UNIT 6  PRENATAL DEVELOPMENT AND CARE

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6.1 INTRODUCTION

The growth of the baby within the mother's womb is most fascinating. It is important to understand prenatal development so that the mother can take adequate care during pregnancy and thereby provide a good environment for the baby to develop. The health of the mother, the amount and the quality of food she eats and her emotional states influence the development of the baby within the womb. The uterine environment not only influences development in the prenatal period but is also important for development and adjustment after birth.

With advancements in the field of medicine we have information about intra-uterine growth which was not available earlier. There are detailed illustrations and pictures of foetuses in textbooks of physiology. Nowadays there are methods to scan the unborn baby in the womb using very advanced techniques. The period of prenatal development is no longer completely mysterious, though we do not know the answers to all the questions.

Objectives

After studying this Unit, you should be able to

- enumerate the stages of prenatal development and describe the characteristics of each stage
- explain the type of care the mother needs during pregnancy in terms of health, nutrition and emotional support
- describe how the body systems begin to function before birth.

6.2 CONCEPTION

Conception occurs around the middle of the woman's menstrual cycle, when a sperm from the male parent unites with the ovum, also called the egg, from the female parent to form a single cell. This cell, called zygote, is the first cell of a new person. The life of a human being thus begins at conception. Prenatal development from conception to birth takes about 266 days or 9 months.
You have read in Block 1 that genes contain all the information necessary for development. They are responsible for the transmission of characteristics from the parents to the child. It is during conception that the genetic material is transmitted. The first cell after conception, i.e. the zygote, contains everything necessary for the development of a person. Let us now read about the development of the baby in the womb.

### 6.3 INTRA-UTERINE GROWTH

The period of prenatal development is usually divided into three stages – the period of the ovum, the period of the embryo and the period of the foetus. We will now read about the developments that take place during each of these stages.

#### 6.3.1 Period of the Ovum

This period lasts from conception to two weeks. During this period, the single-celled zygote begins to multiply rapidly and forms several dozen cells. This mass of cells differentiates into an inner and outer layer of cells, separated by a hollow cavity. The group of inner cells will form the baby. The cells of the outer layer will form the placenta, umbilical cord, amniotic sac and other structures. In the earlier Block you read that development proceeds through differentiation. This division of the zygote into an outer and inner layer of cells, which later form different structures, illustrates the process of differentiation.

During this period, small tendrils begin to project from the outer wall of the zygote and burrow into the wall of the uterus. In this manner the zygote attaches itself to the wall of the uterus and begins to get its nourishment from the mother's blood. This process is called implantation. Later these tendrils form the placenta and the umbilical cord. The implantation of the zygote occurs by the end of the second week. This is the end of the period of the ovum.

#### 6.3.2 Period of the Embryo

The term ‘embryo’ is used to refer to the developing baby from the time of implantation until the beginning of bone formation. In other words, this period begins from the third week after conception and ends in the eighth week. During this period cell division continues and the cells differentiate into various types. Development during this short period of five weeks is very rapid. This period is crucial in prenatal development since it is now that all the major organs, tissues and systems of the body are being formed. The most rapid development of a majority of the organs and systems occurs during this period and in the early part of the foetal period, i.e. upto 12 weeks after conception. You have read in Unit 3 that an organ is most vulnerable to harmful influences at the time when it is developing most rapidly. Thus the period of the embryo and the early foetal period are critical in development. If the mother takes drugs, is exposed to radiation, has an accident or has an infection like rubella during these periods, it can cause most harm to the developing baby.

You would also recall reading in Unit 3 that development follows two directions—head-to-toe and centre-to-ends. These are evident in prenatal development also. In keeping with these principles of development, can you state which organs would be the first to develop and which ones would develop later? Write down your answers and check them from the following description.

By three weeks the head and the posterior region, the front and the back of the embryo can be distinguished easily. The brain and the spinal cord also begin to develop and they develop faster compared to other organs during this period. By this time a rudimentary heart also develops and it begins to beat a few days later. This is an important sign of life in the embryo and indicates that basic functions are beginning. By the end of four weeks the sensory organs (eyes, ears, nose) kidneys, liver and the alimentary canal begin to develop. Small projections begin to appear where the arms and the legs will be formed.
Between five and eight weeks the eyes, nose and ears become more distinct and the baby's face begins to have a human appearance. During the fifth week the reproductive system begins to form. By the seventh week the arms and legs, hands and feet, toes and fingers are formed though all of these are still to develop fully. The internal organs like the intestines, liver, pancreas, lungs and kidneys take a definite shape and some organs begin to function: the liver begins to produce red blood cells, the kidneys start to excrete urine and the circulatory system becomes operative. The respiratory and digestive systems are formed though they do not begin to function yet. By this time the embryo has a skeleton made of soft bony tissue called cartilage. Thus by the end of this period, the main parts of the body are developed in some basic form. The embryo by this time is one and a half inches long.

During this period a sac-like structure forms around the embryo and encloses it totally. This is called the amniotic sac and it contains the fluid within which the developing baby floats. The sac with the fluid serves to protect the developing baby from any injury or shock the mother may have. It also helps to maintain a constant temperature for the foetus.

The placenta and the umbilical cord also form in the period of the embryo. The placenta is a disc-like organ formed from the tissues of the mother and the embryo. It is attached to the wall of the uterus. The placenta has a very important function. It is here that the exchange of oxygen and nutrients from the mother's blood to the embryo's blood takes place. Also, the waste products and carbon dioxide from the baby's blood are passed onto the mother's blood. The placenta is connected to the embryo by the umbilical cord. Thus the umbilical cord carries food substances from the mother's blood to the embryo's and removes the waste products from the embryo's blood into the mother's blood. The placenta and the umbilical cord enable the baby to survive in the womb.

6.3.3 Period of the Foetus

This period extends from the beginning of the ninth week until birth. Its beginning is marked by the development of the bone structure. During this period refinement and development of the various body systems takes place. Now the growth of the head region slows down and the rest of the body grows more rapidly. The major development changes in this period have been summarized in the table that follows.

**Table 6 (a): Major Developments during the Period of the Foetus**

<table>
<thead>
<tr>
<th>Age</th>
<th>Major Developments</th>
</tr>
</thead>
<tbody>
<tr>
<td>By the end of 3 months</td>
<td>Muscles develop more extensively; nerve-muscle connections increase; sex of the foetus can be determined; eyelids, lips and nails begin to form; vocal cords are formed; digestive secretions of liver and stomach begin to be produced; spontaneous movements of arms and legs of the foetus occur which the mother may not feel because the foetus is too small; however, the foetus even somersaults in the amniotic sac.</td>
</tr>
<tr>
<td>By the end of 4 months</td>
<td>The mother can now feel the movements of the foetus because it grows in size. This makes the baby real to the mother. Growth of the lower parts of body takes place.</td>
</tr>
<tr>
<td>By the end of 5 months</td>
<td>Skin begins to form; hair appear on the head; eyebrows and eyelashes form; hands become capable of opening and closing and gripping; some photographs show the foetus sucking its thumb; facial muscles become capable of movement; a layer of fat begins to form under the skin.</td>
</tr>
<tr>
<td>By the end of 6 months</td>
<td>Eyes are completely formed though they are closed; taste buds, fingernails and sweat glands are formed; the foetus can inhale and exhale; if prematurely born at this time it can breathe but survival rate is low.</td>
</tr>
<tr>
<td>By the end of 7 months</td>
<td>The eyelids open and blink; all the systems are developed and functioning so that if the child is born prematurely now it can survive. However, each additional week the foetus stays in the womb after this period, increases its chances of survival after birth. The premature baby can see, hear and differentiate tastes just like full-term babies.</td>
</tr>
<tr>
<td>By the end of 9 months</td>
<td>During the eighth and ninth months the body structures further refine; the foetus gains in height and weight.</td>
</tr>
</tbody>
</table>
About two weeks before birth, most babies settle with the head towards the lower end of the uterus. Generally babies are born this way — head first — and this is the easiest and safest way of delivery for the mother as well as for the child.

Sometimes the baby does not position itself head downwards in the uterus. It lies in a crosswise manner or lies with its feet towards the lower end of the uterus. If the baby cannot be turned while in the uterus, it will have to be a breech delivery or it will have to be delivered by caesarean section.

6.4 BIRTH OF THE CHILD

When the baby positions itself head downwards in the mother’s body, the mother feels lightened pressure on the upper abdomen but greater pressure upon the bladder. This lightening which the mother feels because of the shifting of the baby’s weight is the first sign that birth may occur within a few days. The onset of labour pains indicate that the birth of the child is imminent. During labour, the amniotic sac ruptures and the fluid comes out. The uterus contracts rhythmically to push the child outward through the birth canal. The structure of the mother’s body and the formation of the baby’s bones, particularly those of the head, make it possible for the baby to emerge. After the child is born, the umbilical cord and the placenta are expelled from the womb. The umbilical cord is surgically cut and the baby, from being totally dependent on the mother for survival, has to learn to lead an independent existence.

The presence of a trained person during the birth process is important whether the delivery is conducted at home or in the hospital. The health of the mother and the baby depends on how the delivery is conducted. If, for example, the umbilical cord is cut with unclean and unsterilized instruments, the child may get tetanus and die. A child is born with well developed and functioning sensory capacities of vision, hearing, touch and smell. In fact research has now shown that some of these capacities are functioning even before the child is born. The evidence from these studies indicates that the auditory system is well developed some weeks before birth and the unborn baby is responsive to sounds and voices in the environment. It is now also known that sounds can be heard in the uterus. Through the use of sophisticated technology, researchers have recorded the sound of the mother’s heart beat, the rumbling of her intestines, the movement of the lungs, the music from the radio, the conversation between the mother and other people, the sound of a passing train and many other sounds as audible in the mother’s womb. That the foetus reacts to these sounds is indicated by many studies. In one study researchers sounded automobile horns and loud buzzers near the mother’s abdomen. The foetus responded by increasing its physical activity such as kicking and other body movements.

Research on babies one to two hours old shows that the newborns responded more to the recording of their mother’s voice compared to those of other women. This is so because the mother’s voice is one which the unborn baby has heard the most. Newborns are also sensitive to the rhythm of their native language. In a study done on French newborns, the babies moved their bodies more to the sound of French than of Russian. In one particular study, pregnant women listened to a particular tune during the last weeks of their pregnancy. After the babies were born, the recordings of this tune as well as other tunes which the pregnant mothers had not heard were played to the newborns. They clearly preferred the familiar tune, i.e. the one they must have heard in the womb.

The above discussion also shows that, contrary to popular belief, the period of prenatal development is not one of passive existence for the child. The child is active and responds to stimulation. It seems that the environment within the womb prepares the child for what lies ahead. Pictures of foetuses show some of them sucking their thumb in the amniotic sac. Thus the child has practised sucking while in the uterus and a normal newborn is able to suck within moments of birth. The foetus does not need to breathe (since it gets oxygen from the mother’s blood through the placenta), yet the diaphragm practises breathing movements while the
child is in the womb. The unborn child does not need to eat and drink, yet it swallows the amniotic fluid and thus the digestive and excretory systems are put to work and prepare for life outside the womb.

Check Your Progress Exercise

In the following puzzle the blank spaces have to be filled with suitable words which you have read in the text. The thirteen sentences written below provide clues for the words which have to be inserted in the puzzle.

The words in the puzzle can be written either horizontally (which means across), or vertically (which means down). Each sentence has a number written before it. The numbers 1 to 13 are written in the squares of the puzzle also. When writing the word for a particular sentence, begin the first letter of the word in the square where that particular number is written. For example, the answer to sentence No. 2 is “Brain” and will be written as indicated in the puzzle.

Sentences for ‘Across’

1) The cord which carries food substances and waste products to and from the embryo.
3) The process of rhythmic contractions of the uterus which cause the baby-to be pushed out of the mother’s womb.
5) The process of attachment of the zygote to the wall of the uterus which occurs by the end of the second week of conception.
7) The term that refers to the developing baby from the time of implantation until the beginning of bone growth.
9) The first cell of the human being formed after the sperm from the male parent unites with the ovum from the female parent.
11) These are responsible for the transmission of hereditary characteristics from the parents to the child and contain all the information necessary for development.
13) The period of the foetus which begins from the ninth week is marked by the development of the . . . . . . . . . . . . .
The Child : Development in the First Twelve Months

2) develops fastest during the period of embryo as compared to other parts.

4) A disc-like structure through which the exchange of oxygen and nutrients from the mother's blood to the embryo's blood and the waste products from the embryo's blood to the mother's blood takes place.

6) The mother can feel the movements of the foetus by the end of months.

8) If the child is born prematurely at months, it can survive.

10) The sex of the foetus can be determined by the end of the month.

12) The sac which encloses the foetus totally and protects it from shocks experienced by the mother and helps to maintain a constant temperature.

6.5 CARE OF THE MOTHER DURING PREGNANCY

Pregnancy brings about many changes in the woman's body. The increased activity of her systems and the growing baby make many demands on her body. The mother requires special care during this period so that her health as well as the baby's does not suffer. You will read about the kind of care the mother needs in the following paragraphs. The care the mother gets will influence the growth of the foetus in the prenatal period. If we view the aspects of care of the mother in another manner, we can also refer to them as the environmental factors that influence prenatal development.

6.5.1 Nutrition

You have read that the developing foetus gets nutrition from the mother. Besides, the mother's body is also undergoing changes and she needs extra calories, proteins, vitamins and minerals. Because of both these reasons, the expectant mother needs extra food. Some minerals and vitamins are required in greater quantities as compared to others. These are calcium, iron and B-complex vitamins. The quality of the diet is as important as its quantity. To ensure that the mother gets a nutritive diet, care should be taken to include fruits, green vegetables, pulses, milk and its products. Mothers who have an adequate diet have better health during pregnancy and fewer disorders. If the mother is healthy, the chances of her delivering a premature baby are low. Children born of mothers who have a good diet have better health during pregnancy and fewer disorders. If the mother is healthy, the chances of her delivering a premature baby are low. Children born of mothers who have a good diet have better health, a higher resistance to infections and fewer chances of contracting cold, bronchitis, pneumonia and tetanus. Mothers who have a poor diet have infants who have low birth weight and this can have adverse effects on the child's physical and mental development.

You shall read in detail about the diet of the mother during pregnancy and lactation in DECE-2.

6.5.2 Health Care

The health of the mother has a direct impact on the health of the growing child. If some disease causing virus, bacteria or harmful chemicals are present in the mother's blood, they pass on to the baby's blood through the placenta. Let us read about the health care which is needed for the mother with reference to the following points.

Diseases and disorders during pregnancy: The organisms that cause rubella, syphilis, diphtheria, influenza, typhoid, hepatitis, tetanus and chicken pox can pass on to the foetus through the placenta if they are present in the mother's blood. The time during which the mother has the infection is critical in determining the degree of effect on the developing foetus. As you know major malformations in the foetus result if these infections occur in the first few months of pregnancy, particularly in
the first twelve weeks, than in the later months. You have read about the effects of rubella on the foetus. Therefore, before the woman conceives she should have been immunized against rubella. The pregnant mother should be immunized against tetanus also as this is a major cause of mortality among mothers and infants.

Another disorder that can occur during pregnancy is toxæmia. In its mild form it is characterized by high blood pressure, rapid and excessive weight gain and retention of fluid in the tissues. If the condition is controlled at this stage there is no danger to the foetus. If it continues to progress, it can lead to convulsions and even coma, which can cause death of the mother and the foetus. If the baby is born, her development in all areas will be seriously affected.

Smoking and Alcohol Consumption: Heavy drinking and excessive smoking during pregnancy can lead to low birth weight of the infant. The infant is also likely to be less active in the first few months. Additionally, alcohol also causes deformities of the foetus' eyes, ears and heart, development of extra fingers and toes and abnormally small head. Illnesses are more common among infants of mothers who smoke and consume alcohol.

Drugs: A mother who takes strong drugs and narcotics is most likely to have an infant who is irritable, has tremors and convulsions, vomiting, diarrhoea and difficulty in breathing. These symptoms may last as long as six months. Besides these drugs, many medicines can also have a harmful effect on the foetus. Some drugs taken by the mother may affect the child later during infancy. For example, the intake of tetracycllin by the pregnant woman can cause stained teeth in the infant. The effects of many drugs, even the most commonly used such as aspirin, are not yet known. A woman who is pregnant should not take drugs/medicines unless absolutely necessary and then too on the advice of a doctor.

You shall read more about the health care during pregnancy in DECE-2.

6.5.3 Emotional States

The mother's emotions can influence the development of the foetus. This is because emotions such as rage, fear and anxiety lead to release of hormones and other chemical substances in the mother's bloodstream. These substances are transmitted through the placenta to the foetus' bloodstream and may be irritating to it. Whenever the mother is undergoing emotional stress, the bodily movements of the foetus increase. If the mother is upset and unhappy for prolonged periods, the baby is likely to have low birth weight. The infant also tends to be irritable, feeds irregularly, has excessive bowel movements, cries excessively and shows an unusual need to be held. Emotional tension can result in difficult labour and delivery. Therefore, it is important that the mother remains happy and relaxed during pregnancy and has an accepting attitude towards the child to be born.

Check Your Progress Exercise 2

Answer the following questions briefly in the space provided below:

1) What are the effects of inadequate diet during pregnancy on the health of the mother and the baby?

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2) In what way does excessive smoking and consumption of alcohol by the pregnant woman harm the baby?

3) List the three environmental factors that affect prenatal development.

4) Why is it important for the mother to remain happy and relaxed during pregnancy?

6.6 SUMMARY

In this Unit you have read about the development of the baby within the mother’s womb. Conception occurs when the sperm unites with the egg to form a single cell called the zygote. This is the first cell of a human being. Development from conception till birth takes around nine months. The period of prenatal development is usually divided into three stages—the period of the ovum which lasts from conception to two weeks, the period of the embryo which lasts from the third week after conception to the eighth week and the period of the foetus which begins from the ninth week and lasts till birth. The period of the embryo and the early foetal period, i.e. the period up to 12 weeks after conception, is a critical period since this is the time when the major organs and systems of the body are being formed and are developing at a fast rate. At this time the embryo is vulnerable to harmful influences. If the mother has an illness, takes drugs, ingests some harmful chemicals or has an accident, it may cause irreversible damage to the developing baby.

The foetus derives its food supply and oxygen from the mother’s blood via the placenta and the umbilical cord. The umbilical cord also carries the waste products and carbon dioxide from the foetus’ blood to the placenta from where it diffuses to the mother’s bloodstream. The seventh month of gestation is an important period in prenatal development. By this time all the systems of the body have developed and are functioning so that if the child is born prematurely, she can survive.

It is important to have a trained person during birth whether the delivery is conducted at home or in the hospital, so that the health of the mother and the baby is ensured. The child is born with well developed capacities of hearing, smell, vision and touch. Research has shown that the capacities of hearing and vision are developed even before birth. The excretory, digestive and circulatory systems are also working during the prenatal period.
You have also read that it is important that the mother take care of herself during pregnancy. She must maintain good health, eat enough food to take care of her increasing nutritional needs and remain relaxed and happy. Anger, tear and tension lead to release of hormones and other chemical substances in her body. These may harm the foetus. All these factors of care of the mother are important because they can affect the development of the foetus.

6.7 GLOSSARY

Gestation Period: The duration/period of pregnancy.

Intra-uterine: Within or inside the uterus. In this case, we mean the development of the baby inside the womb.

Vulnerable: Sensitive, open to harmful influences.

6.8 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

ACROSS

1) Umbilical
3) Labour
5) Implantation
7) Embryo
9) Zygote
11) Genes
13) Bone

DOWN

2) Brain
4) Placenta
6) Four
8) Seven
10) Third
12) Amniotic

Check Your Progress Exercise 2

1) Inadequate diet can adversely affect the mother's health leading to disorders and diseases. It can also cause low birth weight of the infant, which leads to lower resistance to infections and the baby has more chances of contacting colds, bronchitis, tetanus and pneumonia. If the diet was very deficient it can also have adverse effect on the child's physical and mental development.

2) Infants born to mothers who smoke and consume alcohol excessively have low birth weight and are less active in the first few months. Alcohol also causes deformities of the eyes, ears, heart and abnormally small head of the infant.

3) The three environmental factors that affect prenatal development are: the health of the mother, her nutritional and her emotional states.

4) It is important for the mother to be relaxed and happy during pregnancy because emotional stress can lead to release of hormones and chemical substances in the mother's blood which get transmitted to the foetus' bloodstream. These are irritating to it.