



Nutrition Habits that Support Transplant Success

Mallory Foster, RD, CNSC, CCTD



Objectives:

- Understand the role and CMS guidelines for the Registered Dietitian working in transplantation
- Gain a better understanding of BMI in kidney transplantation
- Identify future directions for nutrition interventions among obese patients preparing for transplant
- Identify potential food drug interactions and food safety concerns for transplant patients

Role of the Transplant Dietitian

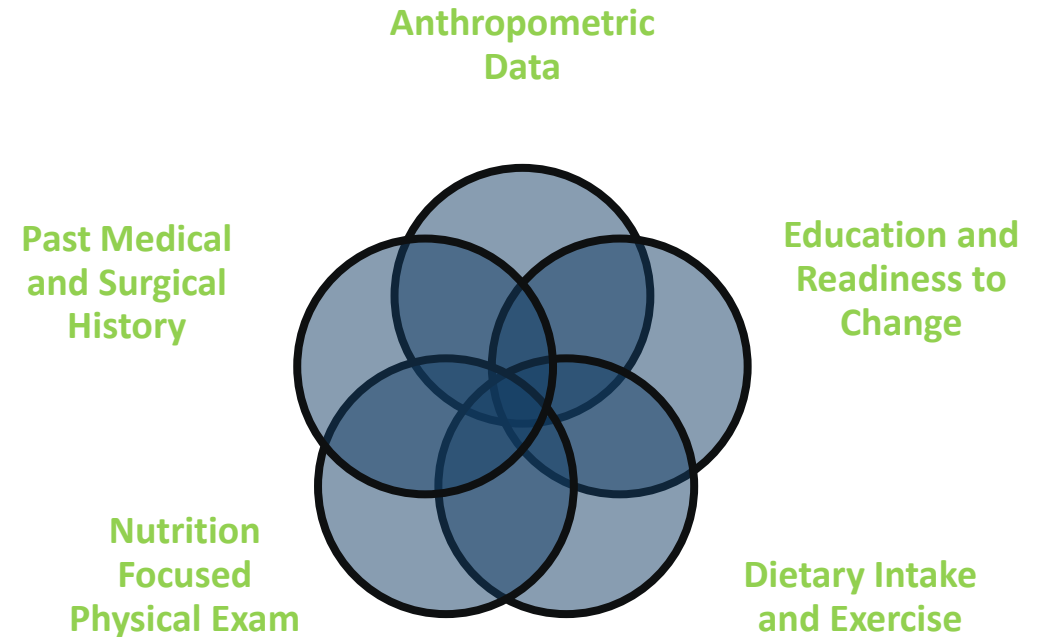
- CMS requires:¹
 - “Transplant programs must make nutritional assessments and diet counseling services, furnished by a qualified dietitian, available to all transplant patients and living donors. A qualified dietitian is an individual who meets practice requirements in the State in which he or she practices and is a registered dietitian with the Commission on Dietetic Registration.”
 - “The transplant program must identify a multidisciplinary transplant team and describe the responsibilities of each member of the team. The team must be composed of individuals with the appropriate qualifications, training, and experience in the relevant areas of medicine, nursing, nutrition, social services, transplant coordination, and pharmacology.”

Role of the Transplant Dietitian

- Each transplant center must have a multidisciplinary care team that includes a Registered Dietitian
- Each transplant center must establish nutrition polices for all phases of transplant and living donation
 - This includes pre-transplant, transplant event, and post-transplant
- Polices that are established must be followed
 - Nutrition policies (including BMI requirements) vary between transplant centers
- In 2017, a group of transplant dietitians published a standardized framework for transplant dietitians, establishing transplant-specific competencies for dietitians²

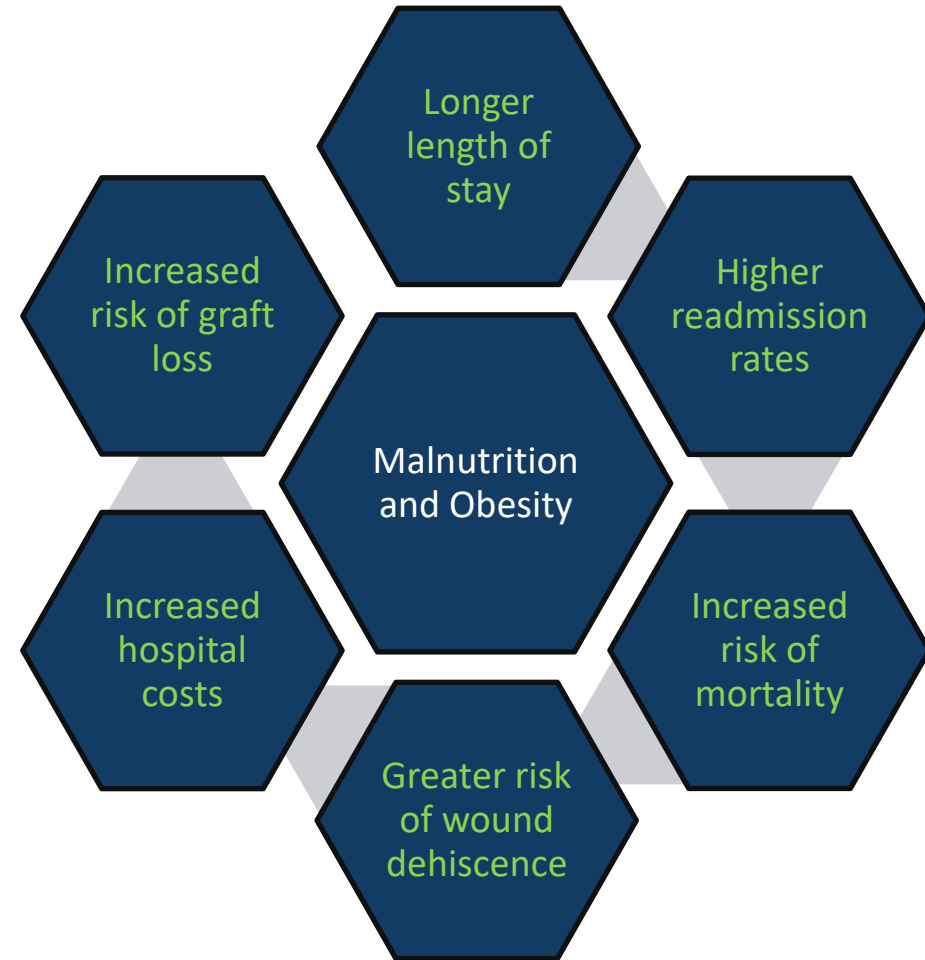
Nutrition Assessment

- Part of the pre-transplant evaluation
- Comprehensive nutrition assessment to provide appropriate intervention
- Provide recommendations to patient and team to optimize nutrition status prior to transplant
- Communicate pertinent recommendations to referring team
- Determine transplant candidacy from a nutrition perspective



Why Does Nutrition Matter?

- Nutritional status, both malnutrition and obesity, are linked with patient outcomes³⁻¹⁰



Malnutrition

- To diagnose malnutrition, at least 2 of the following must be present⁴
 - Insufficient energy intake
 - Weight loss
 - Loss of muscle mass
 - Loss of subcutaneous fat
 - Localized or generalized fluid accumulation that may mask weight loss
 - Reduced functional status
- It's estimated that ~35-50% of those with chronic kidney disease have some degree of malnutrition¹¹
- A patient can be malnourished at any BMI!

Why Does Malnutrition Matter?^{3-8,12-16}

- Undernourished dialysis patients shown to have increased mortality
- Associated with higher mortality, morbidity, LOS, readmission, and hospital costs post-transplant
- Underweight status associated with lower rate of survival and graft survival compared to normal weight and obese transplant recipients
- Significant weight loss prior to transplant associated with longer LOS, higher risks for all-cause graft loss, and death regardless of BMI
- Poor wound healing
- Increased infectious complications
- Ultimately affects transplant outcome

Frailty¹⁷⁻²⁶

- Described as a physiologic decline vs an accumulation of deficits
- Associated with higher risk of mortality, institutionalization, falls, and hospitalizations



How is Frailty Measured?

- Fried Frailty Phenotype¹⁸
 - Unintentional weight loss
 - Low physical activity
 - Exhaustion
 - Slow gait speed
 - Weak handgrip strength
- Score of 3 or higher is indicative of frailty
- Frequently used in the CKD population¹⁷

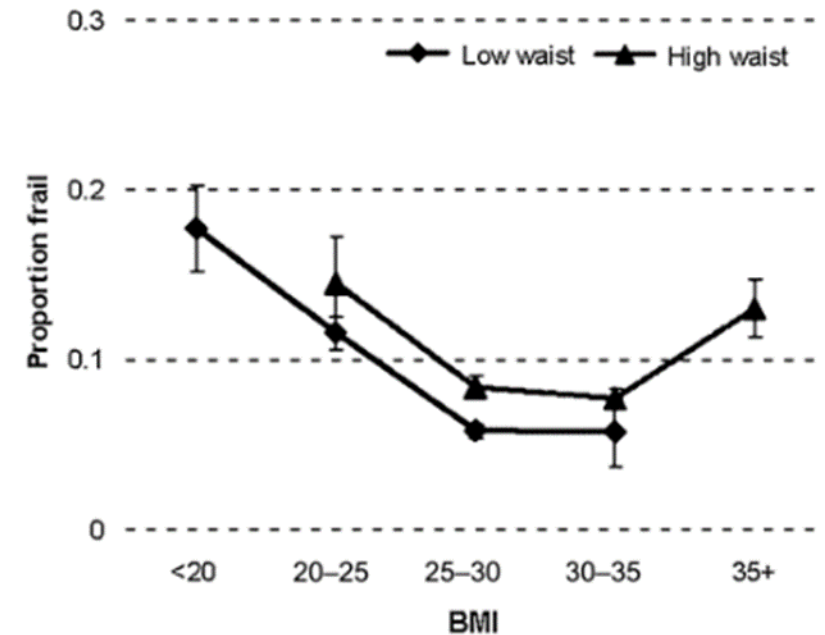
Table 1. Operationalizing a Phenotype of Frailty

A. Characteristics of Frailty	B. Cardiovascular Health Study Measure*
Shrinking: Weight loss (unintentional) Sarcopenia (loss of muscle mass)	Baseline: >10 lbs lost unintentionally in prior year
Weakness	Grip strength: lowest 20% (by gender, body mass index)
Poor endurance; Exhaustion	“Exhaustion” (self-report)
Slowness	Walking time/15 feet: slowest 20% (by gender, height)
Low activity	Kcals/week: lowest 20% males: <383 Kcals/week females: <270 Kcals/week
	C. Presence of Frailty
	Positive for frailty phenotype: ≥ 3 criteria present
	Intermediate or prefrail: 1 or 2 criteria present

*See Appendix.

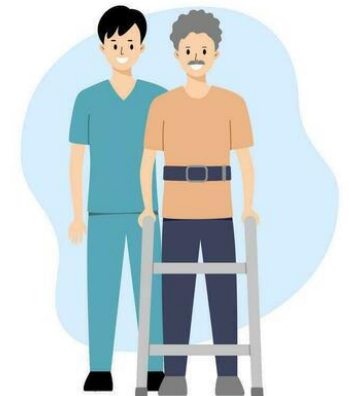
Nutrition and Frailty^{18, 25-27}

- Unintentional weight loss, low weight status, and sarcopenia are commonly considered indicators of frailty
- High BMI and high waist circumference can also be associated with frailty
- A patient can be frail at any BMI!



Why Does Frailty Matter?^{19, 21, 28-30}

- Frailty is associated with:
 - Higher risk of mortality for patients on the waitlist
 - Increased risk of DGF, longer LOS, readmission, and decreased survival post-transplant
- Combined Nutrition and Physical Therapy interventions can help improve outcomes!



Obesity³¹⁻³²

- **More than 40% of all American adults are obese**

- Causes of obesity:

- Dietary patterns
 - Portion sizes
 - Unstructured meal schedule
 - Grazing
 - SSB intake
 - Emotional eating
 - Environment of mealtime
 - Conscious of hunger cues
 - Physical activity
 - Medications
 - Access to food
 - Community environment
 - Education/Lack of knowledge
 - Socioeconomic status
 - Marketing
 - Genetics/Family history

- Consequences of obesity:

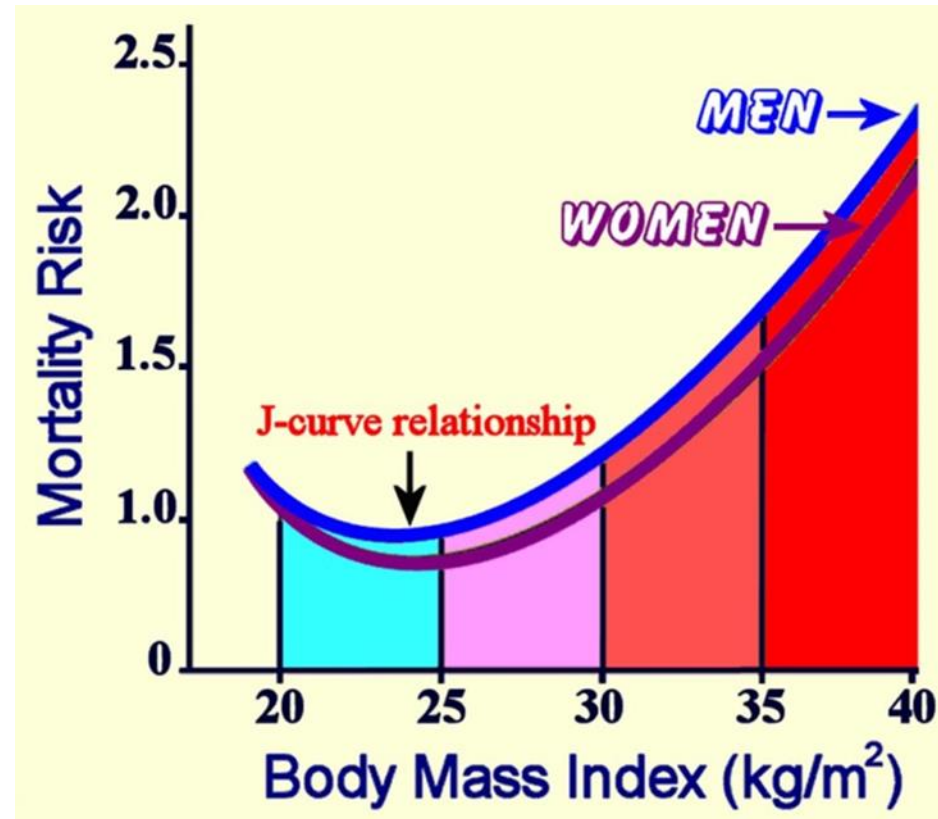
- Hypertension
 - Dyslipidemia
 - Type 2 diabetes
 - Coronary heart disease
 - Stroke
 - Gallbladder disease
 - Osteoarthritis
 - Sleep apnea
 - Some cancers
 - Low quality of life
 - Depression
 - Decreased mobility
 - Increased medical costs

BMI³³

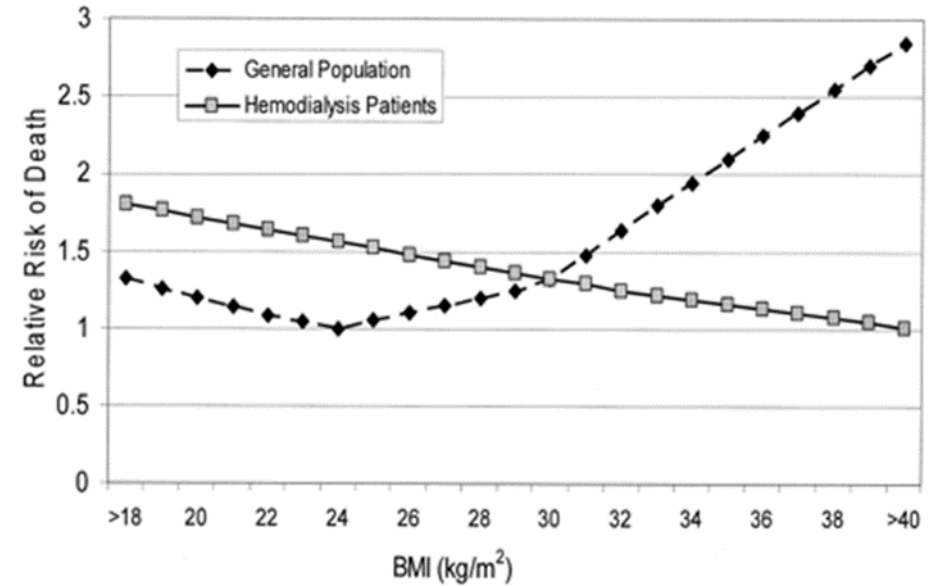
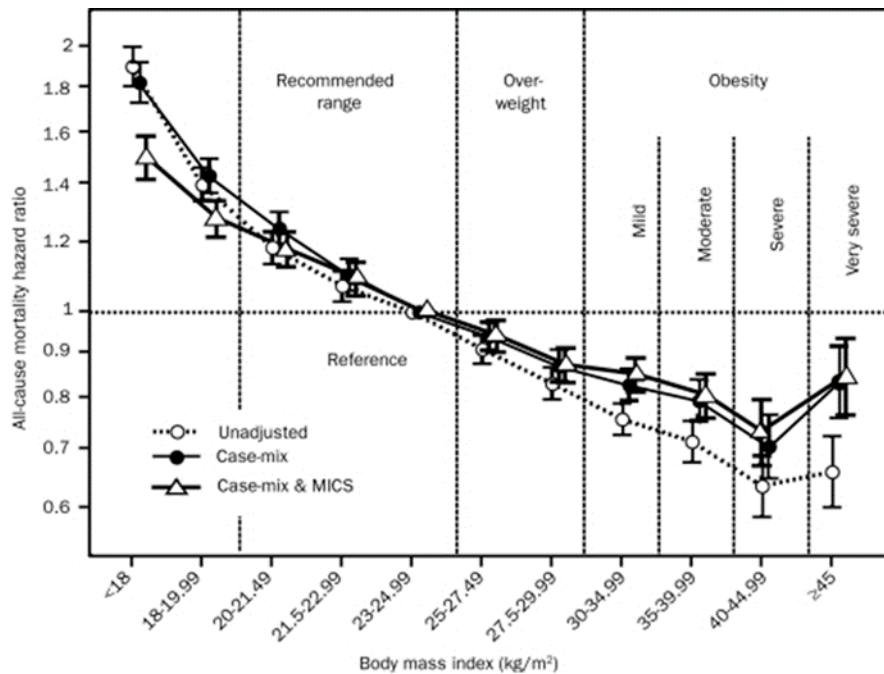
- Measure of weight adjusted for height (kg/m²)
- Convenient, inexpensive, noninvasive
- Limitations:
 - Measures excess weight, but does not differentiate between excess fat, muscle, or bone mass
 - Doesn't indicate differences in body fat distribution
- BMI often used alongside waist circumference and/or waist hip ratio

BMI	Considered
<18.5	Underweight
18.5-24.9	Normal
25.0-29.9	Overweight
30.0 and Above	Obese
30-34.9	Obese Class 1
35-39.9	Obese Class 2
40+	Obese Class 3 ("extreme" or "severe" obesity)

Relationship Between BMI and Mortality in the General Population³⁴



Relationship Between BMI and Mortality for those on Dialysis – “Obesity Paradox”³⁵⁻³⁶



Obesity Paradox

- Obesity increases the risk for CKD and progression to ESRD³⁷
- Obesity is a major risk factor for HTN and T2DM, which are leading causes of ESRD
- However, obese patients have better outcomes when on dialysis
- But... after transplant, the medical consequences of obesity are still present and the mortality associated with obesity is similar to that of the general population

BMI in Transplant³⁸⁻⁴⁵







- No nationwide standard for BMI criteria and transplant eligibility, it is transplant center specific
- Traditional cutoff at BMI of 35-40
 - Not based on specific evidence-based guidelines or clinical trials
 - More complicated surgery, longer operative times, increased wound complications, potentially prolonged hospitalization and delayed graft function
 - Long-term post-transplant complications such as weight gain post-transplant, post-transplant, hyperlipidemia, hypertension, and osteoporosis
- Transplantation always offers better survival and quality of life outcomes as compared to dialysis, however the survival benefit is lower when BMI is >40
- Robotic surgical technique alleviates some of the concerns associated with wound complications

BMI in Transplant⁴⁶⁻⁵⁷

- Most studies show that obesity is associated with increased risk of DGF, however, not all studies confirmed this
- Some studies show that there is a relationship between obesity and acute rejection, but the evidence is inconclusive
- Obesity is associated with a longer average LOS
- Potential that DGF in the obese population could be a contributing factor to increased LOS
- Obesity is associated with more complicated surgery, increased risk of wound complications and wound infections, which could ultimately lead to graft loss
- Evidence is inconclusive about the relationship between obesity and kidney graft failure post-transplant

BMI in Transplant⁵⁸

Obesity and Kidney Recipient Outcomes: Mate-Kidney Analysis

Design	Analysis	Results
<p>Retrospective analysis  2000-2016</p> <p>44,560 adult 1st-time deceased-donor kidney recipients matched by mate-kidney receipt</p> <p>Outcomes by BMI category</p>  <p> ≤25 kg/m² >25-30 kg/m² >30-35 kg/m² >35 kg/m² </p>	<p>Conditional logistical and stratified proportional hazards models</p> <p>Outcomes:</p> <ul style="list-style-type: none"> (i) Graft failure  (ii) Death-censored graft failure (iii) Patient survival  (iv) Delayed graft function (DGF)  (v) Hospital length of stay (LOS)  	<p>↔ Patient survival: not different across BMI categories</p> <p>↔ Hospital LOS: not different across BMI categories</p> <p>✓ Graft outcomes: better for BMI ≤ 30 than BMI > 35 (reference)</p> <p>✓ DGF less common in recipients with BMI >30-35 than BMI > 35 (reference)</p> <p>↔ No difference in graft or patient outcomes between BMI >30-35 and BMI > 35 (reference)</p>

CONCLUSION: Patients with BMI > 35 vs >30-≤35 kg/m² have similar long-term outcomes, suggesting flexibility when considering patients with extreme obesity for transplantation.

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BMI in Transplant

- Is it okay for transplant patients to be obese?
 - Good outcomes have been seen among “patients that lost weight pre and post operatively” following kidney transplantation⁵⁹
- Each center establishes their own BMI criteria for transplant
- Encouraging healthy weight loss is important for overall health and longevity

Weight Loss Pre-Transplant

- Weight management is a complex issue and is often difficult
- Traditional Weight Management Strategies



- Is this a realistic recommendation for an ESRD patient?
- Does this type of recommendation lead to successful weight loss?

Weight Loss Pre-Transplant – Lifestyle Modification

- Dietary intake
 - Daily schedule, timing of meals (does patient have a structured meal schedule, are they grazing, what are the barriers to meal times, etc)
 - Portion sizes
 - Composition of meals
 - SSB intake
 - Night time eating
- Physical activity
 - What physical activity is medically feasible?
 - Creative ideas for increasing activity
 - Frailty – maintaining lean muscle mass and functional status is essential
- What other factors may be contributing to obesity?
 - Socioeconomic status, access to food, community environment, education/lack of knowledge, stress, sleep schedule



Weight Loss Pre-Transplant – Lifestyle Modification

- Use of Motivational Interviewing
- Meet the patient where they are!
- Collaborating with the patient to facilitate behavior change
 - As opposed to just giving recommendations
- Finding out what motivates the patient to change
 - Asking open ended questions about why they're interested in pursuing weight loss
 - The hope of receiving a transplant and being a good steward as the recipient of a transplant can be motivating factors for many patients
- Establishing “SMART” goals
 - Specific, Measurable, Achievable, Relevant, and Time-Based
- Start with a small, achievable weight loss goal, and create an individualized plan on how to make that happen



Weight Loss Pre-Transplant – Bariatric Surgery

- Timing of bariatric surgery? – pre-transplant,⁶⁰ post-transplant, or at time of transplant⁶¹
 - Bariatric surgery is usually associated with rapid weight loss
 - Generally recommend patient wait until 1 year post-bariatric surgery, or until weight stable, before pursuing transplant after bariatric surgery
- Successful in facilitating weight loss of 20-30%⁶²
- Sleeve gastrectomy is preferred over Roux-en-Y gastric bypass (RYGB)
 - Potential for inadequate absorption of medications, including transplant immunosuppression
 - Increased risk of hyperoxaluria and calcium oxalate kidney stone formation with RYGB
- Need for lifelong vitamin supplementation
- Still requires diet and lifestyle changes
- Side effects may include surgical complications, dumping syndrome, malabsorption

Weight Loss Pre-Transplant - Medications

- GLP-1 agonists
 - Increase insulin release
 - Reduce appetite and increase satiety
 - Slow gastric emptying
 - Promote weight loss and can help improve glycemic control
- Successful average weight loss of 15-20%⁶³

Weight Loss Pre-Transplant – Medications⁶⁴

- Approved by FDA for patients with CKD
- GLP1 may play a role in preventing CKD progression
- Access and cost can sometimes be a barrier



Weight Loss Pre-Transplant - Medications

- Part of the mechanism of action is to slow gastric emptying
 - This can be a problem for patients who already have gastroparesis
 - Can contribute to GI side effects like N/V/D/C, reflux, abdominal pain
- Potential risk for malnutrition with significantly decreased hunger cues and PO intake
- Muscle mass loss and worsened frailty can be associated with rapid weight loss on GLP-1s
 - Adequate protein intake and physical activity are very important

Weight Loss Pre-Transplant - Medications

- Generally recommended to hold GLP1 for ~2- weeks prior to surgery
 - However, a deceased donor transplant is unplanned
 - Important to coordinate with surgery and anesthesiology teams
- Likely needed as a long-term therapy, as stopping the medication often leads to regaining weight
- It's important to use anti-obesity medications in conjunction with healthy diet, exercise, and lifestyle changes

Transplant Event



**Quality
Insights**
Renal Network 5

Nutrition Challenges Acutely

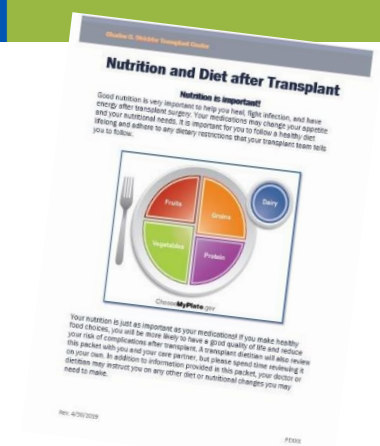
- Determining route of nutrition – Oral? Tube feeding? Parenteral nutrition?
 - Usually patients are started on a diet by post-op day 1 after kidney transplant
- Nutritional needs
 - Increased protein needs for wound healing
 - Calorie needs similar to other surgical/trauma patients
 - Fluid requirements vary initially post-op, but usually patients will need to increase fluid intake
- Hyperglycemia
 - Surgical stress
 - Steroids
 - Immunosuppression
 - History of diabetes
 - Post-transplant diabetes

Nutrition Challenges Acutely

- Electrolyte disarray
 - Hyperkalemia most common
 - Potential need for dialysis post-transplant (delayed graft function)
 - Electrolyte abnormalities related to medications
 - Is a renal diet still needed?
- Reduced appetite
 - Can they meet estimated nutrition needs with current appetite and PO intake?
- Gastrointestinal abnormalities
 - Ileus
 - Nausea
 - Constipation
 - Side effects of new immunosuppression
- Wounds & healing

Post-Transplant Nutrition Education

- Food Drug Interactions
 - Grapefruit, pomegranate, starfruit, pomelo, herbal teas, and herbal supplements
- Food Safety
 - Immunosuppressed patients are at 15-20% increased risk of developing a foodborne illness
 - Appropriate food handling practices
 - Recommend all meats well done, eggs fully cooked, pasteurized dairy, wash fruits and vegetables, heat deli meats due to risk of listeria, avoid buffets and salad bars
- Avoid all vitamins/minerals, OTC, and herbal supplements unless recommended by transplant team



Post-Transplant Nutrition Education

- Hydration
 - After kidney transplant, most patients need to drink a minimum of 2-3 L of fluid (ideally water) per day
- General Healthy Eating
 - A balanced diet is key!

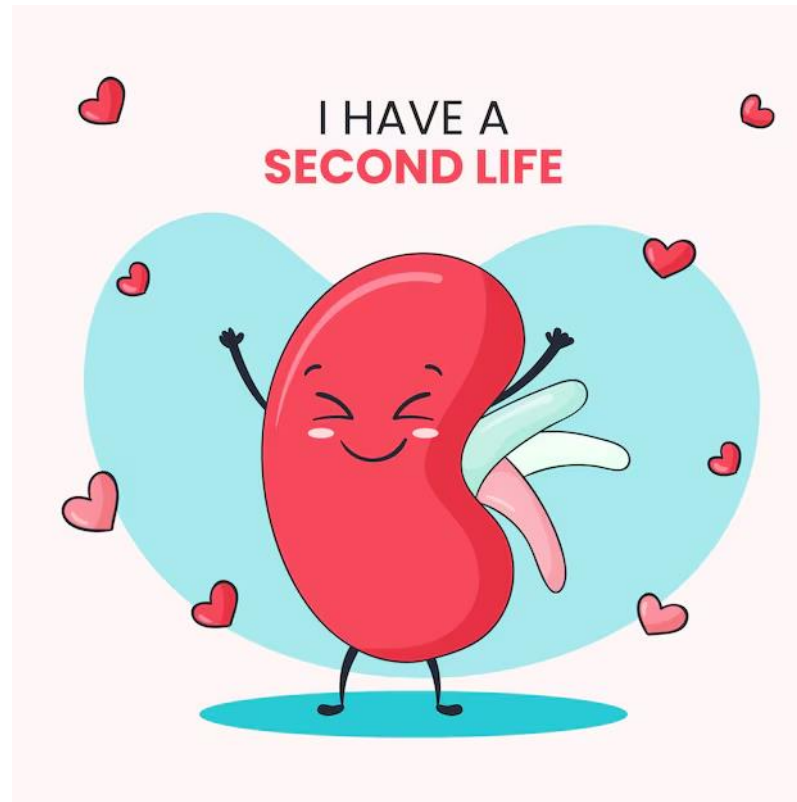


Post-Transplant



Nutrition Goals Post-Transplant

- Maximize quality and quantity of each patient's life
- Help sustain transplanted organ's function



Weight Gain Post-Transplant⁶⁵⁻⁶⁶

- 50% of patients will gain weight after kidney transplant
- Most weight gain occurs within the first year post-transplant
- Weight gain is associated with long-term transplant complications including diabetes, hyperlipidemia, and hypertension
- Obesity ultimately impacts graft function and is an independent risk factor for poor graft survival

Why do patients gain weight after transplant⁶⁶⁻⁶⁷

- Appetite is often poor on dialysis
 - Patients are usually feeling better after transplant!
- Liberalized diet
 - No longer limiting potassium and phosphorus intake after transplant!
- Hyperphagia related to steroids

Weight Loss Post-Transplant

- Patients should not work on intentional weight loss until at least 6-8 weeks post-transplant, or until wound is completely healed
- Successful weight loss usually involves a multifaceted approach
 - Lifestyle Modification
 - Involves diet and exercise, but also addressing environmental factors as able (ie- schedule), use of motivational interviewing, setting obtainable goals
 - Medications?
 - If a patient was on a GLP1 pre-transplant, will likely need to re-start GLP1 post-transplant to avoid regaining weight
 - When should GLP1 be re-started post-transplant?
 - At 6 weeks? (or earlier?), 3 months? 6 months?
 - Depends on post-op progress
 - Bariatric surgery?
 - Wait until at least 6 months – 1 year post-transplant
 - Gastric sleeve preferred over RYGB

Post-Transplant Diabetes⁶⁸⁻⁶⁹

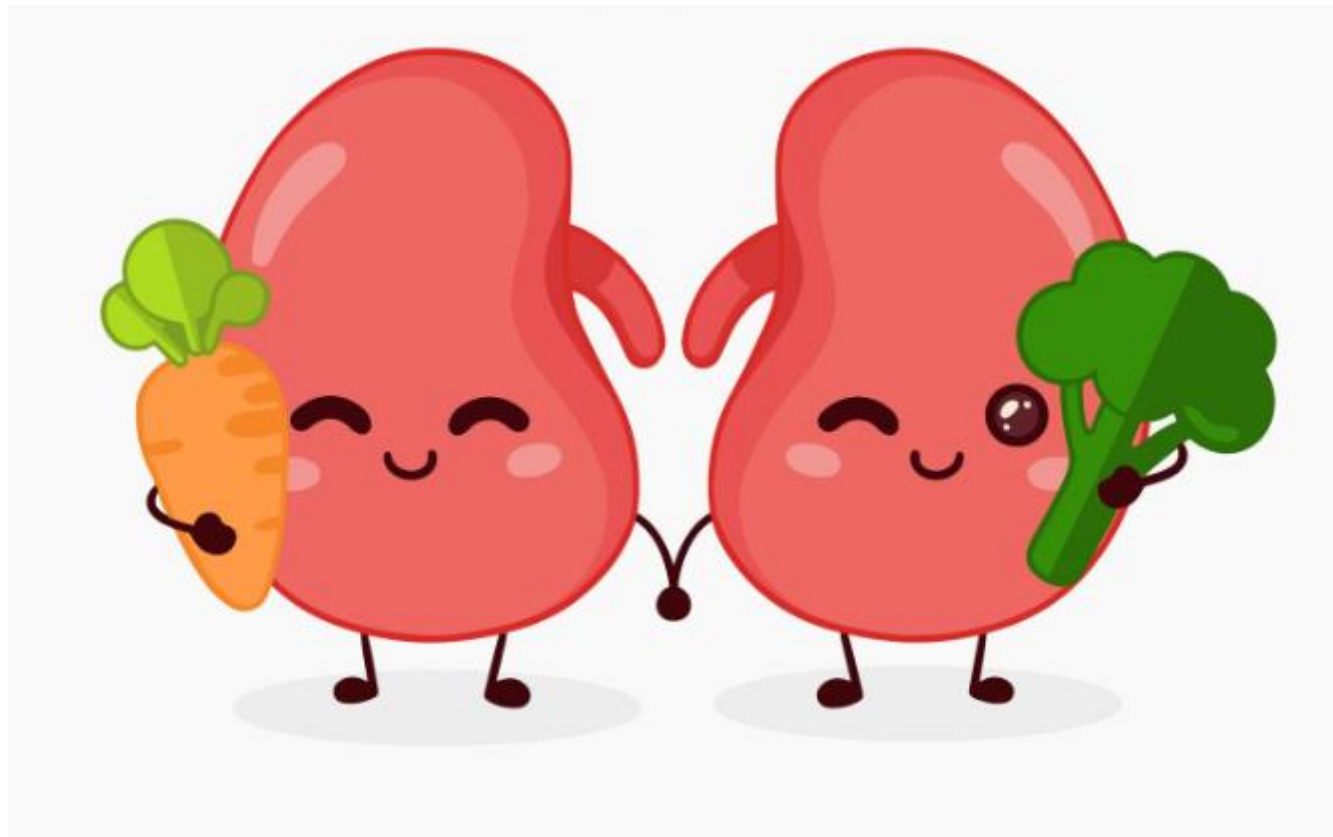
- Estimated 4-25% of kidney transplant recipients will develop post-transplant diabetes
 - Diabetes is the leading cause of kidney failure
 - 44% of those with CKD already have diabetes
- Associated with
 - Decreased patient and graft survival
 - Increased risk of cardiovascular disease
 - Increased risk of infection and rejection



Post-Transplant Diabetes⁶⁸⁻⁶⁹

- Causes
 - Increased blood sugar related to transplant medications
 - Both steroids and calcineurin inhibitors
 - Improved insulin clearance by the kidney post-transplant
- Risk factors:
 - Pre-existing insulin resistance
 - Obesity
 - Age
 - Family history of diabetes

Good Nutrition is Important During all Phases of Transplant Care!



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Questions?



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