

Dietary Habits of Kidney Stone Patients of Kangra District, Himachal Pradesh, North India

Madhvi Awasthi, S. R. Malhotra* and Rajni Modgil

*Department of Food Science and Nutrition, College of Home Science, CSK Himachal Pradesh
Krishi Vishvavidyalaya, Palampur 176 062, Himachal Pradesh, India
E-mail: s_rekha1@yahoo.co.in*

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ABSTRACT Dietary habits of one hundred and thirty kidney stone patients from various hospitals of Palampur of Kangra District in Himachal Pradesh, North India were studied. Majority of the patients were non-vegetarian (60 per cent) and many of them (40 per cent) were consuming more salted foods. Water consumption amount revealed that majority (59.23 per cent) of the patients were consuming 1000 ml of water per day. Frequency of consumption of foodstuffs revealed that it varied from weekly to rarely for most of the items from various selected categories.

INTRODUCTION

Among urinary disorders, stone formation is of paramount importance. The incidences of kidney stones are rising in rural and urban societies in India. A large population of the country suffers from kidney stones which are formed due to deposition of calcium, phosphates and oxalates. The chemicals start accumulating over a nucleus, which ultimately takes the shape of a stone (Misra and Kumar 2000). These stones may persist for indefinite period of time, leading to secondary complications thereby causing serious consequences to patient's life. Kidney stones are of two types, that is, primary and secondary stones. The former includes stones of calcium, oxalate, uric acid, cystine and xanthine (Garrow 2000). Calcium oxalate stones are common clinical problem and population studies indicate that one in thousand suffers from such stones each year. The secondary stones are formed by urea splitting organisms such as *Proteus*, *Pseudomonas* and *Klebsiella* species and are known as struvite stones. They are composed of magnesium, ammonium and phosphates (Grasses et al. 2007).

The occurrence of renal stone disease is related to food habits of individuals. Dietary factors include a high intake of animal proteins and oxalates and a low intake of potassium containing citrus fruits and fluids (Tur et al. 1991). Inadequate fluid consumption decreases total urinary volume thereby increasing the concentration of stone forming salts. Intake of sodium is also associated with increased risk of stone

formation presumably because of increased urinary calcium excretion (Carbone et al. 2003).

The present study, based on selected kidney stone patients of Kangra District in Himachal Pradesh, North India, is an attempt to study the relationship between dietary habits and incidence of stone formation.

METHODOLOGY

The study was conducted on a total of 130 kidney stone patients, comprising 78 males and 52 females, selected randomly from various medical institutions such as CSK HPKV Health centre, Civil Hospital Palampur and Karan Hospital, Palampur of Kangra district of Himachal Pradesh. A comprehensive and exhaustive questionnaire was formulated specifically keeping in mind the objectives of the study. This sample questionnaire was presented to 10 kidney stone patients other than the selected patients and was then evaluated for response of the patients. The necessary improvements / alterations/modifications were incorporated on the basis of collected information, thus making the questionnaire more functional. The data were collected during the months of July-October, 2009.

The patients were interviewed to collect information regarding the detailed dietary history with added information about his/her food likes/dislikes, preferences/intolerances (if any), eating habits, general meal pattern and dietary intake. Added information about dietary modifications (if any) in relation to the kidney stone

conditions such as foods especially taken or avoided, consumption of salt and amount and source of water consumed were also collected. Information on food preferences of the patients in terms of frequency of consumption was collected. In addition, detailed list of foodstuffs selected with special reference to their mineral content (calcium, phosphorus magnesium, oxalates), stone forming constituents and foodstuffs helping in reducing the risk factors of stones was collected from the patients. Questions used to collect information for the present study are given in Appendix-I.

RESULT AND DISCUSSION

Eating Habits of Kidney Stone Patients

The eating habits of kidney stone patients are presented in Table 1. Data in the table revealed that 67.95 per cent of total male patients were non-vegetarian while 19.23 per cent were vegetarian and 12.82 per cent were eggatarian. In case of female kidney stone patients, 48.08 per cent were non-vegetarian, 36.54 per cent were vegetarian and 15.38 were eggatarian. The high non-vegetarian diet may be a reason of stones in the patients suffering with problems of uric acid and cystine stones. Similar results were obtained by Vasanthamani and Sushmitha (1997) who reported that about 87 per cent kidney stone patients were non-vegetarian while only 13 per cent were vegetarian. Sinha et al. (2010) also reported more incidences of kidney stones in non-vegetarians.

Table 1: Eating habits of kidney stone patients

Particular	Male (n=78)	Female (n=52)	Total (N=130)
<i>Eating Habits</i>			
Vegetarian	15 (19.23)	19 (36.54)	34 (26.15)
Eggatarian	10 (12.82)	8 (15.38)	18 (13.85)
Non-vegetarian	53 (67.95)	25 (48.08)	78 (60.00)
<i>Salt Consumption</i>			
Low	27 (34.62)	7 (13.46)	34 (26.15)
Normal	17 (21.79)	27 (51.92)	44 (33.85)
More	34 (43.59)	18 (34.62)	52 (40.00)

Figures in the parentheses indicate percentages

All kidney stone patients were asked for their liking for salt in food. No standards were specified and results are based on the terms of taste. Salt consumption by kidney stone patients was also reported. The data obtained indicated that 40 per cent of the total kidney stone patients

were taking high salt in their diet. In males, 43.59 per cent were taking high salted food while 34.62 per cent and 21.79 per cent were taking respectively low and moderate amounts of salt in their diet. Among female patients, the consumption of high salt was observed in 34.62 per cent, 51.92 per cent were taking moderate amount of salt while 13.46 per cent were consuming low amount of salt in their diet. High intake of salt among kidney stone formers may also be a reason for recurrence of stone (Bharathi and Amirthaveni 2008). The common salt (sodium chloride) is being consumed in varying amounts by patients as observed in the present investigation. As reported by Carbone et al. (2003), sodium may increase urinary calcium excretion with which chances of stone formation also increase.

Water Consumption by Kidney Stone Patients

The amount of water consumed by kidney stone patients and source of water used for consumption varied widely and the results are presented in Table 2. This table revealed that majority of the male kidney stone patients (57.69 per cent) were consuming 1000 ml of water per day, followed by 23.08 per cent consuming 1500 ml, 16.67 percent consuming 500 ml and 2.56 per cent consuming 2000 ml. In case of females, majority (61.54 per cent) was consuming 1000 ml of water per day, followed by 19.23 per cent consuming 500 ml, 17.31 per cent consuming 1500 ml and 1.92 per cent consuming 2000 ml. As evident from the data, the water consumption was not sufficient as per the recommendations, lesser amount of water consumption may attributed as one of the causes for kidney stones formation in the present patients. Similar results were reported by Vasanthamani and Sushmitha (1997) and Bharathi and Amirthaveni (2008). Inadequate fluid consumption decreases total urinary volume, thereby increasing the concentration of stone forming salt promoters like calcium, oxalates, uric acid or lower inhibitors like citrate, glycoaminoglycans and kidney proteins such as nephrocalcin or both.

Table 2 also reveals that in the majority of male kidney stone patients (88.46 per cent), the source of water was hand pump (groundwater). Only 2.56 per cent and 8.98 per cent of males were using water from tap (Surface water) and *babdi* (Stagnant Water), respectively. In case of females kidney stone patients, 61.54 per cent were using water from hand pump while 28.85 per cent

Table 2: Water consumption by kidney stone patients

Particular	Male (n=78)	Female (n=52)	Total (N=130)
<i>Amount of Water Consumed/ Day</i>			
8 glasses (2000 ml)	2 (2.56)	1 (1.92)	3 (2.31)
6 glasses (1500 ml)	18 (23.08)	9 (17.31)	27 (20.77)
4 glasses (1000 ml)	45 (57.69)	32 (61.54)	77 (59.23)
2 glasses (500 ml)	13 (16.67)	10 (19.23)	23 (17.69)
<i>Source of Water</i>			
Tap (surface water)	2 (2.56)	15 (28.85)	17 (13.08)
Hand pump (groundwater)	69 (88.46)	32 (61.54)	101 (77.69)
<i>Babdi</i> (stagnant water)	7 (8.98)	5 (9.61)	12 (9.23)

Figures in the parentheses indicate percentag

were using tap water. 9.61 per cent were still dependent on *babdi* for drinking water. Different rocks have different minerals and groundwater is always in contact with these rocks for example, sandstone, limestone and basalt and minerals and moves more slowly than surface water, that is, centimeters per day instead of kilometers per hour for the latter. As a result, groundwater often contains more dissolved minerals than surface water. Consumption of groundwater may be one of the reasons of stone formation in patients (Siener 2006). The longer the groundwater is in contact with the minerals, the greater the extent of its reaction with those minerals and higher will be the content of dissolved minerals in it. In case of *babdi* (stagnant water), water remains static for lesser time than underground which may be a reason of less mineral content in its water.

Frequency of Consumption of Foodstuffs by Kidney Stone Patients

Data of consumption of various foodstuffs by the kidney stone patients with special reference to their calcium, phosphorous, purine and oxalate content are presented on the basis of availability and seasonal consumption of different foodstuffs.

Cereal Products and Pulses

Among cereal products *dalia* (porridge) and *suji* (semolina) were consumed rarely by majority of male kidney stone patients (44.87 and 50

per cent, respectively) while respectively 44.23 and 55.77 per cent of female kidney stone patients were regularly consuming these food items. However, *dalia* was preferred by 32.05 per cent of male kidney stone patients. There was only one male kidney stone patient who was taking cornflakes daily and its consumption was rare among male and female kidney stone patients. Corn and wheat bran are rich in phytate (IP-6), which act as inhibitor of stone formation (Curhan et al. 2004). As evident from data such seasonal and rare consumption of some foods may be a cause of kidney stone formation in these patients.

In addition horse gram was consumed regularly by male and female kidney stone patients (37.18 and 46.15 per cent, respectively). Horse gram contains inhibitor of crystallization and is effective on calcium-phosphate kidney stones (Peshin and Singla 1994). Seasonal consumption of horse gram may be attributed to causation of kidney stone formation.

Vegetables

Among vegetables, cauliflower was consumed weekly by majority of patients (37.18 per cent and 48.08 per cent males and female, respectively). Brinjal (eggplant) was consumed regularly by both male (43.59 per cent) and female (61.54 per cent) kidney stone patients. Maximum male and female kidney stone patients (30.77 per cent and 40.38 per cent, respectively) were consuming capsicum. Mushroom was preferred rarely by majority of male kidney stone patients (51.25 per cent) but preferred regularly by majority female patients (80.77 per cent). Cauliflower, brinjal, capsicum and mushroom are rich sources of purine and consumption of such food items may contribute to one of the risk factors of kidney stone formation.

All kidney stone patients were consuming seasonal green leafy vegetables and in this case frequency of consumption varied from alternate day to rarely. All the green leafy vegetables viz. cabbage, mustard leaves, and spinach were consumed weekly by majority of male and female kidney stone patients (41.03 and 46.15 per cent, 41.03 and 51.92 per cent, 43.59 and 55.77 per cent, respectively) depending on availability. Only *amaranth* was consumed regularly by maximum male (46.15 per cent) and weekly by female (55.77 per cent) kidney stone patients. Green leafy vegetables are grown and available throughout the

year in Kangra district, and being rich in oxalate. The oxalates bind calcium and make it unavailable for body functions. This causes hyperoxaluria which is a causative factor in formation of kidney stones (Daudon 2005).

Fruits

Tomato was consumed daily by maximum kidney stone patients (58.97 per cent males and 75 per cent females). Excessive consumption of tomato may be one of the causes of stone formation. Banana was consumed on every alternate day by majority of patients (37.18 and 51.92 per cent male and female, respectively). Lemon/*Druj* was consumed regularly by maximum male patients (37.18 per cent) and alternatively by maximum female patients (36.54 per cent). *Sapota*, *Amla* and dates were consumed regularly (21.79 and 33.33 and 47.44 per cent, respectively) by male patients. In case of female patients, consumption of *sapota* was regular (40.38 per cent), while *amla* and dates were consumed rarely (51.92 and 57.69 per cent, respectively). The general precaution in dietary treatment of kidney stones is to avoid foods which irritate the kidneys to control the acidity or alkalinity of the urine. Grapes, *Sapota* and *Amla* are known as stone formers (rich in oxalates) as these foods irritate the kidneys while date, banana and lemon are known as stone inhibitors as they are rich in B-complex vitamins and citric acid (Daudon 2005).

Milk and Milk Products

Milk and milk products are good source of calcium. Majority of kidney stone patients were consuming milk and curd daily (respectively 57.69 and 38.46 per cent males and 36.54 and 44.23 per cent females). Cheese was taken regularly by maximum male (61.54 per cent) and female (46.15 per cent) patients. Consumption of milk and milk products in this may be a reason for formation of stones in kidney stone patients as they are rich in calcium. High blood level of calcium increases excretion of calcium in the urine. An abnormally high intake of milk, alkalis or vitamin D may result in the formation of calcium phosphate stones (Vasanthamani and Sushmitha 1997).

Animal Foods

Data in the Table 3 reveals that egg was consumed daily by only 5.13 per cent of male pa-

tients and 3.85 per cent of female patients. Maximum males were taking egg weekly (28.21 per cent) and females on every alternate day (30.77 per cent). Chicken was preferred regularly by maximum male patients (73.08 per cent) and rarely by female patients (40.38 per cent). Fish was consumed rarely by male (46.15 per cent) and regularly by majority of female (46.15 per cent) patients. Sinha et al. (2010) reported that intake of animal foods being rich in purines is directly associated with risk of stone formation in cases of kidney stone patients. Similar observation was made in the present investigation.

Nuts and Beverages

Among nuts, cashew was not preferred by kidney stone patients, 15.38 per cent of male and 11.54 per cent of female patients were taking almonds daily. All the kidney stone patients were taking tea daily, which may be a risk factor for development of kidney stone as tea and coffee are rich sources of oxalates (Liebman and Murphy 2007). Coffee was preferred daily by 2.56 per cent of males and on alternative days by 7.69 per cent of female patients. 32.05 per cent male and 23.08 per cent female kidney stone patients were taking coffee regularly. Gasinska and Gajeswka (2007) investigated the feeding habits of 22 adult (12 men and 10 women) patients with kidney stones from Poland to determine the main food sources of oxalate and reported that the main dietary sources of oxalates were tea and coffee (80-85 per cent) in these patients. It was concluded that frequent consumption of oxalate rich foods such as tea and coffee is a significant risk factor for kidney stones. About 15.38 per cent of male patients and 7.69 per cent of female patients were taking cold drinks on alternative days which may be a reason of stone formation in them. Saldana et al. (2007) reported that drinking two or more colas per day is associated with diabetes, hypertension and kidney stones.

CONCLUSION

Dietary habits of kidney stone patients of Kangra District, Himachal Pradesh, North India revealed that majority of patients were non-vegetarian (60 per cent) and many of them were consuming more salted foods (40 per cent). Majority (59.23 per cent) of the patients were consuming only 1000 ml of water per day which may be a

Table 3: Frequency of consumption of special foodstuffs by selected kidney stone patients

Food stuffs	Frequency of consumption									
	Male					Female				
	Daily	Alternately	Weekly	Regularly	Rarely	Daily	Alternately	Weekly	Regularly	Rarely
<i>Cereal Products and Pulses</i>										
Dalia	4 (5.13)	4 (5.13)	10 (12.82)	25 (32.05)	35 (44.87)	2 (3.84)	-	8 (15.38)	23 (44.23)	19 (36.54)
Suji	-	-	2 (2.56)	35 (44.87)	39 (50.00)	-	-	8 (15.38)	29 (55.77)	15 (28.85)
Corn flakes	1 (1.28)	-	-	-	77 (98.72)	-	-	-	-	52 (100.00)
Horse Gram	-	6 (7.69)	18 (23.08)	29 (37.18)	25 (32.05)	-	5 (9.62)	5 (9.62)	24 (46.15)	18 (34.62)
<i>Vegetables</i>										
Cauliflower	-	20 (25.64)	29 (37.18)	26 (33.33)	3 (3.85)	-	18 (34.62)	25 (48.08)	3 (5.77)	6 (11.54)
Brinjal	-	16 (20.51)	18 (23.08)	34 (43.59)	10 (12.82)	-	-	16 (30.77)	32 (61.54)	4 (7.69)
Capsicum	-	12 (15.38)	23 (29.49)	24 (30.77)	19 (24.36)	-	-	21 (40.38)	13 (25.00)	18 (34.62)
Mushroom	-	-	-	38 (48.72)	40 (51.28)	-	-	-	42 (80.77)	10 (19.23)
Cabbage	-	19 (24.36)	32 (41.03)	19 (24.36)	8 (10.26)	-	16 (30.77)	24 (46.15)	8 (15.38)	4 (7.69)
Mustard-Leaves	-	22 (28.21)	32 (41.03)	20 (25.64)	2 (2.56)	-	7 (13.46)	27 (51.92)	8 (15.38)	4 (7.64)
Spinach	-	21 (26.92)	34 (43.59)	16 (20.51)	7 (8.97)	-	10 (19.23)	29 (55.77)	4 (7.69)	9 (17.31)
Amaranth	-	7 (8.97)	28 (35.90)	36 (46.15)	7 (8.97)	-	10 (19.23)	29 (55.77)	10 (19.23)	3 (5.77)
<i>Fruits</i>										
Tomato	46 (58.97)	18 (23.08)	6 (7.69)	-	8 (12.26)	39 (75.00)	3 (5.77)	2 (3.85)	-	8 (15.38)
Sapota	-	10 (12.820)	21 (26.92)	17 (21.79)	30 (38.46)	-	5 (9.61)	12 (23.08)	21 (40.38)	14 (26.92)
Amla	-	5 (6.41)	15 (19.23)	26 (33.33)	32 (41.03)	-	-	6 (11.54)	19 (36.54)	27 (51.92)
Banana	14 (17.95)	29 (37.18)	17 (21.79)	17 (21.79)	1 (1.28)	10 (19.23)	27 (51.92)	9 (17.31)	6 (11.54)	-
Dates	-	-	4 (5.13)	37 (47.44)	37 (47.44)	-	-	6 (11.54)	16 (30.77)	30 (57.69)
Lemon /Darunji-	-	6 (7.69)	21 (26.92)	29 (37.18)	1 (1.28)	14 (26.92)	19 (36.54)	12 (23.08)	7 (13.46)	-
<i>Milk And Milk Products</i>										
Milk	45 (57.69)	10 (12.82)	23 (29.49)	-	-	19 (36.54)	17 (32.69)	16 (30.77)	-	-
Curd	30 (38.46)	23 (29.49)	22 (28.21)	-	-	23 (44.23)	17 (32.69)	10 (19.23)	2 (3.84)	-
Cheese	-	-	22 (28.21)	48 (61.54)	8 (10.26)	-	-	18 (34.62)	24 (46.15)	10 (19.23)
<i>Animal Foods</i>										
Egg	4 (5.13)	15 (19.23)	22 (28.21)	20 (25.64)	17 (21.79)	2 (3.85)	16 (30.77)	10 (19.23)	4 (7.69)	20 (38.46)
Chicken	-	-	-	57 (73.08)	21 (26.92)	-	-	14 (26.92)	17 (32.69)	21 (40.38)

Table 3: Contd.....

Food stuffs	Frequency of consumption									
	Male					Female				
	Daily	Alternately	Weekly	Regularly	Rarely	Daily	Alternately	Weekly	Regularly	Rarely
Fish	-	-	18	24	36	-	-	4	24	21
	-	-	(23.08)	(30.77)	(46.15)	-	-	(7.69)	(46.15)	(40.38)
<i>Nuts and Beverages</i>										
Cashewnuts	-	-	-	-	78	-	-	-	-	52
	-	-	-	-	(100.00)	-	-	-	-	(100.00)
Almonds	12	4	18	15	29	6	2	7	14	23
	(15.38)	(5.13)	(23.08)	(19.23)	(37.18)	(11.54)	(3.85)	(13.46)	(26.92)	(44.23)
Tea	78	-	-	-	-	52	-	-	-	-
	(100.00)	-	-	-	-	(100.00)	-	-	-	-
Coffee	2	1	12	25	38	-	8	4	12	28
	(2.56)	(1.28)	(15.38)	(32.05)	(48.72)	-	(15.38)	(7.69)	(23.08)	(53.85)
Cold drink	-	12	20	17	29	-	4	8	25	15
	-	(15.38)	(25.64)	(21.79)	(37.18)	-	(7.69)	(15.38)	(48.08)	(28.85)

Figures in parentheses indicate percentages

cause of stone formation in them as less water consumption increases crystallization, which leads to kidney stone formation. Majority (77.69 per cent) of kidney stone patients were using groundwater from hand pump which may be attributed as another reason for stone formation. Food preferences in terms of overall frequency of consumption of special foodstuffs revealed that frequency varied from weekly to rarely for most of the foodstuffs from various selected categories. Tea, coffee, milk products and green leafy vegetables were most consumed by the patients which may be a cause of stone formation in them.

RECOMENDATIONS

A better understanding of the relationship between the diet and the risk of urinary tract calculus formation can provide simple and more cost effective measure of prevention of stones in kidney stone patients. If proper counseling and guidance is provided to such patients at the right time regarding dietary management depending upon the stage of the disease and condition of the patient, it can prove to be helpful in preventing further complications due to kidney stones, including its recurrence in the long run. Kidney stone patients should follow these guidelines as stated below:

- Drink plenty of fluids (2-2.5 lit per day) such as coconut water, corn silk tea, barley water and pineapple juice to prevent stone formation.

- Take banana, carrots, bitter guard and horse gram as they are rich in stone inhibitors.
- Take more citrus fruits such as, lemon, orange and *kinnnow* to dissolve stones.
- Avoid foods rich in oxalates such as spinach, *amaranth*, tomato, *amla*, *sapota*, cashew nuts and cucumber.
- Avoid excessive use of animal foods such as chicken, egg, fish and meat to prevent uric acid stone formation.
- Restrict cauliflower, brinjal and pumpkin in diet as they form uric acid stones.

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Appendix 1: Questions used to collect information for present study

<i>Questions</i>	<i>Responses (Yes/No)</i>
<i>Eating Habits</i>	
Are you vegetarian	
Non-vegetarian	
Eggetarian	
<i>Your Preference About Salt Consumption in Meals</i>	
More salted	
Moderate	
Low	
<i>How Much Water You Drink Every Day</i>	
2 glasses	
4 glasses	
6 glasses	
8 glasses	
<i>Frequency of Consumption(List of Common Food Items)</i>	
Cereal products and pulses	Daily Alternatively Weekly Regularly Rarely
Vegetables	
Fruits	
Milk and milk product	
Animal foods	
Nuts and beverages	