Know Your Carbohydrates (KYC)

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The major dietary carbohydrates

From: Carbohydrate terminology and classification

1.^aDegree of polymerization or number of monomeric (single sugar) units.

2.Based on Food and Agriculture Organization/World Health Organization 'Carbohydrates in Human Nutrition' report (1998), and <u>Cummings et al. (1997)</u>

| Class (DP ^a) | Subgroup | Principal components | | |
|--|--|---|--|--|
| Sugars (1–2) | Monosaccharides | Glucose, fructose, galactose | | |
| | Disaccharides | Sucrose, lactose, maltose, trehalose | | |
| | Polyols (sugar alcohols) | Sorbitol, mannitol, lactitol, xylitol, erythritol, isomalt, maltitol | | |
| Oligosaccharides (3–9) (short- chain carbohydrates) | Malto-oligosaccharides (α- glucans) | Maltodextrins | | |
| | Non-α-glucan oligosaccharides | Raffinose, stachyose, fructo and galacto oligosaccharides, polydextrose, inulin | | |
| Polysaccharides (≥10) | Starch (α-glucans) | Amylose, amylopectin, modified starches | | |
| | Non-starch polysaccharides (NSPs) | Cellulose, hemicellulose, pectin, arabinoxylans, β-glucan, glucomannans, plant gums and mucilages, hydrocolloids | | |

Cummings, J., Stephen, A. Carbohydrate terminology and classification. *Eur J Clin Nutr* **61**, S5–S18 (2007)

Carbohydrates- definition, classification with structure and functions



1

2

Oligo 3 -9

10+

Definitions/Terminology/Uses-1

- Sugars--mono- and disaccharides in food.
 (Glucose, fructose, galactose, Sucrose, lactose, maltose, trehalose)
- Principal monosaccharides are glucose, fructose and galactose
- Free glucose and fructose occur in honey , fruit and berries
- Corn syrup, a glucose syrup produced by the hydrolysis of corn starch,
- High fructose corn syrup, enzymatic conversion of some of glucose to fructose. HFCS 42 in processed foods, HFCS 55 in Beverages
- Fructose is the sweetest of all the food carbohydrates.

Definitions/Terminology/Uses-2

- Sugars are used as a sweetener
- **Preservatives** in jams and jellies.
- Sugars confer functional characteristics to foods, like viscosity, texture, body and browning capacity.
- Increase dough vield in baked goods. influence starch and protein breakdown, and control moisture thus preventing drying out (Institute of Medicine, 2001).
- (EJCN 2007)

Definitions/Terminology/Uses-3

- Total Sugars- All sugars from all sources except Polyols
- Free Sugars- Unbound
- Added Sugar
- Intrinsic Sugar- Integral part of unprocessed foods
- Extrinsic sugar- Extracellular (eg Juices) and added Sugar

Physiological Properties of Carbs

Physiological properties of dietary carbohydrates

Cummings, J., Stephen, A. Carbohydrate terminology and classification. Eur J Clin Nutr 61, S5–S18 (2007)

| | Provide energy | Increase satiety | Glycaemic ^ª | Cholesterol lowering | Increase calcium absorption | Source of SCFA | Alter balance of microflora (prebiotic) | Increase stool output | Immunomo dulatory |
|---|-------------------|---------------------|------------------------|-------------------------|-----------------------------------|-------------------|--|--------------------------|----------------------|
| Monosacch arides(gluco se,Fructose) | \checkmark | | \checkmark | | | | | | |
| Disaccharid es(Lactose) | \checkmark | | \checkmark | | \checkmark | | | | |
| Polyols | \checkmark | | | | | √ ^c | | \checkmark | |
| Maltodextri ns | \checkmark | | \checkmark | | | | | | |
| Oligosaccha rides (non- α-glucan)(Inulin) | \checkmark | | | | \checkmark | \checkmark | \checkmark | | \checkmark |
| Starch(Amyl o pectin) | \checkmark | | \checkmark | | | \checkmark^{d} | | √ ^d | |
| NSP(cellulos e, pectin) | \checkmark | \checkmark | | √ ^e | | \checkmark | | \checkmark | |

Glycaemic carbohydrate



Glycemic carbs-2

Slowly digested starches are also considered to be glycaemic carbohydrate though glucose is less rapidly generated.

The remaining oligosaccharides, NSPs and RS are considered to be non-glycaemic carbohydrates.

Most carbohydrate-containing unprocessed foods contain both glycaemic and non-glycaemic carbohydrate.

Glycaemic response to carbohydrate, depends on the intrinsic properties of the food and also extrinsic factors such as the composition of the meal, the overall diet and biological variations of the host

Polyols (Sorbitol, mannitol, lactitol, xylitol, erythritol, isomalt, maltitol)

Alcohols of glucose and other sugars.

Naturally in some fruits

Synthesised by using aldose reductase to convert the aldehyde group of the glucose molecule to the alcohol.

Sorbitol is used as a replacement for sucrose in the diet of people with diabetes.

"Healthy vs Unhealthy"

Healthiest sources of carbohydrates—unprocessed or minimally processed whole grains, vegetables, fruits and beans—.

Unhealthier sources of carbohydrates include white bread, pastries, sodas, and other highly processed or refined foods.

Freingy Management in Cells



Dynamic Adaptation of Nutrient Utilization in Humans By: Tatiana El Bacha, Ph.D. Et al (2010) Dynamic Adaptation of Nutrient Utilization in Humans. *Nature Education* 3(9):8

Fuel Molecules are different for different tissues

- Red Cells- Only Glucose
- Brain- Glucose and Ketone Bodies
- Adipose Tissue- Fatty Acids and Glucose
- Liver- Fatty Acids
- Muscle- Fatty Acids, Glucose, Amino Acids

How and why do Cells use only glucose-1

- Red Blood Cells- They don't have mitochondria
- Brain cells BBB block lipid entry -except in prolonged fasting state
- (Daily consumption of nerve cells is about 120 g of glucose equivalent or 60% of glucose utilization or 20% of the energy needs of the human body in the resting state).

How and why do Cells use only glucose-2

- Eye lens and Pigment layer of retina- No mitochondria
- Renal Medulla Mito+ but less Oxygen supply
- After meals glucose is the primary source of energy for adipose tissue and skeletal muscle.GLUT4 I
- After CHO meal liver mops up glucose-GLUT2
- Cells that grow and divide fast- WBC, Stem Cells, some Epithelial cells and Cancer Cells

Basis for Recommendation of Energy Requirements

- Not on Intakes(error prone) but on equating with expenditure + BMR (more accurately measurable)
- PAL + BMR = TEE
- BMR of Indians is 10% < than western data
- PAL have come down considerably

AMDR

• Acceptable Macronutrient Distribution Range (AMDR): This is the recommended proportion of a person's daily calories that should come from protein, fat, and carbohydrates.

ACCEPTABLE MACRONUTRIENT DISTRIBUTION RANGE (AMDR) BY AGE AND PHYSIOLOGICAL GROUPS AS PERCENT OF ENERGY (%E)

| <u>Age group</u> Nutrients | 1-2 years | 3-18 years | Adults | Pregnant and lactating women |
|-------------------------------|--------------|---------------|--------|---------------------------------------|
| Protein (PE ratio)* | 5-15 | 5-15 | 5-15 | 5-15 |
| Total Fat | 30-40 | 25-35 | 15-35 | 20-35 |
| n-6 PUFA [#] | 4-10 | 4-10 | 4-10 | 4-10 |
| n-3-PUFA | 0.5-1 | 0.5-1 | 0.5-1 | 0.5-1 |
| Carbohydrate | 40-60 | 45-65 | 45-65 | 45-65 |

*Depends on protein quality and total energy intake

[#] n-6 to n-3 ratio should be between 5-10:1

Note: For good health, adults should consume minimum of 100 to 130g of carbohydrates and atleast 20g fats (food sources)

ICMR RDA 2020



Choose wisely Thank You