Review article

Food strategies of renal atrophy based on Avicenna and conventional medicine

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A B S T R A C T

Kidneys have an important role in the body. Any damage to kidney role can damage many organs of the body. Traditional Persian Medicine (TPM) or Iranian traditional medicine (ITM) is an ancient temperamental medicine with many literatures about kidney diseases and Avicenna (980—1025 AD) describes kidney diseases in details. This is a review study by searching of the most important clinical and pharmaceutical TPM textbooks such as The Canon of Medicine by Avicenna and scientific data banks using keywords such as “Hozal-e-Kolye”, renal atrophy, tubular atrophy, kidney, chronic kidney disease, and end stage renal disease. This paper found that “Hozal-e-Kolye” in TPM texts is the same tubular atrophy in conventional medicine due to some similar symptoms between them. Lifestyle modification and use of proposed foodstuffs can be considered as a complementary medicine in addition to conventional treatments to manage these patients. TPM scholars prescribed some foodstuffs such as camel milk, sheep’s milk and Ficus carica for this disease as a complementary management. This study aimed to explain HK (the same tubular atrophy considering their similar symptoms) and introduce some foodstuffs. It seems using of foodstuffs affecting tubular atrophy based on TPM literatures can has a role as a supplemental method in company with conventional kidney management.

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1. Introduction

Chronic kidney disease (CKD) can lead to end stage renal disease (ESRD). Renal atrophy is one of the kidney diseases occurring due to shrinkage of the kidney in which the nephrons are lost and tubular atrophy is the loss of parenchymal renal cells characterizing in CKD. Tubular atrophy is a hallmark of chronic kidney disease. The prevalence of CKD is increasing and estimated to be 8–16% worldwide. Treatment of CKD considering the stages of the disease is various and the relationship between nutrition and kidney disease has a main effect on outcomes. Using complementary medicine (CAM) in treatment of chronic disease is growing in the past 10 years in the U.S. The management of CKD based on herbal traditional medicine is recommended as a preventive and therapeutic strategy and medicinal plants with kidney protective activities is prescribed. Traditional Persian Medicine (TPM) is an ancient temperamental medicine with a history of over one thousand years. Temperament is made of a normal interaction between four basic elements, named hot, cold, wet, and dry elements. And dystemperament occurs when the whole body or an organ’s temperament changes. The kidney dystemperament occurs when the kidney temperament is changed and its function is disturbed. These conditions can lead to “Hozal-e-Kolye” (HK). HK in TPM occurs when the kidney becomes thin means its fat gets low or eliminates. This study aimed to explain HK (the same tubular atrophy

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considering their similar symptoms) and introduce some foodstuffs as a complementary food management based on TPM.

2. Materials & methods

This is a review study by searching of the most important clinical and pharmaceutical TPM textbooks (That is not derived from the other books) such as The Canon of Medicine by “Avicenna” (10th and 11th centuries), Exir-e-Azam by Chishti (19th century), Tubjat Al-momeni by Tonkaboni (17th century) and Makhzan-Al-advie by Aqili (18th century), with the keyword of “Hozal-e-Kolye” (the same tubular atrophy). Then, all of the foodstuffs extracted from this study were searched to find the related activity concerning the kidney function improvement by searching in scientific data banks such as Medline with these keywords: renal atrophy, tubular atrophy, kidney, chronic kidney disease, end stage renal disease. Finally, the results were inserted into a table.

3. Results

3.1. CKD in conventional medicine

CKD occurs when the impaired kidney function persists for three months or more. In this disorder, there is a decrease clinical function based on the presence of kidney damage. Glomerular filtration rate (GFR) has a central role in the pathophysiology of CKD complications. There are five stages in CKD classification on the basis of GFR: stage1 (more than 90 ml/min/1.73 m²), stage2 (60–89 ml/min/1.73 m²), stage3 (30–59 ml/min/1.73 m²), stage4 (15–29 ml/min/1.73 m²), stage5 (less than 15 ml/min/1.73 m²). Proteinuria has an important role in the pathogenesis CKD progression. When GFR is less than 15 ml/min/1.73 m², kidney failure occurs and it needs dialysis or transplantation for treatment. Manifestations of CKD include: fluid and electrolyte imbalance (impaired ability to excrete leading to severe hypertension and edema due to reduce GFR), acid base abnormalities, carbohydrate intolerance, calcium and phosphate abnormalities and metabolic bone disease, hematologic abnormalities, gastrointestinal abnormalities, dermatological abnormalities, neuromuscular abnormalities. These patients are at risk of cardiovascular diseases. Also, there is a nocturnal polyuria in renal insufficiency that is a precocious symptom in CKD.

3.2. Phosphorus and tubular defect

The main homeostasis of phosphorus occurs in the kidney and the small intestine. A large part of phosphate from eating is excreted in the urine. There is a hypophosphatemia in the renal tubular defect. 80% of the phosphorus reabsorption occur in the proximal tubule of the kidney, but in a tubular defect such as tubular atrophy this process doesn’t occur so in this condition there is a hypophosphatemia and phosphaturia. The urine color is white because of phosphaturia.

3.3. Renal atrophy in conventional medicine

3.3.1. Renal atrophy

Renal atrophy caused by many diseases such as acute or chronic pyelonephritis and obstruction of the urinary tract, the systemic atherosclerosis, metabolic syndrome, sickle cell disease, atherosclerotic renal artery stenosis, after hereditary renal cell carcinoma surgery, xanthogranulomatous pyelonephritis (Cortical renal atrophy), posttraumatic (injury), Etiology of unilateral renal atrophy includes hydropnephrosis, tumor, tuberculosis, Calculous, chronic pyelonephritis, congenital hypoplastic kidney, renal infarction, radiation, renal artery stenosis, partial nephrectomy. The classic signs of renal atrophy in modern medicine include high blood pressure, low calcium, acidosis, anorexia, malnutrition (serious deficiency minerals and vitamins), elevations in the serum creatinine concentration. Acute kidney injury (AKI) can lead to renal atrophy by incomplete tubular repair, tubulointerstitial inflammation, and interstitial fibrosis. Insufficient blood flow of kidney, can result in the renal atrophy too.

3.3.2. Renal tubular disorder

Renal tubules are very important in the homeostasis. The proximal tubules play a main role in the transport of phosphate, glucose, amino acid, bicarbonate and sodium. The dysfunctions of these tubules are primary or secondary. When these tubules are injured, some disorders occur, such as hypophosphatemia, and aminoaciduria. Common symptoms of most renal tubulopathies include polyuria and also growth failure and resistant rickets (in children). If tubular dysfunction occurs, phosphaturia will be present. Phosphaturia cause white urine.

3.3.3. Etiologies of tubular atrophy

After allografts, persistent glomerulonephritis and proteinuria, antiglomerular basement membrane disease, medullary cystic kidney disease type I (a mutation in the mucin 1 gene), chronic tubulointerstitial diseases, allergic interstitial nephritis, granulomatous interstitial nephritis, vesicoureteral reflux and reflux nephropathy, lithium salts, the calcineurin inhibitor (CNI) immunosuppressive agent’s cyclosporine and tacrolimus, prolonged and severe hypokalemia nephropathy, diphtheria toxin.

3.4. HK in Traditional Persian Medicine

TPM scholars believed that any organ of the body has a typical temperament. In an ideal healthy state, the individual function is very good and dysstemeremtem occurs when the whole body or an organ’s temperament changes. In other words, it grows up in the imbalance of the quality or quantity of humors including phlegm, bile, blood and black bile. The kidney dysstemperemtem occurs when the kidney temperament is changed and its function is disturbed. This kidney dysstemperemtem can lead to “Hozal-e-Kolye” (HK). HK in TPM occurs when the kidney becomes thin (its fat gets low or eliminates), hot or cold. In high kidney temperature, the kidney fat is lost because of the warmth and in low kidney temperature, the kidney equalizer is disturbed. TPM scholars believed that HK occurred by several reasons such as dysstemeremtem of the kidney, evacuation (in TPM, evacuation means excretion of many fluids from the body, such as excessive hemorrhage, diarrhea, severe vomiting, expelling excess semen and excess usage of purgative or diuretic drugs resulting severe dehydration). Symptoms of HK include white urine, polyuria, weight loss, permanent low back pain and low libido. (Table 1).

| Symptoms of tubular disorders in conventional medicine | Ref | Symptoms of HK in TPM | Ref |
|-------------------------------------------------------|-----|-----------------------|-----|
| Polyuria                                              | 17  | Polyuria               | 11–14|
| White urine (because of phosphaturia)                 | 20  | White urine            |      |
| Growth failure                                        | 32  | Weight loss            |      |
| Resistant rickets                                     | 32  | Permanent low Back pain|      |
| Hypophosphatemia in the laboratory test               | 18  | Low libido             |      |
|                                                      |     | There was not laboratory test at Avicenna’s time |      |
TPM scholars believed that eye weakness and headache are caused due to the kidney fat loss in HK process. It was written in the other book that one of the symptoms of HK is mild pain in the back of head.\textsuperscript{34,35}

### 3.5. Food strategies in CKD in conventional medicine

Nutrition has a main role in the treatment of CKD. Nowadays in America, diet and lifestyle behaviors are important. There are food strategies recommending in CKD such as:

- Intake of protein and energy (Considering the risk of malnutrition in CKD) is recommended. However, protein-restricted diets are used to decrease uremic symptoms.\textsuperscript{36}
- A calorie of at least 30–35 kcal/kg is recommended.
- Adequate Intake of vitamin supplements (vitamin C, Thiamin, Riboflavin, Niacin, Folate, Pyridoxine, Cobalamin, Biotin, and Pantothenic acid) is recommended.
- Use of vitamin D to prevent bone loss is needed.\textsuperscript{36}
- Use of phosphorus intake (ideally 700 mg/day) especially in ESRD is needed. However, adequate protein intake must be maintained.\textsuperscript{37}
- Low fat diets including nonhydrogenated and unsaturated fats are recommended to prevent and treat the progression of cardiovascular disease (CVD) in these patients. Intake of whole grains, fruits, vegetables, and omega-3 fatty acids to correct dyslipidemias.\textsuperscript{36}
- Control of hypertension with DASH plans (Dietary Approaches to Stop Hypertension) including lower in fat and sodium and high in potassium, magnesium, calcium, fiber and antioxidant is necessary.\textsuperscript{36}
- Considering the risk of diabetes, diabetic regimen is needed.\textsuperscript{36}
- Allergen foods such as gluten, nuts, dairy foods, citrus foods such as oranges and grapefruit, cantaloupe, honeydew, berries, chocolate, shellfish, eggs, and sulfites should be restricted.\textsuperscript{36}

### 3.6. Food strategies in HK in Traditional Persian Medicine

The principle of treatment of any disease is the elimination of its main causes and modifying the lifestyle.\textsuperscript{1} The management of HK is based on the etiologies too. Avicenna and the other TPM scholars prescribed fattening foods for patients with HK (Table 2):

#### 3.6.1. Herbal-derived compounds

Herbal drugs mentioned in TPM literature include \textit{Ficus carica}, \textit{Dava-Al-Taranjabin} (milk + Manna of Alhagi), safflower, raisin, banana, chickpea, kidney bean, rice flour, fluxweed, sesame oil, coconut, and almond.\textsuperscript{11,12,14}

#### 3.6.2. Animal-derived compounds

Animal-derived compounds prescribed in TPM to fatten the thin kidney include poultry meat, lamb meat, camel milk, sheep’s milk and the other food materials like honey, egg.\textsuperscript{11,12,14}

#### 3.7. Foodstuffs forbidden in CKD in conventional medicine

Eating of some foodstuffs are forbidden in CKD such as: Alfalfa, Aloe, Aristolochic acid, \textit{Artemisia absinthium} (wormwood plant), Autumn crocus, Bayberry, Blue cohosh, Broom, Buckthorn, Capsicum, Cascara, Chaparral, and Chufiongtuokwan (Black Pearl), Coltsfoot, Comfrey, Dandelion, Ephedra (Ma Huang), Ginger, Ginsko, Ginseng, Horse chestnut, Horsetail, Licorice, Lobelia, Mandrake, Mate, Nettle, Noni juice, Panax, Pennyroyal, Periwinkle, Pokerooot, Rhubarb, Sassafras, Senna, St. John’s wort, Tung shueh, Vandeliacordifolia, Vervain, Yohimbe.\textsuperscript{52}

#### 4. Discussion

According to this study, HK is the same tubular atrophy in the early stages of CKD. There is oliguria in CKD; however, there is polyuria in the early stage of CKD.\textsuperscript{3,17} Tubular atrophy is a hallmark of CKD\textsuperscript{3} and polyuria is one of its symptoms,\textsuperscript{37} so HK is the same tubular atrophy at the beginning of CKD.

The management of tubular atrophy is based on the causes in both CM and TPM. In both of these medicines, the diet is important.\textsuperscript{37} In CM, restriction of protein in the diet is discussed. Some researchers believed that restriction in the intake of protein and energy is not necessary to prevent the risk of malnutrition.\textsuperscript{37} In a clinical trial, restricted protein diet was more effective.\textsuperscript{52} Some scientists believed that restriction of protein is needed to decrease of uremic symptoms.\textsuperscript{52} Although some scientists have proven that a

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Table 2: Fattening foods and herbal or animal-derived compounds in tubular atrophy based on TPM resources.

| Common name | Local name | Family | Scientific name | Fattening cause in conventional medicine | Reference |
|--------------|------------|--------|----------------|----------------------------------------|-----------|
| **Herbal-derived compounds** | | | | | |
| Safflower | Ghortom | Asteraceae | Carthamus tinctorius | The source of fat | 39 |
| Fig | Tin | Moraceae | Ficus carica | Excellent source of mineral, vitamin & carbohydrates | 40 |
| Raisin | Zahib | Vitaceae | Vitis vinifera | A rich source of carbohydrate | 41 |
| Banana | Mauz | Musaceae | Musa spp | High carbohydrate & energy | 42 |
| Manna of Alhagi with milk | Taranjabin | — | — | High calorie\textsuperscript{a} | 43 |
| Chickpea | Hemmas | Fabaceae | Cicer arietinum | A good source of carbohydrate & protein | 44 |
| Kidney bean | Loubia | Fabaceae | Phaseolus vulgaris | High carbohydrate & protein | 45 |
| Rice flour | Ard-e-brenj | Oryza sativa | Oryza sativa | High carbohydrate | 45 |
| Flixweed | Bazr al Katan | Brassicaceae | Brassica napus | Stomach strengthening, appetizer | 46 |
| Sesame oil | Dohn al Samsem | Pedaliaceae | Sesamum indicum | High fat | 45 |
| Coconut | Nargil | Areaceae | cocos nucifera | High carbohydrate | 47 |
| Almond | Louz | Rosaceae | Prunus dulcis L | High carbohydrate | 48 |
| **Animal-derived compounds** | | | | | |
| Camel milk | Laban al Baghar | — | — | Rich in protein | 49 |
| Sheep’s milk | Laban al Ghanam | — | — | High protein | 50 |
| Poultry meat | Laham al Bot | — | — | High protein | 45 |
| Lamb meat | Laham al Hamalan | — | — | High protein | 45 |
| Honey | Asal | — | — | High protein | 45 |
| Egg | Bayz | Gallus domesticus | — | High quality protein, vitamin B, minerals | 49 |

\textsuperscript{a} Dava al taranjabin is a compound of manna of alhagi (high calorie) with milk (high protein).
restricted protein diet supplemented with keto analogues (a diet of essential amino acids such as phenylalanine and Valine) can delay the progression of CKD without malnutrition.25 In TPM, correction of the kidney dystemperament by some foodstuffs prescribed in addition to fattening foodstuffs, including some nuts and seeds, meats, and natural drugs is done.23 In CM some chemical drugs prescribe instead of that, in addition to recovery of the complications and comorbidities. Nutrition therapy in CM is recommended for prevention of malnutrition and decreasing the progression of CKD. In CM, some foodstuffs should be avoided as mentioned in the results. Albeit neither of them is mentioned in TPM as a prescribed food strategy.

In CM, low phosphorus intake is recommended. Of course phosphorus is not typically restricted until hyperphosphatemia is present.26 Low sodium intake to control of hypertension and low phosphorus intake for prevention of progressive CKD are recommended in CM.27 At TPM scientist’s time, there were not laboratory tests to control of these cases. Then, they detected diseases by clinical symptoms and observing touching the skin surface of involved organ to find organ’s temperament.

It needs to be cared about using of egg yolk and almond. They are not forbidden in tubular atrophy due to low phosphorus and high protein (an adequate phosphorus-to-protein ratio: 24.7 in egg yolk and 22.3 in almond).28 But increasing in their usage can cause a problem. Also using of some allergen foods as mentioned in this paper should be cared and it needs to be sure that the consumer has not allergy to these foodstuffs.

5. Conclusion

It seems using of foodstuffs affecting tubular atrophy based on TPM literatures can have a role as a supplemental method in company with CM management. However, more studies about these foods and their effects on these cases are needed.

Conflict of interest

The authors declare that there are no conflicts of interest.

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