CALORIC BALANCE & RESPIRATORY QUOTIENT

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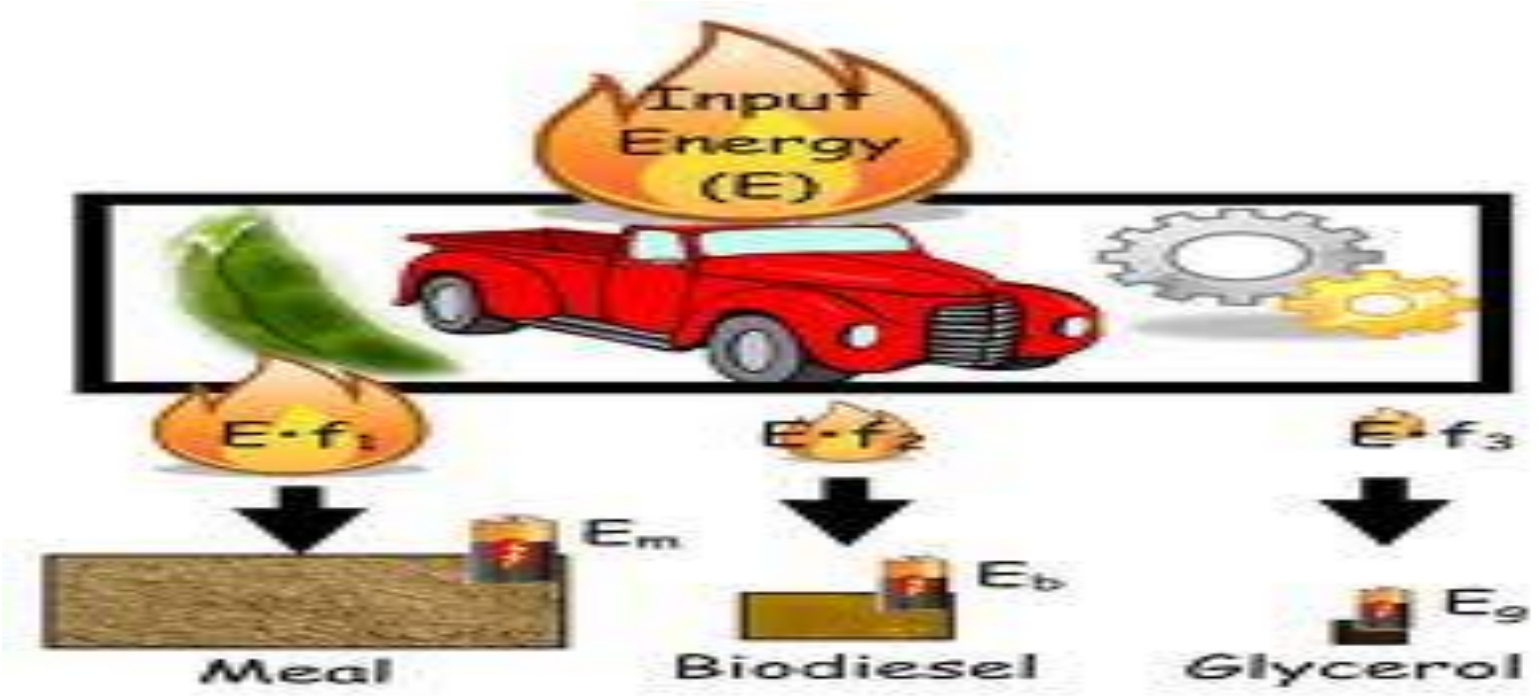
Energy Input

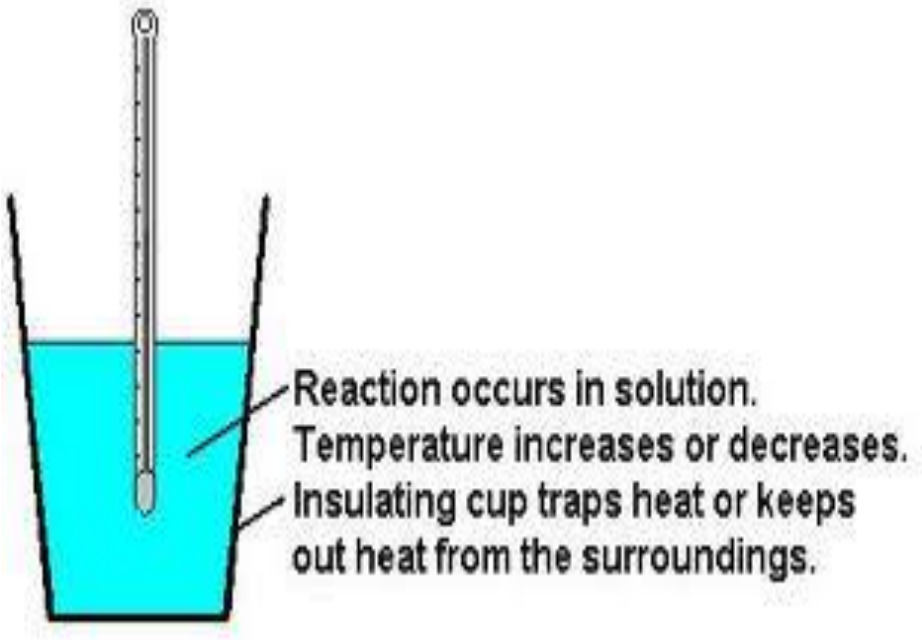
Energy:

The capacity to do work, such as moving or heating something



Definition of calorie (in Physics)

calorie:
The amount of energy necessary to raise the temperature of one gram of water by one degree Celsius.



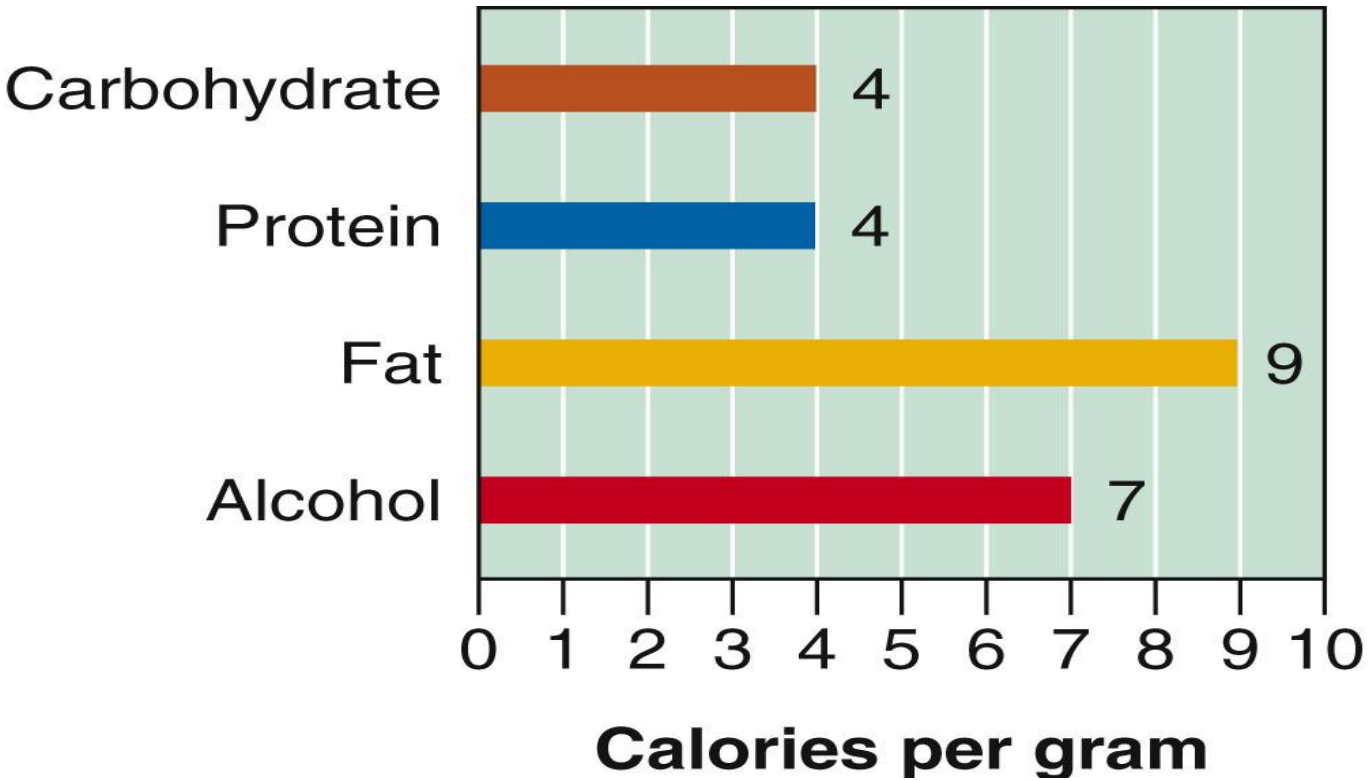
ENERGY CONTENT OF FOOD (CALORIFIC VALUE)

The energy content of a food is calculated from the heat released by the total combustion of food in Calorimeter.

Unit of heat or energy- Calorie
In Nutrition one uses Calorie=kcal (1000 calories)

•a kilocalorie is a unit of energy

In the body



In Calorimeter

Carbohydrate- 4.1 Calories

Fat- 9.4 Calories

Protein- 5.4 Calories

Caloric values

45 grams of carbohydrate × 4 calories	=	180 calories
39 grams of fat × 9 calories	=	351 calories
27 grams of protein × 4 calories	=	108 calories
Total:		639 calories

Remember this number…

Calorie value of carbohydrate, fat, and protein…

- If you know the number of grams of carbohydrate, fat, and protein in a food, you can calculate the number of calories in it. For example, a deluxe fast-food hamburger contains about 45 grams of carbohydrate, 27 grams of protein, and 39 grams of fat (above).

Percentage of Total Energy Intake

$$\text{calories from carbohydrate} = \frac{45 \times 4 \text{ cal/g}}{639} = 0.281 \times 100 = 28\%$$

$$\text{calories from fat} = \frac{39 \times 9 \text{ cal/g}}{639} = 0.548 \times 100 = 55\%$$

$$\text{calories from protein} = \frac{27 \times 4 \text{ cal/g}}{639} = 0.168 \times 100 = 17\%$$

The percentage of your total energy intake from carbohydrate, fat, and protein can then be determined by dividing the number of calories from each energy nutrient by the total calories, and then multiplying the result by 100.

Calculating Energy Intake

Counting Calories

- If you know the approximate composition of the foods you eat (% carb, protein, fat), and can estimate the weight, you can calculate the number of calories.

  By using the food composition tables

Food composition table

• **CALORIES from:**	**FAT**	**CARB**	**PRO**	**Total**
• Honey Wheat Roll	27	192	28	**247**
• Crispy Chicken	81	52	76	**209**
• Bacon	63	4	28	**95**
• Ranch Sauce	18	8	0	**26**
• Leaf Lettuce	0	0	0	**0**
• Tomato Slice	0	4	0	**4**
• **Medium Fries**	144	188	16	**348**
• **Medium COKE**	0	232	0	**232**
				1611 kcal

Components of Energy Output

We Need Energy for:

- Basal Metabolism

  BMR = Basal Metabolic Rate

- Physical Activity
- Metabolizing Food

Method to determine the Caloric needs

Factors to determine the caloric need:

- Age
- Sex
- Height
- Weight
- Lean body mass and
- Activity level

The "quick" method (based on body weight)

- A fast and easy method to determine Calorie needs is to total current body weight times a multiplier.
- Fat loss=12-13 calories per lb of body weight
- Maintenance=15-16 calories per lb of body weight
- Weight gain=18-19 calories per lb of body weight

This is very easy way to estimate.

Drawbacks…

- It doesn't take into account the activity levels or body composition.
- Extremely active individual may require far more calories than this formula indicates.
- The more lean body mass one has, the higher the TDEE will be.

The ABCs of Eating for Health

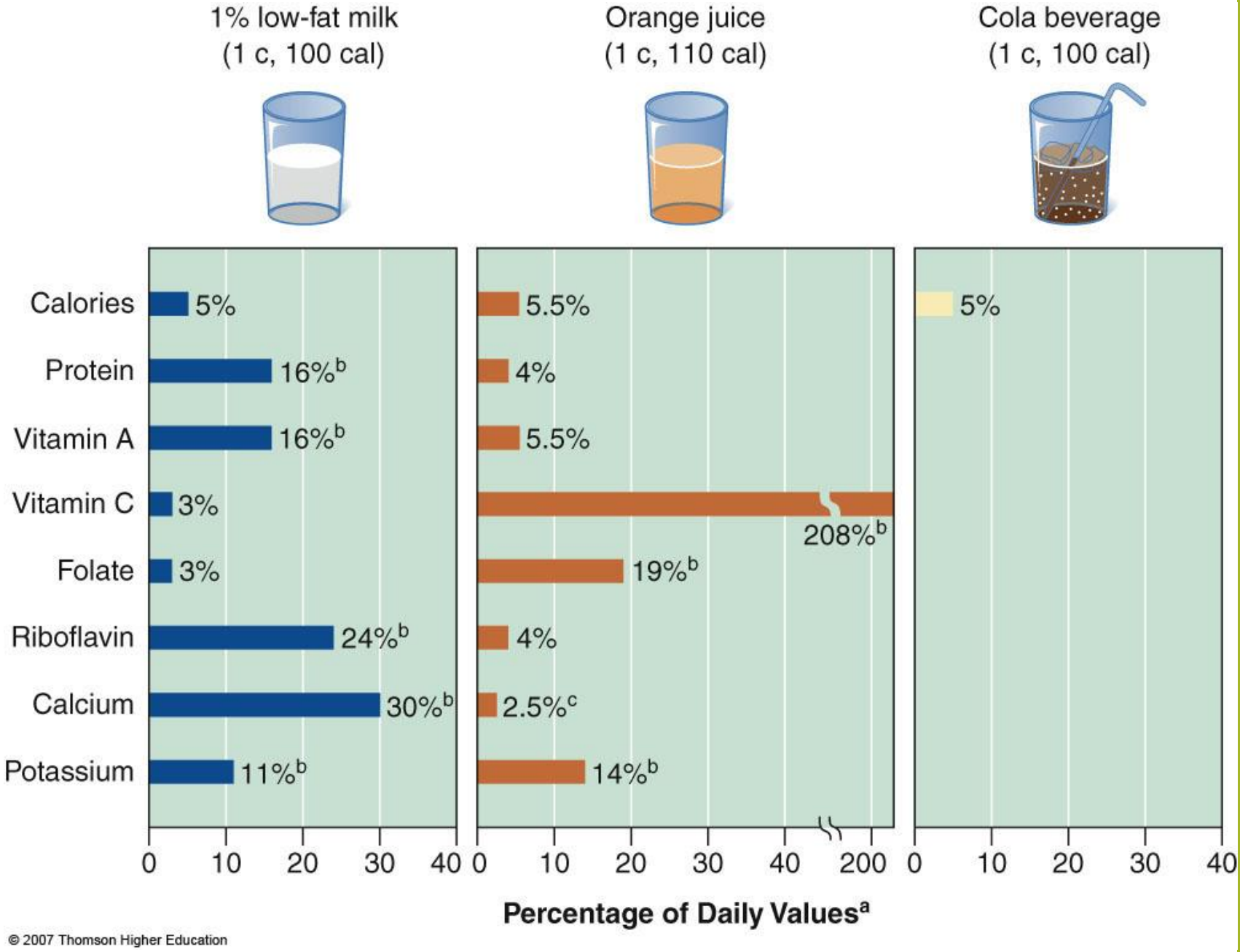
Adequacy
getting all of the essential nutrients, fiber, and energy (calories) in amounts sufficient to maintain health

Balance
eating foods rich in one nutrient while not crowding out foods that are rich in another nutrient

Calorie control
control of energy consumption

Moderation
no unwanted constituent in excess

Variety
different foods, same purposes, different occasions



Energy Balance

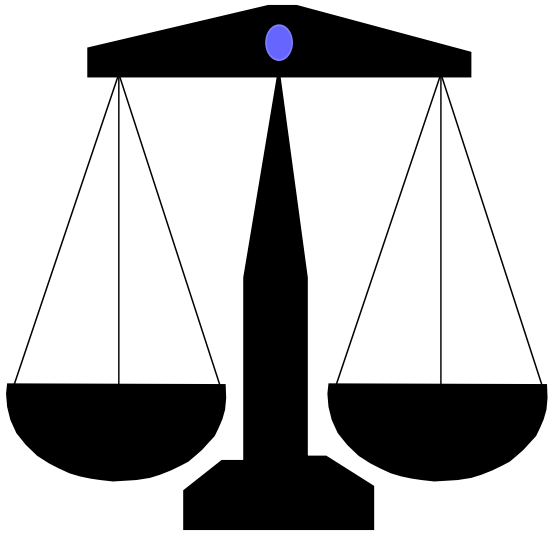
In accord with the Ist law of thermodynamics, the energy balance equation dictates that body mass remain constant when caloric intake equals caloric expenditure.

- **Caloric expenditure**
  - **Neutral balance**

    -Caloric intake equals expenditure.
  - **Positive balance**

    -More calories consumed than expended.
  - **Negative balance**

    -More calories are expended than consumed.



Calories and Energy Balance

Calories IN = Calories OUT Maintain Weight

Calories IN > Calories OUT GAIN Weight

Calories IN < Calories OUT LOSE Weight

To maintain a desirable weight, energy intakes should not exceed energy needs.

It's all about Calorie Balance

- If you eat more calories than your body uses, they will be stored as fat
- **One pound of body fat is equal to 3,500 kcal**
  - **In theory, losing one pound requires a deficit of 3,500 Calories**

Eating 500 fewer Calories per day - or expending 500 more Calories - would result in losing **one pound per week**

Weight Management

- To maintain body weight in a healthy range, balance calories from foods and beverages with calories expended

- To prevent gradual weight gain over time, make small decreases in food and beverage calories and increase physical activity

Energy Expenditure

- Calorie expenditure depends on:
  - Weight of person
  - Type of activity
  - Length of activity
  - Speed of activity
  - Metabolic rate

RESPIRATORY QUOTIENT (RQ)

- The respiratory quotient (**R. Q.**) is the **ratio of** the volume of **CO2** produced to the volume of **O2** utilized in the oxidation of foodstuffs.

Carbohydrates-

- The carbohydrates are completely oxidized and their R. Q. is close to 1, as represented below for glucose.
- $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$

R.Q. for carbohydrate = $CO_2/O_2 = 6/6 = 01$

Fats-

Fats have relatively lower R.Q. since they have a low oxygen content. For this reason, fats require more O2 for oxidation. The R.Q. for the oxidation of the fat, is -

- $2\ C_{57}H_{110}O_6 + 163O_2 \longrightarrow 114\ CO_2 + 110\ H_2O$

R.Q. for fat = $CO_2/O_2 = 114/163 = 0.7$

Proteins-

- The chemical nature of proteins is highly variable, and this cannot be represented by any specific formula. By indirect measurements, the R.Q. of protein is found to be around 0.8.

Mixed Diet-

- The R. Q. of the diet consumed is dependent of the relative composition of carbohydrates, fats and proteins. For a normally ingested diet, it is around 0.8.