

Nutritional Status' Impact on the Management of Vesical Calculi: A Systematic Review of a Twenty-Two-Year Database

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ABSTRACT

Introduction: Acidogenic diets cause a drop in urinary pH, and increasing features of metabolic syndrome are associated with increased calcium oxalate precipitation. Nowadays, it is well accepted that dietary variables promote the formation of vesical calculi, contributing to the prevalence of vesical stones.

Aim: The aim of this study is to estimate the impact of nutritional status on the management of vesical calculi.

Materials and Methods: A literature search was conducted in PubMed, Medline, Web of Science, Cochrane library, as well as additional sources such as Google Scholar and ClinicalTrials.gov, covering the period from 2001 to 2022. The most important electronic databases were checked, and all types of studies, including expressive studies, trials, commentaries, and editorials, were considered due to the nature of the studies. The risk of bias

was assessed using the recommended methodology. A two-part tool was used to address five specific domains: selection bias, performance bias, attrition bias, selective reporting, and other biases. Quality diagnostic accuracy studies were evaluated using a quality assessment tool.

Results: This study included 12 literature sources, of which five were nutrition-based studies and seven were focused on vesical calculi. Dietary modifications and medical treatments were found to be the most important factors in preventing recurrence.

Conclusion: Dietary and medical treatments are of utmost importance in preventing recurrence. As per physician advice for vesical calculi, a proper dietary plan that includes a mineral-rich diet is needed. Consumption of ample fluids is essential for the removal of stones.

Keywords: Prevention, Recurrence, Surgery, Ultrasonography, Urolithiasis

INTRODUCTION

Vesical stones are primarily formed due to urinary stasis and can occur in otherwise healthy individuals without any anatomical or pathophysiological defects in the urinary system. The stones concentrate and solidify in stagnant urine, forming hard lumps. Variations in urine's degree of saturation, pH, and concentration can disrupt the existing equilibrium, leading to urolithiasis [1]. Vesical calculi can be either primary or secondary. Primary stones typically form in sterile urine, originating in the kidney and then passing into the bladder. They may be associated with nutritional deficiencies of vitamin A, magnesium, phosphate, and vitamin B6 [2,3]. In contrast to secondary vesical calculi, which form under abnormal upper urinary tract conditions, primary vesical calculi form in the bladder under normal conditions. Primary vesical calculi are most commonly observed in malnourished children [4].

Previous research has indicated that childhood urinary stones predominantly occur as bladder calculi [5]. It was commonly believed that these were endemic Bladder Stones (BS). In his groundbreaking investigations conducted in India in 1931, McCarrison R introduced the concept of a shifting aetiopathology of stone disease and demonstrated that nutritional deficiencies remained the primary cause [6]. Stone formation was associated with a deficiency of vitamin A in the diet. Although the frequency of stones in India remained high during childhood, he claimed that malnutrition was the cause of BS both in India and the UK [7].

The role of a dietitian is crucial in the management of nephrolithiasis and vesical calculi. Dietary evaluation is essential for treating and preventing stone formation. The dietitian should assess dietary calcium intake, oxalate intake, sodium intake, protein intake (both animal and plant), dietary supplements, and fluid intake to determine whether they promote or inhibit stone formation. Accurate measurement of fluid intake is particularly important [8].

Many researchers studying vesical stones have linked dietary factors to stone development. Children from the Ahmadnagar region in India with vesicle stones consume a diet high in cereals and low in animal proteins, particularly milk, according to epidemiological literature on dietary intake [9].

Generally, the diet's protein consumed from animals is less than 25%. Cereals such as whole wheat flour, millets, and pulses like black gram, red gram, and green gram are among the most popular cereals [10].

According to the majority of studies [11,12], consuming whole wheat flour as a staple food leads to the production of urine with a high Specific Gravity (SG), increased excretions of calcium, phosphorus, magnesium, oxalate, and uric acid, and supersaturation of urine with uric acid. These effects are particularly noticeable in Indian children with kidney stones [11].

Children have a higher uric acid/creatinine ratio, which decreases as they grow older. Due to the increased saturation and precipitation of uric acid in children who primarily consume wheat as their main source of nutrition, they are more likely to develop kidney stones [12].

Vesical stones are more common in areas with mild to moderate Protein Energy Malnutrition (PEM) compared to areas with severe PEM, according to a study of vesical stones in Indian children. Numerous publications have reported on the chemical analysis of renal and vesical stones from various endemic areas of India [13-16]. The main component of urinary calculi is calcium oxalate, which is also supported by numerous research studies from India [17].

Over the past 20 years, there has been a significant shift in the treatment of ureteric stones. The most effective diagnostic procedures continue to be intravenous urography and conventional diagnostic instruments such as Kidney, Ureter, and Bladder (KUB) radiograph. The majority of ureteric stones dissolve naturally without the need for surgery. Historically, open ureterolithotomy was the most

common surgical stone therapy. Today, available treatment options include stenting, Extracorporeal Shock Wave Lithotripsy (ESWL), percutaneous nephrolithotomy, laparoscopic ureterolithotomy, and occasionally open ureterolithotomy [18].

The management of stones has been transformed by the use of ESWL, percutaneous nephrolithotomy, and endoscopic technologies [19]. Two-thirds of all urinary calculi brought to a doctor's attention are ureteric stones [20]. However, the nutritional condition and eating habits of patients with specific vesical calculi are not well understood. Therefore, this present systematic review aims to evaluate the nutritional status and management of vesical calculi.

MATERIALS AND METHODS

The protocol for this study was based on the approved reporting articles for systematic review (PRISMA-P) declaration, and all changes were properly reported. The Cochrane handbook and the PRISMA statement were followed in conducting and reporting this systematic review, respectively. However, it is important to note that the review was not registered. The literature search included various computerised databases such as MEDLINE, Google Scholar, PubMed, Cochrane Library, Web of Science, and Scopus. The search terms used included keywords related to nutritional status and the management of vesical calculi, such as "Vesical calculi," "Management of vesical calculi," "Diet for prevention of vesical calculi," and "Management of stone diseases." The search was limited to publications in English. Notably, the search syntax was customised for each database based on their unique requirements and instructions. Several eligibility factors, including inclusion and exclusion criteria, were considered during the study selection.

Inclusion criteria:

1. Articles published between 2001 and 2022.
2. Studies focusing on the management of vesical calculi in patients with documented nutritional status.
3. Human clinical studies.
4. Full-text articles.
5. English language literature.

Exclusion criteria:

1. Non-English language literature.
2. Letters, book chapters.
3. Short communications.
4. Conference articles.
5. Patents.
6. Duplicate articles.
7. Studies involving individuals with frequent or widespread vesical calculi, as this condition may have had an impact on their dietary habits.

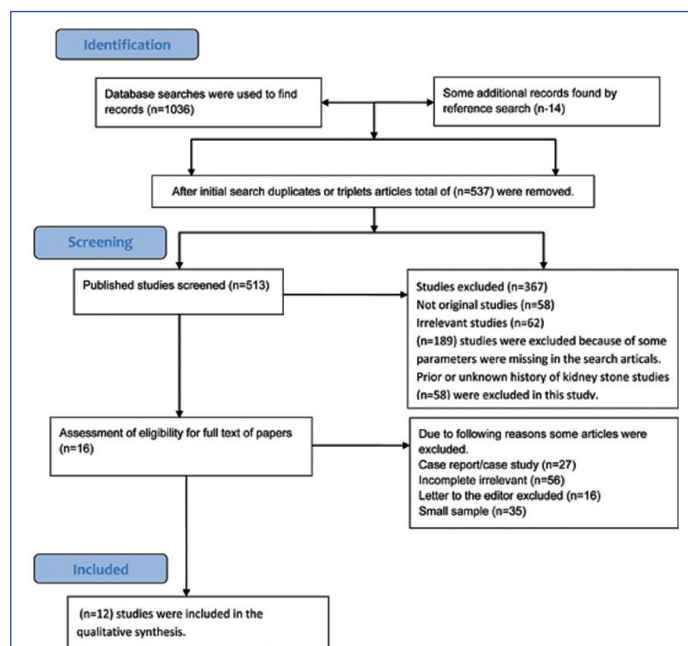
After retrieving articles from the databases, they were organised in an Excel sheet, and duplicates were eliminated. Two authors then independently assessed the abstract of each article, and a selected group of papers was chosen for full-text reading. Finally, a final selection of relevant research was made independently by the authors.

STATISTICAL ANALYSIS

Quality assessment of individual studies was conducted using the domain-based calculation method recommended by the Cochrane Handbook for systematic reviews of interventions. The following domains were examined: bias resulting from randomisation procedures, bias arising from deviations from the proposed interventions, bias due to lack of outcome data, bias in the evaluation of outcomes, and bias in the selection of reported results [20]. The assessment of "Risk of Bias" was performed using Review Manager Software Version 5.3, developed by The Cochrane Collaboration (Software Update, Oxford, UK).

RESULTS

The present systematic review yielded 1,036 articles in the initial search. Fourteen additional articles were identified from cross-references, resulting in a total of 1,050 articles. From these, 537 duplicate or triplet publications were removed, leaving 513 studies for screening. On detailed screening, 367 articles were excluded due to missing parameters in 189 articles and irrelevance in 62 articles. Fifty-eight articles were not original studies. Based on the inclusion criteria, 146 text articles were evaluated. However, during the review of full-text articles, some were removed due to reasons such as small sample sizes, incomplete/irrelevant data, case reports/case studies, and letters to the editor. Finally, after a thorough screening and analysis, a total of 12 studies were included in this systematic review [Table/Fig-1]. The articles ranged in date from 2001 to 2022.



[Table/Fig-1]: Represents PRISMA flow diagram and eligible database selected for this study.

In this study, 12 literature sources were included, with five studies focusing on nutrition and seven studies on vesical calculi management [Table/Fig-2] [21-32].

Quality evaluation of the included studies was conducted using the Cochrane Collaboration tool in RevMan version 5.4. The risk of bias was assessed based on selection bias, performance bias, attrition bias, selective reporting, and other biases. Each article's risk was categorised as low, unclear, or high based on these domains and criteria. The risk of bias evaluation for the 12 studies is shown in [Table/Fig-3]. All studies exhibited substantial methodological issues in at least one bias category. The most problematic categories included insufficient or non-existent randomisation (11.66% high risk), low outcome assessor blinding (55% of the trials), and unclear risk in 31.66% of the trials [Table/Fig-4].

Dietary factors were evaluated in five studies [21,23-25,32]. Meschi et al., revealed that the urinary stone risk profile changes negatively when fruits and vegetables are completely eliminated from normal individuals' diets, and these changes are only partially offset by a decrease in oxalate [24]. Zein-el-Amir et al., demonstrated that an unbalanced diet is the main risk factor for pediatric bladder calculi [25]. Sarica et al., calculated the potential impact of the calcium entry blocking agent medication 'verapamil' on new stone initiation and/or regrowth of residual fragments after SWL during long-term follow-up (>30 months), and the results opposed the outcomes with satisfactory fluid intake rates [22].

According to data analysed by Borghi et al., and Dussol et al., a normal-calcium diet caused fewer stone recurrences than a low-protein, low-salt diet [21,23]. Similarly, Borghi et al., assessed men with recurring

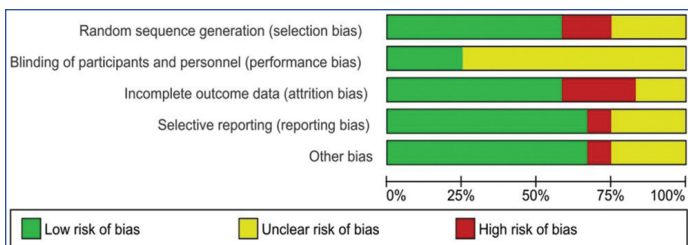
Author	Study design	Study place	Sample size	Age of patients (years)	Types of stone	Site of the stone	Nutritional status (rehabilitation)	Medical surgery (outcomes)
Borghì L et al., 2002 [21]	Randomised prospective trial	Internal Medicine and Nephrology (UM), University of Parma, Parma, Italy	120 patients	44.8±9.2	Calcium oxalate/ Calcium phosphate	Ureter	In this study men with hypercalciuria and recurring calcium oxalate stones, limiting salt and animal protein intake while maintaining adequate calcium intake, offers more protection than the conventional diet	In their study, patients recovered without any surgery.
Sarica K et al., 2006 [22]	Randomised control trial	Department of Urology, Memorial Hospital, Istanbul, Turkey	70 patients	-	Calcium oxalate	Ureter	High fluid intake should be done	NS
Dussol B et al., 2008 [23]	Randomised control trial	Centre de Néphrologie et de Transplantation Rénale, Assistance Publique, Hôpitaux de Marseille, Université Aix-Marseille II, (it is cited in French language in paper)	120 patients	44±12	Calcium oxalate	Ureter	They reported that in idiopathic calcium stone formers, neither Low Animal Protein Diet (LAPD) nor a High Fibre Diet (HFD) appeared to provide protection against recurrence	No surgery was performed.
Meschi T et al., 2004 [24]	Clinical trial	Department of Clinical Sciences, University of Parma, Parma, Italy	NS	Mean age 37.7	Calcium oxalate, uric acid stone	Urinary	The destruction of fruits in addition to vegetables are effective for the normal subjects, leads about adversative changes in the calculi risk profile that are only partially corrected by a reduction in oxalate	Surgery was not done.
Zein-el-Amir Z et al., 2012 [25]	Descriptive study	Department of Urology Benazir Bhutto Hospital and Rawalpindi Medical College, Rawalpindi, Pakistan	52 patients	2-14	Idiopathic	Bladder	In this study they concluded that because of malnourishment the vesical calculi is formed	NS
Tondare SB et al., 2013 [26]	Prospective study	Department of Surgery at Annasaheb Chudaman Patil Memorial Medical College, and Hospital Dhule, Maharashtra, India	577 patients	21-40	Calcium oxalate	Ureter	NS	Ureteroscopic intervention is the most commonly performed endourological procedure which is commonly used surgical intervention and treatment by open surgery is decreasing day by day.
Malladad N et al., 2018 [27]	Prospective study	Department of General Surgery, SDM Medical College and hospital, Dharwad, Karnataka, India	42 patients	Less than 10- above 50 year	Calcium phosphate, calcium oxalate and uric acid	Vesical	They reported that the drinking hard (Bore well) water brings a high risk of vesical calculus	Due to its 100% sensitivity, ultrasonography is the research of choice in vesical calculus.
Esposito C et al., 2021 [28]	Retrospective study	Paediatric Surgery Unit, Federico II University of Naples, Naples, Italy	13 patients	5±18	Calcium oxalate stone	Vesical	NS	They suggested surgery for the stone which is >10 mm and <20 mm.
Singh KJ and Kaur J et al., 2011 [29]	Randomised control trial	Chief Gynaecologist and Laparoscopic Surgeon, Family Hospital, Amritsar, India	67 patients	10±50	NS	Vesical, urethra reagon	NS	Stone removal by suing the nephroscope.
Türk C et al., 2015 [30]	Observational study	Department of Urology, Rudolfstiftung Hospital, Vienna, Austria	NS	NS	Calcium oxalate dihydrate, calcium phosphate, calcium oxalate monohydrate	Kidney	NS	MET is used to remove the stone easily and reduce the use of analgesics.
Stamtiou KN et al., 2006 [31]	Cross-sectional study	Department of Urology, General Hospital of Thebes, University of Crete School of Medicine Department of Urology, Koumerki, Thebes, Greece	422 patients	20-90	-	Urinary, renal	In this study, they stated that the water quality should be examined	NS
Jagannath K et al., 2019 [32]	Prospective observational study	PES Institute of Medical Sciences and Research, Kuppam, Andhra Pradesh, India	135 patients	31-50	Sodium, oxalate, phosphate	Ureter was common site	Dietary habits, fluid intake as well as co-morbidities such as diabetes mellitus and obesity play a main role for the proper treatment as well as observation	The minimal invasive surgeries have made management of vesical calculi much easier than early time.

[Table/Fig-2]: Study characterisation of included studies [21-32].

NS: Not stated; MET: Medical expulsive therapy

calcium oxalate stones and hypercalciuria. They restricted the intake of animal protein and salt while maintaining a normal calcium intake, which provided higher protection than the conventional low-calcium diet [21].

Regarding the management of vesical calculi, Singh and Kaur divided patients into three groups: the first group underwent transurethral removal of stones employing a nephroscope, the second group



[Table/Fig-3]: Review authors' evaluations of each risk of bias item are represented as percentages through all involved articles in the risk of bias graph.

	Random sequence generation (selection bias)	Blinding of participants and personnel (performance bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Dussol B et al., 2008 [23]	+	+	?	+	?
Turk C et al., 2015 [30]	?	?	-	+	+
Esposito C et al., 2021 [28]	?	+	?	-	+
Jagannath K et al., 2021 [28]	+	?	+	+	?
Singh KJ and Kaur J, [29]	+	?	-	+	-
Sarica K et al., 2006 [22]	+	?	+	?	+
Stamtiou KN et al., 2006 [31]	?	?	+	+	+
Borghi L et al., 2002 [21]	-	?	-	+	+
Malladad N et al., 2018 [27]	+	?	+	?	+
Tondare S et al., 2013 [26]	+	?	+	+	?
Meschi T et al., 2004 [24]	+	?	+	+	+
Zein-el-Amir Z et al., 2012 [25]	-	+	+	?	+

[Table/Fig-4]: Summary of risk of bias: evaluations of each study's involved item's risk of bias.

high risk (+), unclear risk (?) or low risk (-)

underwent transurethral elimination utilising a cystoscope, and the third group underwent percutaneous exclusion with a nephroscope [29]. They reported that the removal of stones through the urethra with a nephroscope is a safe and effective procedure that doesn't cause patient morbidity.

Jagannath et al., evaluated that Ureteroscopic Lithotripsy (URSL) was an alternative procedure for ureteric and vesicoureteric junction calculi. Percutaneous Nephrolithostomy/Push Back Percutaneous Nephrolithostomy (PCNL/PBPCNL) was the treatment alternative for stones at the pelviureteric junction and upper 1/3rd of the ureter with a size >1 cm. The success rate of the surgical process in their study was 80-100%. They demonstrated that westernisation, modern lifestyle, and changes in dietary practices may be to blame for the rising occurrence of stones in younger age groups and the female population. Knowledge about novel methods will enable surgeons to personalise the procedure, increasing the likelihood of success and lowering morbidity [32].

According to Stamtiou KN et al., (2006), extracorporeal shock wave lithotripsy (ESWL) was conducted on patients who had kidney

and urinary stones [31]. They claimed that urolithiasis was more common during the course of a person's lifetime in the rural districts of Thebes, Greece.

In a pilot study conducted by Tondare S et al., (2013) at the Department of Surgery, Annasaheb Chudaman Patil Memorial Medical College and Hospital Dhule [26], a total of 577 patients were included. The study reported that the majority of patients with ureteric calculi present with abdominal pain, and medical therapy is typically used as treatment. Endourological techniques are increasingly being employed as surgical intervention methods, reducing the need for open surgery. With surgical expertise, complications from endourological operations are extremely rare.

Turk C et al., who accompanied the study at the Department of Urology, Rudolfstiftung Hospital, Vienna, Austria [30], described urinary calculi diagnosis, observational management, and medicinal treatment as standard procedures. They utilised low-dose Computed Tomography (CT) to quickly make the diagnosis while limiting radiation exposure. Particularly for stones in the lower pole, active therapy may not be required. Medical Expulsive Therapy (MET) is advised to encourage spontaneous stone ejection.

Malladad et al., (2018) conducted a study at the Department of General Surgery, SDM Medical College and Hospital in Dharwad, Karnataka, India [27]. They examined 42 patients with vesical calculi. The study found that males experienced greater effects than females (6:1). The most common symptom was abdominal pain, occurring 71% of the time. Approximately 52% of the patients consumed water from a bore well. Ultrasonography was the most sensitive investigation method used in the study. Surgical intervention was performed in all cases, with transurethral cystolithotripsy using an 80-watt holmium laser being used in 50% of the patients. Open suprapubic cystolithotomy was performed in 29% of the patients, and percutaneous cystolithotripsy was performed in 21% without any complications. The majority of vesical calculi were mixed types, consisting mainly of calcium phosphate, calcium oxalate, and uric acid. The study concluded that vesical calculus is more common in children under the age of 10, and abdominal pain is the most frequently reported symptom. The consumption of hard water increases the risk of developing vesical calculus. Ultrasonography is the preferred method for studying vesical calculus due to its 100% sensitivity.

In a study conducted by Esposito et al., (2021) at the Department of Pediatric Surgery Unit, Federico II University of Naples, Naples, Italy [28], they observed 13 patients and concluded that minimally invasive methods for treating bladder stones in children are safe and efficient. Endourological management was the most cost-effective approach, resulting in a shorter hospital stay, but it was primarily recommended for small stones with a diameter less than 10 mm. Robotic surgery appeared to be a feasible approach for treating larger bladder stones measuring more than 15-20 mm. The use of robot technology allowed for easy suturing, enabling the removal of large stones without crushing them and ensuring secure closure of the bladder wall.

DISCUSSION

The formation of vesical calculi is significantly influenced by dietary variables, and customised food advice based on patients' metabolism should be provided for nutritional evaluations in order to prevent stone recurrence. Bladder calculi are associated with a variety of urinary compositional abnormalities.

Dietary discretion, physiological metabolic abnormalities, or both can be urinary risk factors. Stone disease is expensive and morbid, and after five years, recurrence rates can reach 30-50%. Therefore, it is crucial to make efforts to prevent stone formation [33]. However, a study indicated that increased consumption of dietary fiber did not successfully decrease the recurrence of calcium oxalate calculi [23]. Another study by Rotily M et al., showed that patients who

consumed dietary fiber did not experience a decrease in calcium oxalate predictive factors, such as calcium or oxalate outputs [34]. [Table/Fig-5] provides a summary of various studies and their outcomes on dietary factors and the occurrence of vesicular calculi and their recurrence.

Authors	Conclusions
Borghini L et al., 2002 [21]	A regular calcium intake along with a limited consumption of animal protein and salt provides better protection in males with hypercalcaemia and recurring calcium oxalate stones than the conventional low-calcium diet.
Sarica K et al., 2006 [22]	Lower calyces residual fragments showed a poor clearance rate and higher regrowth rates. Verapamil treatment was shown to be efficient enough to prevent residual fragment regrowth and to speed up clearance of residual fragments following SWL. Individuals using this medicine appeared to pass the retained pieces more quickly than the other patients.
Dussol B et al., 2008 [23]	A Low Animal Protein Diet (LAPD) or High Fibre Diet (HFD) didn't seem to offer any protection against recurrence in calcium stone formers who developed the condition idiopathically.
Meschi T et al., 2004 [24]	As compared to their routine food patterns, they found that modifying the imbalanced diet common of highly developed regions is genuinely effective in preventing stone recurrence in hypercalcaemic people.
Zein-el-Amir Z et al., 2012 [25]	Imbalance diet is also major risk for the paediatric vascular calculi.
Tondare S et al., 2013 [26]	The majority of patients with ureteric calculi appear with abdominal discomfort, and the treatment is often medical therapy. Open surgery is becoming less necessary as better facilities become available, and endourological techniques are taking its place as the primary surgical intervention method. With surgical competence, endourological operations have very few complications.
Malladad N et al., 2018 [27]	Children under 10-year-old are most frequently affected by vesical calculus. The majority of them complain of stomach cramps. Less fortunate people are more impacted. Consuming hard water increases your chance of developing vesical calculus. Due to its complete sensitivity, ultrasonography is the preferred method of study in vesical calculus.
Esposito C et al., 2021 [28]	The treatment of Bladder Stones (BS) in children with minimally invasive methods proved secure and efficient. The least expensive treatment, endourological management, permitted for a shorter hospital stay than the other operations, although it was mostly recommended for tiny stones with a diameter of less than 10 mm. Robotic surgery seems to be a reasonable therapeutic option for BS bigger than 15-20 mm. Because to the simple suturing made possible by robot technology, it was possible to remove the large stones without crushing them and easily repair the bladder wall.
Singh KJ and Kaur J 2011 [29]	Using a nephroscope to remove stones from the urethra transurethrally is a safe and effective procedure that helps to minimise patient morbidity.
Turk C et al., 2015 [30]	Urinary calculi are generally treated with medical intervention, observational care, and diagnosis. Rapid diagnosis is possible with low-dose CT. Radiation exposure is a restriction, though. Particularly with regard to stones in the lower pole, active therapy may not be required. To assist spontaneous stone ejection, Medical Expulsive Therapy (MET) is advised.
Stamtiou KN et al., 2006 [31]	Thebes' rural region had a greater lifetime prevalence rate of urolithiasis than earlier studies among men and women in the country's general population had shown.
Jagannath K et al., 2019 [32]	The increasing occurrence of calculi in the younger age group and among women may be related to western influence, the daily lifestyle, and dietary habits. Knowing about novel methods will enable surgeons to personalise the procedure, increasing the likelihood of success and lowering morbidity.

[Table/Fig-5]: Studies and their outcomes on the dietary factors and their occurrence of vesicular calculi and their recurrence [21-32].

In this review, most studies did not include biochemical data such as urinary compositions, which would be useful in explaining the biological effect of specific dietary factors on stone development [18,20,21,29].

A recently conducted study by Lin BB et al., investigated a wide range of modifiable lifestyle factors and clarified their association with incident kidney stones by comparing the highest vs lowest categories of exposure [35]. Their findings suggested that total fluid intake, water, coffee, tea, alcohol, beer, fruit, vegetables, dietary fiber,

dietary potassium, magnesium, and calcium decreased the risk of kidney stones. On the other hand, high Body Mass Index (BMI), total meat intake, animal protein, dietary sodium, spinach, oxalate, fructose, and soda increased the risk. Total and supplemental vitamin C intakes were associated with non-significant risk of renal stones. Supplemental vitamin D and calcium alone increased the risk in observational studies but not in Randomised Control Trials (RCTs). In contrast, co-supplementation conferred the risk in RCTs. No significant associations were found with physical activity, energy intake, dietary vitamin B6, and total vitamin D [35].

Grases F et al., reported that fruits, vegetables, and dietary fiber are essential sources of phytate, which decreases the risk of calculi by inhibiting the urinary crystallisation of calcium salts [36]. Additionally, Noori N et al., showed that a Dietary Approaches to Stop Hypertension (DASH) style diet non-significantly decreased urine calcium oxalate supersaturation among stone formers with hyperoxaluria compared to an oxalate-restricted diet [37].

Regarding the management of vesicular calculi, another study conducted by Jagannath K et al., demonstrated that for stones located at the pelvi-ureteric junction and the upper third of the ureter with a size greater than one centimeter, PCNL/PBPCNL can be an alternative to URSL [32]. The surgical operations performed in their study had a success rate of 80-100%. They suggested that PCNL/PBPCNL is a safe and efficient treatment for the management of ureteric stones. A similar study was conducted for treating urinary reservoir calculi, where Natalin RA et al., combined percutaneous dilation with a laparoscopic trocar [38]. The results of certain studies considered indications that calcium channel blocker therapy can be protective in certain models of ischemia-induced acute renal failure. Previous investigations on Mad in Darby Canine Kidney (MDCK) cells demonstrated a protective effect of calcium channel blockers against shockwave-induced tubular dysfunction, as well as high-energy shockwave-induced renal damage in both humans and animal models [37-39].

Limitation(s)

Information on stone composition was not available, and no association was made with specific types of stones. Biochemical data, such as urinary compositions, were missing. It remained unknown whether the impact of lifestyle factors on stone risk varies by gender due to a paucity of included studies.

CONCLUSION(S)

The present systematic review concludes that medical and dietary treatments are most important in preventing the recurrence of kidney stones and renal stones. As per physicians' advice for managing vesicular calculi, a proper dietary plan with a mineral-rich diet is required. Consumption of ample fluids is essential for stone removal. It is important to effectively manage vesicular calculi to achieve better analysis. Surgical and medical treatments are the primary considerations in managing vesicular stones, but dietary modifications are not receiving the attention they deserve in stone treatment. Diet plays a crucial role and has combined effects with other risk factors in stone formation and recurrence. Therefore, the present systematic review suggests conducting additional long-term studies in this direction.

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