

# HEART RATE

## **Heart rate:**

Frequency of heart beat per minute is called heart rate. It is about 60-90 beats/min.

## **Normal heart rate:**

- In adult: 60-90 beats/min (average 72 b/min)
- In Fetus: 140-150 beats/min
- In new born: 130-140 beats/min
- In old age: 75- 80 beats/min
- Athlets: 40 beats/min

## **The maximum effective Heart rate:**

Means it is effective in maintaining stroke volume. It is 180 beats /min.

Above this value → decrease stroke volume → decrease cardiac output  
→ decrease blood pressure.

**Tachycardia:** Heart rate above 100 beats /min

## Causes of increase heart rate:

- Sympathetic stimulation
- Exercise
- Fever
- During inspiration
- Decrease activity of baroreceptors
- Epinephrine, nor epinephrine & thyroxin.
- Excitement, emotional state, anger & painful stimulation.
- Hypoxia.
- Bainbridge reflex

**Bradycardia:** Heart rate below 60 beats /min

**Causes of decrease heart rate:**

- Parasympathetic stimulation
- During normal expiration
- Increase activity of baroreceptors
- Fear
- During sleep

**Heart rate is regulated by following mechanism:**

1. Neural regulation
2. Chemical regulation
3. Thermal regulation
4. Reflex mechanism:

Baroreceptor reflex, Bain bridge reflex, Chemoreceptor reflex, Reflexes arises from left ventricle, Reflexes arises from atrial receptors.

**Neural regulation:**

- Sympathetic stimulation increase heart rate.
- Parasympathetic stimulation decrease heart rate.

**Chemical regulation of heart rate:**

- Adrenalin increase heart rate.
- Thyroxin increase heart rate.

**Thermal regulation:**

- During fever heart rate increase.
- For every degree rise of temperature in Fahrenheit scale, heart rate rises 10 beats / min

## **Reflexes regulating heart rate:**

### **The Bainbridge Reflex:**

An increase in atrial pressure also causes an increase in heart rate, sometimes increasing the heart rate as much as 75 percent. A small part of this increase is caused by a direct effect of the increased atrial volume to stretch the sinus node; direct stretch can increase the heart rate as much as 15 percent.

An additional 40 to 60 percent increase in rate is caused by a nervous reflex called the Bainbridge reflex. The stretch receptors of the atria that elicit the Bainbridge reflex transmit their afferent signals through the vagus nerves to the medulla of the brain. Then efferent signals are transmitted back through vagal and sympathetic nerves to increase heart rate and strength of heart contraction. Thus, this reflex helps prevent damming of blood in the veins, atria, and pulmonary circulation.

### **The baroreceptor reflex:**

Increased blood pressure → baroreceptors are stimulated → impulse goes to the nucleus tractus solitarius of medulla → excite the vagal parasympathetic center → decreased heart rate.

### **Factors affecting Heart rate:**

1. Age – progressively decreased.
2. Sex- Female heart rate is faster than male.
4. Impulses from the higher centers, emotions & excitement.
5. Respiration

6. Cardiovascular reflexes-

(a) Bainbridge reflex (cardio acceleratory reflex) – increase heart rate.

(b) Baro-receptor reflex- decrease heart rate.

7. Muscular exercise increase heart rate by- decrease  $O_2$ , increase  $CO_2$  &  $H^+$  tension.

8. Temperature- increased body temperature by  $1^\circ F$ , increased heart rate 10 beats.

9. Hormone – some hormones increase heart rate such as Thyroxin, Adrenalin.

**Sinus rhythms:** Normal sinus rhythm is characterized by-

- Regular pulse at a rate of 60-90 b/min
- Normal ECG.

## **Arrhythmia:**

The irregular heart beat is called arrhythmia.

**Normotropic arrhythmias:**-In this type SA node is the pacemaker.

- Sinus Tachycardia.
- Sinus Bradycardia,
- Sinus arrhythmia.

**Ectopic arrhythmias:** In this, structure of the heart other than SA node in the pacemaker .

### **Example –**

- i.** Heart block
- ii.** Extra systole
- iii.** Paroxysmal tachycardia
- iv.** Atrial flutter
- v.** Atrial fibrillation
- vi.** Ventricular fibrillation.

**Sinus Bradycardia:** Decrease heart rate below 60 b/min.

Physiological cause-

- During sleep,
- Athlets.

Pathological cause-

- Sick sinus syndrome,
- Heart block,
- Hypothyroidism,
- Cholestatic jaundice,
- Vagal stimulation,
- Raised intracranial pressure.

Drugs :

- Beta – blocker,
- digoxin,
- anti arrhythmic drugs.

## **Sinus Tachycardia:**

increased heart rate above normal physiological limit usually >100 b/min.

Physiological cause –

- High altitude
- Pregnancy
- Emotion,
- Exercise.

Pathological cause -

- Anxiety
- Fever
- Anaemia
- Heart failure
- Thyrotoxicosis
- Drugs: Bete- agonist