

Carbohydrate

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Slide 1



Six Classes of Nutrients

1. Carbohydrate
2. Protein
3. Fat
4. Vitamins
5. Minerals
6. Water



General Carbohydrate Info

- Made of carbon and water $C_n(H_2O)_n$

All carbohydrates are composed of single sugars, alone or in various combinations

Widely distributed in plant foods



Types of Carbohydrates

There are 3 types of carbohydrates:

- Sugars,
- Starch
(*also known as complex carbohydrates*)
- Fibers.

These are made up of basic units such as Glucose, Fructose and Galactose. ***but they differ in how they are put together.***

Sugar = Glucose + Fructose



Types of Carbohydrates

Sugars



Simple Sugars

- Simple carbohydrates exist as independent glucose or fructose molecules
- Simple sugars provide the **sweet taste** in foods



Types of Carbohydrates

Sugars

Simple Sugars

- Simple sugars are found naturally in:

Milk products, Vegetables and
Fruit.






- Sugars can also be added to food. These sugars include:
White sugar, Brown sugar, Honey,



Carbohydrate Structure



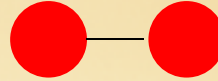
Simple Sugars are the Building Blocks

MONOSaccharides

- Glucose 
- Fructose 
- Galactose 

***All** carbohydrates are composed of single sugars, alone or in various combinations*

DISaccharides

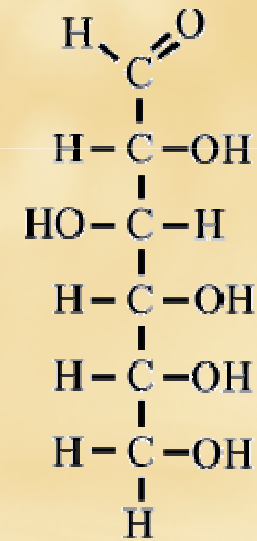
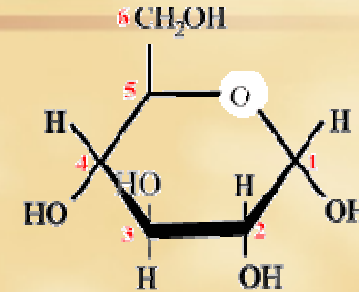
- Sucrose 
- Lactose 
- Maltose 



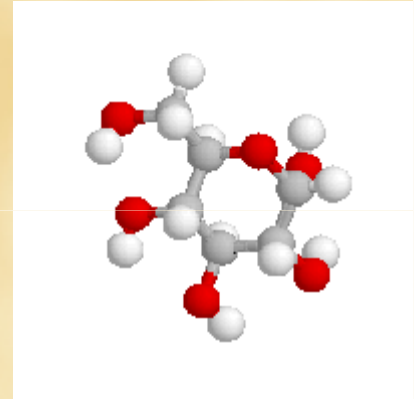
Simple Sugar

Glucose = Blood Sugar

- most common carbohydrate
 - also known as dextrose
- main source of energy
- most quickly absorbed



glucose

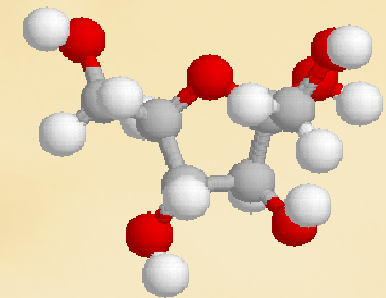
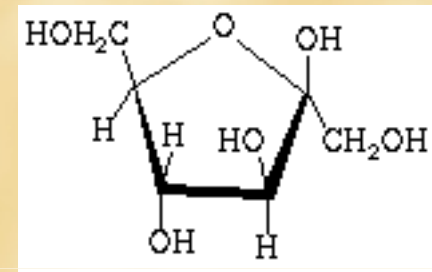




Simple Sugar

Fructose = Fruit Sugar

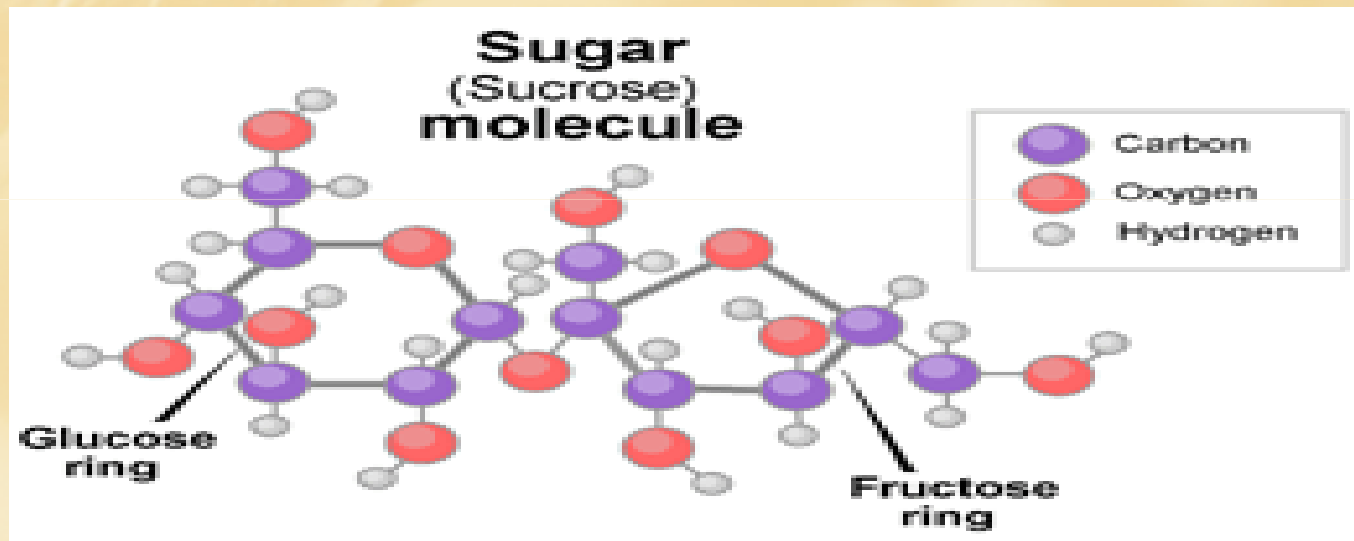
- absorbed much slower than glucose
- predominantly metabolized in the liver
 - does not require insulin to be used
- natural sources include:
 - fruits, some vegetables
 - honey, sugar cane and sugar beets
- 15 to 80% sweeter than sucrose





Simple Sugar Sucrose

- Table sugar





Complex Carbohydrates

- Long chains of sugars
- Also called polysaccharides
 - *poly* = many
 - *saccharides* = sugar unit
- Starch
- Fibers



Complex Carbohydrates

Starch

digestible plant polysaccharide

Fiber

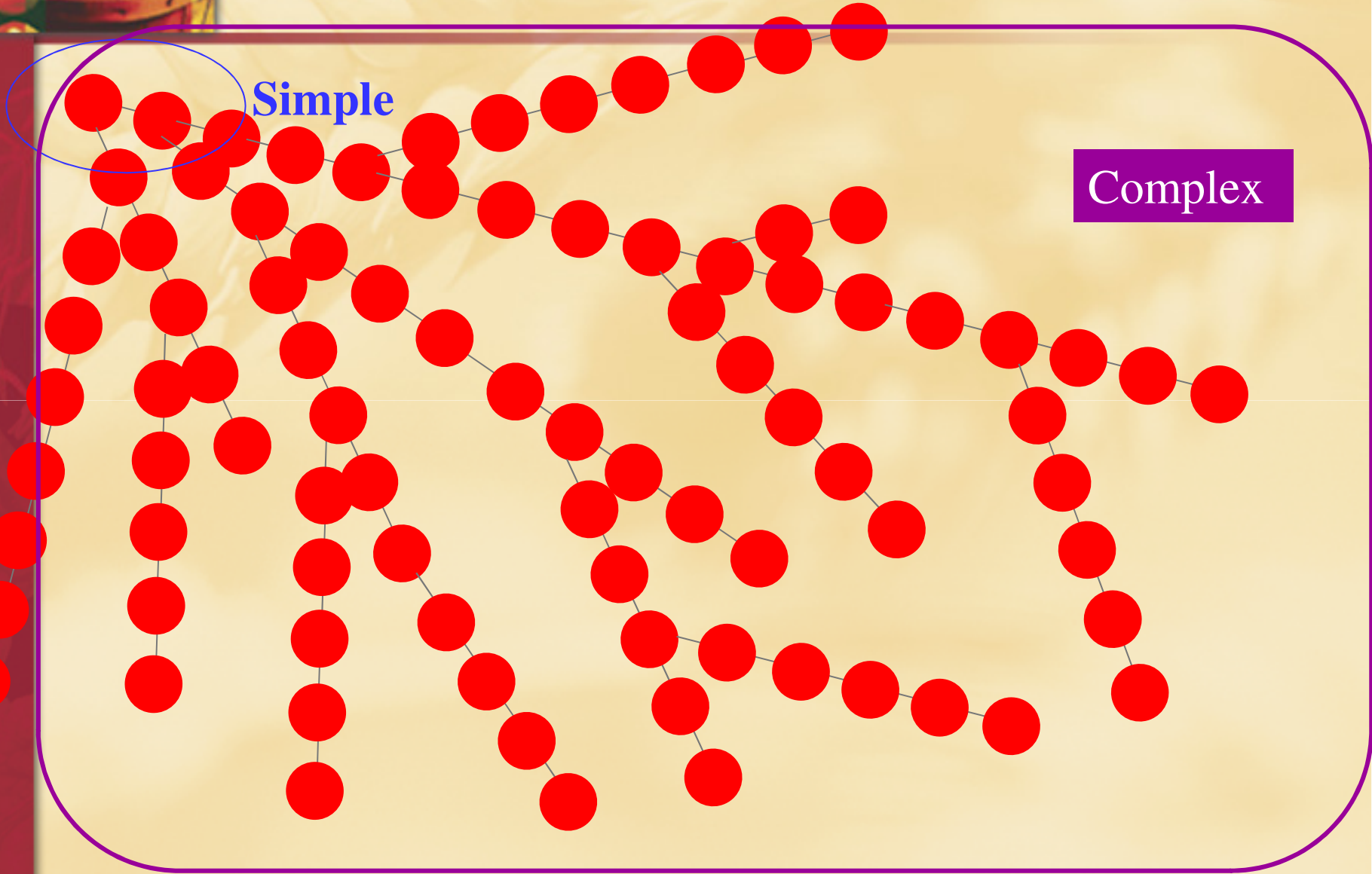
indigestible polysaccharide residues of food

- Cannot be broken down by human digestive enzymes
 - some broken down by bacteria in the digestive tract
- few, if any, calories because not digested
- Examples: cellulose, hemicellulose, pectin, gums

Polysaccharide: long chain of 10 or more glucose molecules linked together; the chains can be straight or branched; another term for complex carbohydrates



Carbohydrate Structure Basics





Types of Carbohydrates

Starch

Starch:

- Starch is a very large molecule, made up of several basic units of glucose linked together
- Complex carbohydrates are found in foods such as:

Cereals

Bread

Pasta

Rice and other grains

Vegetables, such as potatoes
and corn





Types of Carbohydrates

Fiber

Fiber:

- Fibre is made up of a number of basic units. Eg : Cellulose.
- Type of linkage is different from starch.
- Humans cannot digest fiber so it passes through the small intestine into the colon, fiber then absorbs water and adds bulk to the stool, which helps to keep the colon healthy.





Dietary Fiber - Two groups

1. Insoluble

- fibers that mostly do not dissolve in water
- not digested by bacteria in the large intestine

2. Soluble

- fibers that either dissolve or swell in water or
- are metabolized by bacteria in the large intestines



Fiber Sources

Soluble Fiber -

- Oatmeal
- Nuts and seeds
- Legumes
 - dried peas
 - beans
- Fruits
 - apples
 - pears



Insoluble Fiber –

- Whole grains
- Wheat bran
- Vegetables
 - carrots
 - celery



Types of Carbohydrates

Fiber

The components of fiber include:

- **Cellulose**: Cellulose is the structural component of the primary cell wall of green plants.
- **Lignin**: main component of wood.
- **Pectin**: the substance in plant sap.



Classification of carbohydrates

Carbohydrates are classified into:

- Available Carbohydrates
- Non-available Carbohydrates



Available Carbohydrates

- Available Carbohydrates:
the word available refers to the availability of body enzymes to digest the carbohydrates

Sugar, Starch, are classified as Available Carbohydrates, because enzymes are available in the body for their digestion.



Available Carbohydrates

- Sources of Available Carbohydrates:
- 1) table sugar
- 2) honey
- 3) fruits
- 4) milk
- 5) starch



Available Carbohydrates



- *Table sugar* is the most abundant sugar and it is obtained by the juice from sugar beets or sugar cane
- It contains the disaccharide sucrose which consist one molecule of glucose and another of fructose. Sucrose is broken down by sucrase, fructose will converted to glucose before absorption.



Available Carbohydrates



- **Honey**: contain the same mono saccharide as white sugar but the differences is:
 - 1) In white sugar the glucose and fructose are bonded together whereas in honey some of them are bonded some of them are free.
 - 2) Honey contain vitamins and minerals.



Available Carbohydrates



- **Fruits**: the main sugar is fructose that will be converted to glucose before absorption



Available Carbohydrates



- **Milk**: it contain the sugar lactose that is broken down to its components (glucose, galactose) by digestive enzyme, some people lack the presence of this enzyme, therefor they can not digested, this condition called **lactose intolerance**.



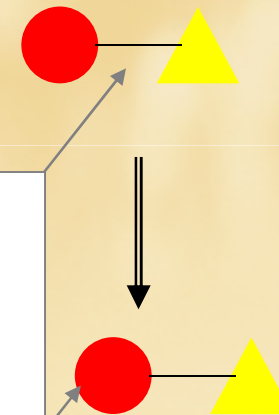
Lactose Intolerance



Insufficient production of the enzyme lactase



Lactose



Lack enzyme to cleave this bond

Disaccharide goes into large intestine where gas producing bacteria break it down for us



Available Carbohydrates



- 5) **starch**: it is a long straight or branched chain of hundreds of glucose units linked together, which is broken down to give energy.



Classification of carbohydrates

Non-available Carbohydrates:

- Fibres are classified under Non-available carbohydrates, because no enzymes are available in the human digestive tract for digesting fibre.
- Fibres are not digested by these enzyme because they splits the α -1—4 glycosidic bond that join glucose molecules in starch, but can not splits the β -1—4 glycosidic bond that join glucose molecules in Fibres



Classification of carbohydrates

Non-available Carbohydrates:

- Fibres pass through the small intestines without change and excreted in faeces.