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Modern and Greco-Arabic Management of Chronic Kidney Diseases (CKD): A Scientific Analysis

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Abstract

Chronic Kidney Disease (CKD) is a progressive condition characterized by a gradual decline in kidney function, leading to the accumulation of metabolic waste and fluid imbalance. The leading cause of CKD is persistent hyperglycemia due to diabetes mellitus. High blood glucose levels damage renal microvasculature, particularly the glomeruli, resulting in proteinuria. Hyperfiltration, intraglomerular hypertension, and the formation of advanced glycation end products (AGEs) further exacerbate renal injury through inflammation, fibrosis, and vascular damage. Hypertension, often coexisting with diabetes, accelerates CKD progression by increasing intrarenal pressure and perpetuating a cycle where elevated blood pressure and renal dysfunction worsen each other. This vicious cycle significantly heightens the risk of cardiovascular events, including myocardial infarction and stroke.

In the Greco-Arabic (Unani) medicine, CKD is described as a chronic imbalance in the body's humors (Akhlat)—particularly involving a derangement of the kidneys' cold and moist temperament (Mizaj). Conditions such as Zauf-e-Kulya (renal weakness), Daffe-e-Baul ka ikhtilal (urinary dysfunction), and Istisqa (dropsy) accentuate the manifestations of CKD. Scholars like Hippocrates, Galen, and Avicenna emphasized the role of humoral imbalance and renal purification in systemic health. Avicenna notably linked Fasad-e-Mizaj (temperamental derangement) with renal dysfunction and advised dietary regulation and herbal interventions (Muqawwi-e-Kilya) for prevention and management of CKD. This integrated perspective highlights the importance of understanding CKD both through modern pathophysiological mechanisms and traditional holistic frameworks for comprehensive care.

Keywords: Chronic Kidney Disease (CKD); Advanced Glycation End Products (AGEs); Humoral Imbalance; Dietary intervention and Greco-Arabic management

Introduction

CKD is a gradual loss of kidney function over time. The kidneys filter waste and excess fluids from the blood, which are then excreted through urine. When kidneys are not properly working, the waste materials are accumulated in the body. This can lead to develop serious health problems. Most com-

mon cause of CKD in worldwide is high blood sugar. Persistent hyperglycemia (high blood glucose levels) leads to damage of small blood vessels (microangiopathy), especially in the glomeruli (filtering units of the kidney). These damaged glomeruli leak proteins (like albumin) into the urine, a condition known as proteinuria, which is an early sign of diabetic nephropathy. It was also found that high blood sugar also causes hyper filtration of the kidneys try to filter too much blood to deal with excess glucose. This extra workload over time increases intraglomerular pressure, causing scarring and worsening kidney function. Recent study suggested that chronic high glucose levels activate inflammatory pathways and the formation of advanced glycation end products (AGEs). The AGEs are formed when proteins or fats combine with sugars in the bloodstream. It is worsen insulin resistance and damage blood vessels. These processes also promote fibrosis (scarring) in kidney tissues, leading to progressive loss of kidney function, atherosclerosis and high blood pressure. It also linked to Alzheimer's disease and cognitive decline.

Hypertension and Diabetes often coexists which further damages the kidneys. Hypertension accelerates the progression of CKD by increasing pressure inside the delicate renal vessels. It puts extra strain on the small blood vessels (glomeruli) in the kidneys. Over time, this pressure damages the vessels, reducing the kidney's ability to filter waste and regulate fluid and electrolytes. As kidney function declines, fluid and waste start to accumulate, which can increase blood pressure even more. This creates a vicious cycle: HTN worsens CKD → CKD worsens HTN → repeat. Uncontrolled hypertension is one of the main causes of CKD progression. It can lead to end-stage kidney disease (ESKD) more quickly if not managed. CKD and HTN together significantly raise the risk of heart attacks, strokes, and heart failure.

Greco-Arabic Concept of CKDs: According to Greco-Arabic Concept, health is maintained by the balance of four humors (Akhlat) such as Dam (Blood), Balgham (Phlegm), Safra (Yellow Bile) and Sauda (Black Bile). Each organ has a specific temperament (Mizaj). The kidneys are considered to have a cold and moist temperament. Disease arises when there's imbalance (Soo-e-Mizaj) in these humors or organ function. CKD is conceptualized as a chronic Soo-e-Mizaj (derangement of temperament) or Daffe-e-Baul ka ikhtilal (urinary dysfunction) involving Qillat-e-tasfiya (reduced filtration of blood), Tahleel-e-mawaad (inability to metabolize and expel waste materials), Sue Tarkeeb (structural abnormality), Dafe-e-Baul ka qabz (obstruction in urination), and Istisqa (dropsy or edema due to fluid retention). It may also be described under Zauf-e-Kulya (renal weakness), particularly when associated with proteinuria, oliguria, or edema. Hippocrates (Buqrat) stated that "CKD begins in the humors before appearing in the organs." He emphasized that humoral imbalance (Akhlat) like excess black bile (Sauda) or yellow bile (Safra) can affect kidney health. Galen (Jalinoos) speculated that "Kidneys are responsible for purifying the blood and regulating fluid balance. Galen recognized the detoxification role of the kidneys and linked renal dysfunction to humoral derangement. Avicenna (Ibn Sina) in *Al-Qanoon fit Tibb* demonstrated that "Fasad-e-Mizaj of Kidney leads to their dysfunction and causes systemic disease." He described symptoms like oliguria, back pain, edema, and fatigue under kidney conditions. Advised regulation of diet, temperament, and use of renal tonics (Muqawwi-e-Kilya).

Present scenario of CKD in Type 2 Diabetes

A systematic review and meta-analysis encompassing 20 studies from 13 countries revealed that approximately 27% of individuals with type 2 diabetes have CKD. Key risk factors include advanced age, obesity, hypertension, smoking, and cardiovascular disease (Eneyew Talie Fenta, Habitu Birhan Eshetu, Natnael Kebede et al., 2023).

A meta analysis of nine studies encompassing 225,206 individuals estimated an overall CKD prevalence of 22.48% in Bangladesh—substantially above the approximately 10% global figure. Females (25.3%) were more affected than males (20.3%). In a two-phase population survey of 928 adults in Mirzapur, showed that Phase I: ~32.2% showed probable CKD. Phase II (confirmation stage after 3 months): 22.0% had confirmed CKD (stage 1: 4%, stage 2: 11.8%, stage 3: 5.5%) (Mohammad Habibur Rahman Sarker, Michiko Moriyama, Harun Ur Rashid et al.,).

Another study conducted on Urban & Slum Population Studies in Dhaka (2003-2005) showed that among 1,000 participants (age 15-65). CKD prevalence ranged from 13.1% (MDRD formula) up to 16% (Cockcroft-Gault formula). Proteinuria was detected in 7.7%, with CKD linked to age over 40, hypertension, diabetes, obesity, and tobacco use (Md Nurul Huda, Kazi Shahnoor Alam, Harun-Ur-

Rashid et al., 2012).

One study revealed that Middle Income Urban Neighborhood, Approximately 20-26% met CKD criteria. About 22% had albuminuria; 26% had CKD overall (most were early-stage, albuminuria only) (Shuchi Anand, Masuma Akter Khanam, Juliann Saquib, et al., 2014).

Another study conducted among the Dhaka Medical University Staff and showed that CKD prevalence of 9.9% (Cockcroft-Gault) and 7.2% (MDRD).Usually early-stage (1-3) and associated with known risk factors like hypertension, diabetes, older age, lower income (S Das, P K Dutta, 2010).

A decade-long analysis at ICDDR,B showed CKD prevalence between 13-26% across various datasets, noting shifts over time but a consistent burden in urban areas. Significant risk factors identified include older age, poor glycemic control, prolonged duration of diabetes, hypertension, obesity, and a family history of diabetic nephropathy (S Das, P K Dutta, 2010).

Data from diverse regions showed that in South & Southeast Asia: Bangladesh (Bangladesh urban): ~20-26% in adults, Thailand: ~17.5% Malaysia: ~9-10%, China: ~10-11% (up to 19% in Tibetan areas), Pakistan: ~30%, Nepal: ~10-11% Sub Saharan Africa:Tanzania, Senegal, DRC, Ghana surveys: ~5-17%; Latin America & Middle East: Mexico urban: 22-33%, El Salvador agricultural: ~18%, Turkey: ~16%, Iran: 5-15%, up to ~15% (John W Stanifer, Anthony Muiru, Tazeen H Jafar, Uptal D Patel., et al., 2016).

A study conducted in 2015 global meta-analysis (100 studies, ~6.9 million people) found that 13.4% overall CKD (stages 1-5), 10.6% for advanced CKD (stages 3-5) (Nathan R Hill, Samuel T Fatoba, Jason L Oke et al., 2016).

Another study conducted on 2010-2014 and found that in high-income countries: ~8.6% (men), 9.6% (women). In low & middle income countries: ~10.6% (men), 12.5% (women) (Katherine T Mills, Yu Xu, Weidong Zhang et al., 2015).

Study conducted on High Income countries showed that USA (2017-2020): ~13.9% in adults UK (circa 2007): ~8.8% symptomatic CKD; Canada (2008): ~1.9-2.3 million (~6-7% of population) ((Katherine T Mills, Yu Xu, Weidong Zhang et al., 2015).

Clinical features of CKD:

Early-Stage CKD (Stages 1-2 or GFR ≥60): Usually asymptomatic. Detected only by:

- Proteinuria/albuminuria.
- Elevated blood pressure.
- Mild changes in lab results (e.g. serum creatinine).

Symptoms in Moderate to Advanced CKD (Stages 3-5)

General Symptoms

- Fatigue, weakness.
- Loss of appetite.
- Nausea, vomiting.
- Weight loss.
- Insomnia.
- Poor concentration.

Fluid & Electrolyte Imbalance

- Swelling (edema) - feet, ankles, face.
- Shortness of breath (pulmonary edema or anemia).
- Hypertension (due to fluid overload and RAAS activation).
- Nocturia (frequent night-time urination).

- Oliguria (late stages).

Hematologic & Metabolic

- Anemia (due to reduced erythropoietin production).
- Bone pain or fractures (renal osteodystrophy - due to calcium/phosphate imbalance).
- Itching (pruritus) - due to uremia and phosphate retention.

Cardiovascular

- Left ventricular hypertrophy.
- Congestive heart failure.
- Arrhythmias.
- Pericarditis (in uremic state).

Neurologic

- Peripheral neuropathy (tingling, numbness).
- Restless leg syndrome.
- Uremic encephalopathy (confusion, seizures - in very advanced stages).

Signs Detected on Examination

- Pallor (anemia).
- Periorbital puffiness, pedal edema.
- Hypertension.
- Dry, scaly skin.
- Fetor uremicus (ammonia-like breath odor).
- Skin excoriations (due to pruritus).
- Asterixis (flapping tremor - in uremic encephalopathy).

Diagnosis of CKD: The diagnosis of Chronic Kidney Disease (CKD) involves identifying persistent kidney damage and/or reduced kidney function for at least 3 months. Diagnostic Criteria (Based on KDIGO Guidelines): CKD is diagnosed when either of the following is present for ≥3 months:

Kidney Damage Markers (with or without decreased GFR)

- *Albuminuria:* ACR ≥ 30 mg/g (≥3 mg/mmol).
- Urine sediment abnormalities (e.g., red/white cells, casts).
- Electrolyte or tubular disorders due to renal cause.
- Histological abnormalities (e.g., biopsy results).
- Structural abnormalities (via imaging: polycystic kidney, hydronephrosis).
- History of kidney transplantation.

Decreased Glomerular Filtration Rate (GFR)

- GFR < 60 mL/min/1.73 m^2 for ≥3 months.

Key Diagnostic Tests

Test	***Purpose***
Serum Creatinine	Estimate GFR (eGFR calculation)
Estimated GFR (eGFR)	Quantify kidney function
Urine Albumin-to-Creatinine Ratio (ACR)	Detect albuminuria/proteinuria
Urinalysis (dipstick, microscopy)	Detect blood, protein, or casts
Renal Ultrasound	Identify structural abnormalities
Blood Urea Nitrogen (BUN)	Assess nitrogenous waste levels
Electrolyte panel	Detect imbalances (Na^+, K^+, HCO_3^-)
Kidney biopsy *(optional)*	Diagnose specific glomerular diseases

CKD Staging (KDIGO 2021): CKD is staged based on GFR (G stages) and Albuminuria (A stages):

GFR Categories (G1-G5):

Stage	***GFR (mL/min/1.73m²)***	***Interpretation***
G1	≥90	Normal/high (with damage)
G2	60-89	Mildly ↓ (with damage)
G3a	45-59	Mild-moderate ↓
G3b	30-44	Moderate-severe ↓
G4	15-29	Severe ↓
G5	<15	Kidney failure

Albuminuria Categories (A1-A3):

Stage	***ACR (mg/g)***	***Interpretation***
A1	<30	Normal to mildly increased
A2	30-300	Moderately increased
A3	>300	Severely increased

CKD is diagnosed when GFR is <60 or ACR ≥30 for more than 3 months.

Supporting Investigations:

- ***Autoimmune tests:*** ANA, ANCA (lupus nephritis, vasculitis).
- ***Hepatitis B/C, HIV:*** rule out infections.
- ***Glycemic control (HbA1c):*** if diabetic nephropathy suspected.
- ***Lipid profile, CBC:*** for cardiovascular risk and anemia of CKD.

Biomarkers for Early Detection & Progression

- New urinary and blood biomarkers are being researched (e.g., NGAL, KIM-1, TNFR1/2).
- *Goal:* predict which patients are at highest risk and intervene earlier.

Preventive measures

Dietary Management: Early stages of CKD often present without symptoms, making prevention through lifestyle and dietary choices essential. CKD patients have to follow the specific dietary recommendation. Focus should be given on easily digestible, low-protein, low salt foods but high-quality diets to reduce uremic toxins, less acid load, better gut micro biome. Avoid barid ratab foods (cold & moist) like curd, fish and melons. Use musakkin-e-kulya (kidney tonics) like: Shaqaqul misri (*Pastinaca Sativa*-Skirret), Qust Shirin (*Saussurea costus*; Sweet Costus), Berge Qinnab (Hemp leaf; *Cannabis sativa* (Berge Qinnab) — used traditionally, not recommended in modern practice), Zanjabeel (Ginger) and Qaranfal (Clove) — warming herbs. Diabetes with Kidney Disease patients should be given focus on blood sugar control (low-glycemic index foods). For the patients of Kidney Stones it is recommended to limit oxalates (spinach, chocolate) and increase citrate intake (lemon water) and Intermittent Fasting which may help slow CKD progression but needs careful monitoring.

Protein: This was observed that excess protein may produce more nitrogenous waste which lead to higher kidney workload. It is recommended protein intake for stage 1-3 of CKD (0.8-1.0g/kg-body weight), stage 4-5 (Non dialysis patients-0.6-0.8g/kg-body weight) and for dialysis patients (1.2-1.4 g/kg -body weights). Again for Non-Diabetic CKD Stages 3-5: 0.55-0.60 grams of protein per kilogram of body weight per day and Diabetic CKD Stages 3-5: 0.6-0.8 grams of protein per kilogram of body weight per day is recommended.

Sodium (Salt): It is recommended that sodium intake should be restricted less than 2,000 mg/day (≈ 1 tsp of salt) and avoids pickles, processed foods, canned soups, salty snacks and restaurant/fast food (hidden salt!).

Potassium: It is also recommended for CKD patients to restrict potassium containing fruits like Bananas, oranges, potatoes, tomatoes, spinach, avocados, dried fruits and coconut water. It can be taken lower potassium alternatives such as Apples, berries, grapes, cabbage, zucchini, white rice.

Phosphorus: Avoid high phosphorus (<800-1,000 mg/day) containing foods like dairy (cheese, milk), nuts, beans, dark sodas, chocolate and organ meats.

Fluids: To prevent fluid overload when urine output is low at Stages 4-5. It is needed to restrict on the basis of urine output, dialysis status, swelling, shortness of breath, high BP, weight gain, It is recommended to limit urine output more than 500 mL (in dialysis patients).

It is advice to take kidney friendly foods like Carbs (white rice, pasta, white bread & oats), Protein (egg whites & chicken), Veggies (cabbage, cauliflower & bell peppers), fruits (Apples, berries, grapes & pineapple), Fluids (water, low-potassium herbal teas) and Fats (olive oil, unsalted butter/margarine). Dietary modifications play a crucial role in preventing the onset and progression of CKD. This comprehensive guide explores various dietary strategies to maintain optimal kidney health.

Therapeutic Life-style modifications: In addition to diet, other lifestyle choices significantly impact kidney health:

- ***Regular Physical Activity:*** Engaging in consistent exercise helps control blood pressure and blood sugar levels, reducing CKD risk.
- ***Adequate Hydration:*** Drinking sufficient water supports kidney function by aiding in the removal of toxins.
- ***Avoiding Tobacco and Excessive Alcohol:*** Both can harm kidney function and overall health.
- ***Maintaining a Healthy Weight:*** Achieving and sustaining an appropriate weight reduces the burden on the kidneys.

Recommended Diet chart for Chronic Kidney Disease (CKD)
(For Non-Dialysis Patients, Moderate Protein Restriction)

Meal	***Food Choices***
Early Morning (6:30-7:00 AM)	1 cup lukewarm water with lemon + 2 soaked almonds + 1 walnut
Breakfast (8:00-9:00 AM)	- Oats with milk (phosphorus binder if prescribed) OR 1 egg white with white bread toast OR 1 vegetable stuffed chapatti (no tomato/spinach) + mint chutney
Mid-Morning Snack (10:30-11:00 AM)	- 1 small apple/pear/papaya OR A handful of unsalted puffed rice + herbal tea
Lunch (1:00-2:00 PM)	- 1 cup white rice OR wheat chapati without salt + 1 cup vegetable (bottle gourd) or ridge gourd) + ½ cup curd (if potassium is controlled) + 1 glass plain water
Evening Snack (4:30-5:00 PM)	- Unsalted crackers with cucumber + 1 cup herbal tea OR ½ cup puffed rice (light snack) + coconut water (if potassium is normal)
Dinner (7:30-8:00 PM)	- 1 bowl vegetable khichuri (white rice + moong dal) OR 1 small roti with mixed vegetable (no high potassium veggies)
Bedtime Snack (9:30-10:00 PM)	- 1 cup warm milk (low phosphorus, as advised) OR 5-6 soaked almonds

Chronic Kidney Disease (CKD) Diet Plan (Bangladesh Edition)
(For Non-Dialysis CKD Patients - Moderate Protein Restriction)

Meal	***Food Choices***
Early Morning (6:30-7:00 AM)	1 glass lukewarm water with a few drops of lemon juice + 2 soaked almonds + 1 walnut
Breakfast (8:00-9:00 AM)	- 1 bowl chira (flattened rice) with milk (boiled to remove excess potassium) OR 1 egg white + 1 slice white bread OR 1 roti with cucumber and mint chutney (no tomato)
Mid-Morning Snack (10:30-11:00 AM)	- 1 small guava/apple/papaya OR 1 bowl puffed rice (muri) with a few unsalted peanuts
Lunch (1:00-2:00 PM)	- 1 small bowl plain white rice + 1 bowl vegetable curry (lau, tori, patol, pumpkin) + 1 piece small fish (rui/ilish, without bones) OR 1 boiled chicken piece (no skin) + ½ cup plain yogurt (if phosphorus is controlled)
Evening Snack (4:30-5:00 PM)	- 1 cup milk tea without sugar + 1 homemade biscuit OR Unsalted puffed rice (muri) with a little mustard oil & chopped onions (small amount)
Dinner (7:30-8:00 PM)	- 1 small bowl vegetable khichuri (white rice + moong dal) OR 1 roti with mixed vegetables (no tomato/spinach/potato)
Bedtime Snack (9:30-10:00 PM)	- 1 glass warm milk (low phosphorus, as advised) OR 5-6 soaked almonds

Treatment of CKD

Recent research has introduced advanced machine learning models, such as a fine-tuned CatBoost algorithm, to improve CKD detection efficiency. This model achieved an accuracy of 98.75% and utilized explainable AI techniques to identify significant clinical features like serum creatinine and albumin levels, aiding early diagnosis, especially in resource-constrained settings.

SGLT2 Inhibitors (Game-Changers): Sodium-Glucose Co-Transporter 2 inhibitors are a class of oral medications initially developed to treat type 2 diabetes by helping the kidneys remove excess glucose through urine. These are:

1. ***Dapagliflozin and Empagliflozin, Canagliflozin and Ertugliflozin:*** These are having lower risk of kidney failure, increase cardiovascular protection and reduced proteinuria
2. ***Finerenone (Non-steroidal Mineralocorticoid Receptor Antagonist):*** It reduces inflammation and fibrosis in the kidneys especially effective in diabetic CKD with proteinuria and shown to reduce kidney disease progression and heart failure risk
3. ***HIF-PH Inhibitors (New for Anemia in CKD):*** Roxadustat and Vadadustat are stimulated to endogenous erythropoietin production
4. ***Semaglutide:*** Ozempic, a GLP-1 receptor agonist initially approved for type 2 diabetes, has received FDA approval to reduce the risk of kidney disease progression in adults with type 2 diabetes and CKD. Clinical trials demonstrated a 24% reduction in CKD progression and a 5% decrease in heart disease-related deaths among over 3,500 participants.
5. ***Sotagliflozin:*** Sotagliflozin, a dual SGLT1 and SGLT2 inhibitor, has been shown to significantly reduce heart attacks, strokes, and cardiovascular-related deaths in patients with type 2 diabetes and CKD. A study involving 10,584 patients reported a 23% reduction in these events compared to placebo.

Holistic Management of CKD: It is needed to shift from "just kidney" to integrated care for heart, kidney, and metabolic health. Collaborative models with nephrology, cardiology and endocrinology are best of choice to treat CKD with cardio metabolic disorders.

The Greco-Arabic measures for CKD: The treatment principle is Ilaj bil Zid (treatment by opposite's temperamental drug/therapeutic measures) for restoring humoral balance.

- ❖ Tanqeeyah (Detoxification / Elimination of morbid humors)
- ❖ Fasd (venesection) — only for selected cases (Imtela or plethora without anemia) to remove harmful blood.
- ❖ Hammam (steam therapy) to eliminate toxins through sweat with direct supervision by the expert of regimental therapy.
- ❖ Qai (emesis) or Ishal (purgation) — with herbal formulations to cleanse the gut and body if needed.
- ❖ Massage with medicated oils — to improve circulation and support elimination.
- ❖ Relaxation techniques — to reduce systemic stress, as mental stress is believed to impact organs.
- ❖ Tadeel-e-Mizaj (Correction of temperament) by using of herbs with hot and dry temperament to balance cold/moist kidney state.
- ❖ Dietary Regimen (Ilaj bil Ghiza)- Easily digestible, low protein, low salt foods. Avoid barid ratab foods (cold & moist) like curd, fish, melons,
- ❖ Musakkin-e-kulya (kidney tonics) -Shaqaqul misri (Skirret), Qust Shirin (Sweet Costus), Zanjabeel (Ginger) and Qaranfal (Clove).
- ❖ Herbal Formulations-Habb-e-Kabid Naushadri, Majoon Dabeed-ul-Ward, Sharbat Bazoori Motadil, Qurs Kushta Faulad (if anemia coexists), Arq-e-Mako, Arq-e-Kasni, Arq-e-Gulab as diuretic and detoxifying agent.

Integration with Modern Care: Greeco-Arabic medicine is increasingly being used as complementary or adjunct or adjuvant to allopathic treatments. Caution should be taken in advanced CKD stages to avoid nephrotoxicity.

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