

BASIC METABOLIC RATE

INTRODUCTION

- ✓ Food is the fuel source of the body, the ingested food undergoes metabolism to liberate energy required for the vital activities of the body.
- ✓ Man consumes energy to meet the fuel demands of the three ongoing processes in the body.
 - i. Basal metabolic rate
 - ii. Specific dynamic action
 - iii. Physical activity

BMR-Basal Metabolic Rate

- ✓ Metabolic rate-MR an expression of the rate at which the body utilizes oxygen.
- ✓ BMR- minimum amount of energy required by the body to maintain life at complete physical and mental rest in post absorptive state.(i.e., the patient should not have taken anything by mouth for the past 12hrs).
- ✓ The basal metabolic rate (BMR) is the basal energy expenditure expressed as kcal/kg body weight

Several functions within the body occurs at basal condition

- ✓ working of heart and other organs
- ✓ conduction of nerve impulse
- ✓ re-absorption by renal tubules
- ✓ GI motility
- ✓ ion transport across membranes

- ✓ **Resting Metabolic Rate (RMR)** is the energy required to perform vital body functions such as respiration and heart rate while the body is at rest. About 50 to 75% of one's daily energy expenditure can be attributed to resting metabolic rate.
- ✓ **Total Energy Expenditure**-the sum of the resting energy expenditure, energy expended in physical activity and the thermic effect of food
- ✓ **Resting Energy Expenditure (REE)**-the amount of energy used by a person in 24 hours when at rest 3-4 hours after a meal

Components of Energy Expenditure

✓ There are three major ways individual can burn calories during the day which account for the total energy expenditure :

1. Resting metabolic rate (RMR),
2. The thermic effect of food (TEF),
3. Physical activity energy expenditure (PAEE).

1-RESTING METABOLIC RATE RMR

- ✓ is the number of calories we burn to maintain our vital body processes in a resting state.
- ✓ It is usually determined by measuring the body's oxygen utilization while the person lay or sit quietly in the early morning before breakfast after a restful night's sleep.
- ✓ RMR typically accounts for about 65-75 percent of the total daily calorie expenditure.

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- ✓ Basal energy expenditure BEE or basal metabolic rate BMR is determined largely by body size, body composition, Gender and age.
- ✓ Lower in females compared to males
- ✓ BMR is typically measured by indirect calorimetry under fasted conditions while subjects lie quietly at rest in the early morning for 30–40 min.

THE THERMIC EFFECT OF FOOD (TEF)

- ✓ results or estimation from eating food, and is the increase in energy expended above your RMR or BMR that results from digestion, absorption, and storage of the food.
- ✓ also called the *specific dynamic effect (SDE) of food* or the *specific dynamic activity (SDA) of food*.
- ✓ It accounts for about 5-10 percent of the total calories human body burn in a day.

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- ✓ effect of foods:
- ✓ Carbohydrate: 5–10%
- ✓ Fat: 0–5% is very easy to process and has very little thermic effect
- ✓ Protein: 20–30% is hard to process and has a much larger thermic effect
- ✓ Alcohol: 15–20%
- ✓ The percentages are calculated by dividing the energy expended during digestion and absorption (above basal) by the energy content of the Food.

PHYSICAL ACTIVITY ENERGY EXPENDITURE PAEE,

- ✓ accounts for the remainder of the daily energy expenditure,
- ✓ PAEE is the energy expended in exercise, the activities of daily living,
- ✓ PAEE can vary considerably depending on how much you move throughout the day.

Total Energy expenditure

- ✓ **Energy expenditure** is the total of resting or basal metabolic rate, thermal effect of food and physical activity
- ✓ Total Energy expenditure or Calories expended =
$$[\text{RMR} + \text{TEF} + \text{PA}]$$

LABORATORY TECHNIQUES FOR MEASUREMENT OF ENERGY EXPENDITURE

- ✓ Measurement of work is not the same as measurement of energy expenditure
- ✓ Most common devices to measure energy expenditure in human are calorimetries
- ✓ measures energy expenditure by;
 - ✓ 1- Direct calorimetry
 - ✓ 2- Indirect calorimetry
 - ✓ 3- Doubly labeled water technique
 - ✓ 4-Computerized Instrumentation

FACTORS AFFECTING BMR

- ✓ Surface area: directly proportional to surface area
- ✓ Gender: men have marginally higher BMR (5%)
- ✓ Age: in infants and growing children BMR is higher. In adults BMR decreases at the rate of 2% per decade of life
- ✓ Physical activity: increase with regular exercise
- ✓ Hormones: thyroid hormones increase BMR.

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- ✓ Environment: BMR is higher in cold climates compared to warm climates
- ✓ Starvation: during starvation a decrease in BMR up to 50% has been reported
- ✓ Fever: fever increases BMR. 10% increase for every 1⁰C rise in body temperature
- ✓ Disease status: BMR is elevated in infections, leukemia, cardiac failure hypertension etc.

SIGNIFICANCE OF BMR

- ✓ BMR is important to calculate the caloric requirement of an individual and planning of diets
- ✓ Assessment of thyroid function
- ✓ BMR is below normal in starvation, under nutrition, Addison's disease
- ✓ BMR is above normal in fever, diabetes insipidus, leukemia and polycythemia

NORMAL VALUES OF BMR

MEN		
Height (feet)	RMR Range	Mean
5'4"	1200-1600	1400
5'5"	1275-1685	1480
5'6"	1340-1750	1550
5'7"	1410-1820	1610
5'8"	1480-1890	1680
5'9"	1550-1960	1750
5'10"	1615-2030	1815
5'11"	1685-2095	1885
6'0"	1750-2165	1950
6'1"	1820-2235	2020
6'2"	1890-2300	2100
6'3"	1960-2370	2160
6'4"	2030-2440	2230

WOMEN		
Height (feet)	RMR Range	Mean
5'1"	1120-1350	1240
5'2"	1135-1370	1255
5'3"	1155-1390	1275
5'4"	1195-1430	1315
5'5"	1235-1470	1355
5'6"	1270-1500	1390
5'7"	1310-1550	1430
5'8"	1350-1585	1470
5'9"	1370-1600	1490
5'10"	1410-1650	1530
5'11"	1450-1685	1570

Thank you