LOW CARB RADIOLGY

ENHANCING YOUR IMAGE

MARK W. BERGER, MD
HIGH CARB VS. LOW CARB
“Now Abel kept flocks, and Cain worked the soil. In the course of time Cain brought some of the fruits of the soil as an offering to the Lord. But Abel brought fat portions from some of the firstborn of his flock. The Lord looked with favor on Abel and his offering, but on Cain and his offering he did not look with favor.”
(*BMI ≥30, or about 30 lbs. overweight for 5’4” person)
OBESITY IN AMERICA

• Body Mass Index is a measurement of weight related to height; mass (kg)/height (cm) squared.

• BMI >25 overweight; >30 obese

• By these criteria, 2/3 US adults overweight, 1/3 obese

• 16% of children and adolescents are obese

• Inaccurate number when looking at individuals; doesn’t take into account body composition or fat distribution
According to this BMI chart... I am too short.
FAT DISTRIBUTION

• Subcutaneous fat: Beneath the skin, venous drainage via systemic circulation, low associated CVD risk

• Visceral fat: Deep inside the abdominal cavity, surrounds organs. Venous drainage via portal vein that empties directly into liver. Elevated risk of CVD, insulin resistance, metabolic syndrome, type 2 diabetes
VISCERAL FAT

• In constant state of turnover, fat deposited and removed on continual basis

• Cortisol mobilizes triglycerides from fat storage and relocates them to visceral fat cells

• Visceral fat contains more cortisol receptors compared to subcutaneous fat, and greater amounts of the enzyme 11-beta hydroxysteroid dehydrogenase, which converts inactive cortisone to active cortisol

• Should be considered an endocrine organ; biologically active, produces own hormones: leptin, resisten, adiponectin

• In association with inflammatory cells also produces cytokines IL-1, IL-6, and TNF-alpha that increase cardiovascular disease risk

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Waist Circumference

- More accurate in assessing visceral fat and abdominal obesity than BMI
- Men > 40 inches; waist/hip of >0.9
- Women > 35 inches; waist/hip of >0.85
METABOLIC SYNDROME

- Waist Circumference: Men > 40 inches; females >35 inches
- Hypertension (BP >130/85)
- Elevated triglycerides > 150 mg/dl
- HDL < 40 (males); <50 (females)
- Elevated fasting blood sugar >100 mg/dl
Waist CIRCUMFERENCE and VISCERAL fat

Variation in visceral fat content in men with the same waist circumference.
NORMAL FAT DISTRIBUTION
BODY HABITUS

"Apple" vs. "Pear"

Above the waist
Below the waist

ADAM.
NORMAL  

VISCERAL FAT  

INCREASED
NORMAL BMI < 25

OBESE BMI > 30
Adipose tissue subtypes

- “TOFI” - Thin on the outside, fat on the inside; BMI <25 kg/sq m, but increased visceral fat and abnormal metabolic parameters
- “Fat-fit” - BMI >30 kg/sq m, but metabolically normal despite increased body adiposity
- Only way to differentiate is with cross sectional imaging or DEXA
Fatty Liver (Hepatic steatosis)

- Reversible condition where fatty acids in the form of triglycerides accumulate within hepatocytes, either deposited or de novo synthesis.
- Associated with alcohol or steroid use, or non-alcoholic causes (NAFLD), including obesity and insulin resistance.
- Cells become inflammed resulting in non-alcoholic steatohepatitis (NASH).
- Can proceed to cirrhosis.
VISCERAL FAT AND PORTAL VENOUS DRAINAGE

- Release of free fatty acids (FFA) from an expanded, and highly active intra-abdominal adipose tissue depot
- Products released from the intra-abdominal depot are drained via the portal vein, leading directly to the liver
- Increased exposure to FFA leads to hepatic insulin resistance, fat deposition, lipotoxicity and metabolic derangements
MEDIVAT STUDY

• Evaluated the effects of a Mediterranean diet on visceral fat volume and hepatic steatosis detected by MRI and metabolic parameters
• 30 overweight or obese participants; 17 male, 13 female
• MRI and blood testing at baseline and at 3, 6 and 12 months with review of images with participants
• Nutritional consultation with dietician at baseline and monthly
• Maintained food journal
• Pedometer, with goal of 10,000 steps/day

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MEDIVAT STUDY

- Mediterranean style diet
- Emphasis on vegetables and fruit
- Higher fat; predominantly monounsaturated olive oil, but included saturated fat/occasional red meat and seafood
- Whole grains
- Legumes, nuts and seeds
- Goal of 30% carbohydrate, 30% protein, 40% fat
9 of 30 participants completed 1 year study period

5 of 9 experienced significant visceral fat reduction (>5%). Of these, 4 of 5 improved hepatic steatosis

3 experienced no change in visceral fat, but improved metabolic markers

1 increased visceral fat by 4%
SHANNON DURING AND AFTER MOUNTAIN DEW.

8 /20 /14

10 /29 /14
EXPECTED METABOLIC PROFILE ON HIGHER FAT DIET

- Increased HDL
- LDL variable; may increase, but type A non-atherogenic particles
- Lower triglycerides
- Lower fasting blood sugar
- Lower HbA1C
- Lower inflammatory markers (CRP, homocysteine, fibrinogen)
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“It may be stated categorically that the storage of fat and therefore the production and maintenance of obesity cannot take place unless glucose is being metabolized. Since glucose cannot be used by most tissues without the presence of insulin, it also may be stated categorically that obesity is impossible in the absence of adequate concentrations of insulin.”

KETONE CONSERVATION
BODY COMPOSITION ANALYSIS

- Skin fold caliper
- Bioelectrical impedance
- Water displacement/Hydrostatic weighing
- DEXA imaging
- CT
- MRI
• Long track record

• Generally an accurate measure of subcutaneous body fat

• Taken at strategic locations: biceps, triceps, mid and lower back, waist, and calf. Results used to calculate total percent body fat

• User dependent
• Based on principle that lean tissue is more electrically conductive than fat

• Mild painless electrical current passed through body, usually from wrist to foot

• Can be performed with individual fully clothed

• Accurate, minimal skill required by examiner

• Favored form of analysis in health clubs, but more expensive than skin caliper measurements
HYDROSTATIC WEIGHING

• Based on principle that fat is less dense than water

• Compares individuals weight on dry land to their underwater weight, and uses results to calculate the proportion of fat to lean tissue

• Due to equipment requirements and operator expertise, not readily available.
Gold standards for assessing visceral fat

Can directly measure and quantify both subcutaneous and visceral compartments

Software programs can automatically measure visceral fat, but expensive and typically limited to academic setting. Manual measurements accurate, but time consuming and operator dependent

Much more expensive than other modalities

CT utilizes radiation; no radiation with MRI
• Dual Energy X-ray Absorptiometry

• 2 low dose X-ray beams of different energy levels. Differential attenuation of the 2 beams used to estimate bone mineral density and soft tissue composition.

• Subtracts directly measured lean body tissue to determine fat mass.

• Similar accuracy to CT

• Very quick, 10 minutes for whole body scan

• Much less expensive than MRI and more available
DEXA
LOW CARB
6-PACK ABS
LOW CARB RADIOLGY

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