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**MATRIC NUMBER: 18/ENG08/022**

**DEPARTMENT: BIOMEDICAL ENGINEERING**

**COURSE: HUMAN PHYSIOLOGY (PHS 212)**

**DATE: APRIL, 2020**

## **FEMALE REPRODUCTION PHYSIOLOGY**

### **1. CYCLIC CHANGES IN THE VAGINA**

The vagina is the tube between the vulva and the cervix. This tube is the connection between your uterus and the outside world. The vagina is what babies exit through during birth, and what menstrual blood exits through during your period. The vagina is also used for insertion, such as with a penis, fingers, female condoms, sex toys, tampons, or menstrual cups.

#### **How the vagina changes with age**

The vagina can change a lot throughout a person's life. An average adult vagina is slightly curved, and can range between 7 to 12 cm in length, but everybody is different, and there's no such thing as a too small or too large vagina.

The vagina is strongly influenced by hormonal changes throughout the body. During the reproductive years after menarche (the first menstrual period) and before menopause, more layers of tissue are present lining the vagina, due to stimulation from higher estrogen levels in the body.

The vagina is also influenced by changing hormone levels during pregnancy. Increased blood flow is directed to the pelvis, causing a deeper color change to the vulva and vagina. Throughout a pregnancy, the connective tissue of the vaginal walls progressively relaxes, in preparation for the delivery of a baby. After delivery, the vagina and vaginal opening temporarily widen, but 6-12 weeks post-delivery, the vagina returns to its pre-pregnancy size.

As people age, the walls of the vagina become more relaxed, and the diameter of the vagina becomes wider. When it comes to sexual satisfaction, vaginal size does not affect sexual function. The perception of vaginal tightness during sex is primarily

related to the pelvic floor muscles, which are present around the base of the vagina and not actually how wide the vaginal canal is.

After menopause, when estrogen is lower, the walls of the vagina become thinner and frailer, which can cause symptoms of vaginal dryness and decreased vaginal secretions. This may result in discomfort during sex and increase the chances of vaginal irritation or infection.

### **How the vagina changes during the menstrual cycle**

The vagina also changes in response to hormonal fluctuations of the menstrual cycle. Around mid-cycle, when estrogen is highest, vaginal tissue becomes thicker and fuller.

The cervix, at the top of the vagina, moves and changes shape throughout the cycle. Before and after the fertile window, the cervix is low and can be felt in the vagina, with a firm texture, and the hole in the center of the cervix is closed. During the fertile window, the hole in the cervix opens to facilitate the entrance of sperm into the uterus, the cervix rises higher in the vagina, and is softer when touched.

### **How the vagina changes during sex**

The vagina can also undergo more rapid changes, such as during sexual activity. When a person with a vagina is sexually aroused, increased blood flow is directed towards the genitals, causing the vaginal tissue to become engorged with blood, and additional lubrication to be produced. This fluid is called arousal fluid.

During sexual excitement, the vagina expands by lengthening and widening in shape. This is called vaginal tenting and ballooning. This shape change happens as the uterus and cervix are drawn higher into the pelvis, which creates more space and moves the cervix farther away from any semen that is ejaculated into the vagina. This allows time for the semen to mix with female genital fluids, stimulating the sperm to undergo the physical changes necessary for fertilizing an egg.

## **2. CYCLIC CHANGES IN THE BREASTS**

The breast is one of two prominences located on the upper ventral region of the torso of primates. In females, it serves as the mammary gland, which produces and secretes milk to feed infants. Both females and males develop breasts from the same embryological tissues. At puberty, estrogens, in conjunction with growth hormone, cause breast development in female humans and to a much lesser extent in other primates. Breast development in other primate females generally only occurs with pregnancy.

During the larche the developing breasts are sometimes of unequal size, and usually the left breast is slightly larger. This condition of asymmetry is transitory and statistically

normal in female physical and sexual development. Medical conditions can cause overdevelopment (e.g., virginal breast hypertrophy, macromastia) or underdevelopment (e.g., tuberous breast deformity, micromastia) in girls and women.

Approximately two years after the onset of puberty (a girl's first menstrual cycle), estrogen and growth hormone stimulate the development and growth of the glandular fat and suspensory tissues that compose the breast. This continues for approximately four years until the final shape of the breast (size, volume, density) is established at about the age of 21. Mammoplasia (breast enlargement) in girls begins at puberty, unlike all other primates in which breasts enlarge only during lactation.

During the menstrual cycle, the breasts are enlarged by premenstrual water retention and temporary growth.

At menopause, breast atrophy occurs. The breasts can decrease in size when the levels of circulating estrogen decline. The adipose tissue and milk glands also begin to wither. The breasts can also become enlarged from adverse side effects of combined oral contraceptive pills. The size of the breasts can also increase and decrease in response to weight fluctuations. Physical changes to the breasts are often recorded in the stretch marks of the skin envelope; they can serve as historical indicators of the increments and the decrements of the size and volume of a woman's breasts throughout the course of her life.

### **3. MENSTRUAL CYCLE**

The menstrual cycle is the regular natural change that occurs in the female reproductive system (specifically the uterus and ovaries) that makes pregnancy possible. The cycle is required for the production of oocytes, and for the preparation of the uterus for pregnancy. The menstrual cycle occurs due to the rise and fall of estrogen. This cycle results in the thickening of the lining of the uterus, and the growth of an egg, (which is required for pregnancy). The egg is released from an ovary around day fourteen in the cycle; the thickened lining of the uterus provides nutrients to an embryo after implantation. If pregnancy does not occur, the lining is released in what is known as menstruation.

Up to 80% of women report having some symptoms during the one to two weeks prior to menstruation. Common symptoms include acne, tender breasts, bloating, feeling tired, irritability and mood changes. These symptoms interfere with normal life and therefore qualify as premenstrual syndrome in 20 to 30% of women. In 3 to 8%, they are severe.

The first period usually begins between twelve and fifteen years of age, a point in time known as menarche. They may occasionally start as early as eight, and this onset may still

be normal. The average age of the first period is generally later in the developing world and earlier in developed world. The typical length of time between the first day of one period and the first day of the next is 21 to 45 days in young women and 21 to 35 days in adults (an average of 28 days). Menstruation stops occurring after menopause which usually occurs between 45 and 55 years of age. Bleeding usually lasts around 3 to 7 days.

The menstrual cycle is governed by hormonal changes. These changes can be altered by using hormonal birth control to prevent pregnancy. Each cycle can be divided into three phases based on events in the ovary (ovarian cycle) or in the uterus (uterine cycle). The ovarian cycle consists of the follicular phase, ovulation, and luteal phase whereas the uterine cycle is divided into menstruation, proliferative phase, and secretory phase.

Stimulated by gradually increasing amounts of estrogen in the follicular phase, discharges of blood (menses) flow stop, and the lining of the uterus thickens. Follicles in the ovary begin developing under the influence of a complex interplay of hormones, and after several days one or occasionally two become dominant (non-dominant follicles shrink and die). Approximately mid-cycle, 24–36 hours after the luteinizing hormone (LH) surges, the dominant follicle releases an ovocyte, in an event called ovulation. After ovulation, the ovocyte only lives for 24 hours or less without fertilization while the remains of the dominant follicle in the ovary become a corpus luteum; this body has a primary function of producing large amounts of progesterone. Under the influence of progesterone, the uterine lining changes to prepare for potential implantation of an embryo to establish a pregnancy. If implantation does not occur within approximately two weeks, the corpus luteum will involute, causing a sharp drop in levels of both progesterone and estrogen. The hormone drop causes the uterus to shed its lining in a process termed menstruation. Menstruation also occurs in closely related primates (apes and monkeys).

The average age of menarche is 12–15. They may occasionally start as early as eight, and this onset may still be normal. This first period often occurs later in the developing world than the developed world.

The length of a woman's menstrual cycle typically varies somewhat, with some shorter cycles and some longer cycles. A woman who experiences variations of less than eight days between her longest cycles and shortest cycles is considered to have regular menstrual cycles. It is unusual for a woman to experience cycle length variations of more than four days. Length variation between eight and 20 days is considered as moderately irregular cycles. Variation of 21 days or more between a woman's shortest and longest cycle lengths is considered very irregular. The average menstrual cycle lasts 28 days. The variability of menstrual cycle lengths is highest for women under 25 years of age and is

lowest, that is, most regular, for ages 25 to 39. Subsequently, the variability increases slightly for women aged 40 to 44.

### **Menstrual disorders**

Infrequent or irregular ovulation is called *oligoovulation*. The absence of ovulation is called *anovulation*. Normal menstrual flow can occur without ovulation preceding it: an anovulatory cycle. In some cycles, follicular development may start but not be completed; nevertheless, estrogens will be formed and stimulate the uterine lining. Anovulatory flow resulting from a very thick endometrium caused by prolonged, continued high estrogen levels is called *estrogen breakthrough bleeding*. Anovulatory bleeding triggered by a sudden drop in estrogen levels is called withdrawal bleeding. Anovulatory cycles commonly occur before menopause (perimenopause) and in women with polycystic ovary syndrome.

Very little flow (less than 10 ml) is called *hypomenorrhea*. Regular cycles with intervals of 21 days or fewer are *polymenorrhea*; frequent but irregular menstruation is known as *metrorrhagia*. Sudden heavy flows or amounts greater than 80 ml are termed *menorrhagia*. Heavy menstruation that occurs frequently and irregularly is *menometrorrhagia*. The term for cycles with intervals exceeding 35 days is *oligomenorrhea*. Amenorrhea refers to more than three to six months without menses (while not being pregnant) during a woman's reproductive years. The term for painful periods is *dysmenorrhea*.