



# **SNS COLLEGE OF ALLIED HEALTH SCIENCES**

SNS Kalvi Nagar, Coimbatore - 35

Affiliated to Dr MGR Medical University, Chennai



## **TOPICS:**

- 1. CALORIFIC VALUE OF FOODS**
- 2. BASAL METABOLIC RATE(BMR)**



# The Energy-Yielding Food Factors



- The energy yielding food factors are
  1. Carbohydrates.
  2. Fats
  3. Proteins.
- Within the body, these units are oxidised in the cells.
- The process is one of the continuous utilisation of oxygen and production of CO<sub>2</sub>, water and heat.

Oxidation
- Carbohydrates and Fats  $\xrightarrow{\text{Oxidation}}$  CO<sub>2</sub> + Water + Heat
- Proteins  $\xrightarrow{\text{Oxidation}}$  CO<sub>2</sub> + Water + Urea



# Calorific Value Definition



- ***“Calorific value refers to the amount of heat produced by unit volume of a substance by complete combustion.”***
- Calorific value is the amount of heat energy present in food or fuel and which is determined by the complete combustion of specified quantity at constant pressure and in normal conditions.
- Also called calorific power.
- The unit of calorific value is kilojoule per kilogram i.e. KJ/Kg.



- Water vapour is generated in the combustion process and the heat should be recovered by using certain techniques.
- If the heat contained in the water vapour could be recovered then it has high calorific value.
- If heat contained in the water vapor could not be recovered when it has low calorific value.
- The efficiency of fuel or food mainly depends on the calorific value.
- If the value is high, its efficiency will also be high.
- If the value is low, its efficiency would also decrease.
- Calorific value is directly proportional to its efficiency.



# Calorific Value



- Calories are the amount of energy released when your body breaks down (digests and absorbs) food.
- Energy value of food stuffs are usually expressed in terms of a term known as calorific value.
- The calorific value is defined as the quantity of heat liberated in calories by the complete combustion of a unit mass of the food stuff in excess air or oxygen under specified standard conditions.
- Depends on the nature of the food and relative proportion of proteins, fats and carbohydrates present in that food.
- It is usually expressed in kilo calories and the standard mass taken is 100 g.
- Greater the calorific value higher the quality of the food stuff or fuel.



# Energy Units



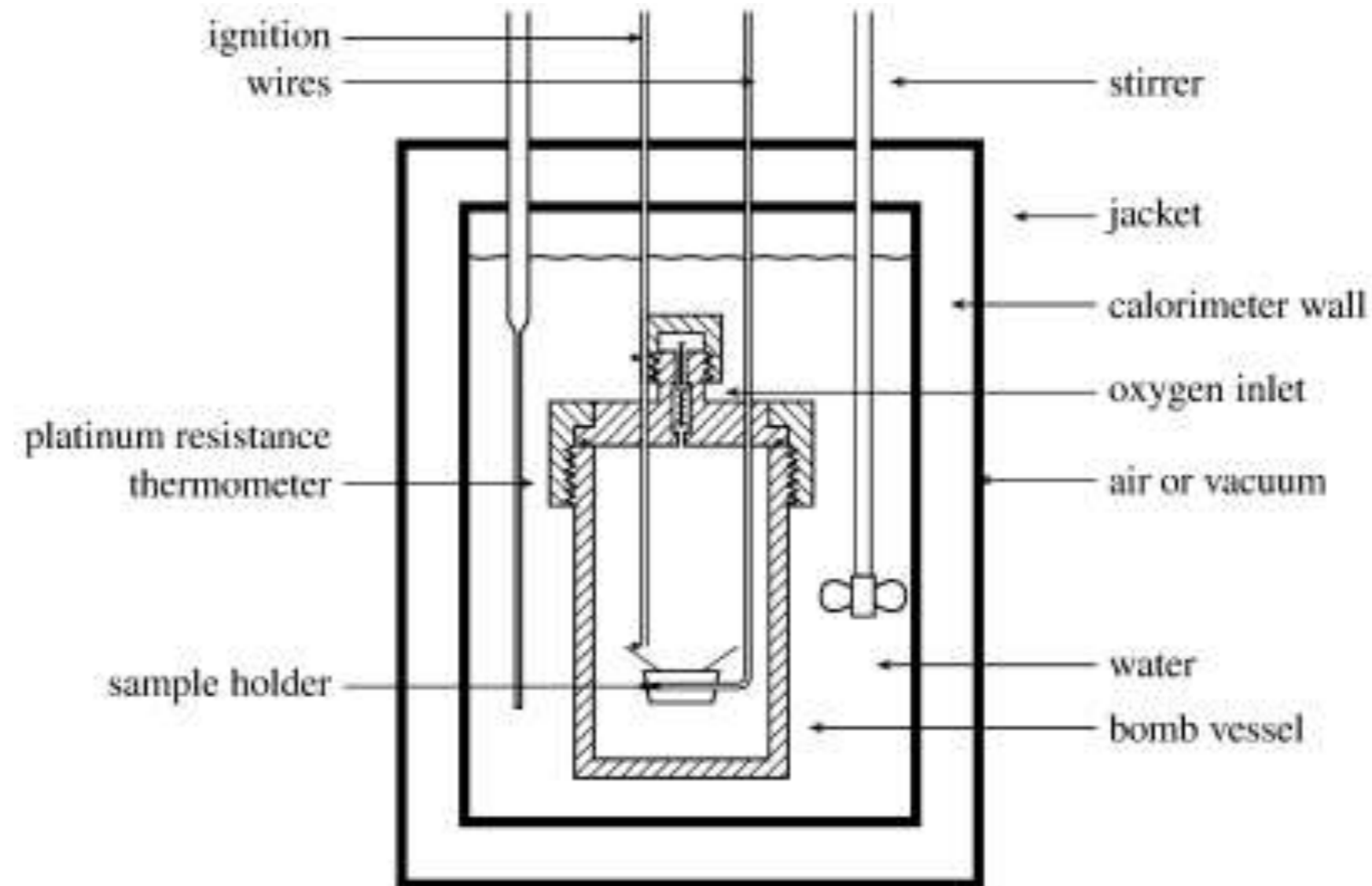
- The calorific value of food is generally expressed in kilocalories i.e. kcal.
- The energy value of foods can be expressed in terms of kilo calories (KCal) or megajoules (MJ).
- The International Union of Nutritional Sciences had suggested the use of Mega Joule(MJ) as the energy unit in place of KCal.
- **Kilo Calorie:** One kilo calorie is the quantity of heat required to raise the temperature of 1 kg of water through 1°C.
- It is one thousand times the small calorie used in physics measurements.
- **Mega Joule :** One kilo calorie equals 4.186 kilo joules.
- Hence thousand kilo calorie equals  $4.186 \times 10^3$  kilo joules or 4.186 mega joules.



# Determination of Energy Value of Foods



- The energy value of foods is usually determined using the instrument called bomb calorimeter.
- It consists of a heavy steel bomb, with a cover held tightly





- A weighed amount of food sample is placed inside the calorimeter, in a crucible.
- It is filled with oxygen under pressure.
- The calorimeter is immersed in a known quantity of water.
- The sample is ignited by means of electric fuse and heat liberated is measured by the rise in temperature.





**For example,**

Evaluation of calorific value of

2 g of wheat measured a calorimeter containing 3 kg of water.



Weight of wheat taken = 2 g

Weight of water in the outside vessel = 3000 g

Water equivalent of calorimeter = 500 g

Initial temperature of water = 24°C

Final temperature of water = 26°C

Rise in temperature = 2°C

Heat gained by water and calorimeter =  $3500 \times 2 = 7000$  calories

2 g of wheat produces 7 kilo calories

1 g wheat produces 3.5 KCal

Calorific value of 100 g of wheat = 350 KCal.



# Gross Energy Value of Foods



- The average gross energy value of pure carbohydrates, fats, and proteins determined with the bomb calorimeter are given below.
- 1 g Carbohydrate yields 4.1 KCal
- 1 g Fat yields 9.45
- 1 g Protein yields 6.65



# Basal Metabolic Rate (BMR)



- It is the number of calories you burn as your body performs basic (basal) life-sustaining function.
- BMR defines your basal metabolism rate which makes up about 60-70% of the calories we use (“burn” or expend).
- Basal metabolic rate is an estimate of the minimum number of calories a person needs each day to maintain these functions at a resting state.
- This includes the energy your body uses to maintain the basic function of your living and breathing body, including:
  - The beating of our heart
  - Cell production
  - Respiration
  - The maintenance of body temperature
  - Circulation
  - Nutrient processing



# BMR vs RMR



- The BMR estimates the minimum number of calories a person needs each day to sustain their basic life functions should they rest for the entire 24 hours of a day.
- However, to get an accurate estimate, a person must undergo monitoring in a clinical setting under tightly controlled conditions. These include:
  - fasting for 12 hours before the test
  - sleeping for 8 hours prior to testing upon waking
  - undergoing monitoring in a darkened, temperature-controlled room
  - testing in a reclined position
- The RMR estimates the number of calories a person burns during a period of inactivity.
- People do not need to fast or rest for an extended period in a controlled environment to get an estimate.



# Normal values of BMR & its Significance



- Adult man: 35-38 cal/sq.m/hr or 1600cal/day
- Adult woman: 32-35 cal/sqm/hr or 1400cal/day

1. The determination of BMR is the principal guide for diagnosis and treatment of thyroid disorders.
2. If BMR is less than 10% of the normal, it indicates moderate hypothyroidism. In severe hypothyroidism, the BMR may be decreased to 40 to 50 percent below normal.
3. BMR aids to know the total amount of food or calories required to maintain body weight.
4. The BMR is low in starvation, under nutrition, hypothalamic disorders, Addison's disease and lipid nephrosis.
5. The BMR is above normal in fever, diabetes insipidus, leukemia and polycythemia



# Factors Affecting Basal Metabolic Rate



- There are many factors that affect the BMR.
- These include body temperature, age, sex, race, emotional state, climate and circulating levels of hormones like catecholamines (epinephrine and nor epinephrine) and those secreted by the thyroid gland.

## **1. Genetics (Race) :-**

- Some people are born with faster metabolism and some with slower metabolism.
- Indians and Chinese seem to have a lower BMR than the Europeans.
- This may as well be due to dietary differences between these races.
- Higher BMR exists in individuals living in tropical climates.

Ex. Singapore.



## 2. Gender :-

- Men have a greater muscle mass and a lower body fat percentage.
- Thus men have a higher basal metabolic rate than women.
- The BMR of females declines more rapidly between the ages of 5 and 17 than that of males.

## 3. Age :-

- BMR reduces with age i.e. it is inversely proportional to age.
- Children have higher BMR than adults.
- After 20 years, it drops about 2 per cent, per decade.

## 4. Weight :-

The heavier the weight, the higher the BMR,

Eg: The metabolic rate of obese women is 25 percent higher than that of thin women.



## 5. Body surface area :

- 1 This is a reflection of the height and weight.
- The greater the body surface area factor, the higher the BMR.
- Tall, thin people have higher BMRs.

## 6. Body fat percentage :-

- The lower the body fat percentage, the higher the BMR.
- The lower body fat percentage in the male body is one reason why men generally have a 10 - 15% higher BMR than women.

## 7. Diet :-

- Starvation or serious abrupt calorie-reduction can dramatically reduce BMR by up to 30%.
- Restrictive low-calorie weight loss diets may cause BMR to drop as much as 20%.
- BMR of strict vegetarians is 11% lower than that of meat eaters.





## **8. Body temperature/health :-**

- For every increase of  $0.5^{\circ}\text{C}$  in internal temperature of the body, the BMR increases by about 7 percent.
- The chemical reactions in the body actually occur more quickly at higher temperatures.
- So a patient with a fever of  $42^{\circ}\text{C}$  (about  $40^{\circ}\text{C}$  above normal) would have an increase of about 50 percent in BMR.
- An increase in body temperature as a result of fever increases the BMR by 14 - 15% per degree centigrade

## **9. External temperature :-**

Temperature outside the body also affects basal metabolic rate.

Exposure to cold temperature causes an increase in the BMR, so as to create the extra heat needed to maintain the body's internal temperature.



## **10. Glands :-**

- Thyroxine is a key BMR-regulator which speeds up the metabolic activity of the body.
- The more thyroxine produced, the higher the BMR.
- If too much thyroxine is produced (thyrotoxicosis) BMR can actually double.
- If too little thyroxine is produced (myxoedema)
- Like thyroxine, adrenaline also increases the BMR but to a lesser extent.

## **11.Exercise :-**

- Physical exercise not only influences body weight by burning calories, it also helps raise the BMR by building extra lean tissue.



## **12. Pregnancy :-**

- The BMR is not changed during pregnancy.
- The higher value of BMR in late pregnancy is due to the BMR of the foetus.

## **13. Sleep :-**

- The BMR in sleep is 5 % less than in the normal Basal Metabolic State.

## **14. Nervous tension :-**

Nervous tension during the test increase the BMR.



# Assessment



1. Calorific Value?
2. Kilo Calorie?
3. Mega Joule?
4. BMR?
5. Normal range?
6. Factors affecting BMR?



**THANK YOU**