



# Basal metabolic Rate (BMR)

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# BMR



## Basal metabolic rate

**Definition:** The minimum amount of energy per unit of time that a person needs to keep the body functioning at rest.

**Unit:**  $\text{Kcal/h/m}^2$

# The conditions for BMR measurement



1. The subject must be on 12 h of caloric fasting
2. Not using medicine for a week before, especially medicines affecting the thyroid function
3. Restful night sleep
4. No activity must be allowed 1 h before the test
5. Mental status
6. Laboratory temperature (20-27 °C)



# Factors that affect BMR

- Growth Hormone
- Cortisol
- Weather
- Sleep
- Fever
- Malnutrition
- Exercise and physical activity
- Age
- Protein consumption
- Thyroid hormone
- Sympathetic stimulation
- Male sex hormones





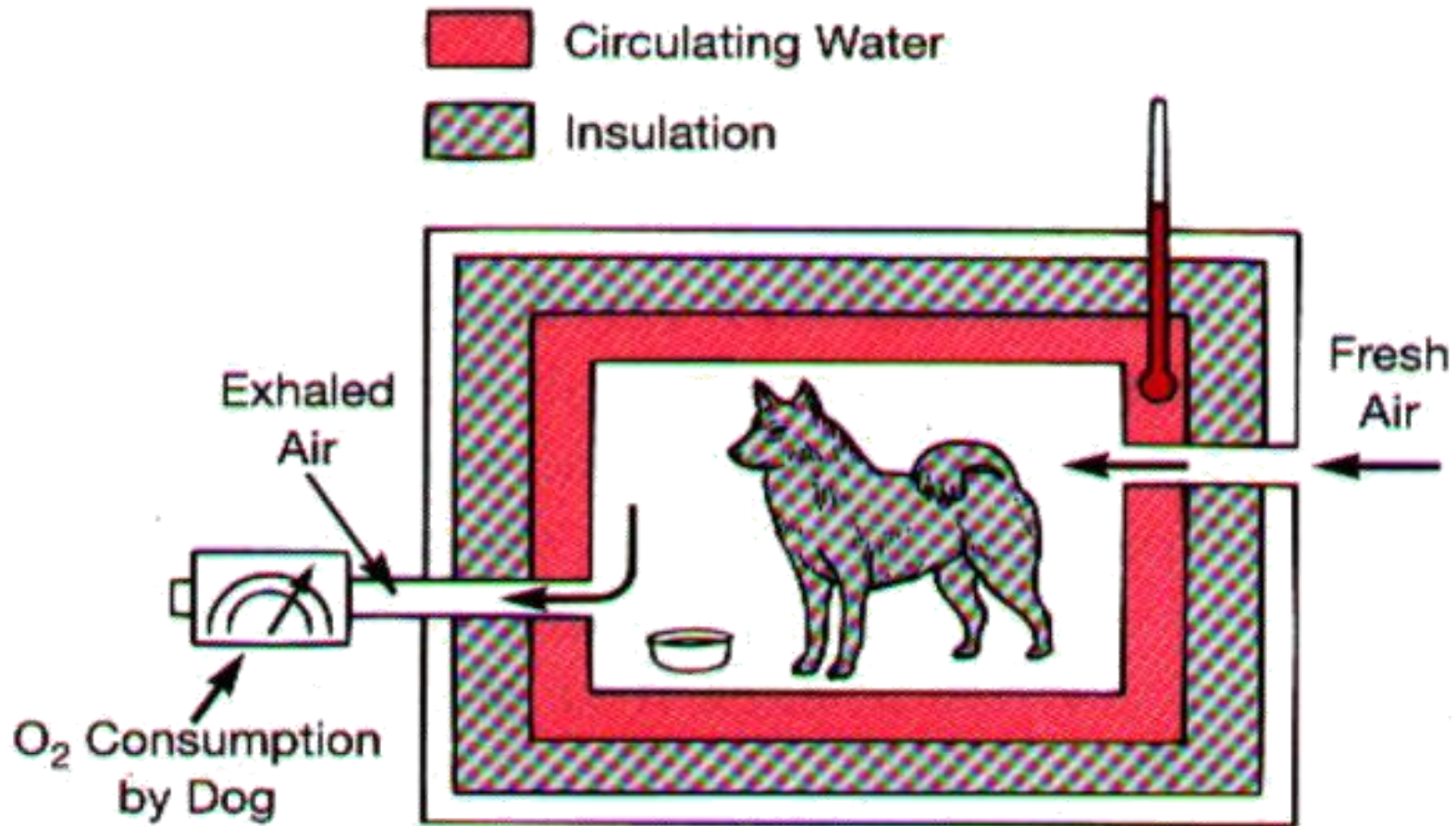
# BMR measurement approaches

Direct calorimetry

Indirect calorimetry

- *Measurement in our laboratory is based on indirect calorimetry and  $O_2$  consumption*

# Direct calorimetry

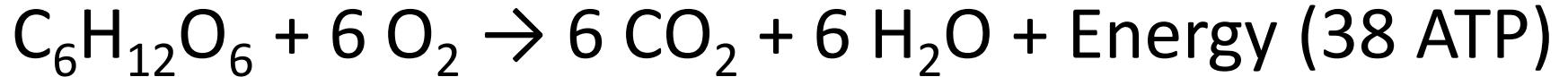




# Energy production

**Anaerobic**

**Aerobic**



The uptake of 1 liter of oxygen is often converted into **4.825** kcal energy.



# BMR measurement

- 1- Breathing in a spirometer and determining the amount of consumed oxygen volume (V) in a certain period of time (M)
- 2- Determining the room temperature, atmospheric pressure, height, weight and age of the individual.







# BMR measurement

3- Using the following formula to convert laboratory conditions to conventional conditions and calculate  $V_0$ :

$$PV = P_0 V_0 (1 + \alpha t)$$

$P$  = Pressure of  $O_2$

$V$  = Volume of consumed  $O_2$

$P_0$  = 760 mmHg

$V_0$  =  $O_2$  volume at standard conditions

$\alpha$  = Gas volume expansion coefficient (1/273)

$t$  = Room temperature

# BMR measurement



## 4- Calculating the heat produced

$$\begin{array}{cc} O_2 & 1 \text{ lit} \\ & V_0 \end{array} \quad \begin{array}{c} 4/825 \text{ Kcal} \\ \times \end{array}$$

$$\times = V_0 \times 4/825 \text{ Kcal}$$

# BMR measurement



## 5- Calculation in one hour

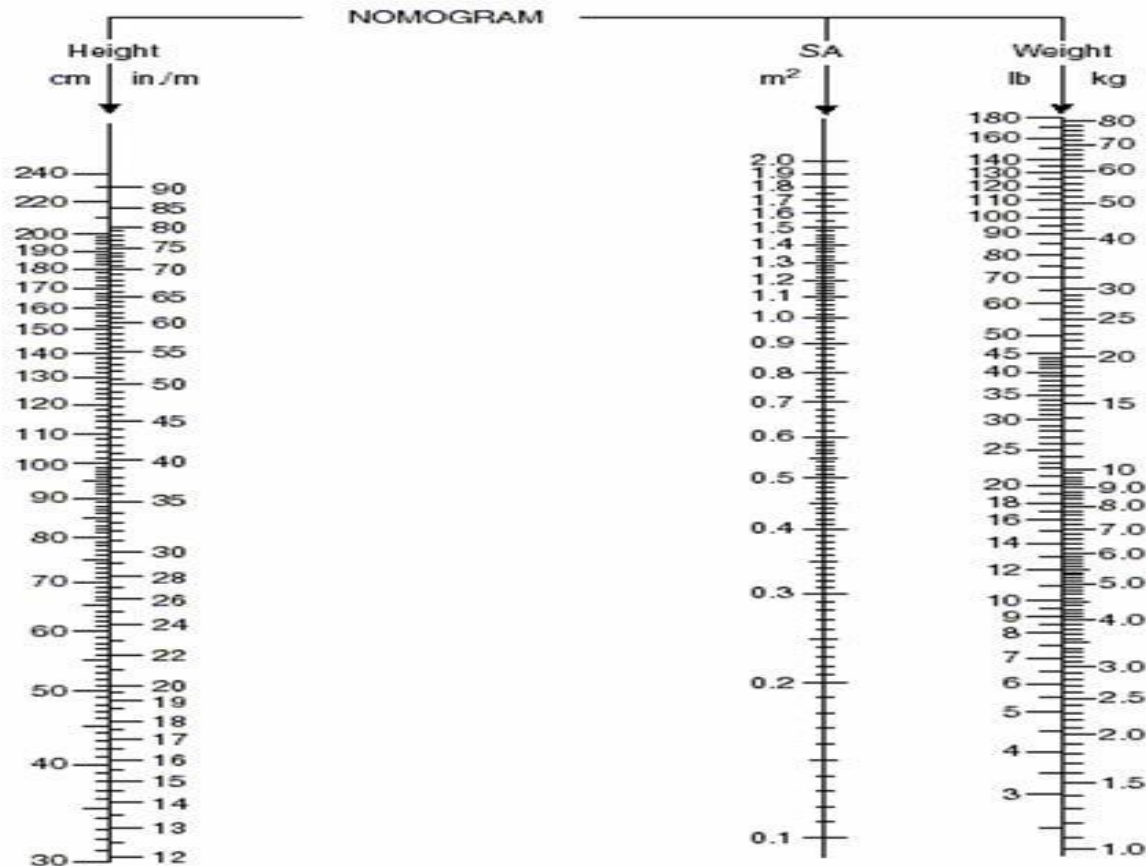
$$V_o \times 4/825 \times 60 \text{ min} \quad \text{Kcal/h}$$

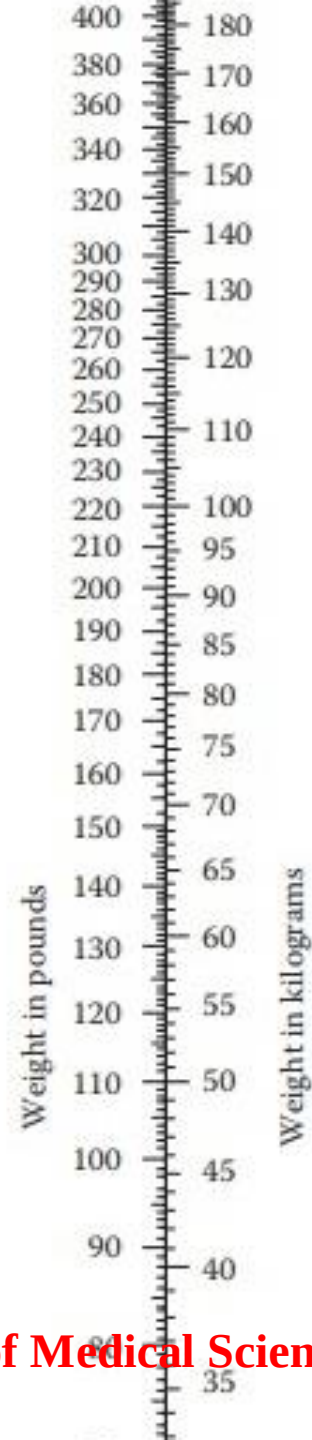
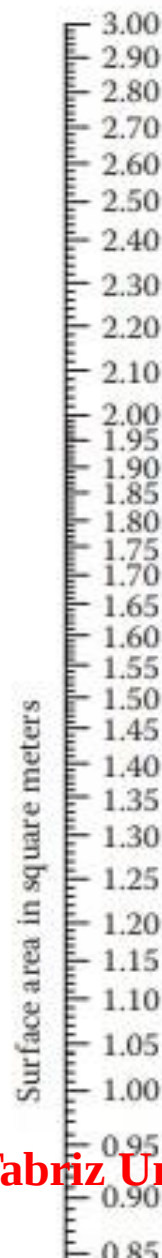
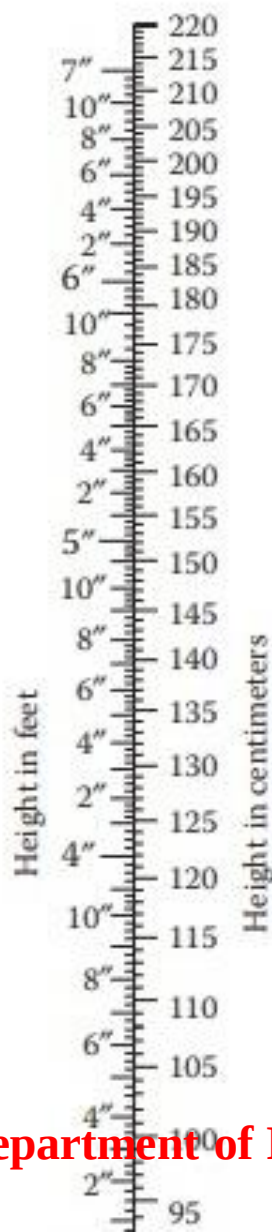
6- The obtained number/ Body surface in square meters  
= BMR



# BMR measurement

## 7- Calculation of body surface area





# BMR measurement



## 7- Calculation of BMR percentage

$$\frac{\text{Individual's BMR} - \text{Normal BMR}}{\text{Normal BMR}} \times 100$$

# Normal BMR values



## Basal Metabolic Rate - Ideal Values

| Age         | Male<br>(calories per hours) | Female<br>(calories per hours) |
|-------------|------------------------------|--------------------------------|
| 20-29 Years | 39.5                         | 37.0                           |
| 30-39 Years | 39.5                         | 36.5                           |
| 40-49 Years | 38.5                         | 36.5                           |
| 50-59 Years | 37.5                         | 35.0                           |
| 60-69 Years | 36.5                         | 34.0                           |
| 70-79 Years | 35.5                         | 33.0                           |

[www.sprintmedical.in](http://www.sprintmedical.in)

**Kcal/h/m<sup>2</sup>**



# An example test



Oxygen consumption = 1800 cc

Age = 30 years

Time = 5 minutes

Weight = 67 kg

Temperature = 17 °C

High = 165 cm

Pressure = 660 atm

Gender = Male

BMR?