Nutritional Viscosity Management for Renal Stones (Nephrolithiasis) Prevention According to Avicenna’s Canon of Medicine

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Authors’ contributions

This work was carried out in collaboration among all authors. Author MAV designed the study. Author AZ wrote the protocol. Author SMAS wrote the first draft of the manuscript. Authors MK, HR and SMAS, managed the analyses of the study. Authors HA and MAV managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The prevalence of renal stones in industrialized countries is about 10 to 12%, and its incidence has increased in recent years. Renal stone is strongly dependent on dietary habits, so dietary changes are the most promising intervention to reduce renal stone production. Nutrition from the perspective of traditional Persian medicine is one of the important pillars of prevention and treatment of diseases such as renal stones. In this article, we intend to outline the nutritional managements indicated in Avicenna’s book of canon of medicine on renal stones. According to Avicenna, renal stone producing foods are concentrated and viscous foods, including some dairy products, meats.
The prevalence of renal stones in industrialized countries is about 10 to 12% [1,2]. The incidence of renal stones has been increasing in recent years and the age of onset is decreasing [3]. Given the high prevalence of the disease and the likelihood of recurrence at around 50%, it places huge costs on the national healthcare system [4]. The cause of renal stones is multifactorial and strongly depends on dietary habits [5]. Increased blood pressure and obesity can increase renal stone production [6]. There are various therapies for renal stones, such as extracorporeal shock wave lithotripsy, ureteroscopy or percutaneous nephrolithotomy [7]. In addition to the side effects and costs of these treatments and the financial burden of hospitalization, renal stone recurrence continues to be mentioned [8-10]. Therefore, a program to change dietary habits and supplements and drug therapy may help prevent new stone production and reduce the financial burden of treatment. Among these, dietary changes are the most acceptable and promising intervention to reduce renal stone production [11-13]. Consequently, achieving a proper diet for patients seems necessary [14].

Nutrition is one of the most important pillars of disease prevention and treatment in Traditional Persian medicine (PM). Thus, major nutritional strategies for the prevention and treatment of renal stones have been discussed under related titles in PM literature. One of the greatest scholars of PM is Avicenna who has also explained nutritional managements for renal stones.

Avicenna, a Persian physician, polymath and philosopher of the 10th and 11th centuries; was born in a village near Bukhara (a city in old Persia) in 980 AD and died in Hamadan (a city West of Iran) in 1037 AD. He is one of the most famous Muslim scholars of his time and centuries after him [15]. His most important worldwide famous medical book is the “Canon of Medicine” compiling the main medical knowledge of his time. The book has been translated into various languages such as Persian, Latin, Chinese, Hebrew, German, French and English [16].

Keywords: Renal stones; nephrolithiasis; avicenna; canon of medicine; persian medicine; viscosity.

1. INTRODUCTION

The cause of renal stones is multifactorial and strongly depends on dietary habits [5]. Increased blood pressure and obesity can increase renal stone production [6]. There are various therapies for renal stones, such as extracorporeal shock wave lithotripsy, ureteroscopy or percutaneous nephrolithotomy [7]. In addition to the side effects and costs of these treatments and the financial burden of hospitalization, renal stone recurrence continues to be mentioned [8-10]. Therefore, a program to change dietary habits and supplements and drug therapy may help prevent new stone production and reduce the financial burden of treatment. Among these, dietary changes are the most acceptable and promising intervention to reduce renal stone production [11-13]. Consequently, achieving a proper diet for patients seems necessary [14].

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2. METHODS

Ancient Persia was the time of great empires. Achaemenids (550-330 BC), Parthians (247 BC-224 AD), and Sassanids (224-637 AD) were the main ancient Persian dynasties. They were the main civilized and powerful governments in the ancient world. Medicine was well organized in these empires, especially in the Sassanid period. Advanced medical organizations and laws, medical councils, hospitals, medical universities, and so forth, are some examples of advanced structures in ancient Persian times. In the Sassanid dynasty, Jundishapur University and Hospital in southwest Persia was the main medical center in the whole world. In the early Islamic period, when Persians lost their political strength, they showed more interest in science, especially medical knowledge. Medical science was popularized and spread by Persian scientists such as Akhawayni, Rhazes, Avicenna, Hally Abbas, Jorjani, and others during 9th to 12th century AD. During later centuries, the growth of medical sciences decreased but continued in Persia until the Renaissance.

In this mini-review article, we intend to introduce the nutritional managements outlined in Avicenna’s canon of medicine on renal stones.

3. RESULTS

The eighteenth section of the third book of Canon discusses kidney diseases including renal stones. In this section, Avicenna explains the nutritional agents susceptible to produce renal stone:

"The viscous and damp material is ready to build stones in the kidneys. Concentrated food is the main precursor of renal stones. Foods such as all kinds of animals milk, especially beestings milk and fresh cheese. Thick meat of large birds living..."
alongside swamps and meadows, camel meat, beef, male goat meat, thick hunt meat, thick fish meat, pan fried foods, non-roasted doughy bread, bread whose wheat is viscous, unleavened bread, curd soup, halim (a kind of porridge made of mashed meat and mashed wheat germs), thick soup of crushed wheat, any bread without bran. Slimy sweets, sour fruits have a long-lasting digestion, fruits that produce slimy humor such as: unripe apple, statafalo (a kind of peach), unripe peach, bergamot and pear, contaminated water, especially water that is not normally consumed for drinking, dark black drinks and etc."

(Table 1).

Elsewhere in his book, Avicenna points out that:

"The effects of these foods are exacerbated when a person eats them in large quantities at once."

Also he believed that most people who are obese are more likely to develop nephrolithiasis.

According knowledge from traditional persian medicine, a viscous matter is a substance that goes on but does not break down, such as honey, wheat gluten, and corn syrup.

4. DISCUSSION

Avicenna’s statements about nutritional management of renal stones can be compared and evaluated with those of modern medicine. In conventional medicine, several nutritional factors are considered to affect nephrolithiasis:

Unbalanced urine pH: Low urine pH increases calcium oxalate and uric acid production and on the other hand increase in urine pH escalates the risk of calcium phosphate stone production. The pH of the urine is influenced by one’s diet, for example, animal protein, because of its high purine and sulfur content in amino acids, reduces the urine pH and increases the risk of producing uric acid stones. The list of foods that make urine acidic or alkaline is summarized in Table 2 [14].

With regard to meat, Avicenna’s views are consistent with recent studies as he refers to the flesh of large birds, camels, cattle, goats, and fish, all of which, according to the above table, make the urine acidic and increase the stone production.

Slimy sweets (plain cakes, cookies, gelatin desserts, puddings) and not well cooked cereals (breads) are considered inappropriate and stone forming by Avicenna, all being urine acidifiers.

Avicenna’s opinion on dairy products such as milk and especially cheese also corresponds to their urine alkalizing effects as listed in Table 2.

Excessive fructose consumption: Fructose intake has increased by about 2000% in the last 30 years due to high fructose corn syrup (viscous substance). Fructose may increase the secretion of calcium and oxalate into the urine. Fructose is the only known carbohydrate that increases the production of uric acid and releases it into the urine. Fructose may also increase insulin resistance, which causes the urine to become acidic. Fructose intake increases the risk of producing all types of renal stones [18]. As the main source of fructose is fruit and vegetables, Avicenna also limits the consumption of viscous fruits.

<table>
<thead>
<tr>
<th>Food category</th>
<th>Renal stone producing foods from Avicenna’s point of view</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy</td>
<td>All kinds of animal milks, especially beestings’ milk and fresh cheese</td>
</tr>
<tr>
<td>Meat</td>
<td>Thick meat of large birds living alongside swamps and meadows, camel meat, beef, male goat meat, thick hunt meat, fish thick meat, fried in the pan foods</td>
</tr>
<tr>
<td>Cereal</td>
<td>Non roasted doughy bread, bread whose wheat is viscous, unleavened bread, curd soup</td>
</tr>
<tr>
<td>Sweets</td>
<td>Slimy sweets</td>
</tr>
<tr>
<td>Fruits</td>
<td>Sour fruits have a long-lasting digestion, fruits that produce slimy sputum such as: unripe apple, statafalo (a kind of peach), unripe peach, bergamot and pear</td>
</tr>
<tr>
<td>Liquids</td>
<td>Contaminated water, especially water that is not normally consumed for drinking, dark black drinks</td>
</tr>
<tr>
<td>Foods</td>
<td>Halim (a kind of porridge made of mashed meat and mashed wheat germs), thick soup of crushed wheat</td>
</tr>
</tbody>
</table>
Table 2. Acid-ash and alkaline-ash foods

<table>
<thead>
<tr>
<th>Foods</th>
<th>Acid-ash foods (acidifiers)</th>
<th>Alkaline-ash foods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat</td>
<td>Meat, shellfish, egg, fish, fowl</td>
<td>None</td>
</tr>
<tr>
<td>Dairy and other proteins</td>
<td>All types of cheese Peanuts Peanut butter</td>
<td>Milk and milk products Butter milk</td>
</tr>
<tr>
<td>Starch</td>
<td>All types esp. whole wheat Crackers, cereal, macaroni, spaghetti, noodle, rice</td>
<td>None</td>
</tr>
<tr>
<td>Vegetables</td>
<td>Corn, lentils</td>
<td>All types except corn and lentils Swiss chard, dandelion greens, Beets, beet greens, spinach, turnip greens kale, mustard greens,</td>
</tr>
<tr>
<td>Fruits</td>
<td>Cranberries, prunes, plums</td>
<td>All types especially currants, dates, figs, bananas, dried apricots, apples, prunes, raisins [17] except cranberries, prunes and plum</td>
</tr>
<tr>
<td>Desserts and Sweets</td>
<td>Plain cakes, cookies, gelatin desserts, pudding [17]</td>
<td>Molasses</td>
</tr>
</tbody>
</table>

Table 3. Food categories and their implication in renal stone production

<table>
<thead>
<tr>
<th>Foods</th>
<th>Acidify the urine</th>
<th>Alkalize the urine</th>
<th>Decrease the production of Calcium phytate complex</th>
<th>Increase the fructose level</th>
<th>Elevate the oxalate level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animals milk, especially beestings milk and fresh cheese</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Thick meat of large birds living alongside swamps and meadows, Camel meat, beef, male goat meat, thick hunt meat, fish thick meat pan fried in the foods</td>
<td>+</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Non roasted doughy bread, bread whose wheat is viscous, unleavened bread, curd soup, halim (a kind of porridge made of mashed meat and mashed wheat germs), thick soup of crushed wheat, any bread without bran</td>
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<td>+</td>
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</table>
Excessive phytate consumption: Phytate, found in whole grains and legumes, can prevent the production of calcium oxalate stones. Calcium phytate in the intestine complex soluble and inhibits the production of crystals in urine, thereby reducing renal stone production [19-21].

Avicenna also points out that breads made from heavily sifted bran-less wheat should not be consumed by individuals prone to renal stone formation.

Excessive obesity: Obesity increases stone production and increases the likelihood of its recurrence [22].

Excessive liquid consumption: All beverages have not the same benefit in reducing the risk of renal stone production. Blueberry juice, for example, is useful in treating struvite stones. Black currant juice may increase uric acid production by increasing urinary citrate and oxalate secretion and alkalizing urine. In contrast, tea, especially green tea, contains high oxalate and is best substituted with herbal teas [23]. However, the over consumption of some beverages may induce adverse effects to the exposed organism.

Avicenna also does not recommend muddy water, dark drinks and thick black. As can be seen, the diet of industrialized countries, which are high in animal protein, inappropriate drinks, and lean foods, results in increased calcium, uric acid, oxalate and phosphorus secretion, and a decrease in citrate and urine, which increases stone production [24-26].

The mechanisms of action of stone production reported by Avicenna in viscous foods have been summarized in Table 3.

5. CONCLUSION

Many foods claimed by Avicenna to be renal stone builders due to their higher viscosity defined in persian medical context, are also known to increase the risk of renal stone production by modern science although from different aspects. This may give a new insight and classification strategy about pathogenic foods considering their macroscopic characteristics and phenotypes which may not only help scientists to induce more precise research hypothesis but also the public to easily identify consumable foods. Since there is a clear relationship between dietary habits and renal stones—production, integrating centuries of past clinical observation/experience transported via traditional medical literature with modern experimental/clinical facilities in designing studies may help to reach better nutritional discoveries.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES


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