

Nutrition in CKD

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Agenda

- Nutrition 101
- Macronutrients Carbs, Protein, Fat,
- Digestion and Metabolism
- Overview of a Dialysis PN
- Review to Adequate Nutrition
- Overview of Malnutrition
 - Terminology and Classification
- Nutrition Needs for Dialysis Patients
- Assessing malnutrition/PEW in Patients
 - ANDA/NPEN
 - Anthropometrics
 - Intake
 - Appetite
 - International Society of Renal Nutrition and Metabolism
 - Body Mass
 - Serum Values
 - Muscle Mass
 - Intake
 - Lab Values to assess Nutritional Status
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 - INCR
 - Lipids
 - Cholesterol
 - Protein Sources
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 - Supplements
 - Dairy based
 - Egg based
 - Plant-based Protein
 - Alternative Approaches to improve Nutrition
 - IDPN

Nutrition 101

Basic Nutrition - Macronutrients

Fats → little fatty acids- (creates a milky solution)

Carbohydrates → Glucose or dextrose

Protein → Amino Acids --Building Blocks for many other functions in our bodies

- Repairs and builds new cells -- Basis of other protein molecules:
- Red and white blood cells, immune factors and antibodies etc

Nutrition: What's In Our Food

Carbohydrates

Simple

Complex

Protein: High Biological or Other

Fats

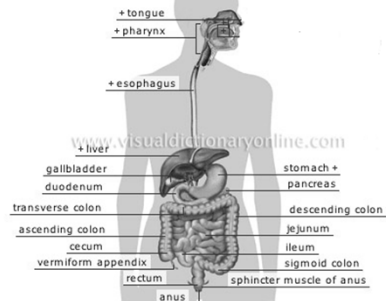
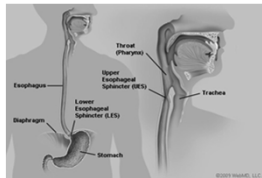
Minerals

Vitamins

Phytochemicals

Water

Digestion



Typical Profile of a Dialysis Patient

- Average age 62
- Chronically ill
- Has multiple other co-morbidities
- Over 50% have Diabetes
- Average BMI is 29.14
- Not in Fluid Balance
- On a Restricted Diet

Nutrition Barriers

- Knowledge- healthy vs. Convenient
- Appetite: Causes and Effects
- Ability to Shop - \$ or Physically
- Ability to Prepare
- Uremia
- Depression
- Dental Problems
- Swallowing
- GI issues: malabsorption, gastroparesis, Constipation, Diarrhea
- Acidosis

Nutrition Barriers

- Mineral Bone Disease
- Inflammation
- Liver Disease
- Inadequate Amino Acids
- Imbalance of Amino Acids
- Altered hormone levels

Nutrition Status Statistics

- Poor nutritional status has been known to have unfavorable effects.
- Individuals with less than 80% expected total body protein levels have demonstrated increased morbidity
- 10% or greater unintentional weight loss has been associated with adverse outcomes and prolonged hospitalizations.
- In lean healthy subjects, weight loss over 35%, protein loss over 30%, and fat loss over 70% from baseline has been associated with death.^[3]

Malnutrition

- The literature reports 18–75 % of people receiving maintenance dialysis have evidence of protein deficits [1].
- Measures of nutritional status generally deteriorate with time in patients with Stage 5 kidney disease, even in the presence of excellent dialytic care and close nutritional monitoring and interventions [3].
- Nutritional status is an important predictor of increased hospitalization rate, hospital days, and mortality.
- Therefore, assessing and optimizing nutritional status is important to improve patients' quality of life, optimize clinical outcome, and help control cost of care.

Terms Related to Under Nutrition

- **Cachexia**- Cytokine induced malnutrition that changes acute phase proteins and nullifies the body's adaptive starvation response.
- **PEW**- decreased body stores of protein and energy r/t metabolic stress
- **PEU** – Generalized term for metabolic derangement driven by pro-inflammatory response and reduced protein & energy intake.

Terms Related to Under Nutrition (cont.)

- **Sarcopenia** – Age-related loss of lean mass. Fat subtly replaces muscle due to blunting of anabolic response.
- **Sarcopenia Obesity** – Muscle wasting associated with pre-cachexia. Seen as unintended weight loss and systemic inflammation in obese patients with chronic disease.
- **Starvation** – Complete lack of nutrients. Acute, severe form of PEU.

Nutrition Needs

Dialysis Patient

- Energy:
 - 30 – 35 kcal/kg/d
- Protein:
 - 1.2 – 1.3 g/kg/d
 - 50% from HBV
- Phosphate (mg/d) 800–1000
- Potassium (mg/g) 2000–2500
- Sodium (g/d) 1.8–2.5
- Fluid (ml) 1000+urine volume

Non-Dialysis Patient

- Energy:
 - 25 kcal/kg/d
- Protein:
 - 0.8 – 1.0 g/kg/d

*Individual requirements may differ in acute conditions

Increased needs: Catabolic State

- Multifactorial
 - Poor appetite/intake
 - Increased leptin
 - Fatigue
 - Protein loss during treatments
 - 8 – 12 g amino acids / treatment average
 - 5 – 20 g amino acids/ treatment range
 - Inflammation
 - Hypermetabolic / hypercatabolic

ROLE of PROTEIN- >225,000

- Makes up critical cell structure, visceral, Hemoglobin, WBC, connective tissue, *Albumin one of multiple*
- Enzymes, hormones, antibodies.
- Skin /collagen
- Protein synthesis crucial for tissue repair
- LBM (Lean body mass) -75% of normal body weight- 50-60% muscle mass
- EVERY protein molecule has a role
- Any loss in LBM can be detrimental

Loss of Lean Body Mass Complications

% LBM	Complication	Associated Mortality
10%	Decreased Immunity, Increased infections	10%
20%	Healing Stops, weakness increases, Infections increase	30%
30%	Too weak to sit, skin breakdown-pressure sores develop, surfactant lining compromised-pneumonia, healing stops	50%
40%	Death	100%

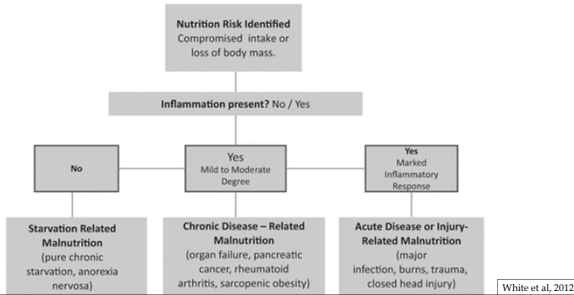
Domline 2008

AND & ASPEN Consensus Malnutrition Characteristics

- Unintentional weight loss
- Evidence of inadequate intake
- Loss of muscle mass
- Loss of subcutaneous fat
- Fluid accumulation
- Reduced hand grip strength

The presence of two or more are necessary for the diagnosis of malnutrition

Etiology-based malnutrition



Chronic Disease Malnutrition Criteria – Unintentional Weight Loss

- **Severe**
 - > 20 % in 1 year
 - > 10 % in 6 months
 - > 7.5% in 3 months
 - > 5 % in 1 month
- **Moderate**
 - 20 % in 1 year
 - 10 % in 6 months
 - 7.5 % in 3 months
 - 5 % in 1 month

Chronic Disease Malnutrition Criteria – Energy intake

- **Severe**
 - < 75 % estimated energy requirement in, ≥ 1 month
- **Moderate**
 - < 75 % estimated energy requirement in, ≥ 1 month

Chronic Disease Malnutrition Criteria – Physical Exam Parameters

- **Subcutaneous fat loss**
 - Orbital region
 - Upper arm
 - Thoracic and lumbar
- **Hand Grip Strength**
 - N/A in moderate
 - Measurably reduced in severe



Chronic Disease Malnutrition Criteria – Physical Exam Parameters (cont'd)

- **Edema**
 - Rule out other causes
 - Dry weight
- **Muscle loss**
 - Temporalis
 - Clavicle bone region
 - Clavicle and acromion bone region
 - Scapular bone region
 - Interosseous muscle
 - Patellar region
 - Anterior thigh region
 - Posterior calf region)
 - (Lower body less sensitive to change)



International Society of Renal Nutrition and Metabolism criteria for PEW

- **Body mass**
 - BMI > 23 using edema free or post-dialysis weight
 - Total body fat < 10%
 - Unintentional non-edema wt loss (5% over 3 months or 10% over 6 months)
- **Serum values**
 - Albumin < 3.8 g/dL
 - Transthyretin < 30 mg/dL
 - Cholesterol < 100 mg/dL

National Kidney Foundation, 2015

International Society of Renal Nutrition and Metabolism criteria for PEW (cont)

- Muscle mass
 - Reduced muscle mass (5% over 6 months or 10% over 6 months)
 - MAMC area 10% below 50th percentile of ref population
 - Creatinine appearance
- Dietary intake
 - Unintentional low protein intake (< 0.8 g/kg/d)
 - Unintentional low calorie intake (< 25 kcal/kg for > 2 months)

National Kidney Foundation, 2015

Visceral Proteins/Acute Phase Reactants

Negative

- Albumin
- IGF-1 (Insulin-like Growth Factor)
- Pre-Albumin
- Retinol binding Protein (RBP)
- Transferrin

Positive

- Ferritin
- C-Reactive Protein (CRP)

Albumin Marker in CKD

RISK	Albumin	Relative RISK of Death
Mild	> 4.0	Reference goal
Moderate	3.5 – 4.0	2 x RRD
Severe	3.0 - 3.5	5 x RRD
Most Severe	<2.5 – 3.0	7-8 x RRD

Lowrie and Lew Data; 1990 n: >12,000 patients

Relationship Between Nutrition & Albumin

- Fresenius Medical Care, North America ESRD patients n = 77, 205
- nutritional interventions:
 - IDPN
 - daily oral dietary assistance or supplementation
 - intradialytic oral nutrition (IDON)
- nutrition interventions improved serum albumin on average by ~ 0.2 g/dL

Lacson et al, 2007

"Power of 0.2"

Increasing albumin by 0.2

- 30% decreased risk of hospitalization due to infection
- 25% decrease in the odds of death
- Could theoretically save our medical system 36 million/year

Normalized Protein Catabolic Rate (nPCR)

- Used interchangeably with nPNA (normalized protein equivalent of total nitrogen appearance)
- Estimates protein intake as g/kg/d
- Low nPCR indicates poor nutritional intake
 - ≥ 1.2 = ideal
 - > 1.4 = excessive intake, excessive LBV, or catabolism
 - $1.0 - 1.1$ = Marginal - Inadequate
 - $0.7 - 0.9$ = Inadequate
 - $0.6 - 0.69$ = Oral supplementation
 - < 0.59 = aggressive nutrition support

National Kidney Foundation, 2015

Lipids

- < 100 mg/dL total cholesterol criteria for PEW
- Paradox
 - Reverse association between cholesterol concentration and mortality in dialysis patients, short-termed
 - Consistent with similar reverse epidemiology seen with protective BMI seen in the obesity paradox

How to Increase Albumin and improve nutritional status

- Oral –FOOD – HBV protein
- Supplements – most pts require
- ONS program – outcomes
 - Decreased hospitalization
 - Decreased in mortality
 - Increase in Albumin
- Feeding Tube
- Nutrition Support: IDPN/IPN

How do we Treat Malnutrition?

- Protein Intake
- Oral issues
- Access issues
- Supplements
- Tube Feeding?
- Parenteral Nutrition/IDPN or IPN
- Appetite stimulants
- Treating Depression
- Treating Inflammation

Proteins



- **High Biological Value protein (animal protein)**
- Dairy (milk, cheese) *
 - Meat (steak, pork)
 - Poultry (chicken, turkey)
 - Eggs
- **Low Biological Value protein (plant protein)**
 - Vegetables **
 - Breads
 - Cereals

Protein Extracts in Supplements

- Dairy
 - Whey
 - Casein
- Eggs
- Plant - based
 - Soy
 - Brown rice
 - Pea
 - Hemp
 - Alfalfa
 - Chia seeds
 - Flaxseeds
 - Artichoke
 - Quinoa



Genysis Brand Solutions, 2016



Abbott, 2018

Summary of Supplements

Supplement	Kcal	Protein (g)	Potassium (mg)	Phosphorus (mg)
Boost	240	10	460	300
Boost Breeze	250	9	0	150
Ensure	220	9	390	250
Ensure High Protein	160	16	170	250
Glucerna	180	10	500	25% DV
LiquaCel Sugar free	90	16	10	0
Nepro	425	19	250	170
Novasource Renal	475	21.6	225	195
Zone Perfect bars	180 - 210	10-15	0 - 170	0 - 200
Pure Protein bars	190 - 210	18 - 21	60 - 180	60 - 150
Pure Protein whey powder	130	23	105 - 140	79 - 95

KDOQI Clinical Practice Guideline for Hemodialysis #19 Indications for Nutritional Support

- Individuals undergoing maintenance dialysis who are unable to meet their protein and energy requirements with food intake for an extended period of time should receive nutrition support. (Evidence and Opinion)
- If oral nutrition (including nutritional supplements) is inadequate, tube feeding should be offered if medically appropriate.
- If tube feedings are not used, intradialytic parenteral nutrition (IDPN; for hemodialysis) or intraperitoneal amino acids (IPAA; for peritoneal dialysis) should be considered if either approach in conjunction with existing oral intake meets the protein and energy requirements

What is IDPN?

Intradialytic Parenteral Nutrition (IDPN): IV nutrition given during dialysis

- Provides amino acids, dextrose, and sometimes lipids
- Assists in improving protein, calorie, or protein/calorie malnutrition in dialysis patients
- Adjunct therapy to patient's current regimen

General Criteria for Initiation of IDPN

- ≥ 1 month nutrition counseling without clinical improvement
- $\geq 1 - 2$ month trial of ONS without improvement
- Continued protein malnutrition:
 - 3 month serum albumin $\text{avg} < 3.5 \text{ g/dL}$
 - Progressive 3 - month decline in serum albumin $< 3.5 \text{ g/dL}$
 - nPNA $< 0.8 \text{ g/kg/d}$ or documented protein intake less than needs
- and/or
- Continued energy malnutrition
 - Edema-free bodyweight $< 90\%$ of IBW
 - BMI < 18
 - Weight loss $> 5\%$ over 3 months

National Kidney Foundation, 2015

Conclusion

Nutrition Plays a crucial role in Mortality and Overall Health

- Albumin is strongly related to mortality in Dialysis patients
- There are other parameters and clinical indicators to determine malnutrition.
- Protein intake is a must for all patients – everyday- with each meal
- Most patients require supplements
- Other proactive approaches need to be considered if oral intake is inadequate

References

- National Kidney Foundation. (2015). *Pocket guide to nutrition assessment of the patient with kidney disease: A concise, practical resource for comprehensive nutrition care in kidney disease*. 3rd ed. New York, NY.
- White, J.V., Guenter P., Jensen, G., Malone, A., Schofield, M., the Academy Malnutrition Work Group; the A.S.P.E.N. Malnutrition Task Force; and the A.S.P.E.N. Board of Directors. (2012). *Consensus statement: Academy of Nutrition and Dietetics and American Society for Parenteral and Enteral Nutrition: Characteristics recommended for the identification and documentation of adult malnutrition (undernutrition)*. *Parenteral Enteral Nutr.*, 36: 275-283.
- Renal Dietitians Dietetic Practice Group of the Academy of Nutrition and Dietetics and the Council on Renal Nutrition of the National Kidney Foundation. (2013). *A clinical guide to nutrition care in kidney disease*, 2nd ed. Cathy Iammarino.
- Lacson E Jr, Alp Bdzler TA, Lazarus JM, Teng M, Hakim RM. (2007). *Potential impact of nutritional intervention on end-stage renal disease hospitalization, death, and treatment costs*. *Journal of Renal Nutrition* 17 (6): 363-371 doi:10.1053/j.jrn.2007.08.009
- Kalantar-Zadeh, K., Cano, N. J., Roudsari, C., Korovesy, C. P., Mak, R. H., ... Bdzler, T. A. (2011). Diets and enteral supplements for improving outcomes in chronic kidney disease. *Nature Reviews Nephrology*, 7(7), 1010-1019. doi:10.1038/nrneph.2011.160
- Zwivel, (2018). *Blepharoplasty*. Retrieved from <https://www.cvs.com/diaphanology/blepharoplasty>
- Jamar Technologies. (2018). *Jamar Technologies hydraulic hand dynamometer*. Retrieved from https://www.4matmedical.com/catalog/products/view/id/23030/PC-AWEIA-ADP-1201431000056386&utm_source=google&utm_medium=ppc&adpos=1o1&cid=sp1p5AMP9303j1&sc=mid=6AMP9303j1&gclid=EAIaQobChMfIeI_so42qVBY5GChMLQ4EAGYASABEgLV7vD_BwE
- Kaminikjia-Philips. (2017). *Stooling/diarrhea*. Retrieved from <http://psdandline.com/ivd-symptoms/soiling-edema/>
- Very Well Health. (n.d.). *Clavicle fracture rehab exercises*. Retrieved from <https://www.verywell.com/clavicle-fracture-rehab-exercises-3120755>
- Genysis Brand Solutions. (2016). *Plant-Based Proteins: The Challenges of Meeting Consumer Demand*. Retrieved from <https://www.genysigroup.com/plant-based-proteins>
- Abbot. (2018). *Jevity 1.0 cal*. Retrieved from https://abbottnutrition.com/jevity-1_0-cal