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To study the effect of dietary modification on Hemodialysis patients
Estudio del efecto de modificación de la dieta en pacientes bajo tratamiento de hemodiálisis

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ABSTRACT

Chronic kidney disease is a world wide public health challenge since patients with end-stage renal disease (ESRD) have to live on haemodialysis (HD) for the rest of their lives unless a kidney donor and a successful kidney transplantation is carried out. Patients on HD have increased mortality compared with the general population. Several factors can play a negative role and increase risk of mortality among HD patients, particularly cardiovascular diseases. An important non cardiovascular risk factor of mortality among HD patients is malnutrition. Malnutrition in HD patients is due to restrictive food recommendations, poor appetite, and drug-related factors. Protein energy wasting (PEW) are common in patients with chronic kidney disease (CKD), especially in patients on dialysis either on haemodialysis or peritoneal dialysis. One of the most important factors affecting the quality of life of chronic kidney disease (CKD) patients is nutrition. Prevention of malnutrition increases patients quality and length of life.

AIM OF THE STUDY

The aim of this review is to discuss the role of dietary modification of patients on dialysis

Keywords: haemodialysis, protein energy wasting, mortality, nutritional status.

RESUMEN

La enfermedad renal crónica (ERC) es un desafío mundial para la salud pública desde que pacientes con enfermedad renal en etapa terminal (ERET), tienen que vivir bajo tratamiento de hemodiálisis (HD) por el resto de sus vidas, a menos que se consiga un donante de riñón y se lleve a cabo un trasplante de riñón de manera exitosa. A comparación con la población general, ha aumentado la mortalidad de pacientes en HD. Varios factores pueden ocupar un rol negativo e incrementar el riesgo de mortalidad en pacientes en HD, particularmente en enfermedades cardiovasculares. La malnutrición es un factor de riesgo no cardiovascular de mortalidad importante en pacientes bajo HD. Aquello se debe a recomendaciones nutricionales restrictivas, falta de apetito y factores relacionados con los medicamentos. El desgaste proteico energético (DPE) es común en pacientes con ERC, en especial en pacientes en diálisis, ya sea hemodiálisis o diálisis peritoneal. Uno de los factores más importantes que afectan la calidad de vida de pacientes con ERC es la nutrición. La prevención de la malnutrición aumenta la calidad y esperanza de vida de los pacientes.

OBJETIVO DEL ESTUDIO

El objetivo de esta investigación es abordar el rol de la modificación de la dieta en pacientes en diálisis.

Palabras clave: hemodiálisis, desgaste proteico energético, mortalidad, estado nutricional.

INTRODUCTION

Chronic kidney disease (CKD) is now a general well being problem. (1) CKD is a moderate, dynamic and irreversible loss of kidney function.(2)

Hemodialysis (HD) is the most well-known renal treatment today. (3)

People experiencing dialysis have a noteworthy pervasiveness of ailing health, which is named mild, moderate, and severe. (4)

The cause of malnutrition is multifactorial and includes inadequate food intake, hormonal and gastrointestinal disorders, dietary restrictions.

Malnutrition is considered as a marker of poor prognosis in CKD.(5,6). The patients nutritional status is inversely associated with increased risk of hospitalization and mortality, thus constituting an important risk factor for the outcome of these patients. (7). Therefore, assessing the nutritional status of patients is essential both to prevent malnutrition and to indicate appropriate intervention in malnourished patients. It is assessed that malnutrition is present in approximately 20-50% of patients with advanced kidney disease. (8).

Nutritional assessment tools

There are various ways of assessing the nutritional status of Chronic Kidney Disease (CKD) patients.

1- Anthropometry
2- Biochemical parameters
3- Nutritional assessment tools

Anthropometry

Anthropometric measurements are a series of quantitative measurements of the muscle, bone, and fat tissue used to evaluate the composition of the body.

There are four major types of anthropometric measurements.

BMI (Body Mass Index)

$$BMI = \frac{\text{Weight (in kgs.)}}{\text{Height}(m^2)}$$

Weight: Weight measurement should be in kilograms.

Equipment used to measure weight:

- Weight scale
- Calibration weights

Height: When measuring height, the patient should stand with his or her heels together and weight evenly distributed. Patient positioning should be with the shoulder blades, buttocks, and heels on the stadiometer's vertical backboard. If not able to have all three points of contact on the vertical backboard, the heels and buttocks must touch the vertical backboard. Feet should face outward at a 60-degree angle.

Equipment used to measure height:

- Stadiometer
- Tape measure
- Infantometer to measure recumbent length

BMI chart (9)

	BMI
Underweight	< 18.5
Normal weight	18.5-24.9
Overweight	25-29.9
Obese	>30

Grading chart of obesity based on BMI endorsed by who

Grade	Range
Grade III	>40
Grade II	30-40
Grade I	25-29.9
Not Obese	<25

Body circumferences (waist, hip, and limbs)

Waist circumference

It is the most practical tool a dietitian can use to evaluate a patient's abdominal fat before and during weight loss treatment.

According to National Institute of Health, if more fat is located around your waist rather than around your hips, you are at higher risk for conditions including heart disease and TYPE 2 Diabetes.(10).

Limbs measurement

To measure upper leg length, have the patient seated with legs at a 90-degree angle. Then, run the measuring tape from the inguinal crease immediately distal to the ASIS to the proximal aspect of the patella.

To measure upper arm length, find the superior edge of the spine of the scapula. Then, run the measuring tape down the center of the triceps to the olecranon.

Equipment used to measure body circumference

1. Knee callipers
2. Skinfold callipers

Mid upper arm circumference (MUAC)

The patient stands upright with the arm hanging freely at the side. The patient should not flex the arm muscles. Measuring tape placement should be snugly around the mid-point of the arm without compressing the skin.

Biochemical parameters

1. Serum Creatinine

2. Serum Sodium
3. Serum Potassium
4. Serum Phosphorus

Serum creatinine

A serum creatinine test measures the level of creatinine in your blood and provides an estimate of how well your kidneys filter (glomerular filtration rate). Results of the creatinine blood test are measured in milligrams per decilitre .The normal range for creatinine in the blood may be 0.84 to 1.21 milligrams per decilitre , although this can vary from lab to lab, between men and women, and by age. Since the amount of creatinine in the blood increases with muscle mass, men usually have higher creatinine levels than do women.

Generally, a high serum creatinine level means that your kidneys aren't working well. Your creatinine level may temporarily increase if you're dehydrated, have a low blood volume, eat a large amount of meat or take certain medications. The dietary supplement creatine can have the same effect.

Serum sodium

Hyponatremia is among the most common electrolyte disorders in dialysis patients. (Hoorn E.J.et.al).Patients with end-stage renal disease are uniquely predisposed to hyponatremia, and a number of shared and distinct risk factors may be contributory among those receiving hemodialysis versus peritoneal dialysis. A number of epidemiologic studies have sought to identify clinical characteristics associated with hyponatremia in the hemodialysis population.

A large body of data has shown that there is an inverse association between lower serum sodium levels and higher mortality risk in hemodialysis patients.

Serum potassium

Potassium is abundant in the ICF compartment in the body and its excretion primarily depends on renal (about 90%), and to a lesser extent (about 10%) on colonic excretion. Total body potassium approximated to 50mmol/kg body weight and 2% of total body potassium is in the ECF compartment and 98% of it in the intracellular compartment. Dyskalemia is a frequent electrolyte imbalance observed among the maintenance hemodialysis patients. In case of hyperkalemia, it is frequently "a silent and a potential life threatening electrolyte imbalance" among patients with ESRD under maintenance hemodialysis. The prevalence of hyperkalemia in maintenance HD patients was reported to be about 8.7-10%. Mortality related to the hyperkalemia has been shown to be about 3.1/1,000 patient-years and about 24% of patients with HD required emergency hemodialysis due to severe hyperkalemia.

The kidney plays a key role in maintaining potassium ([K]) homeostasis by excreting excess potassium. Potassium excretion primarily depends on renal (about 90%), and to a lesser extent (about 10%) on colonic excretion.(11).

Serum phosphorus

Hyperphosphataemia, a common biochemical abnormality in Haemodialysis, poses significant management challenges. Epidemiological and observational studies have shown a strong association between hyperphosphataemia and mortality in dialysis patients.(12). Adequate control of serum phosphate levels in patients undergoing haemodialysis (HD) is poorly achieved.(13)Reasons proposed for this are multifactorial and include poor knowledge of consequences of phosphate control, poor understanding of the low phosphate diet and poor adherence with the diet and phosphate binders.(14)

Nutritional assessment tools

Tools used to do nutritional assessment in CKD patients

There are many instruments or assessment tools used for measuring CKD patient's nutritional status such as:

1. Malnutrition Screening Tool (MST)
2. Mini Nutritional Assessment (MNA)
3. Malnutrition Universal Screening Tool (MUST)
4. Nutrition Risk Screening (NRS-2002)
5. Subjective Global Assessment (SGA)

Malnutrition screening tools (MST)

This has been used for acute hospital patients; it incorporates 3 components:

Components	Score
Weight loss	0 or 2
Amount of weight loss	1-4
Poor food intake or poor appetite	0 or 1

Mini nutritional assessment (MNA)The total score ranges from 0 to 14. It comprises 6 components:

Components	Score
Declining food intake over 3 months	0-2
Weight loss during the past 3 months	0-3
Mobility	0-2
Psychological stress in the past 3 months	0-2
Neuropsychological problems	0-2
BMI	0-3

Malnutrition universal screening tool (MUST)

MUST was developed and validated in 2003 and has been promoted by BAPEN as a nutrition screening tool. It consists of 3 components:

Components	Score
Current weight status measured by BMI	0 to-2
Unintentional weight loss	0 to -2
Acute disease effect producing no nutritional intake for >5 days	0 or 2

Nutrition risk screening (NRS-2002)

This has been developed for hospitalized patients. It has 5 components. Each component is scored from 0 to 3; the total score ranges from0 to 15. Components are: unintentional weight loss in the past 3 months, BMI, appetite, ability to eat or retain food and Clinical or medical stress factor.

Dialysis malnutrition score (DMS)

The DMS consists 7 original SGA components (weight change, dietary intake, gastrointestinal symptoms, functional capacity, disease and physical examination of signs of muscle and fat wasting) provides a 5 point ranging from 1 to 5.

Subjective global assessment (SGA)

It has been widely used tool for nutritional assessment. SGA tool was proposed to be a quicker and superior tool.

Subjective global assessment form

Medical history
Patient name : _____Date :_____

Nutrient intake

1. No change ()
2. Inadequate ( ) ; duration of inadequate intake_____

- Suboptimal solid diet
- Full fluids or only oral nutrition supplements
- Minimal intake, clear fluids or starvation

3. Nutrient Intake in past 2 weeks*

- Adequate
- Improved but not adequate
- No improvement or inadequate

TM MC

Weight

Usual weight_____ Current weight_____

1. Non fluid weight change past 6 months Weight loss (kg)

- <5% loss or weight stability
- 5-10% loss without stabilization or increase
- >10% loss and ongoing

If above not known, has there been a subjective loss of weight during the past six months?

- None or mild
- Moderate
- Severe

2. Weight change past 2 weeks* Amount (if known)

- Increased
- No change
- Decreased

Symptoms (Experiencing symptoms affecting oral intake)

1. (A)Pain on eating (B) Anorexia (C)Vomiting (D)Nausea (E)Dysphagia (F)Diarrhea (G)Dental problems (H) Feels full quickly (I)Constipation
   2. (A)None (B)Intermittent/mild/few (C)Constant/severe/multiple
   3. Symptoms in the past 2 weeks*
   (A)Resolution of symptoms (B)Improving (C) No change or worsened

Functional capacity (Fatigue and progressive loss of function)

1. No dysfunction
2. Reduced capacity; duration of change_____
   (A)Difficulty with ambulation/normal activities (B)Bed/chair-ridden
   3. Functional Capacity in the past 2 weeks*
   (A)Improved (B)No change (C) Decrease

Metabolic requirement

High metabolic requirement (A) No (B)Yes

Physical examination

Loss of body fat	(A)No	(B)Mild/Moderate	(C) Severe
Loss of muscle mass	(A) No	(B)Mild/Moderate	(C)Severe
Presence of edema/ascites	(A) No	(B)Mild/Moderate	(C)Severe

SGA rating

(A) Well-nourished

Normal

(B) Mildly/moderately malnourished

Some progressive nutritional loss

(C)Severely malnourished

Evidence of wasting and progressive symptoms

Contributing factor

CACHEXIA - (fat and muscle wasting due to disease and inflammation)

SARCOPENIA - (reduced muscle mass and strength)

Subjective global assessment guidance for body composition

Subcutaneous fat

Physical examination	Normal	Mild/Moderate	Severe
Under the eyes	Slightly bulging area	Somewhat hollow look, Slightly dark circles	Hollowed look, depression, dark circles
Triceps	Large space between fingers	Some depth to fat tissue, but not ample. Loose fitting skin.	Very little space between fingers, or fingers touch
Ribs, lower back, sides of trunk	Chest is full; ribs do not show. Slight to no protrusion of the iliac crest	Ribs obvious, but indentations are not marked. Iliac Crest somewhat prominent	Indentation between ribs very obvious. Iliac crest very prominent

Muscle wasting

Physical examination	Normal	Mild/Moderate	Severe
Temple	Well-defined muscle	Slight depression	Hollowing, depression
Clavicle	Not visible in males; may be visible but not prominent in females	Some protrusion; may not be all the way along	Protruding/prominent bone
Shoulder	Rounded	No square look; acromion process may protrude slightly	Square look; bones prominent
Scapula/ribs	Bones not prominent; no significant depressions	Mild depressions or bone may show slightly, not all areas	Bones prominent; significant depressions
Quadriceps	Well defined	Depression/atrophy medially	Prominent knee, Severe depression medially
Interosseous muscle between thumb and forefinger (back of hand)	Muscle protrudes; could be flat in females	Slightly depressed	Flat or depressed area

Fluid retention

Physical examination	Normal	Mild/Moderate	Severe
Edema	None	Pitting edema of extremities / pitting to knees, possible sacral edema if bedridden	Pitting beyond knees, sacral edema if bedridden, may also have generalized edema
Ascites	Absent	Present (may only be present on imaging)	

A - Well-nourished no decrease in food/nutrient intake; < 5% weight loss; no/minimal symptoms affecting food intake; no deficit in function; no deficit in fat or muscle mass OR *an individual with criteria for SGA B or C but with recent adequate food intake; non-fluid weight gain; significant recent improvement in symptoms allowing adequate oral intake; significant recent improvement in function; and chronic deficit in fat and muscle mass but with recent clinical improvement in function.

B - Mildly/moderately malnourished definite decrease in food/nutrient intake; 5% - 10% weight loss without stabilization or gain; mild/some symptoms affecting food intake; moderate functional deficit or recent deterioration; mild/moderate loss of fat and/or muscle mass OR *an individual meeting criteria for SGA C but with improvement (but not adequate) of oral intake, recent stabilization of weight, decrease in symptoms affecting oral intake, and stabilization of functional status.

C - Severely malnourished severe deficit in food/nutrient intake; > 10% weight loss which is ongoing; significant symptoms affecting food/ nutrient intake;severe functional deficit OR *recent significant deterioration obvious signs of fat and/or muscle loss.

Stages of CKD

Stages 1 and 2: There is increased creatinine or urea in the blood, blood and/or protein in the urine, a family history of polycystic kidney disease, or evidence of kidney damage on radiologic exams.*(14).*

Stage 3: As patients progress to stage 3, they will experience uremia, anemia, high blood pressure, and slight metabolic bone disorders. These disturbances will lead to fatigue, fluid accumulation, decreased urine output, sleep disturbances, and kidney pain.

Stage 4: As patients progress to stage 4, uremia, anemia, high blood pressure, and bone disorders become more prominent.

Stage 5: In stage 5, the patient has reached full kidney failure.

CKD Stages and Associated GFR (*Kopple JD.)*

CKD Stage	GFR
Normal	≥ 90
Mild	60 to 89
Moderate	30 to 59
Severe	15 to 29
Failure	< 15

Process of determination of subjective global assessment tool on CKD patients

Malnutrition is a common problem in CKD patients as metabolic system gets disturbed and patients lead to poor appetite and weight loss.

Subject Global Assessment shows both physical and medical data. This include weight and appetite changes, functional status , medical history, etc.

The Academy and the KDOQI recommend that during each visit, dietitian should conduct an SGA and physical measurement of the patient, weigh the patient, check the patient's recent lab results for protein , and monitor the patient's sodium, and fluid intake. This can be done by using the following six evidence-based guidelines:

Nutritional assessment

In nutritional assessment following assessment such as energy status , calorie intake, protein intake, sodium intake, potassium intake and fluid intake should be done**.**

Dietary recommendation for CKD patients

Energy: the patient must take sufficient calories which will provide energy to the body. Patients are usually given simple carbohydrates and mono and polyunsaturated fats.

30-35 kcal/kg/d.

Protein**:** in patients with extremely high BUN , high biological value protein is recommended. Beginning renal insufficiency is usually referred to as a predialysis situation and requires restriction of protein intake. Patients on haemodialysis should be recommended high protein diet. Animal protein foods are called complete proteins as they provide all the essential amino acids. However, these are usually high in fat and cholesterol. Hence there intake should be controlled. Vegetarian sources of protein should be combined with milk products to get complete proteins.

g/kg/d (for dialysis)

0.6 g/kg/d (for CKD patients)

Sodium: the sodium intake of patients with renal failure must be restricted to prevent sodium retention in the body, and hence oedema.

The following guidelines are recommended for sodium intake in CKD patients:

Stages 1 to 4 CKD: 1 g to 3 g/daily

Stages 1 to 4 CKD with hypertension: Fewer than 2.4 g/daily

Stage 5 CKD on dialysis: 750 mg to 1,000 mg/daily

Potassium: potassium needs to be evaluated on individual basis. Hypokalemia can cause cardiac arrhythmias and eventually cardiac arrest. Hyperkalemia can be life threatning. To maintain potassium levels between 3.5 and 5.5 mEq/L, patients should consume at least 4 g of potassium daily for stages 1 and 2 CKD or fewer than 2.4 g daily for stages 3 to 5 and transplant recipients.

Fluid intake: patients who are predialysis and those who are on dialysis need to restrict fluid intake. All foods contain some fluids, but it is especially important to count water,tea,coffee,milk,juices,soup etc. as the part of the allowance**.**

CONCLUSION

This study report suggests, in spite of nutritional counseling there is considerable proportion of patients have deviated from dietary guidelines which can be minimized with reinforcing counseling by dietitians and other health care providers. In hemodialysis patients, the dietitians and other health system personnel should identify strategies to improve communication with reinforcing dietary counseling to patients and family members to help them to adhere with treatment regimen, and dietary guidelines. The assessment of nutritional needs and dietary modifications in patients with CKD, or on haemodialysis can become easy with a close co-ordination between nephrologist, dietician.

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