

Unit Five: The human body systems

Human Musculoskeletal System

What is the Musculoskeletal System?

The musculoskeletal system is an organ system that enables humans to move. It consists of two main parts: the **muscular system** and the **skeletal system**.

Components of the Musculoskeletal System

1. **Bones:** Provide structure and support. They protect vital organs, store minerals, and produce blood cells.
2. **Muscles:** Enable movement and maintain posture.
3. **Joints:** Connect bones and allow movement.
4. **Tendons:** Attach muscles to bones.
5. **Ligaments:** Connect bones to other bones.
6. **Cartilage:** Covers joints and prevents bones from rubbing against each other.
7. **Connective Tissues:** Support and stabilize the skeletal system.

Types of Muscles

1. **Cardiac Muscle:**
 - Found only in the heart.
 - Involuntary and striated.
 - Pumps blood throughout the body.
2. **Skeletal Muscle:**
 - Attached to bones.
 - Voluntary and striated.
 - Allows for movement and maintains posture.
3. **Smooth Muscle:**
 - Found in the walls of hollow organs (e.g., stomach, intestines).
 - Involuntary and non-striated.
 - Controls the flow of substances through organs.

How Muscles Work

Muscle contraction involves:

1. **Activation:** Nerve impulses stimulate muscles.
2. **Contraction:** Myosin and actin filaments interact to shorten muscle fibers using ATP.

3. **Relaxation:** Calcium is pumped back into the muscle cells, and the muscle returns to its resting state.

Types of Muscle Contractions

1. **Isometric:** Muscle length does not change.
2. **Concentric:** Muscle shortens.
3. **Eccentric:** Muscle lengthens.

The Skeleton

The skeleton has two main parts:

1. **Axial Skeleton:**
 - Includes the skull, spine, and rib cage.
 - Protects the brain, heart, and lungs.
2. **Appendicular Skeleton:**
 - Includes the limbs and girdles (shoulder and pelvic).
 - Supports movement and manipulation of the environment.

Types of Joints

1. **Ball and Socket:** Allows movement in all directions (e.g., shoulder, hip).
2. **Hinge:** Allows movement in one direction (e.g., elbow, knee).
3. **Condylloid:** Allows movement but no rotation (e.g., fingers).
4. **Pivot:** Allows rotational movement (e.g., neck).
5. **Gliding:** Allows sliding movements (e.g., wrist).
6. **Saddle:** Allows movement back and forth and side to side (e.g., thumb base).

Functions of the Musculoskeletal System

- **Support:** Provides structure and stability.
- **Movement:** Enables locomotion and manipulation.
- **Protection:** Shields internal organs.
- **Blood Cell Production:** Produces blood cells in bone marrow.
- **Mineral Storage:** Stores and releases minerals like calcium.

The Human Reproductive System

Overview:

The human reproductive system consists of male and female organs that work together to produce offspring. The main purpose is to produce and deposit sperm in males and eggs in females. Fertilization typically happens through

sexual intercourse, where sperm travels through the cervix and uterus into the fallopian tubes to meet the egg.

Male Reproductive System

1. Penis:

- **Function:** Delivers sperm into the female reproductive tract during ejaculation.
- **Structure:** Contains spongy tissue that allows for erection through increased blood flow. Erection is a physical and sexual response, while ejaculation releases sperm.

2. Urethra:

- **Function:** Carries urine from the bladder and sperm from the reproductive tract out of the body.

3. Scrotum:

- **Function:** Holds the testes and regulates their temperature for optimal sperm production.

4. Testes:

- **Function:** Produce sperm and testosterone.
- **Structure:** Contain seminiferous tubules where sperm are created and matured in the epididymis.

Key Structures and Their Functions:

Structure	Function
Testes	Produce sperm and testosterone.
Seminiferous Tubules	Produce immature sperm cells.
Epididymis	Matures and stores sperm cells.
Vas Deferens	Transports sperm from the epididymis to the urethra.
Seminal Vesicle	Adds fructose to semen for sperm energy.
Prostate Gland	Adds alkaline fluid to semen to protect sperm from vaginal acidity.

Structure	Function
Cowper's Gland	Secretes mucus to protect sperm from urethra acids.
Urethra	Excretes urine and semen.
Penis	Delivers sperm into the vagina and contains the urethra.

Female Reproductive System

1. Labia Majora and Labia Minora:

- **Function:** Protect the internal reproductive organs. Labia majora are larger and outer, while labia minora are smaller and surround the openings to the vagina and urethra.

2. Bartholin's Glands:

- **Function:** Produce mucus to lubricate the vaginal opening.

3. Clitoris:

- **Function:** Sensitive structure analogous to the penis in males; involved in sexual arousal.

4. Vagina:

- **Function:** Canal connecting the external environment to the uterus; serves as the birth canal.

5. Uterus (Womb):

- **Function:** Houses and nourishes a developing fetus.
- **Structure:** Includes the cervix (lower part) and the corpus (main body).

6. Ovaries:

- **Function:** Produce eggs and hormones like estrogen and progesterone.

7. Fallopian Tubes:

- **Function:** Transport eggs from the ovaries to the uterus; typically the site of fertilization.

Key Structures and Their Functions:

Structure	Function
Ovaries	Produce eggs and hormones (estrogen and progesterone).
Fallopian Tubes	Transport eggs from ovaries to uterus; site of fertilization.
Fimbria	Sweep the ovum into the fallopian tube after ovulation.
Uterus	Where the fetus develops; involved in menstruation.
Cervix	Connects the uterus to the vagina; dilates during childbirth.
Vagina	Passageway for menstrual flow, sperm, and childbirth.

Gametogenesis

Definition:

The process of forming gametes (sperm and eggs) from germ cells through meiosis.

1. Spermatogenesis (Males):

- **Process:** Formation of sperm from primordial germ cells in the testes.
- **Stages:** Mitosis → Primary Spermatocytes → Meiosis I → Secondary Spermatocytes → Meiosis II → Spermatids → Spermatozoa (mature sperm).

2. Oogenesis (Females):

- **Process:** Formation of eggs in the ovaries.
 - **Stages:** Primary Oocytes → Meiosis I (stalled) → Secondary Oocyte (released) → Meiosis II (if fertilized) → Ovum.
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Menstrual Cycle

Phases:

1. **Follicular Phase:**
 - **Description:** Follicles mature in the ovary; estrogen levels rise.
2. **Ovulation:**
 - **Description:** Release of a mature egg from the ovary; peak in estrogen triggers LH surge.
3. **Luteal Phase:**

- **Description:** Corpus luteum forms and secretes progesterone; prepares the uterus for pregnancy.
4. **Menstruation:**
- **Description:** Shedding of the uterine lining if no fertilization occurs.

Duration:

Typically 28 days, but can range from 20 to 45 days.

Feedback Mechanisms

Positive Feedback:

Increases the production of hormones (e.g., estrogen surge leading to ovulation).

Negative Feedback:

Regulates hormone levels to maintain balance (e.g., decreasing estrogen and progesterone leading to menstruation).

Fertilization and Pregnancy

1. Fertilization

- **Definition:** Fertilization is the process where an egg and sperm cell join together to form a new cell called a zygote. This happens in the ampulla of the fallopian tube.
- **Chromosomes:** Each sperm and egg cell carries 23 chromosomes. When they unite, they form a zygote with 46 chromosomes.
- **Development:** After fertilization, the zygote starts dividing as it moves down the fallopian tube towards the uterus. Around six days later, it attaches to the uterine lining in a process called implantation, which takes about nine to ten days.

2. Pregnancy

- **Definition:** Pregnancy is the period when a fetus develops inside a woman's uterus. It lasts about 40 weeks, starting from the last menstrual period.
- **Multiple Pregnancy:** If there is more than one fetus, it's known as a multiple pregnancy (e.g., twins or triplets).
- **Signs and Symptoms:**
 - Missed periods
 - Tender breasts

- Morning sickness (nausea and vomiting)
- Increased hunger and frequent urination
- Pregnancy test confirmation

Contraceptives

1. Barrier Methods

- **Definition:** Barrier methods prevent sperm from reaching the egg by creating a physical barrier.
- **Examples:**
 - **Condoms:** Both male and female condoms prevent sperm from entering the vagina and can also protect against sexually transmitted infections (STIs).
 - **Diaphragm:** A soft, silicon dome placed inside the vagina to block sperm.

2. Non-Barrier Methods

- **Chemical Barriers/Spermicides:** These kill sperm and come in forms like foams, gels, or suppositories.
- **Oral Contraceptive Pills:**
 - **Combined Pills:** Contain estrogen and progesterone to prevent ovulation and make it harder for sperm to reach the egg.
 - **Progesterone-Only Pills:** Thicken cervical mucus and may also stop ovulation.
- **Intrauterine Device (IUD):** A small device placed in the uterus to prevent sperm from fertilizing an egg and make it harder for a fertilized egg to implant.
- **Contraceptive Implant:** A small rod placed under the skin that releases progesterone to prevent pregnancy for up to three years.
- **Contraceptive Injection:** Contains progesterone to prevent ovulation, effective for several months.
- **Emergency Contraceptive Pill (Post Pill):** Taken after unprotected sex to prevent pregnancy by stopping ovulation or implantation.
- **Contraceptive Ring:** Releases hormones to prevent pregnancy and is worn inside the vagina.

3. Sterilization

- **Definition:** A permanent method of contraception.
- **For Women:** Tubal ligation prevents eggs from traveling through the fallopian tubes.

- **For Men:** Vasectomy blocks the vas deferens, preventing sperm from being part of the semen.

Infertility

1. Causes in Women

- **Ovulatory Problems:** Issues with the menstrual cycle affecting ovulation.
- **Thyroid Problems:** Can disrupt ovulation.
- **Pelvic Surgery:** Damage to fallopian tubes or ovaries.
- **Cervical Mucus Issues:** Thick mucus that prevents sperm entry.
- **Fibroids and Endometriosis:** Growths that affect fertility.
- **Infections and Sterilization:** Infections or intentional sterilization procedures.
- **Medicines and Drugs:** Certain medications and drug use can affect fertility.

2. Causes in Men

- **Low Sperm Production or Abnormal Sperm:** Can be due to health problems, injuries, or hormonal imbalances.
- **Blockages:** Prevent sperm from reaching the ejaculate.
- **Risk Factors:**
 - Smoking and alcohol use
 - Being overweight
 - Exposure to toxins
 - Previous STDs and overheating of testicles

Major Sexually Transmitted Infections (STIs) in Ethiopia

Sexually Transmitted Infections (STIs) are diseases spread primarily through sexual contact. Here's an overview of common STIs, their causes, symptoms, and prevention methods:

Bacterial STIs

1. Bacterial Vaginosis

- **Cause:** Overgrowth of normal vaginal bacteria.
- **Symptoms:** Thin, grayish discharge; fishy odor; itching and burning.
- **Prevention/Treatment:** Use protection during sex; seek medical treatment.
- **Prevalence:** 2.8%–19.4% in Ethiopia.

2. Chlamydia

- **Cause:** *Chlamydia trachomatis* bacteria.
- **Symptoms:** Often asymptomatic; possible discharge or pain.

- **Prevention/Treatment:** Use condoms; antibiotics.
- 3. **Syphilis**
 - **Cause:** *Treponema pallidum* bacteria.
 - **Stages:**
 - **Primary:** Painless sores on genitalia.
 - **Secondary:** Rash on hands and feet.
 - **Latent:** No symptoms.
 - **Tertiary:** Severe complications affecting organs.
 - **Prevention/Treatment:** Use protection; antibiotics.
- 4. **Gonorrhea**
 - **Cause:** *Neisseria gonorrhoeae* bacteria.
 - **Symptoms:** Painful urination; abnormal discharge.
 - **Prevention/Treatment:** Use condoms; antibiotics.
- 5. **Chancroid**
 - **Cause:** *Haemophilus ducreyi* bacteria.
 - **Symptoms:** Painful ulcers on genitals.
 - **Prevention/Treatment:** Use protection; antibiotics.

Viral STIs

1. **Genital Herpes**
 - **Cause:** Herpes simplex viruses HSV-1 and HSV-2.
 - **Symptoms:** Painful sores or blisters in the genital area.
 - **Prevention/Treatment:** Use condoms; antiviral medications.
2. **Genital Warts**
 - **Cause:** Human papillomavirus (HPV).
 - **Symptoms:** Painful, itchy warts; increased cancer risk.
 - **Prevention/Treatment:** Use protection; HPV vaccine.
3. **Molluscum Contagiosum**
 - **Cause:** Molluscum contagiosum virus.
 - **Symptoms:** Small, round bumps on the skin.
 - **Prevention/Treatment:** Good hygiene; antiviral treatments.
4. **HIV (Human Immunodeficiency Virus)**
 - **Cause:** Retrovirus attacking the immune system.
 - **Stages:**
 - **Acute:** Flu-like symptoms.
 - **Chronic:** No symptoms, virus still active.
 - **AIDS:** Severe immune system damage.
 - **Prevention/Treatment:** Use protection; antiretroviral therapy.
5. **Hepatitis B**
 - **Cause:** Hepatitis B virus.
 - **Symptoms:** Jaundice; abdominal pain; fatigue.
 - **Prevention/Treatment:** Vaccination; avoid sharing needles or unprotected sex.

Parasitic STIs

1. Pubic Lice (Crabs)

- **Cause:** Small parasites in pubic hair.
- **Symptoms:** Itching and irritation.
- **Prevention/Treatment:** Use protection; topical treatments.

2. Trichomoniasis

- **Cause:** *Trichomonas vaginalis* parasite.
- **Symptoms:** Discharge; itching; discomfort.
- **Prevention/Treatment:** Use protection; antibiotics.

3. Scabies

- **Cause:** Mite infestation.
- **Symptoms:** Intense itching; rash.
- **Prevention/Treatment:** Good hygiene; topical medications.

Epidemiology of STIs in Ethiopia

- **Definition:** Study of how STIs spread, their causes, and how to control them.
- **Current Situation:** Many STIs are common, especially among young people (ages 15–24).
- **Risk Factors:**
 - Unprotected sex.
 - Multiple sexual partners.
 - History of STIs.
 - Substance misuse.
 - Needle sharing.

Prevention: Consistent use of condoms, limiting sexual partners, and regular medical check-ups.

Harmful Traditional Practices and Family Planning

Harmful Traditional Practices

Harmful traditional practices are actions that negatively impact individuals' physical and mental health. These practices often violate human rights and can lead to serious health problems.

1. **Female Genital Mutilation (FGM):** This practice involves the partial or complete removal of the external female genital organs. It has severe health consequences, including pain, infections, and long-term complications in childbirth and sexual health.

2. **Early Marriage:** This practice forces underage girls into marriage based on cultural norms. It often results in girls dropping out of school, early pregnancies, and long-term health issues.
3. **Kidnapping for Marriage:** Girls are abducted and forced into marriage against their will, leading to psychological trauma and health problems.
4. **Gender-Based Violence:** This includes any form of unwanted sexual contact or violence, such as sexual abuse or harassment, often within families or relationships.

Family Planning

Family planning involves managing the number and timing of children, considering personal and financial circumstances, and ensuring the resources needed for raising a family.

1. **Benefits of Family Planning:**
 - Allows individuals and couples to plan their family according to their needs and resources.
 - Helps in spacing births and improving the health of mothers and children.
2. **Risks of Poor Family Planning:**
 - Increases risks related to maternal health, such as complications during pregnancy and childbirth.
 - Can lead to unintended pregnancies, which may impact the health and well-being of the mother and child.
3. **Family Planning Actions:**
 - Prevention of unwanted pregnancies.
 - Safe methods to prevent sexually transmitted infections (STIs).
 - Counselling on fertility and reproductive health.
 - Options like adoption and birth control methods.
4. **Family Planning Services:**
 - Pregnancy testing and counseling.
 - Basic infertility counseling.
 - STI and cancer screenings.

Effects of Alcohol, Khat, and Other Drugs

1. **Alcohol Use:**
 - Short-term effects include confusion and impaired coordination.
 - Long-term effects can lead to liver damage, cardiovascular issues, and increased risk of certain cancers.
 - Alcohol use is linked to risky behaviors and increased likelihood of STIs
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2. **Khat Chewing:**

- Immediate effects include increased alertness and heart rate.
- Long-term effects can cause hypertension, heart issues, and mental health problems.

3. **Drug Use:**

- Marijuana, cocaine, heroin, and inhalants can have severe effects on physical and mental health, including addiction, organ damage, and impaired cognitive functions.

By understanding and addressing harmful traditional practices, practicing effective family planning, and avoiding substance abuse, individuals can significantly improve their health and well-being.