

# Body Temperature



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# Learning objectives:

At the end of this lecture the student should be able to:

- Define body temperature.
- Identify sites of measuring body temperature.
- Convert temperature measured in centigrade to Fahrenheit.
- Convert temperature measured in Fahrenheit to centigrade.
- Identify contraindication of measuring body temperature from the various sites.

- Identify the normal average and range of body temperature.
- Explain in simple terms the various regulating factors of body temperature.
- Explain the mechanisms of heat loss.
- Explain factors increasing heat production.
- Explain factors decreasing heat production.
- Define fever (pyrexia) and hyperpyrexia.
- Identify causes of fever.
- Describe the various types of fever.

- Explain the various stages of fever.
- List signs and symptoms of fever.
- Identify and intervene appropriate measures to reduce fever.
- Identify and intervene general nursing care of patient with fever.
- Define hypothermia.
- Identify causes of hypothermia.
- List signs and symptoms of hypothermia.
- List nursing care of hypothermic patient.

# Introduction:

- Despite extremes in environmental conditions and physical activity, temperature-control mechanisms of human beings keep the body core temperature (temperature of the deep tissues) relatively constant. However, surface temperature fluctuates depending on blood flow to the skin and amount of heat lost to the external environment.

- The measurement of body temperature is aimed at obtaining a representative average temperature of core body tissues.
- Sites reflecting core temperature are more reliable indicators of body temperature than sites reflecting surface temperature. In addition, the temperature value obtained may differ depending on the measurement site.

# Definition of body temperature:

- It is the degree of heat maintained by the body or it is the balance between heat produced in the tissues and heat lost to the environment.



# Sites and normal ranges of measuring body temperature:

- No single temperature is normal for all people.
- The average of normal oral temperature is 37C.
- The acceptable temperature of human being ranges from 36 c – 38 C.
- The normal range of oral temperature is 36.1c – 37.5 C.
- The normal range of rectal temperature is 36.1c– 38.1 C.
- The normal range of axillary temperature is 35.5–36.4 C.
- The normal range of tympanic temperature is 36.4 C – 38.1C.

- Temperature of 34°C to 41 °C is the approximate range within which body cells can function.
- If body temperature decreased than 34°C or increased than 41°C body, cells can not function.
- Temperature can be measured with a mercury thermometer, an electronic digital thermometer, or a tympanic thermometer.

- Body temperature is recorded either in degree centigrade (C) or degree Fahrenheit (F).
- To convert centigrade to Fahrenheit, multiply by  $9/5$  and add 32.
- $F = (9/5 \times C) + 32$
- To Change Fahrenheit to Centigrade subtract 32 and multiply by  $5/9$ .
- $C = (F - 32) \times 5/9$

## **Contraindication of oral temperature:**

- Infants and children.
- Unconscious patients.
- Inflammation or surgery of mouth.
- Persistent frequent coughing.
- Mouth breathing patients.

- Very weak who cannot close his mouth well.
- Very old and weak patient.
- Patient with seizure disorder.
- After drinking hot fluids or cold fluids.

# Contraindication of axillary temperature

- Skin disease.
- Axillary operation.

## **Contraindication of rectal temperature:**

- Patients with surgical operation in the rectum or perineal region.
- Disease or inflammation of the rectum.
- Diarrhea.

# Temperature regulation:

There are various regulating factors that affect body temperature. These are:

- Physical control.
- Chemical control.
- Nervous system control.



# Physical control

- The body gains heat from its environment, for example clothing, sun and ingestion of hot food.

# Chemical control.

- The body produces heat through the metabolism of food.
- Body metabolism increases in order to produce more heat for the body as necessary.
- Thus, the rate at which metabolism takes place affects and controls body temperature, an increase in the metabolic rate will result in an increase in body temperature and vice versa.

# Nervous system control.

- Body temperature is maintained by the hypothalamus in the central nervous system, located at the base of the brain.
- The anterior portion of the hypothalamus is concerned with heat dissipation (loss), and the posterior portion of the hypothalamus governs heat conservation (gain).

# Heat dissipating mechanism:

- The anterior part of the hypothalamus is stimulated by very slight increase in the temperature of the blood above normal.
- It stimulates the sweat glands to increase their rate of secretion.
- Evaporation of the larger amount of sweat causes a greater heat loss which causes dilatation of surface blood vessels; so more heat is lost by radiation from the larger quantity of blood circulating near the surface in the dilated skin vessels (Figure 1).

# Heat gaining mechanism:

- In a cold environment, the posterior portion of the hypothalamus is stimulated, this causes skin blood vessels constriction which decreases the volume of blood circulating near the surface and so decreases the heat loss by radiation.

- In addition there is decrease in activity of sweat gland. Thus, decreases heat loss by evaporation.
- Also shivering and voluntary muscle contractions occur, thereby accelerating catabolism and heat production.

# Mechanisms of heat loss:

- Body heat is lost through the skin, lungs, and excretion (digestive and urinary tracts).
- The loss through the skin accounts about 85% of the total.

# There are four mechanisms by which heat loss takes place:

**1. Radiation:** is the process whereby heat is transferred from one object to another without direct contact between the two.

The heat is carried from one object to the other in the form of rays. For example, the use of heat lamp involves the transfer of heat by radiation.



**2. Convection:** heat is lost through convection when air currents pass over a warm object, carrying its heat away with them.

- **For example,** using of fans, open doors and windows to Create drafts.

**3. Conduction:** is the transfer of heat by direct contact between two objects. Heat passes from the warmer object to the colder.

**For example,** contact between skin of increased temperature and cold water, swimming or cold showers.

**4. Evaporation:** process whereby a substance in liquid state is changed to a vapor state.

- The more heat the body generates (as in muscular exertion), the more active the sweat glands become, thereby, increasing the rate of cooling.

**For example,** sponging a patient with alcohol and water provide for cooling by evaporation, Also evaporation of water vapor through respiratory tract with expiration.

# Factors increasing heat production:

1. **Muscular activity:** leads to an increase in tissue metabolism which in turn increases heat production, e.g. shivering, muscular exercises.
2. **Ingestion of food:** by increasing the fuel supply, body heat is increase.
3. **Time of day:** Body temperature tends to be at its highest in the late afternoon or early evening.

4. **Emotion:** stimulate the sympathetic nervous system with release of epinephrine and nor epinephrine, which increases the metabolic activities of body tissues which in turn increases heat production.
5. **Hormones:** increase in the production of thyroxin by the thyroid gland increases basal metabolic rate thereby stimulates heat production.
6. **Infections:** cause increase in body temperature.

## **7. Increased temperature of the environment:**

high room temperature or a hot water bath may increase body temperature.

**8. Menstruation and pregnancy:** At a time of ovulation a woman's body temperature may raise as much as 0.3°C. It falls again one or two days before the onset of menstruation.

The first 3 to 4 months of pregnancy are characterised by a slight rise of the temperature, then falls slightly below normal for the remainder of the pregnancy. It returns to normal after child birth.

# Factors decreasing heat production:

- 1. Prolonged illness:** muscular activity is diminished and less heat is produced.
- 2. Fasting:** an inadequate supply of food or fuel leads to decreased heat production.
- 3. Sleep:** during sleep, when the body is less active, less heat is produced and body temperature is lowered.
- 4. Depression of the nervous system:** mental depression, unconsciousness and the use of narcotic drugs, all act to lessen body activity and thus, decrease heat production.

**5. Time of day:** body temperature tends to be at its lowest in the morning

**6. Age:** the body temperature of young children tends to vary more than that of adults.

This is due to the relative immaturity of the child's nervous system.

In the aged the temperature is subnormal because the body is less active, the circulation is feeble, and therefore, old people are intolerable extremes of external temperature.



# **Disorders of body temperature**

Disorders of body temperature may be either elevation or reduction of temperature above or below normal range.

# Fever (pyrexia)

- Is abnormal elevation of body temperature above the normal range. It is common symptom of illness. Fever may be:
- low-grade fever: is temperature, slightly elevated to approximately 37.3 °C to 38.2 °C.
- High-grade fever: temperatures above 38.3 °C to 40.5 °C.
- Hyperpyrexia: is a condition in which body temperature is above 41.6 °C.

## Causes of fever:

1. Damage to heat - regulating centre due to head injuries. Cerebrovascular accidents and abnormally high body temperature. This leads to disturbance in the heat regulating mechanism.
2. Acute infectious disease e.g. Malaria:
3. Acute inflammatory conditions.
4. Acute and prolonged pain.

5. Extreme nervousness.
6. Emotional stress.
7. Trauma or injury to body tissues.
8. Conditions that increase heat production, e.g., thyrotoxicosis there is an increased metabolic rate which causes elevation of body temperature.
9. Conditions that decrease heat loss e.g. dehydration which results in decreased secretion of sweat.

# Types of fever:

1. Constant fever (continuous fever):

Temperature remains constantly elevated and fluctuates very little (1.2 °C).

## 2. Remittent fever:

Temperature is high and fluctuates several degrees more than 1.0 °C but does not reach normal during the day.

### 3. Intermittent fever:

Temperature alternates regularly between  
A period of fever and a period of normal or  
subnormal temperature.

# Stages of fever:

1. The chill phase: or a period of raising temperature. A chill may last few minutes it may reach an hour.

The patient experiences a feeling of cold and shivering, skin is cool and pale.



2. The course of fever: when the temperature is maintained at an elevated level. The skin feels warm and flushed.

The patient feels-thirst, malaise, weakness, aching muscles and drowsy or restless

3. The termination or decline period: it is a period when temperature falls to normal either by:

a - Crisis: the temperature falls quickly over a period of few hours.

b- Lysis: the temperature falls gradually over a period of days or weeks.

A short lysis takes about 3 days.

A long lysis takes from 7 to 10 days.

## **Signs and symptoms of fever:**

1. Rapid pulse
2. Rapid shallow respiration
3. Cold, then hot skin
4. Flushed face
5. Headache
6. Malaise

7. Sweating and shaking chill
8. Restlessness
9. Thirst
10. Anorexia
11. Nausea and vomiting
12. Dehydration
13. Constipation
14. Diarrhoea if accompanied by gastrointestinal (G.I.T) infection

- Decrease urinary out put (oliguria)
- Delerium and may be hallucination
- If temperature increased above 41o C, damage of brain tissues may occur.

## Measures to reduce body temperature:

- Bed rest and inactivity to decrease the rate of the metabolic process and also muscular activity, thereby, decrease the amount of heat produced in the body.
- Sponging the patient's body a cool solution of water and alcohol to promote heat loss by evaporation.
- Ice bags on the groin, axilla and forehead to promote heat loss by conduction.

4. Cool quiet environment to promote heat loss by radiation and convection.
5. Force cold fluids up to 2.500 to 3000 cc/day, in small amount and frequent intervals. Fluids increase sweating, which promotes heat loss through evaporation.
6. Administration of antipyretic drug according to doctor's order.

# **Nursing care of patient with fever:**

1. Apply measures to reduce body temperature (mentioned above).
2. Accurate measuring of vital signs at frequent intervals (every 1 to 2 hours) and they should be reported and recorded appropriately.
3. If fever is accompanied by chills, patient should be covered by several light blankets.



4. Frequent oral hygiene, to prevent dryness of lips. Cracked lips may be avoided by the use of petroleum jell or cold cream applications.
5. Hygienic care, body cleanliness, light clean dry clothes, and light bed covers.
6. Implement safety precautions to protect the patient if restless or delirious or if convulsions occur.

7. Maintain nutritional status because of the increase in the metabolic rate brought on by fever, it is important that the patient maintains high caloric intake.
  
8. Supply supplement oxygen if the patient has preexisting cardiac or respiratory problem.

# **Hypothermia:**

A condition in which temperature is abnormally lower than normal

Classification of hypothermia:

- Mild: 34° – 36° C
- Moderate: 30° – 34° C
- Sever: <30° C

# **Causes of Hypothermia:**

1. Lowered metabolism.
2. Decreased activity usually occurs in elderly.
3. Heavy sedation.
4. Circulatory failure.
5. Exposure to extremely cold environmental temperature.

# **Signs and symptoms of hypothermia:**

1- Pale skin.  
lips.

2- Cyanosed

3- Cold hands and feet.

4- Chilling.

5- Goose skin.

6- Drowsiness.

7- Slow pulse rate.

8- Slow respiration.

9- Decreased physical and mental capabilities.

10- Patient feels sleepy and may become comatose.

# **Nursing care of patient with hypothermia:**

1. Increase physical activity.

2. Warm the patient by:

Use of more blankets, extra clothes, heaters, hot application to the skin such as hot water bottles and heating pads to the skin, friction of body surfaces and warm food and drinks.

**Thank you**