

TET 103: CHILD DEVELOPMENT (0–3 YEARS)

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Introduction

- Even though there are some birth abnormalities or defects caused by some inherited traits, majority are caused by environmental influences/factors during the pre-natal period or during childbirth or by an interaction of heredity and environmental influences.
- The study of developmental abnormalities caused by the environmental influence is called teratology
- Teratogen therefore refers to specific agents that cause damage, serious abnormalities or even death during the pre-natal period.

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Lecture 7: PRENATAL ENVIRONMENT INFLUENCES & MATERNAL FACTORS

Objectives

- At the end of this lecture the learner should be able to:
 - a) Explain prenatal environmental influences that cause child abnormalities
 - b) Define Teratogen
 - c) Highlight that determine the effect of teratogen
 - d) Describe the effect of teratogens
 - e) Explain maternal factors that influence fetal and child development

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Introduction

- Teratogens are substances that may produce physical or functional defects in the human embryo or fetus after the pregnant woman is exposed to the substance.

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Lecture 7: PRENATAL ENVIRONMENT INFLUENCES

Objectives

- At the end of this lecture the learner should be able to:
 - a) Explain prenatal environmental influences that cause child abnormalities
 - b) Define Teratogen
 - c) Highlight that determine the effect of teratogen
 - d) Describe the effect of various types of teratogens

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Introduction

- The effect or influence or harm of teratogens depends on factors such as:
 - a) Amount and length/duration of exposure - doses taken over longer time usually have more negative effects
 - b) The developmental stage of the fetus
 - c) Presence of other several harmful influences and the health of the mother
 - d) Genetic factors of the mother and the baby
 - e) Delayed and indirect effects.

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Factors that determine effect of teratogen

a) Amount and length of duration

- The greater the amount and length of exposure, the more damage done to the embryo or fetus. Small amounts of exposure to a toxic agent of this kind may have no effect
- However, a small amount of cocaine, for example, can move through the mother's tissues quickly, with no permanent damage to her but can be caught in the immature fetal tissue causing growth retardation or permanent nervous damage. However, a healthy mother can also clear most of the toxic substances from her body quickly

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Factors that determine effect of teratogen

d) Genetic factors of the mother and baby

- The heredity of the mother and baby determine their resistance to harmful agents
- For example cases have been reported in which fraternal twins have been born to drug-abuse mothers where one is affected and the other is not

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Factors that determine effect of teratogen

b) Developmental stage of fetus

- The effects of environmental influences depend on the relative age or development of the fetus or embryo .
- Extensive damage to body structures is most likely during the embryonic period - before the woman is even aware that she is pregnant; although some organs can still be strongly affected during the fetal period.
- The same teratogen can have quite different effects or no impact at all, depending on when it reaches the embryo/fetus.

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Factors that determine effect of teratogen

e) Delayed and indirect effects

- Teratogens can have psychological consequences that are delayed or indirect
- Physical defects caused by teratogens prenatally can restrict the child's positive interactions with others and exploration of the environment
- These experiences in turn can hinder many aspects of development, such as cognitive, emotional and social development

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Factors that determine effect of teratogen

c) Presence of other several harmful influence or agents

- Pregnant women exposed to one harmful agent are often affected by others
- For example, illegal drug users tend to have poor nutrition and more infections
- The presence of these factors can worsen the impact of the drug on the embryo or fetus

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TYPES OF TEROTOGENS

1) Legal drugs and chemicals agents

- These include prescribed and non prescribed drugs
- A drug that may be safe to an adult pregnant woman may not necessarily be safe for the tiny developing organism that depends and shares the environment provided by the mother
- Examples of legal drugs that have been linked to most abnormalities in children include:

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TYPES OF TEROTOGENS

a) Thalidomide

- Used between 1956 - 1961 in Europe, Canada and South America as a sedative drug used to control nausea, insomnia and other symptoms of morning sickness
- The women who took the drug were unharmed by it and many of the children born did not suffer any defect
- However, some children had serious deformities such as:

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TYPES OF TEROTOGENS

c) Antibiotics

- These include: streptomycin, tetracycline, anticoagulants, anticonvulsants,
- d) Most artificial hormones and valium (banquilizer)**

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TYPES OF TEROTOGENS

- Born without ears, arms and legs
- Defects in the intestines or gall bladder
- Their hands and feet were attached directly to their torsos like flippers
- Some had defects of sight and hearing
- Low or impaired their intellectual Development.
- Drug was withdrawn from the market after many thousands of children were born with defects that could be trace back to the drug

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TYPES OF TEROTOGENS

2) Illegal drugs

- Use of highly addictive and mood altering drugs such as cocaine and heroine is becoming more widespread
- Babies born to mothers who took these drugs are at high risk of a wide variety of problems such as:-
 - Premature death
 - Low birth weight
 - Physical defects such as genital, urinary track, breathing problems
 - Death around the time of birth.

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TYPES OF TEROTOGENS

b) Aspirin

- Repeated use of aspirin is linked to:
 - Low birth weight
 - Infant death around the time of birth
 - Poor motor development
 - Lower intelligence test scores in early childhood.

c) Caffeine contained in coffee

- Heavy caffeine intake is associated with premature births, miscarriage and newborn withdrawal syndrome, such as irritability and vomiting.

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TYPES OF TEROTOGENS

- Withdrawal symptoms such as extreme irritability-shrill crying, vomiting, shaking and poor temperature control, disturbed sleep and have difficulty sucking
- Such children, up to 12 months have difficulty maintaining attention which may persist to childhood extent of the mother's addiction, the amount doses and how close the last dose was to the time of delivery.

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TYPES OF TEROTOGENS

3. Smoking

- The most well known effects of smoking during pregnancy is low birth weight, miscarriages and infant deaths
- The more cigarettes a mother smokes, the greater the chances that her baby will be affected.
- Even when a baby of a smoking mother appears to be born in good physical condition, the child is affected by some slight behavioral abnormalities. Newborns of smoking mothers are less responsive to their surroundings than other infants.

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TYPES OF TEROTOGENS

4. Alcohol

- Infants born to mothers who drink heavily during pregnancy have a very high chance of suffering from **Fetal Alcohol Syndrome (FAS)**
- These are a set of symptoms that include abnormal physical features such as: slow physical growth, a particular pattern of facial abnormalities such as wide spaced eyes, short eye-lid openings, a small upturned nose, and a thin upper lip. The head is also small restricting the brain from reaching full development.

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TYPES OF TEROTOGENS

- For example they have been observed to turn to the direction of sound (such as jingles of a bell) more slowly and they stop responding to it more quickly than children of non-smoking mothers.

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TYPES OF TEROTOGENS

- Other defects of the eyes, ears, throat, heart, genitals, urinary track or immune systems may be present
- Mental retardation, poor attention and over-activity are typical behavioral characteristics of children with this (FAS) disorder
- Sometimes children do not display all the above abnormalities of FAS, but only some of them. In such cases the child is said to suffer from **Fetal Alcohol Effect (FAE)**
- The mothers of such children took smaller amounts of alcohol

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TYPES OF TEROTOGENS

How does cigarettes harm the fetus?

- Nicotine causes the placenta to grow abnormally resulting to reduced transfer of nutrients, thus the fetus cannot gain weight.
- Smoking also raises the concentration of carbon monoxide in the bloodstream of both the mother and fetus. Carbon monoxide replaces oxygen from the red blood cells, thus leading to damages of the central nervous systems and reduces birth weight
- Smoking fathers are also likely to cause such effects to their unborn babies if they smoke in environment where their expectant wives are - passive smoking.

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TYPES OF TEROTOGENS

How does alcohol affect the growing fetus

- Alcohol interferes with cell duplication and migration in the neural tube - thus reduced number of cells will cause major structural abnormalities.
- Large quantities of oxygen are required to metabolize alcohol in the human body - thus drinking mothers draw oxygen away from the embryo or fetus that is vital for cell growth in the brain and other parts of the body – brain damages – cognitive abnormal
- **NB:** Given the potential risks of alcohol drinking, it is best therefore for pregnant mothers to avoid drinking.

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TYPES OF TEROTOGENS

5. Hormones

- Some hormones taken by the mother could damage the embryo or fetus
- For example, continued use of birth control pills during the early weeks after conception - before a woman knows she is pregnant - may cause malfunction of the sexual organs.
- Mothers who took the hormones **diethylstilbestrol (DES)**, to prevent miscarriages in women who had a history of pregnancy problems, have had daughters with high incidence of vaginal cancer or cervical abnormalities. Sons were either sterile or prone to develop testicular cancer.

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TYPES OF TEROTOGENS

- ii. Lead poisoning of mothers and infants. Exposure to moderate levels of lead, either prenatally or after birth impairs the cognitive development of infants. Affected children have slower reaction time, difficulty maintaining attention, are more distractible, disorganized and restless.
- iii. Several other chemicals found in the environment are also suspected to have negative effects. One such is polychlorinated biphenyls (PCBS) a common set of compounds found in electrical transformers and plants. Infants exposed to these toxic substances showed weak reflexes and motor immaturity and premature births and underweight.

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TYPES OF TEROTOGENS

- In some cases the Y chromosomes which causes male sex hormone called androgen to be secreted prenatally fails to take place. In the absence of this male hormone, female structures develop or development of a body type opposite to the baby's genetic sex.

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TYPES OF TEROTOGENS

- iv. Research however still continues on a wide range of other potential environmental toxins, including food preservatives, insecticide, some cosmetics and hair treatments.
- v. Radiation - Radio active emissions from electrical plants and equipment such as X-ray machines are also harmful to both the mother and the baby

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TYPES OF TEROTOGENS

6. Pollution and other chemical agents

- There are several other chemical substances in the mother's environment which she has no control over but are harmful to the fetus
- There are:-
 - i. **Mercury:** Women living around a plant discharging mercury by into water bodies are likely to give birth to children with profound retardation and neurological impairment.

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MATERNAL FACTORS

- Teratogens can come from the external environment or from the mother's own metabolism or biochemistry
- The external environmental factors can be avoided by the mother in order to ensure the healthy development of a fetus
- The following are some of the maternal factors which affect the fetus:

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MATERNAL FACTORS

1) Diseases

- Most diseases which an expectant mother suffers do not appear to affect the embryo or fetus at all
- For example most types of bacteria do not cross the placental barrier
- On the other hand many viruses especially rubella, syphilis, herpes, poliomyelitis and many varieties of viral colds, do cross the placental barrier and thus affect the growing fetus.
- The baby may also become infected as it passes through the birth canal.

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MATERNAL FACTORS

- Some common diseases are:
 - i. RUBELLA (German measles)**
- The symptoms of this disease are a mild rash, swollen lymph gland and lower fever. This disease may cause blindness, heart defects, deafness, brain damage and limb deformity in the embryo or fetus, depending on the specific time the mother contracts the disease.
- The greatest damage occurs during the embryonic period/ over 50% of infants born to mothers who suffer from the disease in the first three months of pregnancy suffer from congenital heart disease,

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MATERNAL FACTORS

How do diseases affect the fetus/baby

- Generally diseases may produce infections that enter the fetus by one of the following two routes.
 - i. The trans placental route – this is the one taken by infectious such as acquired immune, deficiency syndrome (AIDS) and rubella.
 - ii. The Ascending Cervical – Amniotic Route. This is the one taken by venereal diseases such as syphilis and gonorrhoea. This infects first the amniotic fluid and then the fetus.

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MATERNAL FACTORS

eye cataracts, deafness, genital, urinary and intestinal abnormalities, and mental retardation. Infections during the fetal period are less harmful but they may cause low birth weight, hearing loss and bone defects.

- A rubella epidemic in the United States during the winter of 1964 – 1965 resulted in 30,600 still births and 20,000 infants who suffered congenital defects.
- The development of a rubella vaccine in 1969 has greatly reduced the incidence of the disease, but it has not yet been completely eradicated.

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MATERNAL FACTORS

- Maternal infections may affect the fetus in a variety of ways. They may infect the fetus and cause a miscarriage, still birth or severe deformity.
- They may also not produce any effect at all especially in the women who have antibodies for the disease to the disease they are exposed. However once the infection reaches the fetus it may produce extremely severe effects, since the fetus lacks an immune system to battle infections.

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MATERNAL FACTORS

- ii. Acquired Immune Deficiency Syndrome (AIDS)**
- This syndrome is transmitted by the HIV virus to newborns from the mother to her baby either by passing through the placental barrier or through exposure of the baby to the mother's infected bloody during delivery.
- The disease causes low immunity to the baby leading to various infections since there is no cure to the disease it may lead to death.

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MATERNAL FACTORS

- Pregnant women diagnosed as HIV positive often need multiple services for their own physical and mental health and counselling in anticipation of a variety ill-health conditions in their baby and possible death
- Mother to child transmission is preventable if medical attention is sought early after conception

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MATERNAL FACTORS

3. RH-Factor or RH Incompatibility

- Rh – Rhesus is a complex substances on the surface of red blood cells which is the blood protein
- The presence of this protein in a person's blood makes a person to be refereed as a RH positive and lack of it as Rh negative
- The Rh positive blood is determined by a dominant gene and the Rh negative blood is determined by a recessive gene
- When a Rh negative woman conceives a child with an Rh positive man the child is likely to be Rh positive.

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MATERNAL FACTORS

2. Radiation

- Ionizing radiation can cause mutation, damaging the DNA in the ovary and sperm
- When expectant mothers are exposed to radiation additional harm can be caused to the embryo and fetus.
- Defects due to radiation were tragically apparent in the children born to pregnant Japanese women who survived the bombing of Hiroshima and Nagasaki during the 2nd World War. Miscarriages slow physical growth, underdeveloped brain, malformation of the skeleton and problems of eyes were common to children born to such mothers.

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MATERNAL FACTORS

- In most pregnancies, same maternal and fetal blood cells manage to cross the placenta during the third trimester or at the time of birth when the placenta is separating from the uterine wall
- When a little of the fetus Rh positive blood passes into the mother's Rh negative blood stream, she begins to form antibodies to the foreign Rh protein.
- If these antibodies leak back into the baby's blood system, they destroy the red blood cells of the baby, reducing the oxygen supply to the fetus

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MATERNAL FACTORS

- It takes large quantities of radiation over an extended period of time to damage the ovum and sperm before conception
- However, once pregnancy takes place and prenatal development is underway, often low levels of radiation from medical x-rays or leakage in the work place may not be safe
- Thus women who are pregnant should avoid taking an x-ray or working in an environment in which they may be exposed to x-rays.

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MATERNAL FACTORS

- This can cause miscarriage, mental retardation, damage to the heart muscles and death around the timed of birth can occur to the baby. No danger, exists for the mother, but only to the unborn child.
- Since the antibodies build up does not usually happen enough to affect the first child, the first born children are rarely affected. The danger however increases with each additional pregnancy.
- Today with modern obstetrical care an Rh-negative mother can be treated after her first and subsequent Rh-positive pregnancies to prevent Rh incompatibility problems.

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MATERNAL FACTORS

- This is done by giving a routine vaccine called RhoGam after the birth of each Rh positive baby to prevent the build – up of antibodies in the mother's blood system.
- If the mother's production of antibodies cannot be controlled, blood transfusion can be performed immediately after birth to the baby, if the baby is in danger or if necessary, even before the baby is born.

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MATERNAL FACTORS

5. Emotional state of the mother

- When women experience severe emotional stress during pregnancy, their babies are at risk of a wide variety of difficulties
- Intense anxiety, which may be caused by stress, is associated with a higher rate of miscarriage, premature, low-birth weight and newborn, respiratory illness. It is also related to certain physical defects such as cleft palate, and pylorus stenosis (which is tightening of the infants stomach outlet, which must be treated surgically).

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MATERNAL FACTORS

4. Maternal age

- The age of the mother can affect the prenatal development of the child
- The incidence of prenatal defects or abnormalities are higher for first time mothers over 35 years of age and for teenage mother than for mother between these ages.
- Woman who delay having children until they are over 35 years face a greater risk of infertility, miscarriages and giving birth to babies with chromosomal defects.

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MATERNAL FACTORS

How does maternal stress affect the developing organism?

- When we experience fear and anxiety, stimulant hormones are released in to our blood stream. These cause us to be poised for action. Large amount of blood are sent to these parts of the body involved in the defensive response, which are the brain, heart and muscles of the arm, legs and trunk. Blood flow to other organs, including the uterus is reduced, thus the fetus is deprived of full supply of blood and thus oxygen and nutrients.

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MATERNAL FACTORS

- Although the precise reason for this is not clear, the hormonal Balance and tissue development in the mother may play a role.
- Remember Down Syndrome occurs most often in children born to such mothers of over 35 years of age. The risk of Downs – syndrome is almost 10 times greater at the age of 40 years than at the age of 30 years.

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MATERNAL FACTORS

- Stress hormones also cross the placenta leading to the fetus heart rate and activity level to rise dramatically. Long-term exposure to these hormones might be responsible for the irritability and digestive disturbance observed in infant of highly stressed mothers, after birth
- Finally, women who experience long-term stress and anxiety are more likely to smoke, drink, eat poorly and engage in other behaviours that might harm the embryo and fetus. These factors contribute to the negative outcomes observed in their babies.

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MATERNAL FACTORS

NB: The risks of stress are reduced when expectant mothers have husbands, other family members and friends to whom they can turn to for emotional support and avoid stress.

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MATERNAL FACTORS

- Prenatally malnourished babies enter the world with serious behavioural problems. They are apathetic and unresponsive to stimulation around them. Like drug-addicted newborns, they have a high – pitched cry that is distressing to their care-givers, thus the mother-infant relationship is likely to get off at a very poor start.
- Since malnutrition is highest in poorly-stricken areas, the effects of poor nutrition quickly combine with a stressful home-life. With age, low intelligence test scores, and serious learning problems become increasingly apparent in such areas.

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MATERNAL FACTORS

6. Nutritional deficiency

- Children grow more rapidly during the prenatal period than any other phase of development.
- During this time, they depend totally on the mother for nutrients to support their growth.
- The impact of nutrition also operates with the critical period concept just as it does with other teratogens.
- A woman affected by famine during the first trimester is more likely to have a miscarriage or to give birth to babies with physical defects.

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MATERNAL FACTORS

Questions

1. As an early years education teacher explain how you would identify children born of mothers preexposed to the following teratogens; (12 marks)
 - a) thalidomide
 - b) aspirin
 - c) caffeine
 - d) alcohol
 - e) smoking
 - f) family planning drugs

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MATERNAL FACTORS

- When famine strikes later in pregnancy, the fetuses usually survive but are born under-weight and with small heads suggesting underdeveloped brain.
- Prenatal malnutrition can cause serious damage to the central nervous system
- The poorer the mother's diet, the greater the loss of brain weight, especially if malnutrition occurs during the third trimester.
- During this time the brain is growing rapidly in size and maternal diet high in all basic nutrients is necessary for it to reach its full potential.

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