

## Enteral and Parenteral Nutrition/Fad Diets

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### Educational Goals:

1. To understand the indications for enteral nutrition, including tube feeding
2. To understand the indications for, contraindications for and complications of parenteral nutrition
3. To review the history of fad diets and understand their place in control of obesity

### Key Words

Atkins Diet  
 Body Mass Index  
 Carbohydrate requirements  
 Elemental formulas  
 Enteral Nutrition  
 Harris-Benedict equation  
 Infection  
 Lipid requirements  
 Nasoenteric feeding

Osmolality  
 Parenteral Nutrition  
 Percutaneous-gastric feeding  
 Percutaneous-jejunal feeding  
 Protein requirements  
 Re-feeding syndrome  
 South Beach Diet  
 Specialized formulas  
 Venous thrombosis

### I. Enteral Nutrition - Feeding "into" the "luminal" gastrointestinal tract.

- A. Includes "normal" eating, tube feeding."
- B. Does not include "intravenous (parenteral) feeding."
- C. Preferred method of nutritional support.
  1. Provides nutrition directly to gut cells.
  2. Avoids bowel edema.
  3. Has "trophic" affects.
  4. Stimulates mucosal blood flow, and maintains normal pH, feed back loops etc.
  5. Without use gut atrophies—increases bacterial translocation—increases systemic inflammatory reaction.
- D. Use of enteral nutrition in critically ill patients reduces septic complications, shortens hospital stays, and decreases risk of multi-organ failure.
- E. Patients who cannot eat but have functional GI tracts are candidates for some form of enteral nutrition.
- F. Contraindications include patients with bowel ischemia, peritonitis, ileus or obstruction, fistulous disease, pancreatitis, or malabsorption/severe diarrhea.
- G. Routes
  1. Nasoenteric-short term < or = 30days
    - a. Uncomfortable, tubes may come out easily, localized complications-sinusitis, pneumothorax, esophageal erosions/stricture, aspiration, etc.
  2. Percutaneous-gastric or jejunal
    - a. May be placed endoscopically, surgically, or radiographically.
    - b. Gastric feeding more physiologic and allows bolus rather than continuous feeding.
    - c. Jejunal feeding may be better for patients with severe gastroesophageal reflux, large hiatal hernias, gastroparesis, history of aspiration and vomiting, or a history of prior gastric surgery.
    - d. Complications include malposition of tubes, bowel perforation, aspiration pneumonia, wound infection/abscess, diarrhea, tube related ulcers or bleeding.
    - e. Medications may also be administered via feeding tubes.
- H. Formula choices
  1. Most pre-prepared
  2. Based on caloric, protein, and other needs

3. Most are lactose free
4. The carbohydrates, proteins, and fats are usually in complex forms and they require relatively normal digestive and absorptive capabilities.
5. There are formulas designed for oral use. They are usually flavored and more costly.
6. Elemental or semi-elemental formulas exist for those with digestive problems-these have nutrients in more "broken-down" forms to allow easier digestion (i.e. small peptides, medium chain triglycerides, or even amino acids). These formulas have very poor taste and are generally given via some type of feeding tube.
7. Specialized formulas exist for specific needs
  - a. Fructose containing formulas for diabetics
  - b. Formulas enriched with branched-chain amino acids for hepatic failure patients
  - c. Pulmonary formulas with decreased carbohydrate to reduce CO<sub>2</sub> production
  - d. Renal failure formulas with essential amino acids
  - e. Immune enhancing agents have been shown to decrease infectious complications-arginine, yeast RNA, fish oil.
8. Most formulas are about 50% carbohydrates, 10-20% proteins, and 15-30% fat.
9. Vitamins and minerals are usually included.
10. Most patients also require some additional water
11. Osmolality varies-anywhere from 300 to 800mOsm/L - If the osmolality is too high or too low one can get "intolerance," diarrhea, "dumping syndrome."
- I. Need cooperation with dietitian/nutrition support team-must calculate patients complete needs-nutrients, free water, etc.

## II. Parenteral Nutrition

- A. Intravenous –central (administered via a larger central vein) and peripheral.
  1. Centrally administered is better for long term tolerance and allows greater flexibility in the types/formulas/ and concentration of the nutrition formula.
  2. There are several types of means of access to the venous system depending on the needs/circumstances/time frame.
- B. Who should receive parenteral nutrition and under what circumstances?
  1. Pre-operative-considered in patients with severe malnutrition, those undergoing esophageal/gastric surgery for cancer, or in those who have had no oral intake for 7 to 10 days.
  2. Pancreatitis-in those patients who are not expected to resume oral intake in 7 to 10 days. Most people with normal nutritional status can go 7 to 14 days without extensive nutritional support (excluding water/fluids).
  3. Inflammatory bowel disease-Useful in patients with severe disease and malnutrition, as therapy (pediatrics), those with short bowel syndrome (history of multiple small bowel resections).
  4. Oncologic patients-avoid in those with less than 3 months to live, though obviously raises many ethical issues.
- C. Home parenteral nutrition-prolonged GI tract dysfunction-life sustaining.
  1. Parenteral nutrition was first developed at HUP in the 1960's-central venous access was combined with nutrient solutions.
- D. Requirements
  1. Malnutrition and negative energy balance decrease resting energy expenditure. Metabolic stress usually increases energy requirements. In general we tend to give slightly on the "too few" caloric side to decrease metabolic and infectious complications.
  2. Calorie requirements- can estimate-25kcal/kg/day; or can calculate-Harris-Benedict equation

Men energy needs	=	$66 + (13.7 \times \text{wt. (kg)}) + (5 \times \text{height (cm)}) - (6.8 \times \text{age})$
Women energy needs	=	$66.5 + (9.6 \times \text{wt. (kg)}) + (1.7 \times \text{height (cm)}) - (4.7 \times \text{age})$

3. Energy needs must be adjusted for particular circumstances-i.e.-extremely over - or under-weight people; excessive fluid and electrolyte losses, large wounds which require healing, etc.
  4. Protein requirements vary from 0.8g/kg/day in normal individuals to 1.5g/kg/d in those with significant metabolic stress/illness. Generally protein makes up about 20% of the total calories.
  5. Carbohydrates-50-65% of total calories. 150g/day spares amino acids from gluconeogenesis. Excess glucose is problematic-fatty liver, and increased CO<sub>2</sub> production.
  6. Lipids-15-30% of total calories. Isosmolar-soybean and safflower. Mostly essential fatty acids-linoleic and linolenic. MUST make up at least 5% of total calories in those totally dependent on IV nutrition to avoid essential fatty acid deficiency.
  7. Most current formulas use "3-in-one" solutions –combined fat, carbohydrates, protein. Isolated lipid infusions may cause significant reactions if given too quickly.
  8. Avoid/"hold" lipids in those patients with serum TG levels>400mg/dl. Should check serum TG before administration. In obese patients we underfeed lipids to help mobilize endogenous fat, improve glucose control and improve insulin sensitivity.
  9. The daily "bag" generally contains pre-measured amounts of vitamins, minerals, trace elements, etc.-this can be adjusted. Medications can be added to the bag (i.e.- insulin, H-2 blockers, etc.).
- E. Monitoring
1. One must monitor, closely, serum electrolytes, I/O, etc., and adjust the formula accordingly. Must also monitor the serum glucose. A patient must be on a stable formula before discharge. Must also monitor the catheter sites for signs of infection, and the "bag" itself for precipitates.
- F. Complications
1. Infection is generally the biggest risk. Formula is perfect culture media and life-threatening infections can and do occur
  2. Venous thrombosis
  3. Nutrient excess/deficiency
  4. Re-feeding syndrome-occurs when one suddenly provides calories to a severely malnourished patient. This results in movements of potassium, phosphorus, and magnesium into cells with subsequent hypokalemia, hypophosphatemia, hypomagnesemia. This can cause fluid shifts, CHF, and death. Must feed such patients slowly with low calorie solutions and careful monitoring
  5. Hepatobiliary-fatty liver, cholestasis, increased liver enzymes
  6. Bone-osteomalacia, osteopenia
  7. Access abuse

### III. Fad Diets

- A. Obesity is defined by the Body Mass Index=wt. (kg)/ht. (m<sup>2</sup>)
  1. Normal BMI is about 18.5 to 24.9
  2. Overweight is about 25-29.9
  3. Obese is about 30-34.9
  4. Greater than 40 is severe/extremely obese.
- B. Major problem with 50% increase in prevalence since 1960's.
- C. 1 in 4 Adult Americans are obese.
- D. 1in 2 adults, and 1in 4 children are over weight.
- E. Behind Samoa US is # 2 in world (International Obesity Task force).
- F. Multiple health risks:
  1. Cardiovascular, Diabetes, Cancer, Respiratory (sleep apnea), Cirrhosis-to name a few.
- G. Philadelphia # 3-Fattest City (Men's Health-2/05).

- H. Most overweight people are overweight due to simple equation:
1. Too many calories in vs. amount of calories burned.
  2. Huge portion sizes in this country.
  3. Beverages with added sugar.
  4. Smoking cessation.
  5. Increased sedentary lifestyle.
  6. "Fast Food".
- I. We are hard wired to eat-it is difficult to turn off the innate "instinct" to eat.
1. Successful weight loss strategies employ a multi-factorial approach that explore and deal with each individual's reasons for over-eating. Must modify behavior, educate, and increase physical activity.
- J. Maintenance is the key!
- K. Among the various methods of weight loss besides diet, and exercise, there are various surgical approaches, pharmacologic therapy (lipase inhibitors and appetite suppressants), gastric pacing, to name a few.
- L. This discussion will be limited to DIETARY therapies.
- M. In particular many turn to "quick" weight loss programs with rapid results=FAD DIETS. Fad diets are defined by the following characteristics:
- 1 Quick fix
  2. Sound too good to be true
  3. Limited scientific evidence/single study
  4. Sell products
  5. Elimination of certain food groups-good/bad foods
- N. The dangers here include:
1. Complications of rapid weight loss-i.e. Malnutrition, Electrolyte disturbances/dehydration, Renal dysfunction, Gallstones, etc.
  2. Rapid gain of weight lost after the diet ends.
- O. Most experts advise a more gradual weight loss program with multidisciplinary approach. Goal is for about 1 to 2 pounds of loss per week. In those patients who are of advanced age, extremely overweight, or with other medical problems medical supervision is essential!
- P. Since many people flock to all these new **Fad Diets** a basic knowledge of these diets is advisable:
1. Robert Cameron-Drinking Men's Diet-claims one can lose weight by drinking wine, and eating steak—he needed CABG!**-1960.**
  2. Dr. Irwin Stillman-Quick Weight Loss Diet-Cut carbohydrates, drink water (large amounts)-**1967.**
  3. Dr. Atkins Diet Revolution-High protein-Low carbohydrate (promotes ketosis)-**1972-** supposedly this will burn fat.
  4. Complete Scarsdale medical diet by Dr. Herman Tarnower-High protein-Low carb-**1978.**
  5. Pritikin program-High fiber, <10% calories from fat, no added salt or sugar, regular aerobic exercise-1979.
  6. Beverly Hills Diet-fruit/water-many have side effect of diarrhea-**1980.**
  7. Optifast (Oprah did this one)-liquid diet-Oprah –regains weight-**1988.**
  8. Fen-Phen-appetite suppressant (fenfluramine/phenteramine)-side effect-heart Valve problems/Pulmonary hypertension-**1994**-many law suits!
  9. Enter the Zone-high protein, fruit vegetable with low carbs-**1995.**
  10. Protein Power-Michael and Mary Eades-Claim NO carbs.**1996.**
  11. Dr. Bob Arnot, Sugar-Busters, and Dr. Atkins new Diet revolution-**1997**-cut-the carbohydrates. Atkins says-eat all the fat and protein you wish.
  12. South Beach Diet-**2003**-3 Phases:
    - a. 14 days lean protein, veggies-NO Carbohydrates.
    - b. bring back minimal complex carbohydrates
    - c. maintenance-low fats ok, complex carbohydrates ok in limited servings
- Q. These fad Diets have significant potential for hazards:

1. Ketosis with dehydration
  2. Vitamin, mineral deficiency and other nutrient deficiency, Osteoporosis, Gout (increased intake of uric acid).
  3. Renal Insufficiency, Heart Disease, Hypertension
  4. Poor Long term weight control
- R. Studies evaluating these diets are difficult to interpret-especially since most are not longer than 6 to 12 months. Significant weight loss by any means will have at least favorable results in the short term on glucose, insulin sensitivity, BP, and Lipids.
- S. Bottom Line:
1. If total calories in is < calories burned= weight loss will happen (despite the make-up) of that total calorie #.
  2. If the average person eats 1500-2000 calories/day some weight loss should occur.
  3. The calorie breakdown should be "well rounded,"-based on New Food Pyramid:
- T. **The newest Recommendations from US Guidelines focus on obesity and were released-January, 05:**
1. Weight management-decrease calories and increase physical activity over time to avoid age-related weight gain.
  2. Regular physical activity-at least 30 minutes each day (ideal is 60 minutes/day).
  3. Variety of nutrients while limiting intake of saturated fats, Trans fats
  4. Encourage fruits/vegetables-2 cups fruit, and 2 ½ cups vegetables per day.
  5. Food safety-hygiene
  6. Limit fats
  7. Carbs-choose fiber rich fruits, vegetables, and whole grains.
  8. Eat < 2,300mg (one teaspoon)/day of sodium
  9. Etoh-max-1/day-women; 2/day-men
  10. Bottom of period is fruits/vegetables.
- U. BOTTOM LINE is as always **MODERATION** and **MAINTENANCE!!!!!!!!!!!!!!!!!!!!!!**

#### IV. References:

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**USDA Guidelines-2005**

#### V. Credits:

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