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18/ENG08/023
BIOMEDICAL ENGINEERING
Course Title: Human Physiology II
Course Code: PHS 212
Assignment Title: Female reproductive physiology

Question

Briefly discuss the CYCLIC CHANGES in any two of the following:

a) CERVIX (b) VAGINA (c) BREASTS

Explicate any one of the following:

1) Menstrual cycle

2) Hormonal regulation of the menstrual cycle

1. CERVIX

The fate of spermatozoa in the various regions of the woman's reproductive tract and correlating the cycle of mucus with other cyclic sexual phenomena led to a study on some practical problems associated with variations in cervical mucus. Samples were aspirated from the normal external os of sterile, amenorrheic, pregnant, and menopausal women. Stilbestrol therapy definitely affected the character of cervical mucus in sterile and menopausal women changing it from acid and impenetrable to alkaline and readily penetrable. Upon discontinuation of stilbestrol, the mucus returned to an impenetrable acid. 14 cervical mucus specimens from pregnant women were observed. In all instances mucus was slightly penetrable but the pH varied from 4.5 to 7.5 making superfetation an unlikely possibility. 20 menopausal preestrogenic therapy patients had scant or moderate viscid or crumbly cervical mucus with a pH of 4.5. Mucus was impenetrable to semen in each case. Estrogen therapy noticeably altered the mucus. These observations indicate that determination of mucus responses will be more exact and simple than the vaginal smear technique.

VAGINA

Vaginal cytology was evaluated weekly over 12 months in 20 adult female *Cynomolgus* monkeys (*Macaca fascicularis*). After sacrifice of the animals the histology of the ovaries, uterus and vagina were studied in different phases of the menstrual cycle. The cytological examination of the vaginal smears showed that the superficial cells increased in number towards the middle of the cycle and the number of intermediate cells declined gradually. Parabasal cells were observed mainly at the beginning of the cycle; they disappeared towards the middle of the menstrual cycle. During the early follicular phase, the cells were moderately separated from each other, and during the second half of the proliferative or follicular phase, the superficial cells appeared clumped together. Leucocytes were usually absent except for at the beginning of the cycle and in the last few days of the late secretory or luteal phase. The maturation index of the vaginal smears can be considered as a tool for distinguishing the different phases of the menstrual cycle. The microscopic examination of the genital organs showed that during the proliferative or follicular phase of the cycle, which corresponds to the development of the ovarian follicles, the uterus showed growth of endometrial glands, stroma and endothelial cell proliferation with capillary sprouts. Shortly after ovulation and parallel to the formation of the corpora lutea, the endometrium enters the secretory or luteal phase, which is characterized by coiling of endometrial glands, glandular secretion and the differentiation of

the spiral artery. The most striking changes in the vagina, is the marked basal cell proliferation and thickening of the stratum granulosum during the follicular phase of the menstrual cycle. The histological changes observed in the vagina demonstrated a good correlation with the observation on cytological examination of the smears. The present study demonstrated that the process of angiogenesis in the uterus during the different phases of the menstrual cycle is a multiple phenomenon involving proliferation, maturation and differentiation.

2. MENSTRUAL CYCLE

The monthly cycle of changes in the ovaries and the lining of the uterus (endometrium), starting with the preparation of an egg for fertilization. When the follicle of the prepared egg in the ovary breaks, it is released for fertilization and ovulation occurs.

The average length of the menstrual cycle is 28–29 days, but this can vary between women and from one cycle to the next. The length of your menstrual cycle is calculated from the first day of your period to the day before your next period starts.

Girls get their first period (menarche), on average, between the ages of 11 and 14 years. By this stage, other sexual characteristics have developed, such as pubic hair and budding breasts.

Hormones and the menstrual cycle

The menstrual cycle is complex and is controlled by many different glands and the hormones that these glands produce. A brain structure called the hypothalamus causes the nearby pituitary gland to produce certain chemicals, which prompt the ovaries to produce the sex hormones oestrogen and progesterone.

The menstrual cycle is a biofeedback system, which means each structure and gland is affected by the activity of the others.

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Phases of the menstrual cycle

The four main phases of the menstrual cycle are:

menstruation
the follicular phase
ovulation
the luteal phase.

Menstruation

Menstruation is the elimination of the thickened lining of the uterus (endometrium) from the body through the vagina. Menstrual fluid contains blood, cells from the lining of the uterus (endometrial cells) and mucus. The average length of a period is between three days and one week.

Sanitary pads or tampons are used to absorb the menstrual flow. Both pads and tampons need to be changed regularly (at least every four hours). Using tampons has been associated with an increased risk of a rare illness called toxic shock syndrome (TSS).

Follicular phase

The follicular phase starts on the first day of menstruation and ends with ovulation. Prompted by the hypothalamus, the pituitary gland releases follicle stimulating hormone (FSH). This hormone stimulates the ovary to produce around five to 20 follicles (tiny nodules or cysts), which bead on the surface.

Each follicle houses an immature egg. Usually, only one follicle will mature into an egg, while the others die. This can occur around day 10 of a 28-day cycle. The growth of the follicles stimulates the lining of the uterus to thicken in preparation for possible pregnancy.

Ovulation

Ovulation is the release of a mature egg from the surface of the ovary. This usually occurs mid-cycle, around two weeks or so before menstruation starts.

During the follicular phase, the developing follicle causes a rise in the level of oestrogen. The hypothalamus in the brain recognises these rising levels and releases a chemical called gonadotrophin-releasing hormone (GnRH). This hormone prompts the pituitary gland to produce raised levels of luteinising hormone (LH) and FSH.

Within two days, ovulation is triggered by the high levels of LH. The egg is funnelled into the fallopian tube and toward the uterus by waves of small, hair-like projections. The life span of the typical egg is only around 24 hours. Unless it meets a sperm during this time, it will die.

When you want to have a baby you can improve your chance of getting pregnant if you know about ovulation and the 'fertile window' in the menstrual cycle. Read more on ovulation and fertility window.

Luteal phase

During ovulation, the egg bursts from its follicle, but the ruptured follicle stays on the surface of the ovary. For the next two weeks or so, the follicle transforms into a structure known as the corpus luteum. This structure starts releasing progesterone, along with small amounts of oestrogen. This combination of hormones maintains the thickened lining of the uterus, waiting for a fertilised egg to stick (implant).

If a fertilised egg implants in the lining of the uterus, it produces the hormones that are necessary to maintain the corpus luteum. This includes human chorionic gonadotrophin (HCG), the hormone that is detected in a urine test for pregnancy. The corpus luteum keeps producing the raised levels of progesterone that are needed to maintain the thickened lining of the uterus.

If pregnancy does not occur, the corpus luteum withers and dies, usually around day 22 in a 28-day cycle. The drop in progesterone levels causes the lining of the uterus to fall away. This is known as menstruation. The cycle then repeats.

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[Common menstrual problems](#)

Some of the more common menstrual problems include:

premenstrual syndrome (PMS) – hormonal events before a period can trigger a range of side effects in women at risk, including fluid retention, headaches, fatigue and irritability. Treatment options include exercise and dietary changes

dysmenorrhoea – or painful periods. It is thought that the uterus is prompted by certain hormones to squeeze harder than necessary to dislodge its lining. Treatment options include pain-relieving medication and the oral contraceptive pill

heavy menstrual bleeding (previously known as menorrhagia) – if left untreated, this can cause anaemia. Treatment options include oral contraceptives and a hormonal intrauterine device (IUD) to regulate the flow

amenorrhoea – or absence of menstrual periods. This is considered abnormal, except during pre-puberty, pregnancy, lactation and postmenopause. Possible causes include low or high body weight and excessive exercise.