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Knowledge, awareness and dietary practice on urolithiasis among general population in Kuantan, Pahang, Malaysia: Preliminary findings

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Abstract

Background: To date, no studies have been published at evaluating the level of knowledge, awareness and practice of dietary, particularly regarding to urolithiasis in patients or the general population. This study aims to provide basic information on the level of knowledge, awareness and dietary practice among general population in Kuantan, Pahang.

Design and Methods: The respondents (n=30) were conveniently recruited within 10 kilometers radius of Kuantan city. The data were obtained using semi-guided administered questionnaires, which consists of four parts: socio-demographic data, lifestyle and clinical history (Part A); attitude and awareness on dietary practice regarding urolithiasis (Part B); food frequency questionnaire on urolithiasis (Part C) and level of knowledge on urolithiasis (Part D).

Results: Majority of the respondents were women (70%), Malay (83.3%), mean age of 33.97 (± 9.27), married (63.3%), completed higher education level (60%), working with government sector (33.3%) and have fixed monthly income (53.3%). Some of them had hypertension (n=4), diabetes (n=1), gout (n=1) and intestinal problem (n=1). Majority (80%) claimed having no family history of urolithiasis, consumed alcohol (10%), exercise with average frequency 2-3 times/week (46.7%) and heard about urolithiasis from healthcare worker (46.7%). The respondents' awareness about urolithiasis is considered to be good [81.23 (± 9.98)] but having poor knowledge score [2.70 (± 1.149)]. Majority preferred whole meal bread, white rice, chicken meat, mackerel fish, chicken

egg, apple, carrot, mustard leave and fresh milk in daily intake. Lesser plain water intake than standard requirement was noticed among respondents. Seasoning powder was commonly used for seasoning.

Conclusions: Generally, the general population of Kuantan, Pahang was aware of urolithiasis disease but needed more information on dietary aspect in terms of knowledge and food choice.

Introduction

Urolithiasis is a terminology referring to a calculi or stones that are form in the urinary tract. It involves the formation of calcifications in the urinary system, usually in the kidneys or ureters, but may also affect the bladder or urethra. The global prevalence, incidence and composition of calculi varies and have changed in the last several decades. The prevalence is between 7% and 13% in North America, between 5% and 9% in Europe and between 1% and 19% in Asia.¹ Furthermore, it is commonly discovered in the upper urinary tract, especially in the kidney and ureter. However, the prevalence and incidence have changed in different countries or regions over the years due to variations in socio-economic status and geographic locations.¹⁻⁴ The incidence attained its peak in population over the age of 30 and commonly reported among males.^{1,5,6}

There are several risk factors associated with urolithiasis, which includes genetic, age, gender, body mass index (BMI), weight, water intake, medical morbidities, occupation, hot climate

Significance for public health

The result of this study provided fundamental findings on the level of knowledge, attitude and dietary practice (KAP) among the general population in Malaysia, particular in Kuantan, Pahang. Based on the literature reviews, most of the results focused on the epidemiological findings on the occurrence of urolithiasis. There were limited findings on KAP conducted locally, among the general population, patients alongside the healthcare professionals. Therefore, the self-developed instrument used in the current study has a future potential to be duplicated and utilized in the previously mentioned population.

and dietary intake.²⁻¹³ Although genetic plays important role in the development of urolithiasis, nevertheless, dietary and lifestyle pattern is believed to have strong association with its occurrence.⁹⁻¹³ Based on findings from previous studies, a recurrent episode may occur within five years after the first onset, especially among population at hot climate regions. Several studies on knowledge, awareness and practice (KAP) have been conducted globally to evaluate the knowledge on the signs, symptoms, risk factors, awareness and diagnostic screening or medical management and practice to adopt healthy lifestyle or adhering with standard guidelines among varies population including patients, general public and healthcare professionals. However, the findings vary from moderate to poor KAP even among the healthcare professionals.¹⁴⁻¹⁶ Most previous researchers highlighted that there is a need to conduct a research particularly on creating awareness about urolithiasis.

Previous studies on KAP highlighted some misconceptions and the need for further education on urolithiasis. In a study conducted in the general population of Saudi Arabia, it was reported that nearly half of the respondents were aware of urolithiasis symptoms, risk factors, and the role of diet in the treatment.¹⁷ Another study claimed that most of their respondents had some knowledge regarding the symptoms but lack of preventive meas-

ures. However, there is no concern about how their dietary habits will contribute to the incidence of urolithiasis.⁶ In contrast, in another study it was mentioned that people experiencing an episode based on their calculations were better informed about certain aspects, in particular by recognizing the risk factors, sign and symptoms that cause urolithiasis.¹⁸ These contradicted findings warrant further exploration on the KAP related to urolithiasis particularly in Malaysia local context.

Several factors, including socio-demographic characteristics and geographical location, can affect the detection of symptoms, risk factors, complications and awareness to seek for medical treatment.¹⁹ Therefore, this study will examine the KAP regarding urolithiasis among general population in Kuantan, Pahang, Malaysia. Hopefully the results of this study will demonstrate the need for an ongoing urolithiasis education and awareness program, as recommended by a previous researcher.²⁰

Design and Methods

The current study was a cross-sectional survey. The source was a general population from Kuantan City, Pahang, Malaysia and visited Taman Bandar, Kuantan between January and February

Table 1. Socio-demographic data of pilot study (n=30).

Variables	Frequency (n)	Percentage (%)	Mean (SD)
Age			33.97 (\pm 9.23)
BMI (kg/m ²)			25.38 (\pm 6.53)
Gender	Male	9	30.0
	Female	21	70.0
Race	Malay	25	83.3
	Chinese	1	3.3
	Indian	2	6.7
	Others	2	6.7
Educational level	Primary school	0	0
	Secondary school	1	3.3
	STPM/STAM/Diploma	11	36.7
	Degree or higher	18	60.0
	Others	0	0
Occupational	Government	10	33.3
	Private	9	30.0
	Self-employed	2	6.7
	Fulltime housewife	3	10.0
	Housewife and work from home	1	3.3
	Unemployed	5	16.7
Income per month	No income	8	26.7
	Unfixed income	6	20.0
	Fixed income	16	53.3
Monthly income (RM)	No income	8	26.7
	Less than RM500	0	0
	RM500-RM999	1	3.3
	RM1000-RM1999	4	13.3
	RM2000-RM2999	2	6.7
	RM3000-RM3999	1	3.3
	RM4000-RM4999	4	13.3
	RM5000-RM10000	8	26.7
	RM10000 and above	2	6.7
Marital status	Married	19	63.3
	Widow	1	3.3
	Single	10	33.3
	Others	0	0

STPM, Sijil Tinggi Pelajaran Malaysia (Malaysian Higher Certificate of Education); STAM, Sijil Tinggi Agama Malaysia (Higher Certificate in Religion); RM, Malaysian Ringgit.

2020. The respondents selected were between 18 and 60 years old, live in Kuantan, Pahang between 10 km radius from Kuantan city and able to answer the questions in English or Malay. The sample size for the actual study was calculated using double proportion of 216 respondents. However, for the purpose of preliminary findings, about 30 respondents were recruited, which was an acceptable rate. The respondents were selected conveniently using non-probability method, and data were obtained using semi-guided administered questionnaires.

There are four parts in the questionnaires. Part A was an open-ended question on socio-demographic, lifestyle and clinical history. Part B was an extreme end 10-point Likert scale on attitude and awareness on dietary practice regarding urolithiasis (0 referred to strongly disagree and 10 referred to strongly agree). The items measured were awareness on urolithiasis from various aspects including recognizing signs and symptoms, increasing fluid intake, information searching, early screening and dietary measures. Later the total score was classified into low (0-39), moderate (40-79) and high (80-100). Part C consists of 12 food groups in food frequency questionnaire on urolithiasis measured in a day, week or month. Finally, Part D includes six multiple choice questions to measure the level of knowledge on urolithiasis. The elements include location of stone formation, risk factors, sign and symptoms, precipitating and preventive measures. Each correct answer was grade with 1 mark, while wrong answer was grade with 0 mark.

The elements in the questionnaire were developed based on the authors' expertise, previous literature reviews and pre-test experience among 15 patients with urolithiasis. The questionnaire was

compiled in both Malay and English version. The translations were examined thoroughly for several times to ensure correct words and proper meaning. The back-to-back translation was performed by four students from nursing course. The two versions were harmonized and compared by three academic nursing experts to determine the presence of obvious differences and to ensure that the items were appropriate for the general population.

The instrument was later subjected to some validation and reliability tests. The content and visual validity was carried out by three multidisciplinary experts in urolithiasis (urologist, dietician and nutritionist). The content validation index (CVI) was calculated using a dichotomous response scale of "clear = 1" and "not clear = 0". The domains of validation were (a) item consistency, (b) item wording clarity, (c) perceived item difficulty and (d) whether (and why) they thought the item should be included in a revised version of the test. The experts took two to four weeks to validate the instruments. The reliability value was checked using Cronbach's alpha for internal consistency.

Prior to the collection of data, the respondents were given detailed explanations on the objective of the study and a signed consent form was obtained. Furthermore, the respondents were given questionnaires and adequate time was allocated to answer it. Researcher was present in order to assist the respondents with unclear questions when filling out the questionnaires. The data obtained were analysed using SPSS 25.0 descriptively. The frequency and percentage were used for categorical data, while mean with standard deviation or median with interquartile range were used for numerical data.

Table 2. Lifestyle and clinical histories of respondents (n=30).

Variables	Frequency (n)		Percentage (%)		
	Yes	No	Yes	No	
Clinical history	Hyperparathyroidism	0	30	0	100.0
	Hypertension	4	26	13.3	86.7
	Diabetes	1	29	3.3	96.7
	Gout	1	29	3.3	96.7
	Chronic kidney disease	0	30	0	100.0
	Intestine-related disease	1	29	3.3	96.7
	Others disease	3	27	10.0	90.0
Family history of urolithiasis	Yes	6	20.0		
	No	24	80.0		
Alcoholic consuming	Yes	3	10.0		
	No	27	90.0		
Exercise	Yes	19	63.3		
	No	11	36.7		
Exercise frequency (week)	Never	11	36.7		
	2-3 times	14	46.7		
	3-5 times	5	16.7		
Have you ever heard of urolithiasis?	Yes	30	100		
Sources of information	No	0	0		
	Healthcare worker	Yes	14	46.7	
Friends/relatives	No	16	53.3		
	Yes	10	33.3		
Patients with urolithiasis	No	20	66.7		
	Yes	5	16.7		
Books/magazines	No	25	83.3		
	Yes	1	3.3		
Television/radio	No	29	96.7		
	Yes	9	30.0		
Have you ever heard of any information on preventive measures of urolithiasis?	No	21	70.0		
	Yes	19	63.3		
	No	11	36.7		

Results and discussions

The content validity index (CVI) was calculated and average score of 78% was obtained from three experts considered as an acceptable range. However, some researcher suggested that revision can be performed to improve the research instrument.²¹ Meanwhile, the reliability obtained was $r^2 = 0.841$ which shows that the instrument has good reliability range.²²

Table 1 shows the characteristics of the respondents that participated in this study. Most of the respondents were women (70%), Malay (83.3%), mean age of 33.97 (± 9.27), married (63.3%), completed higher education level (60%), working with government sector (33.3%) and have fixed monthly income (53.3%) with average salary from RM5,000 to RM10,000 (26.7%). Table 2 highlights the lifestyle and clinical histories of the respondents. Some had hypertension (n=4), diabetes (n=1), gout (n=1) and intestinal problem (n=1). Majority (80%) had no family history of urolithiasis, consumed alcohol (10%), exercise with average frequency 2 to 3 times/week (46.7%) and heard about urolithiasis from healthcare worker (46.7%).

Awareness domain on urolithiasis

The total score of awareness domain related to urolithiasis was 100. The highest score obtained by the respondents was 100, while the lowest score was 50. The score of 25th percentile was 77, 50th percentile was 80.5 and 75th percentile was 87.23. Overall, the mean score obtained from the respondents in the current pilot study was 81.23 (± 9.98). Therefore, it can be concluded that the respondents have a good awareness on urolithiasis.

Practice domain on dietary intake associated with urolithiasis

The results in Tables 3 and 4 explain the food selection in 12 food groups that are regularly consumed by the respondents on a daily, weekly or monthly basis. Overall, it can be concluded that most of the respondents consume whole grains, white meat product, vegetables and fruits as recommended for dietary intake. However, the respondents practice inadequate water intake as required daily and the used of seasoning powder in daily cooking.

Based on Tables 3 and 4, dietary intakes and portions of respondents were as follows. *Bread/grains*: Whole meal bread was preferred to white bread daily. Maximum intake was seven times per day with a mean of 0.37 (± 1.33) and the range of portion up to 11 pieces. *Rice*: White rice was usually consumed compared to brown rice or parboiled rice in daily. The frequency range was between zero to three times per day with a mean of 1.33 (± 1.03) and the range portion of about 11 cups. *Beef/beef products*: Chicken meat was more often eaten compared to other meat product. The frequency is measured as maximum of five times daily with a mean 0.70 (± 1.21) and the range portion between one to three pieces. *Fish and seafood*: Mackerel and anchovies was usually consumed for at least once a day with a mean 0.10 (± 0.40) for mackerel and 0.07 (± 0.25) for anchovies. The portion taken are two wholes for mackerel and two tablespoons for anchovies. *Eggs*: Chicken egg was usually consumed at least one whole maximum for five times daily with mean 0.37 (± 1.07). *Nuts*: Sunflower seeds was more preferable compared to beans and 'tempeh'. It was consumed at least one tablespoon for two times daily with mean 0.07 (± 0.37). *Fruit and juices*: Apple usually consumed compared orange and watermelon in a day. The frequency of consumption was one time per day with a mean of 1.33 (± 1.03) and the range portion was one to two wholes. *Vegetables*: Carrot was consumed at least about four tablespoon maximum for three times daily with

a mean of 0.30 (± 0.70). *Milk and dairy products*: Fresh milk was more often consumed at about two cups for one time daily with a mean of 0.13 (± 0.35). *Drinks*: Plain water was consumed for eight cups for at least 10 times daily with a mean of 5.90 (± 2.55). *Others*: Seasoning powder (MSG) was used in cooking maximum three teaspoon for three times daily with a mean of 0.20 (± 0.66). *Food and drinks for non-Muslim*: One slice smoked pork and one matchbox grilled pork was usually consumed for at least once per week with a mean 0.03 (± 0.18). They were also taking alcoholic drinks one cup once in week with mean 0.07 (± 0.25).

Knowledge of respondents on urolithiasis

The total score for the knowledge domain was 6. The score at 25th percentile was 2.0, 50th percentile was 3.0 and 75th percentile was 3.25. The highest score obtained by the respondents was five while the lowest score was one. The mean score obtained by the respondents in the current pilot study was 2.70 (± 1.149), below the 50th percentile, and it turned out that the data was distributed normally. Therefore, it can be concluded that the respondents' knowledge on urolithiasis was poor.

This study was conducted among the general population of Kuantan city, Pahang, one of the states in East Coast Malaysia. Majority of the respondents in the current study were Malay, female, mean age of 33.97 (± 9.27), married and had completed degree or higher education level. Since this was only a preliminary determination of the Malaysian context, a direct comparison with other previous studies due to different geographic locations should be interpreted with caution. Almost similar pattern was reported in previous studies performed in Albaha, Al-Riyadh, Al-Hassa and Jeddah cities of Saudi Arabia regarding awareness and role of diet in renal stones formation.^{17,18,23} Most of their respondents were females, age between 26 to 49 years, married and had high education too.^{17,18,23}

In terms of lifestyle and clinical histories, most of the general population was considered to be healthy. Only few had hypertension, diabetes, gout and intestinal problem. Majority state that they have no family history of urolithiasis, that they consume alcohol (10%) and that they exercise regularly 2-3 times a week. The mean body mass index (BMI) of the general population was 25.38 (± 1.19), with 63.6 % as normal, 16.6% overweight and 19.8% obese. The pattern of BMI among the population is in control compared with the study performed in Jeddah, Saudi Arabia.²³ The BMI reported among the general population in Jeddah, Saudi Arabia were 6% underweight, 39.5% normal weight, 32.9% overweight, 14.5% obese, and 7.1% were morbidly obese from the total Jeddah population.²³ An increased BMI apart of other risk factors such as age, gender, genetic factor, medical morbidities, water intake, dietary intake and living in hot climate regions may predispose one's to urolithiasis.⁵⁻⁹ Therefore, there is a need for an optimum BMI control, especially among those within overweight and obesity categories in reducing the occurrence of urolithiasis.

Majority of the general population have heard about urolithiasis from the healthcare worker (46.7%) and reported having received information regarding preventive measure of the diseases. In contrast, contradicted findings was reported among the general population in Al-Riyadh and Al-Hassa cities of Saudi Arabia whereby 89.9% claimed that they had never received any awareness campaign on stones disease.¹⁸ Besides that, 35.3% of the general population in Albaha City, Saudi Arabia reported that although they had received previous information on urolithiasis yet it was inadequate to change their dietary pattern.¹⁷ Therefore, regular and continuous dissemination of information, especially by the healthcare worker is needed for primary and secondary prevention of urolithiasis.

Table 3. List of food associated with urolithiasis based on frequency of intake (n=30)

Types of food	Number of respondents taken (n=30)		
	Daily	Weekly	Monthly
Bread/grains			
White bread	4	15	7
Whole meal bread	4	8	4
Rice			
Brown rice	1	1	1
White rice	21	9	-
Parboiled rice (<i>e.g.</i> , Basmati)	2	-	1
Beef/beef products			
Meat	-	13	9
Buffalo meat	-	1	1
Beef	-	3	5
Mutton	-	1	-
Chicken meat	11	18	-
Duck meat	-	1	-
Internal organs (<i>e.g.</i> , heart, liver, spleen, kidney)	1	1	10
Fish and seafood			
Mackerel	2	17	3
Fish ball	1	4	4
<i>Ikan parang</i>	1	3	2
Sardine	1	4	12
Tuna	1	1	2
Anchovies	2	9	5
Shells (<i>e.g.</i> , cockle, oyster, kupang)	1	1	5
Squid	-	10	9
Crab	2	2	7
Prawn	2	10	7
Salted fish	1	5	6
Egg			
Chicken egg	5	17	5
Duck egg	-	1	3
Quail egg	-	-	5
Nuts			
<i>Tempeh</i>	-	6	8
<i>Tau-hoo</i>	-	3	4
Beans	-	1	7
Sunflower seeds	1	2	3
<i>Kacang kuda</i>	1	1	1
Fruits/juices			
Lemon	1	4	6
Orange	1	8	10
Mango	1	5	10
Pineapple	1	4	7
Starfruit	1	1	1
Pear	1	2	3
Grapes	2	4	9
Watermelon	2	6	11
Apple	3	6	12
<i>Longan</i>	1	-	2
Durian	-	2	5
Banana	1	10	8
Vegetables			
Cabbage	7	9	3
Tomato	5	10	3
Cucumber	6	12	2
Broccoli	5	7	5
Pumpkin	2	5	5
Spinach	5	10	3
Carrot	6	8	4
Cauliflower	5	10	3
Potato	2	12	9
Green peas	1	4	4
Mushroom	2	6	6
Salad/ <i>ulam</i>	4	11	5
Sweet potato	1	3	5
Yam	1	-	1
Eggplant	1	2	8
Mustard leaves	6	14	6

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The mean score obtained from the general population of Kuantan city, Pahang was 81.23 (± 9.98) which can be considered as having good awareness on urolithiasis compared to the study conducted in Jeddah, Saudi Arabia. Low level of awareness was observed among general population in Jeddah with a mean score of 37.7%; 64.1% of the population were in the low awareness level, 35.3% were in the medium level, and only 0.6% were in the high level of awareness.²³ However, some of the general population in Albaha city, Saudi Arabia were actually aware that extra effort (53.3%) was required in prevention of urolithiasis.¹⁷ Interestingly, although the awareness level among general population in Kuantan city, Pahang was considered good yet the knowledge score was classified as poor. The total mean score obtained was 2.70 (± 1.15) which was below the 50th percentile score. The finding was almost similar with the study conducted in Albaha City, Saudi Arabia whereby some misconceptions appeared, especially on the risk factors despite most respondents had higher educational level.¹⁷

In terms of nutritional practices, most of the population of Kuantan City in Pahang, with the exception of a few food groups, practiced a balanced diet on a daily basis. In addition, seafood such as anchovy, which is usually consumed daily, can be a cause of uric acid buildup in the urinary tract.²⁴ Excessive consumption of chicken egg (up to five/day) among certain participant was noticed, which can lead to urolithiasis due to the high protein intake. Furthermore, a lower regular water intake (maximum 8 cups) was less than the recommended daily intake for the prevention of urolithiasis. Reduction of fluid intake of less than 2L/day

can cause urine to be concentrated and stone formation.^{7,10,25} Similarly, the used of seasoning powder in cooking can increase the level of sodium intake daily, which cause frequent urination, dehydration, fluid loss and urine supersaturation.²⁵

Based on the findings above, it is important to reduce the incidence of urolithiasis by educating the general public, especially the patients. Frequent reoccurring episode of urolithiasis can lead to the development of chronic kidney disease (CKD). The Malaysian Ministry of Health (2011) mentioned that the number of patients with CKD is increasing, and this is predicted to continue.²⁶ Almost 5,000 new patients are diagnosed with kidney failure every year, and therefore, the number of Malaysians dependent on dialysis was predicted to increase to more than 30,000 by the end of 2015.²⁶⁻²⁸ Thus, academicians, and clinicians must play a role in advising, educating, and empowering self-care management of the general population or patients, as recommended by the health authority to treat urolithiasis at earlier stage.

The strength of this study highlighted in such a way that it provides vital implications for health education on urolithiasis in Malaysia because the awareness and knowledge levels of the general population was limited. This is a common issue in other nations as well as mentioned in the previous discussion. In contrast, some limitations were encountered, such as lack of generalizability, as it was only a preliminary finding conducted only in a single city, and a larger scale study is recommended for future examination.

Table 3. Continued from previous page.

Types of food	Number of respondents taken (n=30)		
	Daily	Weekly	Monthly
Milk/dairy products			
Fresh milk	4	14	5
Powdered milk	-	3	2
Cheese	1	7	5
Yogurt	-	3	6
Butter	3	4	3
Drinks			
Plain water	29	1	-
Tea	4	10	1
Coffee	7	9	3
Coco drinks	3	9	4
Cola drinks	-	1	8
Cordial drinks	-	5	6
Others (seasoning)			
<i>Belacan</i>	-	5	2
<i>Budu</i>	-	1	5
<i>Kicap</i>	1	4	1
Chili/tomato sauce	5	12	3
Oyster sauce	4	5	5
Seasoning powder / monosodium glutamate (MSG)	3	5	3
Food and drinks (for non-Muslim only)			
Smoked pork	-	1	2
Grilled pork	-	1	2
Luncheon meat	-	-	-
Pork meat	-	-	-
Alcoholic drink	-	2	1

Table 4. Frequency and portion taken based on the list of foods (n=30).

Types of food	Frequency taken, Mean (SD)			Portion taken (in range)
	Daily	Weekly	Monthly	
Bread/grains				
White bread	0.23 (± 0.69)	1.07 (±1.20)	0.57 (±1.31)	0 to 10 pieces
Whole meal bread	0.37 (±1.33)	0.63 (±1.33)	0.43 (±1.41)	0 to 11 pieces
Rice				
Brown rice	0.03 (±0.18)	0.03 (±0.18)	-	0 to 1 cup
White rice	1.33 (±1.03)	1.57 (±3.21)	-	0 to 11 cups
Parboiled rice (e.g. Basmati)	0.10 (±0.40)	-	0.03 (±1.83)	0 to 2 cups
Beef/beef products				
Meat	-	0.73 (±0.98)	0.47 (±0.86)	0 to 5 matchbox size
Buffalo meat	-	0.03 (±0.18)	0.03 (±0.18)	0 to 1 matchbox size
Beef	-	0.30 (±1.15)	0.23 (±0.57)	0 to 1 matchbox size
Mutton	-	0.07 (±0.37)	-	0 to 1 matchbox size
Chicken meat	0.70 (±1.21)	2.27 (±2.35)	-	0 to 3 pieces
Duck meat	-	0.07 (±0.37)	-	0 to 1 piece
Internal organs (e.g. heart, liver, spleen, kidney)	0.03 (±0.18)	0.03 (±0.18)	0.47 (±0.86)	0 to 3 matchbox size
Fish and seafood				
Mackerel	0.10 (±0.40)	1.30 (±1.42)	0.30 (±0.95)	0 to 2 wholes
Fish ball	0.03 (±0.18)	0.20 (±0.55)	0.27 (±0.79)	0 to 3 pieces
<i>Ikan parang</i>	0.03 (±0.18)	0.13 (±0.43)	0.07 (±0.25)	0 to 1 whole
Sardine	0.03 (±0.18)	0.17 (±0.46)	0.53 (±0.86)	0 to 2 wholes
Tuna	0.03 (±0.18)	0.07 (±0.37)	0.07 (±0.25)	0 to 1 tablespoon
Anchovies	0.07 (±0.25)	0.63 (±1.10)	0.37 (±1.07)	0 to 2 tablespoons
Shells (e.g. cockle, oyster, <i>kupang</i>)	0.07 (±0.37)	0.03 (±0.18)	0.20 (±0.48)	0 to 1 tablespoon
Squid	-	0.40 (±0.62)	0.33 (±0.55)	0 to 5 wholes
Crab	-	0.10 (±0.40)	0.30 (±0.60)	0 to 2 wholes
Prawn	0.10 (±0.40)	0.53 (±0.97)	0.30 (±0.65)	0 to 5 wholes
Salted fish	0.07 (±0.37)	0.23 (±0.57)	0.30 (±0.70)	0 to 3 wholes
Egg				
Chicken egg	0.37 (±1.07)	1.70 (±1.78)	1.33 (±5.18)	0 to 2 wholes
Duck egg	-	0.10 (±0.55)	0.13 (±0.43)	0 to 1 whole
Quail egg	-	-	0.23 (±0.57)	0 to 2 wholes

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Table 4. Continued from previous page.

Types of food	Frequency taken, Mean (SD)			Portion taken (in range)
	Daily	Weekly	Monthly	
Nuts				
<i>Tempeh</i>	-	0.33 (±0.76)	0.40 (±0.72)	0 to 2 slices
<i>Tau-hoo</i>	-	0.17 (±0.53)	0.17 (±0.46)	0 to 2 slices
Beans	-	0.03 (±0.18)	0.40 (±0.86)	1 to 10 tablespoons
Sunflower seeds	0.07 (±0.37)	0.13 (±0.51)	0.10 (±0.31)	0 to 1 tablespoon
<i>Kacang kuda</i>	0.07 (±0.37)	0.03 (±0.18)	0.03 (±0.18)	0 to 3 tablespoons
Fruits/juices				
Lemon	0.03 (±0.18)	0.33 (±0.92)	0.90 (±2.85)	0 to 1 slice
Orange	0.03 (±0.18)	0.03 (±0.18)	0.60 (±1.07)	1 to 3 wholes
Mango	0.03 (±0.18)	0.27 (±0.69)	0.50 (±0.82)	0 to 3 wholes
Pineapple	0.03 (±0.18)	0.27 (±0.79)	0.30 (±0.65)	0 to 3 slices
Starfruit	0.03 (±0.18)	0.10 (±0.55)	0.03 (±0.18)	1 to 3 wholes
Pear	0.03 (±0.18)	0.20 (±0.76)	0.13 (±0.43)	0 to 3 wholes
Grapes	0.10 (±0.40)	0.23 (±0.68)	0.43 (±0.77)	0 to 10 wholes
Watermelon	0.07 (±0.25)	0.40 (±0.86)	0.93 (±1.51)	1 to 3 slices
Apple	0.13 (±0.43)	0.37 (±0.89)	0.60 (±0.86)	1 to 2 wholes
<i>Longan</i>	0.03 (±0.18)	-	0.10 (±0.40)	0 to 1 whole
Durian	-	0.10 (±0.40)	0.20 (±0.48)	0 to 3 pieces
Banana	0.03 (±0.18)	0.77 (±1.17)	0.80 (±2.04)	0 to 2 wholes
Vegetables				
Cabbage	0.33 (±0.71)	0.73 (±1.23)	0.63 (±2.76)	0 to 3 tablespoons
Tomato	0.30 (±0.79)	0.70 (±1.12)	0.17 (±0.53)	0 to 3 tablespoons
Cucumber	0.37 (±0.93)	0.93 (±1.44)	0.80 (±3.70)	0 to 5 tablespoons
Broccoli	0.23 (±0.63)	0.37 (±0.72)	0.87 (±3.67)	0 to 3 tablespoons
Pumpkin	0.13 (±0.57)	0.33 (±0.84)	0.27 (±0.64)	0 to 3 tablespoons
Spinach	0.40 (±1.10)	0.53 (±0.86)	0.20 (±0.76)	0 to 3 tablespoons
Carrot	0.30 (±0.70)	0.50 (±0.97)	1.00 (±3.74)	0 to 4 tablespoons
Cauliflower	0.23 (±6.27)	0.70 (±1.12)	0.77 (±3.66)	0 to 3 tablespoons
Potato	0.07 (±0.25)	0.70 (±1.06)	0.83 (±1.53)	0 to 3 tablespoons
Green peas	0.03 (±0.18)	0.23 (±0.63)	0.17 (±0.46)	0 to 3 tablespoons
Mushroom	0.07 (±0.25)	0.37 (±0.81)	0.33 (±0.76)	0 to 3 tablespoons
<i>Salad/ulam</i>	0.13 (±0.35)	0.77 (±1.17)	1.10 (±3.75)	0 to 3 tablespoons
Sweet potato	0.03 (±0.18)	0.17 (±0.53)	0.27 (±0.69)	0 to 3 tablespoons
Yam	0.03 (±0.18)	-	0.07 (±0.37)	0 to 3 tablespoons
Eggplant	0.07 (±0.37)	0.07 (±0.25)	0.43 (±0.77)	0 to 3 tablespoons
Mustard leaves	0.27 (±0.64)	1.20 (±1.67)	0.70 (±1.78)	0 to 3 tablespoons

Continued on next page.

Table 4. Continued from previous page.

Types of food	Frequency taken, Mean (SD)			Portion taken (in range)
	Daily	Weekly	Monthly	
Milk/dairy products				
Fresh milk	0.13 (±0.35)	1.10 (±1.63)	0.63 (±1.73)	0 to 2 cups
Powdered milk	-	0.30 (±1.06)	0.17 (±0.65)	0 to 3 tablespoons
Cheese	0.03 (±0.18)	0.43 (±0.90)	0.27 (±0.64)	0 to 6 slices
Yogurt	-	0.23 (±0.77)	0.30 (±0.70)	0 to 1 cup
Butter	0.13 (±0.43)	0.23 (±0.68)	0.30 (±1.06)	0 to 1 tablespoon
Drinks				
Plain water	5.90 (±2.55)	0.17 (±0.91)	-	0 to 8 cups
Tea	0.13 (±0.35)	0.77 (±1.28)	0.07 (±0.37)	0 to 2 cups
Coffee	0.37 (±0.96)	0.73 (±1.44)	0.20 (±0.66)	0 to 2 cups
Coco drinks	0.10 (±0.31)	0.83 (±1.46)	0.23 (±0.68)	0 to 3 cups
Cola drinks	-	0.07 (±0.37)	0.43 (±0.94)	0 to 1 cup
Cordial drinks	-	0.27 (±0.69)	0.43 (±1.17)	0 to 1 cup
Others				
<i>Belacan</i>	-	0.47 (±1.07)	0.10 (±0.40)	0 to 1 teaspoon
<i>Budu</i>	-	0.10 (±0.55)	0.17 (±0.38)	0 to 2 teaspoons
<i>Kicap</i>	0.17 (±0.46)	0.03 (±0.18)	0.13 (±0.73)	0 to 2 teaspoons
Chilli/tomato sauce	0.23 (±0.57)	1.33 (±1.79)	0.70 (±2.34)	0 to 3 teaspoons
Oyster sauce	0.20 (±0.55)	0.47 (±1.25)	0.57 (±1.65)	0 to 1 teaspoon
Seasoning powder / monosodium glutamate (MSG)	0.20 (±0.66)	0.57 (±1.36)	1.37 (±5.74)	0 to 3 teaspoons
Food and drinks (for non-Muslim only)				
Smoked pork	-	0.03 (±0.18)	0.07 (±0.25)	0 to 1 slice
Grilled pork	-	0.03 (±0.18)	0.07 (±0.25)	0 to 1 matchbox
Luncheon meat	-	-	-	None
Pork meat	-	-	-	None
Alcoholic drink	-	0.07 (±0.25)	0.03 (±0.18)	0 to 1 cup

Conclusions

This study provides basic information on the level of KAP of urolithiasis in the general population in Kuantan city of Pahang State, Malaysia. Although this study did not reflect the general population in Pahang, the findings only highlighted the importance of continuous health education and awareness program. This is to improve the general population understanding and knowledge on urolithiasis, especially on practicing good dietary intake. Further replications of this study with larger sample size should be performed to confirm the significance of the relationship between sociodemographic aspects, comorbidities, lifestyle pattern and dietary intake in the general population.

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