

# Awareness about Symptoms and Role of Diet in Renal Stones among General Population of Albaha City

Saeed Y.S. Alghamdi, Ali M.A. Alamri, Raed A.M. Alzahrani, Abdulrahman H.A. Alghamdi, Abdulaziz A.A. Alghamdi, Abdulrahman A.M. Alghamdi, Raad J.D. Alghamdi  
Faculty of Medicine, Albaha University, Albaha, KSA

## ABSTRACT

**Background:** nephrolithiasis is an extremely common disorder in Saudi Arabia. Certain dietary changes and practices can influence the development of renal stones.

**Aim of the work:** the aim of this study was to evaluate the awareness about the symptoms and proper diet of renal stones among general population of Albaha city in Saudi Arabia.

**Methods:** a questionnaire was distributed among the general public in Albaha City, Saudi Arabia. The questionnaire was consisted of two sections: section 1 included personal data and section 2 explored the awareness and knowledge about the most common symptoms and complications of renal stones.

**Results:** 417 participants were recruited. Most of the respondents were females, aged between 34 to 49 years, married and had high education. About one third of respondents had previous information about renal stones. Nearly half the respondents recognized only one risk factor and only one identified all the eight factors listed (0.2%). There was lack of knowledge about some symptoms and false beliefs about some foods (fish and sea food, greens and spinach). **Conclusion:** some misconceptions were revealed about risk factors and symptoms of renal stones. There was a lack of sufficient knowledge about the role of diet in medical management of renal stones. Educational programs should focus on these points of defect in knowledge and attitude. We recommended providing the health information concerning renal stone disease through the Internet (being the source of information used by most participants) and ensuring the inclusion of these information in the routine instructions and health education of patients.

**Keywords:** urolithiasis, symptoms, risk factors, knowledge, questionnaire.

## INTRODUCTION

Kidney stones are a very common urologic problem. Their incidence is rising, with an estimated global prevalence of 10%–15%<sup>(1)</sup>. It is a recurrent condition and stone formers are much more likely to have a further stone. Sometimes the condition passes asymptotically; however, many patients had pain, urinary tract infection, hematuria or impairment of renal functions, which may require multiple hospital admissions or multiple surgical procedures<sup>(2)</sup>. In Saudi Arabia, renal stone disease represented a significant health problem, affecting a much higher percentage of Saudi people than in western countries<sup>(3-5)</sup>. The high incidence and prevalence of renal stone disease in KSA can be attributed to the effect of a certain diet peculiar to the Gulf region and Middle East with decreased calcium intake and high intake of animal protein (whether meat, fish or poultry) and oxalate; thus resulting in enteric hyperoxaluria and an increased risk of calcium-oxalate stone formation. Moreover, the lower urine volumes, due to the hot, dry climate, increased the risk of stone formation<sup>(4)</sup>. Fortunately, prevention of recurrent calculi is feasible and easily obtainable<sup>(6)</sup>. Most stone formers respond to changes in dietary habits and environmental factors. Therefore,

correction of dietary habits and avoidance of unfavourable environmental factors (if possible) are integral parts of the medical management of renal stones<sup>(7)</sup>.

Public knowledge about renal stones can improve the patient's quality of life. Research concerning the level of health knowledge in the general public is limited; few studies evaluated knowledge and practice of medical practitioners in management of renal stones<sup>(8-10)</sup>.

In general, higher level of knowledge would allow people to better comply and manage their own care, for example by avoiding nephrotoxic agents and maintaining a healthy diet. Hence, we conducted this study on the general population of Albaha city in Saudi Arabia to assess their awareness about renal stones regarding the symptoms and proper diet of this disease and also, to explore their practices and attitudes in relation to prevention and management of renal stones.

## METHODS

### *Ethical considerations*

This study design was approved by the institutional review board of the Faculty of

Medicine, Albaha University. An informed consent was obtained from each participant.

**Study design**

This study had a random cross-sectional design that was used to evaluate the awareness about symptoms and complications of renal stones among general population of Albaha city in Saudi Arabia. This study was carried out from the beginning of June, 2017 to the end of August, 2017, among the general population of Albaha city, Saudi Arabia.

A sample size of 417 participants (both males and females), aged between 18 to 60 years were randomly selected from the population in Albaha city. People who approved to participate in this study were included, but those who did not achieve inclusion criteria and those with incomplete data were excluded from this study.

A self-administered questionnaire was used for data collection. The questionnaire had two parts. The first part recorded the personal information of the participants. The second part was about awareness and knowledge of people regarding the symptoms and complications of renal stones. The questionnaire was distributed to the participants by direct contact with them. Data were confirmed then coded and entered to a personal computer. Thanks and appreciations were used to inspire the participants to be involved in the study.

**The study was done after approval of ethical board of Albaha university.**

**Statistical analysis:**

Data analysis was carried out by using SPSS version 22. All variables were checked for normality with Shapiro Wilk test. The results were reported as frequencies and percentages for categorical variables. Association between past experience of renal stones and other variables were tested using Pearson's Chi square, Fisher's exact or Fisher-Freeman-Halton Exact tests as appropriate. A p-value of < 0.05 was considered statistically significant.

**RESULTS**

In this study, 417 participants were recruited. Most of the respondents were females (71.2%), aged between 34 to 49 years, married (79.4%) and had high education (70%). Approximately 12% of the respondents had a past history of renal stones. There was no significant association between the past history of renal stones on one side and the socio-demographic factors recorded (sex, age, marital status and education) on

the other side (**Table 1**). Most of the respondents (77.5%) disagreed that prevention of renal stones is expensive; but slightly more than half the respondents agreed that there was no need to make efforts to prevent renal stones. Among the respondents, 48.2% recognized only one risk factor among the eight medical conditions in the questionnaire and only one respondent identified all of them. The most correctly identified risk factors of renal stones included recurrent urinary tract infections (63.1%) and chronic dehydration (53.2%). There was no significant association between having past history of renal stones and knowledge about risk factors; though, those with past history had slightly higher percentages than the other group (**Table 2**).

Lack of knowledge and misconceptions appeared in the respondent's answers about some symptoms of renal stones. Nearly half of the respondents didn't know urine color or odor with renal stones (43.9% and 52.8%). Other symptoms like nausea and vomiting, an urge to urinate frequently, chills and fever were identified only by small proportions of the participants. The characters of pain with renal colic were recognized to a better extent as 69.5% of respondents stated that it is severe pain in the sides and back and 13.7% chose that it radiates to the lower abdomen and groin (**Table 3**).

Most of the respondents agreed that a certain diet could prevent development of kidney stone. Interestingly, the percentage of those with past history of renal stones was significantly lower than those without (68% versus 87.5%;  $p < 0.001$ ). A high proportion of the respondents recognized correctly some dietary changes that can reduce the complications of renal stones. These dietary changes included: a) decreased intake of meat (65.7 % of respondents), salty foods (65.9%), dark chocolate (48.9%) and nuts (45.1%); and b) increased intake of water (83.7%), vegetables (67.1%) and fruits (75.1%). However, some misconceptions existed about the dietary effect of certain types of foods including greens (71%), spinach (55.6%), and fish and sea food (51.8%). Generally, respondents with a past history of renal stones - as compared to those without - demonstrated better knowledge of proper dietary changes and had significantly higher percentages as regards the proper change in dietary intake meat ( $p = 0.030$ ) and nuts (0.009) (**Table 4**). The majority of the respondents recognized the

important role played by sufficient water intake in preventing renal stones and agreed with practices that foster it: drinking plenty of fluid in hot weather (90.4% of respondents), before sleep or at wake up (87.3%), in case of fever or severe diarrhea (81.5%) and replacing lost fluids if working for a long time in hot areas (85.1%). Other sound practices that were identified by the respondents included increasing intake of cranberry juice (71.9%) and reducing the consumption of cola beverages and stimulants (63.3% and 57.8%) as shown in **table 5**.

Most of the respondents (60.4%) believed that the renal physician should be consulted if they

had renal stones. Respondents who had previous information about renal stones comprised only about one third and a significantly higher percentage of them had a past experience of renal stones (48% versus 31.1%). Internet represented the main source of information (55.8%), followed by urologists (19.6%), brochures (13.8%) and television (10.9%). The effect of their previous information on diet was small or partial in about half the respondents and a definite change occurred in 35.3%; while no change was produced in 11% of respondents (**Table 6**).

**Table 1: socio-demographic data of the respondents.**

		Are you ever suffering from Kidney stone disease?						Tests of significance	
		All respondents (N = 417)		No (N = 367)		Yes (N = 50)		Test statistic	P
		N	%	N	%	N	%		
Sex	F	297	71.2%	266	72.5%	31	62.0%	$X^2_{\text{ChS}}=2.35$ 8	0.125
	M	120	28.8%	101	27.5%	19	38.0%		
Age	18 - 20	18	4.3%	18	4.9%	0	0.0%	$X^2_{\text{ChS}}=12.8$ 53	0.169
	>20 - 24	34	8.2%	31	8.4%	3	6.0%		
	>24 - 29	36	8.6%	34	9.3%	2	4.0%		
	>29 - 34	49	11.8%	46	12.5%	3	6.0%		
	>34 - 39	72	17.3%	65	17.7%	7	14.0%		
	>39 - 44	94	22.5%	78	21.3%	16	32.0%		
	>44 - 49	61	14.6%	53	14.4%	8	16.0%		
	>49 - 54	32	7.7%	25	6.8%	7	14.0%		
	>54 - 59	13	3.1%	11	3.0%	2	4.0%		
≥ 60	8	1.9%	6	1.6%	2	4.0%			
Marital status	Married	331	79.4%	287	78.2%	44	88.0%	$X^2_{\text{FFH}}=6.38$ 5	0.105
	Single	65	15.6%	59	16.1%	6	12.0%		
	Divorced	11	2.6%	11	3.0%	0	0.0%		
	Widow	10	2.4%	10	2.7%	0	0.0%		
Education	School (less than 10 years)	7	1.7%	5	1.4%	2	4.0%	$X^2_{\text{FFH}}=8.61$ 7	0.053
	School (10 years)	13	3.1%	9	2.5%	4	8.0%		
	Professional technical education (10-13 years)	65	15.6%	60	16.3%	5	10.0%		
	Institute/University	292	70.0%	260	70.8%	32	64.0%		
	Postgraduate	40	9.6%	33	9.0%	7	14.0%		

N: number;  $X^2_{\text{ChS}}$  = Pearson's Chi square test;  $X^2_{\text{FFH}}$  = Fisher-Freeman-Halton Exact Test.

**Table 2: attitude and knowledge about the risk factors of renal stones in the respondents**

		Are you ever suffering from Kidney stone disease?						Pearson's Chi square test	
		All respondents (N = 417)		No (N = 367)		Yes (N = 50)			
		N	%	N	%	N	%	X <sup>2</sup>	p
Do you agree or disagree that kidney stone prevention is expensive?	Agree	94	22.5%	83	22.6%	11	22.0%	0.010	0.922
	Disagree	323	77.5%	284	77.4%	39	78.0%		
Do you agree or disagree that there is a need to make efforts to prevent kidney stone?	Agree	221	53.0%	194	52.9%	27	54.0%	0.023	0.880
	Disagree	196	47.0%	173	47.1%	23	46.0%		
In your opinion, could working in a hot condition/under sun lead to KSD?	No	80	19.2%	69	18.8%	11	22.0%	X <sup>2</sup> <sub>ChS</sub> = 1.352	0.509
	Don't know	182	43.6%	164	44.7%	18	36.0%		
	Yes	155	37.2%	134	36.5%	21	42.0%		
Which of the following do you think will increase the risk factor and complication of kidney stones?									
Hyperparathyroidism		36	8.6%	31	8.4%	5	10.0%	0.010	0.922
Gout		112	26.9%	95	25.9%	17	34.0%	1.475	0.225
Recurrent urinary tract infections		263	63.1%	229	62.4%	34	68.0%	0.593	0.441
Chronic dehydration		222	53.2%	193	52.6%	29	58.0%	0.518	0.472
Prolonged catheterization		54	12.9%	47	12.8%	7	14.0%	0.056	0.814
Hypertension		63	15.1%	53	14.4%	10	20.0%	1.060	0.303
Diabetes mellitus		98	23.5%	83	22.6%	15	30.0%	1.335	0.248
Crohn's disease		10	2.4%	10	2.7%	0	0.0%	0.474	0.491

N: number; KSD: kidney stone disease.

**Table 3: Knowledge about the symptoms of renal stones.**

		Are you ever suffering from Kidney stone disease?						Tests of significance	
		All respondents (N = 417)		No (N = 367)		Yes (N = 50)			
		N	%	N	%	N	%	Test statistic	p
Which do you think is a symptom of kidney stone?	Urination more often than usual	15	3.6%	13	3.5%	2	4.0%	$X^2_{FFH}=3.818$	0.419
	Urinate small amount	239	57.3%	208	56.7%	31	62.0%		
	Persist need for urinate	61	14.6%	56	15.3%	5	10.0%		
	Fever and chills	57	13.7%	53	14.4%	4	8.0%		
	Nausea and vomiting	45	10.8%	37	10.1%	8	16.0%		
What you consider urine color with kidney stones?	Brown.	117	28.1%	93	25.3%	24	48.0%	$X^2_{ChS}=13.452$	0.004*
	Don't know	183	43.9%	171	46.6%	12	24.0%		
	Not affected	12	2.9%	10	2.7%	2	4.0%		
	Pink, red	105	25.2%	93	25.3%	12	24.0%		
What you consider urine odor with kidney stones?	Cloudy urine	73	17.5%	62	16.9%	11	22.0%	$X^2_{ChS}=8.608$	0.035*
	Foul	106	25.4%	88	24.0%	18	36.0%		
	Don't know	220	52.8%	203	55.3%	17	34.0%		
	No smell	18	4.3%	14	3.8%	4	8.0%		
Where do you think the location of pain during kidney stone?	Pain during urination	35	8.4%	33	9.0%	2	4.0%	$X^2_{FFH}=2.860$	0.571
	Severe pain in the side and back, below the ribs	290	69.5%	253	68.9%	37	74.0%		
	Pain in urination	14	3.4%	13	3.5%	1	2.0%		
	Pain that come in waves and fluctuates	21	5.0%	20	5.4%	1	2.0%		
	Pain that radiates to the lower abdomen and groin	57	13.7%	48	13.1%	9	18.0%		

N: number;  $X^2_{ChS}$  = Pearson's Chi square test;  $X^2_{FFH}$  = Fisher-Freeman-Halton Exact Test; \*Significant at  $p < 0.05$ .

**Table 4: knowledge about effect of diet on reducing complications of renal stones.**

		Are you ever suffering from Kidney stone disease?						Tests of significance	
		All respondents (N = 417)		No (N = 367)		Yes (N = 50)		Test statistic	p
		N	%	N	%	N	%		
Is it unlikely that a certain diet could prevent kidney stone development?	Agree	355	85.1%	321	87.5%	34	68.0%	$X^2_{ChS}=13.174$	<0.001*
	Disagree	62	14.9%	46	12.5%	16	32.0%		
Do you think that consuming more, the same amount or less of these foods would help to reduce complications of kidney stones?									
Vegetables	Less	72	17.3%	65	17.7%	7	14.0%	$X^2_{ChS}= 1.933$	0.380
	More	280	67.1%	248	67.6%	32	64.0%		
	Not sure	65	15.6%	54	14.7%	11	22.0%		
Fruits	Less	72	17.3%	67	18.3%	5	10.0%	$X^2_{FFH}= 2.070$	0.363
	More	313	75.1%	272	74.1%	41	82.0%		
	Not sure	32	7.7%	28	7.6%	4	8.0%		
Sugary food	Less	256	61.4%	222	60.5%	34	68.0%	$X^2_{ChS}= 1.112$	0.573
	More	45	10.8%	41	11.2%	4	8.0%		
	Not sure	116	27.8%	104	28.3%	12	24.0%		
Fish and sea food	Less	109	26.1%	99	27.0%	10	20.0%	$X^2_{ChS}= 2.386$	0.303
	More	216	51.8%	185	50.4%	31	62.0%		
	Not sure	92	22.1%	83	22.6%	9	18.0%		
Meat	Less	274	65.7%	234	63.8%	40	80.0%	$X^2_{ChS}= 6.189$	0.030*
	More	58	13.9%	52	14.2%	6	12.0%		
	Not sure	85	20.4%	81	22.1%	4	8.0%		
Greens	Less	89	21.3%	80	21.8%	9	18.0%	$X^2_{FFH}= 1.326$	0.512
	More	296	71.0%	257	70.0%	39	78.0%		
	Not sure	32	7.7%	30	8.2%	2	4.0%		
Nuts	Less	188	45.1%	156	42.5%	32	64.0%	$X^2_{ChS}= 9.441$	0.009*
	More	111	26.6%	105	28.6%	6	12.0%		
	Not sure	118	28.3%	106	28.9%	12	24.0%		
Water	Less	53	12.7%	49	13.4%	4	8.0%	$X^2_{FFH}= 1.119$	0.624
	More	349	83.7%	305	83.1%	44	88.0%		
	Not sure	15	3.6%	13	3.5%	2	4.0%		
Fatty food	Less	274	65.7%	238	64.9%	36	72.0%	$X^2_{ChS}= 1.949$	0.377
	More	49	11.8%	46	12.5%	3	6.0%		
	Not sure	94	22.5%	83	22.6%	11	22.0%		
Dark chocolate	Less	204	48.9%	175	47.7%	29	58.0%	$X^2_{ChS}= 2.306$	0.316
	More	76	18.2%	70	19.1%	6	12.0%		
	Not sure	137	32.9%	122	33.2%	15	30.0%		
Spinach	Less	124	29.7%	104	28.3%	20	40.0%	$X^2_{ChS}= 3.468$	0.177
	More	232	55.6%	210	57.2%	22	44.0%		
	Not sure	61	14.6%	53	14.4%	8	16.0%		
Egg	Less	206	49.4%	180	49.0%	26	52.0%	$X^2_{ChS}= 2.486$	0.288
	More	93	22.3%	86	23.4%	7	14.0%		
	Not sure	118	28.3%	101	27.5%	17	34.0%		
Salty foods	Less	275	65.9%	239	65.1%	36	72.0%	$X^2_{ChS}= 3.555$	0.169
	More	62	14.9%	59	16.1%	3	6.0%		
	Not sure	80	19.2%	69	18.8%	11	22.0%		

N: number;  $X^2_{ChS}$  = Pearson's Chi square test;  $X^2_{FFH}$  = Fisher-Freeman-Halton Exact Test; \*significant at  $p < 0.05$ .

**Table 5: knowledge and attitude about practices that prevent kidney stones formation.**

	Are you ever suffering from Kidney stone disease?						Tests of significance	
	All respondents (N = 417)		No (N = 367)		Yes (N = 50)		Test statistic	p
	N	%	N	%	N	%		
Do you think the following practices will prevent kidney stones formation?								
Calcium restriction	143	34.3%	122	33.2%	21	42.0%	$X^2_{ChS}=2.237$	0.327
Drink plenty of fluid in hot weather	377	90.4%	330	89.9%	47	94.0%	$X^2_{FFH}=1.232$	0.525
The use of ventilation and replace lost fluids if the business for a long time in hot areas such as kitchen and oven	355	85.1%	311	84.7%	44	88.0%	$X^2_{FFH}=1.425$	0.526
Drinking a large amount of fluid in fever and severe diarrhea	340	81.5%	296	80.7%	44	88.0%	$X^2_{FFH}=1.441$	0.458
Drink water before sleep or when you wake up at morning by a one or two cups	364	87.3%	321	87.5%	43	86.0%	$X^2_{FFH}=2.084$	0.334
Taking adequate amounts of fluids with and between meals	298	71.5%	263	71.7%	35	70.0%	$X^2_{ChS}=0.166$	0.920
Decrease drinking cola beverage such as Pepsi cola coca cola	264	63.3%	225	61.3%	39	78.0%	$X^2_{FFH}=7.764$	0.017*
Decrease stimulants drinking such as tea, coffee and cocoa	241	57.8%	208	56.7%	33	66.0%	$X^2_{ChS}=4.875$	0.087
Increase juices intake like orange juice, lemon juice citrus	176	42.2%	154	42.0%	22	44.0%	$X^2_{ChS}=0.126$	0.939
Cranberry juice intake	300	71.9%	265	72.2%	35	70.0%	$X^2_{ChS}=0.380$	0.827
Checking the amount of urine output which must not be less than (2.5) liter/24 hours	239	57.3%	206	56.1%	33	66.0%	$X^2_{ChS}=2.217$	0.330
Do you think holding urine in bladder will cause renal stone disease?	298	71.5%	255	69.5%	43	86.0%	$X^2_{FFH}=6.362$	0.036*

N: number;  $X^2_{ChS}$  = Pearson's Chi square test;  $X^2_{FFH}$  = Fisher-Freeman-Halton Exact Test; \*Significant at  $p < 0.05$ .

**Table 6: knowledge about the concerned medical specialty and sources of information about renal stones**

		Are you ever suffering from Kidney stone disease?						Tests of significance	
		All respondents (N = 417)		No (N = 367)		Yes (N = 50)		Test statistic	p
		N	%	N	%	N	%		
Who should be consulted for treatment if a person has renal stone disease	Folk medical practitioner	1	0.2%	1	0.3%	0	0.0%	$X^2_{FFH}=6.909$	0.200
	General practitioner	7	1.7%	6	1.6%	1	2.0%		
	Urologist	110	26.4%	92	25.1%	18	36.0%		
	General surgeon	5	1.2%	4	1.1%	1	2.0%		
	Internist	42	10.1%	35	9.5%	7	14.0%		
	Renal physician	252	60.4%	229	62.4%	23	46.0%		
Previous information about stones	Yes	138	33.1%	114	31.1%	24	48.0%	$X^2_{ChS}=5.701$	0.017*
Information source	Internet	77	55.8%	66	57.9%	11	45.8%	$X^2_{FFH}=3.285$	0.337
	Television	15	10.9%	13	11.4%	2	8.3%		
	Brochures	19	13.8%	16	14.0%	3	12.5%		
	Urologist	27	19.6%	19	16.7%	8	33.3%		
Information effect on diet	Some extent	73	53.7%	64	57.1%	9	37.5%	$X^2_{FFH}=3.375$	0.170
	No	15	11.0%	12	10.7%	3	12.5%		
	Yes	48	35.3%	36	32.1%	12	50.0%		

N: number;  $X^2_{ChS}$  = Pearson's Chi square test;  $X^2_{FFH}$  = Fisher-Freeman-Halton Exact Test; \*Significant at  $p < 0.05$ .

## DISCUSSION

In the present study, 417 participants were recruited. Most of the respondents were females, aged between 34 to 49 years, married and had high education. Respondents who admitted had previous information about renal stones comprised only about one third and approximately 12% of all respondents had a past history of renal stones. In the present study, the respondent's information about renal stones was derived mostly from the Internet and urologists. Although most respondents (77.5%) in this study disagreed that prevention of renal stones is expensive; about half of them stated that there is no need to make efforts to prevent renal stones. This is a false concept and should be changed by health education as the average rate of stone recurrence for patients is seven during a lifetime, which can be economically and practically prevented<sup>(11)</sup>. Medical conditions that may increase the risk of development of kidney stones or affect their clinical course included: primary hyperparathyroidism, gout, diabetes mellitus, inflammatory bowel disease<sup>(12,13)</sup>, hypertension<sup>(14)</sup>, chronic dehydration<sup>(15)</sup>, and prolonged catheterization with recurrent urinary tract infections<sup>(16)</sup>. In the current study, respondents were able to identify correctly some of the risk factors of renal stones, particularly recurrent urinary tract infections (63.1%) and chronic dehydration (53.2%). However, nearly half the respondents (48.2%) recognized only one factor among the provided eight factors in the questionnaire and only one respondent identified all the factors listed (0.2%). Knowledge about these predisposing conditions can direct the individuals at risk to take measures, which could prevent occurrence of renal stones such as adopting changes in their diet and controlling their medical conditions. Typical symptoms of renal stones are acute renal colic (intermittent colic in the flanks that may radiate to lower abdomen or groin) often associated with nausea and vomiting<sup>(12)</sup>. Dysuria, urgency and frequency may occur when the stone passes into the ureter. Other symptoms included fever and chills, blood in urine and foul odour<sup>(13)</sup>. The respondents displayed lack of knowledge about some symptoms (such as urine color and odor, nausea and vomiting, an urge to urinate frequently, chills, and fever), while the characters of renal pain were better recognized. Beneficial changes in the diet of renal stone formers included: increased intake of fluids<sup>(17)</sup>, vegetables<sup>(18)</sup> and citrus fruit

(orange juice and home-made lemonade); decreasing animal protein, sodium, oxalate (avoidance of spinach, tea, nuts), refined sugars; and optimising dietary calcium intake<sup>(19, 20)</sup>. Dietary calcium restriction can increase the risk of stone formation and lead to bone demineralisation<sup>(21)</sup>.

In the present study, most respondents agreed that a certain diet could prevent formation of renal stones; however, the percentage of those with past history of renal stones was significantly lower than those without; raising concerns about the adequacy and efficiency of health education delivered to those patients by health professionals. The dietary changes recognized correctly included: decreased intake of nuts, dark chocolate, meat, and salty foods; and increased intake of vegetables, fruits, and water. The respondents appeared to have false beliefs about fish and sea food, greens, and spinach. Apparently, the role of excess intake of animal protein (and that poultry and fish are animal proteins!) and oxalate intake in the development of renal stones is not clear to non-medical subjects. We observed that respondents with a past history of renal stones displayed relatively better knowledge of proper dietary changes; though not reaching the desired level. Similarly, **Chan *et al.***<sup>(22)</sup>, in their survey of general public in Hong Kong about renal stone disease, reported that only 9% of their respondents stated that salty food should be decreased and less than 3% picked other relevant items (meat, nuts, and spinach), whilst 66% had no idea.

In the present study, although one third of respondents had a previous knowledge about the role of diet in renal stone formation, only 35.3% of them admitted that the previous information produced a definite change on their diet; while the effect was small or partial in about half the respondents and no change occurred in 11%.

In this study, the majority of respondents agreed to the practices that ensure adequate intake of water (drinking plenty of fluid in hot weather, before sleep or at wake up, in case of fever or severe diarrhea), replacing lost fluids, increasing intake of cranberry juice and decreasing intake of cola beverages and stimulants. Most of the respondents stated that the renal physician should be consulted if they had renal stones. On the other hand, **Chan *et al.***<sup>(22)</sup> found that 48% chose urologists to be consulted but 43% chose either an internal medicine or renal physician.

**Conclusion:**

Despite the high educational level of most respondents, some misconceptions appeared about the risk factors of renal stones (particularly hyperparathyroidism and Crohn's disease) and their symptoms (urine color and odor, nausea and vomiting, fever and chills). There was a lack of sufficient knowledge about the role of diet in medical management of renal stones. Educational programs for renal stone disease should focus on these points of defect in knowledge and attitude. We recommended providing the health information concerning renal stone disease through the Internet (being the source of information used by most participants) and ensuring the inclusion of these information in the routine instructions and health education of patients.

**REFERENCES**

1. **Cheungpasitporn W, Rossetti S, Friend K et al. (2016):** Treatment effect, adherence, and safety of high fluid intake for the prevention of incident and recurrent kidney stones: a systematic review and meta-analysis. *Journal of Nephrology*, 29(2):211-220.
2. **New F and Somani BK (2016):** A Complete World Literature Review of Quality of Life (QOL) in Patients with Kidney Stone Disease (KSD). *Current Urology Reports*, 17(12):88.
3. **Barkworth SA, Louis S, Walker VR et al. (1989):** Stone Type and Urine Composition in the Middle East with Particular Reference to Saudi Arabia. In: **Walker VR, Sutton RAL, Cameron ECB, Pak CYC, Robertson WG**, editors. *Urolithiasis*. Boston, MA: Springer US, p. 715.
4. **Robertson WG (2012):** Stone formation in the Middle Eastern Gulf States: a review. *Arab Journal of Urology*, 10(3):265-72.
5. **Robertson WG and Hughes H (1994):** Epidemiology of Urinary Stone Disease in Saudi Arabia. In: **Ryall R, Bais R, Marshall VR, Rofe AM, Smith LH, Walker VR**, editors. *Urolithiasis 2*. Boston, MA: Springer US, p. 453-5.
6. **Pietrow PK and Karellas M (2007):** Medical management of common urinary calculi. *South African Family Practice*, 49(3):44-8.
7. **Abeygunasekera A (2011):** Urinary stone disease in Sri Lanka. *Ceylon Medical Journal*, 49(2).
8. **Binsaleh S, Habous M, Madbouly K (2016):** Knowledge, attitudes, and practice patterns of recurrent urinary stones prevention in Saudi Arabia. *Urolithiasis*, 44(2):135-43.
9. **Bos D, Abara E, Parmar MS (2014):** Knowledge, attitudes, and practice patterns among healthcare providers in the prevention of recurrent kidney stones in Northern Ontario. *Canadian Urological Association Journal*, 8(11-12):E795-E804.
10. **Nieder AM, Lotan Y, Nuss GR et al. (201):** Are patients with hematuria appropriately referred to Urology? A multi-institutional questionnaire based survey. *Urologic Oncology*, 28(5):500-3.
11. **Downey P and Tolley D (2002):** Contemporary management of renal calculus disease. *Journal of the Royal College of Surgeons of Edinburgh*, 47:668-75.
12. **Eskelinen M, Ikonen J, Lipponen P (1998):** Usefulness of history-taking, physical examination and diagnostic scoring in acute renal colic. *European Urology*, 34:467-73.
13. **Miller NL and Lingeman JE (2007):** Management of kidney stones. *British Medical Journal*, 334(7591):468.
14. **Ramello A, Vitale C, Marangella M (2001):** Epidemiology of nephrolithiasis. *Journal of Nephrology*, 13:S45-S50.
15. **Venugopal V, Kamalkannan L, Shanmugam R et al. (2017):** 0223 Occupational heat exposures in industries and renal health—findings from india. *Occupational and Environmental Medicine*, 74:A66-A67.
16. **Warren JW (2001):** Catheter-associated urinary tract infections. *International Journal of Antimicrobial Agents*, 17(4):299-303.
17. **Borghgi L, Meschi T, Amato F et al. (1996):** Urinary volume, water and recurrences in idiopathic calcium nephrolithiasis: a 5-year randomized prospective study. *The Journal of urology*, 155(3):839-43.
18. **Frassetto L and Kohlstadt I (2011):** Treatment and prevention of kidney stones: an update. *American Family Physician*, 84(11):1234.
19. **Seltzer MA, Low RK, McDonald M et al. (1996):** Dietary manipulation with lemonade to treat hypocitraturic calcium nephrolithiasis. *The Journal of Urology*, 156(3):907-9.
20. **Wabner CL and Pak CY (1993):** Effect of orange juice consumption on urinary stone risk factors. *The Journal of Urology*, 149(6):1405-8.
21. **Curhan GC, Willett WC, Rimm EB et al. (1993):** A prospective study of dietary calcium and other nutrients and the risk of symptomatic kidney stones. *New England Journal of Medicine*, 328(12):833-8.
22. **Chan SW, Ng CF, Man CW et al. (2008):** A report on a randomly sampled questionnaire survey about renal stone disease in Hong Kong. *Hong Kong Medical Journal*, 14(6):427-31.