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A Theory Based Discharge Plan Instructions to Reduce the Risk of Kidney Stone Recurrence among Adult Patients

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Abstract: ***Background:*** *Kidney stone disease is considered a third most common complaint of the urinary system. In recent years the incidence of kidney stone has been increased. Community health nurses have a definitive role in doing effective discharge plan instructions for patients with kidney stones to keep a healthy diet, improve awareness and prevent kidney stone recurrence.* ***Aim:*** *This study was conducted to examine the effectiveness of a nursing discharge plan instructions on reducing the risk of kidney stone recurrence among adult patients based on Pender's model.* ***Design:*** *Quasi-experimental design (study and control group) with pre and posttest was utilized.* ***Setting:*** *This study was conducted at urology outpatient clinics at university hospital and educational Shebin El-Kom hospital at Menoufia Governorate, Egypt.* ***Sample:*** *A purposive sample of 140 adult patients with kidney stones divided randomly into study and control groups.* ***Tools:*** *1. Structured interview questionnaire included socio-demographic data, past and present history was used. 2. Behavior specific cognition, Likert scale based on Pender's model. 3. Bio physiological measurements that included anthropometric measurements, urine analysis and abdominopelvic ultrasound.* ***Results:*** *Biochemical tests approved the lower recurrence rate of kidney stones among the study group than the control group after twelve months of implementing the discharge plan instructions. The majority of the study group had normal values of urine analysis related to pH, RBCs, pus cells and presence of crystals and had no renal gravels in abdominopelvic ultrasound after twelve months of implementing the discharge plan instructions compared to the control group with statistically significant difference. Also, the mean total scores of perceived benefits, perceived self-efficacy and health promoting behavior to reduce kidney stone recurrence increased significantly among the study group at post intervention compared to control group. However, the mean total score of perceived barriers of behavior modification to reduce kidney stone recurrence was significantly decreased among study group compared to control group.* ***Conclusion:*** *Nursing discharge plan instructions were effective in reducing the risk of kidney stone recurrence among study group at post intervention compared to control group.* ***Recommendations:*** *Future studies are needed for developing a nursing discharge protocol for behavior modification to prevent risk of kidney stone recurrence among adult patients.*

Key words*: Kidney stone, Nursing discharge plan instructions, Recurrence, Pender's model*

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I. Introduction

Kidney stone disease is considered the third most common disorder of the urinary system. It has been known for thousands years but in recent years the incidence of kidney stone has been increased [1]. One of the major causes of the increased incidence of nephrolithiasis is the dramatic changes in dietary habits. Kidney stone forms when the urine becomes supersaturated with specific crystals such as calcium, oxalate, uric acid, or cysteine [2]. Kidney 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. It has been suggested that kidney stone may be a systemic disorder associated with metabolic syndrome. Nephrolithiasis is responsible for 2 to 3% of end-stage renal cases if it is associated with nephrocalcinosis [3]. Also, nephrolithiasis has been associated with an increased risk of chronic kidney diseases, end-stage renal failure, cardiovascular diseases, diabetes, and hypertension [4].

Recurrence rate of nephrolithiasis is 70-80% in males and 47-60% in females, with majority (80%) of calcium oxalate stones. High incidence rate is reported in Middle East (20-25%) as a result of hot climate and increased chances of dehydration [5]. Among kidney stone formers, stones containing more than 50% calcium oxalate are significantly more common among Middle Eastern patients [6]. Recent studies have reported that

the prevalence of kidney stone disease has been increasing in the past decades in both developed and developing countries. This growing trend is believed to be linked to changes in lifestyle modifications such as lack of physical activity and dietary habits [7]. Thus, prophylactic management is of great importance to manage urolithiasis [8].

The prevention of stone recurrence requires better understanding of the mechanisms involved in stone formation [9]. Effective kidney stone prevention depends upon addressing the cause of stone formation. Generally, to prevent the first episodes of kidney stone formation or its secondary episodes, proper management of diet and the use of medications are required. Primary prevention of kidney stone disease through dietary intervention is low-cost public health initiative with massive societal implications. Therefore, nutritional management is the best preventive strategy against urolithiasis [10].

It is important to understand kidney stone patients' behaviors and the factors which influence this behavior through Pender's health promotion model (HPM) to develop appropriate nursing interventions for kidney stone patients. Pender puts her efforts to develop a model that guide nursing society as a whole through interactions at the individual level and biophysical processes that motivate individuals to engage in health-promoting behaviors leading to overall well-being [11]. Different studies stated that HPM is important in decreasing risk factors of diseases, especially chronic diseases and symptoms, and promote healthy lifestyle [12]. Healthcare providers can understand determinants of health-promoting behaviors and modifiable behavior-specific cognitions which include health benefits, barriers, and self-efficacy to recommend health-promoting behaviors guidance and social support to all people [13].

Discharge plan instructions for patients with kidney stones should include knowledge of the signs and symptoms indicating the need to return for medical care, maintaining adequate hydration, urine analysis, and evaluation and encouraging urologic follow up [14]. Discharge plan is an opportunity not only to educate but also to provide proper continuity of care and ensure best patient centered outcomes [15]. Community health nurses have a definitive role in doing an effective discharge plan for patients with kidney stones to keep a healthy diet and prevent kidney stone recurrence. Also, they improved awareness and education among both patients and health-care providers about risk factors of kidney stones to improve general health and decrease morbidity and mortality caused by nephrolithiasis [16].

- **Significance of the study**

Globally, kidney stone is one of the oldest disorders of human and one of the major health burdens. Large number of peoples is affected with this disorder all over the world. Urolithiasis affects about 12% of the world population at some stage in their lifetime. It affects all ages, sexes, and races but occurs more frequently in men than in women within the age of 20–49 years [17]. The relapsing rate of secondary stone formations is estimated to be 10–23% per year, 50% in 5–10 years, and 75% in 20 years of the patient. In Middle East, high incidence rate is reported 20-25% due to hot climate with increased chances of dehydration [18]. In Egypt, according to the WHO data, kidney disease deaths reached 15,820 (3.41%) of total deaths. The age adjusted death rate is 26.63 per 100,000 of population. Egypt is ranked the 12th country in the world had a high death rate of kidney diseases [19]**.**

The consequence of the increase in the prevalence of stone disease, the cost associated with diagnosis, treatment and follow-up of individuals with stones has risen accordingly and affects the working-age population due to lost workdays [8]. Also, nephrolithiasis has been associated with an increased risk of chronic kidney diseases, end-stage renal failure, cardiovascular diseases, diabetes, and hypertension. Consequently, prophylactic management is important to manage urolithiasis [4]. Therefore, the aim of the present study was to examine the effectiveness of a nursing discharge plan instructions on reducing the risk of kidney stone recurrence among adult patients based on Pender's model.

- **Aim of the study**

The aim of the study was to examine the effectiveness of a nursing discharge plan instructions on reducing the risk of kidney stone recurrence among adult patients based on Pender's model.

- **Research hypotheses**

- Study group who will implement the nursing discharge plan instructions based on Pender's model for reducing kidney stone recurrence will have lower recurrence rate of kidney stones than control group.
- The mean total score of perceived benefits, perceived self-efficacy and health promoting behavior to reduce the risk of kidney stone recurrence will increase among the study group after 12 months of intervention compared to control group.
- The mean total score of perceived barriers to reduce a risk of kidney stone recurrence will decrease among the study group after12 months of intervention compared to control group.

II. Subjects and Methods

2.1. Research design

Quasi experimental design (study and control group) with pre and posttest was utilized to achieve the aim of the study.

2.2. Research setting

The study was conducted at urology outpatient clinics at university hospital and educational Shebin El-Kom hospital at Menoufia Governorate.

2.3. Sample

- A purposive sample of 140 adult patients who were between 19- < 60 years old and recently discharged from the hospital after removal of kidney stone within 4 weeks. Exclusion criteria: patients with chronic diseases as gout, high blood pressure, diabetes mellitus, inflammatory bowel disease as crohn's disease and ulcerative colitis, urinary tract infections, hyperparathyroidism and other medical conditions such as kidney disease, chronic diarrhea, and certain cancers such as leukemia and lymphoma, because all of which put people at higher risk for stones.
- The sample was divided randomly into two equal groups (study group and control group 70 subjects each). The two groups were followed up immediately after discharge till one year. The study group received the nursing discharge plan instructions and guidelines while control group received the routine hospital care.

2.4. Sample size

- The sample size was calculated according to effect size that is expected to be 0.3 [20].
- To achieve 80% power to detect this difference with a significance level of 5% it is estimated that 63 subjects per group would be required.
- With a withdrawal/non-evaluable subject rate of 10% a total of 70 per group subjects were recruited leading to a total required sample size of 140 subjects.

2.5. Tools of the study

Data was collected through using the following tools:

2.5.1. Structured interview questionnaire: It was developed by the researchers after reviewing the related studies. It included:

- **Socio-demographic data:** It consisted of seven items including name, age, gender, educational level, marital status, occupation, family income and number of family members.
- **Medical assessment sheet:** It included past and present medical history. Past medical history (previous hospital admission with urinary tract stones) consisted of five questions e.g. time of diagnosis with urinary tract stones and previous method of treatment etc. The current medical history consists of seven questions e.g. time of stone removal, location of the stone, size of the stone, type of the stone and number of removed stones etc.

2.5.2. Behavior specific cognition questionnaire (Likert Scale): It was developed by the researcher based on Pender's health promotion model [21] to assess kidney stone patients' behavior cognitions to reduce kidney stone recurrence after patient discharge. It is composed of four elements which included perceived benefits of the action, perceived barriers to action, perceived self-efficacy and behavioral outcomes.

- **Perceived benefits of compliance with behavior modification** included 15 items e.g. reducing the financial burden of frequent hospitalization and surgical procedures and reducing exposure to stone recurrence etc using a three point Likert scale (1-3). **The scoring of items** was 1 point for disagree, 2 points for may be and 3 points for agree. The assessment of the perceived benefits was done by giving a total score between 15- 45. Accordingly, participants who had 15 - 24 points of the total score were considered as "disagree", and those who had 25 - 35 points were considered as "may be", and those who had 36 - 45 points were considered as "agree".
- **Perceived barriers of non-compliance with behavior modification** consisted of 18 items e.g. ignorance of the principles of reading and writing, lack of sufficient time to follow a healthy diet and unwillingness to drink water etc. **The scoring of items** used three points Likert scale (1 – 3), 1 point for disagree, 2 points for may be and 3 points for agree. The assessment of the perceived barriers was done by giving a total score of 18-54. Accordingly, participants who had 18 - 30 points of the total score were considered as "disagree", and those who had 31 - 42 points were considered as "may be", and those who had 43 - 54 points were considered as "agree".
- **Perceived self-efficacy of behavior modification** consisted of 17 items about participants confidence to do the following e.g. drinking a large amount of liquids 3 liters per day**,** reducing salt in food and ability to provide

time and money for regular follow-up and to make the necessary tests etc. **The scoring of items** used three points Likert scale (1 – 3), 1 point for no confidence, 2 points for moderate degree of confidence, and 3 points for great confidence. The assessment of the perceived self-efficacy was done by giving a total score of 17-51. Accordingly, participants who had 17 - 28 points of the total score were considered as having "no confidence", and those who had 29 - 40 points were considered as having "moderate confidence" and those who had 41 - 51 points were considered as having "great confidence".

- **Behavioral outcomes (health promoting behavior) of compliance with behavior modification** consisted of 19 items e.g. choosing the proper food even if being hungry**,** drinking a large amount of liquids 3 liters per day and reducing salt in food etc. **The scoring of items** used three points Likert scale (1 – 3), 1 point for never, 2 points for sometimes and 3 points for always. The assessment of the behavioral outcomes was done by giving a total score of 19-57. Accordingly, participants who had 19 - 31 points of the total score were considered as "never", those who had 32 - 45 points were considered as "sometimes", and those who had 46 - 57 points were considered as "always".

Validity and reliability of the tool:

Validity of the tool was tested for its content by a jury of five experts in the field of family and community health nursing and urology medicine to ascertain relevance and completeness. It was done before the pilot study. Reliability of the tool was estimated among 10 participants using test retest method with two weeks apart between them. Then Cronbach's alpha, α (or coefficient alpha), to measure reliability, or internal consistency was calculated between the two scores. The total Cronbach alpha for the study tool was 0.85. The value of Cronbach's alpha for each component of Pender's model was as follow: perceived benefits was 0.81, perceived barriers was 0.83, perceived self-efficacy was 0.80 and behavioral outcomes was 0.84. This indicates that the tool was consistent and reliable.

2.5.3. Bio physiological measurements: It included anthropometric measurements, biochemical measurements and abdominopelvic ultrasound.

- **Anthropometric measurement**s: This included weight, height and body mass index.
- **Biochemical measurements:** It included urine analysis to measure pH, crystals such as calcium, oxalate, uric acid, and other substances that may have caused the stone to form.
- Most of these factors are considered as indicators for kidney stone recurrence like ph, RBCs, pus cells and presence of crystals. When urinary pH greater than 7.5 may be suggestive of a urease producing bacterial infection and indicate the presence of calcium phosphate stones and struvite stones, while pH less than 5.5 may indicate the presence of uric acid calculi and systine stones [22].
- Also, the presence of RBCs greater than 5 h.p.f. (high power field) indicates hematuria which is considered a sign of presence of renal gravels (urolithiasis), infections of the lower urinary tract, especially the bladder and ureteral colic [23]. Also, the presence of pus cells greater than 5 h.p.f indicates signs of infection and reflect the unhealthy dietary behavior of the patient of not drinking enough water 3 liters per day. Moreover the presence of crystals in urine analysis like uric acid, phosphate, calcium and oxalate indicates for kidney stone recurrence and unhealthy dietary behavior [24].

- **Abdominopelvic ultrasound:** It was performed to identify the presence of renal stones in both kidneys, bladder and pelvis. The procedure was achieved for each participant by an ultrasound technician (sonographer) under his instructions.

2.6. Pilot study

A pilot study was conducted on 14 patients of the study sample to assess the feasibility of the study as well as clarity and objectivity of the tools. Based on the findings of the pilot study, the needed modifications were achieved and participants of pilot study were not included in the actual study.

2.7. Ethical considerations

- Approval of ethical and scientific research committee was obtained at Faculty of Nursing, Menoufia University.
- Oral and written consent was obtained from the participants at urology outpatient clinics at university hospital and educational Shebin El-Kom hospital at Menoufia Governorate.
- Confidentiality of the information was assured.

2.8. Data collection procedure

- A reviewing of past and current literature covering the various aspects of the topic was done using books, articles, magazines and studies related to kidney stones and reducing kidney stones recurrence.

- An official letters were issued from the Faculty of Nursing, Menoufia University and sent to the directors of educational Shebin El-Kom hospital and university hospital and the director of urology department to get their permission for data collection. The letters explained the purpose of the study and sought their cooperation.
- Data collection was started on August 2017 and lasted until December 2018 with continuous follow up during this period.
- The initial visit **(**pre-test): First time meeting with the participants was considered the baseline for the study. At the beginning, it was necessary for the researcher to introduce herself and explain the purpose of the study. Each participant was personally interviewed. The researcher took telephone number from each participant to facilitate communication.
- Participants (study and control groups) were interviewed at urology outpatient clinics at university hospital and educational Shebin El-Kom hospital using structured interview questionnaire to collect sociodemographic data, medical assessment sheet that included past and present medical history and behavior specific cognition questionnaire and measured anthropometric measurements which included weight, height and body mass index. The interview took about 25-35 minutes according to participant understanding.
- After collection of the data (pre- test), participants were divided randomly into two groups (study and control). Participants of the control group received the routine hospital care.
- Participants of the study group were divided randomly into groups; each group consisted of 10- 15 participants.
- Each group attended four sessions at urology outpatient clinics at university hospital and educational Shebin El-Kom hospital and the duration of each session was an hour.
- The first session included information related to functions of the kidneys and the renal system, importance of the study, prevalence and types of kidney stones.
- The second session included causes and risk factors, clinical manifestation, diagnosis and investigations and complications of kidney stones.
- The third session included proper healthy diet (Dietary Approaches to Stop Hypertension (DASH) diet for kidney stone patients) [25] according to Pender health promotion model that included perceived benefits of dietary behavior modification, perceived barriers to non-compliance with dietary modification and how to overcome them.
- The fourth session included weight management, any signs for kidney stone recurrence, importance of periodic medical checkup and adherence to medical regimen and nursing discharge plan instructions.
- Each session followed by a summary of essential points. The teaching methods included lectures and group discussion while the teaching media included posters, handout and educational videos.
- In the last session, participants were given a guide booklet about kidney stones and prevention of its recurrence. This booklet was developed by the researcher after reviewing the related literature; it included knowledge about kidney stones, types, causes, clinical manifestation, proper health diet, weight management and regular checkup.
- After completing the sessions, participants were followed up during their attendance at urology outpatient clinic every month and by telephone number.
- At the end of intervention period of follow up (1 year) a posttest was performed for both study and control groups using behavior specific cognition questionnaire which included perceived benefits, perceived barriers, perceived self-efficacy and behavioral outcomes of dietary behavior modification. Moreover, the anthropometric measurements (weight, height and BMI) were measured. Also, urine analysis and abdominopelvic ultrasound were performed after 1 year from discharge date from the hospital.

2.9. Statistical analysis

- Data was coded and transformed into specially designed form to be suitable for computer entry process. Data was entered and analyzed by using SPSS (Statistical Package for Social Science) statistical package version 22. Graphics were done using Excel program.
- Quantitative data were presented by mean (X) and standard deviation (SD). It was analyzed using student t-test for comparison between two means.
- Qualitative data were presented in the form of frequency distribution tables, number and percentage. It was analyzed by chi-square (χ^2) test. However, if an expected value of any cell in the table was less than 5, Fisher Exact test was used(if the table was 4 cells) , or Likelihood Ratio (LR) test (if the table was more than 4 cells). Level of significance was set as P value <0.05 for all significant tests.

III. Results

Table (1): Shows that the mean age of both study and control groups was 37.9±2.5 years and younger age groups (31-40 years) were predominant among the study group (34.3%) and control group (40%) than older age groups (51-<60 years). Approximately more than half of participants (58.6%) were males and 41.4% were females. Regarding education level, about one third of participants were illiterate and 40% of them were moderate education. As regards marital status, 82.9% of them were married and 8.6% were widowed. Concerning occupation, 32.9% of participants were housewives, one fifth was employee or workers, and farmer had the lowest percentage of 12.9%. Regarding family income, approximately one half of participants (48.6%) reported that their income was not enough. Approximately more than half of participants (57.1%) were living with a family of 5-7 members.

Figure (1): Reveals that at pre intervention, about half of both study and control groups had reported agree response regarding the perceived benefits of behavior modification to reduce kidney stone recurrence with no statistically significant difference between both groups (P=0.09) compared to post intervention, the majority of the study group (80%) had reported agree response about perceived benefits of behavior modification versus 54.3% of control group and there was statistically significant difference between both groups (P=0.000).

Figure (2): Shows that at pre intervention, 82.8% of study group and 77.1% of control group had reported agree response regarding the perceived barriers of behavior modification to reduce kidney stone recurrence with no statistically significant difference between both groups (P=0.08) compared to post intervention, agree responses regarding the perceived barriers of behavior modification among study group were significant decreased to 31.4% versus 80% among control group (P=0.000).

Figure (3): Presents that at pre intervention, 57.1% of study group and 60% of control group had reported no confidence response regarding the perceived self-efficacy of behavior modification to reduce kidney stone recurrence with no statistically significant difference between both groups (P=1.0) compared to post intervention, 40% among study group had reported great confidence response regarding the perceived self-efficacy of behavior modification versus 10% of control group and there was statistically significant difference between both groups (P=0.000).

Figure (4): Reveals that at pre intervention, 65.7% of study group and 68.6% of control group had reported never response regarding the health promoting behavior to reduce kidney stone recurrence with no statistically significant difference between both groups (P=0.90) compared to post intervention, the majority of the study group (82.9%) had reported always response regarding the health promoting behavior versus 14.3% of control group and there was statistically significant difference between both groups (P=0.000).

Table (2): Reveals that at pre intervention, there was no significant difference between study and control groups regarding the mean total score of perceived benefits, perceived barriers, perceived self-efficacy of behavior modification to reduce kidney stone recurrence and health promoting behavior (P>0.05) compared to post intervention, the mean total score of perceived benefits of behavior modification among study group was significant increased to 43.9±1.7 versus 40.5±6.6 among control group. Additionally, the mean total score of perceived self-efficacy of behavior modification among study group was significant increased to 39.4±2.7 versus 30.7±2.0 among control group. Moreover, the mean total score of health promoting behavior among study group was significant increased to 51.9±1.7 versus 40.6±3.0 among control group. However, the mean total score of perceived barriers among study group was significant decreased to 31.2±4.4 versus 43.8±3.5 among control group (P=0.000).

Table (3): Shows that at pre intervention, there was no significant difference between study and control groups regarding the mean weight and BMI (P>0.05) compared to post intervention, the mean weight among study group was significant decreased to 77.5±7.6 versus 84.3± 6.40 among control group (P=0.000) and the mean BMI among study group was significant decreased to 28.7±2.3 versus 30.1±2.5 among control group (P=0.001).

Table (4): Shows that biochemical tests approved the lower recurrence rate of kidney stones among study group than control group after twelve months of implementing the discharge plan instructions. At post intervention, the majority of the study group had normal values of urine analysis related to pH, RBCs, pus cells and presence of crystals compared to control group with statistically significant difference (P=0.000). Also, the majority of the study group had no renal gravels in abdominopelvic ultrasound compared to control group with statistically significant difference (P=0.000).

Table (5): Reveals that, there was a good significant positive correlation between total score of perceived benefits of behavior modification to reduce kidney stone recurrence and total score of health promoting behavior (r=0.625; p=0.030). This indicated that when total score of perceived benefits increased, the health promoting behavior increased too. Also, There was a strong significant positive correlation between total score of perceived self-efficacy of behavior modification to reduce kidney stone recurrence and total score of health promoting behavior (r=0.681; p=.040). This indicated that when total score of perceived self-efficacy increased, the health promoting behavior increased too. On the other hand, there was a significant negative correlation between total score of perceived barriers of behavior modification to reduce kidney stone recurrence and total score of health promoting behavior (r=-0.590; p=0.020). This indicated that when total score of perceived barriers decreased, the health promoting behavior increased.

Table 1: Distribution of socio-demographic characteristics of the studied sample (N= 140)

Socio-demographic characteristics		Groups				Total	
		Study group		Control group			
		No.	%	No.	%	No.	%
Age groups	20-30 Y	22	31.4	18	25.7	40	28.6
	31- 40 Y	24	34.3	28	40	52	37.1
	41-50 Y	16	22.9	16	22.9	32	22.9
	51- <60 Y	8	11.4	8	11.4	16	11.4
Mean± SD		37.4±3.2Y		38.2±2.6Y		37.9±2.5Y	
Sex	Male	40	57.1	42	60	82	58.6
	Female	30	42.9	28	40	58	41.4
Education	Illiterate	20	28.6	20	28.6	40	28.6
	Basic	6	8.6	10	14.3	16	11.4
	Moderate	28	40	28	40	56	40
	University	16	22.8	12	17.1	28	20
Occupation	Housewife	26	37.2	20	28.6	46	32.9
	Employee	20	28.6	10	14.3	30	21.4
	Worker	8	11.4	22	31.4	30	21.4
	Farmer	8	11.4	10	14.3	18	12.9
	Others	8	11.4	8	11.4	16	11.4
Marital status	Single	2	2.9	8	11.4	10	7.1
	Married	66	94.3	50	71.4	116	82.9
	Divorced	0	0	2	2.9	2	1.4
	Widowed	2	2.8	10	14.3	12	8.6
Income	Not enough	36	51.4	32	45.7	68	48.6
	Enough	34	48.6	36	51.4	70	50
	Enough & save	0	0	2	2.9	2	1.4
Family size:	2-4members	28	40	32	45.7	60	42.9
	5-7 members	42	60	38	54.3	80	57.1
Total		70	100%	70	100%	140	100

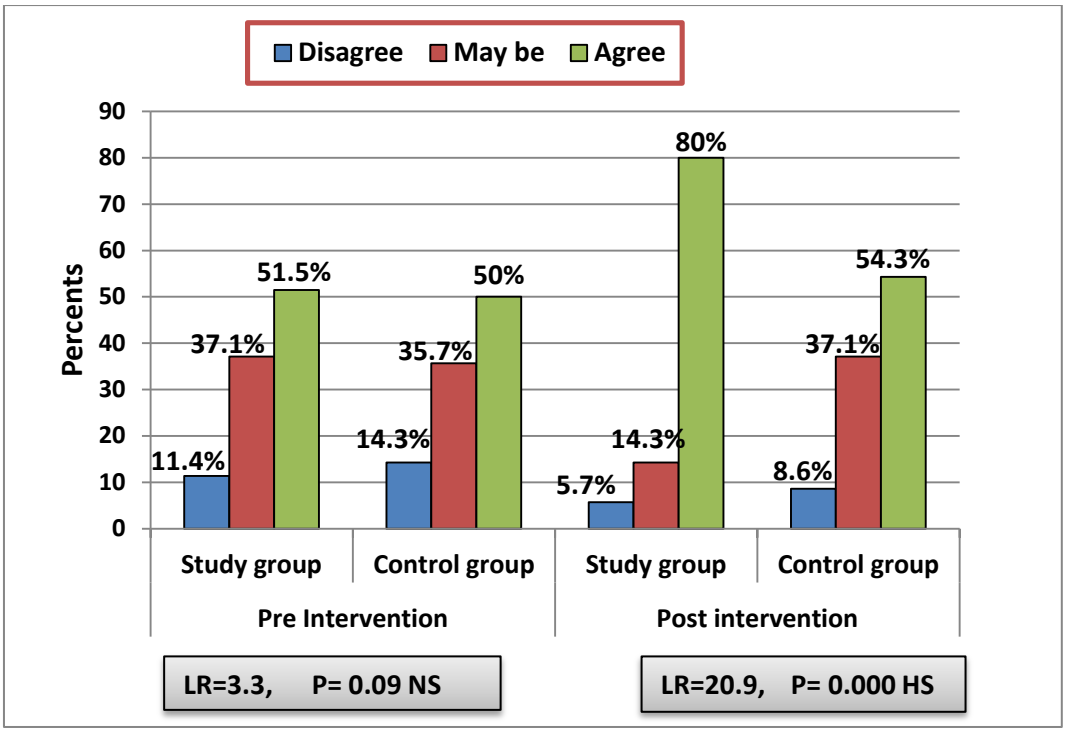


Figure (1): Distribution of total score groups of perceived benefits of behavior modification among the studied sample pre and post intervention (N= 140)

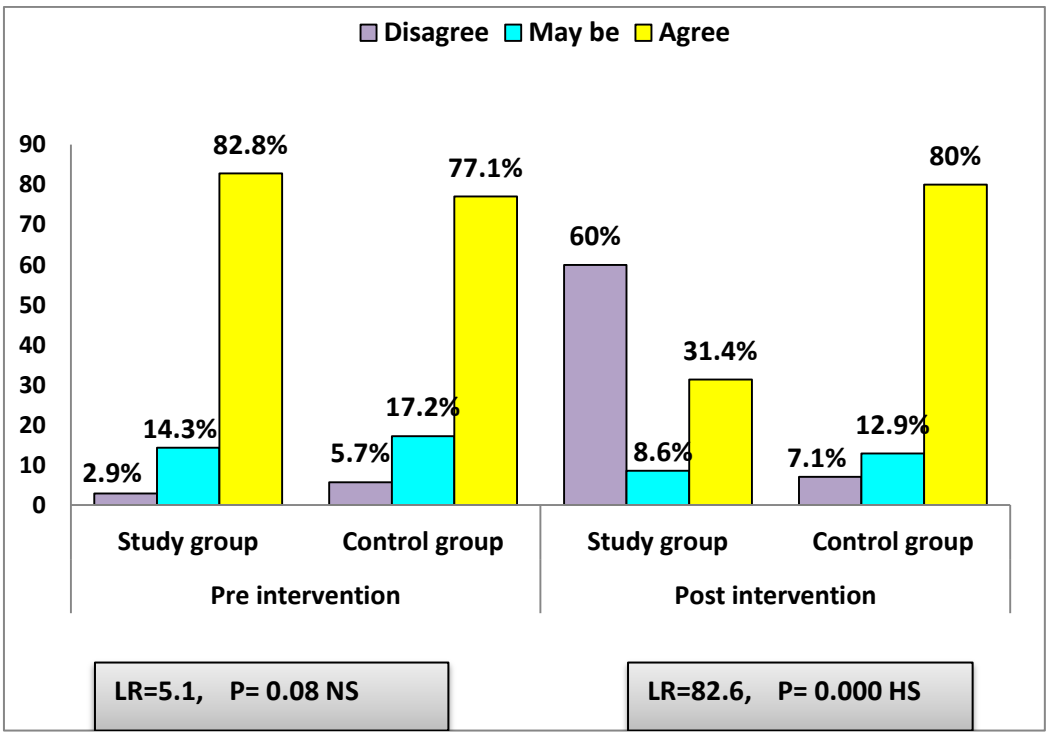
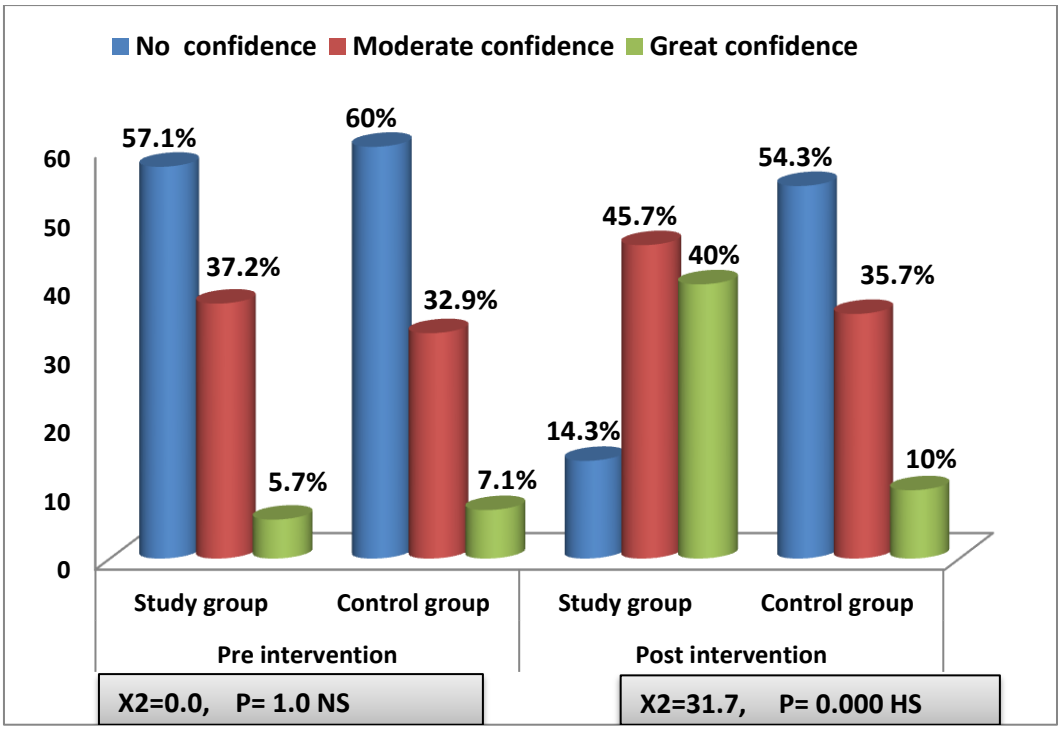
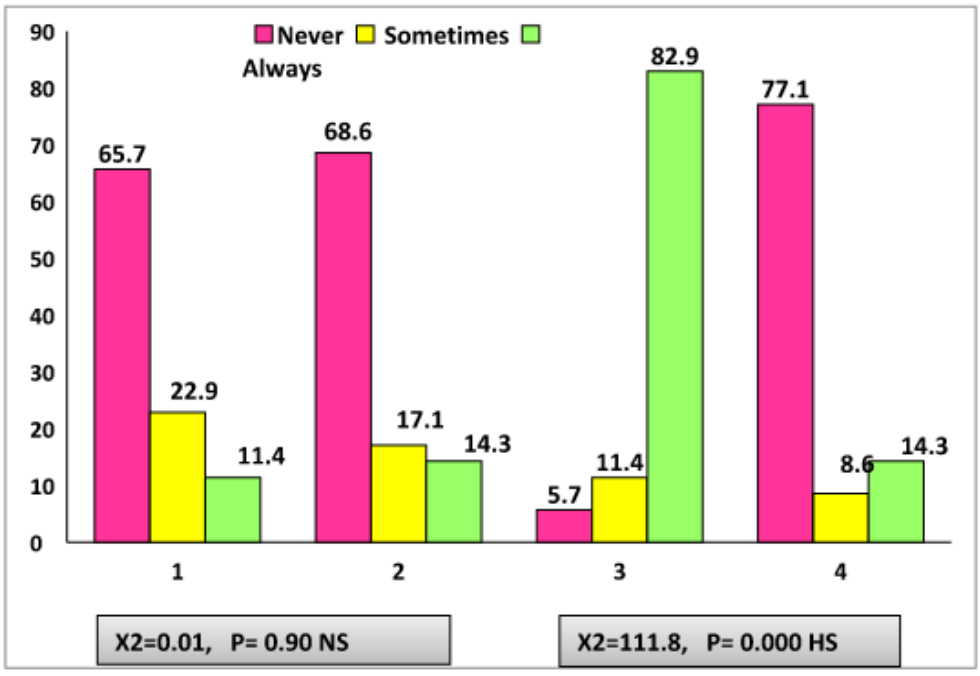


Figure (2): Distribution of total score groups of perceived barriers of behavior modification among the studied sample pre and post intervention (N= 140)



Significance (P value < 0.05)

Figure (3): Distribution of total score groups of perceived self-efficacy of behavior modification among the studied sample pre and post intervention (N= 140)



Significance (P value < 0.05)

Figure (4): Distribution of total score of health promoting behavior among the studied sample pre and post intervention (N= 140)

Table 2: Distribution of mean total score of components of Pender health promotion model among the studied sample pre and post intervention (N= 140)

Components of Pender health promotion model	Pre intervention			Post intervention		
	Study group (70)	Control group (70)	P Value	Study group (70)	Control group (70)	P Value
	Mean ± SD			Mean ± SD		
Perceived benefits of behavior modification	37.9±5.5	39.1±6.3	t=1.2 P = 0.11 NS	43.9 ±1.7	40.5±6.6	t=4.1 P = 0.000 HS
Perceived barriers of behavior modification	40.6±4.1	41.4±4.6	t=0.92 P = 0.10 NS	31.2 ±4.4	43.8±3.5	t=18.5 P = 0.000 HS
Perceived self-efficacy of behavior modification	33.4±3.4	32.9±2.5	t=0.86 P = 0.21 NS	39.4 ±2.7	30.7±2.0	t=21.0 P = 0.000 HS
Behavioral outcomes (health promoting behavior)	39.4±7.3	40.5±3.1	t=1.1 P = 0.09 NS	51.9 ±1.7	40.6±3.0	t=28.0 P = 0.000 HS

Significance (P value < 0.05)

Table 3: Distribution of mean of weight, height and body mass index among studied sample pre and post intervention (N= 140)

Measurements	Pre intervention			Post intervention		
	Study group (70)	Control group (70)	P Value	Study group (70)	Control group (70)	P Value
	Mean ± SD			Mean ± SD		
Weight (Kg)	83.6 ±12.2	84.9±12.4	t=0.43, P=0.24 NS	77.5±7.6	84.3± 6.40	t=5.9, P=0.000 HS
Height (Cm)	164.4±6.7	166.2±7.4	t=1.3, P=0.07 NS	164.4±4.7	166.3±5.4	t=1.2, P=0.09 NS
Body Mass Index (BMI)	30.9±4.1	31.1±3.6	t=0.21, P=0.83 NS	28.7±2.3	30.1±2.5	t=3.3, P=0.001 HS

Significance (P value < 0.05)

Table 4: Distribution of biochemical tests among the studied sample post intervention (N= 140)

Biochemical Tests	Post intervention				
	Study Group (70)		Control group (70)		P value
	No.	%	No.	%	
Urine Analysis: PH:					
Normal	48	68.6	18	25.7	X2=25.7, P=0.000 HS
Abnormal	22	31.4	52	74.3	
RBC:					
Present	20	28.6	52	74.3	X2=29.3, P=0.000 HS
Absent	50	71.4	18	25.7	
RBCs number:					
<5	49	70	19	27.1	X2=85.2, P=0.000 HS
5-<10	21	30	0	0	
10-<15	0	0	34	48.6	
15-25	0	0	17	24.3	
Pus cells:					
Present	17	24.3	51	72.9	X2=33.1, P=0.000 HS
Absent	53	75.7	19	27.1	
Pus cells number:					
<5	53	75.7	19	27.1	X2=84.0, P=0.000 HS
5-<10	17	24.3	0	0	

10-<15	0	0	24	34.3	
15-<25	0	0	13	18.6	
≥ 25	0	0	14	20	
Crystals:					
Present	21	30	52	74.3	X2=27.5, P=0.000
Absent	49	70	18	25.7	HS
Abdominopelvic ultrasound Renal gravels: Present	21	30	52	74.3	X2=27.5, P=0.000
Absent	49	70	18	25.7	HS

Significance (P value < 0.05)

Table 5: Correlation coefficient between total score of health promoting behavior and each of perceived benefits, perceived barriers, and perceived self-efficacy among study group post intervention (N=70)

		Total score of perceived benefits	Total score of perceived barriers	Total score of perceived self-efficacy	Total score of behavioral outcomes
Total score of health promoting behavior	Pearson Correlation	0.625	-0.590	0.681	1
	P value	0.030*	0.020*	0.040*	

Significance (P value < 0.05)

IV. Discussion

Kidney stone disease is considered a third most common disorder of the urinary system. It has been known for thousands years but in recent years the incidence of kidney stone has been increased [1]. Dramatic changes in dietary habits are one of the major causes of an increased incidence of nephrolithiasis in recent years. Kidney stone forms when the urine becomes supersaturated with specific crystals such as calcium, oxalate, uric acid, or cysteine [2]. Community health nurses have a definitive role in doing an effective discharge plan for patients with kidney stones to keep a healthy diet and improve awareness and education about the risk factors of kidney stones to improve general health and prevent kidney stone recurrence [16].

Therefore, the aim of the present study was to examine the effectiveness of a nursing discharge plan instructions on reducing the risk of kidney stone recurrence among adult patients using Pender model

The present study revealed that at post intervention of "about twelve months", the mean total score of perceived benefits of behavior modification to reduce kidney stone recurrence among study group was significantly increased to 43.9±1.7 versus 40.5±6.6 among control group. This result was in accordance with Alghamdi, Alamri and Alzahrani, (2018) [26] they studied "awareness about symptoms and role of diet in renal stones among general population of Abaha City, Saudi Arabia". They reported that, individuals of study group had high perceived benefit scores and the mean score was higher than the mid-point of the subscale total scoring post intervention. Furthermore, most of the study group significantly agreed that a certain diet could prevent development of kidney stone compared to about two thirds among those without intervention. Moreover, this finding was consistent with kok, (2016) [27] who reported that, at post intervention, the scores for the subscale of perceived benefits were also significantly higher in cases compared to controls.

The current results showed that at post intervention, the mean total score of perceived barriers of behavior modification to reduce kidney stone recurrence among study group was significantly decreased to 31.2±4.4 versus 43.8±3.5 among control group. This result was in agreement with Shao, Wang, Liu, Tian and Li, (2017) [28] they examined "the effect of a health belief model-based education program on patients' belief, physical activity, and serum uric acid of kidney stone patients in Pudong Xin District in Shanghai, China". They found that, in the intervention group, the mean scores of perceived barriers were decreased significantly after the intervention. This reduction of perceived barriers might enhance the lifestyle adherence among them whereas no significant differences were detected in the control group between baseline and follow-up measures.

The present finding revealed that at post intervention, the mean total score of perceived self-efficacy of behavior modification to reduce kidney stone recurrence among study group was significantly increased to 39.4±2.7 versus 30.7±2.0 among control group. This result was in accordance with Kok, (2016) [27] who found that, at post intervention, the mean scores of self-efficacy in the intervention group had increased more than the control group (33.01 and 23.63, respectively). Also, there were statistical significant differences after the intervention and at 3-month follow-up. Moreover, this result was supported by Sorat, (2018) [29] who assessed "the association of self-efficacy and self-management behavior in adult patients with kidney stones in USA".

The researcher showed that, there was significant improvement in self-efficacy scores. At three months and six months, self-efficacy score was increased in the intervention group compared to the control group.

The current study revealed that at post intervention of "about twelve months", the mean total score of health promoting behavior (behavioral outcomes) to reduce kidney stone recurrence among study group was significantly increased to 51.9±1.7 versus 40.6±3.0 among control group. This finding was consistent with Ahmed, Hussein, Shahat, Ahmed & Abdalla (2017) [30] who evaluated "the impact of nursing interventions and patients' education on quality of life regarding renal stones treated by percutaneous nephrolithotomy, at Assiut, Egypt". They found that, the study group showed a good improvement on behavioral outcomes after providing nursing interventions and patients' education. Majority of patients in the study group were having health behavior improvement, compared to significant decrease in health behavior improvement among the control group. Additionally, this result was in agreement with Dion et al., (2016) [31] who studied "evaluation and medical management of the kidney stone patient in Canada". They reported that, there was significant improvement in behavioral outcomes in patients who received specific dietary recommendations than those who only received general dietary advice. Also, they found that, basic dietary and fluid intake advice showed to be effective in reducing stone recurrence rates and counseling on appropriate fluid intake to avoid dehydration and dietary excesses significantly reduced stone recidivism among the study group compared to control group.

The present study revealed that at post intervention, the mean weight among the study group was significantly decreased to 77.5±7.6 versus 84.3±6.40 among control group and the mean BMI among study group was significantly decreased to 28.7±2.3 versus 30.1±2.5 among control group. The present study findings were supported by Naslund et al., (2017) [32] who performed a systematic review and meta-analysis to "estimate effects of lifestyle intervention participation on weight reduction among overweight and obese adults with kidney stone disease in USA". They found that, lifestyle modification interventions of more than twelve months duration for study group showed a significant greater reduction in the mean weight and BMI compared to control group. Additionally, this result was in accordance with Yoshimura et al., (2016) [33] who assessed "body mass index and the incidence of kidney stones among Japanese men". They reported a significant decrease in body weight and BMI at the end of study period in study group compared to control group.

As regard to urine analysis post intervention of "about twelve months", the present study revealed that about two thirds of the study group had normal pH compared to quarter of the control group, and the difference was high statistically significant. This result was consistent with Carvalho, (2018) [34] who examined "urinary pH in calcium oxalate stone formers in Brazil" and reported that, urinary pH is a major determinant for kidney stone formation, and the majority of the study group of calcium stone formers had normal value of urinary pH level. In addition, hypercalciuric and/or hyperuricosuria patients of control group presented higher organic acid levels and lower urinary pH. Furthermore, this finding was in accordance with Mitra, Pal and Das, (2018) [35] they assessed "quality of drinking water in kidney stone disease in West Bengal, India". They found that, the majority of study group had normal pH and alkalinity compared to one quarter of the control group with significant difference between both groups. Moreover, this result was supported by Shi et al., (2018) [36] they evaluated "the relationship between urinary citrate/urinary calcium ratio and postoperative recurrence of ureteral calculus in China". They reported that, after intervention, the majority of the study group had significantly normal pH compared to control group and the recurrence rate of the study group was significantly lower than the control group within 1 year, which had a statistical difference.

Regarding RBCs, the current study showed that at post intervention, the majority of the control group had RBCs on urine analysis compared to about one third of the study group, and the difference was high statistically significant. This result was supported by Inci et al., (2016) [37] they studied "correlation of volume, position of stone, and hydronephrosis with microhematuria in patients with urolithiasis in Turkey". They reported that, detection of 5 or more red cells on urinalysis was regarded as microscopic hematuria. The majority of the control group had hematuria compared to one third of the study group with a statistically significant difference. Also, this finding was in accordance with Mefford et al., (2017) [38] they assessed "a comparison of urolithiasis in the presence and absence of microscopic hematuria in the emergency department in California". They found that, the majority of the control group had microscopic hematuria present on urinalysis compared to one quarter of patients of the study group without microscopic hematuria on urinalysis.

Concerning pus cells, the present study revealed that at post intervention, the majority of the study group had no pus cells on urinalysis compared to the majority of the control group, and the difference was high statistically significant. These findings were consistent with Muhbes, (2016) [39] who examined the most "common risk factors which may cause urinary calculi in Iraq" and found that, about half of patients in their control group were complaining from urinary tract infections and pus cells in urine sample in compared with one fifth of the study group with significant differences between the study group and the control group.

The present result revealed that at post intervention, the majority of the control group had crystals on urinalysis compared to one third of the study group, and the difference was high statistically significant. This result was in accordance with Zisman, (2017) [40] who evaluated "effectiveness of treatment modalities on

kidney stone recurrence in Chicago" and reported that, after follow-up, study group had significant increased fluid intake and had a significantly lower stone recurrence rate with reduction in the presence of adequate quantities of crystallization and urinary excretion of other contributors to stone risk such as calcium, oxalate, and uric acid, compared with a significantly higher rate in the control group. Furthermore, the present study findings of urine analysis were consistent with Dion et al., (2016) [31] they found that, after assessment and specific recommendations were made by a registered dietician, significant improvements were noted in urine pH, sodium, calcium, uric acid, citrate, and oxalate. Patients who received specific dietary recommendations based on a comprehensive evaluation had fewer stone recurrences than those who only received general dietary advice.

Concerning abdominopelvic ultrasound, the current result showed that at post intervention of "about twelve months", the majority of the control group had renal gravels compared to one third of the study group, and the difference was high statistically significant. This finding was supported by Cheungpasitporn, Rossetti, Friend, Erickson and Lieske, (2016) [41] they conducted a systematic review and meta-analysis to "examine treatment effect, adherence, and safety of high fluid intake for the prevention of incident and recurrent kidney stones in USA". They reported that, when radio-sonographic investigation of the abdomen and pelvis was performed for study group with high fluid intake was associated with decreased presence of renal stones compared to majority of the control group without high fluid intake who reported increased presence of renal calculus with statistical heterogeneity among the two groups. Also, this result was in accordance with Simon, Maxwell and Bailey, (2018) [42] they assessed "the diagnosis and management of kidney stones with ultrasound in USA". They reported that, the majority of participants of the control group had renal gravels and were at an increased risk of forming stones because of dehydration compared to one third of the study group with statistical heterogeneity.

The current study revealed that there was a significant positive correlation between total score of perceived benefits of behavior modification to reduce kidney stone recurrence and total score of health promoting behavior at post intervention among the study group ($r=0.625$; $p=0.030$). This indicated that when total score of perceived benefits increased, the health promoting behavior increased too. This result was consistent with Doan and Preechawong, (2014) [43] they examined "factors related to dietary behaviors in Vietnamese persons with recurrent kidney stone post-operation". They reported that, there was strong significant positive correlation between perceived benefits of dietary behavior modification and total score of health promoting behavior ($r=0.83$; $p<0.05$). This means that increased perceived benefits correlated with increased health promoting behavior to reduce kidney stone recurrence.

The present study showed that there was a strong significant positive correlation between total score of perceived self-efficacy of behavior modification to reduce kidney stone recurrence and total score of health promoting behavior at post intervention among study group ($r=0.681$; $p=0.040$). This indicated that when total score of perceived self-efficacy increased, the health promoting behavior increased too. This finding was in accordance with Kiajamali et al., (2017) [44] they studied "the correlation between social support, self-efficacy and health promoting behaviors in kidney stone patients in Karaj city, Iran". They found that, self-efficacy had a significant positive correlation with health-promoting behaviors ($r=0.592$, $p<0.001$). This finding means that the greater the perceived self-efficacy, the more the person will engage in the behavior in spite of the internal and external conflicts within the environment. Also, the current findings supported that the perceived self-efficacy had a greater role in improving health-promoting behaviors.

On the other hand, the current study revealed that there was a significant negative correlation between total score of perceived barriers of behavior modification to reduce kidney stone recurrence and total score of health promoting behavior at post intervention among study group ($r=-0.590$; $p=0.020$). This indicated that when total score of perceived barriers decreased, the health promoting behavior increased. This result was consistent with Ali, Pirouzeh, Hemayati and Askarshahi, (2015) [45] they evaluated "preventive behaviors in recurrent kidney stone and barriers to performing these behaviors in Iran". They reported that, there was an inverse and significant correlation between preventive behavior and perceived barriers ($P=0.000$, and $r=-0.31$) when perceived barriers increased affect health-promoting behavior directly as well as indirectly through decreasing commitment to a plan of action. It is very logical that by reducing barriers could increase behavior performance significantly.

V. Conclusions

After twelve months of implementing the discharge plan instructions, the present study concluded that:

- Biochemical tests approved the lower recurrence rate of kidney stones among the study group than control group. The majority of the study group had normal values of urine analysis related to pH, RBCs, pus cells and presence of crystals and had no renal gravels in abdominopelvic ultrasound compared to control group with statistically significant difference.

- The mean total score of perceived benefits, perceived self-efficacy and health promoting behavior to reduce kidney stone recurrence had significant increased among the study group compared to control group. However, the mean total score of perceived barriers of behavior modification to reduce kidney stone recurrence was significantly decreased among study group compared to control group.
- There was a significant positive correlation between total score of perceived benefits, perceived self-efficacy of behavior modification and total score of health promoting behavior among study group. While, there was a significant negative correlation between total score of perceived barriers of behavior modification and total score of health promoting behavior.

VI. Recommendations

Based on the results of this study, the following recommendations were suggested:

- Future studies are needed for developing a nursing discharge protocol for behavior modification to prevent risk of kidney stone recurrence among adult patients.
- Enhance awareness of the community regarding prevention and control of kidney stones.
- Community health nurses should take a more active role for providing education programs about kidney stones and prevention of its recurrence.
- Regular follow up examination for patients with high risk of recurrent renal stones.

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