Effect of Online Education on Nurses' Performance Caring for Patients with Kidney Stones

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Abstract

Background: Renal stone disease is a significant public health burden around the world. Increasing nurses' awareness about the variables risk that influence disease progression in patients with urinary tract stones is an important aspect of controlling and improving the quality of life among those group of patients. **Aim:** The study aimed to evaluate the effect of online education on nurses' performance caring for patients with kidney stones. **Design**: A quasi-experimental research design was used (pre/post-test). **Setting**: The research was carried out in the Urology and Nephrology Unit at South-Vally University Hospital. **Sample**: A convenient sampling included all 50 registered nurses were worked in the previously mentioned setting. **Tools**: Two tools were used for data collection: Tool (I) Nurses' interview questionnaire included Part (1) demographic characteristics of the studied nurses, Part (2) Nurses' knowledge assessment questionnaire, and Tool (II) Assessment of nurses' reported practices regarding caring of patients with kidney stones. **Results**: The study revealed that nurses' Mean ± SD of age were (25.3 ± 2.8) and 60% of them were female. A statistically significant difference and improvement was found between nurses' knowledge and reported practices caring for patients with Kidney Stones post- online education than before. Also, a statistically significant correlation was observed between nurses' knowledge and reported practices post- online education**. Conclusion**: The study results concluded that online education had positive effects on improving nurses' performance caring for patients with kidney stones. **Recommendations**: Providing online education for nurses' performance caring for patients with kidney stones is recommended to improve their knowledge and reported practices.

Keywords: Kidney stones, Nurses' performance, Online education.

Introduction:

Renal stone disease is a crystal concretion formed usually within the kidneys. It is an increasing urological disorder of human health, affecting about 12% of the world population also; it has been associated with an increased risk of end-stage renal failure (**Alelign T, Petros, 2018**). Renal stones form when compounds in the urine aggregate into a solid mass (**Aggarwal et al., 2019**). Renal stones form in the kidneys as a result of precipitation of urinary constituents and may develop in one or both of the kidneys. Renal stone disease is a considerable burden on public health worldwide (**Lewis**, **2019**). Kidney stones could cause extreme pain and urinary blockage in severe cases (**University of Maryland Medical Center**, **2019**).

The prevalence of urinary stones is high, estimated at 2 to 3% in the general population. The disease is a common cause of emergency hospitalizations, with more than 30,800 reported

hospitalizations per year in England and 550,000 emergency room visits in the United States. The risk of recurrence is estimated at 50% within 5 years of the first stone episode (**Raja et al., 2020, & Snicorius et al., 2021**)

Very small stones can pass through the entire urinary tract without causing symptoms, but larger stones could be lodged in the kidneys, ureters, bladder, or urethra. (National Library of Medicine, 2019) Renal stones are frequently passed without complications, using only conservative treatment such as pain relief and hydration (**Aliotta et al., 2019**)

Although the etiology of kidney stones is multifactorial, diet appears to be an important factor due to its ability to affect urine composition. Certain components of the diet, in addition to fluid intake, could alter important factors that increase the risk of kidney stones (**Prieto et al., 2019**). Dietary habits play an important role in the formation and recurrence of kidney stones, food manipulation has become a fundamental tool in the medical treatment of nephrolithiasis. Dietary counseling aims to reduce most lithogenic risk factors by reducing urinary super saturation, mainly calcium oxalate, calcium phosphate, and uric acid (**Ferraro et al., 2020).**

Renal stones increase the risk of chronic kidney disease and end-stage renal disease, independently of risk factors shared by stone formers and those with chronic kidney diseases such as high blood pressure and diabetes. It is estimated that the risk of chronic kidney disease is twice as high in stone formers compared with non-stone formers (**Frassetto & Kohlstadt, 2018**). Renal stone is one of the most vulnerable diseases in the renal system. One person in every 20 people suffers from this disease in Bangladesh. Renal stone is a high risk for males after 40 years old, and for females is after 50 years old (**Solberg et al., 2017**). However, at any time of aged people could suffer from renal stones and that could be repeated several times. In Bangladesh, 20 million people are suffering from renal diseases. In this type of disease 5 people are died at an early age. At present renal stone accounts for about 1 in every 10 patients worldwide and 63% of people die from the noncommunicable disease (**Samad et al., 2017**)

Online education and distance learning were first established in wealthy countries (**Cassum, et al., 2020**). Nurses could use online education to hone and polish their existing skills and knowledge, resulting in higher quality treatment. Furthermore, continuing education led to upgrading their knowledge and abilities. As a new option for nurses to acquire continual education, online educational models have emerged (**Abd Elaziz, et al., 2021**).

The management approach includes various techniques such as action plans, problem-solving, self-monitoring, coping skills, stress management, experience sharing, coaching, motivation, confidence, positive feedback, and peer role models to support and empower patients to improve their quality of life (**Hassan et al., 2019**). Nurses are the key and have the most important role in health education to support and persuade patients to self-medicate (**Mohamed et al., 2017**).

Online education management system afford various advantages that encourages nurses for autonomous learning and promote discovery for particular knowledge provided through presentations, videos, live interactive activities, tests that has automatic correction of questions, re-grading system, immediate scoring, and instant feedback, persistent assignments and assessment, training activities that govern the behaviors of nurses (**Stange et al., 2017**). Hence, the study aimed to evaluate the effect of online education on nurses' performance caring for patients with kidney stones.

Significance of the study:

The lifetime risk of urinary stone disease is 12% among males and 6% in females and the prevalence of the condition is increasing, resulting in approximately 12,000 hospital admissions every year. Kidney stones are becoming an increasing clinical and economic burden on global health services (**Hughes et al.,2020**). Stone disease and its treatment(s) could impair patients' health-related quality of

life, increase hospital admissions, and even cause kidney damage or infection with poor health outcomes and an increased financial burden **(Raja et al., 2020 & Abdelwahab et al., 2021).**

Lack of knowledge about renal stones, the nurse would not be able to provide the appropriate care to the patients; as a result, there was a possibility to increased risk for such group of patients to develop chronic kidney disease. In this situation, the patients suffered, and they couldn't take their treatment properly. The management of renal stones largely depends on medical and surgical procedures (according to patients' needs) and nurses' duties mainly are pre and postoperative management of renal stones. If the nurses have proper knowledge about the management of patients with renal stone, they would be able to perform their responsibilities efficiently. Therefore, it is important to know the level of nurses' knowledge regarding the care of patients with renal stones.

Aim of the study:

The study aimed to evaluate the effect of online education on nurses' performance caring for patients with kidney stones through:

- Assessing nurses' level of knowledge regarding care of patients with kidney stones pre- and post-online education.
- Assessing nurses reported practice level regarding care of patients with kidney stones pre and post-online education.
- Designing and implementing online education based on the nurse's needs.
- Evaluating the effect of online education on nurses' performance caring for patients with kidney stones.

Research hypothesis:

Nurses' knowledge and practices about caring for patients with kidney stones will improve post-receiving the online education.

Operational Definitions:

Online education: a method of acquiring skills and knowledge by using electronic devices such as computers, mobile phones, and laptop computers to access the internet.

Subjects and Method:

Research design:

A quasi-experimental research design was utilize in the study (one group, pre/post-test)

Setting:

The research was carried out in the Urology and Nephrology Unit at South-Vally University Hospital, Egypt. This setting was selected because it serves the most populated region of the city.

Subjects:

A convenient sampling included all the available nurses (50), who were worked in the previously mentioned setting

Data collection tools:

Two tools were used to collect data and carry out the present study:

Tool I: Nurses' interview questionnaire: It was designed by the researcher based on a literature review and opinions of experts for content validity. It was translated into Arabic form to avoid misunderstanding; it was applied to all nurses in the study before and after the implementation of the online education. The questionnaire covered four main parts as the following:

Part I: Nurses Demographic characteristics. It included five items of personal demographic characteristics of the nurses such as age, gender, qualifications, years of experience, residence, and source of knowledge.

Part II: Nurses' knowledge assessment questionnaire: To assess nurses' level of knowledge about care of patients with kidney stones, it assessed nurses' level of knowledge twice pre/post implementation of the online education. It was adopted from (**Almuhanna et al., 2018, Almutairi et al., 2019 &Mahmoud et al., 2019).** Total items list was 13 classifieds into three different sections as the following:

First section: Assessment of nurses' knowledge regarding kidney stones: It consisted of nine multiple choice questions (MCQ) about the definition of kidney stone, risk factors of stone formation, types of kidney stone, symptoms, diagnosis, methods of prevention, factors that increase the formation of stones, methods of treatments, and what are the stones that respond to drug treatment.

The second section: Assessment of nurses' 'knowledge regarding stone formation and diet: it is composed of four (MCQ), about the relation between stone formation and diet, foods that reduce and/or increase the chance of stones formation, and amount of water that must be consumed throughout the day.

Scoring system: Response scores were assigned as follows: each question has one correct answer, and if the patient answer is correct, the nurse would score one grade, zero was given for incorrect answers or for "I do not know" and then all selected options are collected, and scores are given. The total scores ranged from 0 to 13 grade. The overall grades were added up, the percentage calculated for all participants, and knowledge level was considered satisfactory at the cut of point ≥ 75 %, while unsatisfactory started from < 75 % based on statistical analysis.

Tool II: Assessment of nurses' reported practices regarding care of patients with kidney stones: It was adapted from **Mahmoud, et al., (2019**).and modified by the researchers after review of the current related literature. It contained items related to permitted foods consumption for patients with kidney stones regarding eating white meat, fresh fruits, fish and sea foods, fiber such as oats/bran, egg, liver, vegetables such as spinach/turnips, and whole grains.

It contained items related to the consumption of restricted foods such as the canned, the salty, the fast, and the sweetened foods, as well the carbohydrates, milk and dairy products, red meat, chocolate, citrus foods like lemon and orange, foods high in oxalates like tomatoes and legumes. It contained items related to consumption of fluids regarding drinking plenty of fluids in hot weather, fever, diarrhea, exercises, heavy physical exertion, avoiding drinking cola, avoiding taking stimulants, such as tea and coffee, drinking fresh fruit juice as cranberry juice, control the amount of urine which should not be less than (2.5) liters / 24 hours, replace fluid loss, drink enough fluids with or between meals, drink water before bed and after waking up.

It contained recommended items related to a patient with renal stone, as they should be counseled on stone-specific dietary interventions. Patient with renal stone should be assessed for risk of chronic kidney disease. Also it including preventive measures for renal stones formation, medication use should be evaluated and modified as needed, patients with renal stone should increase fluid intake to at least 2 L per 24 hours, renal stone type should be identified when possible, even on initial stone occurrence, urine characteristics should be obtained in patients with renal stones to guide treatment and preventive measures, patients should avoid calcium supplements unless their health care provider approves, decreasing animal protein and oxalate intake is recommended, eliminating oxalate-containing foods is unnecessary. (e.g. chocolate, coffee, strawberries, and tea)

Scoring system:

Assessment of nurses' reported practices regarding kidney stones was calculated as:

- (2 grade) for the "correct" answer
- (0 grade) for the "incorrect" answer.

The total score ranges from 0 – to 20. For the reported practices, for each part, the score of the items was summed up and the total was divided by several items, giving a mean score for the area. These scores were converted into a percent score, mean and standard deviations were computed as follows the competent level of practices ≥ 75 %, incompetent level of practices < 75 % based on statistical analysis.

Tool Validity and Reliability:

The content validity of the tools, their clarity, comprehensiveness, appropriateness, and relevance were reviewed by five expert professors with more than ten years of experience: three experts in medical-surgical nursing, and two expert physicians from the medical-surgical department. No modifications were made according to the panel judgment. Examination of the content validity index (CVI) showed that CVI = 89%.

The reliability was used to assess the tools' internal consistency by repeatedly giving the same tool to the participants under the same settings. The correlation coefficient for knowledge was 0.93 and for practice was 0.89 by Cronbach's alpha.

Procedure:

The actual study included three phases:

A-Preparatory phase:

The researchers reviewed the current and past available literature as textbooks, articles, magazines, and internet searches to develop the tools for data collection and prepare the online education contents. The brochure was written in Arabic language, printed out regarding the sample size, and given after implementing the online education.

Administrative Design:

An official letter requesting permission to conduct the study was directed from the dean of the faculty of nursing at South-Vally University to the directors of the previously selected setting to obtain their approval to carry out this study.

Ethical consideration:

Official permission was obtained through an issued letter from the Dean of Faculty of Nursing, South-Vally University to conduct this study. Written consent was obtained from the directors of the previously mentioned setting after explaining the aim of the study. An informed consent form was obtained from the nurses before starting the study and a brief introduction about the study's objectives was explained, the researchers informed the participants that, the study was voluntary, they were allowed to refuse to participate and they had the right to withdraw from the study at any time, without giving any reason, anonymity and confidentiality were preserved for the participant

Pilot study:

A pilot study was carried out on (10%) of the nurses (5nurses) from the selected unit using the previously mentioned tools, to evaluate their applicability, clarity, and estimate time for each tool. Nurses involved in the pilot study were included in the main study subjects.

Implementation phase:

Data were collected from the beginning of March to the end of August 2021. The questionnaire took between 25 and 35 minutes to complete.

Nurses were approached in the previously selected setting to fill out the printed pre-test questionnaire during face-to-face interviews with the researchers.

The researchers created an educational package based on the pre-test results for determining the nurses' actual needs. An online link was created and given to the nurses who were included in the study via social media web pages (Facebook and WhatsApp). It focused on

knowledge and practice issues that should be improved.

This phase included 12 weeks to implement online education regarding kidney stones. The subject contents have been sequenced through six sessions (four sessions for theoretical content and two sessions for practice), and each session took 40-50 minutes. The total time was about 3 hours for each group; nurses involved in the study were divided into 7 groups. Each group included seven to eight nurses.

Four theoretical online lectures were part of online education. **The first online lecture** covered an overview the definition of kidney stones, risk factors of stone formation, types of kidney stones, symptoms, diagnosis, and complications.

The second and third lectures focused on methods of prevention, factors that increase the formation of stones, methods of treatments, and what are the stones that respond to drug treatment. Knowledge regarding stone formation and diet was covered in **the fourth online lecture**.

The fifth online lecture focused on the consumption of the permitted food for patients with kidney stones and the consumption of restricted foods.

The sixth online lecture was on the consumption of fluids regarding drinking plenty of fluids in hot weather, fever, diarrhea, exercises, heavy physical exertion, avoiding drinking cola, avoiding taking stimulants, such as tea and coffee, drinking fresh fruit juice as cranberry juice, control the amount of urine which should not be less than (2.5) liters / 24 hours, replace fluid loss, drink enough fluids with or between meals, drink water before bed and after waking up.

A simplified booklet was used as a supportive resource and delivered to the nurses in Arabic language to cover all elements of the knowledge and practice about caring of patients with kidney stones. This online education was delivered to nurses using a live broadcast Zoom meeting and the researchers began the session by giving a review of the prior session in 5 minutes. And 10 minutes are included at the end of each presentation for questions and/or clarification. For attracting the studied nurses, PowerPoint presentations, brainstorming, questioning, and responses were employed as teaching methods during each lecture.

Evaluation phase:

After one month of implementing the online education, a post-test was administered to evaluate the level of knowledge and practice of the nurses participating in the research, using the same format of tools (tool I and II) which were used in the pre-test to evaluate the effect of the online education through Google Forms. The nurses were invited to respond to it and submit it via an internet link. The online link was distributed to all the nurses who participated in the study via the previously mentioned online social media web domains.

Statistical Design:

Data entry and statistical analysis were performed using SPSS for Windows, version 20. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables and mean and SDs for quantitative variables. Differences between the two means tests (t-test) were used. Statistical significance was considered at P-value < 0.05.

Results:

Table (1) showed that nurses' Mean ± SD of age was (25.3 ± 2.8) and 60% of them were female, while 41% were male. Concerning the qualification of the studied nurses, it was observed that 40% have a diploma from secondary nursing school. Regarding years of experience, 42% of the studied nurses have less than ten years of experience.

Figure (1): Showed the percentage distribution of the studied nurses regarding their source of knowledge about kidney stones, it was observed that the main source of knowledge of the studied nurses was doctors, followed by media, and books.

Table (2): Illustrated the nurses' knowledge regarding kidney stones pre and post-online education. Also, there were highly statistically significant differences found between nurses' knowledge regarding kidney stones pre/post-online education with (P<0.001).

Figure (2) showed that 40% of the studied nurses had a satisfactory level of knowledge about kidney stones in the pretest but after online education implementation, (95%) of them had a satisfactory level of knowledge.

Regarding the comparison of the studied nurses' practice about kidney stones pre and post-online education **table (3)** illustrated that there were

highly statistically significant improvements and differences between nurses' **reported** practices pre and post-online education with (p<0.001).

Figure (3) portrayed nurses' total practices regarding kidney stones pre and post-online education, and indicated that 54% of the studied nurses had a competent level of practice pre- online education, improved post-online education to reach 87% of them had a competent level of practice with significant improvement (P<0.001).

Table (4): Showed that there was a significant positive correlation with (P=0.001) between nurses' knowledge scores and their practice post online education implementation.

Table (1): Frequency and percentage distribution of the studied nurses regarding their demographic characteristics (n=50)

Variables.	The Studied Nurses (n=50)	
	N	%
Age:		
• 20 < 30	27	54.0
• 30 < 40	13	26.0
• ≥40	10	20.0
(Mean±SD): 25.3 ± 2.8		
Gender:		
• Male	20	40.0
•Female	30	60.0
Qualification:		
• Nursing Diploma.	20	40.0
• Bachelor of nursing.	19	38.0
• Master of nursing.	11	22.0
Years of experience:		
• < 5	18	36.0
• <10	22	44.0
• >10	10	20.0

Figure (1): Percentage distribution of the studied nurses regarding their source of knowledge about kidney stones (n=50)

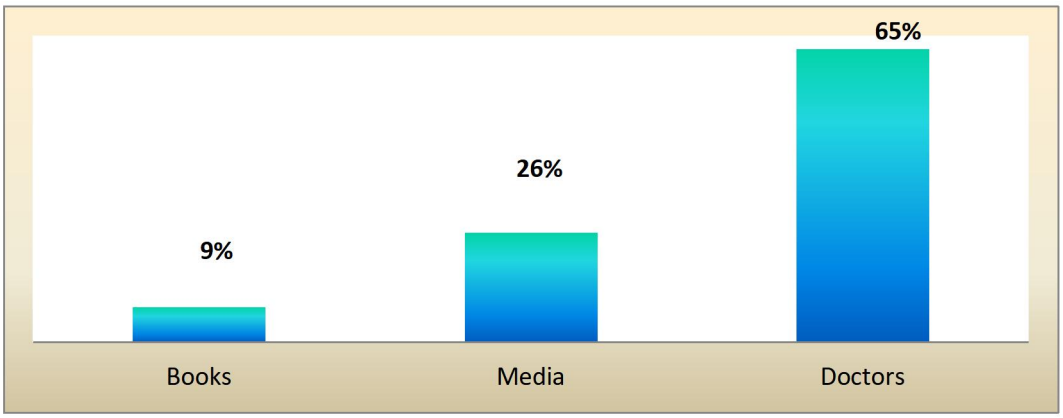

Table (2) Comparison between Nurses' Knowledge regarding kidney stones pre and post-online education (N-50)

Knowledge items	Pre- the online education		Post- the online education		X^2	'-value
	No	%	N No	%		
Definition of kidney stone	27	54	50	100	137.53	<0.001**
Risk factors of stone formation, types of kidney stone, symptoms, diagnosis, methods of prevention, and factors that increase the formation of stones	29	58	47	96	160.20	<0.001**
Methods of treatments, and what are the stones that respond to drug treatment	28	56	48	94	126.25	<0.001**
Relationship between stone formation and diet	24	48	45	90	133.23	<0.001**
Foods that increase the chance of stone formation	25	50	46	92	140.21	<0.001**
Amount of water that must be consumed throughout the day	23	46	44	88	121.28	<0.001**

****; Highly significant at p-value < 0.001**

Figure (2): Percentage distribution of the total nurses' knowledge level regarding kidney stones pre- and post-online education (n=50).

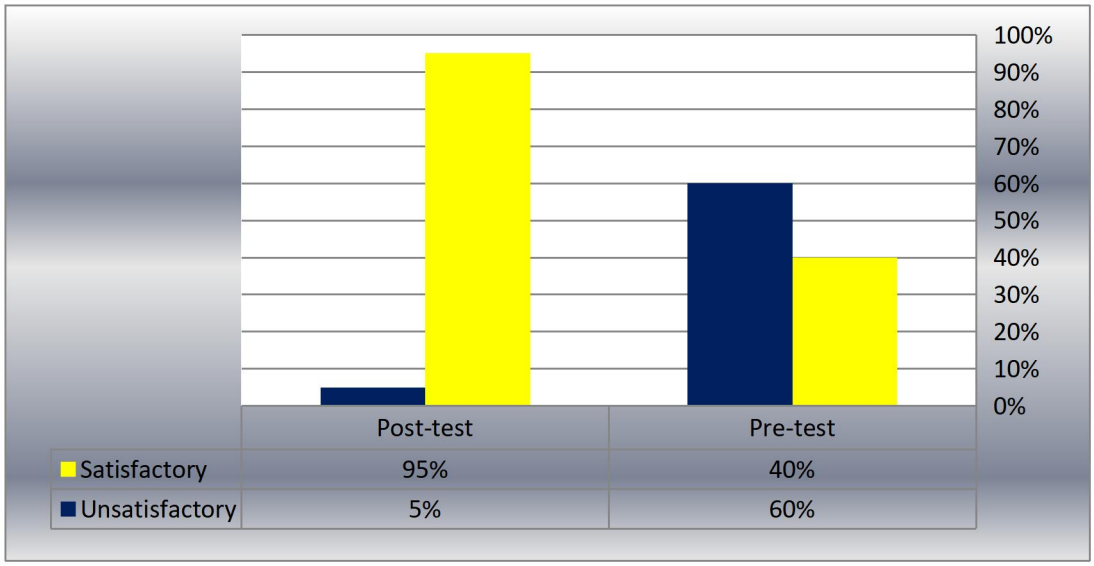

Table (3): Comparison between nurses' practices regarding kidney stones pre- and post-online education (n=50).

Nurses' practices	Studied nurses (n=50)				X^2	P-value
	Pre- the online education		Post- the online education			
	N	%	N	%		
Permitted foods consumption						
- Correct	32	64.0	50	100	73.06	<0.001**
- Incorrect	16	36.0	0	0.0		
A patient with renal stone should be counseled on stone-specific dietary interventions						
- Correct	35	70.0	47	94.0	122.03	<0.001**
- Incorrect	15	30.0	3	6.0		
A patient with renal stone should be assessed for risk of chronic kidney disease						
- Correct	39	68.0	47	94.0	68.72	<0.001**
- Incorrect	16	32.0	3	6.0		
To prevent renal stones, medication use should be evaluated and modified as needed						
- Correct	31	62.0	49	98.0	63.90	<0.001**
- Incorrect	19	38.0	1	2.0		
Patients with renal stones should increase fluid intake to at least 2 L per 24 hours 71						
- Correct	27	54.0	48	96.0	29.72	<0.001**
- Incorrect	23	46.0	2	4.0		
Renal stone type should be identified when possible, even on the initial stone occurrence						
- Correct	31	62.0	48	96.0	84.82	<0.001**
Incorrect	19	38.0	2	4.0		
Consumption of fluids						
- Correct	25	50.0	46	92.0	39.73	<0.001**
- Incorrect	25	50.0	4	8.0		
Consumption of restricted foods						
- Correct	32	64.0	49	98.0	69.32	<0.001**
- Incorrect	18	36.0	1	2.0		
Urine characteristics should be obtained in patients with renal stones to guide treatment and prevention						
- Correct	27	54.0	49	98.0	64.82	<0.001**
- Incorrect	23	46.0	1	2.0		
Patients should avoid calcium supplements unless their health care provider approves						
- Correct	30	60.0	49	98.0	49.73	<0.001**
- Incorrect	20	40.0	1	2.0		
Decreasing animal protein and oxalate intake are recommended, and eliminating oxalate-containing foods is unnecessary. (e.g. chocolate, coffee, strawberries, and tea)						
- Correct	32	64.0	48	96.0	59.32	<0.001**
- Incorrect	18	36.0	1	4.0		

****; Highly significant at p-value < 0.001**

Figure (3): Percentage distribution of the total nurses' practices level regarding kidney stones pre- and post-online education (n=50).

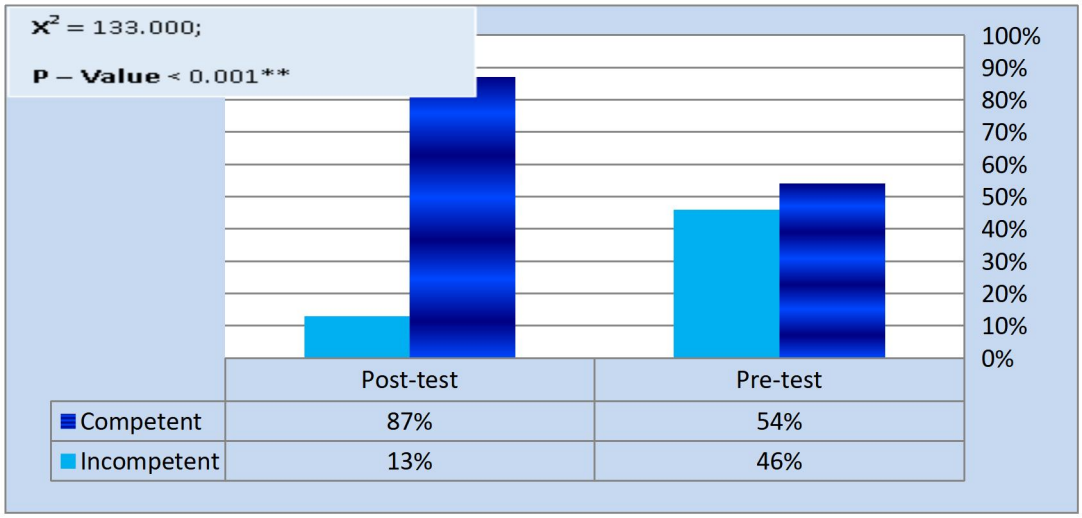

Table (4): Correlation between knowledge and practices of the studiednurse's pre- and post-online education implementation (n=100).

Knowledge	Practice			
	Pre		Post	
	R	p	r	P
Pre	0.45	0.47*		
Post			0.86	0.001*

Statistically significant at p<0.01

**** Correlation is significant at the 0.0001 level**

Discussion:

The current study found that nurses' mean ± SD of age was (25.3 ± 2.8). From the researchers' point of view, it reflected that the young age of studied nurses may be the cause of deficit knowledge and insufficient training**.**

The current study found that the main source of knowledge of the studied nurses was doctors. This confirmed that the nurses seeking information from the right personnel.

The results of the present study revealed that there were highly statistically significant differences between nurses' knowledge regarding kidney stones post-online education. These findings are in the same line with a study conducted by **Derek et al., (2018**) who studied in Northern Ontario "Knowledge, attitudes, and practice patterns among healthcare providers in the prevention of recurrent kidney stones" and reported that only 43% of nurses had a good level of knowledge about kidney stones. This result is similar to study done by **Khondoker et al., (2019**) in Bangladesh's under the title "Knowledge regarding renal stone among the nurses working in a selected specialized hospital " and found that about one-third of the study participants had a good level of knowledge regarding the renal stone. This result reflects the positive effect of post-online education implementations on knowledge regarding kidney stones, which met the nurse's needs and provide them with sufficient knowledge. This indicates the actual need of the studied nurses for the implementation of the current online education.

These findings were similar to those of **AbdElkodoos et al., (2018**) in Madurai who conducted a study about "Assess the knowledge of Renal Calculi among Patients Admitted in Urology Ward at Selected Hospital " which reported that only one percent of the respondents had a good level of knowledge regarding the renal stone.

This also agreed with the results of **Mahmoud et al, (2019**) who conducted a study about "Effectiveness of Self-Care Intervention for Patients with renal stone on Their Practices Regarding Nutrition" and revealed an improvement in the level of knowledge among the studied group related to renal stone post-intervention compared to pre-intervention. On the other hand, the current study findings are consistent with the results of study done by **Pethiyagoda et al, (2017**) under the title " Survey on knowledge, attitudes, and practices on urolithiasis among final year students" and showed that the majority of the studied sample had sufficient knowledge regarding kidney stone post program implementation.

Concerning the studied nurses' total knowledge, the current study revealed that two-fifths of them had satisfactory knowledge regarding kidney stones pre- online education implementation which improved post-intervention. From the researchers' point of view, this reflects the importance and effectiveness of online education implementation which developed based on identified nurse's needs, so that are commonly associated with improving in nurses level of knowledge and a better understanding regarding kidney stones among the studied nurses.

Concerning the nurses' reported practice regarding kidney stones, there were highly statistically significant improvements and differences between nurses' reported practices post online education. According to the researchers' point of view, the improvement in knowledge and practice reflects the positive effect of online education.

This result is in the same line as **Shahmoradi et al., (2021**) who conducted a study on "Prevention and control of urinary tract stones using a smartphone-based self-care application" and concluded that significant differences were found between nurses' practice pre- and post-educational smartphone-based self-care application.

The present study results revealed that more than half of the nurses had a competent level of practice pre- online education, which improved post- online education regarding kidney stones. From the researchers' point of view, it reflected the positive impact of online education in improving nurses' practices. These confirmed the effective modifications in nurses' practices that reflected the success of the main goals of online education implementation. This result is in the same line with the finding of a study done by **Derek et al., (2018**) who found that only more than two-fifths applied their knowledge effectively in clinical practice.

Findings of the current study found that there was a significant positive correlation with (P=0.001) between nurses' knowledge scores and their practice post-online education implementation. This ensured the effectiveness of online education in improving the nurses' knowledge, and practices. This reflected the importance of improving nurses' knowledge and practices to help them learn and acquire satisfactory level of knowledge and apply it effectively. This association is explained that when nurses acquire sufficient knowledge could help them to practice well which will be reflected on their patient care.

This result was not supported by **Sedek et al. (2015**) in their study, as they found that knowledge had no significant relationship with the practices. Furthermore, the results of the current study were similar to **Rasouli-Ghahroudi et al. (2016**) in the study entitled" Oral health status, knowledge and practice of patients with heart disease" they illustrated that there was strength significant correlation between knowledge and attitude, as well between knowledge and practice too. Supportive to these findings, **Maya et al., (2021**) conducted a study that revealed a correlation between knowledge level and Practice.

The findings of the current study supported the aim and hypothesis of the study and confirmed that the knowledge and practices among the studied nurses have improved. From the researchers' point of view, this reflected the success of online education implementation and its positive effects. Also, reflects the importance and effectiveness of introducing online education for nurses caring for patients with kidney stones which met their needs regarding improving their knowledge and their practices, resulting in acceptance of the research hypothesis and objectives.

Conclusion:

The result of the present study revealed that the majority of nurses had unsatisfactory knowledge and incompetent practices pre-online education implementation which improved post-implementation of the online education. So, online education which developed based on participant nurses needs assessed had positive effects on improving nurses' performance caring for Patients with Kidney Stones.

Recommendations:

In the light of the results of this study, the following recommendations were suggested:

- Providing online education for nurses' caring for Patients with kidney stones is recommended to improve their knowledge and reported practices.
- A simplified illustrated booklet regarding kidney stones should be available to nurses during care for patients with kidney stones
- Further studies and replication of the current study with a larger sample in different settings are required for generalizing the results.

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