	Enough	279	69.8
	Not enough	121	30.3
Religion	Muslim	386	96.5
	Christian	14	3.5

X^2: Chi square test MC:
Monte Carlo t: Student t-test

Table (2): Distribution of the studied students according to frequency, experience and management of UTI, Vaginal infections

Demographic data		Total (n=400)	
		No.	%
Previous experience of UTIs	No	205	51.2
	Yes	195	48.8
Frequency of previous UTIs (last year)		**N= 195**	
	Once	117	60.0
	Twice	38	19.5
	Three times and more	40	20.5
Presented manifestations of UTIs #	Pain in urination	133	68.2
	Frequent urination	27	13.8
	Urgency	23	11.8
	Abdominal pain	13	6.7
	Fever	5	2.6
Best way to manage UTIs #		**N= 400**	
	Go to hospital	261	65.3
	Take antibiotics	80	20.0
	Take more shower	36	9.0
	Take rest	16	4.0
	Take analgesics	8	2.0
Previous experience of vaginal infections		**N= 400**	
	No	228	57.0
	Yes	172	43.0
Frequency of previous vaginal infections (last year)		**N= 172**	
	Once	99	57.6
	Twice	34	19.8
	Three times and more	39	22.7
Presented manifestations of vaginal infections #	Vaginal itching	134	77.9
	Vaginal discharge	99	57.6
	Burning sensation	82	47.7
	Soreness & discomfort	78	45.3
	Dyspareunia	77	44.7
	Vaginal rash	77	44.7
Best way to manage vaginal infection #		**N= 400**	
	Go to hospital	291	72.8
	Take antibiotics	51	12.8
	Take more shower	45	11.3
	Take rest	10	2.5
	Take analgesics	4	1.0

 # Multiple responses were allowed

Table (3): Distribution of the students studied according to the levels of knowledge about UTIs and vaginal infections preventive measures:

Items		No.	%	Min- Max	Mean ±SD
Knowledge about UTIs	Poor	19	4.8	14.0-36.0	27.78±3.749
	Fair	331	82.8		
	Good	50	12.5		
Knowledge about vaginal infections	Poor	5	1.3	15.0-46.0	38.07±4.448
	Fair	84	21.0		
	Good	311	77.8		
Overall knowledge about UTIs & vaginal infections	Poor	3	0.8	29.0-80.0	65.85±6.680
	Fair	219	54.8		
	Good	178	44.5		

Table (4): Distribution of the students studied according to the levels of preventive practices of UTIs and vaginal infections:

Items		No.	%	Min- Max	Mean ±SD
General practice	Satisfactory	389	97.3	1.0-12.0	10.16±1.461
	Unsatisfactory	11	2.8		
Specific practice	Satisfactory	387	96.7	1.0-8.0	7.620±1.024
	Unsatisfactory	13	3.3		
Overall preventive practices	Satisfactory	390	97.5	2.0-20.0	17.78±2.236
	Unsatisfactory	10	2.5		

Figure (1): Distribution of the students studied according to their sources of information about UTIs and vaginal infections preventive measures:

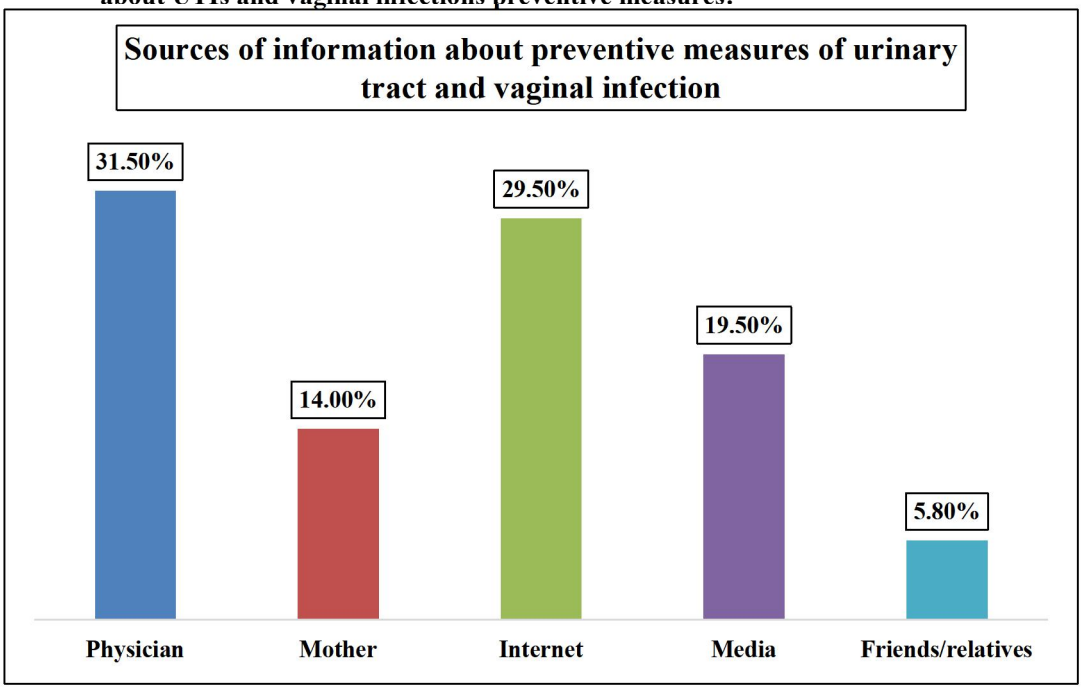

Table (5): Relationship between the studied students' levels of knowledge and their basic characteristics:

Items	Levels of Knowledge						Total (n=400)		Test of Significance
	Poor (N= 3)		Fair (N= 219)		Good (N= 178)				
	No.	%	No.	%	No.	%	No.	%	
Age (years)									
20-	3	1.5	104	52.0	93	46.5	200	50.0	X^2= 7.522 P= 0.275
22-	0	0.0	65	52.4	59	47.6	124	31.0	
24-	0	0.0	13	61.9	8	38.1	21	5.3	
≥26	0	0.0	37	67.3	18	32.7	55	13.7	
Academic level									
First	1	2.0	30	58.8	20	39.2	51	12.8	X^2= 9.234 P= 0.161
Second	2	1.8	70	61.4	42	36.8	114	28.5	
Third	0	0.0	44	51.8	41	48.2	85	21.3	
Fourth	0	0.0	75	50.0	75	50.0	150	37.5	
Place of residence									
Urban	3	0.9	182	54.7	148	44.4	333	83.3	X^2= 0.608 P= 0.738
Rural	0	0.0	37	55.2	30	44.8	67	16.8	
Marital status									
Single	3	0.9	185	53.6	157	45.5	345	86.3	X^2= 1.632 P= 0.442
Married	0	0.0	34	61.8	21	38.2	55	13.8	
Income sufficiency									
Enough	1	0.4	153	54.8	125	44.8	279	69.8	X^2= 1.906 P= 0.386
Not enough	2	1.7	66	54.5	53	43.8	121	30.3	
Religion									
Muslim	3	0.8	213	55.2	170	44.0	386	96.5	X^2= 1.005 P= 0.605
Christian	0	0.0	6	42.9	8	57.1	14	3.5	
Previous UTIs									
No	1	0.5	111	54.1	93	45.4	205	51.2	X^2= 0.484 P= 0.785
Yes	2	1.0	108	55.4	85	43.6	195	48.8	
Previous vaginal infection									
No	3	1.3	119	52.2	106	46.5	228	57.0	X^2= 3.369 P= 0.186
Yes	0	0.0	100	58.1	72	41.9	172	43.0	

X^2= Chi Square test * Significant at p ≤0.05

Table (6) Relationship between the studied students' levels of practice and their basic characteristics:

Items	Levels of Practice				Total (n=400)		Test of Significance
	Unsatisfactory (N= 10)		Satisfactory (N= 390)				
	No.	%	No.	%	No.	%	
Age (years)							
20-	4	2.0	196	98.0	200	50.0	X^2= 1.303 P= 0.728
22-	4	3.2	120	96.8	124	31.0	
24-	0	0.0	21	100.0	21	5.3	
≥26	2	3.6	53	96.4	55	13.7	
Academic level							
First	1	2.0	50	98.0	51	12.8	X^2= 2.570 P= 0.463
Second	5	4.4	109	95.6	114	28.5	
Third	2	2.4	83	97.6	85	21.3	
Fourth	2	1.3	148	98.7	150	37.5	
Place of residence							
Urban	8	2.4	325	97.6	333	83.3	X^2= 0.078 P= 0.677
Rural	2	3.0	65	97.0	67	16.8	
Marital status							
Single	6	1.7	339	98.3	345	86.3	X^2= 5.959 P= 0.015*
Married	4	7.3	51	92.7	55	13.8	
Income sufficiency							
Enough	6	2.2	273	97.8	279	69.8	X^2= 0.462 P= 0.497
Not enough	4	3.3	117	96.7	121	30.3	
Religion							
Muslim	10	2.6	376	97.4	386	96.5	X^2= 0.372 P= 0.542
Christian	0	0.0	14	100.0	14	3.5	
Previous UTIs							
No	6	2.9	199	97.1	205	51.2	X^2= 0.314 P= 0.575
Yes	4	2.1	191	97.9	195	48.8	
Previous vaginal infection							
No	8	3.5	220	96.5	228	57.0	X^2= 2.214 P= 0.137
Yes	2	1.2	170	98.8	172	43.0	

X^2= Chi Square test * Significant at p ≤0.05

Table (7): Relationship between the studied students' levels of practice and knowledge:

Items	Levels of Practice				Total (n=400)		Test of Significance
	Unsatisfactory (N= 10)		Satisfactory (N= 390)				
	No.	%	No.	%	No.	%	
Level of knowledge							
Poor	3	100.0	0	0.0	3	0.7	X^2= 122.00 P= 0.000*
Fair	7	3.2	212	96.8	219	54.8	
Good	0	0.0	178	100.0	178	44.5	

X^2= Chi Square test * Significant at p ≤0.05

Discussion

Urogenital infections are a significant global health concern, particularly among adolescent females. The increased susceptibility in females is primarily due to their shorter urethra and the proximity of the urethral opening to the rectum, facilitating bacterial entry into the genitourinary tract. Research has identified key risk factors for these infections, including poor personal hygiene, disrupted voiding patterns, and a lack of awareness regarding menstrual hygiene practices (Sequera et al., 2021). Addressing these risk factors through education and improved hygiene practices is essential for reducing the prevalence of urogenital infections.

Knowledge level of female nursing students regarding the preventive measures for urinary tract infections (UTIs).

In evaluating the knowledge levels of female nursing students regarding the preventive measures for urinary tract infections (UTIs) , this study identified significant differences in their understanding of infection prevention. The majority of students demonstrated a fair level of knowledge concerning UTI prevention, with only a small proportion exhibiting a high level of understanding.

The variations in knowledge levels among female nursing students regarding UTI prevention can be attributed to differences in curricular emphasis, clinical exposure, and access to educational resources. The extent to which UTI prevention is integrated into nursing curricula, along with variations in practical training and instructional methodologies, may influence students' comprehension. Additionally, disparities in personal experiences, cultural awareness, and prioritization of other infections over UTIs may contribute to differing levels of understanding. These factors collectively account for the predominance of a fair level of knowledge among students, with only a minority demonstrating a high level of proficiency in UTI prevention.

The findings of this study are consistent with previous research identifying substantial gaps in nursing students' knowledge regarding the prevention of urinary tract as Hussein et al. (2021) assessed the knowledge of nursing students at Mosul University, Iraq, in a study titled *"Assessment of Nursing Students' Knowledge toward Preventive Measures of Urinary Tract Infections in Mosul Teaching Hospitals."* The study found that a moderate number of participants had an average level of knowledge, while a significant minority demonstrated poor understanding. The researchers emphasized the necessity of educational programs to improve students' awareness of the seriousness of UTIs and the importance of preventive measures.

In their study titled "Knowledge and Awareness of Urinary Tract Infections among University Students in Bangladesh," Tabassum et al. (2021) explored the awareness levels of university students regarding urinary tract infections (UTIs). The research revealed that a significant majority of participants correctly identified bacteria as the primary pathogens responsible for UTIs and recognized the importance of antibacterial medications in their treatment. However, a notable portion of the respondents exhibited limited understanding of the long-term consequences associated with untreated UTIs. The authors concluded that it is essential to educate students about the symptoms, causes, and preventive measures related to UTIs to mitigate morbidity rates.

On the other hand, the current study was inconsistent with a study conducted by Abdallah et al. (2024) titled "Knowledge and Habitual Practice Regarding Prevention of Genito-urinary Tract Infection among Adolescent Nursing Girls Students" assessed both knowledge and habitual practices related to the prevention of Genito-urinary tract infections (GUTIs) among adolescent nursing students. The study revealed that the majority of the participants had unsatisfactory habitual practices regarding GUTI prevention. The authors emphasized the necessity for educational programs to enhance awareness and promote effective preventive practices among adolescent nursing students.

The discrepancies between the findings of this study and previous research may be attributed to variations in methodological approaches, including differences in sample size, study duration, and population characteristics. Studies with smaller sample sizes may lack statistical

power, limiting the generalizability of their findings, whereas larger sample sizes provide more reliable and representative data. Additionally, variations in study duration and data collection timelines may influence the assessment of knowledge retention and behavioral changes. Short-term studies may not fully capture the long-term effects of educational interventions, whereas longer-duration studies allow for a more comprehensive evaluation of knowledge acquisition and implementation of preventive measures.

Furthermore, differences in study populations and educational settings play a critical role in the observed inconsistencies. While some studies focus on adolescent girls with limited exposure to formal infection prevention training, others assess nursing students with varying levels of theoretical knowledge and clinical experience. Additionally, differences in assessment tools and evaluation criteria, such as variations in questionnaire design, scoring systems, and classification of knowledge levels, may result in inconsistent findings across studies. Standardizing research methodologies and assessment tools across studies would enhance comparability and provide a more accurate understanding of nursing students' knowledge regarding the prevention of urinary tract infections and vaginal infections.

Knowledge level of female nursing students regarding the preventive measures for vaginal infection:

The study findings revealed that most female nursing students had a high level of knowledge regarding the preventive measures for vaginal infections. Specifically, approximately three-quarters of the participants were classified as having good knowledge, while only a small proportion demonstrated poor knowledge in this area. The resulting finding may be attributed to the integration of vaginal infection prevention into nursing education curricula, which ensures that students receive comprehensive theoretical knowledge on the topic. Formal instruction on infection control, reproductive health, and hygiene practices equips nursing students with the necessary information to understand risk factors, symptoms, and preventive measures, contributing to their high level of knowledge in this area.

The findings of this study are consistent with the previous four research as first, Ahmed et al. (2020) conducted a study titled *"Reproductive Health Awareness and Vaginal Infection Prevention Among Nursing Students in Egypt."* The study evaluated nursing students' knowledge and awareness of vaginal infection prevention and found that over 70% of participants demonstrated good knowledge. The authors attributed this to their academic training and clinical exposure. However, the study highlighted gaps in students' understanding of lifestyle-related risk factors, emphasizing the need for improved educational interventions to enhance preventive practices.

Second, Kumar et al. (2019) in their study *"Knowledge and Awareness of Vaginal Infections Among Female Healthcare Students in India"* examined the level of awareness among nursing and medical students. The findings revealed that nursing students had significantly higher knowledge compared to non-medical students, largely due to their curriculum and hands-on training. Despite this, some participants exhibited misconceptions regarding self-care and personal hygiene, suggesting the need for more targeted health education programs.

Third, Al-Mousa et al. (2021) conducted a cross-sectional study titled *"Understanding of Vaginal Infections Among University Students in Saudi Arabia."* The study reported that while nursing and medical students demonstrated a strong understanding of preventive measures, knowledge gaps persisted in areas such as lifestyle modifications and hygiene practices. The authors recommended integrating more practical training and awareness campaigns to reinforce theoretical knowledge and encourage effective preventive behaviors.

Fourth, Chen et al. (2022) conducted a study titled *"Knowledge, Attitudes, and Practices Regarding Vaginal Infections Among Nursing Students in China."* The study highlighted that while most students possessed strong theoretical knowledge, their practical application of preventive measures varied. The findings indicated that gaps in personal preventive behaviors could be addressed through enhanced clinical training and awareness programs focusing on real-life applications. The authors emphasized the importance of bridging the gap between theoretical learning and practical implementation in nursing education.

The consistency between the findings of this study and the referenced studies can be attributed to two primary factors. Firstly, the integration of vaginal infection prevention into nursing curricula across various educational institutions ensures a standardized level of theoretical knowledge among nursing students. This structured academic framework provides comprehensive instruction on risk factors, symptoms, and preventive strategies, contributing to a high level of awareness. Secondly, clinical training and practical exposure serve to reinforce theoretical learning by allowing students to apply evidence-based infection prevention measures in real-world healthcare settings. Through clinical rotations and direct patient care, students develop a deeper understanding of infection control practices, further supporting the observed consistency in knowledge levels across studies.

On the other hands, the findings of this study are inconsistent with Johnson et al. (2020) conducted a study titled "Gaps in Knowledge and Awareness of Vaginal Infection Prevention Among Nursing Students in South Africa." The study found that a significant proportion of nursing students had limited knowledge regarding vaginal infection prevention, with less than half demonstrating adequate understanding of risk factors and preventive measures. The authors attributed this inconsistency to gaps in nursing curricula, insufficient emphasis on reproductive health, and a lack of practical training opportunities. They recommended curriculum enhancements and targeted educational programs to improve students' awareness and preparedness in infection prevention.

The differences between this study's findings and those of other research can be attributed to the variation in nursing curricula and educational emphasis on vaginal infection prevention across different regions. Differences in course content, teaching methodologies, and the extent of practical training may lead to discrepancies in students' knowledge levels. In regions where reproductive health and infection prevention receive less emphasis in nursing programs, students may exhibit lower awareness compared to those in institutions with a more comprehensive curriculum.

Self-care practices

The assessment of nursing students' preventive practices regarding urinary tract infections (UTIs) and vaginal infections revealed a high level of adherence, with the majority demonstrating satisfactory compliance with recommended preventive measures. The findings indicate that nearly all participants consistently followed both general and specific infection prevention strategies. This high adherence can be attributed to two primary factors. Firstly, the structured academic and clinical training provided in nursing programs emphasizes infection prevention, equipping students with essential knowledge and skills to implement effective hygiene and preventive measures. Through theoretical instruction and practical experience in healthcare settings, students develop a comprehensive understanding of infection control principles. Secondly, their continuous exposure to clinical environments enhances their awareness of the risks associated with inadequate infection prevention. Direct patient care experiences, clinical supervision, and peer observation reinforce the importance of adherence to preventive practices, fostering the development of consistent and effective infection control behaviors.

The findings of this study align with several previous research studies that have assessed nursing students' adherence to preventive practices regarding urinary tract infections (UTIs) and vaginal infections. Firstly, Smith et al. (2023) conducted a study titled "Exploring the Determinants of UTI Preventive Behavior's in Female University Students: The Role of Education and Demography," which examined factors influencing UTI) preventive behaviors among female university students. The findings revealed that knowledge about UTIs, age, education level, personal health history, and healthcare engagement played a significant role in shaping preventive practices. Notably, students with a history of UTIs and those who attended frequent health check-ups demonstrated higher adherence to preventive behaviors. The study emphasized the importance of education and proactive healthcare engagement in promoting effective UTI prevention strategies among female university students. These results align with previous research that highlights the role of healthcare exposure and structured education in

reinforcing adherence to infection prevention measures.

Secondly, A study by Gaheen et al. (2021) titled "Knowledge and Compliance of Nursing Students Regarding Infection Control Standard Precautions During Their Clinical Training" assessed nursing students' adherence to infection prevention practices. The study found that a significant majority of students demonstrated good compliance with infection control measures, which was attributed to the integration of infection control education within the nursing curriculum and reinforcement during clinical training.

The consistency between this study's findings and the referenced studies can be attributed to two primary factors. Firstly, the incorporation of infection prevention education within nursing curricula provides students with structured and comprehensive training on hygiene and preventive strategies. This standardized instruction ensures a uniform level of knowledge and practice among nursing students across different study settings. Secondly, extensive clinical exposure and practical training in healthcare environments play a crucial role in reinforcing adherence to infection control protocols. Supervised clinical practice, peer collaboration, and direct patient care experiences enhance students' awareness of the significance of preventive measures, leading to consistent adherence to best practices across various studies.

While some studies report high adherence to preventive practices for urinary tract infections (UTIs) and vaginal infections among nursing students, others present contrasting findings, indicating suboptimal and inadequate preventive behaviors. A study conducted by Mahmoud et al. (2019) assessed the preventive self-care practices against urinary tract infections (UTIs) among secondary nursing students, revealing that less than two-thirds demonstrated inadequate self-care behaviors. Many students failed to follow essential hygiene measures, such as proper wiping techniques and regular undergarment changes, which are crucial for preventing bacterial infections. Additionally, poor hydration habits, including insufficient water intake and infrequent urination, increased their risk of UTIs. The study also highlighted a lack of awareness regarding dietary practices beneficial for urinary health, such as consuming cranberry juice and probiotics. These findings emphasize the need for targeted education to improve self-care practices and reduce the risk of UTIs among nursing students**.**

Furthermore, Akinwaare et al. (2020) conducted a study titled "Perceived Barriers, Knowledge and Reported Practices of Infection Prevention and Control Among Clinical Nursing and Medical Students of a Nigerian University," which revealed that although the majority of students possessed adequate knowledge about infection control, a considerable proportion exhibited low compliance with infection control measures. The study identified significant barriers to effective infection control practices, including the unavailability of gloves, the lack of color-coded waste disposal systems, time constraints, and the demanding nature of handwashing procedures. These findings underscore the necessity for healthcare institutions to address these obstacles by ensuring the availability of essential resources, providing comprehensive training, and fostering a culture that prioritizes infection prevention and control.

The discrepancy between the findings of this study and the previously mentioned studies can be attributed to two primary factors. Firstly, differences in educational resources and institutional infrastructure significantly influence adherence to infection prevention practices. In settings with limited access to updated educational materials, inadequate hygiene facilities, and insufficient hands-on training, students may face challenges in effectively implementing preventive measures. In contrast, the participants in this study may have benefited from a well-structured curriculum and comprehensive clinical exposure, enhancing their adherence to infection control protocols. Secondly, variations in the level of clinical supervision and reinforcement of preventive practices contribute to the observed disparities. Studies reporting lower adherence rates often highlight insufficient clinical oversight, which may lead to gaps in compliance with infection prevention guidelines. Conversely, the nursing students in this study may have received continuous supervision, peer collaboration, and systematic reinforcement of infection control measures, fostering a higher level of adherence.

The relationship between students' levels of knowledge and their preventive practices regarding urinary tract infections (UTIs) and vaginal infections.

The findings of this study demonstrate a strong positive correlation between nursing students' knowledge levels and their adherence to preventive practices for urinary tract infections (UTIs) and vaginal infections. The statistically significant association (p=0.000) indicates that students with higher knowledge consistently engage in effective preventive behaviors, whereas those with poor knowledge exhibit inadequate practices. These results reinforce the essential role of health education in fostering infection prevention, suggesting that enhanced instructional programs can significantly improve students' adherence to best practices. Strengthening educational interventions and clinical training is crucial to bridging knowledge gaps and promoting effective infection control strategies.

The findings of this study are consistent with two researches as Juniar et al. (2023) conducted a study titled "The Relationship Between Level of Knowledge and Vaginal Discharge Prevention Behavior for Nursing Students," which examined the correlation between students' knowledge and their preventive practices. The findings revealed a statistically significant relationship between knowledge levels and adherence to vaginal discharge prevention measures, with the majority of students demonstrating a good understanding of the condition and its associated risk factors. Additionally, a high proportion of participants exhibited appropriate preventive behaviors, including maintaining proper hygiene and adhering to recommended self-care practices. The study concluded that higher knowledge levels strongly correlate with better compliance with infection prevention measures, emphasizing the need for targeted health education programs to enhance awareness and reinforce preventive strategies among nursing students.

Similarly, Mahmoud et al. (2019) conducted a study titled *"Self-Care Practices Regarding Prevention of Urinary Tract Infection Among Secondary Nursing Students."* Their results showed a strong positive correlation between students' knowledge levels and their preventive behaviors. The study reported that students with high knowledge scores were significantly more likely to engage in proper hygiene and preventive measures ($p<0.001$). These findings highlight the critical role of knowledge in shaping infection prevention behaviors and stress the need for integrating structured educational interventions into nursing curricula.

Conclusion

The findings of this study indicate that while the majority of nursing students exhibited a fair level of knowledge regarding urinary tract infections (UTIs), their understanding of vaginal infections was comparatively higher, with most students demonstrating good knowledge. Additionally, adherence to preventive practices was notably high, with the vast majority of students engaging in satisfactory behaviors. The statistically significant association between knowledge levels and preventive practices ($p = 0.000$) underscores the critical role of education in promoting adherence to infection prevention measures.

Recommendations

In light of the study findings, the following recommendations are suggested:

- **Enhancement of Educational Programs** – Structured educational interventions should be implemented to strengthen nursing students' knowledge of urinary tract infection (UTI) and vaginal infection prevention, ensuring a more comprehensive understanding of risk factors, transmission pathways, and evidence-based preventive measures.
- **Integration of Practical Training** – Practical, hands-on training sessions and case-based learning should be incorporated into nursing curricula to reinforce the application of infection prevention strategies in clinical practice, thereby bridging the gap between theoretical knowledge and practical implementation.
- **Implementation of Awareness Initiatives** – Regular awareness campaigns, seminars, and workshops should be conducted to highlight the significance of adherence to infection prevention practices and to address prevailing misconceptions, thereby fostering a culture of compliance among nursing students.

- **Development of Monitoring and Evaluation Frameworks** – A systematic mechanism for assessing students' knowledge and adherence to preventive measures should be established, allowing for continuous evaluation, feedback, and refinement of educational strategies to enhance long-term adherence to best practices.
- **Promotion of Peer-Led Educational Approaches** – Peer-led learning initiatives should be encouraged, wherein students with advanced knowledge levels mentor their peers, facilitating collaborative learning and reinforcing adherence to evidence-based infection prevention practices.

Limitations of the study:

- Despite the significant findings of the present study, the following limitations should be acknowledged:
- The study was conducted in a single educational setting, limiting the generalizability of findings to other institutions and populations.
- Self-reported data may be affected by recall and social desirability bias, impacting response accuracy.
- Cross-sectional design prevents the assessment of changes in knowledge and practice over time.
- Variations in clinical experience among participants were not considered, potentially influencing their understanding and adherence to preventive measures.
- The study focused solely on nursing students, limiting its applicability to practicing nurses and the general population.

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Conflicts of interest disclosure

The authors have no conflicts of interest to declare.

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