Optimal BMI and nutritional support of the obese hospitalized patient

I. Chermesh-Rozenwaser (IL)
Ideal body weight - a myth?

What aren’t they telling us?

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Rambam health care campus
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Ethical dilemmas
Bioethical principles
Application of bioethical principles to “Nutrition at the end-of-life”
The decision-making process
Body Mass Index = \frac{\text{Weight (in kg)}}{\text{Height}^2 (\text{in m})}
BMI and mortality 35-69 old

Higher BMI related to:
Increased cardiovascular disease and cancer mortality.

According to this BMI chart... I am too short.
That simple?
Maybe BMI is only a surrogate marker?

One size fits all?
Or maybe—there are other factors?

• Waist circumference
• Healthy diet
• Fitness
• Fat free mass
• Low fat mass
Association of body mass index and waist circumference with successful aging

- BMI/WC were assessed in 4869 persons
- 42-63 years old
- 16 years follow-up
- Survival
- successful aging
  - Alive
  - No chronic disease at age >60 years
  - Not in the worst age- and sex-standardized quartile
    - Cognitive
    - Physical
    - Respiratory
    - Cardiovascular
    - Mental health
Results

- **Survival 4362/ 4869 (~90%)**
  - BMI > 30 OR 0.55
  - Large waist circumference OR = 0.57

- **Successful aging 1008/4869 (~20%)**
  - BMI ≥ 30 OR 0.37
  - Large waist circumference OR 0.41

Reference values:
BMI 18.5-25 as reference
small waist (<94/80 cm in men/women).
Large waist circumference (≥102/88 cm in men/women)
A score of recommendations for death prevention- the whole picture

Man- 6 recommendations score range: 0–6
• Body fatness
• Physical activity
• Foods and drinks that promote weight gain
• Plant foods
• Animal foods
• Alcoholic drinks

Women- 7 recommendations score range: 0–7
• Above+7+ breastfeeding

• Higher scores indicated greater concordance with recommendations

Vergnaud Am J Clin Nutr. 2013
Results

- Median follow-up time of 12.8 y
- 23,828/378,864 deaths were identified
- Participants within the highest category of the score (5–6 points in men; 6–7 points in women) had a 34% lower hazard of death (95% CI: 0.59, 0.75) compared with participants within the lowest category of the score (0–2 points in men; 0–3 points in women).
- Significant inverse associations were observed in all countries.
- The WCRF/AICR score was significantly associated with a lower hazard of dying from cancer, circulatory disease, and respiratory disease.
1512 elderly followed for 7.9 years

Low (1st quartile) SMMI - 2-fold increase in total mortality (1.96; 1.63-2.35) and cardiovascular mortality (2.16; 1.51-3.08) risk compared to those with a normal [2nd, 3rd, or 4th quartile] SMMI
Fitness vs. Fatness
All-Cause Mortality

• Unfit individuals regardless of BMI $\times 2$ normal weight-fit individuals

• Overweight and obese-fit individuals = normal weight-fit individuals

Better fit and fat than lean and lazy

(Vaughn W. Barry Prog Cardiovasc Dis. 2014)
Groups of people

• Elderly
• ICU patients
• Dialytic patients
• Trauma patients
• Heart disease
  – Heart failure
  – Patients with atrial fibrillation
Elderly
BMI and mortality 35-69 old

The BMI was not related to total mortality among individuals aged 70 years and older

BMI and all cause, mortality adults >65 years

**FIGURE 2.** HRs (95% CIs) of all-cause mortality according to BMI for men and women aged ≥65 y. BMI was modeled with restricted cubic splines in a random-effects dose-response model. A BMI (in kg/m²) of 23.5 (most common midpoint for the reference BMI category) was used as the reference to estimate all HRs. The vertical axis is on a log scale.
Obesity Can Benefit Survival-
A 9-Year Prospective Study
1614 Chinese Nursing Home Residents

1614 69.5% female
mean age 83.7 ± 8.4 years
mean BMI 21.7 ± 4.8

<table>
<thead>
<tr>
<th></th>
<th>6 months</th>
<th>1 year</th>
<th>2 years</th>
<th>4 years</th>
<th>9 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>6.3%</td>
<td>14.3%</td>
<td>27.1%</td>
<td>47.3%</td>
<td>78.1%</td>
</tr>
<tr>
<td>Mortality reduction/1 unit increase BMI</td>
<td>9%</td>
<td>10%</td>
<td>9%</td>
<td>7%</td>
<td>5%</td>
</tr>
</tbody>
</table>
FALL

TRAUTMA

BMI

and

FALL
Obesity and trauma

- Increased mass may be associated with more frequent or more severe injuries at equal velocity.

Or

- some level of adiposity maybe protective, by imparting a “cushion” effect
Higher BMI was associated with different patterns of injury and complications, longer hospitalization, but lower mortality in both groups.
BMI and dialysis metaanalysis- 8 studies 190,163 people

<table>
<thead>
<tr>
<th>Study ID</th>
<th>RR (95% CI)</th>
<th>Weight (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iseki (1993)</td>
<td>0.64 (0.37, 1.11)</td>
<td>0.13</td>
</tr>
<tr>
<td>Wiesholzer (2003)</td>
<td>0.67 (0.36, 1.26)</td>
<td>0.09</td>
</tr>
<tr>
<td>Mutsert (2007)</td>
<td>0.93 (0.78, 1.11)</td>
<td>0.65</td>
</tr>
<tr>
<td>Yen (2010)</td>
<td>0.90 (0.60, 1.34)</td>
<td>0.17</td>
</tr>
<tr>
<td>Agarwal (2011)</td>
<td>0.89 (0.65, 1.21)</td>
<td>0.23</td>
</tr>
<tr>
<td>Subtotal (I-squared = 0.0%, p = 0.661)</td>
<td>0.87 (0.76, 1.00)</td>
<td>1.27</td>
</tr>
<tr>
<td>Large</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stack (2004)</td>
<td>0.76 (0.75, 0.78)</td>
<td>58.75</td>
</tr>
<tr>
<td>Kalantar-Zadeh (2005)</td>
<td>0.76 (0.73, 0.78)</td>
<td>28.99</td>
</tr>
<tr>
<td>Molnar (2011)</td>
<td>0.74 (0.71, 0.78)</td>
<td>11.00</td>
</tr>
<tr>
<td>Subtotal (I-squared = 0.0%, p = 0.536)</td>
<td>0.76 (0.75, 0.77)</td>
<td>98.73</td>
</tr>
<tr>
<td>Overall (I-squared = 16.1%, p = 0.303)</td>
<td>0.76 (0.75, 0.77)</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Li T, Int Urol Nephrol. 2014
Median survival of 175 patients according to BMI or body-composition classification

<table>
<thead>
<tr>
<th>BMI</th>
<th>Survival</th>
<th>P</th>
</tr>
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<tbody>
<tr>
<td>&lt;18.5 kg/m²</td>
<td>0.52 (0.19–0.98)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>18.5–24.9 kg/m²</td>
<td>2.03 (0.06–3.05)</td>
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<tr>
<td>25–29.9 kg/m²</td>
<td>2.64 (0.23–3.16)</td>
<td></td>
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<tr>
<td>&gt;30 kg/m²</td>
<td>2.61 (0.26–3.20)</td>
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<table>
<thead>
<tr>
<th>Fat free mass</th>
<th>Survival</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>0.47 (0.06–2.98)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Normal/high</td>
<td>2.59 (0.23–3.20)</td>
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<table>
<thead>
<tr>
<th>Fat mass</th>
<th>Survival</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>1.93 (0.19–3.16)</td>
<td>0.002</td>
</tr>
<tr>
<td>High</td>
<td>2.60 (0.06–3.20)</td>
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<table>
<thead>
<tr>
<th>Sarcopenic obesity</th>
<th>Survival</th>
<th>P</th>
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</thead>
<tbody>
<tr>
<td>Sarcopenia</td>
<td>0.53 (0.19–2.98)</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>2.54 (0.27–3.16)</td>
<td></td>
</tr>
<tr>
<td>Obesity</td>
<td>2.61 (0.23–3.20)</td>
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</table>

*All values are medians; ranges in parentheses. P values were determined by using the log-rank test. FFMI, fat-free mass index; FMI, fat mass index.*

The obesity paradox in cancer (2)
Overweight and atrial fibrillation

Clin Res Cardiol. 2014 Feb 18
Overweight is associated with improved survival and outcomes in patients with atrial fibrillation.
Obese ICU - Special considerations

Intubation  
GERD and aspiration pneumonia

Poor wound healing

Tracheostomy

CVP-RR 6.15

metabolic
Could obesity be protective?

- If the mortality graph of BMI versus outcome is U shaped what is the nadir?
- What is the optimal BMI?
  - ‘ICU patients: fatter is better?’
  - ‘Are the fat really fit?’

Druml Intensive Care Med. 2008
Singh N Crit Care Med. 2007
16,812 adult patients

Abhyankar et al. Critical Care 2012
Principals of Nutrition in ICU

- The sooner the better
- The lesser the nutritional deficit the better
- Less is (sometimes) more
- Avoid hyperglycemia
- Perform calorimetry

Do these principles apply to obese patients?

Obese patients have a catabolic response to injury similar to that of normal-weight patients
'The paucity of information for the nutrition management of the obese, critically ill patient in the literature and in specialty society guidelines is problematic'

Basic principles of critical care nutrition should be applied to the obese critically ill patient. The need for and the benefit gained from early enteral nutrition (EN) is no different from that of their lean counterparts

McClave SA Nutrition therapy of the severely obese, critically ill patient: summation of conclusions and recommendations JPEN 2011
Obese patients in ICU

- Large fat stores do not protect obese patients against the loss of lean mass in catabolic states

- An obese patient should be fed in order to minimise the loss of lean mass

- Obese patients should receive nutrition support without delay

- Our ability to calculate energetic requirements in obese patients is even less accurate than in non-obese patients
Hypocaloric high protein feeding

Rational

Obesity is associated with insulin resistance and hyperglycemia

Weight reduction can help with managing IR

- Provide energy and protein to conserve lean body mass
- Studies prove:
  - safety
  - better glucose control
  - shorter ventilation and ICU
  - lower antibiotic use
  - better nitrogen balance
  - No difference in mortality

Dickerson Nutrition 2002
Raza Crit Care Clin 2010
Critically ill obese patient

ASPen guidelines

- Permissive underfeeding or hypocaloric feeding with EN is recommended.

- BMI is >30 provide
  - EN < 60%-70% of target energy
  - 11-14 kcal/kg actual body weight per day (or 22-25 kcal/kg ideal body weight per day)

- Protein should be provided
  - BMI 30-40: ≥2.0 g/kg IWW/d
  - BMI >40: ≥2.5 g/kg IBW/d

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Current enteral formulations do not meet recommendations

A.S.P.E.N. Clinical Guidelines: Nutrition Support of Hospitalized Adult Patients With Obesity

Patricia Choban, MD1; Roland Dickerson, PharmD, BCNSP2; Ainsley Malone, MS, RD, CNSC3; Patricia Worthington, MSN, RN4; Charlene Compher, PhD, RD, CNSC, LDN, FADA, FASPEN5; and the American Society for Parenteral and Enteral Nutrition

Abstract

Background: Due to the high prevalence of obesity in adults, nutrition support clinicians are encountering greater numbers of obese patients who require nutrition support during hospitalization. The purpose of this clinical guideline is to serve as a framework for the nutrition support care of adult patients with obesity. Method: A systematic review of the best available evidence to answer a series of questions regarding management of nutrition support in patients with obesity was undertaken and evaluated using concepts adopted from the Grading of Recommendations, Assessment, Development and Evaluation working group. A consensus process, that includes consideration of the strength of the evidence together with the risks and benefits to the patient, was used to develop the clinical guideline recommendations prior to multiple levels of external and internal review and approval by the A.S.P.E.N. Board of Directors. Questions: (1) Do clinical outcomes vary across levels of obesity in critically ill or hospitalized non-intensive care unit (ICU) patients? (2) How should energy requirements be determined in obese critically ill or hospitalized non-ICU patients? (3) Are clinical outcomes improved with hypocaloric, high protein diets in hospitalized patients? (4) In obese patients who have had a malabsorptive or restrictive surgical procedure, what micronutrients should be evaluated? (JPEN J Parenter Enteral Nutr. XXXX;XX:XX-XX)

<table>
<thead>
<tr>
<th>Question</th>
<th>Recommendation</th>
<th>Recommendation Grade and Evidence Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do clinical outcomes vary across levels of obesity in critically ill or hospitalized non-ICU patients?</td>
<td>1a. Critically ill patients with obesity experience more complications than patients with optimal BMI levels. Nutrition assessment and development of a nutrition support plan is recommended within 48 hours of ICU admission.</td>
<td>Recommendation: Strong, Evidence: Low</td>
</tr>
<tr>
<td></td>
<td>1b. All hospitalized patients, regardless of BMI, should be screened for nutrition risk within 48 hours of admission, with nutrition assessment for patients who are considered at risk.</td>
<td>Recommendation: Strong, Evidence: Low</td>
</tr>
<tr>
<td>2. How should energy requirements be determined in obese critically ill or hospitalized non-ICU patients?</td>
<td>2a. In the critically ill obese patient, if indirect calorimetry is unavailable, energy requirements should be based on the Penn State University 2010 predictive equation, or the modified Penn State equation if the patient is over the age of 60 years.</td>
<td>Recommendation: Strong, Evidence: High</td>
</tr>
<tr>
<td></td>
<td>2b. In the hospitalized obese patient, if indirect calorimetry is unavailable and the Penn State University equations cannot be used, energy requirements may be based on the Mifflin–St Jeor equation using actual body weight.</td>
<td>Recommendation: Weak, Evidence: Moderate</td>
</tr>
<tr>
<td>3. Are clinical outcomes improved with hypocaloric, high protein diets in hospitalized patients with obesity?</td>
<td>3a. Clinical outcomes are at least equivalent in patients supported with high protein, hypocaloric feeding to those supported with high protein, eucaloric feeding. A trial of hypocaloric, high protein feeding is suggested in patients who do not have severe renal or hepatic dysfunction. Hypocaloric feeding may be started with 50%-70% of estimated energy needs or &lt; 14 kcal/kg actual weight. High protein feeding may be started with 1.2 g/kg actual weight or 2-2.5 g/kg ideal body weight, with adjustment of goal protein intake by the results of nitrogen balance studies.</td>
<td>Recommendation: Weak, Evidence: Low</td>
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<tr>
<td></td>
<td>3b. Hypocaloric, low protein feedings are associated with unfavorable outcomes. Clinical vigilance for adequate protein provision is suggested in patients who do not have severe renal or hepatic dysfunction.</td>
<td>Recommendation: Weak, Evidence: Low</td>
</tr>
</tbody>
</table>
Take home messages

• BMI does not tell the whole story- lifestyle is important as well as body composition

• Obese patients have higher complication rates but, better overall prognosis in ICU

• They suffer loss of lean body mass like any other patient and should be nourished promptly

• Hypocaloric feeding with low calories but high protein is a reasonable approach

• Calorimetry is best otherwise use an equation using adjusted body weight
The obesity paradox in cancer (1)

- Is it the BMI?
- Fat?
- Muscle mass?

The obesity paradox in cancer (3)
BMI and Months of survival in dialysis patients

- **Underweight**: 26 months
- **Normal**: 50 months
- **Overweight**: 57.7 months
- **Obese**: 49 months
Overweight and atrial fibrillation

**Fig. 1** Event rates of outcome variables in patients with atrial fibrillation in BMI subgroups. Normal BMI range 18.5–24 kg/m², dark color. CNS central nervous system

Clin Res Cardiol. 2014 Feb 18
Overweight is associated with improved survival and outcomes in patients with atrial fibrillation.
What about obese patients?

- Do these principles apply to obese patients?
- Do they have a reserve that can serve them during the stress of ICU
- We know only some of the answers-