TO EAT OR NOT TO EAT DURING HEMODIALYSIS TREATMENT?

Rana G. Rizk, PhD, MPH, LD
Maastricht University, The Netherlands

November, 2017
Learning objectives

• Review the evidence behind benefits and concerns of oral feeding & supplementation during dialysis treatment

• Discuss the optimal approach to oral feeding & supplementation during hemodialysis treatment

• Identify global trends regarding eating during dialysis treatment

• Recognize the need for additional research on the effect of oral feeding & supplementation on hard patient outcomes, & consensus on pertaining best practices
Economic burden of hemodialysis (per patient per year)

Klarenbach et al., 2014; Just et al., 2008; Mushi et al., 2015; Akobundu et al., 2006; Rizk et al., 2016

Turkey
$30,467

Jordan
$10,844 - $22,368

South Africa
$7,608 - $25,682

Lebanon
$18,517

Klarenbach et al., 2014; Just et al., 2008; Mushi et al., 2015; Akobundu et al., 2006; Rizk et al., 2016
The death probability of hemodialysis patients is unacceptably high.
Target Weight Gain during the First Year of Hemodialysis: A Population-Based Study

Kamyar Kalantar-Zadeh, Kevin C Abbott, Abdulla K Salahudeen, Ryan D Kilpatrick, and Tamara B Horwich

Nutrition and Dialysis
Influence of nutritional factors and hemodialysis adequacy on the survival of 1,610 French patients

Christian Combe MD, PhD, Philippe Chauveau MD, Maurice Laville MD, Denis Fouque MD, PhD, Raymond Azar MD, Noel Cano MD, Bernard Canaud MD, Hubert Roth Eng, Xavier Leverve MD, PhD, Michel Aparicio MD, the French Study Group Nutrition in Dialysis

Jialin Wang, MD, Elani Streja, MPH, PhD, Connie M. Rhee, MD, MSc, Melissa Soohoo, MPH, Mingliang Feng, MD, Steven M. Brunelli, MD, MSCE, Csaba P. Kovesdy, MD, Daniel Gillen, PhD, Kamyar Kalantar-Zadeh, MD, MPH, PhD, and Joline L. T. Chen, MD, MS
Why do we care?!

Obi et al., Curr Opin Clin Nutr Metab Care. 2015;18:254-62
Why do we care about patients’ nutrition?

Time-dependent association between BMI & 2-year mortality
n=54,535

Kalantar-Zadeh et al., AJKD. 2005;46:489-500
Why do we care about patients’ nutrition?

Fully adjusted HR & 95% CI (dashed lines) for mortality associated with body weight changes (%); n=6,296. Adjusted HR achieved after controlling for age, sex, smoking, country, type of center (public or private), primary kidney disease, diabetes, dialysis vintage, & PTH.
Why do we care about patients’ nutrition?

Association between weight change over time & all-cause mortality; n=46,629

Kalantar-Zadeh et al., AJKD. 2005;46:489-500
Why do we care about patients’ nutrition?

Mortality predictability of quartiles of baseline MIS

Kaplan-Meier proportion surviving after 5 years of observation according to quartiles of baseline MIS; n=809

Rambod et al., AJKD. 2009;53:298-309
Baseline serum albumin concentration & survival
n=58,058
Case-mix-adjusted covariates: age, sex, diabetes mellitus, race, ethnicity & dialysis vintage
The arrows & numbers indicate the incremental increase in mortality risk compared with the previous group

Kalantar-Zadeh et al., AJKD. 2005;46:489-500
Why do we care about patients’ nutrition?

Change in serum albumin & survival  
n=30,827

Why do we care about patients eating?

Association between nPNA & 2-year mortality based on time-dependent models using quarterly varying repeated measures n=53,933

Shinaberger et al., AJKD. 2006; 48:37-49
Why do we care about patients eating?

Association between change in nPNA (nPCR) & subsequent death in patients with a baseline nPNA of 0.8 to 1.2 g/kg/d

Shinaberger et al., AJKD. 2006; 48:37-49
Why do we care about patients eating?

- Kaplan–Meier survival curves showing 120-month survival according to energy intake
- Survival rate significantly lower in patients with energy intake <25kcal/kg
- n=144

Kang et al., *Nutrients*. 2017;399; doi:10.3390/nu9040399
Nutrition seems an appropriate target to improve outcomes in HD population

Obi et al., Curr Opin Clin Nutr Metab Care. 2015;18:254-62
Are we there yet ?!

18% to 75% of hemodialysis patients show evidence of wasting

(depending on the definition)

Are we there yet?!

Association between nPNA & 2-year mortality based on time-dependent models using quarterly varying repeated measures n=53,933

Shinaberger et al., AJKD. 2006; 48:37-49
Are we there yet?!

Gap between recommendation & actual intake

- **Recommended Dietary Requirement:**
  - Protein: 1.2 g/kg/d protein
  - Energy: 30 to 35 Cal/kg/d

- **Average Nutritional Intakes of Dialysis Patients:**
  - Protein: 0.8 to 1.0 g/kg/d
  - Energy: 20 to 25 Cal/kg/d

- **Estimated Dietary Need to Cover Daily Nutritional Deficiency:**
  - Additional Protein Intake: 0.2 to 0.4 g/kg/d
  - Additional Energy Intake: 5 to 10 Cal/kg/d

- **Suggested Format/Route of Nutritional Therapy:**
  - In-Center/Intra-Dialytic: At least 1/7 of all meals
  - At Home: Frequent meals ingestion (>3 times/day)

Figure 1.
Justification of the additional need of dialysis patients to supplemented meals and nutrition

Why are we addressing the issue of eating during dialysis?

*Reduced dietary intake on treatment days*

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**Table 1.** Total Dietary Energy Intake (kcal/day) and Weight-Adjusted Dietary Energy Intake (kcal/kg/day) Between Dialysis and Nondialysis Treatment Days in HEMO Study Participants at Baseline (Mean ± SD)

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Dietary Energy Intake (kcal/day and kcal/kg/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DD and NDD Combined</td>
</tr>
<tr>
<td>Overall cohort</td>
<td>1,901</td>
<td>1,527 ± 551 (22.7 ± 8.3)</td>
</tr>
</tbody>
</table>

**Table 2.** Total Dietary Protein Intake (g/day) and Weight-Adjusted Dietary Protein Intake (g/kg/day) Between Dialysis and Nondialysis Treatment Days in HEMO Study Participants at Baseline (Mean ± SD)

<table>
<thead>
<tr>
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<tr>
<td>Overall cohort</td>
<td>1,901</td>
<td>62.6 ± 23.2 (0.93 ± 0.35)</td>
</tr>
</tbody>
</table>
Why are we addressing the issue of eating during dialysis?

*Reduced dietary intake on treatment days*

<table>
<thead>
<tr>
<th>Standardized calorie, protein, and sodium intake (recommended)</th>
<th>Weekday Nondialysis Day (n=22)</th>
<th>Weekday Dialysis Day (n=21)</th>
<th>Weekend Nondialysis Day (n=21)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (%)</td>
<td>SD</td>
<td>Mean (%)</td>
</tr>
<tr>
<td>Total grams of food consumed</td>
<td>1614.4</td>
<td>591.8</td>
<td>1378.7</td>
</tr>
<tr>
<td>Calories kcal/kg edema-free adjusted body weight/day</td>
<td>21.0</td>
<td>6.8</td>
<td>19.0</td>
</tr>
<tr>
<td>% of recommended calorie intake (30–35 kcal/kg/day)*</td>
<td>(70.0)</td>
<td>(63.3)</td>
<td>(74.3)</td>
</tr>
<tr>
<td>Protein gm/kg edema-free adjusted body weight/day</td>
<td>0.9</td>
<td>0.3</td>
<td>0.8</td>
</tr>
<tr>
<td>% of recommended protein intake (&gt;1.2 g/kg/day)*</td>
<td>(75.0)</td>
<td>(66.6)</td>
<td>(75.0)</td>
</tr>
<tr>
<td>Sodium concentration of foods consumed (mgs Na(^+)/Total grams/day)</td>
<td>1.7</td>
<td>0.7</td>
<td>1.6</td>
</tr>
</tbody>
</table>

*Based on nutritional recommendations established by K/DOQI. [5]*

Stark et al., *Top Clin Nutr.* 2011;26:45–56
Why are we addressing the issue of eating during dialysis?

**Net ↑ in protein catabolism during hemodialysis**

The procedure of hemodialysis leads to

| ↑ Energy expenditure (200 kcal extra energy) | Net loss per session: 6-8 g AA ≈ 40 g protein | Whole-body catabolism | ↑ muscle catabolism to replenish plasma AA + inadequate compensatory anabolism |

Eating or Oral Nutrition Supplementation Should Be Encouraged During Hemodialy

Janie Xiong, RD, CNSC
Outpatient Renal Dietitian
Community Regional Medical Center
Fresno, CA
Email: jxiong2@com...
WHAT IS THE AVAILABLE EVIDENCE?

In God we trust, all others must bring data!

William Edwards Deming
## Intradialytic oral nutrition & nutritional status

<table>
<thead>
<tr>
<th>Intra-dialytic renal-friendly oral nutrition (meal or supplement) with ↑ protein content</th>
<th>↑ dietary intake on treatment days (Burrowes et al., 2003)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compensates for the hemodialysis-associated catabolism &amp; ↑ protein anabolism during dialysis (Caglar et al., 2002; Pupim et al., 2006; Ikizler et al., 2002; Veenom et al., 2003; Sundell et al., 2009; Dong et al., 2011)</td>
<td></td>
</tr>
<tr>
<td>↑ (Caglar et al., 2002; Sundell et al., 2009; Pupim et al., 2006; Sezer et al., 2014)</td>
<td>or → (Scott et al., 2009) serum albumin</td>
</tr>
<tr>
<td>Improve Subjective Global Assessment (Calegari et al., 2011) &amp; Malnutrition Inflammation Score (Sezer et al., 2014)</td>
<td></td>
</tr>
</tbody>
</table>
Intradialytic Oral Nutrition Improves Protein Homeostasis in Chronic Hemodialysis Patients with Deranged Nutritional Status

Lara B. Pupim,*† Karen M. Majchrzak,* Paul J. Flakoll,a and T. Alp Ikizler*
Effect of high-protein meals during hemodialysis combined with lanthanum carbonate in hypoalbuminemic dialysis patients: findings from the FrEDI randomized controlled trial

Connie M. Rhee¹, Amy S. You¹, Tara Koontz Parsons², Amanda R. Tortorici³, Rachelle Bross³, David E. St-Jules³, Jennie Jing⁴, Martin L. Lee⁵, Debbie Benner⁵, Csaba P. Kovesdy⁶, Rajnish Mehrotra⁶, Joel D. Kopp⁷,⁸,⁹,¹⁰ and Kamyar Kalantar-Zadeh¹¹,¹²,¹³

RCT; 8 weeks
n=110 hypoalbuminemic (<4.0mg/dL) hemodialysis patients (I=51; C=55)

- I: high protein meals (meal boxes: 50 g protein, 850 Cal, P-to-protein ratio <10 mg/gm) + 0.5-1.5g lanthanum carbonate titrated as needed
- C: low calorie meals (<50 Cal) & almost no protein (<1g)

↑ albumin ≥0.2g/dL + phosphorus 3.5-<5.5mg/dL: I: 27%; C: 12% (p=0.04)
- Patients reported satisfaction with high protein meals during hemodialysis

Nephrol Dial Transplant (2016) 0:1–11
doi: 10.1093/ndt/gfw923
Intradialytic oral nutrition & nutritional status

“Can a nutritional intervention (intradialytic eating) improve nutritional status of patients?”

- Given available observational & experimental data
  - The answer might be positive

- Might be a powerful preventive measure against malnutrition & PEW

- Lack of well-designed & well-performed RCT with adequate sample size
Intradialytic oral nutrition & other benefits

Intra-dialytic renal-friendly oral nutrition when continued for extended periods of time

↑ physical function (Tomayko et al., 2015)

↑ quality of life (Calegari et al., 2011; Scott et al., 2009)

↓ hemodialysis-related inflammation (Tomayko et al., 2015)

↓ mortality in malnourished patients (Lacson et al., 2012; Wiener et al., 2014)

↓ hospitalization in malnourished patients (Cheu et al., 2012; Lacson et al., 2007; Lacson et al., 2012; Collins et al., 2014)
Retrospective cohort; n=4,289 as-treated matched pairs

Hemodialysis patients with albumin ≤3.5 g/dL
1 dose of intradialytic oral nutritional supplements trice weekly for 1 year or until albumin ≥4.0 g/dL
4 products (bars or shakes) to avoid taste fatigue
(proteins: 14-20 g; energy: 60-425 Kcal)

Unadjusted & adjusted Cox models for mortality risk, comparing patients who received monitored oral supplements with controls using a 1:1 as-treated matched cohort
Distribution of time to death among patients with baseline albumin $\leq 3.2$ g/dL between ONS & controls 1:1 “as-treated” matched cohort
### Intradialytic oral nutrition & other benefits

<table>
<thead>
<tr>
<th>Intra-dialytic renal-friendly oral nutrition when continued for extended periods of time</th>
<th>Keeping hemodialysis patients hungry during dialysis treatment is argued as an <strong>unethical</strong> action</th>
</tr>
</thead>
</table>

**Economically**, feasible patient-friendly strategy?
Can we save lives & ↓ costs?!

Projections of Possible Impact of a Systematic Intervention That Improves Albumin by 0.2 g/dL in 25% to 75% of Patients With a Baseline Serum Albumin ≤3.5 g/dL From the FMCNA Dialysis Population

<table>
<thead>
<tr>
<th>FMCNA Population, Possible Impact of Intervention</th>
<th>% of Patients With Albumin ≤3.5 Improved by 0.2 g/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25%</td>
</tr>
<tr>
<td>Number of hospitalization potential events avoided (%)</td>
<td>823  (0.80%)</td>
</tr>
<tr>
<td>Potential hospital days avoided (%)</td>
<td>2824 (0.67%)</td>
</tr>
<tr>
<td>Potential percentage decline in crude death rate</td>
<td>-0.24%</td>
</tr>
<tr>
<td>Potential lives saved</td>
<td>189</td>
</tr>
</tbody>
</table>

**Table 2.** Projected patient years gained, based on relative risk for 100% compliance with guidelines and other practice patterns (over 5 years, US)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Current statistics</th>
<th>1 Kt/V ≥1.2</th>
<th>2 PO₄ ≤5.5</th>
<th>3 Hgb ≥11 g/dl</th>
<th>4 IDWG ≤5.7%</th>
<th>5 Albumin ≥3.5 g/dl</th>
<th>6 Facility catheter use ≤7%</th>
<th>Total (sum of 1–6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual death rate</td>
<td>0.24</td>
<td>0.2305</td>
<td>0.2229</td>
<td>0.2264</td>
<td>0.2287</td>
<td>0.2172</td>
<td>0.2108</td>
<td>0.186</td>
</tr>
<tr>
<td>Annual rate of other loss²</td>
<td>0.065</td>
<td>0.065</td>
<td>0.065</td>
<td>0.065</td>
<td>0.065</td>
<td>0.065</td>
<td>0.065</td>
<td>0.065</td>
</tr>
<tr>
<td>Total loss rate</td>
<td>0.30</td>
<td>0.2955</td>
<td>0.2879</td>
<td>0.2914</td>
<td>0.2937</td>
<td>0.2822</td>
<td>0.2758</td>
<td>0.251</td>
</tr>
<tr>
<td>Patient years (total)</td>
<td>1,746,401</td>
<td>1,758,847</td>
<td>1,780,194</td>
<td>1,770,311</td>
<td>1,763,865</td>
<td>1,796,480</td>
<td>1,815,054</td>
<td>1,890,018</td>
</tr>
<tr>
<td>Potential patient years gained if 100% brought within targets</td>
<td>–</td>
<td>12,446</td>
<td>33,793</td>
<td>23,910</td>
<td>17,464</td>
<td>50,079</td>
<td>68,653</td>
<td>143,617²⁴⁶</td>
</tr>
<tr>
<td>Potential patient years gained if 50% brought within targets</td>
<td>–</td>
<td>6,011</td>
<td>16,322</td>
<td>11,548</td>
<td>8,435</td>
<td>24,185</td>
<td>33,159</td>
<td>69,367³</td>
</tr>
</tbody>
</table>

**Intradialytic oral nutrition & intradialytic hypotension**

*Systematic review of the literature:*

- **Observational studies:** mixed results
- **Interventional studies:** intradialytic eating $\rightarrow$ transient ↓ BP
  - **Limited evidence** that transient ↓ BP $\rightarrow$ **clinical consequences** or symptomatic intradialytic hypotension, especially in the era of bicarbonate-based dialysate

This observation is supported by the large number of intradialytic eating or supplementation studies not reporting higher incidence of hemodynamic complications, yet **further studies are needed**!
Intradialytic oral nutrition & other concerns

Dialysis efficiency
• Systematic review: unclear if intradialytic feeding influences dialysis efficiency
• Modest & transient ↓ in treatment efficiency may not be clinically relevant

GI symptoms (nausea, vomiting)
• Occur acutely during approximately 10% of all treatments
• Nutritional intradialytic feeding studies tracking GI symptoms: incidence ≤10%
• No available RCTs
• Quasi-experimental study: no increased GI symptoms with intradialytic meals & no effect of mealtime on incidence & intensity of GI symptoms

Better quality data are needed

(1) Eating is commonly allowed & encouraged in most countries

(2) Providing additional energy: primary reason to permit eating

(3) Many clinics provide food & supplements at no cost

(4) Many of the proposed concerns: not commonly observed

Table 1. Clinician Experiences With Six Commonly Cited Reasons to Restrict Eating During Hemodialysis Treatment

<table>
<thead>
<tr>
<th>Reason</th>
<th>Never</th>
<th>Rarely</th>
<th>Occasionally</th>
<th>Frequently</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postprandial hypotension (n = 53)</td>
<td>18 (34.0)</td>
<td>15 (28.3)</td>
<td>18 (34.0)</td>
<td>2 (3.8)</td>
</tr>
<tr>
<td>Gastrointestinal symptoms (n = 52)</td>
<td>14 (26.9)</td>
<td>23 (44.2)</td>
<td>15 (28.8)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Reduced treatment efficiency (n = 45)</td>
<td>42 (93.3)</td>
<td>2 (4.4)</td>
<td>1 (2.2)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Spills or pests (n = 46)</td>
<td>31 (67.4)</td>
<td>7 (15.2)</td>
<td>5 (10.9)</td>
<td>3 (6.5)</td>
</tr>
<tr>
<td>Choking (n = 46)</td>
<td>39 (84.8)</td>
<td>6 (13.0)</td>
<td>1 (2.2)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Infection control issues (n = 46)</td>
<td>42 (91.3)</td>
<td>2 (4.3)</td>
<td>2 (4.3)</td>
<td>0 (0.0)</td>
</tr>
</tbody>
</table>

Kistler et al., J Ren Nutr. 2014;24:349-52
Prevention & treatment of PEW in CKD patients

A consensus statement by the ISRNFM

In-center intradialytic high-protein meals are a feasible strategy & should be advocated in patients at risk

Ikizler et al., Kidney Int. 2013;84:1096-107
Rethinking the restriction on nutrition during hemodialysis treatment

Table 1. Proposed Advantages and Disadvantages to Intradialytic Nutrition

<table>
<thead>
<tr>
<th>Proposed Advantages</th>
<th>Proposed Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced mortality</td>
<td>Postprandial hypotension</td>
</tr>
<tr>
<td>Improved nutritional status</td>
<td>Reduction in efficiency</td>
</tr>
<tr>
<td>Patient adherence and satisfaction</td>
<td>Gastrointestinal symptoms</td>
</tr>
<tr>
<td>Educational opportunity</td>
<td>Hygiene</td>
</tr>
<tr>
<td>Improved blood glucose control</td>
<td>Increased staff burden</td>
</tr>
<tr>
<td>Provide more appropriate food choices</td>
<td>Financial constraints</td>
</tr>
<tr>
<td>Reduced inflammation</td>
<td>Aspiration</td>
</tr>
</tbody>
</table>
Take-home message

• Need for WELL DESIGNED & WELL-PERFORMED RCTs

• Allow eating in tolerant patients

• Encourage eating in malnourished/at-risk patients
  - Choose a kidney-friendly meal & make of the meal a learning opportunity
  - Include at least 15 g of protein
  - Encouraging eating before or earlier in dialysis (during 1st hour)
  - Add phosphate binders & renal vitamins, when needed
  - Not creating spills
  - Limit the size of the meal & fluid consumption ???

• Put a protocol in place, a doctor/dietitian’s order & patient consent
  - Exercise caution & strive for improved safety
What to Eat at the Dialysis Center

Choose kidney-friendly foods when eating at the dialysis center.

The potassium, phosphorus and fluid you eat or drink just before or during a dialysis treatment will not be removed during that treatment.

Remember to include a good source of protein. Try to have 12 - 20 grams for the snack.

Here are some suggestions for what to bring to eat before, during or after your treatment:

- Sandwich that includes 1/2 cup tuna, chicken or egg salad
- Sandwich that includes 2 ounces of meat (fresh turkey, roast beef, chicken)
- 2 hard boiled eggs and 4-6 unsalted crackers
- 2 deviled eggs and 1/2 cup of grapes or apple wedges
- 1/2 cup cottage cheese and 1/2 cup canned fruit
- 1/2 cup tuna or chicken salad and 4-6 unsalted crackers
- 8 ounces liquid supplement suggested by your dietitian
- Protein bar suggested by your dietitian

Be sure to bring your phosphate binders and take them when you eat.
Thank you!

“(...) We must have perseverance and above all confidence in ourselves. We must believe that we are gifted for something and that this thing must be attained.

MARIE CURIE