



# **Digestion and Aging**

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# DIGESTION

- Food enters the mouth and exits at the anus
- Digestion starts as soon as food enters the mouth and ends when it exits at the anus
- Food is moved on from one part of the digestive tract to the next by a specific process involving signals and muscle contractions



## **DIGESTION (continued)**

- Each part of the digestive tract has a specific function:
  - Processing
  - Digestion
  - Absorption
  - Utilisation
  - Excretion

# WHEN THINGS GO WRONG

- Distressing symptoms result when any of these functions is upset
- This can happen with aging
  - The body slows down
  - Secretions decrease
  - Injury heals more slowly
  - Dryness, soreness, pain, in the mouth discourage eating "irritating food"- fibre intake decreases
  - Exercise decreases
  - Fluid intake changes
- Movement of food through the digestive system is disturbed



# MOUTH

## Functions

- Physical breakdown of food - Chewing
- Starch breakdown by amylase enzyme in saliva

## Problems:

- Tissue injury due to:
  - tooth and gum problems
  - ill-fitting dentures
- Reduced saliva - dry mouth
- Infection and irritation
  - burning mouth syndrome
  - canker sores

# MOUTH: Solutions

- Visit dentist to address tooth and gum problems and adjust dentures
- Try sodium bicarbonate (baking soda) mouthwash
- Try baking soda toothpaste
- Avoid acid foods
- Sour foods increase saliva flow
- Cook raw foods
- Increase liquids
- Avoid irritating spices

# OESOPHAGUS

## Function

- Food passes from the mouth to the stomach through the oesophagus

## Problems

- "Throat tightening" or a "lump in the throat" can impede movement of the food from the mouth
- Mucus secretions can produce unpleasant sensation and even nausea
- Reflux from the stomach causes burning and regurgitation
- Stress can produce "a lump in the throat"
- Fear of choking can impede swallowing

# OESOPHAGUS: Solutions

- Increase chewing of food
  - Attend to dental health
  - Reduce injury of oral tissues
- Increase fluid intake - drink water with meals
- Eat in a calm, serene environment to reduce tension and stress
- Eat slowly
- Eat small portions, chew well
- Change texture of food
  - Pureed is often tolerated better than whole foods



# STOMACH

## Functions

- Acid environment starts the process of digestion of proteins (meat, poultry, fish, eggs)
- Acid "weakens" linkages between molecules to make protein bonds more accessible to enzymes in the small intestine
- Acid kills any micro organisms entering with food, so they do not pass into the body to cause disease



# STOMACH

- Churning in stomach forms food into a smooth paste
- Pyloric sphincter muscle allows food paste to pass through from stomach into the duodenum of the small intestine a little at a time

# Problems in the Stomach

- Too little acid:
  - Does not kill micro organisms efficiently
    - Infections in the digestive tract may increase
  - Does not hydrolyse (weaken) linkages between protein molecules efficiently
    - Inefficient digestion of high protein foods
    - More undigested protein passes into the large bowel
    - Micro-organisms ferment the extra protein
    - Leads to “smelly wind”
    - Problems with bowel evacuation



# Problems in the Stomach (continued)

- Too much acid:
  - Heartburn
  - Reflux
- Burping:
  - Swallowing air with food
  - Taking antacids
    - Neutralise stomach acid with production of carbon dioxide gas
  - Carbonated beverages



# Solutions

- Eat food slowly and chew well
- If chewing is a problem, eat food pureed
- Do not talk while eating - talk between mouthfuls
- Drink slowly
- Do not drink carbonated beverages with meals
- Take antacids only for heartburn
- Do not take antacids (Tums, Rolaids) as a source of calcium
- Avoid irritating foods and beverages such as spices, high fat foods, foods high in sugar, caffeine

# SMALL INTESTINE

## Functions

- Food paste passes from the stomach into the small intestine in small squirts
- The small intestine is about 20 feet long
- With all the folds at the surface, the small intestine has an enormous surface area (as large as two tennis courts)
- This allows adequate digestion and absorption of nutrients as food passes along the whole length
- Food is propelled along by rhythmic contractions of the muscles lining the intestine (peristalsis)

# Small Intestine

- Churning allows food to mix with digestive juices and enzymes
- Secretions change the acid of the stomach to alkaline, to allow enzymes to function
- Enzymes come in from the pancreas to digest starches and proteins
- Bile comes in from the gall bladder to break fats into small droplets
- Sugars (sucrose, lactose, maltose) are digested by enzymes produced in the cells lining the small intestine

## Small Intestine (continued)

- When nutrients are small enough they are carried through the lining of the small intestine into blood
- Nutrients are carried to the organs that need them
- Excess nutrients are stored as fat until required
- Nutrients not wanted by the body are broken down and excreted in the kidneys
- Undigested and unabsorbed food passes into the large bowel - the caecum and colon



# Problems in the Small Intestine

- If food passes through too quickly (in chronic and severe diarrhoea), inadequate digestion takes place
- Decrease in absorption means too few nutrients are getting into the body
- Insufficient bile causes inadequate breakdown of fats, which are not absorbed

## Problems in the Small Intestine

- Damage to the cells lining the intestine, or natural decay of the cells, means sugars are not adequately digested
- Can result in lactose intolerance
- And occasionally intolerance of sucrose (table sugar, syrup, high sugar desserts)
- Results in diarrhoea, flatulence, bloating

# Solutions

- Dietary measures to promote digestion and absorption in the small intestine
- And to reduce the amount of undigested food material passing into the large bowel:
- Eat **moderate** amounts of all nutrients
- Moderate fat diet for normal digestion:
  - Reduce fat if there is a problem with production of bile
- Diet low in disaccharide sugars (sucrose, lactose) and starches for severe or chronic diarrhoea

# Dietary Solutions

- Lactose-free dairy products for lactose intolerance (different from milk allergy)
- Complex carbohydrates (fruits, vegetables, whole grains) rather than processed sugars and free starches
- Pasteurised honey and fructose instead of syrups and table sugar (unless diabetes is a problem)



# Dietary Solutions (continued)

- Reduce insoluble fibre:
  - Runner beans, green beans instead of peas and beans with hard skins (green peas, broad beans)
  - Lentils and split peas rather than peas and beans with indigestible skins (navy beans, kidney beans, white beans)
- Reduce resistant starch:
  - Eat all free starches **hot** - cold starch crystallizes and is more difficult to digest
- Eat only **hot, freshly-cooked**:
  - pasta
  - white rice (no sushi!)
  - boiled, baked, mashed potatoes (no potato salad!)

# Dietary Solutions (continued)

- Eat only **very ripe** bananas
  - 89% starch in banana passes undigested into the colon
- If bloating, flatulence, pain are frequent problems, cook **all** fruits and vegetables, including bananas and salad vegetables
- Nuts and seeds are more efficiently digested when ground into flours or pastes with the consistency of smooth peanut butter

# THE LARGE BOWEL

## Functions

- Undigested food passes into the caecum and colon
- Millions of micro organisms, especially bacteria, live in the large bowel at all times
- They digest foods that humans are unable to do because we lack the right enzymes
- The bacteria make extra nutrients from our undigested foods, which are then absorbed into our bodies

## The Large Bowel (continued)

- These nutrients include essential vitamins:
  - vitamin K (used in blood clotting)
  - some B vitamins
- Short chain fatty acids made by bacteria may protect against cancer
- Water and electrolytes are extracted from the food and reabsorbed back into the body to maintain balance



# Problems in the Large Bowel

- **Constipation:**

- Food sits for too long in the colon
- Bacterial fermentation proceeds too far and produces gas, bloating, and sometimes toxic products
- Too much water is extracted from the faeces which become very hard
- Hard stool might cause small tears in the anus (fissures) which bleed
- Haemorrhoids become painful and sometimes bleed



## Problems in the Large Bowel: Gas

- Produced by bacterial fermentation of undigested foods
- Gas distends the abdomen and causes bloating
- Bloating causes pressure, which results in pain ("cramping")
- Excess flatus causes wind

# Problems in the Large Bowel:

## Gas (continued)

- Inadequate digestion of proteins provides "proteolytic substrate" which is fermented in the process called "putrefaction"
- Gas is malodorous (smelly)
  - Acidophilus milk or tablets may encourage "saccharolytic" (sugar and starch) bacteria and reduce the "putrefactive" types
  - This only works after the putrefactive bacteria have been killed off, e.g. after oral antibiotics



## Problems in the Large Bowel: Diarrhoea

- Food passes through the digestive tract too quickly and nutrients are not absorbed
- Insufficient reabsorption of water and electrolytes can result in dehydration
- Bacteria do not have time to break down the undigested food, so:
  - Do not provide the required nutrients
  - Do not make the short chain fatty acids which might protect from cancer



## Solutions: Constipation

- Eat sufficient fibre to stimulate of movement of food through the digestive tract
- Soluble (e.g. psyllium) rather than insoluble fibre (e.g. wheat bran) is better tolerated
- Insoluble fibre tends to stay within the bowel for long periods, is fermented by micro-organisms and stool becomes dry and hard
- Rice bran, oat bran, psyllium, tend to be better than bran from wheat or rye

## Solutions: Constipation (continued)

- Eat a wide range of fruits, vegetables, and whole grain products (complex carbohydrates) cooked and pureed if necessary
  - Cooking and pureeing do not change the nature of the fibre
- Drink plenty of water:
  - caveat: excessive amounts of water dilute electrolytes and can lead to hyponatremia
- Exercise to promote movement of food through the digestive tract

# Solutions: Diarrhoea

- Drink sufficient water and fluids:
- Drink water between meals
  - Water with a meal can increase the speed at which food moves through the digestive tract
  - May need to increase quantity to balance rapid fluid loss in the faeces
  - If diarrhoea is severe may need electrolytes in water to provide adequate amounts until diarrhoea abates
- Pureed rather than liquid diet
- Increase non-irritating fibre to provide "bulk"
  - Psyllium (Metamucil) often helps.

## Solutions: Diarrhoea (continued)

- Reduce disaccharide sugars (sucrose, lactose)
- Increase honey, glucose and fructose (monosaccharides)
- Promote absorption in the small intestine and reduce residue passing into the large bowel:
  - reduce "non-starch polysaccharides"
  - reduce "resistant starches"



## Solutions: Flatulence (wind)

- Promote digestion and absorption of nutrients in the small intestine
- Reduce the undigested residue passing into the colon
- Address constipation - the longer the food remains in the colon, the greater the degree of fermentation, and the more gas is produced

## Solutions: Flatulence (continued)

- Ensure adequate stomach acid to start the process of protein breakdown
- Don't take antacids unless absolutely necessary for heartburn or reflux
- Increase complex carbohydrates, cooked and pureed fruits and vegetables, to increase the "sweet substrate" - encourages saccharolytic bacteria

# The Balanced Diet

- Good health depends on supplying the body with all the nutrients it needs
- In spite of food restrictions eat a balanced diet that includes foods from all essential food groups
- Best source of information in achieving the diet suited to your needs is a registered dietician
- Contact local hospital, GP, health care clinic to find a suitably qualified dietician