TOPICS:

1. RQ

2. SDA

Respiratory Quotient

- Aerobic respiration is the process most living things undergo to use food energy efficiently.

- In this **aerobic respiration**, oxygen is consumed and carbon dioxide is released.

- The actual ratio of the volume of carbon dioxide eliminated/released to the volume of oxygen consumed during the act of cellular respiration is called the respiratory quotient.

- It is also referred to as the respiratory ratio. It is denoted by RQ.

- Respiratory quotient may be represented as:

$$RQ = \frac{Volume\ of\ Carbon\ dioxide\ eliminated}{Volume\ of\ Oxygen\ consumed}$$

- The respiratory quotient (RQ, carbon dioxide emission/oxygen consumption) is believed to range from 0.7–1 depending on the fuels used for catabolism.

- However, RQ can rise above 1 when CO_2 is released without oxygen consumption

Normal Respiration

- Vol CO2 = 200 mL/min and Vol O2 = 250 mL/min, resulting in 0.8 respiratory ratio

- A respirometer is a device used to measure the rate of respiration of a living organism by measuring its rate of exchange of oxygen and/or carbon dioxide.
- Here equal amounts of carbon dioxide and oxygen are evolved and consumed, respectively.
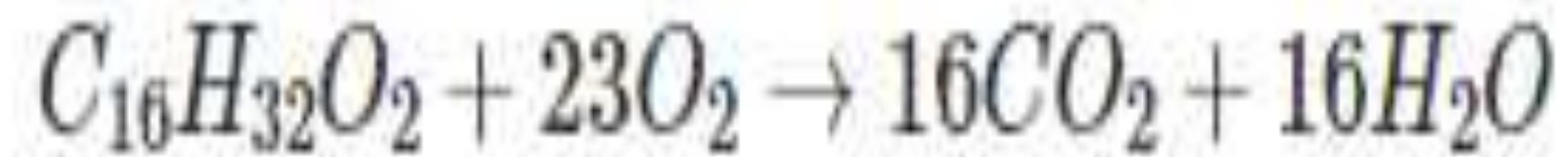
$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + Energy$$
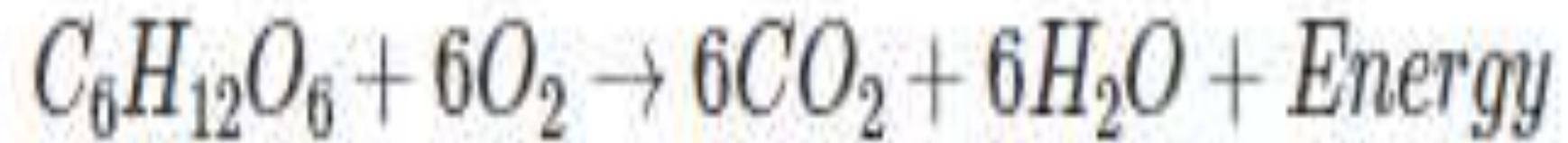
- **The RQ for carbohydra** $RQ = \dfrac{6\,CO_2}{6\,O_2}$

- Fats are also involved in the process of [cellular respiration](). Unlike carbohydrate molecules, fat molecules are not completely oxidised.

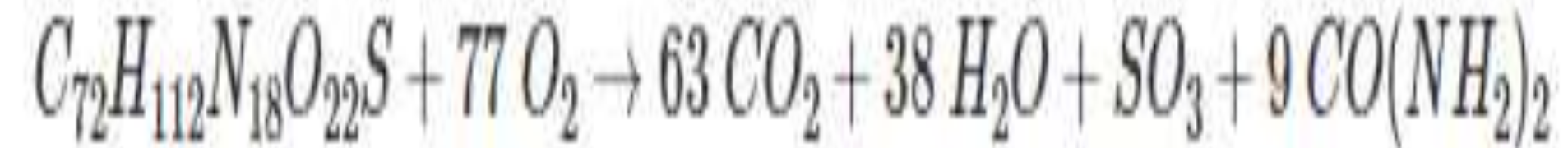- Therefore, the respiratory quotient is lower than 1.

- For example,

$$C_{16}H_{32}O_2 + 23O_2 \rightarrow 16CO_2 + 16H_2O$$

$$RQ = \frac{16\,CO_2}{23\,O2} = 0.696$$

- **The RQ for fats is approximately 0.7.**

- When proteins are respiratory substrates the ratio would be about 0.9.
- For example,

$$C_{72}H_{112}N_{18}O_{22}S + 77\,O_2 \rightarrow 63\,CO_2 + 38\,H_2O + SO_3 + 9\,CO(NH_2)_2$$

$$RQ = \frac{63\,CO_2}{77\,O_2} = 0.8$$

- **The RQ for protein is approximately 0.8.**

Application of Respiratory Quotient

- Found in severe cases of chronic obstructive pulmonary disease.

- Used as an indicator of over or underfeeding.

- Used for analysing the functioning of the liver.

- Used to predict weight gain in non-insulin-dependent diabetic patients.

- Used for diagnosing the patient's conditions, who are suffering from liver cirrhosis and non-protein respiratory quotient.

Clinical Significance

Chronic Obstructive Pulmonary Disease

- Chronic Obstructive Pulmonary Disease (COPD) is a pulmonary disease that causes chronic obstruction of airflow.

- The patient is not able to fully exhale, carbon dioxide remains in the alveoli due to the loss of elasticity of the sac.

- The patients suffer from shortness of breath, productive cough, respiratory acidosis, and complicated pneumonia.

Non-Insulin Dependent Weight Gain

- The respiratory quotient can be used to predict weight gain in non-insulin-dependent diabetic patients.

- Normally, a diabetic patient has insulin-resistant receptors, which results in hyperglycemia.

SPECIFIC DYNAMIC ACTION OF FOODS

- The specific dynamic action of food is the amount of energy it takes to break a food down to its basic unit so that it can be absorbed by the bloodstream.

- Represented as a percentage of calories spent to break down the food.

- This stimulating effect of carbohydrates, fats and proteins on energy metabolism is called Specific Dynamic Action (S.D.A.) or calorigenic action of food.

- Specific dynamic action (SDA) is the postprandial increase in oxygen uptake.

- The total increase in heat production which occurs after the ingestion of a meal and which continues for the entire period of subsequent metabolic processes.

- SDA may be defined as "extra heat" production, over and above the actual heat ought to be produced outside from a given amount of food, when this food is metabolised inside the body.

- **Specific dynamic action** (**SDA**), also known as **thermic effect of food** (**TEF**) or **dietary induced thermogenesis** (**DIT**)

- It is the amount of energy expenditure above the basal metabolic rate due to the cost of processing food for use and storage.

- Proteins have the greatest SDA, amounting to about 30 per cent above its caloric value.

- Carbohydrates cause an increase of about 5 per cent or 6 per cent, and

- Fats cause about 4 per cent

- Ordinarily, the SDA of all together amounts to about 6 per cent of the BMR.

- All foodstuffs, after being ingested, increase the rate of heat production though the subject is in a basal state. This increased heat production due to ingestion above the basal metabolic rate (B.M.R) is known as Specific Dynamic Action (S.D.A) or calorigenic action of foods.

THANK YOU