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TEXTBOOK FOR UNDERGRADUATED DEGREE

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CONTENTS

FERTILIZATION, NESTING AND DEVELOPMENT OF THE OVUM

OBJECTIVES

1. Describe the process of spermatogenesis
2. Describe the process of oocyte production
3. Describe the process of fertilization
4. Describe the phenomenon of movement and nesting of fertilized ovum

CONTENTS

Fertilization is the union of a male cell (sperm) and a female cell (ovum) to form a new zygote, also known as a fertilized ovum. Conception is fertilization followed by implantation of an ovum. After implantation, the ovum develops into the fetus and its appendages (placenta, membranes, umbilical cord, and amniotic fluid).

1. Fertilization

1.1. The development of gametes

Gametes are sex cells, highly differentiated, with the sole function of reproduction and are unlike any other cell.

Sex cells are quite large (25-30 μm), pale cytoplasm, rich in lipids, nucleated and an Idiosome (consists of 2 centrosomes and the Golgi apparatus). The male gamete is a sperm with a haploid set of chromosomes. The female gamete is an ovum that also carries a haploid set of chromosomes.

1.1.1. Spermatogenesis

Sperm are produced in the seminiferous tubules. Spermatogenesis goes through several stages for a spermatozoon to turn into a sperm capable of fertilization. Out of the seminiferous tubules, sperm have a fixed shape but have not moved, have not been fertilized, they only have the above ability after passing through the epididymis. Sperm are stored in the epididymis, seminal vesicles, and mostly in the seminal vesicles. Through 5 divisions, one cell produces 32 sperm, a process that takes 74 days. Spermatogenesis is continuous starting from puberty (about 200 million per day)

Sperm structure:

Sperm is a highly differentiated cell consisting of a head, body and tail. The head is a round nucleus (chromatin). The head is protected the front 3/4 by a special structure called the cephalopod. The cephalopod contains a variety of enzymes that affect ovulatory proteins such as Hyaluronidase, Fertilysine. The tail connects to the head through the cervical segment. The tail consists of the intermediate, main and final segments. The shaft of the tail has a special structure consisting of many pairs of peripheral tubes and a pair of central tubes, which is the apparatus that creates the movement of the tail. Sperm are pushed forward by waves generated by the tail.

Sperm characteristics:

- Length 65μm.
- Amount 60-120 million/ml of semen
- Activity rate at first ejaculation >80%.
- Movement speed 1.5 - 2.5mm/min.

- The average life time in the female genital tract depends on the pH of the vagina. If vaginal pH, sperm live < 2 hours; in cervical canal with alkaline pH (pH > 7,), sperm can live for 2-3 days; in the fallopian tube, sperm live for 2-3 days.

1.1.2. Oocyte production

The oocyte is formed from the follicles.

Most oocytes in girls are formed during the fetal period. A large number of primary follicles degenerate during the phase from birth to puberty. Therefore, at puberty each ovary has about 60,000-80,000 primary follicles, which are formed by the mitotic division of the germ cells. The surface of the oocyte has many microcapillaries that penetrate the transparent membrane, and the cytoplasm accumulates many mucopolysaccharides, alkaline phosphates and RNA. Most RNA is concentrated in specific regions.

Each month, one follicle in one ovary takes turns going through selection, maturation, and ovulation from puberty to menopause. Ovulation usually occurs between days 12 and 14 of the menstrual cycle and divides the cycle into 2 phases: the follicular phase (before ovulation) and the luteal phase (after ovulation).

If fertilization does not occur, the degeneration of the follicle and the corpus luteum leads to menstruation. Between the end of the last menstrual period and the beginning of the follicular phase, several dozen follicles enter the growth phase by increasing the volume of the follicular fluid and the follicular cavity gradually enlarges. On the 6th day only a single follicle is selected to reach maturity called an overgrowth. When a dominant follicle is present, the remaining follicles that develop to the mature stage are regressed. About 36 hours before ovulation there is a maximum increase in the level of the hormone LH (Luteinizing Hormone) which promotes rapid ovum maturation. The ovum is shed with a transparent membrane, oocyte, ray cells, and granulosa cells, all entering the tubal cavity..

1.2. Fertilization

Fertilization is the union of a male gamete, a sperm, and a female gamete, an ovum, to form a new zygote called a fertilized ovum. Fertilization occurs in the outer third of the fallopian tube.

There are about 200 million sperm present in each ejaculation into the vagina. The cervix was previously sealed by a thick mucus plug, under the influence of estradiol secreted by the follicle. As the follicle develops, the cervical mucus plug will become thinner, in the pre-ovulatory phase this mucus plug allows the fastest and strongest motile sperm to pass through, the rest is located in the cervical region and sacral sac. In general, several million sperm reach the ovum in the appropriate time because sperm can live up to 1 week after ejaculation, while ovum only 2 days after ovulation occurs. In general, several million sperm reach the ovum in the appropriate time because sperm can live up to 1 week after ejaculation, while ovum only 2 days after ovulation occurs. When the sperm crosses the transparent membrane of the ovum, a fusion of the oocyte and spermatozoa occurs, the sperm nucleus is completely inserted into the oocyte cytoplasm, the tail leaving the head is retained outside the transparent membrane, a cortical reaction prevents any other sperm from entering the ovum. At that time, there appears in the ovum a male pronucleus and a female pronucleus. These two pronucleus continued to develop separately, then came close

to each other and merged into one after the complete removal of the nuclear envelope. From there, a zygote is formed and cleavage begins.

The result of fertilization:

- Reconstruction of the chromosome of the species (2n).
- Determining the sex of the blastocyst: if the sperm has a Y chromosome, the blastocyst is male; if the sperm has an X chromosome, the blastocyst is female.
- Preparing for zygote cleavage.

2. Movement and nesting of fertilized ovum

2.1. The movement of the ovum

After fertilization occurs in the outer third of the fallopian tube, the fertilized ovum continues to travel in the fallopian tube to implant in the uterus.

The fertilized ovum moves through the rest of the fallopian tube for 3-4 days; after that, it is still free to live in the uterus for another 2-3 days before the implantation process begins.

There are 3 mechanisms involved in the movement of the fertilized ovum:

- Peristalsis of the fallopian tubes.
- The activity of the villi lining the fallopian tubes.
- The flow of fluid flows from the speaker of the fallopian tube to the uterine cavity.

On the way, the fertilized ovum divides very quickly, from a single cell, it divides into 2 and then 4 equal germ cells, then divides into 8 cells: 4 large germ cells and 4 small germ cells. The small germ cells grow faster than the large germ cells and surround the large germ cells, forming the morula embryo, which has a strawberry-like appearance. The small germ cells that form the trophoblast have the effect of nourishing the fetus; the large germ cells located in the middle will become the fetal leaves, which will develop into the fetus. At the morula stage, the larger central cell group will produce chrysalis, the smaller peripheral cell group at the 32-cell stage will secrete fluid, forming a sinus that pushes the chrysalis to an angle.

2.2. Factors affecting fallopian tube movement

- Estrogen increases the peristalsis of the fallopian tubes, thereby helping the movement of the fertilized ovum faster. In contrast, progesterone reduces muscle tone, reduces peristalsis of the fallopian tubes, so the fertilized ovum will move slowly.
- Fallopian tubes are too long or broken due to adhesion or pressure from the outside, or chronic inflammation of the fallopian tubes, making the lumen of the fallopian tubes irregular, the narrowing leads to the movement of the fertilized ovum being hindered and unable to enter the uterus, causing ectopic pregnancy.

2.3. Nesting of a fertilized ovum

At the morula stage, when it has entered the uterus (about the 5th - 6th day after fertilization), a small cavity in the lumen of the morula will develop, small cells expand around the cavity, creating into blastocyst (hình 4). The blastocyst will implant in the endometrium (about the 6th day after fertilization). At this point the transparent film has disappeared. Normal development requires the presence of two sets of chromosomes from the father and the mother, whose roles are not the same. The paternal set of chromosomes will be needed for the development of the appendages and the maternal set of chromosomes will be needed for the development of the embryo. The blastocyst forms on

day 5, most of the peripheral cells form the trophoblast. Chrysanthemum embryos contain two types of cells, one in small numbers will be the source of the embryo, the other will produce extraembryonic appendages needed to maintain the embryo. The blastocyst begins to implant on the 6th or 7th day and implants on the basal surface of the chrysalis by the lytic action of the trophoblast by erosion and gradual penetration into the endometrium. At this stage, chrysanthemum embryos begin to separate from the trophoblast.

The implantation site is usually on the back of the fundus, but can also be "out of place". The process goes as follows

- Days 6-8: adhesion and rooting of the embryo: blastocyst adheres to the uterine lining, pseudopods derived from trophocytes adhere to the epithelium, some intercellular cells are destroyed and blastocysts pass through the epithelium
- Days 9-10: embryos pass through the columnar epithelium, not yet deep in the stroma and the surface is not covered by the epithelium.
- Day 11-12: embryo is completely in the buffer layer but the hole through is not covered yet
- Days 13-14: embryo lies completely in the stroma, covered by epithelium. The mesenteric mesoderm differentiates into two cell types and forms the first chorionic ridges. Before implantation, the endometrium is under the influence of progesterone and endothelial stimulating factors (Vascular Endothelial Growth Factor- VEGF) develop to be eligible to receive the zygote. During the development of the vascular endothelium, the lining is congested, edematous, the gland grows long and curvy, and accumulates a lot of glycogen and mucus in the gland and in the cells

2.4. Abnormalities in the nesting process

Normally, the embryo implants on the front and back of the uterus. Abnormal locations can be encountered: fallopian tubes, ovaries, cervix, intra-abdominal or clinging to old cesarean section scars that are "ectopic" pregnancy, also known as ectopic pregnancy.

Development of a fertilized ovum: divided into 2 periods.

- Organizational arrangement period starts from fertilization until the end of the 2nd month (first 8 weeks)

- Organizational completion period: From the 3rd month to full-term.

Organizational arrangement period

Formation of the fetus:

In the process of moving from the site of fertilization to the site of implantation, the fertilized ovum continues to develop through the morula stage and until implantation at the blastocyst stage. The large germ cells continue to divide and develop into a fetus with two layers of cells: the outer placenta and the inner placenta. On the 6th-7th day after fertilization, it begins to differentiate into the inner fetal leaf, on the 8th day it differentiates into the outer fetal leaf, in the third week between the two leaves will develop more middle fetal leaf On the 6th-7th day after fertilization, it begins to differentiate into the inner fetal leaf, on the 8th day it differentiates into the outer fetal leaf, in the third week between the two leaves will develop more middle fetal leaf. These leaves produce an embryo and from the 8th week the embryo is called a fetus (Table 1). In the newly formed embryo, people distinguish 3 regions: the anterior region is the head, the

midsection protrudes to become the abdomen, the back has a neural groove, the posterior region is the tail and has a neural network. The anterior and posterior regions gradually bulge to shape the upper and lower extremities. At the end of the embryonic period, the embryo's head is disproportionately large, with outlines of eyes, nose, mouth, and outer ears; extremities become prominent (with finger buds), major organs such as the digestive circulation are also established at this time. The fetus is curved in the shape of a shrimp's back, and the belly side generates an umbilical follicle to provide nutrients. From the fetal arterial arches, the blood vessels emanate and enter the umbilical follicles, bringing nutrients to the fetus. This is the first circulatory system, also known as the umbilical follicular circulation. Later, in the tail and abdomen of the fetus grew another sac called the cystic cyst, in which there was the terminal part of the aorta.

Table 1. Origin and formation of parts of the fetus

Original	**Forming parts of body structure**
External fetal leaves	- Nerve system - Skin
Middle fetal leaves	- Skeleton system - Muscle system - Connective tissues - Circulatory system - Urinary system
Internal fetal leaves	- Digestive system - Respiratory system

Development of the fetus's parts:

- Endoderm: Some cells of external fetal leaves on the dorsal side of the fetus dissolve to form a fluid-filled chamber called the amniotic cavity. The wall of the amniotic chamber is the amniotic membrane. The amniotic cavity is growing and gradually the fetus lies completely in the amniotic cavity.

- Mesoderm: Small germ cells that develop into mesoderm. The mesoderm has two layers, the synovial layer and the Langhans cell layer. This period is the dense mesoderm period or the full placental period.

- Ectoderm: The lining of the uterus changes into ectoderm. Ectoderm has 3 parts: ovum ectoderm, uterus ectoderm, and uterus – placenta ectoderm.

Organizational completion period

The development of the fetus

At this stage, the embryo is called a fetus, begins to have all the parts, and continues to develop until the organization is complete. The genitals are clearly recognized at the 4th month, the fetus also begins to move at the end of the 16th week. At the end of the 6th month, the skin of the fetus is still wrinkled, covered with substances, in the 7th month, the skin is less wrinkled due to a lot of subcutaneous fat, appearance of fingernails and toenails. The ossification points at the lower end of the femur appeared at 36 weeks and at the top of the tibia at 38 weeks.

During this period, the fetus lives by the second circulatory system or the cystic circulatory system. Urinary cysts gradually pull the blood vessels of the umbilical follicles,

and the umbilical cysts gradually atrophy. Finally, the cystic circulation completely replaces the umbilical cyst circulation, then gradually the cystic cysts also atrophy, leaving only the blood vessels, which are the umbilical artery and the umbilical vein.

Development of the fetus's parts [4]

- The endoderm is growing. The amniotic cavity expands and surrounds the fetus.

- Mesoderm: Mesoderm only develops in nesting part and combines to uterus-placenta ectoderm to become the placenta. The chorionic ridges destroy the ectoplasm and form blood pools. In the blood pool, there are two types of thorns, nutritional thorns and clinging thorns. Other parts of the mesoderm atrophy to a thin membrane.

- Ovum ectoderm and uterus ectoderm atrophy thins and merges into a membrane. Ectoderm uterus placenta and part of the mesoderm develops into the placenta to nourish the fetus.

- The fetus carries out its metabolism through the placental circulatory system.

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TERM FETUS – TERM PLACENTATION, AMNION, AMNIOTIC FLUID AND UMBILICAL CORD

OBJECTIVES

1. Describe the general characteristics of a term fetus.
2. Describe the anatomical features of the fetus.
3. Describe the physiological characteristics of a term fetus.
4. Describe the characteristics of the term placetation, amnion, amniotic fluid and umbilical cord.

CONTENTS

A full-term fetus has an anatomical structure nearly similar to an adult. Fetus lies in the amniotic cavity, the back is curved, the head is bowed, the chin is close to the chest, the hands are crossed in front of the chest, the legs are folded into the thighs, the thighs are folded close to the abdomen.

1. Term fetus

1.1. General features

- Fetus lives in the uterus from 38 to 42 weeks or about 280 days from the first day of the last menstrual period
- Average weight is from 2800g to 3200g
- Average length is 50cm.
- The skin is ruddy, and smooth. There is little fluff on the shoulders and neck.
- Fingernails are longer than fingertips.
- The ear is hard because it is full of cartilage.
- Hair is longer than 1cm.
- Breasts are 7-10mm in size.
- In male fetus, testicles have descended into the scrotum; in female fetus, labia majora cover labia minora.

1.2. Anatomical features

1.2.1. Head:

- The head of a full-term fetus is the part that needs the most attention because it is related to the delivery mechanism. The head is the largest and most solid part.
- The head consists of two parts, the skull, and the face. The skull consists of two regions: the base of the skull or *cranial base* and the top of the skull or *the calvaria*.
- The base of the skull includes part of the frontal, temporal, and occipital bones, and the sphenoid and ethmoid bones. The base of the skull is not shrinking.
- The top of the skull consists of two frontals, two parietals, and occipital bones. Between the bones are membranous joints. The *calvaria* is an area that can be narrowed, the bones can overlap when the fetal head passes through the mother's pelvis.

Figure 1. *Full-term fetus in utero*
Source: Wikipedia

- The horizontal and vertical sutures form the fontanels. There are two important fontanels: anterior and posterior fontanels. The anterior fontanelle is formed by four bones: the two parietal bones and the two frontal bones. The posterior fontanelle is formed by three bones: the occipital bone and the two parietal bones.

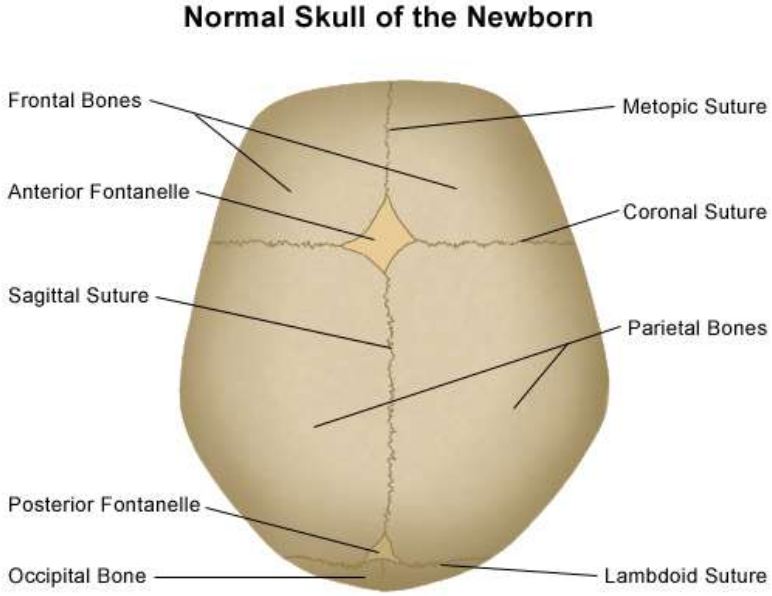

Figure 2. Anatomy of the Newborn Skull
Source: https://www.stanfordchildrens.org/en/topic/default?id=anatomy-of-the-newborn-skull-90-P01840

1.2.2. Other parts of fetus:

- Neck: Thanks to the vertebral joints of the neck, the baby's head can turn 180^0, bend, and tilt easily.

- Body and extremities: the bisacromial diameter is 12cm long, from one side of the shoulder to the other, when the fetus is engaged, this diameter can be narrowed to 9.5cm.
- Diameter between two femurs is 9cm long.

1.3. Physiological features

1.3.1 Circulation: From the end of the second month onwards, the fetus lives by the placental circulatory system.

Features of the placental circulatory system are:

- The two atria are connected by the foramen ovale.
- The aorta is connected to the pulmonary artery by the ductus arteriosus.
- The fetal lungs are not yet functioning and are solid organs.
- The iliac arteries *branch off the bottom of the aorta*. Then, each common iliac artery splits into an internal iliac artery and an external iliac artery. From the internal iliac artery, the two umbilical arteries go to the placenta. The umbilical artery carries a mixture of oxygenated blood.
- Oxygenated blood from the mother in the placenta flows through the umbilical vein to be distributed partially to the fetal hepatic circulation but mostly into the inferior vena cava bypassing the liver via the ductus venosus, with an estimated oxygen saturation of 70-80%.

Blood circulation in the placental circulatory system:

From the inferior vena cava, blood travels through the heart's right atrium before being directed across a shunt into the left atrium. In fetal circulation, there is greater pressure in the right atrium compared to the left atrium. Therefore, most of the oxygenated blood is shunted from the right atrium to the left atrium through an opening called the foramen ovale. Meanwhile, a mixture of oxygenated blood from the inferior vena cava and deoxygenated blood from the superior vena cava becomes partially oxygenated blood in the right atrium.

Once the oxygenated blood reaches the left atrium, it travels through the left ventricle into the coronary arteries and aorta, which branches to provide the most oxygenated blood to the brain. Before a shunt from the pulmonary artery, called the ductus arteriosus, allows partially oxygenated blood to be combined with the blood supply that will then flow to the systemic circulation. The partially oxygenated blood in the right atrium, mentioned above, can also enter the right ventricle and then the pulmonary artery. Because there is high resistance to blood flow in the lungs, the blood is shunted from the pulmonary artery into the aorta via the ductus arteriosus, mostly bypassing the lungs. Blood then enters systemic circulation, and the deoxygenated blood is recycled back to the placenta via the umbilical arteries to be oxygenated again by the mother.

After birth, the baby begins to breathe, the foramen ovale closes, the ductus arteriosus is blocked, and the umbilical blood vessels stop working. Newborns begin to live with the same circulatory system as adults.

1.3.2 Respiration: The fetus in the uterus uses oxygen and nutrients from the mother through the umbilical vein. CO_2 is released through the umbilical artery into the placenta and brought back to the mother's body through the blood in the placenta. The fetus is not breathing, the lungs are not active, so the lungs are still a solid organ.

1.3.3 Digestion: The nutrients the fetus needs are carried by the mother's blood through the placenta. The digestive system is not working. In the digestive tract, there is meconium, which is a thick greenish-black fluid, without bacteria. The composition of meconium includes mucus secretions of the stomach and intestinal mucosa, bile secreted by the liver, cells shed from the digestive tract, and a little amniotic fluid swallowed by the fetus.

1.3.4 Excretion: The skin begins to secrete sebum and waste products from the fifth month of pregnancy. The kidneys also begin to excrete urine.

2. Term placetation, amnion, amniotic fluid, and umbilical cord

2.1. Amnion

The amniotic membrane surrounds the fetus during pregnancy and is a thin tissue composed of two layers, the chorion, and the amnion, which are transparent and very tough.

2.2. Placenta

The placenta is a discoid-shaped organ, facing the inside of the uterus, 15-20cm in diameter. The thickest part in the middle is 2cm, the thinnest at the edge is 0.5cm. The weight of the full-term placenta is about 1/6 of the fetal weight (about 500g).

The placenta has two different surfaces: the fetal surface (or chorionic plate) is smooth, covered with endometrial tissue, and attached to the umbilical cord, and the maternal surface (or basal plate) is attached to the uterus. On the maternal surface, there are slightly elevated regions called lobes (approximately 15-20 lobes), separated by grooves.

Placenta has two main functions. It is responsible for providing nutrition and oxygen to the fetus as well as removing waste material and carbon dioxide. Nutrients and oxygen are transported from the mother's blood to the placenta and into the fetus by their mechanism. This organ has an endocrine function as it secretes hormones (such as pregnancy hormones (HCG), estrogen, and progesterone).

Figure 3. *Placenta*

2.3. Umbilical cord

It is an opaque, white, soft, and smooth cord, about 45-60cm long. It extends from the umbilicus of the fetus to the center of the placenta. The umbilical cord is composed of a gelatinous ground substance called Wharton's jelly. Between Wharton's jelly, there are three vessels, comprising the umbilical cord: two umbilical arteries and one umbilical vein.

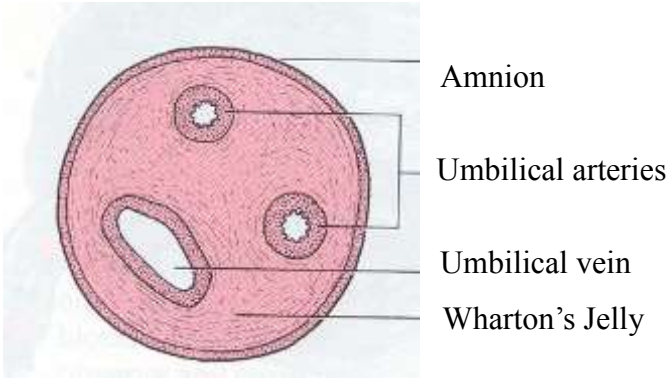

Figure 4. *Umbilical cord*

2.4. Amniotic fluid

The volume of amniotic fluid increases gradually until 38 gestational weeks, then decreases again at full term (about 500-800ml). Amniotic fluid at full term is pale white, with a strong fishy odor. The amniotic cavity is mainly responsible for protecting the fetus from trauma, helping to stabilize the fetal position. During labor, the formation of the amniotic sac will help the cervix dilate and efface. Amniotic fluid also lubricates the genital tract to help the fetus pass easily.

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ANATOMICAL AND PHYSIOLOGICAL CHANGES DURING PREGNANCY

OBJECTIVES

1. Describe the changes in the reproductive system during pregnancy.
2. Describe changes in female external genitalia during pregnancy.

CONTENTS

During pregnancy, a woman's body undergoes many physical, physiological, psychological, and endocrine changes in response to pregnancy, labor, childbirth as well as the postpartum period. These changes happen gradually so that the woman can adapt gradually. During this process, many adverse events can occur that affect the health of the mother and the fetus. Thus, there is a need to understand what changes are suitable for normal physiology and detect abnormalities early so that healthcare providers can take appropriate care to ensure a healthy pregnancy. During pregnancy, most changes take place in the female reproductive organs.

1. Changes in the uterus

1.1. Body of uterus

During pregnancy the body of the uterus changes greatly in shape, size, structure, and position.

Weight

Without pregnancy, the uterus weighs about 50g - 60g. From the beginning of pregnancy, the uterus gradually enlarges. Until full term, it weighs about 900g - 1200g. The weight of the uterus increases mainly in the first half of pregnancy.

Without pregnancy, the uterine muscle is about 1cm thick. The 4th - 5th month of pregnancy, the thickest uterine muscle is about 2.5cm. As muscle mass increases, weight also increases. Increased uterine muscle weight is due to increased production of new muscle fibers, proliferation of blood vessels including arteries, veins, and capillaries; increased water retention in the uterine muscles; uterine muscle fiber hypertrophy. These muscle fibers can grow significantly compared to their original width and length. During the second half of pregnancy, the generation of new muscle fibers decreases or stops.

Capacity

Without pregnancy, the capacity of the uterus is about 2ml - 4ml. Until the pregnancy is full term, the capacity of the uterus is about 4000ml - 5000ml.

In some cases, such as multiple pregnancies or polyhydramnios, the uterine volume can be up to 7000ml.

Size

Without pregnancy, the uterus is about 7cm high, 4-5cm wide, and about 3cm in anteroposterior diameter. When a woman is full-term pregnant, it is about 30-32cm high, 22cm wide, and 20cm in anteroposterior diameter.

During the first months of pregnancy, the uterus enlarges under the influence of estrogen and progesterone. After 12 weeks, the fetus and other parts like the placenta, amniotic fluid grow, causing the uterus to enlarge.

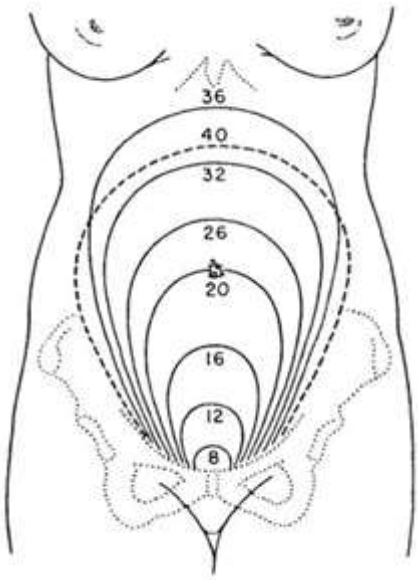

***Figure 1**. Uterine height at gestational weeks*

Image source: https://brooksidepress.org/ob_newborn_care_1/?page_id=331&cn-reloaded=1

Shape

In the third month of pregnancy, the uterus is spherical in shape. From the fourth month onwards, the uterus is ovum shaped.

In the first trimester, the anteroposterior diameter grows larger than the transverse diameter, so the uterus is spherical, and the lower part of the uterus can be palpated through the ipsilateral pouch on manual vaginal examination.

In the middle trimester, the uterus is ovum-shaped, extremely large at the top, and small at the bottom.

In the last trimester, the shape of the uterus depends on the fetal position. If the fetus is located vertically, the uterus is ovum-shaped, if the fetus is horizontal, the uterus will be transverse.

During labor, the uterus gradually changes into a tubular shape to prepare the fetus to come out.

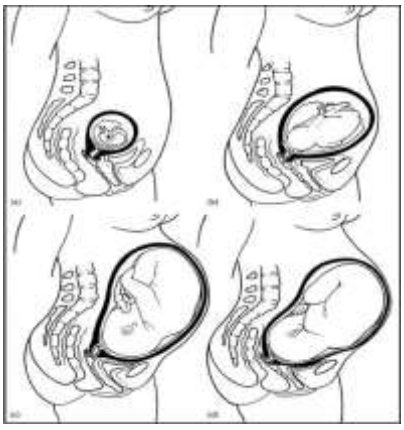

Figure 2. Uterine shape changes during pregnancy

Location

During the first trimester of pregnancy, the uterus is in the pelvis. From the fourth month onwards, it grows and protrudes towards the abdomen.

When a woman is not pregnant, her uterus is also in the pelvis. During pregnancy, the uterus grows towards the abdomen, pushing the intestines up and to the sides. At the end of pregnancy, the fundus of the uterus approaches the liver. As the uterus increases in height, the wide and round ligaments are stretched.

When the uterus enlarges and occupies the entire abdominal cavity, it pushes the intestines to the sides. The stomach becomes horizontal, making it easier to experience reflux. Pregnant women should be advised to eat small meals throughout the day. If appendicitis occurs, it may be more difficult to diagnose due to the displacement of the intestines.

Structure

From outside to inside, the uterine wall has 3 layers: peritoneum, muscle, and mucosa.

The peritoneum covers the uterus and adheres to the muscle layer. As the uterus grows, the peritoneal layer also enlarges and stretches along with the muscular layer of the uterus. At the isthmus of the uterus, the peritoneum can easily separate from the muscle layer. The boundary between the body and the isthmus of the uterus is the tight line of the peritoneum.

The uterine wall is made up of three layers of muscle tissue. The outer layer is the longitudinal muscle layer. The inner layer is the circular layer. This layer has sphincter-like muscle fibers around the fallopian tubes and cervix. Between the longitudinal and circular layers is a layer of oblique muscle. This muscle layer is thickest and most developed during pregnancy. There are many blood vessels in this layer of muscle. After delivery placenta, this muscle layer contracts, tightening blood vessels to help stop bleeding. This is a physiological hemostasis mechanism.

In the lower uterine segment (formed from the isthmus during pregnancy), there is no oblique muscle layer, so it is thinner than the body of the uterus.

Uterine density

During pregnancy, the uterus becomes softer than before pregnancy. Without pregnancy, the density of the uterus is firm and elastic. During pregnancy, due to the influence of progesterone, the uterine muscles and other smooth muscles soften and decrease in tone. On the other hand, during pregnancy, the muscle fibers enlarge and absorb water, so it also softens the uterus.

The ability of uterus contraction and involution

During pregnancy, the contraction and involution of uterine muscles are greatly increased. This is due to two factors: the uterine muscle fibers are in an excitable state, making them easy to contract; and the muscle fibers are relaxed, making them ready for involution. After delivery, the empty uterus can revert to two-thirds of its volume and becomes firmer.

The endometrium

After the fertilized ovum is implanted, the endometrium will gradually change into the decidua. The decidua forms the placenta, the fetus is in the placenta and the amniotic cavity.

1.2. The isthmus of the uterus

The isthmus of the uterus gradually elongates into the lower uterine segment. Without pregnancy, the isthmus of the uterus is about 0.5cm - 1cm long and located between the body of the uterus and the cervix. During pregnancy, the isthmus gradually becomes longer and thinner, forming the lower uterine segment. The lower uterine segment is fully formed during labor by uterine contractions and is about 10cm long when established. For primiparous women, the lower uterine segment is established from the beginning of the ninth month, while for multiparous women, it is established in the early stages of labor.

The lower uterine segment has only two layers of muscle: the outer longitudinal layer and the inner circular layer, without an oblique muscle layer in the middle. During the first trimester of pregnancy, under the influence of pregnancy hormones, the lower uterine segment (the isthmus) becomes soft and palpable on vaginal examination. This is the Hegar sign, a physical sign of early pregnancy diagnosis.

1.3. Changes in the cervix

The cervix becomes purple and soft. It is sealed by a mucus plug called the "cervical mucus plug". During pregnancy, the cervix softens, and the squamous epithelium turns purple due to the increased proliferation of blood vessels in the lower part. The cervix of primiparous women softens earlier than that of multiparous women. The position of the cervix does not change during pregnancy, but when the lower uterine segment forms, the cervix usually points toward the sacrum. The cervix is usually soft and purple about a month after pregnancy. This is also one of the signs used to diagnose pregnancy in the first trimester.

Glands in the cervical canal secrete little or no secretion. The cervical mucus becomes cloudy and thickens to form a plug that seals the cervix, called the cervical mucus plug. This mucus plug works to prevent second fertilization and the entry of bacteria from the vagina into the uterine cavity. During labor, the cervix dilates and effaces, causing the mucus plug to peel off and be pushed out. It may mix with a little blood, resulting in a pinkish or bloody discharge, which is a sign of labor.

2. Other organs

2.1. Changes in vulva, vagina

Due to increased perfusion, the vaginal mucosa becomes purple, soft, and easy to stretch, with increased secretion. During pregnancy, the vaginal mucosa becomes purple due to increased perfusion and proliferation of blood vessels. The vaginal wall thickens, and the connective tissue becomes loose. The smooth muscles of the vagina enlarge, like the muscles of the uterus. These changes make the vagina soft, elongated, and easy to stretch. During pregnancy, the vaginal mucosa increases secretion, resulting in more fluid in the vulva and vagina. This discharge is usually milky white and, when there is no infection, has no odor and does not cause itching. An increase in the pH of the vagina from

3.5 to 6 is due to the bacteria Lactobacillus Acidophilus, which increases the production of lactic acid from glycogen in the vaginal epithelium.

The labia majora and labia minora have dilated veins. Blood vessels in the perineum and vulva also proliferate, and blood stasis under the skin makes the connective tissue in this area softer than before pregnancy. Even the clitoris becomes purple.

2.2. Changes in the ovaries

The follicles stop developing in the ovaries. During the first trimester of pregnancy, the corpus luteum continues to develop. The corpus luteum of pregnancy is larger than the menstrual corpus luteum. During pregnancy, there is no ovulation, and the follicles do not develop, so the woman does not have a period. From the fourth month of pregnancy, the corpus luteum will gradually atrophy. The ovaries during pregnancy are also congested, edematous, enlarged, and heavier. The veins of the ovary also enlarge.

2.3. Changes in the fallopian tubes

There are few changes in the fallopian tubes during pregnancy. As the uterus enlarges, the fallopian tubes and ovaries are also pushed up into the abdomen. During pregnancy, the fallopian tubes remain inactive and undergo minimal changes. The muscle of the fallopian tubes is less enlarged, the mucosa is thinner than before pregnancy, and it is also congested and softer.

2.4. Changes in skin and muscle

Some pregnant women may develop dark pigmentation (melasma) on their face and neck, while stretch marks may appear on their abdomen and inner thighs. Some muscles in the abdominal wall like rectus abdominis muscle, oblique muscle and so on also expand as the fetus grows, along with the large rectus fascia, which can sometimes expand too much and cause a hernia in the abdominal wall.

In the abdomen, the pigment is concentrated in the midline, also known as the brown line. This line usually disappears or fades after birth, and the source of these pigment changes is currently unknown.

As the uterus expands, the abdominal wall also expands, which can cause stretch marks. These stretch marks can also appear on the inner sides of the thighs and sometimes on the breasts. About 50% of pregnant women develop stretch marks, which are pale pink in color for primiparous women and white as mother-of-pearl for multiparous women.

2.5. Breast changes

Areolas and nipples enlarge and darken during pregnancy as the milk glands and milk ducts develop and enlarge, causing the breasts to grow. The purpose of these changes is to prepare for breastfeeding after birth.

Additionally, the areola becomes darker and dilated, and Montgomery granules appear on it due to enlarged sebaceous glands. Pregnant women may feel an erection in the breast during this time. The milk glands and ducts continue to develop and enlarge after the second month, further increasing the size of the breasts. The circulatory system in the breast also increases, resulting in large, prominent veins that are visible under the skin, known as the accessory venous circulation or the Haller's vascular network. Finally, colostrum secretion may occur in the first and last months of pregnancy.

2.6. Changes in the circulatory system

Changes in blood

Increased blood volume, mainly increased plasma, serves to improve perfusion of the genital organs and blood reserves to protect the mother from blood loss during childbirth.

During pregnancy, blood volume increases by about 50%. If a woman has about 4 liters of blood, she has about 6 liters of blood during pregnancy. Blood volume increases starting in the first trimester of pregnancy, increases rapidly in the second trimester, and peaks in the seventh month of pregnancy. Thereafter, blood volume remains constant in the last weeks of pregnancy. After delivery, the blood volume decreases rapidly and gradually return to its non-pregnant state.

The increased blood volume is due to a large increase in plasma volume, and the number of red blood cells increases slightly, so the number of red blood cells in the blood decreases slightly. Hematocrit decreases from 39.5% to 35.8% at 40 weeks gestation. The decrease in blood viscosity and low number of red blood cells causes a reduction in osmotic pressure and hypochromic anemia.

When not pregnant, normal fibrinogen is about 2-4g/l. During pregnancy, the amount of fibrinogen increases by about 50% (3-6g/l). The increased concentration of fibrinogen causes an increase in the sedimentation rate of the blood.

Other clotting factors such as factor VI, factor VIII, factor IX, and factor X are all increased during pregnancy. Platelets increase from 300,000/ml to 400,000/ml during pregnancy. The white blood cell count increases to 12,000/ml during pregnancy. During labor and the first days after birth, the white blood cell count can reach 25,000/ml, averaging 14,000-16,000/ml. The cause of the increase in the white blood cell count is still unknown.

Serum calcium and iron decreased; alkaline reserves decreased.

2.7. Changes in the heart

During pregnancy, the heart rate increases by 10-15 beats per minute, and cardiac output increases by 50%. These changes begin at the start of pregnancy and gradually increase to their highest levels in the seventh gestational month before gradually decreasing until full-term pregnancy.

Vascular changes also occur, with blood vessels becoming soft, long, large, and easily dilated. Normally, blood pressure drops slightly during the second and third trimesters before rising again. The maternal position also greatly affects blood pressure, with the highest readings when sitting, the lowest when lying on the side, and an average reading when lying on the back. Due to the compression of the abdominal vena cava by the uterus, hemorrhoids and varicose veins in the lower extremities and vulva may appear.

2.8. Changes in the respiratory system

Breathing rate increases moderately during pregnancy, often with shallow tachypnea. Oxygen consumption in pregnant women is 15% higher than in non-pregnant women.

There are two important respiratory changes during pregnancy: an increase in tidal volume (which is the source of increased alveolar ventilation) and a decrease in expiratory reserve volume.

During pregnancy, the diaphragm is pushed up about 4cm.

Ventilation: during pregnancy, tidal volume increases from the third month to term by about 40%. Expiratory reserve volume begins to decrease from the fifth month, until full term decreases by about 15%. The volume of residual gas also begins to decrease from the fifth month and decreases by about 20% at term. However, vital capacity (which is the sum of tidal volume, inspiratory reserve volume, and expiratory reserve volume) does not change during pregnancy.

2.9. Urinary changes

During pregnancy, the kidney size is slightly increased. The glomerular filtration rate increases by 50% from the second trimester of pregnancy. Renal blood flow increased from 200ml/min to 250ml/min.

Excretory function of the kidney: There is a loss of nutrients in the urine. More water-soluble amino acids and vitamins are found in the urine of pregnant women than in non-pregnant women. The concentration of urea and creatinine in pregnant women's serum decreased due to increased glomerular filtration rate.

In the urine of a pregnant woman, there is usually no protein or red blood cells, so the presence of protein or red blood cells is abnormal. There may be sugar in the urine due to increased glomerular filtration rate and poor tubular reabsorption. However, the presence of sugar in the urine should be carefully considered to rule out gestational diabetes.

Ureters are elongation, curvature, and hypotonicity, reducing the ability to conduct urine. As the uterus grows, it passes through the pelvis and into the abdomen and presses on the ureter. The ureter is compressed leading to the calyx, and the renal pelvis dilates. Compression of the ureters by the uterus and the effect of progesterone on smooth muscle relaxation cause changes in the kidneys, ureters, and pyelonephritis. Consequences of ureteral changes are misjudgment of urine volume and quality, increased incidence of urinary tract infections, and altered urinary tract imaging.

Bladder and urethra

During the first months of pregnancy, the bladder can become irritated and be compressed by the uterus, causing the need to urinate. Bladder pressure during pregnancy increases from 8cm H_2O to 20cm H_2O at full term. The urethra is also long and enlarged.

2.10. Digestive changes

Morning sickness can occur in some pregnant women, lasting during the first three months of pregnancy. In a small number of cases, morning sickness becomes severe and requires some intervention.

In the first trimester, pregnant women may have some symptoms of morning sickness such as nausea, vomiting, cravings for strange foods, and frequent fatigue. A small number of pregnant women have increased salivation. After 3 months, the symptoms of morning sickness gradually decreased and disappeared, and the pregnant woman returned to eating and drinking normally.

As the fetus develops, the uterus expands into the abdomen, pushing the intestines to the sides and changing the position of the stomach. Typically, the appendix is often pushed up, sometimes pushed to the side.

Pregnant women can also have heartburn caused by reflux of gastric juice; sometimes pregnant women feel stomach pain.

The small intestine and colon decrease motility due to compression and hypotonicity, so pregnant women have constipation.

An enlarged uterus causes compression that increases venous pressure in the lower half of the body along with constipation makes pregnant women more susceptible to hemorrhoids during pregnancy.

There is little change in liver and bile function during pregnancy.

2.11. Changes in the musculoskeletal system

During pregnancy, calcium in the mother's body is mobilized to create the fetal skeleton, so pregnant women are prone to calcium deficiency and osteoporosis.

The lumbar and cervical spines are bent forward, the thoracic and sacral spines are curved posteriorly. The last months of pregnancy often have lower back pain because the spine is more curved, and the belly is bigger and heavier. In the last month of pregnancy, there can be pain in the pelvic joints, which is caused by the pubic joints, sacroiliac joints, sacrococcygeal joints, making the pelvis bigger to prepare for the upcoming birth.

2.12. Metabolic changes

Water metabolism: increased extracellular and plasma water retention.

The total volume of water in plasma, breast and intrauterine is about 3 liters. The increased tubular reabsorption of water and salt, increased aldosterone secretion, and altered posterior pituitary control of urine secretion causes the increased water retention.

Minerals: Calcium and magnesium levels drop during pregnancy. The demand for iron increased.

Lipid metabolism: concentrations of lipids, lipoproteins and apoliproteins are increased during pregnancy.

Protein and carbohydrate metabolism also increases during pregnancy.

2.13. Body weight

Body weight increases on average from 10 kg to 12 kg during pregnancy.

In the first trimester, little increase is due to morning sickness. The second trimester increased more, and the last trimester increased less.

In some special cases, such as pregnant women with excessive weight before pregnancy, it is recommended to gain about 8-10 kg during pregnancy. Pregnant women with a low weight of less than 40 kg before pregnancy can gain more than 10 -12 kg, but it should not be too much.

2.14. Body temperature

In the first trimester of pregnancy, the body temperature can be around 37.5 degrees Celsius, which is caused by the activity of the corpus luteum of pregnancy.

From the fourth month onwards, the body temperature will return to normal.

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PSYCHOLOGY OF PREGNANT WOMEN

OBJECTIVES

1. Analyze factors that affect the psychology of pregnant women.
2. Describe the psychological characteristics of pregnant women.
3. Describe the clinical phenomenon of psychological disorders in pregnant women.
4. Analyze factors that provide psychological support for pregnant women.

CONTENTS

Pregnancy is an important stage in a woman's life. It is considered a milestone that helps pregnant women overcome the challenges of psychological changes, thereby forming and developing their role as a mother.

1. Factors that affect the psychology of pregnant women

1.1. Hormones

Changes in hormones during pregnancy can have a profound psychological impact on pregnant women.

Estrogen, Progesterone

Estrogen and progesterone are the main hormones of pregnancy, produced by the corpus luteum (fertilization-13 weeks of pregnancy) or the placenta (after 13 weeks of pregnancy), and increase with gestational age, peaking in the last weeks of pregnancy. Estrogen plays an important role in the formation of new blood vessels in the placenta and uterus to prevent miscarriage and fetal growth restriction. Progesterone promotes the development of the uterus to accommodate the growing fetus.

The first three months of pregnancy are a period when the mother's body is getting used to the increased secretion of estrogen and progesterone. High levels of these hormones can cause symptoms such as nausea, vomiting, breast tenderness, frequent urination, fatigue, and exhaustion in pregnant women.

During the middle and late trimesters, the mother's body becomes accustomed to the levels of estrogen and progesterone, which help stabilize the pregnant woman's mood through neurotransmitter transmission that reduces stress and increases dopamine secretion to reduce anxiety.

Progesterone supports the expansion of ligaments and loosening of joints, alongside the hormone relaxin, which helps the mother's body adapt to fetal development. However, this also increases the risk of falls and makes it difficult for pregnant women to move.

Human Chorionic Gonadotropin(hCG)

Human Chorionic Gonadotropin (hCG) is a hormone produced by the placenta and trophoblast cells about 8 days after ovulation and 1 day after fertilization.

Before 6 weeks of pregnancy, hCG levels double every 2 days and reach their peak during weeks 8-10. Afterward, hCG levels gradually decrease and reach their lowest point between weeks 16-20, stabilizing until the end of pregnancy. hCG is the main cause of nausea and vomiting in pregnant women from weeks 8-12, and then it gradually decreases along with hCG levels.

1.2. Acceptance ability of pregnant women.

The ability to accept and face the new state of oneself is formed from the environment and quality of life from the past to the present of each individual. Pregnant women with high-risk factors such as an unhappy childhood (lack of motherly care, growing up in a single-parent family, parents' divorce, poor quality of life) or current factors such as unintended pregnancy, being a single mother, difficulties and material deprivation during pregnancy, lack of care and support from family, lack of sharing from the husband, pressure from the child's gender... often accept the difficulties of pregnancy, worry about the pregnancy process, plan to take care of themselves and the fetus during pregnancy and after childbirth. These factors contribute to the development of psychological disorders in mothers.

1.3. Fetal development

The development of the fetus greatly affects the physical and psychological changes of the mother. Abnormalities in fetal health are the leading cause of anxiety and insecurity in pregnant women. Changes in fetal weight over time can cause disorders of the respiratory, digestive, urinary, muscular, skeletal system, such as shortness of breath, constipation, frequent urination, back pain, pelvic pain, and joint pain which can lead to insomnia and poor sleep quality. In addition, changes in appearance such as weight gain, darkened skin, and difficulty in movement are negative experiences for pregnant women. All of these factors have a significant impact on the mother's mental state.

2. Psychological characteristics of pregnant women

2.1. First trimester

The first trimester of pregnancy is a period of significant physiological and hormonal changes, which can cause various symptoms such as nausea, vomiting, breast tenderness, fatigue, and exhaustion. These symptoms can lead to psychological fluctuations in pregnant women, who may feel uncomfortable, dissatisfied, and sensitive to the environment. They may become more concerned about their health and appearance, worry about the safety of the fetus, and feel more passive or dependent on those around them. Pregnant women can also become sensitive to the attitudes and comments of others, which can exacerbate their anxiety and stress levels. Sleep disorders due to anxiety and frequent urination in the early stages can further increase feelings of discomfort, tension, and anxiety. This is the stage with the most significant psychological fluctuations for pregnant women

2.2. Second trimester

During the second trimester, the expectant mother starts to develop a deeper understanding and connection with the fetus and the process of pregnancy. The mother begins to see the fetus as a separate entity, with a unique identity and personality.This stage is marked by the development of the mother's role as a caregiver, as she begins to take more responsibility for the health and well-being of her growing baby.

Hormone levels, including estrogen, progesterone, and hCG, stabilize during this stage, reducing many of the discomforts experienced in the first trimester. Additionally, the mother does not experience as many changes in weight or appearance that may affect her

other activities. Overall, the second trimester is considered a more stable psychological stage for the expectant mother during pregnancy

2.3. Third trimester

In the third trimester, the emotional state of the expectant mother is different from the first and second trimesters. The mother desires to give birth, but is often anxious about the process of labor and delivery. The mother's concerns are focused on both herself and the fetus, and she experiences feelings of vulnerability due to significant physical changes such as weight gain, darkened skin, back pain, and joint pain in the lower limbs, causing difficulty in movement, work, and communication with the surrounding environment. The expectant mother also has many concerns and worries about the health of the newborn, her ability to be a mother, and the love and support of her partner. However, the expectant mother is often more mentally prepared and more aware of what to expect, thanks to prenatal education and counseling. This stage requires close attention and support from the surrounding environment, especially family and healthcare professionals, to help the mother feel more comfortable and confident before entering the final stage of pregnancy.

During this stage, the expectant mother may also experience increased levels of anxiety and negative thoughts related to the upcoming labor and delivery, as well as the postpartum period. These concerns can cause stress and worry, which may contribute to the development of insomnia and other sleep disorders. The expectant mother may also feel overwhelmed by the physical changes in her body and the preparations necessary for the arrival of the newborn. However, with the support of healthcare providers, family, and friends, many expectant mothers are able to manage their anxiety and negative thoughts and prepare for the upcoming birth and transition to motherhood. It's important for expectant mothers to discuss any concerns or questions they have with their healthcare provider and to seek support from their health care workers and partner.

3. Abnormal clinical psychological phenomenons of pregnant women

3.1. Stress

Pregnancy is a time of significant physiological and emotional changes, and pregnant women may experience stress due to various factors such as financial concerns, relationship issues, and health concerns for themselves and their fetus. Stress during pregnancy can have negative consequences for both the mother and the fetus. In the short term, stress can cause symptoms such as sadness, insomnia, loss of appetite, and social withdrawal in pregnant women.

However, chronic stress during pregnancy can also lead to long-term harm for the fetus and child. Stress in the last trimester of pregnancy has been linked to slower fetal development in the uterus, and young mothers who experience stress during pregnancy are at an increased risk of having children with asthma and allergies. Additionally, stress during pregnancy can significantly affect the mother's hormone levels, leading to reduced nutrients supplied to the fetus and potentially affecting the development of fetal organs such as the liver, heart, kidneys, and brain. This can have long-lasting effects on the child's physical and mental development in the future. Therefore, it is important for pregnant

women to manage stress through various techniques such as mindfulness, exercise, and seeking social support to promote their own health and the health of their fetus.

3.2. Depression

Excessive worrying about their future role as a mother can lead to problems with sleep such as insomnia, nightmares, persistent sadness, and thoughts of death or suicide. Depression during pregnancy can have negative consequences for both the pregnant woman and the fetus. It can increase the risk of miscarriage, premature birth, poor fetal development, and the child may develop autism or have delayed development.

However, experiencing depression during pregnancy does not necessarily mean that the person will be depressed after giving birth. Approximately 50% of women who suffer from severe depression during pregnancy continue to experience depression after giving birth. Treatment during pregnancy can significantly reduce the risk of postpartum depression.

Symptoms of postpartum depression can vary in severity. Mild symptoms may include crying, being easily emotional without clear reasons, and feeling constantly tired. With severe depression, pregnant women may experience feelings of anxiety, followed by sadness and irritability without clear reasons. They may also engage in harmful behaviors towards the newborn. Excessive worrying about their future role as a mother can lead to problems with sleep such as insomnia, nightmares, persistent sadness, and thoughts of death or suicide. Depression during pregnancy can have negative consequences for both the pregnant woman and the fetus. It can increase the risk of miscarriage, premature birth, poor fetal development, and the child may develop autism or have delayed development.

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3.3. Behavioral disorders

Pregnant women with behavioral disorders may be sad, cry for no reason, lose direction in space and time, worry excessively because of fear of serious illness, pay little attention to personal hygiene, dress inappropriately, engage in violent behavior, and offend those around them. Some behaviors can harm themselves and their fetuses, such as hurting themselves and attempting suicide.

4. Psychological support during pregnancy

Providing psychological support during pregnancy is crucial for midwives as it is an essential part of their mission. Support involves a series of activities that show care and

understanding, enabling pregnant women to adapt to changes in themselves and their environment. These activities include assessing a woman's ability to accept and cope with new challenges, screening for those who may be at risk, and enhancing the support provided by the father, family, and society during pregnancy. It also involves providing information, supportive methods, and suitable treatments for each pregnant woman to promote physical and mental comfort.

Currently, healthcare workers tend to focus more on the physical health of the fetus and the pregnant woman, neglecting their mental health. Therefore, it is necessary to establish teams consisting of obstetricians, psychologists, midwives, and mental health professionals with clear missions to identify and provide timely support for pregnant women with abnormal psychophysiology. The father of the child also plays an extremely important role in detecting and helping to improve the negative psychological state of the pregnant woman. By working together, healthcare providers, mental health professionals, and family members can ensure that pregnant women receive the psychological support they need for a healthy pregnancy and positive birth experience.

4.1. Assessment of pregnant woman's acceptance and coping ability

The ability to cope and adapt to changes, new situations, and tasks for each person is formed from past experiences, culture, environment, and quality of life. The adaptation process of pregnant women to pregnancy, childbirth, and child-rearing is also formed based on these foundations.

Maternity healthcare workers need to pay attention to abnormal signs to screen for them during pregnancy. Particularly, attention should be paid to pregnant women with high risk factors such as difficulty accepting their pregnancy, no emotional connection with the fetus, and no ability to perceive the fetus as a separate individual.

Factors affecting the acceptance and coping ability of pregnant women

- Absence of the mother's figure during childhood and adolescence.
- Conflict with biological mother or other female relatives.
- Child with congenital defects or delayed neural development before birth.
- Abnormalities during pregnancy: pregnancy-induced hypertension, gestational diabetes …
- Lack of knowledge and planning for self-care, the fetus during pregnancy and postpartum.
- Low quality of life: low income, poor living environment, stressful work environment, pollution ….
- Marital status: separation, divorce, unhappiness.
- Adolescent age.
- Communication barriers: ethnic minorities.
- Use of addictive substances.

Signs of abnormal acceptance and coping ability of pregnant women.

The physiological changes during pregnancy are significant and continuous, affecting the body image, mood, and energy of pregnant women. Relationships with those around them and non-scientific sources of information about pregnancy, childbirth, and motherhood can cause confusion, anxiety, and fear. Pregnant women may feel vulnerable

and dependent, especially those who have not given birth before, lack experience with pregnancy and childbirth, or do not have a strong personality. Pregnant women with abnormalities in their acceptance and coping abilities often exhibit the following signs:

- Pregnant women request more frequent or earlier appointments than scheduled.
- Appointments often last longer than usual.
- Questions often revolve around the health of the fetus and themselves.
- They express excessive concern about their physiological changes during pregnancy.
- Obstetric healthcare professionals need to approach, assess the risk, screen, and identify emotional conflicts of pregnant women in order to intervene early to prevent risks to the pregnant woman and fetus. The content of appointments should be adjusted to help alleviate the pregnant woman's stress. A combination of obstetric healthcare professionals, psychologists, psychiatrists, and social workers is necessary to evaluate and screen for abnormal psychological conditions of pregnant women to help them adjust to their new roles. Additionally, pregnant women and their families should be provided with information and guidance on methods to adapt to the numerous changes that come with pregnancy and child-rearing.

4.2. Screening for psychological disorders during pregnancy

The world association of obstetricians and gynecologists recommends that pregnant women be screened at least once during pregnancy, particularly in high-risk individuals with factors that may affect their ability to cope with changes, for symptoms of depression and anxiety by obstetric healthcare workers using available scales. The Edinburgh Postnatal Depression Scale (EPDS), with 50 different language versions, including a Vietnamese version, is an effective tool commonly used in research or clinical practice. However, the EPDS focuses on anxiety symptoms and lacks content related to sleep quality. Therefore, like any screening tool, the results of the scale need to be evaluated and explained by combining clinical symptoms. Screening alone helps detect psychological disorders during pregnancy, but treatment should be carried out by mental health professionals. Women with depression, a history of perinatal mood disorders, or suicidal ideation need to be closely monitored and evaluated. A combination of expertise is needed to assess, detect, and treat to improve the psychological disorders of pregnant women.

4.3. The role of the father

Pregnancy is an important milestone for the family. Fathers also need to make many changes in their lifestyle, work, and relationships with the environment to fit their new role. Therefore, psychological anxiety and stress are inevitable. In addition, future fathers may also experience similar disorders as pregnant women such as nausea, vomiting, loss of appetite, toothache, indigestion, and abdominal pain. Therefore, fathers need to be encouraged to attend prenatal visits, creating opportunities to ask questions related to pregnancy and childbirth. This will reduce anxiety and promote the participation, companionship, and experiences of fathers with mothers throughout the pregnancy and childbirth process.

The companionship of the father during pregnancy can be described as a coach (people who play an active role in caring for pregnant women and fetuses), teammates (people who listen and share the worries and difficulties that pregnant women encounter

during pregnancy). Pregnant women who do not receive care and empathy from their partners are often more vulnerable and lack support from others compared to other pregnant women. Single mothers have a higher risk of economic, social, and physical problems that lead to instability in their mental health.

5. Conclusion

Pregnant women are supported during pregnancy to reduce anxiety, worry, negative thinking, and become more confident about their role as a mother, increase physical and psychological health after childbirth, and extend the time of breastfeeding. During pregnancy, pregnant women need to rest, work lightly, exercise and relax reasonably. In particular, husbands and relatives need to care, monitor and encourage them to overcome difficult stages, helping them have a good pregnancy experience.

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MANAGEMENT OF PREGNANCY

OBJECTIVES

1. Describe the purpose of each antenatal checkup.
2. Describe all the steps for each routine antenatal checkup.
3. Describe the antenatal appointment schedule and abnormalities that require immediate attention.

CONTENTS

One of the most crucial phases of prenatal treatment is an antenatal checkup. Through antenatal care, it enables physicians and midwives to evaluate the growth and health of the fetus, offer recommendations on the best diet and lifestyle for expectant mothers, and identify and treat early maternal disorders that may have an impact on the fetus. Early fetal abnormality discovery, advice for expectant mothers on how to take care of themselves during pregnancy, postpartum, and selecting a safe delivery location are all important considerations.

The Ministry of Health's 2016 "National Guidelines for Reproductive Services" recommended at least four visits throughout pregnancy—one in the first trimester, one in the second, and twice in the third.

1. First trimester antenatal checkup: from the first day of the last menstrual period to 13 weeks and 6 days.

1.1. Purposes

- Determining pregnancy, fetal position, number of fetuses, normal pregnancy status or pathological pregnancy.
- Determine the gestational age and due date.
- Detect the mother's medical and gynecological conditions.

The position of the fetus inside or outside the uterus, a normal pregnancy or a pathological pregnancy, and the number of fetuses are all shown by ultrasound.

Currently, the last menstrual cycle and a first trimester ultrasound are the two most commonly used ways to determine gestational age. Calculate the gestational age using the last menstruation day only if the expectant mother can recall the precise date on the solar calendar and the menstrual cycle is regular and lasts between 28 and 30 days. The ultrasound performed during the first trimester of pregnancy is the most frequently used one clinically.

It will be easier to organize care, monitoring, and treatment to limit the consequences for the unborn if medical and gynecological conditions in the mother are discovered early.

1.2. Make a pregnancy assessment form

Each examination's outcomes and follow-up care will be noted on the form for easy and ongoing pregnancy monitoring.

Depending on the location, a prenatal check-up sheet (or antenatal check-up book) may have a different structure, but it must have the following fundamental information: an administrative section, an obstetric history, a record of the results of the examination, and laboratory tests.

The antenatal check-up sheet must include all the details from the pre-examination questionnaire, the outcomes of each examination, and the findings of any para-clinical tests that were carried out. To find out the outcomes of the prior exam and what was done, the next visit only needs to consult the assessment form.

1.3. Examination contents

History taking

- Name, age (year of birth).

When the pregnant woman is under 18 and the adult is above 35, take note. If the pregnant woman is under the age of 18, a guardian is necessary.

- Occupation, working conditions, working posture, and chemical exposure.

Some jobs can harm a pregnant woman's health and pregnancy. For instance, working in cold factories, standing for extended periods of time when pregnant, or employment requiring exposure to chemicals that can harm the fetus is not recommended. If it is recognized that pregnant women spend a lot of time standing or sitting at work, they should be given instructions on how to decrease leg edema caused by poor posture.

- Address: Write the address of the pregnant woman's place of residence.

There may be differences between urban and rural locations in terms of living standards, conditions, and customs. Place of living is derived by epidemiological conditions or accessibility to nearby or far-off medical treatments.

- Ethnic

Due to the fact that various ethnic groups have different cultures, customs, and habits as well as varied behaviors about the same issue, it is helpful for midwives to have rules that are acceptable for the pregnant woman's culture.

- Educational level.
- Living conditions, family economy.

When midwives explain pregnancy status to pregnant women and their families, having knowledge of the mother's cultural background will help them select the best counseling approach.

Midwives can choose nutrition and lifestyle advice appropriate to the living and economic circumstances of pregnant women by being aware of the family economy and living situation.

- Ask about medical history.

+ Have you ever had any past medical conditions (such as diabetes, hypertension, goiter, kidney disease, cardiovascular disease, endocrine disorders, blood clotting issues, cancer, etc.)? Keep track of illnesses that necessitate hospitalization for treatment or blood transfusions in pregnant women.
+ Previous medicines or dietary allergies
+ Prior surgical history. Note the incisions on the body of the uterus
+ Addicted to alcohol, tobacco, drugs?
+ Gynecological diseases have or are, gynecological tumors, sexually transmitted diseases. If yes, has it been treated and cured?
+ Does your current health have any diseases, treatment status, medications you are taking (if any).

+ Year of marriage. Types and duration of of contraception used. This aids in gaining insight into how simple or challenging it is to become pregnant.
+ Whether the menstrual cycle is regular. The first day of the last period. If the last menstruation day is vividly remembered and the cycle is a regular 28–30 days, it is easy to determine the due date when you know the first day of the last menstrual period.

The due date is determined based on the latest menstrual cycle (Naegele's formula): days plus 7, months minus 3. Add 9 if the month is less than 4. The 40th week of pregnancy is when the baby is due.

+ Family history: father/mother, brother/sister has high blood pressure, diabetes, cancer, tuberculosis, has twins, born with birth defects. Discover several illnesses that may run in families.
+ Age, health status and disease of husband (if any).

- Pregnancy or obstetric history (PARA) includes 4 numbers as follows (excluding this pregnancy)
  - Number of births that occurred at full term (37 weeks or more of gestation).
  - Number of premature births.
  - Number of spontaneous abortions, miscarriages, or both. Time
  - Number of children alive today.
    + previous births: ask pregnant women about
      - Abnormalities in previous pregnancy: diabetes, preeclampsia, placenta previa….
      - Birthing methods include vaginal delivery, vacuum delivery, forceps delivery, and cesarean section.
      - Birth year. weight of the newborn.
      - The circumstance in which the newborn suffocates or cries right away.
      - If a cesarean section is performed, find out why it was done, what the surgical technique was, and how many days it took to heal.
      - The birthplace can be a household, a hospital, or a clinic.

• Hemorrhage and infection are postpartum consequences. If the pregnant women had a previous cesarean section, they would be transported to the hospital, where has the operation room, in last month of pregnancy. The incision should always be examined during this prenatal visit because there is a danger of rupture (particularly in the third trimester) and a chance that this pregnancy will require another cesarean section. The number of days after surgery helps to direct post-operative infection; nevertheless, if it occurs, there is a high risk of the wound breaking.

Predicting this birth is made easier by being aware of previous vaginal births, vacuum deliveries, birth weights, and birth weights. Spacing between births also requires consideration. When the gap is too close, it is important to pay attention to pregnancy-related nutrition and lifestyle recommendations.

+ Ask about this pregnancy: morning symptoms, unusual signs such as abdominal pain and vaginal bleeding.

Clinical examination

- General examination

+ Assess gait, weigh, measure, and compute BMI.

Our ability to judge the relative width and misalignment of the pelvis depends on our height and walk. In the final month of her pregnancy, the expectant mother may receive a pelvic X-ray if there is a suspicion of pelvic restriction or deviation.

BMI-based nutrition coaching is helpful in ensuring that weight growth is neither excessive nor nonexistent.

+ Examine the mucous membranes and skin to check for edema and anemia.

Pregnancy can cause melasma to form on the skin. When the mucous membranes are pale pink, check them for any indications of anemia, especially on the mucous membranes surrounding the eyes.

+ Check your temperature, breathing rate, pulse, and blood pressure.

During every appointment, take a blood pressure reading and count your pulse to help identify cardiovascular disease and hypertension in pregnancy.

+ Inspection of the heart and lungs (doctor's examination)

Identify lung and cardiac conditions. Because the heart and lungs are working harder during pregnancy, it's important to treat these conditions as soon as possible if you have them.

+ Mammogram

- Montgomery granules and a dark areola are two of the early indicators of pregnancy in the first trimester. Look for a convex or concave nipple if there is an unusual lump in the breast.

+ When there are anomalies, look at other areas.

- Obstetric examination

+ Examine the pubic bone for any visible uterus.

+ + Look for any obvious surgical scars (horizontal or vertical).

+ + Examine the vagina by seeing the vulva and using a speculum to peek inside to check for a septum or vaginal infection. Cervix observation: color, glandularity, absence of polyps.

+ Manual vaginal examination to assess firmness or softness in the uterus. Tumors are absent from the two appendages.

The initial appointment is when a vaginal examination is done; further visits are only necessary if an anomaly is found. To keep the pregnancy from being impacted, vaginal infections must be identified and treated. The cervix will bleed readily if there is a polyp or when it is exposed.

Subclinical

- Ultrasound to measure the nuchal translucency of the fetus when the gestational age was in 11 to 13 weeks 6 days.
- Blood test:

  Total blood cell analysis, Blood group, Rhesus factors, Immunity:
  HbsAg – HIV – Rubella – Syphilis
  Double test, NIPT.

Urine test.

Medicines: Iron supplements or other necessary drugs

2. Second trimester antenatal checkup: from full 14 weeks to 28 weeks 6 days

2.1. Objective

- Monitor fetal development.
- Ultrasound-based morphological assessment of the fetus.
- Spot high-risk pregnancy conditions such placenta previa, gestational diabetes, pre-eclampsia, and umbilical cord adhering to the edge...

2.2. Ask

- Morning sick? Most expectant mothers begin to feel better by the fourth month of their pregnancy.
- Sensing a pregnancy. Pregnancy typically begins in the fourth month of gestation.

2.3. Clinical examination

- Edema, temperature, pulse, blood pressure, and weight.
- Determine the uterus's height.
- To ascertain whether the fetal position, the back position, and the fetal position have penetrated the pelvis, palpate by four Leopold maneuvers.
- Listen to the heart of the fetus.
- Only a vaginal examination should be performed in the event of anomalies like bleeding, itching, or watery or foul-smelling vaginal discharge.

2.4. Subclinical

- 4D ultrasound to assess the morphology of the fetus at 19–22 weeks of gestation. If there is a chance that a pregnant woman will give birth before her due date, measure the length of the cervical canal.
- For the fifth and sixth months, a two-way ultrasound is sufficient.
- A general urinalysis.
- The NIPT test, or the Triple test if NIPT was not done in the first trimester, to evaluate the risk of prenatal abnormalities.
- If the screening findings indicate a significant risk of aneuploidy, think about amniocentesis.
- A test for sugar tolerance to determine whether the expectant mother has gestational diabetes.

2.5. Medicine

- Vaccination against tetanus.
- Calcium and iron.

3. Third trimester antenatal checkup: from 29 weeks until labor

3.1. Objectives

- Monitor fetal growth.
- Determine fetal position, pelvis, preliminary prognosis of birth.

3.2. Ask

- Feeling baby movement
- Feeling of heaviness in the lower abdomen.

- A few weeks before delivery, the fetus will move slowly into the pelvis, making the pregnant woman feel heavy in the lower abdomen. Then the uterine height will not increase or increase very little.

3.3. Clinical examination

- Weight.
- Measure blood pressure, pulse, edema.
- Look at the shape of the uterus.
- Measure the fundus height.
- An abdominal tuck is performed using four Leopold movements to verify the fetal position.
- Listen to the heartbeat of the fetus.
- Examining the vagina at 36 weeks pregnant or if there is an unusual discharge.
- Pelvic examination from 38 weeks of pregnancy to pelvic examination when there is a suspicion of pelvic restriction.

3.4. Subclinical

- Ultrasound 2D
- Color doppler ultrasound at 36 weeks' gestation
- Urinalysis.
- Glucose tolerance test to see if the mother has gestational diabetes.
- GBS test when pregnant ≥ 36 weeks
- Assess fetal health by non-stress test.

3.5. Medicine

- A second dosage of tetanus shots, if the child is younger (final injection is 4 weeks before the due date, and the first dose must be had at least 4 weeks apart).
- Give two shots if it is the first birth; give only one injection for subsequent deliveries.
- Calcium and iron supplements.

4. Pregnancy appointment schedule

For the first trimester, you can schedule a visit every four to five weeks.

For second trimester each four-week appointment

A weekly appointment is scheduled starting in the 36th week.

Week 40: Three-day appointments once a week

5. Abnormalities that require immediate medical attention

Apart from routine prenatal care visits, pregnant patients and their families also need to be informed about unusual symptoms that should be checked out right away. To reduce the risk to the mother and fetus, medical personnel will identify the cause and take prompt action.

5.1. The first trimester

This is regarded as a delicate period because, following fertilization, the ovum enters the uterus and is successfully implanted, starting the process of developing into a child. The mother's body starts to progressively adjust to being pregnant at this trimester and experiences obvious changes. In the event that you have any of the following symptoms, get help right away:

- Extreme vomiting that prevents you from eating or drinking, which weakens you and dehydrates you.
- Abdominal pain in the lower abdomen
- At times, the lower abdomen pains and feels heavy. This may indicate that a miscarriage is imminent.
- Bleeding in vagina. In the event of a successful implantation, the uterus will stop bleeding. Thus, vaginal bleeding may indicate an impending miscarriage or indicate a miscarriage that has already occurred. Vaginal bleeding may also occur when there is cervical ectropion or polype, especially if it is handled.
- The morning sickness sensation abruptly goes away. Most morning sickness cases last for around the first four and a half months. You should visit a doctor right away if the morning sickness feeling abruptly goes away during this time.

5.2. The second trimester

Pregnancy is thought to be at its most stable during this time. But it's also critical to recognize any potential anomalies.

- Headache, lightheadedness, blurred vision, or severe edema, particularly in the hands or face." You should see a doctor right away if you notice these symptoms in order to rule out preeclampsia and high blood pressure.
- Abdominal pain that is ongoing or getting worse.
- Chills or fever.
- Dysuria.
- Drooling or discharge from the vagina. Reexamining the pregnant lady is advised if vaginal bleeding or atypical vaginal discharge (such as a poor smell, itching, etc.) is observed.
- The frequency and strength of the pregnancy feeling are lower than they were in the preceding days.
- Fetal movement absent.
- Note that the belly does not grow or shrink.

5.3. The last trimester

In addition to the symptoms of the second trimester, labor also manifests as the following:

- Periodic, intense abdominal discomfort at different times.
- Vaginal discharge that is pink or watery.
- Back pain. Some pregnant women experience back discomfort instead than abdominal pain.
- Feeling tender in the lower abdomen.
- Showed up on the due date devoid of any labor symptoms.

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ANTEPARTUM FETAL SURVEILLANCE BY NON-STRESS TEST

OBJECTIVES

1. Describe the technique of measuring Non-stress test.
2. List the cases to measure Non-stress test.
3. Describe a non-stress test tape.
4. Classify a tape of Non-stress test.

CONTENTS

Assessing the health of the fetus is one of the main tasks of midwives when monitoring pregnancy, to detect abnormal signs of the fetus so that measures to prevent complications of the fetus, especially is stillbirth. Depending on the purpose of the assessment, the health status of the pregancy and the fetus, there are different methods of monitoring and evaluating the health of the fetus. One of the methods of assessing the health of the fetus is widely used clinically, does not pose a risk to the pregnancy and the fetus, is easy to implement and low cost, reliable predictive value is Non - stress test.

1. The role of Non-stress test method in antennal fetal assessment

In 1975, for the first time, Freeman, Lee and colleagues introduced a Non-stress test based on the assumption that the fetal heart rate will temporarily increase in response to fetal movement in the absence of acidosis status due to tissue hypoxia or neurological suppression. Later, more than 100 NST studies appeared in the English literature and various approaches to using this method were evaluated. Since then, *Non-stress test has been widely used as an independent trial or in combination with other trials to assess fetal health*

Non-stress test is the recording of the fetal heart when there is no ***uterine contraction*** *to investigate the changing response of the fetal heart rate when there is a pregnancy movement.*

As a rule, the fetal heartbeat and movements are one of the main techniques for assessing the health of the fetus. Therefore, one of the main tests used to evaluate fetal heart and fetal movement, in other words, the health of the fetus is the Non-stress test. For the most part, normal Non-stress results are reliable. This result means that fetal death rarely occurs within a week after the normal Non-stress test results. In a study of 1542 women who underwent non-stress testing on a weekly basis, Freeman et al. reported 109 out of 1000 false-negative results. Currently, fetal health is evaluated using a non-stress test. Prenatal treatment is most frequently utilized. In order to correctly identify fetal risks, reduce perinatal morbidity and mortality, as well as prevent potential complications, health professionals must regularly update their knowledge and abilities in prenatal fetal evaluation. Preterm birth risk is increased by needless intervention.

2. Description of usage

The fetal heart rate monitor, which consists of an ultrasound probe with two piezoelectric units, one of which continuously transects ultrasound to the fetal heart and the other of which receives echoes of the fetal heart reflex (fetal heart probe), is one of the three main components of a non-stress test done by an obstetric monitor. The other two components

are the amniotic fluid pressure recording unit and the amniotic fluid pressure recording probe.

Non-stress tests are only carried out at medical institutions that have obstetricians since it is important to utilize a monitor to record the signals of the fetal heart and analyze these signals for adequate and immediate treatment.

3. Non-stress test measurement technique

3.1 Principles of operating obstetric monitor:

- When the heart valve or red blood cell leaves move, the frequency of echoes from them changes.
- Each cardiac cycle will cause a cycle of reversal frequency changes
- Number of cycles to change the response frequency / minute corresponding to fetal heart rate / minute
- The distance between two cycles is used to calculate the immediate value of fetal heart value.
- Each instant value is represented by a point on the tape.

3.2 Pregnant women

Pregnant women who are well-prepared will lessen the impact of factors that alter the quality of signals or measurement findings from non-stress tests. Pregnant women will be urged to urinate first and eat properly before undergoing a non-stress test. Women who are expecting will be told to lie in the Fowler or left-handed posture. Pregnant women will be explained the purpose, measurement, and meaning of measurement of Non-stress test for pregnant women to be assured that they will cooperate with medical staff because the test of Non-stress test at least 20–40 minutes will limit the activity of pregnant women, as well as back pain due to prolonged lying... Women who are expecting must record any apparent fetal movements.

3.3 Medical staff

After completing four Leopold procedures for abdominal ablation, medical professionals conducted probes on the uterus at its base outside the abdominal wall without tightening it; the probe's head was inserted in the fetus's snout due to the fetal heart, and gel was used to fix it in place.

Before recording the non-stress test, check the environment.

- Verify that the time is current.
- Speed recording tape (1 cm per minute by default).
- Always begin the recording with a paragraph in white.
- Label the tape with the pregnancy code or name.
- Verify the tape's legality. In other words, the tape hasn't been ripped up or switched.**3.4 Measurement time of Non-stress test**

Non-stress tests typically last for 20 minutes, but they may need to go another 20 if they show aberrant results in the first 20. Continue to analyze the Non-stress test chart after the first 20 minutes have passed:

- The non-stress test may be stopped if it is normal.
- Non-stress testing can last up to 90 minutes and an additional 20 minutes if normal circumstances are not met.

The fetus's reduced fetal and intrinsic variations during sleep may be the rationale behind extending the non-stress test period. Most of the healthy fetuses in the 40% of cases where the heart rate did not increase in 40 minutes.

4. Indications for Non – stress test [2]

Prenatal fetal health assessment is beneficial for those with an obstetric history and current pregnancy that increase the rate of perinatal morbidity/mortality.

Obstetric history

- Maternal conditions:
  - Gestational hypertension
  - Abruptio placentae
- Pregnancy-related conditions:
  - Fetal growth restriction

Current pregnancy

- Maternal conditions:
  - Gestational hypertension
  - Preeclampsia
  - Pregestational diabetes mellitus
  - Advanced mother age
  - Car accident
  - Assisted Reproductive
  - Vaginal bleeding before labor
  - Medical diseases: hyperthyroidism, kidney disease, severe anemia…
- Pregnancy-related conditions:
  - Decreased fetal movement
  - Fetal growth restriction
  - Multi-pregnancy
  - Fetal growth restriction
  - Small fetus for gestational age
  - Pre-term labor
  - Breech presentation

What are the indications for Non–stress test

For all pregnancies, there are currently no recommendations for routine non-stress testing. However, the Non-stress test can be performed regardless of any risks.

Non-stress tests are used to evaluate fetal health in pregnant women who are not in labor and have gestational ages of less than 32 weeks.

In high-risk pregnancies, such as those with gestational diabetes, gestational hypertension, or intrauterine growth retardation, non-stress tests can be used to evaluate the health of the fetus.

The indication received during the test and the outcomes of the Non-stress test determine how frequently the test is conducted. It may be carried out once or twice per week in some circumstances.

In women with acute issues including placental abruption and umbilical cord prolapse, non-stress testing is not helpful in predicting outcomes or determining fetal well-being. Such urgent issues demand timely clinical evaluation and appropriate care.

5. How to read the results of Non-stress test

The sequences of reading the tape recorder

- Baseline
- Baseline variability
- Acceleration
- Deceleration

5.1 Baseline

The mean FHR rounded to increments of 5 beats per minute during a 10-minute segment.
Normal FHR baseline: 110–160 beats per minute, tachycardia: FHR baseline is greater than 160 beats per minute, bradycardia: FHR baseline is less than 110 beats per minute
The baseline must be for a minimum of 2 minutes in any 10-minute segment

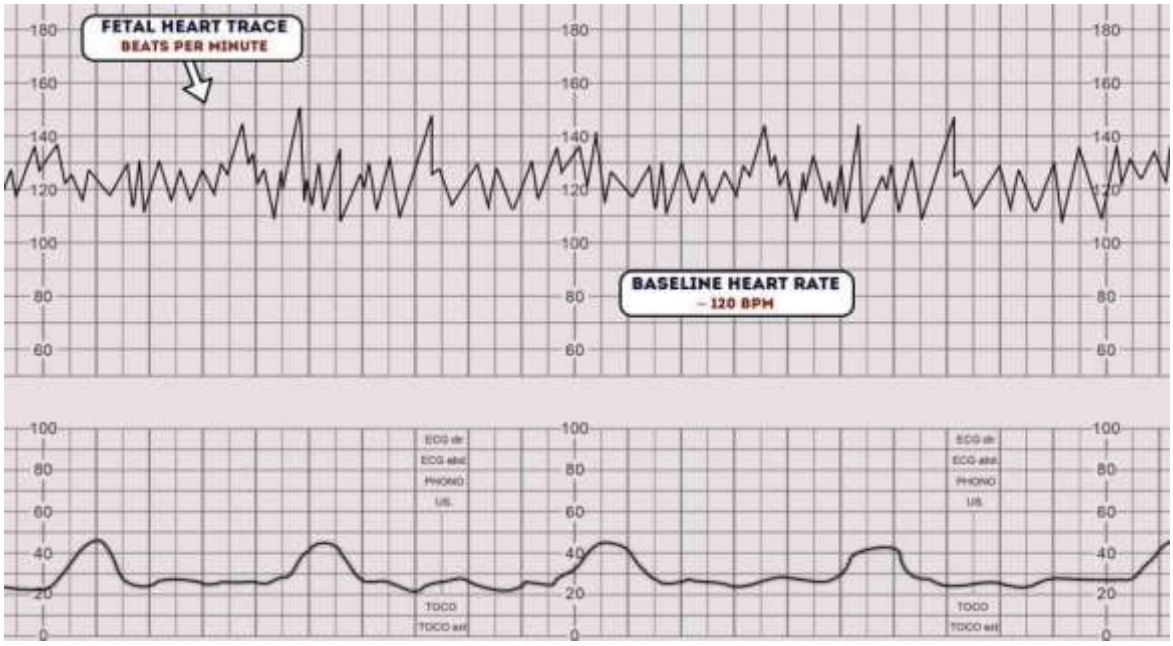

Fig 1. *Baseline [6]*

5.2 Baseline variability

Fluctuations in the baseline FHR that is irregular in amplitude and frequency
Variability is visually quantitated as the amplitude of peak-to-trough in beats per minute.
Absent—amplitude range undetectable
—Minimal—amplitude range detectable but 5 beats per minute or fewer
—Moderate (normal)—amplitude range 6–25 beats per minute—Marked—amplitude range greater than 25 beats per minute

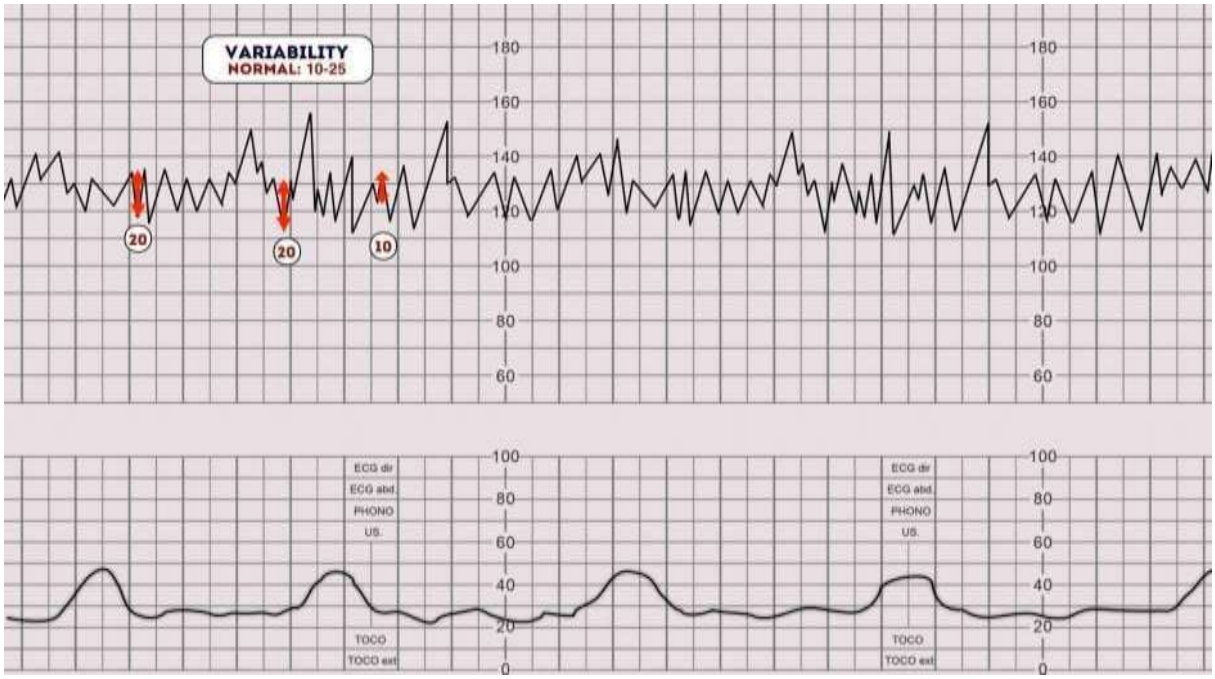

Fig 2. *Baseline variability [6]*

5.3 Acceleration

A visually apparent abrupt increase (onset to peak in less than 30 seconds) in the FHR

• At 32 weeks of gestation and beyond, an acceleration has a peak of 15 beats per minute or more above baseline,

with a duration of 15 seconds or more but less than 2 minutes from onset to return.

• Before 32 weeks of gestation, an acceleration has a peak of 10 beats per minute or more above baseline, with a

duration of 10 seconds or more but less than 2 minutes from onset to return.

• Prolonged acceleration lasts 2 minutes or more but less than 10 minutes in duration.

• If an acceleration lasts 10 minutes or longer, it is a baseline change.

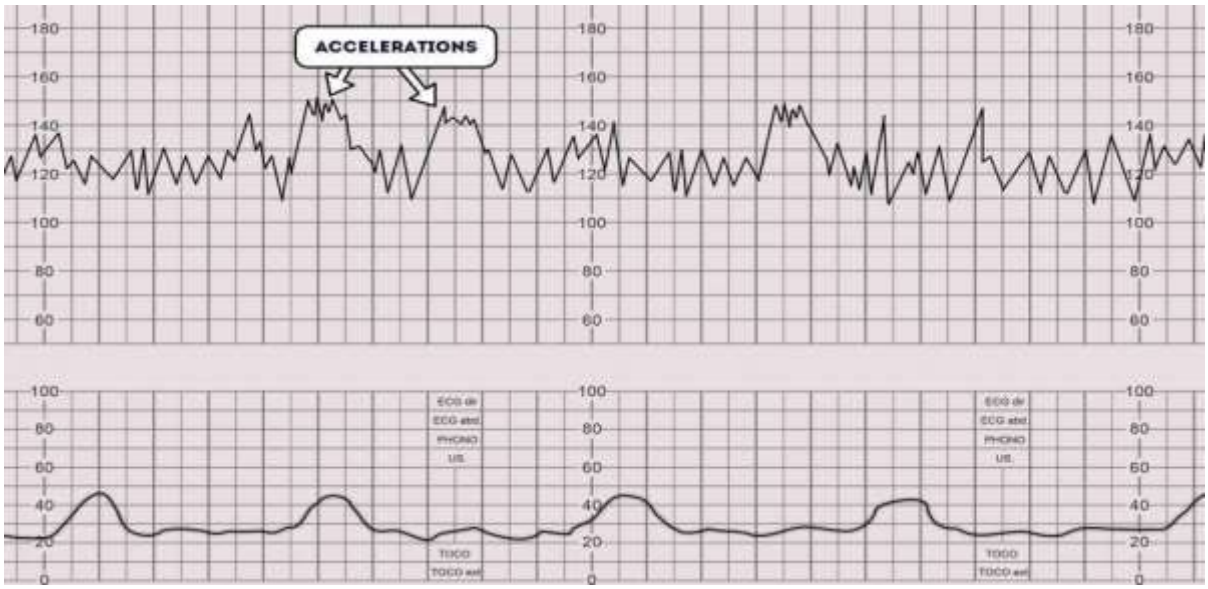

Fig 3. *Acceleration [6]*

5.4 Deceleration

5.4.1 Early deceleration

Visually apparent usually symmetrical gradual decrease and return of the FHR associated with a uterine contraction

A gradual FHR decrease is defined as from the onset to the FHR nadir of 30 seconds or more.

The decrease in FHR is calculated from the onset to the nadir of the deceleration.

The nadir of the deceleration occurs at the same time as the peak of the contraction.

In most cases the onset, nadir, and recovery of the deceleration are coincident with the beginning, peak, and ending of the contraction, respectively.

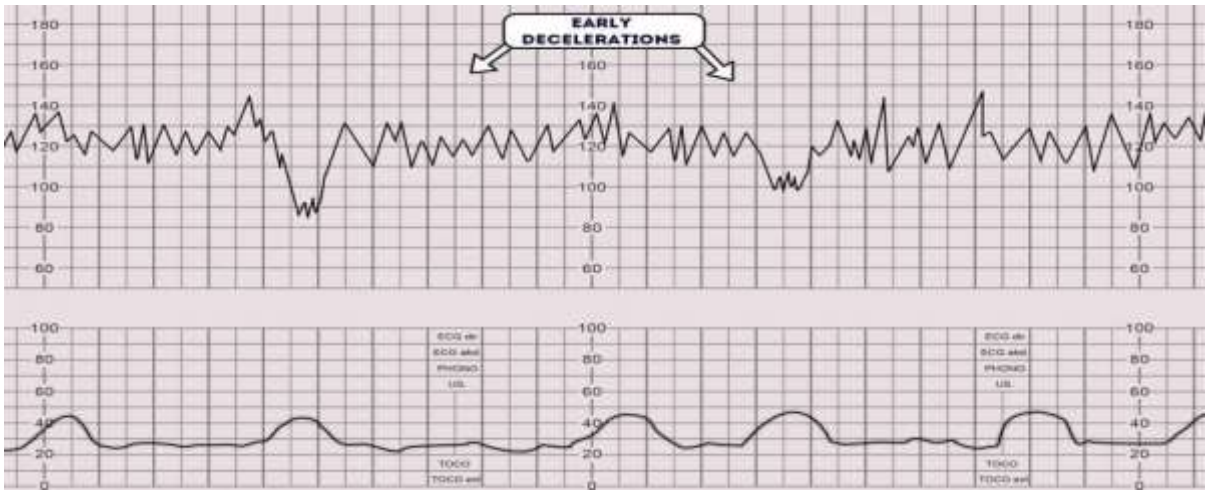

Fig 4. *Early deceleration [6]*

5.4.2 Late deceleration

Visually apparent usually symmetrical gradual decrease and return of the FHR associated with a uterine contraction

• A gradual FHR decrease is defined as from the onset to the FHR nadir of 30 seconds or more.

• The decrease in FHR is calculated from the onset to the nadir of the deceleration.

• The deceleration is delayed in timing, with the nadir of the deceleration occurring after the peak of the contraction.

• In most cases, the onset, nadir, and recovery of the deceleration occur after the beginning, peak, and ending of the contraction, respectively.

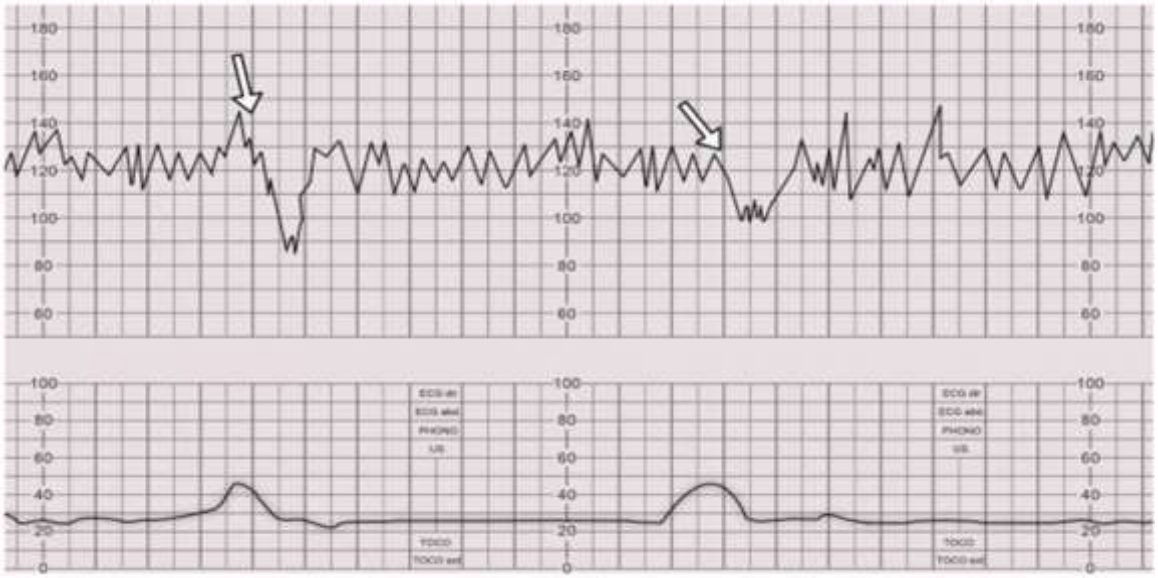

Fig 5. *Late deceleration [6]*

5.4.3 Variable deceleration

Visually apparent abrupt decrease in FHR

An abrupt FHR decrease is defined as from the onset of the deceleration to the beginning of the FHR nadir of less than 30 seconds.The decrease in FHR is 15 beats per minute or greater, lasting 15 seconds or greater, and less than 2 minutes in duration.

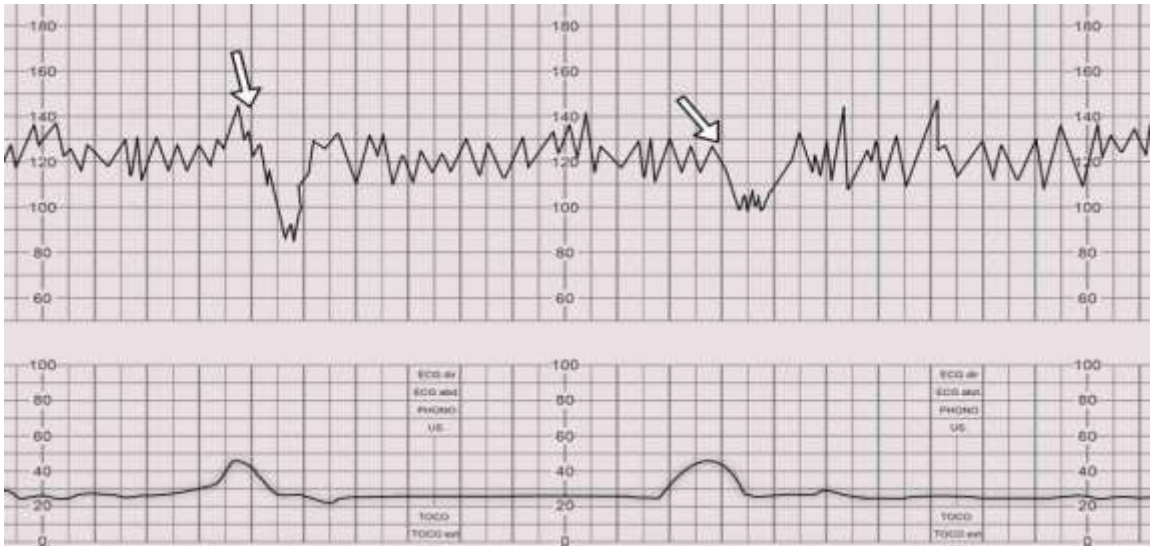

Fig 6. *Variable deceleration [6]*

5.4.4 Prolonged deceleration

Visually apparent decrease in the FHR below the baseline

Decrease in FHR from the baseline that is 15 beats per minute or more, lasting 2 minutes or more but less than 10 minutes in duration.

If a deceleration lasts 10 minutes or longer, it is a baseline change.

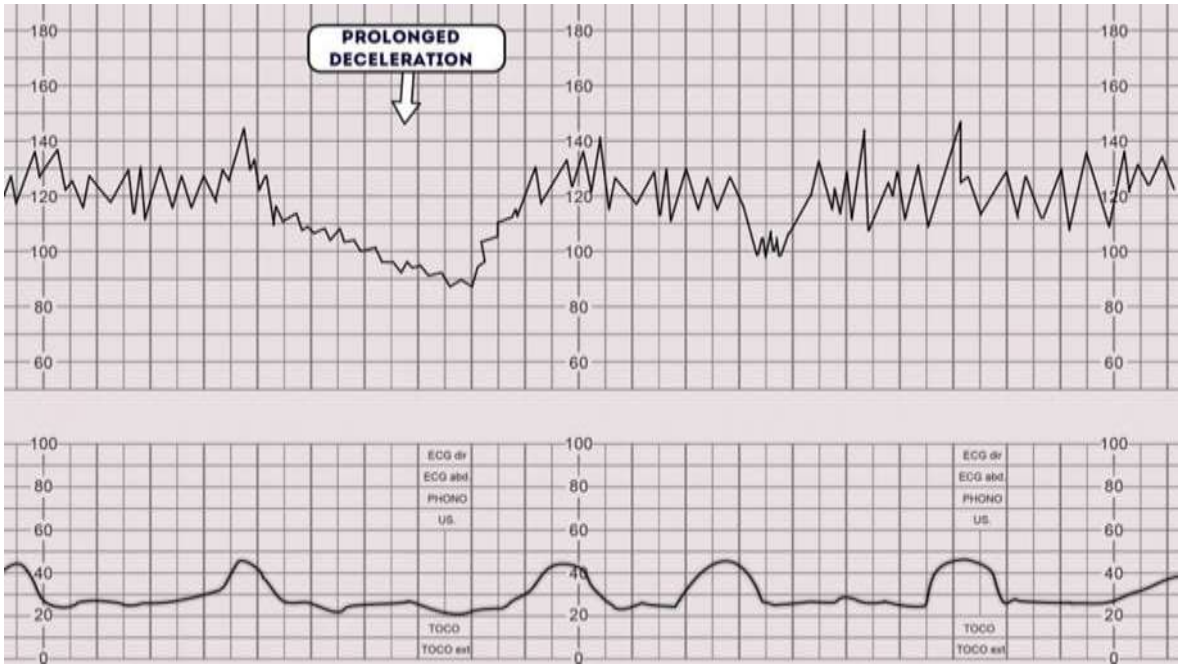

Fig 7. Prolonged deceleration [6]

Categorize of Non–stress test

Non-stress test results are classified into 2 categories as reactive or non-reactive [1].

Reactive	**Non-reactive**
Baseline: 110 – 160 bpm Variability: 10-25 beat Non-stress test results are reactive when there are at least two fetal movements that increase the fetal heart rate over a period of 20 minutes, each increase is at least 15 beats and lasts for 15 seconds, with no reduction. Meaning: The pregnancy is fine after 1 week	A nonreactive NST is one that lacks sufficient FHR accelerations over a 40-minute period (mother uses sedatives, narcotics, sleeping fetus) and calculates gestational age. Meaning: alarm. Need to double check with more valuable tests

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FETAL EDUCATION

OBJECTIVES

1. Present the general definition about fetal education
2. Describe about the method of direct fetal education
3. Present the definition of indirect fetal education

CONTENTS

Fetal education (education of the fetus from the time he/she is in the womb) is a very effective method to optimize the child's thinking ability, brain development, psycho-physiological stability, etc. creating a basis for continuing the educational process after the child was born.

1. Introduction about fetal education

Fetal education is a scientific method, an educational process with integrated many methods such as music, nutrition, light, language, etc. is started from the time the mother is pregnant to give the healthy development both physically and mentally for the fetus [1].

Practicing fetal education has been proven to bring great effects and benefits for both mother and fetus during pregnancy [1], [2]:

- The intelligence quotient (IQ) and emotional quotient (EQ) were high: research showed that children who were practiced fetal education will be more intelligent when they were born and because they were raised with love and positive emotions from the mother and people around her, they will have a higher emotional index than those who were not practiced fetal education.
- Stimulates fetal sensory development including sight, hearing, touch, smell, and taste
- Strengthening the immune system, helping the baby to be healthy, obedient, active, agile and less sick.
- Adaptable and have a lot of creative ability: children going through the process of fetal education often have independence in life, learn to be independent early, have the ability to adapt to different living environments, and have strong personalities, rich imagination, creative spirit, responsible for self, family and society.
- Developing a spiritual bond between mother and child, helping mothers reduce stress, maintain positive emotions, feel more comfortable and feel happier.

2. Direct fetal education method

Direct fetal education is carrying out early education for the fetus. Teach the fetus through exercises that affect the five senses of both mother and baby [2].

2.1. Hearing

Along with the development of the brain, the fetus can remember the types of sounds, and the earliest sound transmitted to the baby's brain is his/her mother’s voice. In the first three months of pregnancy, the baby's brain is in a period of formation and development, so the practice of auditory teaching during this period mainly maintains the mother's positive emotions, helps her relax, and happy. Starting from the 13th week of pregnancy, the fetus's hearing has begun to develop, at this time, practicing fetal education not only helps the mother relax and maintain positive emotions, but also helps the fetus

feel better. The fetus might have feeling relaxed, peaceful, and creating conditions for them to develop their hearing and musical appreciation [1].

At the week 27, baby's hearing has developed and he/she can hear and respond to external sounds. [3]; therefore, the best time to practice fetal education for children is from week 27 onwards. The fetus can then hear all kinds of sounds such as music, birdsong, running water, talking, telling stories, singing.

Music has an effect on a baby's brain development, research showed that listening to the song "Twinkle twinkle little star" five times a week during the last trimester of pregnancy had long-term and positive effects on the baby's brain development in children [4]. In addition, listening to music is not merely a simple auditory experience for children, but it also links distinct neural substrates, activating a wide range of social and emotional perceptions in children. Therefore, music can be considered as a useful tool for multi-sensory stimulation in infants [5].

Fetal education by music and singing can create early social interactions for babies from the time they are in the womb. In addition to enhancing auditory skills, through the organization of primary and secondary auditory brain regions, early experiences with music and singing can also be a way for infants to be sensitive to the dynamics of social interactions. When the mother sings or talks directly to the child, the mother's voice is not only related to the child's behavior but also carries emotional content [6].

Therefore, during this period, the fetus needs to hear soft, loving words, and gentle and clear lullabies that are repeated over and over, or father/mother can read for the child educational stories, or symphonic music, Mozart music, Beethoven music, or gentle rhymes, or father/mother can talk to the fetus, teach the child a language: Vietnamese or a foreign language.

2.2. Sighting

Around week 7 of pregnancy, the major parts of the eye - the cornea, iris, pupil, lens and retina - begin to develop, and they are almost fully formed just a few weeks later. Around the 10th week, the eyelids are formed and closed until the 27th week of gestation. At 27 weeks, baby's eyes are open and he/she can blink in response to light. If shining a flashlight on the mother’s belly, the mother can feel the baby respond with a series of swaying and wiggling [7]. Therefore, sight fetal education for fetus at this stage is appropriate

The visual education of the fetus is mainly done indirectly through the mother's vision. What the mother sees affects the mother's mood and consciousness, thereby affecting the fetus' psychology.

The mother can practice daily the following exercises:

- The mother looks at beautiful scenes, beautiful pictures: sunrise, sunset, green trees, fresh flowers, watercolor paintings, pictures of beautiful babies, beautiful landscape paintings, etc. avoid looking at anything evil or violent, monstrous.
- The mother looks at the lovely children, or the people she loves, and respects
- The house is neat, clean, beautifully decorated, with fresh flowers in the room

- The mother dresses elegantly, neatly, confidently with her image. When a mother looks in the mirror and feels satisfied with her self-image, she will associate a beautiful image of her baby in the future

2.3. Smelling

At 6 weeks of pregnancy, the baby's nose has begun to form, by 27-28 weeks, the fetus can completely smell; however, in the fetal environment, the function of the nose is not effective until after the baby is born that the sense of smell quickly takes effect and the baby is able to turn his head to find the mother's breast. Therefore, the time in the uterus is a stage to prepare the baby's sense of smell, and the mother can practice smelling exercises such as: smelling her favorite scents such as perfume, flowers, plants, or the smell of favorite foods.

2.4. Touching

Fetal education about touching is the act of influencing to create stimulation on the mother's abdomen, helping the baby to be healthy, active and agile. From the 16th week of pregnancy, the fetus has started to have the first movements, but at this time most mothers do not feel it until between 18 and 24 weeks that the mother can feel the fetus movement [8]. Therefore, the right time to practice the fetal education by touching is when the mother feels the fetus movements. Tactile exercises such as the mother patting the abdomen during pregnancy, gently massaging the abdomen, stroking the belly while talking to the baby, or the father rubbing the mother's back also help the baby feel happy, happiness, peace of mind.

2.5. Tasting

Baby's tongue and palate begin to form at 6 weeks of pregnancy. At 11 weeks, taste buds appear for the first time, but they can't transmit the actual sense of taste to the fetus until 13 to 15 weeks. By the week 20, many of baby's taste buds - and his/her neural connections - are fully formed and functioning. When the mother eats, the molecules of the food pass through the blood and into the amniotic fluid, and some studies show that the food a mother eats during pregnancy affects the child's taste later in life. In a small study done in 46 pregnant women who drank carrot juice during the last weeks of pregnancy and while they were breastfeeding, the results showed that when the baby was 6 month olds seem to prefer carrot-flavored cereals over regular cereals. Experiments were also done with garlic, anise (a licorice-flavored spice), mint, and vanilla. Infants exposed to these flavors in the womb tend to prefer these flavors both in breast milk and solid foods during the weaning period [9].

Starting in the second half of pregnancy, the foods a mother eats can affect the flavors the baby will like later on; therefore, pregnant women need to pay attention to the taste of their food and drinks so that the fetus always enjoys when absorbing delicious and nutritious flavors and nutrients from the mother. The mother should eat a diet that is as varied and healthy as possible. The mother only needs to keep in mind the basic food safety rules for pregnancy (for example, do not eat raw ovums, raw fish, or unpasteurized milk).

3. Indirect fetal education method

3.1. Definition

Indirect fetal education is a method of using measures to directly take care of the mother's body in terms of nutrition and spirituality, avoiding negative stimuli for mother and baby [2]. This method helps the fetus to receive all the actions, thoughts and feelings of the mother during pregnancy

3.2. How to perform indirect fetal education

- Prevention of harmful stimuli for the fetus: do not use stimulants such as alcohol, beer, tobacco; limit the use of drugs when there are no indications; avoiding to contact with people who have colds or viruses.

+ *Fetal education about spiritual:*

- During pregnancy, mothers need to pay attention to keep their spirits healthy, happy, and should think of good things in the future. Create for yourself a gentle, comfortable environment, remove worries and troubles, live in moderation and rules. In addition, pregnant women should enjoy melodious music, beautiful natural scenes, and elegant works of art, should read all kinds of fairy tales stories, poems and books about children's education, etc. In conclusion, pregnant women need to keep themselves feeling full of happiness, because that feeling of happiness will produce beneficial endocrine substances, thereby giving the fetus the richest source of spiritual nutrition.
- The role of the husband: need to treat his pregnant wife intimately, close, warm and affectionate, always trying to bring her joy and humor. Comfort, care about material and spiritual life for his wife. Regularly take his wife for a walk, talk with her, be a solid spiritual support for her.

+ Fetal education about nutrition: it is necessary to pay attention to a reasonable diet for both mother and child during pregnancy. Nutrition must be complete, variety foods, eat with rules and absorb a moderate amount. Pregnant women should not eat too much or eat less, divide meal into many meals, eat less salt and liquid foods, eat less fat and spicy food. Should eat more garlic and sweetness in a reasonable way.

4. Conclusions

All family members need to love and help the pregnant woman take care of the fetus carefully and thoughtfully, which is a good way to practice fetal education. In order to be effective fetal education, pregnant women need to do it gently, moderately, and in moderation. The impact on the mother's abdomen during pregnancy such as abdominal rubs, abdominal massage, and abdominal patting should be done gently, on time, repeated during pregnancy, and the forms of fetal education must be appropriate for each stage of fetal development.

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NUTRITION DURING PREGNANCY

OBJECTIVES

1. State the appropriate weight for pregnant women during pregnancy
2. Present the nutrition needed for pregnant women during pregnancy
3. Applying the concept of safe nutrition in pregnancy care

CONTENTS

Adequate nutrition is one of the best things women can do during pregnancy. Good nutrition helps pregnant women meet the additional needs of the fetus as the pregnancy progresses. The purpose of a balanced diet is to support fetal growth and maintain a healthy weight.

1. Weight

Pregnant women only need to increase their energy intake, from 100 kilocalories (kcal) per day during the first trimester to 300 kcal during the second and third trimesters. Pregnant women need 10–15% more calories than they did before pregnancy, especially during the last months of pregnancy [1]. This amount of energy can be provided by small amounts of food; however, pregnant women often overestimate their energy needs. Recommended increases depend on basal metabolic rate, lifestyle, physical activity, and preconception BMI.

The recommended weight gain during pregnancy for women of normal weight is 10–16 kg for those with a normal BMI, 13-18kg for underweight women, 7-11kg for overweight women, and 5-9kg for obese women [2]. Too much or too little weight gain is not good for pregnancy. For example, for every kilogram of weight gain above the recommendations, the risk of a child becoming obese in adulthood increases by 8%, just as women who gain weight above the recommendation have an increased risk of having a baby are 3.4 times weight higher than those women who gain weight as recommended, so it is easy to lead to complications such as postpartum bleeding, cesarean section. [3].

If the mother was a normal weight before pregnancy (BMI about 18.5-24.9): the ideal weight gain of the mother is between 10-12 kg. The specific distribution is as follows:

The first trimester: increase 1 kg

The second trimester: increase 4 – 5 kg

The third trimester: increase 5 – 6 kg

The mother should always maintain a healthy weight before and during pregnancy, this will help the fetus develop stably. Pregnant women can stabilize their own weight through a reasonable diet with appropriate energy levels as mentioned above.

Table 1. Weight gain during pregnancy based on BMI [2]

BMI of mother	***Recommend weight gain***	
	Singleton fetus	***Twin***
Underweight (BMI <18,5)	13-18 kg	
Moderate (BMI = 18,5-24,9)	10-16 kg	17-25 kg
Overweight (BMI = 25-29,9)	7-11 kg	14-23 kg
Obese (BMI ≥30)	5-9 kg	11-19 kg

2. Nutrition during pregnancy

2.1. Protein

During pregnancy, it is important to consume adequate amounts of protein because it is the basic building block for maternal and fetal tissues. Protein requirements in the first half of pregnancy are roughly the same as for non-pregnant women, ranging from 0.8–1.0 g/kg per day or 10–15% of energy requirements, and in the second half of pregnancy period is 1.1g/kg per day. Teenage pregnant women need more protein, 1.5g/kg of protein per day. Recommended sources of protein are reduced-fat dairy products, fish and lean meats; proteins from vegetable, such as legumes, nuts and seeds, although the vegetable protein content is lower than that of animal products. For instance, 100g of cooked meat contains 25–35g of protein, 120g of fish contains 25–30g of protein, an ovum has 6g of protein, a thin slice of cheese has 15g of protein, while 150g of beans contains only 15g of protein. [1].

2.2. Sugar

Sugar is a source of energy for both mother and fetus. The amount of sugar required for pregnant women is the same as that recommended for the general population (50–60% of calories). Maintaining an appropriate level of sugar helps control blood glucose levels and protects against ketosis. Recommended sources of sugar are whole-grain products and potatoes, which should be boiled or baked and not deep-fried.

Sugar consumption should be limited and should not exceed 5% of energy intake or 25g (five teaspoons). Excess sugar levels can increase the risk of obesity and gestational diabetes. Pregnant women should avoid sugary soft drinks because they increase the risk of pre-eclampsia and premature birth.

2.3. Lipid

Fats are an integral part of the diet and a source of energy; they are also necessary for many metabolic processes.

Pregnant women do not need to change the amount of fat in their body. The recommended amount is 30% of total energy consumption. However, the choice of fat is very important. Both fatty acids - eicosapentaenoic and docosahexaenoic acids - are essential for the development of the baby's brain and retina, and they reduce the risk of premature birth, the baby's risk of future cardiovascular diseases and the risk mother has perinatal depression. Fatty acids are especially important during the second and third trimesters of pregnancy. The recommended intake of docosahexaenoic acid is 200–300 mg/day, which can be ensured by two servings (150–300g) of fish per week, of which one portion should be oily fish (e.g. herring, salmon, pilchard) [1]. However, attention should be paid to fish selection and cooking: fish should be grilled, steamed or baked in the oven; and salted, pickled, salted or smoked fish should not be used. Eating too much fish can lead to too much mercury being absorbed, which can harm a child's nervous system. The amount of mercury depends on the type of fish and the geographical area (large fish in the ocean contain more mercury).

If pregnant women don't eat fish, they can choose plant-based fatty acids, e.g. α-linolenic acid, found in flaxseed and hemp. However, only a portion of α-linolenic acid is converted to eicosapentaenoic and docosahexaenoic acids in the human body, and pregnant

women need to be supplemented with fatty acids in oral form. Fish oil supplements are not recommended because of their high vitamin A content, fatty acid-containing foods are recommended during pregnancy, such as ovums and milk. Saturated fats found in butter, cream, fatty meats and palm oil should be limited, and trans fatty acids, commonly found in partially hydrogenated vegetable fats, should be avoided, such as in dairy products and confectionery.

2.4. Fiber

The amount of fiber needed for pregnant women is 30–35g [1].

Fiber is needed to prevent constipation and thus reduce the risk of hemorrhoids for pregnant women; It also reduces the risk of gestational diabetes and preeclampsia. Furthermore, fiber-rich products contain minerals, vitamins and other biologically active substances. The main sources of fiber are whole-grain products (for example, whole-grain bread, porridge or pasta), legumes, fresh and dried fruits, vegetables, nuts and seeds . The required amount of fiber can be absorbed in a balanced diet.

2.5. Vitamins and minerals

The need for vitamins and minerals during pregnancy is much higher than the need for energy supplements; therefore, pregnant women should pay attention to the quality of food they eat and balance their diet.

Most women only need nutritional supplements after the fourth month of pregnancy, but supplementing with certain micronutrients, such as folic acid, iodine and iron, is important before conception and during early pregnancy.

Table 2. Daily supplement of micronutrient for mother during pregnancy and breastfeeding period according to the recommendation from World Health Organization (WHO) [1]

Micronutrient	**Recommendation from WHO**
Vitamin A, µg	800,0 µg
Thiamine (vitamin B_1), mg	1,4 mg
Riboflavin (vitamin B_2), mg	1,4 mg
Niacin (vitamin B_3), mg	18,0 mg
Vitamin B_6, mg	1,9 mg
Vitamin B_{12}, µg	2,6 µg
Vitamin C, mg	55,0 mg
Vitamin D, µg	5,0 µg
Vitamin E, mg	15,0 mg
Folic acid, µg	600,0 µg
Iron, mg	27,0 mg
Zinc, mg	10,0 mg
Copper, mg	1,15 mg
Selenium, µg	30,0 µg
Iodine, µg	250,0 µg

Micronutrient	Recommendation from WHO
Calcium, g	1,5-2,0 g

2.6. Water

The volume of fluid needed per day is 2–2.5 liters, mostly in the form of water.

The volume of water consumed should be increased gradually as the pregnancy progresses. During the last months of pregnancy, the required volume increases by 300 ml/day. The volume of water intake required depends on a woman's body mass: the recommended amount of water (from both food and drink) is 35 ml/kg body weight per day and not less than 1.5 l /day. Pregnant women need to drink more water when the weather is hot and during hard work. An adequate amount of water not only ensures vital functions, but also reduces the risk of urinary infections, urinary stones and constipation.

2.7. Caffeine

Large amounts of caffeine inhibit the growth of the fetus, so pregnant women are not recommended to take more than 200 mg / day.

The amount of caffeine in foods and beverages varies; however, two cups of coffee or three cups of tea contain 200 mg of caffeine. Pregnant women should avoid caffeinated beverages during pregnancy. Here are a few drinks and their caffeine content [6]

1 can of soft drink: 40 mg

1 cup of tea: 75 mg

1 can of energy drink 250 ml: up to 80 mg

1 instant coffee cup: 100 mg

1 pure coffee cup: 140 mg

1 Chocolate cup: 31 mg

A cup of decaffeinated coffee: 12 mg

A cup of hot chocolate: 9 mg

2.8. Alcohol

Drinking alcohol, beer and alcohol-containing substances during pregnancy is harmful to the fetus.

Children who are heavily exposed to alcohol before birth can experience a number of physical and mental disorders before and after birth and throughout life. Newborns are at increased risk for growth impairment and neurological disorders, leading to serious learning and behavior problems [7], [8]. Children exposed to smaller amounts of alcohol may develop similar but milder symptoms.

Research has demonstrated that heavy maternal alcohol consumption is associated with increased risk to the fetus, and that "safe" amounts of alcohol that will not harm the baby have not yet been determined or standardized. There is evidence that drinking more than one alcoholic beverage per day during pregnancy increases the risk of preterm delivery and low birth weight. Therefore, the only "safe" level is complete abstinence during pregnancy and lactation.

3. Nutritional balance during pregnancy

The amount of nutrients listed above can be provided in a balanced and comprehensive diet, with the exception of folic acid and iodine, all pregnant women do not need vitamin supplements.

A comprehensive, balanced diet is: includes all protein product groups (vegetable and animal), fats (preferably unsaturated fats), sugars and fruits. Healthy products from each product group should primarily contain a variety of foods. Ideally, the diet should include foods containing seasonal fruits, berries, and vegetables and recommended foods in quantities determined for each individual based on weight, physical activity level, and physical activity levels and possible metabolic problems.

The best source of cereals should be whole-grain products. Whole grain products and potatoes are good sources of complex carbohydrates and contain significant amounts of vitamins, minerals and fiber. Large amounts of fats and oils should be avoided during their preparation (e.g. crisps).

Vegetables and fruits are good sources of vitamins, minerals and antioxidants. It is recommended to eat five servings of fruit and vegetables per day (≥ 400–500 g), a ratio of vegetables to fruits. Vegetables should be eaten raw; Preserved, salted and deep-fried vegetables should be avoided. They can also be stewed, cooked into soups or lightly fried. Fruit in general should be eaten fresh and consumption of canned fruit should be limited. Juice should contain 100% fruit, and fruit drinks and nectarines that contain less fruit and have been sweetened with sugar, sweeteners or other undesirable additives should be avoided.

Dairy products are a good source of protein, calcium, iodine, and other nutrients. High-fat varieties and yogurts that contain large amounts of sugar or artificial sweeteners should be avoided, preferring unsweetened fermented products, such as buttermilk and natural yogurt. Cheese is also an important source of protein and calcium.

The best protein products are lean meats and ovums. Meat is an important source of iron. Meat should be stewed or oven-baked, but not overcooked. Products such as sausages, smoked meats and ham should be avoided as their protein content is much lower than raw meat and they contain large amounts of salt, fat and often unwanted food additives. Fish is an important source of omega-3 fatty acids and vitamin D; should be eaten twice a week, one of which should be oily fish (eg herring or salmon). Plant-based foods, such as legumes (beans, lentils, peas), nuts are another important source of protein.

The oil should contain adequate amounts of monounsaturated fats (olive oil, canola oil) or omega-3 fatty acids (linseed oil).

4. Safe nutrition

A pregnant woman's immune system is partially suppressed during pregnancy, increasing her risk of food-borne infections. Therefore, all hygienic requirements must be respected during cooking, with proper temperature treatment for ovums, meat and fish. Single-celled Toxoplasma gondii is found in undercooked produce of animal origin, and vegetables and berries can also become contaminated with toxoplasma larvae if they come into contact with infected soil. In addition, all vegetables and fruits that might contact with the soil should be washed carefully to remove disease-causing spores, and women should avoid eating meat that has not been heat-treated or only mild heat-treated during pregnancy, as larvae persist in frozen and smoked meat. To avoid infection with Toxoplasma gondii:

- Washing hand with soap,

- Meat must be properly cooked, and
- All kitchen equipment and utensils must be washed carefully after use.

Listeriosis is caused by the bacteria Listeria monocytogenes found in food products that have not been stored properly. Listeria bacteria proliferate very slowly in the refrigerator, but when entering the mother's body, this bacteria can cross the placental barrier and infect the fetus. To avoid Listeria infection, regular cleaning requirements should be observed:

- Do not consume raw, unpasteurized milk and its products;
- Food with an inappropriate shelf life must not be consumed, and the food must be stored appropriately; and
- Soft cheeses made from unpasteurized milk should be avoided (usually stated on the package)

Undercooked products of animal origin also increase the risk of other infections, such as salmonella.

5. General recommendation

- Do not eat undercooked products of animal origin, such as raw meat, undercooked meat products such as sausages and hams, undercooked fish and seafood (e.g. sushi), smoked fish, unpasteurized milk and raw ovums.
- Uncooked and sprouted nuts and beans should be avoided.
- Frozen meat should not be defrosted or marinated at room temperature, but in the refrigerator.
- Soft cheeses should be avoided unless the label clearly states that the product is made from pasteurized milk.
- Vegetables and fruits should be washed carefully before use.
- Products grown in or near soil should be stored separately from other products.
- Food should be eaten immediately after cooking.
- Hygiene requirements should be strictly followed: hand washing, adequate food storage and use of separate kitchen utensils for cooked and uncooked products.

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PHYSICAL ACTIVITY DURING PREGNANCY

OBJECTIVES

1. Analyze the benefits of physical activity during pregnancy.
2. Analyze the changes in anatomical and physiological responses affecting physical activity during pregnancy.
3. Analyze the fetal responses to maternal physical activity during pregnancy.
4. Analyze the steps for counseling physical activity during pregnancy

CONTENTS

Physical activity is defined as any movement of the body created by muscle contractions. It helps reduce the risk of overweight, obesity, gestational diabetes, gestational hypertension, pre-eclampsia, caesarean section, antenatal and postnatal depression.

This healthy lifestyle needs to be maintained before, during and after pregnancy to improve maternal and fetal health and pregnancy outcomes. Physical activity is beneficial for most pregnant women, fetuses and pregnancies. However, some habits of physical activity need to be adjusted to fit the changes in anatomy and physiology during pregnancy.

Assessing the health status of the mother, fetus, and pregnancy carefully before proposing exercises for pregnant women, especially high-risk pregnancies, to avoid complications.

1. Benefits of physical activity during pregnancy

The biggest change for pregnant women during pregnancy is weight gain leading to obesity. Excess weight and obesity increase the risk of gestational diabetes, pregnancy-induced hypertension, pre-eclampsia, and delivery complications. Physical activity helps pregnant women control weight gain within safe limits, thereby reducing the risk of health complications during pregnancy, labor, and postpartum.

1.1. Pregnancy

Reducing the rate of overweight and obesity

- Increasing metabolism, building muscle, burning calories and fat tissue helps maintain weight at a moderate level, avoiding overweight and obesity.

Reduce the risk of gestational diabetes

- Promote bone muscle cells to increase glucose uptake
- Improve the function of the pancreas to increase the production of protein that transports insulin. Thus, it helps stabilize blood sugar levels and reduce the risk of gestational diabetes.

Reducing the risk of high blood pressure during pregnancy, pre-eclampsia

Pregnancy is considered a challenge to the cardiovascular system, requiring adaptation to physiological changes including increased blood volume, cardiac output, formation of new blood vessels, decreased vascular resistance, and stiffness of blood vessels.

Disorders of the cardiovascular system such as high blood pressure and preeclampsia are caused by the cardiovascular system's inadequate response to the changes during

pregnancy. Insufficient development of the arteries in the uteroplacental circulation leads to local ischemia and the generation of a large amount of free radicals causing oxidative stress, which is a major factor in the development of preeclampsia. Furthermore, free radicals activate white blood cells and peripheral capillary endothelium, leading to inflammation and endothelial dysfunction.

- Maintaining regular physical activity:
    - Improves cardiovascular function by strengthening the vasculature, supporting adaptation to the physiological changes of pregnancy.
    - Improves endothelial function: reduces oxidative stress, decreases pro-inflammatory cytokines such as CRP, IL-18, IL-8, and increases anti-inflammatory cytokines such as IL-10.
    - Balances vasoconstrictor factors (reduces vasoconstrictors such as endothelin and norepinephrine) and vasodilator factors, reducing resistance and stiffness of the vasculature to adapt to pregnancy.

Through these effects, physical activity should be started early and maintained to improve cardiovascular function appropriate for pregnancy, supporting a decrease in the incidence of high blood pressure and preeclampsia.

Reduce back pain, constipation

The focal point of the changes in pregnancy is the forward shift of the center of gravity due to weight gain and fetal development, leading to spinal curvature and back pain in pregnant women. Physical activity helps control weight at a moderate level, reduces the rate of fetal growth, increases muscle strength, flexibility of the ligaments, and thereby reduces spinal deformity and back pain.

- Improves bowel motility to support reducing constipation in the later stages of pregnancy.

Reduce depression during pregnancy

- Promotes the secretion of hormones that improve the psychological state of pregnant women: increases the secretion of dopamine, Gaba, serotonin, endorphins and reduces the secretion of hormones cortisol, IL-6, etc.
- Positive pregnancy experiences can reduce discomfort such as back pain, constipation, etc…..

Reduce the rate of fetal growth

- Reducing the rate of overweight, obesity, gestational diabetes thereby reducing the rate of fetal growth.

1.2. Labor and delivery

Reduce the rate of cesarean delivery, instrumental delivery

Regular exercise helps pregnant women regulate their breathing to suit their body condition, which is important during labor and delivery. Proper breathing can maintain stable oxygen levels, reduce pain, anxiety, fatigue, and provide enough oxygen and nutrition to the fetus for a successful delivery.

In addition, there are the following benefits:

- Enhance the function of the heart, lungs, muscles, and ligaments to adapt to increasing contractions during labor.

- Reduce the rate of macrosomia, and shoulder dystocia.

The above benefits promote successful delivery, reduce the rate of prolonged labor, obstetric pain, cesarean delivery, and assisted delivery.

1.3. Postpartum.

– Mothers quickly regain their pre-pregnancy weight and shape after childbirth.
– Reduce the rate of postpartum depression.

2. Physiological changes affecting physical activity

Changes in anatomy and physiology during pregnancy should be taken into account to avoid risks during physical activity.

Blood volume, heart rate, and cardiac output increase but flow rate decreases during pregnancy to maintain stable levels of oxygen and nutrients for the mother and the fetus during both activity and rest. The supine position during physical activity increases the pressure on the inferior vena cava and uterine artery. The reduced flow rate due to physiological changes and compression leads to decreased blood flow to the fetus. The position also hinders the return of blood from the inferior vena cava to the heart, leading to low blood pressure and an increased risk of venous stasis. Therefore, it is recommended not to exercise in a supine position from week 20 onwards to avoid pressure on the major arteries and veins.

Exercises that involve reduced oxygen reserves, such as diving, are not recommended during pregnancy.

Strenuous physical activity (training for competition) can cause disturbances in acid-base metabolism in fetuses. Therefore, it is necessary to limit high-intensity physical activity for pregnant women, especially in cases of overweight and obesity, to avoid adverse effects on fetuses and pregnant women.

The regulation of body temperature in pregnant women and fetuses depends on the process of water absorption, excretion, and environmental factors. During exercise, it is necessary to ensure adequate water supply for the body before, during, and after exercise, a well-ventilated environment, loose clothing, and avoid contact with high temperatures and humidity to stabilize body temperature for pregnant women. The pregnant body can cool down quickly while the fetus still maintains a high body temperature due to incomplete thermoregulation function, leading to increased and sustained demand for oxygen consumption.

Exposure to high heat sources such as hot baths, dry saunas, or high fever may increase the risk of neural tube defects in fetuses. However, no correlation was found between exercise and neural tube defects in fetuses.

Weight gain of the mother and fetus changes the center of gravity of the pregnant woman forward. The change in center of gravity leads to an increased risk of falling. Therefore, imbalanced postures, such as standing on one leg or leaning forward, are not recommended for exercise during pregnancy.

Relaxin hormone secretion increases during pregnancy, which helps ligaments and bone joints become soft and flexible, adapting to the development of the fetus and preparing for childbirth. However, changes in the curvature of the spine, loose joints and ligaments can

cause back pain and joint pain in the lower limbs. Therefore, it is necessary to avoid exercises that increase pressure on the spine and joints of the lower limbs to reduce back pain and joint pain for pregnant women.

3. The impact of physical activity on the fetus

Changes in heart rate and weight are some of the effects found of physical activity on the fetus. Studies have shown that fetal heart rate increases by 10-30 beats per minute compared to baseline during or after maternal physical activity. Maternal high-intensity exercise during the last three months of pregnancy is likely to result in delivering a baby weighing 200-400g less than the control group, although it does not increase the risk of adverse effects on fetal development.

A study evaluating blood flow in the umbilical artery and fetal heart rate before and after strenuous physical activity during the second trimester found no differences in fetal heart rate and blood flow in the umbilical artery between the group of pregnant women who engaged in strenuous physical activity and those who engaged in moderate physical activity after 30 minutes of exercise. However, if high-intensity physical activity is maintained regularly, it can be harmful to the fetus.

4. Advice on exercise during pregnancy

4.1. Motivating pregnant women

Pregnancy is a time that requires pregnant women to adjust their behavior and practice a healthy lifestyle to ensure the health of both the mother and the fetus. Using motivational counseling tools such as the Five A's (Ask, Advise, Assess, Assist, and Arrange) in advising physical activity and diet can help pregnant women control weight gain and increase physical activity.

4.2. Guidance on physical activity

The principles governing exercise for pregnant women are no different from those for the general population. Thorough clinical assessment should be conducted before proposing a physical activity program to ensure the safety of both the mother and the fetus. Ensure a minimum average intensity of physical activity for 20-30 minutes/day and 5-7 days/week. Overweight pregnant women should start with gentle exercises, low intensity, and gradually increase.

Delayed heart rate response has been reported in pregnant women with strenuous exercises. Using the "talk test" is another way to measure effort: if a pregnant woman can continue to talk during physical activity, it means she is not exerting too much. Pregnant women should maintain adequate hydration before, during, and after physical activity by continuously supplementing with water and avoiding supine position from week 20 onwards.

Pregnant women who did not or rarely engage in physical activity before pregnancy should start with gentle exercises for a short period and gradually increase intensity over time. Pregnant women who regularly engage in physical activity before pregnancy can participate in moderate-intensity exercise programs such as jogging and aerobic exercise. High-intensity exercise or exercises lasting more than 45 minutes can lead to low blood sugar. Therefore, pregnant women should supplement enough calories before and after exercising and not exceed the prescribed time.

Pregnant women should exercise in a cool environment and avoid prolonged exposure to high temperatures to prevent complications for themselves and the fetus. The pregnant body temperature may increase, but it can quickly decrease due to the body's cooling mechanism. However, the fetal heat-regulating system is not mature enough to cool down as quickly as the mother's body. High fetal body temperature leads to an increase in oxygen consumption. Pregnant women should exercise in a suitable temperature environment, and body temperature can increase by about 1.5°C after 30 minutes of exercise and remain within the safe range.

Physical activity during pregnancy can cause water loss and may lead to an increase in uterine contractions. Therefore, attention should be paid to providing enough water before, during, and after exercise.

Pregnant women with normal weight can maintain exercise with intensity of 30-90 minutes per session, 3-4 times per week without increasing the risk of premature birth or decreasing the average gestational age at delivery. Some studies recommend against complete bed rest as there is no reliable evidence to support it for preventing preterm birth.

Prolonged bed rest or limited physical activity increases the risk of venous thromboembolism, osteoporosis, and decreased mobility. Limiting activity should not be regularly recommended as a treatment to reduce premature birth.

4.3 Cases that require consultation before starting physical activity

4.3.1. Gestational hypertension, preeclampsia, eclampsia

Pregnant women with gestational hypertension, preeclampsia, or eclampsia should maintain or start physical activity during pregnancy. However, it is necessary to consult with healthcare professionals to select appropriate exercises and workout times that are suitable for their health conditions, in order to avoid any risks

Pregnant women with mild hypertension I degree (140/90-160/95 mmHg) can maintain or start physical activity during pregnancy.

- However, it is necessary to consult with healthcare professionals to select appropriate exercises and exercise time to avoid risks.

Pregnant women with moderate hypertension II degree (160/100 -180/110 mmHg) have already had organ damage, so they need to choose gentle exercises such as walking, and use blood pressure-lowering medication before exercising They should only exercise when their health is stable, and stop immediately if they experience any abnormal symptoms such as dizziness, blurred vision, headaches, or upper abdominal pain.

Pregnant women with severe hypertension III degree (180/110-200/120 mmHg) should stop exercising immediately to avoid putting pressure on the heart. Therefore, they need to consult with obstetric and cardiac doctors to choose appropriate exercises for pregnant women with hypertension and preeclampsia.

4.3.2. Gestational diabetes

Divide meals appropriately for physical activity, ensuring not to lower blood sugar levels before, during, and after physical activity. Signs of low blood sugar: sweating, fatigue, dizziness ….

4.3.3. Threatened preterm labor, preterm labor

Physical activity at the recommended level has been reported not to increase the preterm labor rate. However, high-frequency activity such as that of athletes is related to preterm labor.

4.3.4. Heart disease

Pregnant women with heart failure level 2, level 3 should limit exercise and rest as much as possible.

4.4. Exercise types

Pregnant women with a normal pregnancy are encouraged to participate in exercises that help increase strength before, during, and after pregnancy. It is important to avoid activities that carry a risk of abdominal trauma or high imbalance, and deep diving underwater as it can cause oxygen deficiency to the fetus.

For pregnant women with back pain, water aerobics is an alternative option. Immersing in water reduces the pressure on the skeletal system of 82.9% of a person's body weight.

Recommended exercises:

Walking

Walking is a safe and commonly recommended exercise for pregnant women. It supports improving heart function. Walking does not increase pressure or compression on the spine, pelvic joint, or lower limbs.

Cycling.

Cycling helps improve the function of the heart, lungs, muscles, bones, and joints, as well as the body's balance ability, and reduces the risk of depression during pregnancy and after birth. The exercise is gentle and avoids putting pressure on the joints. The activity is simple, does not take up much time or cost, and all pregnant women can practice it. However, cycling in the late stages of pregnancy requires attention to maintaining balance to avoid falls.

Aerobic exercises.

Aerobic exercises are physical activities that help improve respiratory and cardiovascular function for pregnant women. A meta-analysis of 14 experimental studies involving 1014 pregnant women showed that aerobic exercises can improve physical and mental health. However, it is necessary to limit movements that are not suitable for physiological and anatomical changes during pregnancy.

Swimming.

In addition to the benefits of other physical activities, swimming helps pregnant women regulate their breathing rhythm, helping to maintain stable oxygen levels in the body during short-term oxygen deficiency. This method is essential for pregnant women during labor and delivery, ensuring adequate oxygen supply to the fetus. Therefore, swimming is one of the recommended exercises during pregnancy to improve the health of pregnant women and their fetuses, and prepare for delivery. However, it is necessary to swim in a safe place, ensure the temperature of the pool, chlorine concentration, and the risk of falling.

4.5. Signs to stop physical activity

- **Signs of labor**
  - Abdominal pain.

- Regular painful contractions.
- Leakage of amniotic fluid.
- Vaginal bleeding.

- **Signs of exertion, lack of oxygen, and low blood sugar.**
  - Shortness of breath before exertion.
  - Dizziness.
  - Headache.
  - Chest pain.
  - Weakness affecting balance.
  - Pain or swelling in the calf muscles.

5. Conclusion

Physical activity is an essential aspect of a healthy lifestyle, particularly for pregnant women, helping to achieve optimal health for both the mother, the fetus, and the outcome of pregnancy. The proven benefits include reducing the incidence of gestational diabetes, cesarean delivery, and postpartum depression. This activity is almost safe for all pregnant women. However, there are still some risks when choosing inappropriate exercises. Therefore, obstetric healthcare professionals need to advise pregnant women on appropriate exercises and precautions for each individual to maintain safe physical activity.

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