Nutrition- Caloric Consumption, Weight variation due to dietary habit. Physiological and Metabolic changes during exercise

INTRODUCTION

Our energy comes from the foods we eat and the liquids we drink. The three main nutrients used for energy are carbohydrates, protein, and fats, with carbohydrates being the most important source. Our body can also use protein and fats for energy when carbohydrate has been depleted. When they eat, their body breaks down nutrients into smaller components and absorbs them to use as fuel. This process is known as metabolism. Carbohydrates come in two types, simple and complex, and both are converted to sugar (glucose). Thereon, the body breaks the sugar down in the blood and the blood cells use the glucose to provide energy.

Diet (Nutrition)

In nutrition, diet is the sum of food consumed by a person or other organism. The word diet often implies the use of specific intake of nutrition for health or weight-management reasons. Although humans are omnivores, each culture and each person holds some food preferences or some food taboos. This may be due to personal tastes or ethical reasons. Individual dietary choices may be more or less healthy. Complete nutrition requires ingestion and absorption of vitamins, minerals, and food energy in the form of carbohydrates, proteins, and fats. Dietary habits and choices play a significant role in the quality of life, health and longevity.

Caloric Consumption

A calorie is a unit of energy, just as a pound is a measure of weight and a mile is a measure of distance. So the amount of energy which exert in doing an activity is measured by the calories burn rate. In short, Calories are a measure of how much energy food or drink contains. The amount of energy required will depend on:

1. Age: for example, growing children and teenagers may need more energy.
2. Lifestyle: for example, how active the individual is.
3. Size – one's height and weight can affect how quickly the energy is used.

Likewise, other factors can also affect how much energy is burned. For example

- Some hormones (chemicals produced by the body) such as thyroid hormones
- Some medications- such as glucocorticoids, a type of steroid used to treat inflammation.
- Being unwell

REQUIREMENT OF THE DAILY CALORIES

There are a right number of calories for a person to eat each day. For example, a 40-year-old, sedentary woman should aim for 1,800 calories a day, while a 25-year-old, sedentary male should aim for 2,400 calories a day. One could use up the entire amount on a few high-calorie items, but chances are he/she won't get the full range of vitamins and nutrients that their body needs.

Eat a variety of nutrient-packed foods and beverages within and among the basic food groups, while limiting foods with saturated fats, Trans fats, cholesterol, added sugars, salt, as well as alcohol. Select a variety of foods from each food group and within food groups. A healthy eating plan is one that:

1. *Emphasizes fruits, vegetables, whole grains, and fat-free or low-fat milk and milk products.*
2. *Includes lean meats, poultry, fish, beans (like legumes), eggs, and nuts.*
3. *Low in saturated fats,* trans *fats, cholesterol, salt (sodium), and added sugars.*
4. *Balances calorie intake with calorie needs*

WEIGHT VARIATION DUE TO DIETARY HABIT

Dietary habits are actually the food choices preferred by a person in their daily life. They differ from person to person. A healthy dietary habit helps an individual to stay fit and well throughout his life. Healthy diet includes fruits, vegetables, cereals, water, low fat dairy products, etc. Dietary habits are the habitual decisions an individual or culture makes when choosing what foods to eat. The word diet often implies the use of specific intake of nutrition for health or weight-management reasons. Although humans are omnivores, each culture and each person holds some food preferences or some food taboos. This may be due to personal tastes or ethical reasons. Individual dietary choices may be more or less healthy. Dietary habits and choices play a significant role in the quality of life, health and longevity. It can define cultures and play a role in religion.

Daily caloric intake was higher by 86 kcal/day during the fall compared to the spring. Percentage of calories from carbohydrate, fat

and saturated fat showed slight seasonal variation, with a peak in the spring for carbohydrate and in the fall for total fat and saturated fat intake. The lowest physical activity level was observed in the winter and the highest in the spring. Body weight varies by about 1/2 kg throughout the year, with a peak in the winter. Greater seasonal variation was observed in subjects who were male, middle aged, nonwhite, and less educated.

HEALTHY EATING FOR A HEALTHY WEIGHT

A healthy lifestyle involves many choices. Among them, choosing a balanced diet or healthy eating plan can be mentioned. According to the *Dietary Guidelines for Americans* 2015-2020, a healthy eating plan:

- Emphasizes fruits, vegetables, whole grains, and fat-free or low-fat milk and milk products.
- Includes lean meats, poultry, fish, beans, eggs, and nuts.
- Low in saturated fats, *trans* fats, cholesterol, salt (sodium), and added sugars.
- Stays within the daily calorie needs.

PHYSIOLOGICAL CHANGES DURING EXERCISE

The pulmonary physiology discussed so far deals largely with patients at rest. Many patients complain of dyspnea only during exercise or during minimal exertion, such as stair climbing. Their resting pulmonary function tests many be normal or, if abnormal, not reduced enough to explain the degree of exercise intolerance. Exercise physiology encompasses aspects of pulmonary, cardiac, and sports medicine, plus cellular metabolism and biochemistry.

WHAT HAPPENS DURING EXERCISE?

At this point it will be useful to review basic lung volumes and ventilations. The most visible change in any subject during exercise is the increase in minute ventilation; this manifests as increase in the rate and depth of breathing. The reason for increased minute ventilation during exercise is because much more oxygen and carbon dioxide are exchanged than at rest. This single metabolic fact accounts for the profound changes not only in respiration, but also in cardiac and circulatory physiology during exercise. Increased oxygen supply is provided by increases in both arterial oxygen delivery and tissue oxygen extraction; at the same time there is increased carbon dioxide transport on the venous side. The need for increased gas exchange by exercising muscles leads to the following general physiologic changes.

Metabolic changes:

Increased oxygen consumption (VO_2) and carbon dioxide production (VCO_2) occur immediately with exercise. During aerobic metabolism, glucose and fats utilize oxygen to form adenosine

triphosphate (ATP), the ultimate source of energy. There is very little oxygen stored in the body, so aerobic metabolism requires continuous delivery of oxygen from the atmosphere to the blood. Without oxygen, glucose is metabolized anaerobically, and the yield of ATP per glucose molecule is much less; in addition, lactic acid is generated as a by-product. Anaerobic metabolism is sufficient for short bursts of activity, but prolonged exercise requires oxygen as energy substrate.

Cardiac changes:

Oxygen consumption (VO_2) is related to cardiac output by the Fick equation:

$$\mathbf{VO_2 = QT \times (CaO_2 - CvO_2)}$$

Where QT is cardiac output in ml/min, and (CaO_2 - CvO_2) is the arterial-venous oxygen content difference in ml/100 ml blood. Since cardiac output is the product of stroke volume (SV) and heart rate (HR),

$$\mathbf{VO_2 = SV \times HR \times (CaO_2 - CvO_2)}$$

Both SV and HR increase immediately with exercise, but stroke volume plateaus early. Further increases in cardiac output are largely due to increase in heart rate.

Systemic circulation changes:

The extra cardiac output delivers more oxygen to exercising muscles. There is a redistribution of the systemic circulation, including vasodilation in the skin and working muscles and vasoconstriction in the visceral organs and nonworking muscles. The net effect of vascular redistribution is a decrease in systemic vascular resistance.

Oxygen extraction changes:

Apart from increased cardiac output and vascular redistribution, a third mechanism to meet oxygen requirements is increased oxygen extraction from the arterial blood; this results in an increased arterial-venous oxygen content difference.

Pulmonary circulation changes:

Pulmonary circulation also increases immediately with exercise. Un-perfused alveoli become perfused (through recruitment of pulmonary capillaries), and under-perfused units receive an increased blood supply. As a result, both pulmonary blood volume and the pulmonary diffusing capacity for oxygen increase.

Ventilation changes:

As pulmonary blood flow increases, both minute ventilation (VE) and alveolar ventilation (VA) increase; in this way the lungs transfer more oxygen and carbon dioxide and keep pace with metabolic demands. Although both tidal volume (VT) and respiratory rate increase with exercise, in the early stages an increase in VT accounts for most of the rise in VE and VA. At a point where VT approaches

approximately 60% of the vital capacity, further increases in ventilation come from increasing respiratory rate.

Hematologic changes:

Although most of the increase in oxygen delivery is accounted for by increased cardiac output, in some individuals hemoglobin concentration may rise. This can occur by red cells entering the circulation from splenic and marrow reservoirs, as well as by reduction of plasma volume. The rise in hemoglobin does not occur in well-trained athletes, who tend to have higher resting blood volume than the general population. In any case, the magnitude of hemoglobin increase is small, approximately 10%, and does not play a significant role in augmenting oxygen delivery during exercise.

METABOLIC CHANGES DURING EXERCISE

Metabolically, there are two types of exercise, aerobic and anaerobic. Aerobic exercise uses oxygen as energy substrate to metabolize food to adenosine triphosphate (ATP). When the supply of oxygen is no longer sufficient to meet the needs of exercising muscles, anaerobic metabolism begins. In anaerobic metabolism, glucose is converted to ATP without oxygen, and lactic acid is generated as a by-product. A healthy person can perform aerobic exercise for several hours; in contrast, pure anaerobic exercise can only be sustained for a few minutes before severe dyspneoa and fatigue set in.

FAT METABOLISM DURING EXERCISE

The key points of fat metabolism during exercise by Dr. Edward F. Coyle are as follows:

1. People store large amounts of body fat in the form of triglycerides within fat (adipose) tissue as well as within muscle fibers (intramuscular triglycerides).When compared to carbohydrate stored as muscle glycogen, these fat stores are mobilized and oxidized at relatively slow rates during exercise.

2. As exercise progresses from low to moderate intensity, e.g., 25-65% VO2max, the rate of fatty acid mobilization from adipose tissue into blood plasma declines, whereas the rate of total fat oxidation increases due to a relatively large use of intramuscular triglycerides. Intramuscular triglycerides also account for the characteristic increase in fat oxidation as a result of habitual endurance-training programs.

3. Dietary carbohydrate intake has a large influence on fat mobilization and oxidation during exercise; when dietary carbohydrate produces sufficient carbohydrate reserves in the body, carbohydrate becomes the preferred fuel during exercise. This is especially important during intense exercise because only carbohydrate can be mobilized and oxidized rapidly enough to meet the energy requirements for intense muscular contractions.

CONCLUSION

The vast majority of scientific evidence supports a beneficial role of exercise on achieving body weight stability and overall health. The goal is to find ways to motivate people to exercise and adopt healthy lifestyles. In order to achieve this objective, we must be innovative and creative in finding ways to fight against the modern way of living that drives excess energy intake relative to expenditure. Future research will be needed to give a better insight into the many issues impacting physical activity levels of people, including the barriers to healthy active living.