

## Adolescence, Puberty and Hormones

In the previous chapter you have studied how animals reproduce and the various reproductive organs of male and female human beings. The process of fertilisation and development of embryo into a baby has also been discussed earlier. Here we will discuss about the growth process in a newborn baby. You will learn about the changes that occur in the body of male and female individuals which enable them to reproduce.

### INFANCY AND CHILDHOOD

The stage of growth of a baby from birth to about two years of age is called **infancy**. During this period a baby grows very fast, learns to sit, stand and walk; eats solid food; expresses its feelings and recognises people around him or her.

The stage of growth of a child from 2 to 12 years of age is called **childhood**. During this period children grow in size and weight at a regular pace. They grow intellectually, emotionally and socially. They start going to school for studies. They become a little bit independent to perform their daily routine jobs.

### ADOLESCENCE

The period of transition from childhood to adulthood is called **adolescence**. The **World Health Organisation (WHO)** defines adolescence as the period of life between 11 and 19 years of age. Since adolescence period

covers the '**teens period**', adolescents are usually called **teenagers**.

The period of adolescence varies from person to person. In girls it may begin a year or two earlier than in boys. During this period, the body attains reproductive maturity. The human body grows rapidly and many changes in the body take place during adolescence.

### PUBERTY

The age at which the sex hormones and gametes begin to be produced and the boy and the girl become sexually matured, is called **puberty**. Generally boys attain puberty at the age of 14 to 15 years while girls reach puberty at a comparatively lower age of 11 to 12 years.

#### Changes at Puberty

The following changes start taking place in the body of boys and girls at puberty.

##### 1. Increase in Height

There is a sudden increase in the height of both boys and girls during puberty. This occurs due to increase in the length of bones of arms and legs. The rate of growth in height varies from person to person. Some may grow rapidly at the start of puberty and then slow down whereas others may grow gradually.

The average rate of growth in height of boys and girls with age is given in Table 10.1.

**TABLE 10.1**  
**Average Growth in Height of Boys and Girls with Age**

| Age in years | Full height (in %) |       |
|--------------|--------------------|-------|
|              | Boys               | Girls |
| 8            | 72                 | 77    |
| 9            | 75                 | 81    |
| 10           | 78                 | 84    |
| 11           | 81                 | 88    |
| 12           | 84                 | 91    |
| 13           | 88                 | 95    |
| 14           | 92                 | 98    |
| 15           | 95                 | 99    |
| 16           | 98                 | 99.5  |
| 17           | 99                 | 100   |
| 18           | 100                | 100   |

#### ACTIVITY 10.1

What is your current age? Measure your actual height with a measuring tape. Now you have your age and actual height. Use Table 10.1 to find out how tall you are likely to be. Use the following formula to calculate your full height in cm.

$$\text{Full height} = \frac{\text{present height (cm)}}{\% \text{ of full height at this age}} \times 100$$

Is there any difference between your actual height and the full height likely to be?

#### ACTIVITY 10.2

Use the data given in Table 10.1 to draw a graph. Take age on the X-axis and the percentage of growth in height on the Y-axis. Use the data for boys and girls separately to draw two graphs.

The height of an individual depends upon the genes which are inherited from parents.

During growing period one should take nutritive diet for the proper growth of bones, muscles and other parts of the body.

#### 2. Change in Body Shape

The changes occurring in adolescent boys and girls are different. In girls hips become broader and the pelvic region widens. Deposition of fat takes place around the hips.

In boys shoulders broaden and the body muscles grow more than that of the girls.

#### 3. Change in Voice

At puberty the **voice box** or the **larynx** begins to grow. The larynx in boys is larger than that in girls. The voice box in boys can be seen as the **Adam's Apple** (Fig. 10.1) in their throat.

Do you find Adam's Apple in girls? In girls, it is hardly visible because of its small size.



*Fig. 10.1 Adam's apple in the throat of an adolescent*

In boys, the voice becomes **deep and harsh** whereas girls have **high pitched** voice.

#### 4. Increased Activity of Sweat and Sebaceous Glands

The secretion of **sweat glands** and **sebaceous glands (oil glands)** increases during puberty. This causes **acne** and **pimples** on the face of boys and girls at this time.

#### 5. Development of Sex Organs

You have learnt about the reproductive organs of humans in the previous chapter. The reproductive organs in boys and girls become fully functional at puberty.



In boys, the male sex organs like the testes and penis develop completely. The testes start producing sperms.

In girls, the ovary enlarges and eggs begin to mature. Ovaries start releasing matured eggs. Only one egg is released per month.

### 6. Production of Hormones

At puberty, testes and ovaries start producing sex hormones. The testes produce the male sex hormone called **testosterone**. The ovaries produce the female sex hormone called **estrogen**. The sex hormones play an important role in the process of reproduction and in the development of secondary sexual characters.

### 7. Reaching Mental, Intellectual and Emotional Maturity

Adolescence is also a period of change in a person's way of thinking. They become more independent and self-conscious. The intellectual development takes place and they spend considerable time on thinking, planning, analysing, evaluating, exchanging views and ideas with others. They need the company of friends and get attracted towards opposite sex.

During adolescence stage young people undergo a period of emotional changes. They may feel depressed and have mood swings and low confidence. They may experience various moods such as being **happy, sad, angry, excited** or **irritated**. They think they need a greater degree of freedom, independence and privacy. These are the major causes of **mental stress**. They start feeling insecure.

### SECONDARY SEXUAL CHARACTERS

Secondary sexual characters are those by which we can distinguish a male from the

female. Some of the secondary sexual characteristics that develop in girls and boys are as follows.

#### In Males (boys)

1. Facial hairs such as beard and moustaches develop.
2. Hairs develop under the arm pit, under chest and in the pubic regions.
3. Voice becomes deeper (low pitched voice).
4. Muscles develop and shoulder becomes broad.
5. Increase in weight.

#### In Females (girls)

1. Development and enlargement of breast (mammary glands).
2. Hairs develop under arm pit and in the pubic regions.
3. Hips broaden and pelvic region widens.
4. Initiation of menstrual cycle.
5. Deposition of fat around hips.
6. Have high pitched voice (shrill voice).

These changes which occur at adolescence are controlled by hormones.

### THE ENDOCRINE SYSTEM AND HORMONES

Our body has two type of glands—one with ducts and the other without ducts. A gland which secretes its products into the blood stream with the help of ducts is called an **exocrine gland**. A gland which does not have a duct and secretes its products directly into the blood stream is called an **endocrine gland**. Thus endocrine glands are **ductless glands**.

A group of endocrine glands which produces various hormones constitutes the **endocrine system**. There are a large number

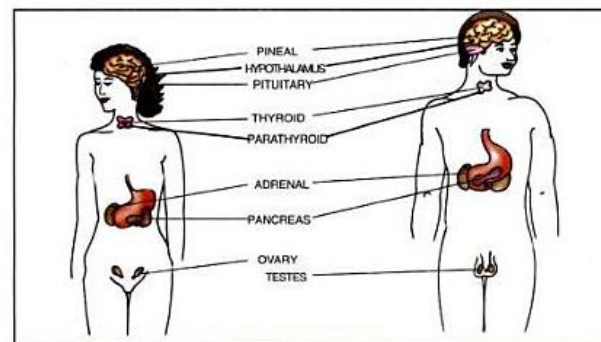


Fig.10.2 Endocrine system

of endocrine glands in the human body. The position of some of the important endocrine glands in male and female is shown in Fig. 10.2.

### Hormones

**Hormones** are chemical substances secreted by ductless glands in the body. These glands release hormones directly into the blood of a person. It is with the circulation of blood that these are carried to target sites. Hormones are required in extremely small quantities. They control growth, development, behaviour and reproduction.

#### Some Important Endocrine Glands

##### 1. Pituitary Gland

The pituitary gland is located just below the brain. It is called the **master gland** because it controls the functioning of all other glands.

It secretes **growth hormone**. Growth hormone controls the development of bones and muscles. A person having less growth hormone remains very short and becomes a dwarf. On the other hand, a person having too much growth hormone becomes very tall (or giant) as shown in Fig. 10.3.



Fig. 10.3 A dwarf and a giant man

##### 2. Thyroid Gland

The thyroid gland is located in the throat region. It makes a hormone called **thyroxine** which contains iodine. The function of thyroxine hormone is to control the rate of metabolism, growth and respiration.

The deficiency of thyroxine hormone in children slows down growth and mental development. This is known as **cretinism**. Its deficiency in adults causes a disease called **goitre** (Fig. 10.4). Too much of thyroxine increases the rate of respiration and makes the person lose weight.





Fig. 10.4 A man with goitre disease

### 3. Pancreas

The pancreas is located just below the stomach in the body. Pancreas is both exocrine as well as endocrine. It secretes **insulin** alongwith some other hormones. The function of insulin hormone is to control sugar metabolism in the body.

Deficiency of insulin in the body causes a disease known as **diabetes**.

### 4. Adrenal Gland

There are two adrenal glands which are located on the top of the two kidneys. The adrenal gland secretes **adrenalin** hormone. This hormone is produced under stress. It regulates heartbeat, breathing rate, blood

pressure, carbohydrate metabolism and mineral balance.

### 5. Ovaries and Testes

Testes produce **testosterone** and ovaries produce **estrogen** hormones.

Some endocrine glands and their functions are summarised in Table 10.2.

### Role of Hormones in Completing the Life History of Insects and Frogs

You have already read the life cycle of a silk moth in class VII. The caterpillar of silk worm has to pass through various stages to become an adult. Similarly, a tadpole also passes through various stages to become a frog.

This process of change from larvae or caterpillar to an adult is called **metamorphosis**. The process of metamorphosis in insects is controlled by **insect hormones**.

In a frog the process of metamorphosis is regulated by thyroxine hormone which is produced by thyroid gland. A tadpole cannot become an adult if there is deficiency of iodine in the water where it is growing.

**TABLE 10.2**  
**Some Endocrine Glands and Their Functions**

| S.No. | Gland     | Hormones secreted | Functions   |
|-------|-----------|-------------------|---|
| 1.    | Pituitary | Growth hormone    | It is the master gland which controls the activities of other glands and helps in growth. |
| 2.    | Thyroid   | Thyroxine         | Causes cretinism in children and goitre in adults.  |
| 3.    | Pancreas  | Insulin           | Regulates sugar metabolism. Deficiency causes diabetes.                                   |
| 4.    | Adrenal   | Adrenalin         | It helps the body to fight stress.  |
| 5.    | Testes    | Testosterone      | Promotes sperm production and development of secondary sex characters.                    |
| 6.    | Ovary     | Estrogen          | Promotes egg formation and development of secondary sex characters.                       |

### ACTIVITY 10.3

You are advised to use iodised salt. Do you know the importance of consuming iodised salt? Collect information from your doctor. You can also look for the information on the Internet. Write a report.

### REPRODUCTIVE PHASE OF LIFE IN HUMANS

In females, the reproductive phase of life begins at puberty and generally continues till they reach the age of approximately 45-50 years. The reproductive age may vary from person to person.

The ovum or egg begins to mature with the onset of puberty. One mature ovum is released by one of the ovaries every month. The released ovum is carried to the fallopian tube and then to the uterus. The process of releasing an egg by an ovary is called **ovulation**.

During this period, the walls of the uterus become thick so as to receive the fertilised egg. The fertilised egg gets implanted in the thick wall of uterus for further development. This results in **pregnancy**.

### Menstrual Cycle

If the ovum does not get fertilised, then the thick and soft inner linings of uterus alongwith the blood and unfertilised ovum are discharged out of the vagina. This flow of blood and other materials is termed as **menstruation**. It continues for 3 to 5 days. Women of reproductive age undergo this periodical release of eggs from the ovary every month. The first menstrual flow begins at puberty and is called **menarche**.

This cycle of menstruation is repeated in a woman after every 28-30 days till an ovum

gets fertilised. Menstruation stops when an ovum gets fertilised and the woman becomes pregnant.

The age at which menstruation stops and a woman loses her ability to bear children is called **menopause**. It occurs in women around the age of 45 to 50 years. The whole menstrual cycle is controlled by estrogen hormones.

### DETERMINATION OF SEX OF THE BABY

The sex of a baby is determined by the nature of gametes that fuse to form the zygote. You have already studied that chromosomes are present inside the nucleus of every cell which carry information in the form of **genes**. These genes determine all inherited characters including the sex of a child.

The nucleus of each human cell contains 23 pairs of chromosomes. The last pair of chromosomes is different in males and females. This last pair is called the **sex chromosomes**. All the remaining 22 pairs of chromosomes are similar in both males and females.

Sex chromosomes are of two types. These are named as X and Y chromosomes. Females have the same kind of sex chromosomes while males have two distinct sex chromosomes. Usually a woman has two X chromosomes (XX) and a man has one X and one Y (XY) chromosome in their cells. Sperms contain only one of these two sex chromosomes (either X or Y) whereas an egg always contains an X chromosome. When a sperm containing X chromosome fertilises the egg, the zygote (fertilised egg) will have two X chromosomes. The zygote will develop into a female child. Similarly when a sperm containing Y chromosome fertilises the egg, the fertilised egg will have one X chromosome

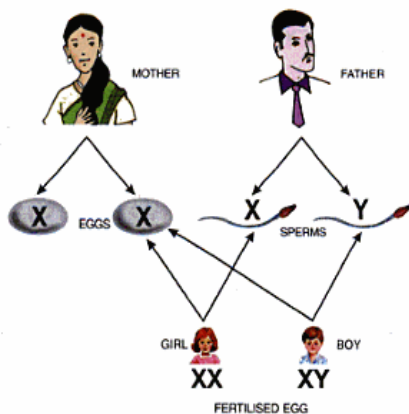


Fig.10.6 Sex determination in humans

and one Y chromosome (XY) and it will develop into a male child.

Traditionally it is believed that a mother is responsible for the sex of a child. But as we can see from the above discussion, it is the sex chromosome in the sperm that determines the sex of a baby. Therefore it is the father who is responsible for a male or female child, not the mother.

### REPRODUCTIVE HEALTH

Health is a state of complete mental, physical and social well being. A person is said to have good health when he is free from any:

1. Disease
2. Social and psychological tension
3. Mental problem
4. Physical handicap

During adolescence, growing children need special attention towards diet, personal hygiene, physical exercise, etc. to stay healthy.

### Nutritional Needs of Adolescents

Each individual should take balanced diet to stay healthy. A typical balanced diet includes carbohydrates, fats, proteins, vitamins, minerals, roughages and water in adequate proportion.

The traditional Indian diet is considered to be a balanced diet because it contains all the nutrients needed by the human body to keep healthy.

We should keep the following points in mind to meet the nutritional needs of adolescents.

1. Include plenty of milk and milk products in the diet.
2. Include fresh fruits in the diet.
3. Include green leafy vegetables.
4. Include eggs, meat and fish to supplement proteins.
5. Avoid consuming junk foods.
6. Avoid eating stale or exposed food.

### Personal Hygiene

Cleanliness must be maintained to prevent any infection during and after menstruation. The following points should be kept in mind by the parents and the family.

1. Keep all the parts of your body clean by taking bath daily.
2. Always wash your hands before and after meals.
3. Keep your nails trim and clean.
4. Wash your teeth and mouth before and after each meal.
5. Change your clothes, especially undergarments, everyday.
6. Use clean toilets for defecation.
7. Do not defecate in open field.

### Physical Exercise

Do physical exercises regularly to keep your body fit and fine. Brisk walking, running, jogging, cycling, swimming, skipping and dancing are good physical exercises. Make it a habit to go for morning and evening walk. For young boys and girls walking and playing outdoor games in fresh air keep them fit and healthy.

### Say 'No' to Drugs and Alcohols

Adolescence is a period of transition between childhood and adulthood. The young adolescents are emotionally vulnerable and often develop a sense of insecurity and confusion. This is the time when they have to keep their balance. In this state of confusion they tend to go to the slippery ground and become the victims of drugs. Soon they get habituated. Once they take it, they will feel like taking it again and again. It ruins their health and happiness for ever.

So, say a big 'No' to drugs, if you come across any temptation in your life.

### AIDS (ACQUIRED IMMUNO DEFICIENCY SYNDROME)

AIDS is a disease which is caused by HIV virus. This virus destroys the natural defence mechanism of the body and makes it susceptible to diseases.

#### Causes of AIDS

1. Sharing the needle of the syringe for injecting drugs.
2. Unprotected sex with an infected person.
3. Transfusing blood into the body of a healthy person from an infected person.
4. Infected mother can pass HIV virus through milk to an infant.

#### How to Prevent AIDS

1. Use disposable syringes.
2. Get blood from registered blood banks for transfusion.
3. Have safe and protected sex.
4. HIV infected mother should not breast feed her baby.
5. Be faithful to your partner.

### EVALUATION

#### OBJECTIVE EVALUATION

A. Write True (T) or False (F) against the following statements in the given brackets.

1. Mother is responsible for the sex of a baby. ( )
2. Estrogen is a female sex hormone. ( )
3. Pituitary gland is also called the master gland. ( )
4. Diabetes is caused due to the deficiency of insulin in the blood. ( )
5. Menstrual cycle starts in a girl at puberty. ( )

B. Fill in the blanks.

1. .... maintains the level of sugar in the blood.
2. .... causes pimples in both boys and girls at puberty.
3. Thyroid gland produces ..... hormone.
4. Testes produce male sex hormone .....
5. .... is also called the emergency hormone.