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Stone diet and dietary change: understanding determinants for dietary change behaviour in patients following urinary stones

Suhana Muhamad[1] | **Siti Noorkhairina Sowtali**[2] | **Siti Roshaidai Mohd Arifin**[3] | **Munjih Ab Rashid Islah**[4] | **Nor Azwani Mohd Shukri**[5]

[1]Department of Medical-Surgical Nursing, Kulliyyah of Nursing (KON), International Islamic University Malaysia, Kuantan, Malaysia

[2]Department of Professional Nursing Studies, Kulliyyah of Nursing, International Islamic University Malaysia, Kuantan, Malaysia

[3]Department of Special Care Nursing, Kulliyyah of Nursing, International Islamic University Malaysia, Kuantan, Malaysia

[4]Department of Surgery, Kulliyyah of Medicine, International Islamic University Malaysia, Kuantan, Malaysia

[5]Department of Nutrition Sciences, Kulliyyah of Allied Health Sciences, International Islamic University Malaysia, Kuantan, Malaysia

Correspondence

Suhana Muhamad, Department of Medical-Surgical Nursing, Kulliyyah of Nursing (KON), International Islamic University Malaysia, Bandar Indera Mahkota Campus, Pahang Darul Makmur, 25200 Kuantan, Malaysia.
Email: suhanamd@iium.edu.my

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Abstract

Background: Dietary habit is one of the most important methods to prevent and treat urinary stones. However, only limited evidence of the experiences of dietary management among urinary stone patients in Malaysia is available. This study aimed to explore participants' current dietary practices after the diagnosis of urinary stones and to identify the factors that facilitate their dietary changes.

Methods: A qualitative study with purposive sampling was conducted using face-to-face semistructured interviews. A total of 20 participants from a tertiary general hospital in Kuantan, Malaysia, were recruited in this study. Data were analysed using framework analysis.

Results: Two themes emerged from the analysis. The first theme explained the changes in the dietary practice of the participants postdiagnosis. The second theme revealed that the participants' dietary changes were greatly influenced by personal factors and external support from professionals, family and peers.

Conclusions: Urinary stone patients highlighted the fear of complications, self-determination and knowledge of nutrition as the main drivers of their dietary change postdiagnosis. Emphasising proper nutritional care by assessing and evaluating dietary self-management among patients can facilitate effective self-care in stone prevention management.

KEYWORDS

dietary changes, experience, qualitative study, self-dietary management, urinary stone disease

Key points

- Patients with urinary stones reported making dietary changes primarily involving increasing water intake and restricting certain food groups, mainly animal proteins.
- Low dietary knowledge and psychological burden related to fear of complications are strong motivators that lead to avoidance of certain dietary groups, such as shellfish and nuts, among patients with urinary stones.
- The study findings offer insights into myths and misconceptions about fluid and food choices for stone prevention, influencing patient engagement and dietary adherence.
- The study reveals that healthcare professionals are vital in facilitating dietary changes in urinary stone cases by providing diet guidance and support.

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INTRODUCTION

Unhealthy dietary habits play a crucial role in the increased risk of urinary stone disease. There is growing evidence demonstrating the association between dietary habits and stone-forming events, thus highlighting the importance of dietary therapy in preventing stone recurrence.[1,2] For instance, a diet high in fruits and vegetables and low in fat and dairy products coupled with an adequate intake of calcium offers a protective effect against a urinary stone event.[3,4] In addition, proper management of fluid intakes such as drinking more water and beverages like decaffeinated coffee, tea and alcohol can also decrease the risk of stone recurrence.[5]

Although previous studies have reported a huge success of dietary modification in preventing urinary stone disease, most of the patients with urinary stones are provided with only a general dietary recommendation. The recommendation is not customised for urinary stone patients due to a lack of information on stone composition and other urinary risk factors.[6] The success of dietary habits depends on the self-discipline of patients to comply with dietary recommendations. However, the dietary recommendation is often not the prioritised information conveyed by healthcare professionals (HCPs). Many patients remain confused and fail to adhere to dietary preventive management.[7] Compliance is closely related to the patient's motivation. Regular live coaching of one to six times per year to provide dietary advice may be able to maintain the patient's level of motivation, leading to positive outcomes of the intervention programme.[8] Long-term compliance can be achieved only if the patients are aware of the urgency and importance of dietary change. Therefore, patients need to be guided professionally for them to understand the importance of dietary change.

Despite the importance of dietary change, current research on patients' experiences and perspectives on making dietary changes across patients with urinary stones is still limited. Only a few qualitative studies are available on the facilitating factors for fluid management.[9–11] However, insights regarding patients' determinants to engage in dietary protective behaviour against urinary stones are still lacking. In Malaysia, urinary stone patients are advised by HCPs to increase fluid intake during hospitalisation and follow-up. However, the practice and adherence to dietary recommendations are not well understood. There is no local study that focuses on exploring urinary stone patients' experience with dietary and fluid adherence. Thus, this study aimed to explore urinary stone patients' experiences of self-dietary management by exploring their understanding and practice of dietary recommendations after diagnosis as well as to identify factors that have influenced their dietary changes.

MATERIALS AND METHODS

Study design and participants

A qualitative semistructured interview approach was undertaken to explore the dietary behaviours and factors that facilitate dietary change among urinary stone patients. The qualitative design was selected to elicit rich information and insights from patients' experiences.

Study participants

A purposive sampling design was adopted to recruit patients from the Urology Clinic in Hospital Tengku Ampuan Afzan (HTAA) in Kuantan, Malaysia, from December 2019 through December 2020. The prevalence of urinary stones increases with age, especially in adult population, reaching its peak in the 30–60 age group and declining thereafter.[12] Therefore, this study was conducted on adult population aged 18–60 years with radiological diagnosis of urinary stones, those who were actively receiving treatment and those who had attended follow-ups at the HTAA clinic for at least 1 year. Participants were recruited until data saturation was reached. Written informed consent was obtained from each participant before enrolment. They were reminded of their voluntary involvement and the possibility to withdraw at any time without repercussions. Pseudonyms were used to maintain anonymity and to ensure the confidentiality of study participants for data presentation.

Data collection

A semistructured interview guide was developed based on the information obtained from the literature review (Table 1). Probes and prompts were used to expand and confirm responses, and notes were taken to ensure all questions were answered by the participants. The first author (S.M.) carried out all interviews within 60 min in a confidential and comfortable environment, such as a room at the urology clinic or another place based on patients' preference, that is, a rest area near the urology clinic. A field note was used to reflect the entire process of each interview. All interviews were audio-recorded and transcribed verbatim by S.M. Data collection was discontinued when the theme became saturated during the last two interviews.

Data analysis

Data were analysed using the framework approach.[13] First, S.M. used open coding to independently code the first four transcripts. Then, an initial working codebook

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TABLE 1 Interview guide.

Number	Questions	Probe
1	Describe what is healthy eating for you?	What food/fluid did you consider as healthy or unhealthy?
		Tell me more about your daily eating habit.
2	How has your diet changed after being diagnosed with urinary stones?	Tell me more about your food or fluid abstinence.
		How long did it take for you to change your diet?
3	Could you share your experiences regarding specific foods or fluids in relation to the prevention of urinary stones?	Do you have any specific beliefs about food or fluids related to urinary stones?
		Do you notice any significant changes after changing your diet habits?
4	How do you maintain your dietary modifications?	What factors influence your dietary adherence?
5	How do people around you help you manage your diet?	What type of support did you get?
		Who gives you support?
6	Tell me about your experience receiving dietary advice.	Recall dietary recommendations from healthcare professionals and other sources, if any.

of themes that included a priori themes of interest and new themes that emerged from the transcripts was developed. Regular meetings with the research team were conducted to discuss the remaining transcripts, arrange the codes, develop subthemes and themes and discuss any discrepancies in coding. The analysis involved the systematic comparison of coded segments across interviews to identify convergent, salient and/or unique themes. Any disputes or ambiguities were resolved by discussion among the research team (S.R.M.A., S.N.S., I.M.A.R. and N.A.M.S.). NVivo software (version 12, QRS International) was used to manage the coding process. The term 'participant' is used throughout the results to illustrate the themes that were reflective of the participants' experiences.

Rigour

The rigour of the study was enhanced through four aspects of trustworthiness: credibility, dependability, transferability and conformability.[14] The principal investigator, S.M., was a nurse (a PhD candidate) and had hands-on experience treating patients with urinary stones. Other team members comprised various HCPs, offering a comprehensive perspective and curbing bias during data interpretation.[15] This diverse team included two nurses specialising in qualitative methodologies (S.R.M.A.) and nursing education (S.N.S.), a dietitian (N.A.M.S.) and a urologist (I.M.A.R.). None of them had previous interactions with the study participants or direct involvement in the research environment prior to the data collection phase. All participant interviews were conducted by the researcher (S.M.), whereas the rest of the team collectively participated in the data analysis process to ensure credibility. To ensure credibility, the researcher (S.M.) independently assessed transcripts and discussed with research members data triangulation and agreement on coding. The researcher (S.M.) also verified the preliminary findings with three participants (member checking). Dependability was achieved through regular discussion among research members to ensure the consistency of the findings. Transferability was enhanced by creating a rich description using the participants' words. Conformability was ensured by reflexivity where the researchers stayed neutral without incorporating their perspective of beliefs to reduce bias during data collection and analysis.

RESULTS

Distributions of participants

A total of 20 participants were interviewed. Then, additional information was obtained for each category or concept in the initial framework of data analysis. The age of participants ranged between 29 and 59 years. The majority of the participants ($n = 19$, 95.0%) were living with their spouse, children or spouse and children. The average year of urinary stone diagnosis was 4.5 years (range: 2–10 years). More than half of them ($n = 13$) had at least one comorbidity, with hypertension listed as the most prevalent comorbidity among the participants, followed by diabetes and gout. Table 2 summarises the participants' demographic and health characteristics.

Theme

Two themes emerged from the interview, namely the practice of dietary change (theme 1) and factors

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TABLE 2 Participants' demographic and health characteristics ($N = 20$).

Sociodemographic details	Frequency (*n*)	Percentage (%)
Gender		
Male	11	55
Female	9	45
Age (years)		
20–29	1	5
30–39	1	5
40–49	12	60
50–59	6	30
Highest level of education		
Degree or higher degree	3	15
Diploma	3	15
Secondary school	11	55
Primary school	2	10
No formal education	1	5
Marital status		
Single	1	5
Married	18	90
Widowed	1	5
Employment status		
Employed	15	75
Unemployed	5	25
Stone status		
First-time stone former	15	75
Recurrent stone former	5	25
Years of experience with stone (including stone recurrence)		
<5 years	11	55
5–10 years	9	45
Comorbidities		
Yes	13	65
No	7	35

influencing behavioural changes (theme 2). Further subthemes were developed for each theme. Figure 1 shows the themes and subthemes from the interview.

The practice of dietary change

In this study, participants reported changing their dietary habits shortly after being diagnosed with urinary stones or gradually after living with the condition for a period of time. For most participants, these immediate changes involve increasing water intake and limiting certain high-risk food (e.g., red meat) and fluid (e.g., caffeinated drinks). Participants perceived that these changes helped reduce disease symptoms and increase their overall health status. Participants interpreted the healthy dietary change as a change concerning their control over diet preparation techniques and consumptions, that is, the exclusion, inclusion or substitution of various types of foods and fluids.

The nature of dietary control

In describing the nature of dietary control, most of the participants were aware of the dietary recommendations to prevent urinary stone disease that they received from multiple sources. Their understanding of the dietary recommendations and beliefs was often reflected in their current dietary practice, which they perceived as healthier compared to their prediagnosis diet.

Restriction of diet

In addition, an ideal way of healthy eating postdiagnosis perceived by the participants was to restrict certain food and fluid that they viewed as causing an increased risk of stone formation. Participants described that their dietary change mainly included restricting their intake of seafood, red meat, nuts, beverages (caffeine and sweet drinks), certain vegetables (e.g., spinach) and sodium.

For example, after being diagnosed with urinary stones, one participant stopped consuming red meat and animal internal organs. In addition, another participant reported a total restriction of anchovies even though it was his favourite food. Several other participants strictly avoided legumes such as nuts as they claimed nuts might induce urinary stone symptoms, that is, pain.

> I have not eaten peanuts in years. I know I have stone and cannot eat peanuts. If I had *Satay*, means I only ate the *Satay*, not the peanut gravy. Like yesterday, there were peanuts in my *Nasi lemak*, I threw it [peanuts]. I had mixed beans ice and there were peanuts inside, I threw it [peanuts] … if you eat nuts, the stone will spread easily. (Rahim, PT12)

However, most participants struggled to change their dietary habits. Therefore, some chose to compromise by practising moderation in dietary intake and being aware of maintaining the necessary restriction. To them, moderation provided 'a moment of relief' whenever they craved restricted foods or fluid. Moderation involves the

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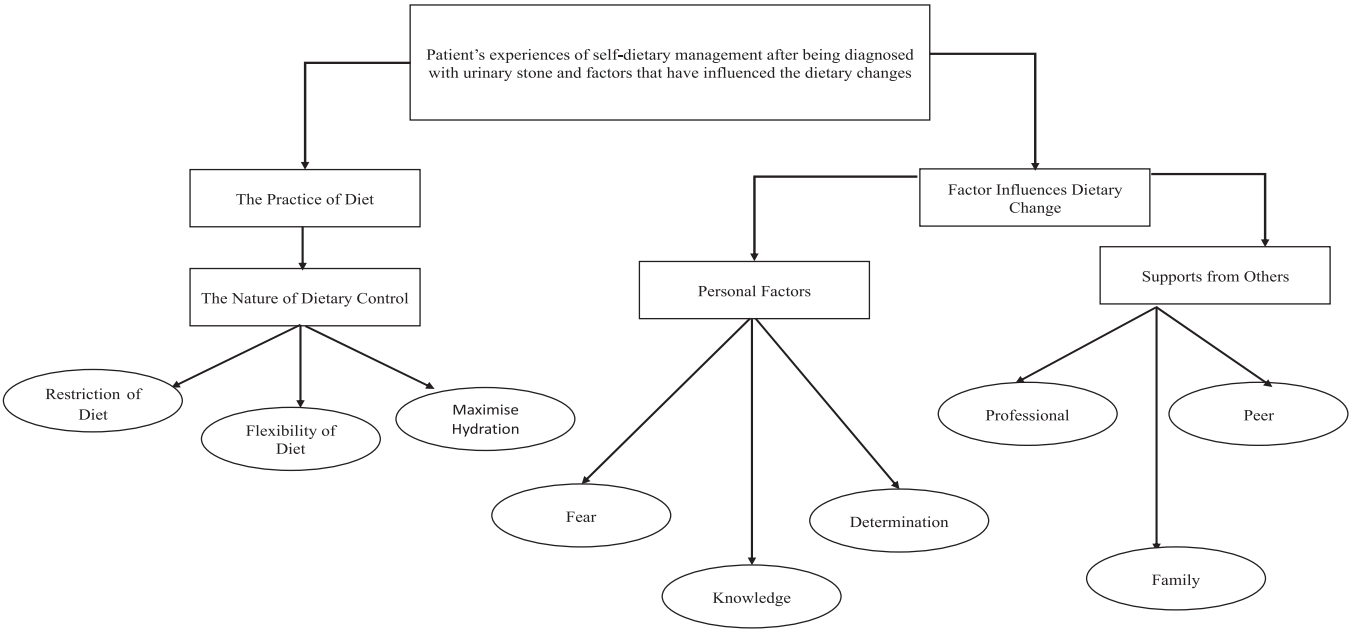

FIGURE 1 Themes.

practice of reducing the consumption frequency and portion of certain foods to a certain limit perceived as safe and healthy by them to protect against urinary stones.

> I like to eat squid and prawns … those are among my favourite food. I can finish a plate full of them. Now, I think I have reduced my seafood intake. I did reduce it (seafood). (Before the diagnosis), I had seafood 2–3 times a week, now only once a week and it is very rare. If I want to eat seafood, I will eat it but in small quantities. (Shamsul, PT6)

Apart from specific food restrictions, some participants also reduced the intake of certain fluids such as sweet-flavoured and caffeinated beverages. Among these types of beverages, carbonated drinks were avoided the most by the participants. In addition, several participants tried to reduce the intake of fatty food and junk foods, both of which were considered unhealthy diets in general.

Flexibility of diet

When the participants were asked whether they had taken anything to prevent the disease, most of them highlighted the intake of alternative foods. They seemed to have a limited understanding of specific dietary factors as they were more preoccupied with the idea of removing 'bad food' or 'bad fluid' from their diet. Most participants usually mentioned 'Now I eat less red meat and eat more chicken', 'I had more fish' or 'Now I only eat chicken'. The practice involved the substitution of food from the same food group, such as replacing high animal protein sources with low animal protein sources, which they perceived as safe for their condition.

> I still choose what to eat; if some food cannot be eaten like seafood, I don't eat it. I take food that can be eaten … chicken, fish [safe food]. (Aman, PT1)

In addition, the participants were flexible in making healthy changes in cooking methods. Postdiagnosis, some participants preferred to boil rather than fry their food. However, even though they did not fully associate the changes with urinary stones, they still avoided certain unhealthy foods such as fatty and oily foods.

> My eating pattern has really changed. Now I think it is healthier. Fried foods were reduced. Before [urinary stone diagnosis], I really like fried foods. Now, sometimes I boiled the food. … I just control it like that. I prepare my meals. If I'm eating outside, I try to find boiled foods as much as I can. (Nadiah, PT18)

Maximise hydration

Furthermore, the participants practised high fluid intake by drinking water, mineral water or tap water. Most participants described their fluid of choice by saying 'I prefer plain water', 'I just drink lots of warm water' and

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'No specific type, just drink lots of water'. Meanwhile, some participants specifically consumed mineral water because they perceived that certain mineral compositions in the water can reduce the risk of urinary stone formation. They believed that maintaining good hydration by increasing mineral water intake can control and alleviate disease symptoms such as pain from the urinary stone.

> I drink lots of plain water, especially mineral water. I felt better about my waist. No pain. So, it means that [mineral water] helps to reduce pain. Previously, I was always drinking soybean or carbonated drinks. Now, I reduce all of that. My urination becomes better. (Zamani, PT5)

Most participants were aware of the required daily intake of water volume. Therefore, they tried to stay hydrated by drinking at least six to eight glasses or more than 3 L of water per day. Many of them showed the water bottle that they always carried with them during the interviews. On the contrary, one participant (Salmi) mentioned that he regularly consumed orange and apple juices to prevent the recurrent formation of stones. Meanwhile, other participants did not have any idea about other types of fluids that are good for stone prevention.

Factors influencing behavioural change

In this study, two main subthemes emerged to explain the factors that triggered the participants' behavioural change in terms of their dietary habits, that is, personal factors and support from others.

Personal factors

Personal factors were identified through participants' perceptions and judgement that contributed to their dietary change after urinary stone diagnosis. Personal factors also reflected their knowledge of diet-related stone prevention, fear of complications and self-determination to attain health benefits.

Knowledge

A few participants seemed to be more knowledgeable about the role of certain dietary risks against the disease. They exhibited precautionary behaviour towards the intake of a diet high in uric acid, oxalate and cholesterol as they perceived it might precipitate stone formation.

> Restrict chocolate … but that is a difficult restriction to do because I really like chocolate. So, when I feel like eating [chocolate], I will eat but not much. … I also like to eat spinach, and long beans. But because they contain oxalate, I have to avoid it. When I feel like want to eat spinach, I will take it in a small amount. One or two small spoons just to taste it. (Hasbullah, PT11)

On the contrary, some participants exhibited poor knowledge and experience in exercising healthy dietary practices postdiagnosis. They reported that they had never received any dietary recommendations from HCPs during their treatment.

> Doctor don't talk about food abstinence. The doctor just asked me to drink lots of water. I don't get any advice on what foods to avoid. (Rohani, PT2)

Meanwhile, the participants' dietary knowledge was also influenced by myths and misconceptions surrounding the stone diet, especially in relation to seafood (e.g., shellfish), animal protein (e.g., red meat) and vegetables (e.g., creeper) that can induce renal colic.

> When you started to have this disease [urinary stone], people will tell you not to eat any creeper plants like beans. You will feel the pain. One more belief is not to take soybeans drink or soy-produced food. For anything related to beans, you have to abstain. I stopped drinking soybean even though it used to be my favourite drink. Give them [urinary stone patients] the same advice, do not eat and drink beans-related food and beverages. (Zamani, PT5)

Fear

The episodes of troublesome urination, deterioration of kidney function and development of other comorbidities were among the most commonly mentioned fears by the participants. In return, these fears have become positive stimuli for the participants to change their unhealthy dietary habits.

> Only this year I started to really control my diet. I'm afraid my kidney function will become worse. Like just now during lunch, I just had a small amount of chicken. I reduced chicken and fish intake because I'm afraid that my creatinine level will increase and my kidney functions will continue to

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> reduce. I want to reduce my creatinine. So, I reduce my protein intake … animal protein. I cannot afford [financially] to undergo surgery. (Nor, PT7)

The main contributor to the participants' fear was the feeling of pain. The participants portrayed the pain symptom as the most terrible situation, which created more fear among the participants for the possibility of recurrent pain.

> When the doctor said that I need to undergo a laser procedure, I felt traumatised. I was like … Again? My whole body feels trembling. I was so afraid. Because previously, my heart had stopped for a moment during the procedure maybe because I was in so much pain. I could not respond. I feel like my body became stiff. Actually, my body could not tolerate too much water, I would feel stuffy but still, I forced myself to drink [water] because I was afraid when thinking about the painful experience. (Maryam, PT10)

One-third of the participants avoided eating food and fluid such as nuts, yellow noodles, caffeinated beverages and sweetened flavoured drinks after experiencing pain. The fear of functional limitations such as difficulty urinating or physical pain was intense. They described the pain onset is immediately after the consumption of food or fluid.

> I am afraid to eat nuts because the effect [pain] is too obvious. The pain onset is so fast, almost right away after you [I] eat it, in less than 15 minutes. My body was shaking. It was so painful. (Zamani, PT5)

Self-determination

Besides, the participants' motivation to adopt healthy eating habits was driven by a desire to cure the urinary stone disease and be stone free so that they can improve their general health. Perceived illness burdens such as dealing with various comorbidities like gout, diabetes and hypertension, along with painful experiences, had triggered these dietary modifications among many participants. One participant explained:

> I have to control my diet because I also have gout. I can't eat nuts because it will cause pain in my leg due to gout. There are also a few food precautions for stone [disease]. I have to reduce my protein intake. … I don't eat meat. I eat chicken but I do not consume beef at all. Vegetables … I also stopped eating beansprouts because of gout. … Basically, I need to take care of my diet because urinary stones and gout are similar, both caused by high uric acid. Haa … if the food has [high] uric acid I will avoid it because it would not be good for both diseases. (Osman, PT8)

A healthy diet has generated positive experiences among many participants, making them feel good and healthy in general. They were also determined to continue with healthy eating habits based on the dietary recommendations in view of the benefits such as weight loss, alleviated physical symptoms, (reduced) pain and lower uric acid levels. Some also reported that they spontaneously passed out a stone and started to have clear urine.

> It's just as effective for both food and fluid control. … What's better is to drink a lot of water, because if you drink more water, it will improve your urination process. Take care of the food you eat to avoid severe and protracted pain. … But what I really like is to drink lots of water because I can pass urine smoothly and that means I have less pain and feel more comfortable. (Nadiah, PT18)

External support from others

The participants also described the important roles of HCPs, family and friends in influencing their action to implement dietary change after urinary stone diagnosis.

Professional guidance

Professional guidance is a common factor that influenced the participants' decision in making dietary changes postdiagnosis. For most of the participants, HCPs, especially doctors were viewed as the most credible sources of information that triggered changes in their dietary habits.

> I prefer information from doctors because they are more experienced and knowledgeable about this disease. I also refer to the internet but there are too many things. I understood well about the things [dietary advice] that the doctor told me. Clear [the advice]. When I tried to do what the doctor recommended, it works for me. (Norman, PT 15)

Several participants mentioned that the list of food given by doctors empowered their knowledge of the role of diet in preventing the development of stones.

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> My doctor gave me a food list about a purine diet, foods that are not good like red meat. That's really good because before this I don't know what is a purine. (Raihan, PT 19)

Family encouragement

Spouses were identified as important facilitators in supporting and assisting the dietary change in the participants. Female participants reported supportive gestures by their husbands, such as giving them reminders, helping them to verify the advice given by the HCP about dietary restrictions and assisting them in shopping for groceries. Meanwhile, male participants reported the active participation of their spouses in monitoring their dietary habits closely. Most of them reported that their wives also helped to prepare healthy meals, besides participating in similar diet regimes and monitoring their diet intake when eating outside.

> My wife prepared a healthy diet for us. Something like grilled chicken and salad. She has been doing it since I had this disease [stone]. I will eat whatever she cooks. (Osman, PT8)

Peers

Some participants mentioned that their peers provided good support that enabled them to make healthy dietary changes. Peers played a vital role in reminding them about the importance of dietary change, apart from respecting their dietary restrictions and sharing dietary tips to alleviate and control the disease symptoms. Meanwhile, some participants also change their dietary habits after receiving dietary advice from traditional healers (*Bomoh*/*shaman*).

> *Bomoh* told me to avoid eating nuts, chicken and red meat. He [*Bomoh*] is familiar with this disease [urinary stone] so he would know. Haa … I just follow *lah* [Bomoh's advice]. (Zamani, PT5)

DISCUSSION

This present study is crucial as the findings enhance our understanding of dietary change behaviour, and it also shed light on the participants' food decision-making against urinary stone symptoms. Our findings suggested that most participants made stone-specific dietary changes by reducing food that they perceived as a threat, such as seafood, animal meat, nuts, salty food, caffeine and sweet drinks. Other healthier dietary changes followed by the participants included an increased water intake and an improved quality of their current eating habits. The participants were committed to the dietary changes as they perceived the changes could facilitate them to control and alleviate symptoms such as pain. In general, the practice of lowering the intake of animal protein and sweet beverages as well as maximising hydration among some of the participants was in accordance with the recommendations from systematic reviews of interventional studies on diets that prevent urinary stones.[1,2]

However, some dietary modifications may have been potentially unsafe, as participants tended to impose strict limitations or attempt to eliminate certain types of foods or fluids from their diet to conform to the dietary recommendation. Participants in this study reported mainly restricting animal protein intake, with some totally avoiding or strictly limiting red meat and seafood. The recommended protein intake for adults is between 0.8 and 1.0 g/kg of normal body weight per day.[16,17] Existing evidence does not support the idea that total avoidance or excessive restriction of animal protein will reduce urinary stone risk, but high protein intake beyond recommendation increases urinary stone formation risk.[18] Therefore, extreme diet measures involving animal protein might not only be ineffective at preventing urinary stones but might also lead to unnecessary risks, such as nutritional deficiencies.[19] Nonetheless, protein intake limitations should be approached with caution, as the risk of urinary stones can vary based on the type of protein consumed.[20] An optimal diet for guarding against urinary stones may consist of low-animal-protein and high-plant-protein consumption,[20,21] combined with reduced sodium and sufficient calcium intake.[4] Complete abstinence from any diet risks is not advocated in current guidelines for urinary stone prevention.[17,22]

This study found that establishing dietary changes after urinary stone formation was challenging for patients. The factors that facilitate and hinder participants from making healthy changes to their diet to prevent urinary stones predominantly involve personal factors. These factors include dietary knowledge, fear and self-determination. Knowledge plays a crucial role in modifying patients' dietary habits. Without proper knowledge, it would be challenging for participants to make changes to their dietary habits.[23] Having dietary knowledge is a strong motivator for patients to make healthy dietary changes to protect themselves from urinary stone disease.[24] Adherence to dietary recommendations such as calcium and water intake was reported to be higher across stone patients with a good knowledge of dietary advice and vice versa.[25–28] In line with previous studies, all participants reported being well acquainted with the recommendation to increase water intake during treatment. They demonstrated understanding the role of

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high water intake in preventing urine supersaturation, leading to their positive fluid change behaviour.

In contrast, inadequate knowledge of the role of diet in the prevention of urinary stones is a significant barrier for patients to change their diet practice against urinary stones effectively.[9,10,29] In this study, the participants exhibited inadequate knowledge, especially related to nutrition and food as they were found to make unnecessary dietary restrictions such as eliminating or overly restricting protein sources from their current diet. Additionally, the findings revealed that participants' dietary knowledge was overshadowed by myths and misconceptions, particularly involving water and animal protein. Most participants reported a common misconception that water was the only fluid that could prevent stone recurrence effectively.[30] They believed that other beverages, such as tea and coffee, were harmful and should be avoided. Consequently, participants overemphasised water consumption while neglecting other fluid sources to maximise hydration in their current dietary practices. Participants' low educational level and health beliefs might also contribute to myths, leading to misconceptions about diet-related stone prevention. Interview revealed that participants' beliefs about the stone diet were influenced by old folktales or multigenerational knowledge sharing that was embedded within community health beliefs. These beliefs subsequently compromised participants' knowledge and made it more challenging for them to practise proper dietary recommendations.[31,32] Future studies to explore the knowledge and belief surrounding the stone diet are crucial to improve the understanding of patients' diet change–related decision-making. Good knowledge of food and fluid types may produce a healthy belief about the stone diet and positively influence dietary practice.[33]

The diagnosis of urinary stones often provokes a range of emotional responses among participants such as fear and stress due to colic pain episodes, repeated surgical intervention, frequent painful urination, stone recurrence and kidney impairment. Stone-related symptoms would increase the patients' emotional burden and subsequently induce stress[34] and anxiety even among asymptomatic urinary stone patients.[35] It is important to note that both symptomatic and asymptomatic patients suffer from the condition on a chronic basis. Therefore, pain during unforeseen exacerbation periods can be inevitable. Uncertainty about the disease prognosis and fear of complications, especially pain, can negatively affect patients' emotional well-being.[36] In this study, fear of painful urinary stone complications strongly motivated participants to change their dietary habits after diagnosis. They believed that increasing their water intake and restricting red meat and seafood consumption could effectively manage and alleviate the painful symptoms. Similarly, avoidance of pain was identified as a strong motivator for fluid change behaviour among stone formers.[9] Fear of disease recurrence and complications also motivates healthy dietary changes among patients with other conditions, such as cancer and kidney disease.[37,38] However, fear can also be a barrier to healthy dietary changes. Patients may be afraid of certain foods that they believe cause their condition. This fear can lead to the avoidance of entire food and fluid groups or the over-restriction of certain nutrients. In this study, some participants reported avoiding or strictly restricting nuts and shellfish as they believed this food could cause painful symptoms. However, as previously mentioned, this over-restriction may not be effective in preventing stone recurrence and may result in an imbalanced diet in the long term.

Although fear has been shown as the prominent factor in driving dietary change among participants, it is often overlooked by HCPs. During clinical consultation, emotional support is usually sidelined by HCPs as they are more focused on educating patients on symptom management, especially since urinary stones commonly manifest as physical pain and the treatment aim is to remove the source of pain. After achieving a stone-free status and experiencing fewer symptomatic stone events, the fear among patients might diminish, making them less motivated to comply with dietary modifications. However, some participants in this study reported being determined and motivated to adhere to dietary recommendations even after stone removal. This was due to the fear of complications such as stone recurrence after they were visually exposed to real stone samples on display in the clinic while attending follow-ups. A significant factor contributing to participants' persistent fear of experiencing recurrent urinary stone episodes is their vivid memory of the severity and intensity of the colic pain they previously endured.[39] Therefore, fear appeals approach should be considered as one of the health education strategies to promote dietary-related health engagement among stone patients.[40,41]

Nevertheless, participants reported that their psychological suffering from illness burden and a desire for positive treatment outcomes induced a strong determination in them to engage in dietary therapy during active treatment of the disease. Their determination was also influenced by their background whereby most of them were in the productive age group and breadwinner of the family. Thus, they were motivated to adhere to dietary recommendations to achieve the desired outcome. This is supported by past studies that described self-determination as an important factor in facilitating dietary changes.[42,43] It can induce self-competence and help motivate patients in making healthy dietary choices, as well as increase their ability to sustain healthy changes. However, sustaining determination to continue a healthy diet practice is tricky as motivation often diminishes over time, particularly in those patients with inadequate or inaccurate recall of information and poor self-control, which become barriers for patients to maintain adherence to the recommended diet.[9] A similar

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situation was reported among study participants, whereby they tried to maintain the habit of eating healthily and drinking large quantities of water, but once the symptoms were under control, they became less compliant. Therefore, the educational strategy should include an assessment of participants' source of motivation such as perceived susceptibility and emphasise the benefit of dietary therapy outcome during disease treatment to sustain their motivation for long-term adherence.

The participants emphasised that their family members, particularly their spouses, played a significant role in supporting their adoption of healthy dietary changes. This support mainly reminded them to adhere to dietary recommendations, prepare a healthy diet and share information. This finding is consistent with previous studies, suggesting that the involvement of partners can positively influence patients' adherence to dietary preventive behaviours and contribute to their overall adaptation to healthier eating habits.[39,44] In addition, the findings revealed that participants received informational support from multiple sources such as peers and traditional healers. Some of them reported that they would make the necessary changes to their diet to lower the risk of the recurrence of stones based on information that they received from these sources. However, information from various sources may contribute to misinterpretation and become a barrier for participants to adopt healthy dietary practices, which was previously identified in a study assessing postdiagnostic dietary change in patients with prostate cancer.[45] Similarly, some participants in this study reported completely eliminating nuts and certain animal proteins from their diet based on information received from multiple non-professional sources, such as traditional healers. This misinformation made it more challenging for them to maintain a healthy diet that effectively protects against urinary stones.

Professional support in the form of customised education is vital to improve patients' knowledge and self-care practices of nutrition in the prevention of stone disease.[46,47] Most of the participants preferred dietary advice from HCPs due to their professional backgrounds. The expertise of HCPs influenced patients' perception of the effectiveness of diet prevention strategies and motivated them to establish a healthy diet change. Comprehensive information from HCPs with a reliable clinical background, such as urologists and dietitians, can guide patients to undergo dietary change to achieve positive clinical outcomes by reducing the risk factors of stone formation.[48,49] Most of the participants were confident of making dietary changes related to water intake. The confidence could stem from the repeated basic preventative measures given by HCPs during follow-up involving water intake. Basic dietary recommendations by HCPs can also influence participants' high recall of certain food types, such as seafood and red meat. This can explain the most specific food changes among participants involving these types of foods. This finding concurs with a previous study, whereby three or fewer dietary recommendations promoted a higher rate of patient recall.[7] Handouts that list foods high in purine serve as valuable supplements and reference materials for participants implementing dietary changes aimed at reducing uric acid. Nonetheless, the inadequate information and explanation provided by HCPs concerning the benefit of diet-related stone prevention, particularly relating to food and fluid types, posed a challenge for some participants in this study to effectively modify their diet. As a result, some participants perceived that taking precautions about their food and fluid intake was unnecessary. This finding concurs with a previous study where inadequate information on the benefits of dietary prevention by HCPs becomes a significant barrier for stone patients to effectively adhere to fluid change behaviour.[9] Therefore, more effort is needed to improve communication skills and personal knowledge among HCPs, where these potential barriers can be overcome using effective communication, patient education, personalised advice and ongoing support.[50] Understanding these barriers can help HCPs provide better patient care and increase the likelihood of successful dietary changes.

LIMITATIONS OF THE STUDY

Although the interview findings indicate a positive dietary change among the participants, this study was unable to determine the accuracy of the dietary behaviour as reported by the urinary stone patients. Future studies may consider observing patients' dietary practices in more detail, such as using different study designs with validated questionnaires to capture the details of the food of choice and the level of knowledge of the stone diet. Furthermore, the number of participants was small and limited to a regional geographical area, thus affecting the generalisability of the results.

CONCLUSION

This study provided an in-depth understanding of the practices and preferences of patients in making dietary changes posturinary stone disease. Dietary change behaviour is primarily driven by fear, dietary knowledge and ongoing support from HCPs and patients' social circles. Understanding patient determinants of dietary change is crucial for HCPs in managing diet recommendations effectively. HCPs should focus on crucial issues such as debunking dietary myths and misconceptions so that patient adherence can improve along the disease

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trajectory. Our findings contribute valuable knowledge of the health beliefs regarding stone diet and how it can influence patient engagement and adherence to dietary recommendations. These findings shed light on the need for more comprehensive patient education focusing on dietary knowledge as a source of motivation to improve the quality of life for patients. Exploring the impact of dietary advice for different types of urinary stones on dietary adherence would be a beneficial direction for future research. This approach could offer a more personalised strategy for patients managing their conditions, potentially leading to improved adherence to dietary recommendations.

AUTHOR CONTRIBUTIONS

Suhana Muhamad was principal investigator and data collector. All authors (Siti Noorkhairina Sowtali, Siti Roshaidai Mohd Arifin, Munjih Ab Rashid Islah and Nor Azwani Mohd Shukri) contributed to data analysis and drafting of the paper. All authors reviewed its content and approved the final version submitted for publication.

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CONFLICT OF INTEREST STATEMENT

The authors declare no potential conflict of interest with respect to the research, authorship and/or publication of this article.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS APPROVAL STATEMENT

This study was approved by the Medical Research and Ethics Committee (MREC) Malaysia (NMRR-19-381-46395 [IIR]).

TRANSPARENCY DECLARATION

The lead author affirms that this manuscript is an honest, accurate and transparent account of the study being reported. The lead author affirms that no important aspect of the study has been omitted and that any discrepancies from the study as planned have been explained.

ORCID

Suhana Muhamad http://orcid.org/0000-0002-9892-2112
Nor Azwani Mohd Shukri http://orcid.org/0000-0001-9955-1379

PEER REVIEW

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AUTHOR BIOGRAPHIES

Suhana Muhamad (BHSc [hons], MSc, PhD, RN) is interested in exploring and improving health and

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behavioural change, focusing on diet care and support.

Siti Noorkhairina Sowtali (BHSc [hons], MEd, PhD, RN) is a research nurse with a special interest in nursing education and nutrition.

Siti Roshaidai Mohd Arifin (BHSc [hons], MSc, PhD, RN) is a research nurse with a special interest in qualitative study and maternal mental health.

Munjih Ab Rashid Islah (MBBCh, MS, MBU, FRCS [urol], AM) is a consultant urologist with a special interest in endourology and stone management.

Nor Azwani Mohd Shukri (BSc, MSc, PhD, RD) is a research dietitian with a special interest in the nutritional management of non-communicable diseases and other clinical conditions.

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