

# Obesity: a Clinical and North American Perspective



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# History of the Obesity Epidemic



- At the end of WWII convenience foods (aka processed) became the hallmark of the modern family and allowed women to join the work force.
- There was also the rise of “fast food”; loaded with calories, carbs, harmful fats and production beef.
- In the 60s-70s there was a new awareness of heart disease and the role of cholesterol
- In the 80s the low –fat diet acquired wide spread endorsement and the high carb calorie counting era that led to fructosification of America was born

# Dimensions of the Problem in the US



- Two –thirds of American Adults are overweight or obese
  - All adults: 133.6 million (66%)
  - Women: 65 million (61.6%)
  - Men: 68.3 million (70.5%)
  - The IOM estimates that >42% of Americans will be obese by 2030!

# Where We've Been



- The prevalence of obesity and overweight has increased across all genders, ages, ethnic groups, and socio-economic groups over time.
    - From 1960-2004 overweight increased from 44.8% to 66% in adults aged 20-74 years.
    - Obesity increased from 13.3% to 32%.
- ✦ **From [win.niddk.nih.gov/statistics/](http://win.niddk.nih.gov/statistics/)**

# Dimensions of the Problem



- Costs associated with obesity
  - Direct costs in healthcare spending for obesity \$11 billion
    - ✦ Finkelstein et al, Journal of Health Economics 2009
  - Mortality estimates have recently doubled the impact of obesity and increased the annual rate to 2 million
    - ✦ CDC 2013

Obesity contributes \$147-\$210 billion in healthcare costs of preventable chronic diseases annually

- Cawley, et al, Journal of Health Economics

# Adipose Tissue



- No longer viewed as simply a fat depot; it is an active secretory organ that modulates:
  - Appetite
  - Energy expenditure
  - Insulin sensitivity
  - Endocrine and reproductive systems
  - Bone metabolism
  - Inflammation
  - Immunity
    - ✦ New obesity classification. Lorenzo, et al World Journal of Gastroenterology 2016

# Why is Obesity a Problem?



- Overweight and Obesity are risk factors for:
  - Diabetes
  - Coronary artery disease
  - Elevated cholesterol
  - Stroke
  - Hypertension
  - Gallbladder and Liver disease
  - Osteoarthritis
  - Sleep apnea and asthma
  - Cancer(breast, colon, endometrial, and kidney)
  - Lymphedema (C. Fife, Ostomy Wound Mgmt, 1/08)

# The Global Burden of Disease



## The US burden of disease report 1990-2016:

- The main causes contributing to total disability in the US were:
  - 1. poor diet
  - 2. smoking
  - 3. high blood pressure
  - 4. **obesity**
    - ✦ US Burden of Disease Collaborators, JAMA 2018, April

# Travels in Chile



# Some Reasons for the Epidemic



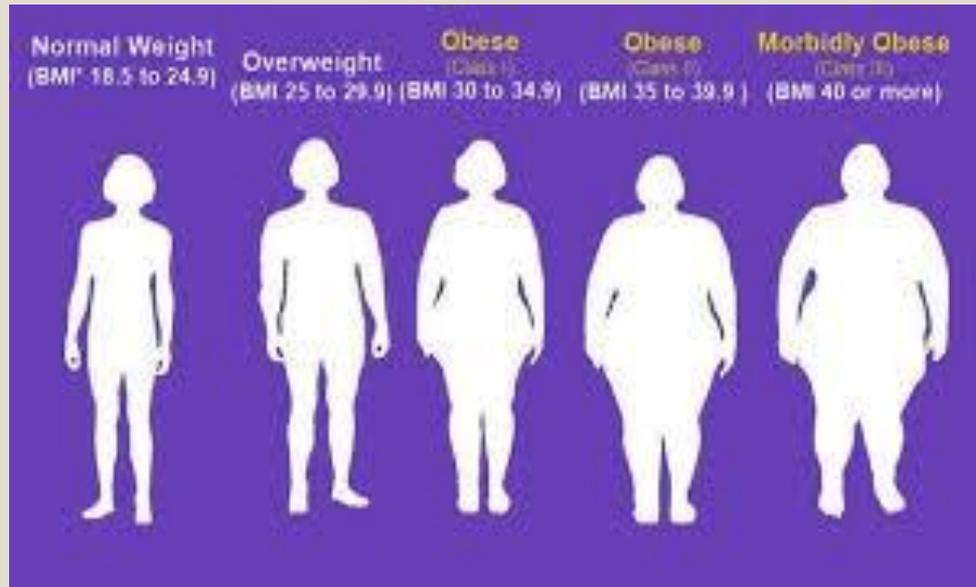
## AN INCREASINGLY SEDENTARY LIFESTYLE

- Driving
- TV
- Video games
- Reduction in PE in schools from 42% in 1980 to 31% in 2001.
- Energy saving devices: escalators, vacuum robots, etc

# VALDIVIA, CHILE



# BMI



# MASSIVE LOCALIZED LYMPHEDEMA



# An Increasingly Sedentary Lifestyle



- Ride elevator 2 Kcal
- Order take out 1 Kcal
- Video game 53 Kcal
- Riding mower 88 Kcal
- Based on 1/2 hour activity by 150# person
- Climb 1 flight of stairs 19 Kcal
- Cook meal 70 Kcal
- Play basketball 280 Kcal
- Power mower 193 Kcal

# Benefits of Physical Activity



- Reduces:
  - Obesity
  - Type II diabetes
  - Cardiovascular disease
  - Dementia
  - 8 forms of Cancer: bladder, breast, colon, endometrium, esophagus, kidney, lung, and stomach)

# Physical Activity Guidelines



- For Adults 150 minutes of aerobic exercise per week and 2 days of muscle strengthening activity
- For youth (6-17) 60 minutes on moderate-intensity activity per day and 3 days per week of muscle strengthening activity
  - 26% of men
  - 19% of women
  - 20% of adolescents currently meet these PAG recommendations
    - ✦ JAMA 2018, November

# Recommendations of the 2018 PAG



- 1. The medical care system must promote physical activity
- 2. Use new technologies i.e. wearables and social media to promote physical activity
- 3. Facilitate physical activity in the work place
- 4. Increase youth participation in sports

# Why is Obesity a Problem?



- **Complications of Obesity:**
  - Pregnancy complications
  - Menstrual irregularity
  - Hirsutism
  - Stress incontinence
  - Psychological disorders i.e. depression
  - Increased surgical risks
  - Increased mortality due to DM, MI, CVA, etc.

# THE COSTS OF OUR SEDENTARY LIFESTYLE



- \$117 Billion in annual healthcare costs
- 10% of all premature mortality could be reduced by meeting the recommendations for physical activity



## Trends in Sedentary Behavior

In the US between 2001 and 2016

- Trends show high rates of sitting outside of school or work to view television or videos 2 hours daily and at least 1 hour was spent sitting using a computer
- A disturbing trend was an increase in sedentary behaviors for adolescents and young adults
  - Lin Yang, et al; JAMA 2019, April

# Childhood Obesity



- The risk of associated health issues increases with the length of time obesity has been present. Thus the alarming increase in childhood obesity is causing concern throughout the medical arena as the incidence of Type II Diabetes is soaring and hypertension, fatty liver gallstones and CVD risk are on the rise in children.

# Childhood Obesity



- **Some Stats:**

- In 1971 4% of 6-11 year olds were obese
- In 2004 19% of 6-11 year olds were obese
- In 2007 32% of all American children were overweight
- 90% of all overweight children have at least one avoidable risk factor for CVD
- Childhood obesity has increased 150% in China over the last decade

# Some Reasons for the Epidemic



- **Calories IN are more than calories OUT**
  - The average sedentary women will expend only 1600 Kcal daily and the average man 2200 Kcal.
  - In 2000 the daily average caloric consumption for a woman was 1877 Kcal and 2,618 Kcal for men.
  - This is more than 300 Kcal excess daily or the equivalent of a 30 pound weight gain per year.
    - ✦ (CDC)

# Some Reasons for the Epidemic



- Calories IN are more than Calories OUT
  - Supersized foods and drinks
    - ✦ Vasan et al found that soft drink consumption has tripled between 1977-2001 and that there is a >50% chance of developing the Metabolic Syndrome in those who consume even one diet or regular soft drink daily.
  - Increased cost of fruits and vegetables by >75% and reduced cost of fats and oils >25% making high calorie foods less expensive.

# How Obesity is Measured



- Early data was based on the Metropolitan Life Insurance desirable-weight –for-height tables (1959-1980s)
- Currently used is the BMI derived from cross – sectional studies conducted by the CDC and the National Center for Health Statistics.
  - (NHANES)

# How Obesity is Measured



- **Body Mass Index (BMI)**
  - $\text{Weight(kg)}/\text{height(m}^2\text{)}$
  - To use pounds and inches :
  - Multiply the weight in pounds by 704.5 ( the American Dietetic Association uses 700), then divide the result by the height in inches and then that result by the height in inches again.
    - ✦ (NIH)

# How Obesity is Measured



- Body Mass Index (BMI):
- Healthy weight to height: 18-24.9
- Overweight: 25-29.9 ( class I)
- Obese: 30-39.9 (class II)
- Morbidly obese: 40-49.9 (class III)
- Super morbid obese 50 +

# What is the Metabolic Syndrome?



- The Metabolic Syndrome is associated with an increased risk of CVD and DM.
- It is defined as the presence of three of the following risk factors:
  - Excess waist circumference
    - ✦ Men : waist size >40” or 102 cm
    - ✦ Women: waist size >35” or 88 cm`
  - Hypertension
  - Elevated triglycerides
  - Low HDL
  - High fasting glucose levels

# Fat Metabolism



- Adipose tissue is an active endocrine organ that regulates metabolic processes by elaborating adipokines, which include TNF, cytokines, hormones, and other inflammatory mediators.
- These appear to be a key link in the development of insulin resistance and type 2 diabetes.(Hotamisligil et al Cell. 2010;140(3):338-348)

# Fat Metabolism



- 20% of obese persons do not develop Metabolic Syndrome and may have higher levels of Adiponectin which increases storage of fat in lipocytes and keeps fat away from the viscera (belly fat). Subcutaneous or peripheral fat is less harmful. (Despres)
- With exercise belly fat is the first fat to be mobilized.

# Other Possible Contributions



- The Thrifty gene
- Growth Hormone/estrogen additives to meats
- Hidden sugars (HFCS) in processed foods and artificial sweeteners causing dysbiosis
- Appetite stimulants in processed foods
- The “lonely” American lifestyle causing stress-> increased cortisol -> increased belly fat -> metabolic syndrome.

# Some Reasons for the Obesity Epidemic



- Obesity is poorly understood and the recent epidemic is clearly a complex interplay of genetic, behavioral, social, economic, psychological and educational factors

# How to Treat BMI>25



- Reduce calories: but which calories???
- Harvard, Stanford, Duke, and UPEN studies have all shown more weight loss, sustained longer with corresponding reductions in triglycerides, increases in HDLs decreased fasting glucose and insulin and lower BP with low carbohydrate diets.

# How to Treat BMI>25



- Increase activity
- (1/4 Americans get NO exercise!)
  - Any increase is good and more is better
  - Even small amounts of activity will increase energy and mental function.
  - Maximal fat oxidation occurs at exercise intensity of 65%  $\text{VO}_2$  max
  - Exercise alone will improve insulin sensitivity and increase lean body mass but exercise alone will rarely reduce weight.

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# How to Treat BMI>25



- Education in a behavioral weight loss program and monthly personal follow-up is more successful than technology based interventions.
  - Svetkey, et al, JAMA 3/12/08-Vol299,no 10
- Although anecdotally, my male patients do well with programs such as Lose It!, which calculate calories in and out for the day against a daily goal.

# How to Treat a BMI >30



- If diet and exercise have failed some will benefit from Pharmacotherapy:
  - Agents blocking fat absorption from the gut
    - Modest weight loss of 2.9kg on average
      - ✦ Drawbacks: diarrhea
  - Anorectics are stimulants that reduce appetite
  - Average weight loss of 4.8kg
    - ✦ Drawbacks: rapid tolerance, cardiovascular risks, and dependence

# How to Treat BMI>30



- Newer Agents

- Sirtuins

- ✦ Increase metabolism by browning of fat (Qiang Cell 2012;150[3])

- Irisin

- ✦ Hormone that increases energy consumption (Speigelman- Ember therapeutics)

- Rimonabant

- ✦ Cannabinoid type 1 receptor antagonist

- Topiramate

- ✦ An AED that is associated with modest weight reduction for reasons that are unclear.

- HCG

- ✦ Encourages lipolysis

# How to Treat BMI of >40



- Bariatric Surgery : reduces calorie intake by modifying the anatomy of the GI tract
  - Restrictive procedures
    - ✦ Laparoscopic adjustable banding
    - ✦ Sleeve gastrectomy
  - Malabsorptive procedures
    - ✦ Biliopancreatic diversion with duodenal switch
  - Combination procedures
    - ✦ Roux-en-Y gastric bypass

# Bariatric Surgery



- Results:
  - Typically 20-50kg loss
  - Weight loss is greater with malabsorptive procedures than restrictive
  - >20% of body weight lost within 2 years
    - ✦ 77% of patients with DM
    - ✦ 83% of patients with hyperlipidemia
    - ✦ 66% of patients with HTN
    - ✦ 88% of patients with OSA no longer need treatment
      - SOS NEJM 2004

# Bariatric Surgery



- **Complications:**
  - Death 0.5%-2%
  - Perioperative complications 13%
  - Nausea/vomiting >50%
  - Dumping syndrome >70%
  - Malnutrition
  - Dehydration
  - GI complications

# Treatment Approaches to Obesity



- 43% of depressed persons are Obese
  - by integrating behavioral weight loss treatment with problem solving therapy and antidepressant medications the study showed a significant weight loss and reduction in depression at 12 months compared to usual care.
    - ✦ The RAINBOW Randomized Clinical Trial, JAMA 2019, March

# SUGAR-SWEETENED BEVERAGE TAX



- In 2017 Philadelphia, PA imposed a 1.5 cent /oz tax on sweetened and artificially sweetened beverages and analysis showed a 51% decrease in in sales and consumption.
  - A decrease from 2.475 billion to 1.214 billion oz in a year.

# Solutions to Share with your Patients



- 1. Try to eat more small meals and at the same time
- 2. Use careful snacking
- 3. Watch portions
- 4. Monitor sweetened beverages
- 5. Eat whole foods, avoid processed
- 6. Move it 150 minutes a week.

# How Obesity Impacts Lymphedema



- There is an increase in circulating blood volume in obesity and increased venous return and venous hypertension with frequent development of varicosities and CVI.

# How Obesity Impacts Lymphedema



- As CVI progresses there is greater strain placed upon the lymphatic system. There is also a mechanical component where the weight of the adipose tissue compresses the lymphatics, further contributing to failure and phlebolymphedema.
- Only 10% of upper extremity lymphedema is associated with CVI but 60% of lower extremity lymphedema is associated with obesity and CVI.
  - Rockson

# Bariatric Clinical Equipment



- Most standard clinical equipment is designed for weights up to 350 lbs.
- Bariatric equipment is safe for weight up to 500-1000 lbs.

# Bariatric Equipment



- High –low exam tables
- Step stools
- Scales
- Heavy duty hoist lifts
- Toilets
- Wheelchairs
- Waiting room seats
- BP cuffs
- Briefs

# Techniques for CDT of the Bariatric Patient with thanks to Joy Cohn



- When patient is unable to lift and hold leg for duration of bandaging:
  - Place bolster under knee and raise high –low bed to waist height.
  - If inadequate clearance, abduct leg on bolster and support foot on your abdomen. You can lower the hi-lo table to allow sitting on a stool.
  - A variation is to place the patient foot on wall to allow bandaging of the calf.

# Additional techniques



- **Patient sitting:**
  - Foot rests on a support to allow bandaging of the toes and foot
  - The foot then can rest on the therapist's thigh while the therapist sits and bandages the calf.
  - The thigh can be bandaged with the patient standing facing the table and the abdomen supported on the table. Therapist can sit.

# Bandaging the Obese Lymphedema Patient



- **Issues:**
  - Lobules and skin folds
  - Containment and slippage
  - Fungal infections
  - Wounds
  - Fibrosis

# Dimensions of the Problem



- Obesity has increased in all developed and developing countries in the last 10 years. This epidemic is impacting the health and quality of life of 1 billion worldwide and threatens to shorten the lives of currently obese children.

# Conclusions



- Obesity is epidemic
- Obesity contributes to the incidence of lower extremity lymphedema
- Therapists treating patients with obesity related lymphedema will have more success if the patient can lose weight
- Therapists treating those with obesity related lymphedema must have appropriate equipment to prevent patient injury and utilize techniques that reduce their risk for injury.

# HOT Springs at the Andes in Chile



# OBESITY



- Overweight and obesity are defined as abnormal or excessive fat accumulation that presents a risk to health.
- The US is the second most obese country in the world, exceeded only recently by Mexico

# THE IMPACT OF FRUCTOSE



- Studies on animal models have shown that a high fructose intake will alter lipid metabolism and can lead to fatty liver (NAFLD /NASH) and metabolic syndrome.
  - Metabolic Syndrome includes abdominal fat, hypertension, diabetes and cardiovascular disease
  - Additional studies showed that animal models suffered oxidative stress and inflammation after consuming fructose syrup. (2018)

# Foods with Fructose



- Sodas, energy drinks, and sports drinks
- Candy and ice cream
- Coffee creamer
- Sauces and condiments i.e. salad dressings, ketchup, and BBQ sauce
- Sweetened foods such as yogurt, juices, and canned foods
- Breakfast cereal, cereal bars, nutrition bars

# The Impact of Sleep

- Poor sl



f obesity