NAME: IKEMEFUNA DUMEBI

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QUESTIONS

Write short notes on the following:

- Spermatogenesis
- Testosterone
- Semen
- Male orgasm
- Male infertility

ANSWERS

- **TESTOSTERONE**

Testosterone is an androgen secreted by the testis in large quantities. Testosterone affects a man's appearance and sexual development. Women's ovaries and adrenal gland also make testosterone, though in much smaller amounts. Testosterone stimulates sperm production as well as a man's sex drive. It also helps build muscle and bone mass.

TESTOSTERONE SECRETION IN DIFFERENT PERIODS OF LIFE

Testosterone secretion starts at 7th week of fetal life by fetal genital ridge. Fetal testes begin to secrete testosterone at about 2nd to 4th month of fetal life. In fetal life, testosterone secretion from testes is stimulated by human chorionic gonadotropins, secreted by placenta. But in childhood, practically no testosterone is secreted approximately until 10 to 12 years of age. Afterwards, the testosterone secretion starts and it increases rapidly at the onset of puberty and lasts through most of the remaining part of life. The secretion starts decreasing after 40 years and becomes almost zero by the age of 90 years.

FUNCTIONS OF TESTOSTERONE

In general, testosterone is responsible for the distinguishing characters of masculine body. It also plays an important role in fetal life.

FUNCTIONS OF TESTOSTERONE IN FETAL LIFE-

Testosterone performs three functions in fetus:

- Sex differentiation in fetus
- Development of accessory sex organs

- Descent of the testes.

FUNCTIONS OF TESTOSTERONE IN ADULT LIFE-

Testosterone has two important functions in adult:

- Effect on sex organs
- Effect on secondary sexual characters.

Effect on sex organs;

Testosterone increases the size of penis, scrotum and the testes after puberty. All these organs are enlarged at least 8 folds between the onset of puberty and the age of 20 years, under the influence of testosterone. Testosterone is also necessary for spermatogenesis.

Effect on secondary sexual characters;

Secondary sexual characters are the physical and behavioral characteristics that distinguish the male from female. These characters appear at the time of puberty in humans. Testosterone is responsible for the development of secondary sexual characters in males.

i. Effect on muscular growth
ii. Effect on bone growth
iii. Effect on shoulder and pelvic bones
iv. Effect on skin
v. Effect on hair distribution
vi. Effect on voice
vii. Effect on basal metabolic rate
viii. Effect on electrolyte and water balance
ix. Effect on blood

MODE OF ACTION OF TESTOSTERONE

Testosterone combines with receptor proteins. The testosterone-receptor complex migrates to nucleus, binds with a nuclear protein and induces the DNA-RNA transcription process. In 30 minutes, the RNA polymer is activated and the concentration of RNA increases. The quantity of DNA also increases. So, the testosterone primarily stimulates the protein synthesis in the target cells, which are responsible for the development of secondary sexual characters. Testosterone is converted into dihydrotestosterone (DHT) in the target cells of some accessory sex organs such as epididymis and penis. DHT combines with receptor proteins and the DHT-receptor complex induces the DNA-RNA transcription process. DHTreceptor complex is more stable than testosterone receptor complex. In brain, testosterone is converted into estrogen (estradiol).

REGULATION OF TESTOSTERONE SECRETION

In Fetus During fetal life, the testosterone secretion from testes is stimulated by human chorionic gonadotropin, which has the properties similar to those of luteinizing hormone. Human chorionic gonadotropin stimulates the development of Leydig cells in the fetal testes and promotes testosterone secretion.

In Adults

Luteinizing hormone (LH) or interstitial cell stimulating hormone (ICSH) stimulates the Leydig cells and the quantity of testosterone secreted is directly proportional to the amount of LH available. Secretion of LH from anterior pituitary gland is stimulated by luteinizing hormone releasing hormone (LHRH) from hypothalamus.

Feedback Control

Testosterone regulates its own secretion by negative feedback mechanism. It acts on hypothalamus and inhibits the secretion of LHRH. When LHRH secretion is inhibited, LH is not released from anterior pituitary, resulting in stoppage of testosterone secretion from testes. On the other hand, when testosterone production is low, lack of inhibition of hypothalamus leads to secretion of testosterone through LHRH and LH.

ANABOLIC STEROIDS

Anabolic steroids are the synthetic forms of testosterone, which are used to increase the growth of muscles and bones. Like androgens, these steroids also increase the growth of muscles and bones by accelerating protein synthesis (anabolic effect). These drugs are also called anabolic-androgenic steroids (AAS).

Therapeutic Uses of Anabolic Steroids

1. Growth stimulation

2. Bone marrow stimulation

3. Hormone replacement therapy

4. Induction of puberty in males.

Abuse of Anabolic Steroids

Anabolic steroids are commonly used by athletes to improve their performances during competitions, particularly in professional sports. Organizations of many sports have banned the use of anabolic steroids by their athletes.

- **SEMEN**

Semen, also known as seminal fluid, is an organic fluid that contains spermatozoa. It is secreted by the gonads (sexual glands) and other sexual organs of male or hermaphroditic animals and can fertilize the female ovum. It is a white or grey fluid that contains sperms. It is the collection of fluids from testes, seminal vesicles, prostate gland and bulbourethral glands. Semen is discharged during sexual act and the process of discharge of semen is called ejaculation. Testes contribute sperms. Prostate secretion gives

milky appearance to the semen. Secretions from seminal vesicles and bulbourethral glands provide mucoid consistency to semen.

NATURE OF SEMEN

At the time of ejaculation, human semen is liquid in nature. Immediately, it coagulates and after some time it becomes liquid once again (secondary liquefaction). Fibrinogen secreted from the seminal vesicle is converted into a weak coagulum by the clotting enzymes secreted from prostate gland. Coagulum is liquefied after about 30 minutes, as it is lysed by fibrinolysin produced in prostate gland. When semen is ejaculated, the sperms are nonmotile due to the viscosity of coagulum. When the coagulum dissolves, the sperms become motile.

PROPERTIES OF SEMEN

1. Specific gravity: 1.028

2. Volume: 2 mL to 6 mL per ejaculation

3. Reaction: It is alkaline with a pH of 7.5. Alkalinity is due to the prostate fluid.

COMPOSITION OF SEMEN

Semen contains 10% sperms and 90% of fluid part, which is called seminal plasma. Seminal plasma contains the products from seminal vesicle and prostate gland. It also has small amount of secretions from the mucus glands, particularly the bulbourethral glands.

SPERM

Sperm is the male gamete (reproductive cell), developed in the testis. It is also called spermatozoon (plural = spermatozoa). Matured sperm is 60 μ long.

Sperm Count

Total count of sperm is about 100 to 50 million/mL of semen. Sterility occurs when the sperm count falls below 20 million/mL. Though the sperms can be stored in male genital tract for longer periods, after ejaculation the survival time is only about 24 to 48 hours at a temperature equivalent to body temperature. Rate of motility of sperm in female genital tract is about 3 mm/minute. Sperms reach the fallopian tube in about 30 to 60 minutes after sexual intercourse. Uterine contractions during sexual act facilitate the movement of sperms.

STRUCTURE OF SPERM

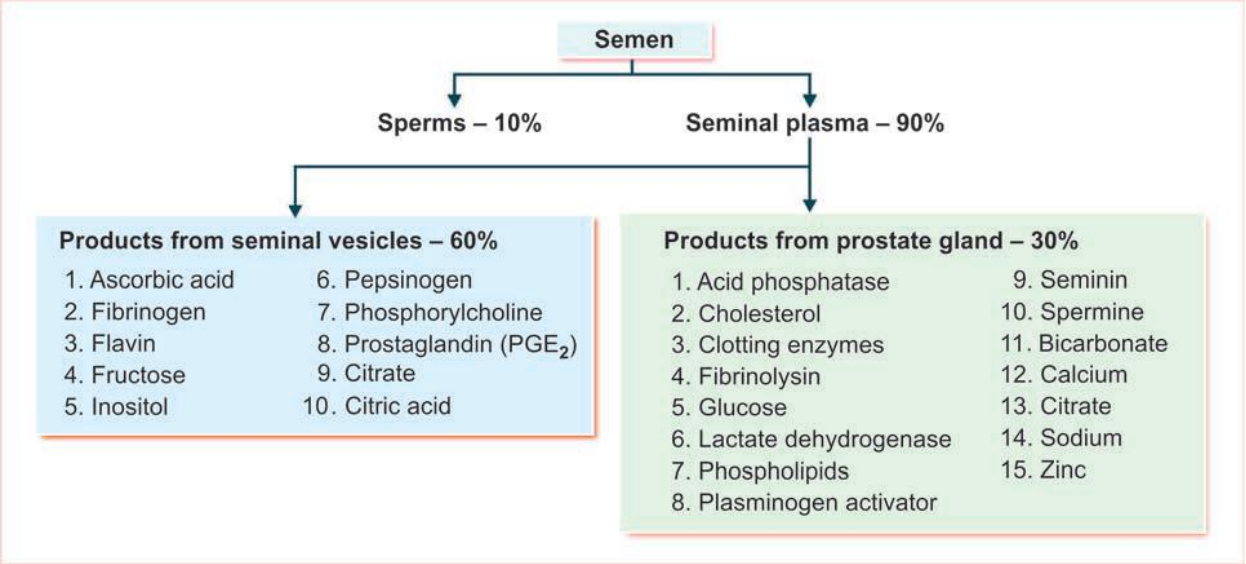
Sperm consists of four parts:

1. Head

2. Neck

3. Body

4. Tail.



SEMEN ANALYSIS

Analysis of semen evaluates the qualities of semen, which is useful to investigate the infertility.

Parameters of semen analysis:

1. Volume
2. Reaction and pH
3. Liquefaction
4. Sperm count
5. Morphology of sperm
6. Motility of sperms
7. Pus cells and RBCs
8. Fructose level.

QUALITIES OF SEMEN REQUIRED FOR FERTILITY

Minimum required qualities of semen for fertility are:

1. Volume of semen per ejaculation must be at least 2 mL
2. Sperm count must be at least 20 million/mL
3. Number of sperms in each ejaculation must be at least 40 million
4. 75% of sperms per ejaculation must be alive
5. 50% of sperms must be motile

6. 30% of sperms must have normal shape and structure

7. Sperms with head defect must be less than 35%

8. Sperms with midpiece defect must be less than 20%

9. Sperms with tail defect must be less than 20%.

APPLIED PHYSIOLOGY

- Azoospermia

Azoospermia is the condition characterized by lack of sperm in semen. It is a congenital disease. It is also caused by excess use of corticosteroids and androgens.

- Oligozoospermia

Oligozoospermia is the low sperm count with less than 20 million of sperms/mL of semen. Oligozoospermia causes infertility.

- Teratozoospermia

Teratozoospermia is the condition characterized by presence of sperms with abnormal morphology. It is also called teratospermia. It occurs in Crohn's disease, Hodgkin disease and celiac disease. The abnormal morphology of sperm results in infertility.

- Aspermia

Aspermia is the lack of semen. It occurs due to retrograde ejaculation. Retrograde ejaculation is the entrance of semen into urinary bladder instead of entering urethra. It is due to dysfunction of sphincter of the bladder, which is caused by prostatic surgery or excess use of drugs. Aspermia leads to infertility.

- Oligospermia

Oligospermia is a genetic disorder characterized by low volume of semen.

- Hematospermia

Hematospermia is the appearance of blood in sperm. It occurs due to infection of urethra or prostate. It is also common in congenital bleeding disorder.