Bariatric Surgery - Insight into pathophysiology of Obesity and Weight Loss

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Disclosure

• I drove to Jeddah
Objectives

- Prevalence worldwide and KSA
- Risk Factors, morbidity and mortality of Obesity
- Pathophysiology
- Mechanism of Obesity-associated Diabetes Mellitus
- Obesity Management:
  - Life Style
  - medications
  - Bariatric Surgery
June 2013, the AMA adopted policy that recognizes obesity as a disease requiring a range of medical interventions to advance obesity treatment and prevention.
WHO Prevalence of Obesity 2008
Obesity in Saudi Arabia

From Wikipedia, the free encyclopedia

Obesity in Saudi Arabia is a growing health concern with health officials stating that it is one of the leading causes of preventable deaths in Saudi Arabia. According to Forbes, Saudi Arabia ranks 29 on a 2007 list of the fattest countries with a percentage of 68.3% of its citizens being overweight (BMI>25).[1] Compounding the problem, according to a presentation at the 3rd International Obesity Conference in February 2014, is that obesity-related surgeries are not covered under Saudi healthcare.[2]

See also [edit]

- Epidemiology of obesity
Definition

Obesity is defined as: abnormal or excessive fat accumulation.

BMI: person's weight in kilograms divided by the square of his/her height in meters (kg/m²).

* Waist Circumference
<table>
<thead>
<tr>
<th>Classification</th>
<th>BMI (kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt;18.5</td>
</tr>
<tr>
<td>Normal weight</td>
<td>18.5 – 24.9</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.0 – 29.9</td>
</tr>
<tr>
<td>Obesity grade 1</td>
<td>30.0 – 34.9</td>
</tr>
<tr>
<td>Obesity grade 2</td>
<td>35.0 – 39.9</td>
</tr>
<tr>
<td>Obesity grade 3</td>
<td>&gt;40.0</td>
</tr>
</tbody>
</table>
Waist Circumference

• Locate the upper hip bone and the top of the right iliac crest.
• Place a measuring tape in a horizontal plane around the abdomen at the level of the iliac crest.
• For women:
  * risk is high at $\geq 88$ cm
  * risk is high at $\geq 102$ cm
Risk Factors

- Food Consumption: Fast foods and any other type of food not prepared at home*.
- Avoiding breakfast **.
- Urbanization***.
- Cultural Factors.

* T. T. Amin, A. I. Al-Sultan, and A. Ali, “Overweight and obesity and their association with dietary habits, and sociodemographic characteristics among male primary school children in Al-Hassa, Kingdom of Saudi Arabia,”
All-cause mortality versus BMI

Number at risk

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2218</td>
<td>3295</td>
</tr>
<tr>
<td>8</td>
<td>4,522</td>
<td>34,617</td>
</tr>
<tr>
<td>16</td>
<td>91,102</td>
<td>88,348</td>
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<tr>
<td>25</td>
<td>160,296</td>
<td>88,070</td>
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<tr>
<td>35</td>
<td>138,592</td>
<td>57,023</td>
</tr>
<tr>
<td>45</td>
<td>62,071</td>
<td>30,824</td>
</tr>
<tr>
<td>55</td>
<td>23,342</td>
<td>18,372</td>
</tr>
<tr>
<td>65</td>
<td>7,360</td>
<td>9,366</td>
</tr>
<tr>
<td>75</td>
<td>2462</td>
<td>5100</td>
</tr>
<tr>
<td>85</td>
<td>843</td>
<td>2821</td>
</tr>
<tr>
<td>95</td>
<td>540</td>
<td>2738</td>
</tr>
</tbody>
</table>

Yearly deaths per 1000 (95% CI)
Medical Complications of Obesity

- Pulmonary disease
  - abnormal function
  - obstructive sleep apnea
  - hypoventilation syndrome
- Idiopathic intracranial hypertension
- Stroke
- Cataracts
- Coronary heart disease
  - Diabetes
  - Dyslipidemia
  - Hypertension
- Severe pancreatitis
- Cancer
  - breast, uterus, cervix
  - colon, esophagus, pancreas
  - kidney, prostate
- Nonalcoholic fatty liver disease
  - steatosis
  - steatohepatitis
  - cirrhosis
- Gall bladder disease
- Gynecologic abnormalities
  - abnormal menses
  - infertility
  - polycystic ovarian syndrome
- Osteoarthritis
- Skin
- Gout
- Phlebitis
  - venous stasis
Pathophysiology (Energy Balance)
Neurophysiological Mechanisms involved in Obesity

Peripheral Signals

- Ghrelin
- Leptin
- CCK
- PYY
- GLP-1
- Insulin
- Amylin

Hypothalamus

- NPY/AGRP Neurons
  - Orexigenic = ↑ food intake
  - Stimulated by ghrelin
  - Inhibited by leptin

- POMC/CART Neurons
  - Anorexigenic = ↓ food intake
  - Stimulated by leptin and other appetite-suppressing signals

- MC4R

PVN, LH

↑ Intake

NPY, Y1R, Y5R

AGRP

↓ Intake

Higher cortical centers

αMSH
Key Hormone Changes Associated with Weight Gain and Regain

<table>
<thead>
<tr>
<th>Hormone</th>
<th>Source</th>
<th>Normal function</th>
<th>Alteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholecystokinin (CCK)</td>
<td>Duodenum</td>
<td>Suppress appetite</td>
<td>Levels decrease during dieting and weight loss</td>
</tr>
<tr>
<td>Glucose-dependent insulinotropic polypeptide (GIP)</td>
<td>Duodenum, jejunum</td>
<td>Energy storage</td>
<td>Levels increase during dieting and weight loss</td>
</tr>
<tr>
<td>Ghrelin</td>
<td>Gastric fundus</td>
<td>Stimulate appetite, particularly for high-fat, high-sugar foods</td>
<td>Levels increase during dieting and weight loss</td>
</tr>
<tr>
<td>Glucagon-like peptide 1 (GLP-1)</td>
<td>Ileum</td>
<td>Suppress appetite and increase satiety</td>
<td>Decreased functionality</td>
</tr>
<tr>
<td>Insulin</td>
<td>Pancreas</td>
<td>Regulate energy balance, signal satiety to brain</td>
<td>Insulin resistance in obese persons Reduced insulin levels after dieting</td>
</tr>
<tr>
<td>Leptin</td>
<td>Adipocytes</td>
<td>Regulate energy balance, suppress appetite</td>
<td>Levels decrease during weight loss</td>
</tr>
<tr>
<td>Peptide YY (PYY)</td>
<td>Distal small intestine</td>
<td>Suppress appetite</td>
<td>Levels decreased in obese persons</td>
</tr>
</tbody>
</table>

Treatment Modalities for Patients with Overweight and Obesity

- Lifestyle Intervention
- Medications
- Bariatric Surgery
When to treat medical/surgical?

- BMI > 27 with comorbidities
- BMI > 30 without comorbidities
Look AHEAD

5145 adults with type 2 diabetes who had a body mass index (BMI) > 25 randomly assigned to the intensive lifestyle arm or the diabetes support and education

Look AHEAD Trial

Patients experiencing death from CV causes, nonfatal MI, nonfatal stroke, or hospitalization for angina (%)

Hazard ratio, 0.95 (95% CI, 0.80–1.09)
P = 0.51

Bariatric Surgery
Surgery

Bariatric surgical procedures affect weight loss through two fundamental mechanisms:

(1) Malabsorption
(2) Restriction
(3) Both ways
# Bariatric Surgery Type and Weight Loss

Weight Loss as a Percentage of Excess Body Weight (EBW) 164 patients

<table>
<thead>
<tr>
<th>Surgical Procedure</th>
<th>%EBW Loss / Follow-up Period</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>1-2 Yrs</td>
</tr>
<tr>
<td>Vertical banded gastroplasty</td>
<td>50-72</td>
</tr>
<tr>
<td>Gastric banding</td>
<td>29-87</td>
</tr>
<tr>
<td>Laparoscopic sleeve gastrectomy</td>
<td>33-58</td>
</tr>
<tr>
<td>Roux-en-Y gastric bypass</td>
<td>48-85</td>
</tr>
<tr>
<td>Roux-en-Y gastric bypass – Long-limb</td>
<td>53-74</td>
</tr>
<tr>
<td>Biliopancreatic diversion ± duodenal switch</td>
<td>65-83</td>
</tr>
</tbody>
</table>

Weight Regain after Bariatric Surgery

SOS Study: Mean Percent Weight over 15 years

<table>
<thead>
<tr>
<th>No. patients</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>15</th>
<th>20</th>
</tr>
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<tbody>
<tr>
<td>Control</td>
<td>2037</td>
<td>1490</td>
<td>1242</td>
<td>1267</td>
<td>556</td>
<td>176</td>
<td></td>
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<tr>
<td>Banding</td>
<td>376</td>
<td>333</td>
<td>284</td>
<td>284</td>
<td>150</td>
<td>50</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Gastroplasty</td>
<td>1369</td>
<td>1086</td>
<td>987</td>
<td>1007</td>
<td>489</td>
<td>82</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bypass</td>
<td>265</td>
<td>209</td>
<td>184</td>
<td>180</td>
<td>37</td>
<td>13</td>
<td></td>
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</tr>
</tbody>
</table>

Bariatric Surgery Outcomes

Patients With Type 2 Diabetes (150 patients)

Bariatric Surgery Outcomes
Mortality Reduced in Severely Obese Patients
Swedish Obese Subjects Study (n=4047)

Who should be referred to surgery?

- Be well-informed and motivated
- Have a BMI $\geq 40$ kg/m$^2$
- Have acceptable risk for surgery
- Have failed previous non-surgical weight loss
- The NIH also suggested that adults with a BMI $\geq 30$ kg/m$^2$ who have serious comorbidities such as severe diabetes, sleep apnea, or joint disease may also be candidates
• Pathophysiology of obesity is complex and include energy scale

• Surgical treatment showed better outcome compared to intusive weight loss

• Endothelial dysfunction play a major role in complication of obesity and complication after weight loss