

CHAPTER 9:

MANAGE NUTRITION IN THE LIFE CYCLE

9.1 Introduction of the Unit of Learning / Unit of Competency

This unit specifies the competencies required to manage nutrition in the life cycle. It involves identifying terminologies in nutrition in the life cycle, demonstrating the knowledge of nutrition during pre-pregnancy, Pregnancy, Lactation, Infancy (0-24 months), pre-schoolers (25-59 months), pre-adolescents (6years-12 years), Adolescents (13years-19 years), adults (20years-60 years) and older persons/geriatric nutrition (60years and above).

9.2 Performance Standard

By the end of this unit of learning/competency, the trainee should be able to describe lifespan stages at a glance and determine the vulnerability associated with each stage based on the existing policies and guidelines; provide nutritional management for clients in the various stages in the lifecycle- pre-pregnancy, pregnancy, lactation, infancy, pre-schoolers, adolescents, adults, and geriatrics- in accordance with RDAs, resource materials and existing policies & guidelines.

9.3 Learning Outcomes

8.3.1 List of Learning Outcomes

1. Identify terminologies in nutrition in the life cycle
2. Demonstrate knowledge in nutrition during pre-pregnancy
3. Demonstrate knowledge in nutrition during pregnancy
4. Demonstrate knowledge in nutrition during lactation
5. Demonstrate knowledge in nutrition during infancy
6. Demonstrate knowledge in nutrition for pre-schoolers
7. Demonstrate knowledge in nutrition for pre-adolescents
8. Demonstrate knowledge in nutrition for adolescents
9. Demonstrate knowledge in nutrition for adults
10. Demonstrate knowledge in nutrition for older persons/geriatric nutrition.

9.3.2 Learning Outcome 1: Identify terminologies in nutrition in the life cycle

9.3.2.1 Learning Activities

Learning Activities	Special instructions
i) Identify terminologies in the lifecycle	➤ Define terminologies in the life
ii) Identify and describe stages in the life cycle	➤ Categorize individuals according to nutritional needs ➤ Describe the characteristics of each stage in the lifecycle
iii) Identified and describe the important roles of nutrition	➤ Demonstrate knowledge of roles of nutrition in different lie stages
iv) Identify and describe nutrition vulnerability and risks	➤ Identify vulnerable groups in different life stages ➤ Formulate strategies to reduce vulnerability
v) Identified the factors that determine nutrition needs	➤ Consider factors that determine nutrition needs of individuals

9.3.2.2 Information Sheet

Definition of terms

Nutrition: all aspects of the interaction between food and nutrients, life, health and disease, and the processes by which an organism ingests, absorbs, transports, utilizes and excretes food substances

Malnutrition: A physiological state that results from nutrient inadequacy, excess or imbalance

Throughout the lifespan, human beings require proper nourishment to meet the changing needs in different life stages. Nutrition is necessary for growth and development, maintenance of quality of life. Poor nutrition prior to conception and during pregnancy has a significant effect on quality of later life.

Nutritional deficiencies in childhood cause poor growth and development. This in turn affects growth, development, maturation, functional capacity as well as the risk of morbidity in the latter stages.

Malnutrition in adulthood affects ageing and jeopardizes quality of life. Poor nutrition also increases susceptibility to infections and incidence of chronic diseases in the elderly.

Importance of Nutrition in the Lifespan

- Supports growth and development
- Prevents disease

- Management of disease
- Improves quality of life

Nutritional Vulnerability

All the stages in the human lifespan face a degree of nutritional vulnerability, which is brought about by various factors. Vulnerability is often caused by factors such as change in nutrient and energy needs, changes in food access and intake, changes in physiological demands and changes in functional capacity.

Nutrition Concerns at Various Stages in the Lifespan

Infancy:

This is a vulnerable stage in the lifespan. The main nutritional concerns during this stage are:

- Birth weight
- Breastfeeding concerns
- Complementary feeding
- Ensuring optimal growth and development
- Failure to thrive
- Preventing under nutrition /morbidity/mortality

Pre-school years:

- Ensuring normal growth and development
- Formation of good food habits
- Preventing malnutrition/morbidity/mortality

School-going Children:

- Ensuring normal growth and development
- Establishing appropriate nutrition behaviour
- Preventing obesity

Adolescence:

- Ensuring normal growth and development
- Preparing girls for motherhood
- Ensuring adequate bone mass
- Preventing under nutrition/overweight and obesity

Adulthood:

- Nutrition and productivity
- Nutrition during pregnancy and lactation
- Prevention of obesity and chronic non-communicable diseases
- Quality of life

Older age:

- Maintaining muscle mass
- Preventing cognitive decline
- Ensuring adequate food and nutrient intake
- Quality of life

People who are at Risk of Malnutrition

They include:

- The poor
- Isolated people
- People with chronic illnesses
- Convalescents
- People with eating disorders
- Socially isolated individual
- Refugees and internally displaced people

Factors that Determine Nutrient Needs

- Age
- Sex
- Occupation
- Physical activity level
- Disease
- Physiological status e.g. pregnancy
- Weather/ environmental conditions

9.3.2.3 Self-Assessment

1. Identify groups of people who are vulnerable to malnutrition
2. Identify the factors that determine nutrient requirement
3. _____ is a physiological state that results from nutrient inadequacy, excess or imbalance
 - A. Nutritional Status
 - B. Stunting
 - C. Malnutrition
 - D. Vulnerability
4. Which one of the following is not a nutritional concern during infancy?
 - A. Birth weight
 - B. Breastfeeding
 - C. Complementary feeding
 - D. Formation of good food habits
5. The following are factors that determine nutrient needs except:
 - A. Age
 - B. Sex
 - C. Race
 - D. Disease
6. _____ are the processes by which an organism ingests, absorbs, transports, utilizes and excretes food substances
 - A. Nutritional status
 - B. Nutrition
 - C. Food consumption
 - D. Dietary intake
7. Which one of the following factors does not cause nutritional vulnerability?
 - A. Changes in nutrient and energy needs
 - B. Changes in food access and intake
 - C. Changes in physiological demands
 - D. None of the above

9.3.2.4 Tools, Equipment, Supplies and Materials

- Nutrition care manuals
- Text books
- Computers with internet
- Library and resource centre
- WHO guidelines
- MOH policies and guidelines
- Ministry of Education
- Skills lab
- LCD projectors, video clips, charts and other teaching aids
- Invitation of competent expertise

9.3.2.5 References

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9.3.3 Learning Outcome 2: Demonstrate knowledge in nutrition during pre-pregnancy

9.3.3.1 Learning Activities

Learning Activities	Special instructions
i) Identify and describe nutrition needs of men and women before conception	➤ Identify functions of Nutrients in Pre-conception
ii) Identify and describe the importance of pre-conception nutrition knowledge and services	➤ Describe the importance of pre-conception care
iii) Identify and describe the risk factors with nutrition implications	➤ Identify factors related to altered fertility in women and men ➤ Demonstrate knowledge of nutrition-related effects of contraceptives
iv) Identify nutrition needs during preconception	➤ Calculate nutritional needs of men and women in preconception

9.3.3.1 Information Sheet

Definition of terms

Conception: the action of conceiving a child or of one being conceived.

Implantation: attachment of a fertilized egg to the uterine lining

Infertility: This is inability to conceive

Antioxidant: Substances that prevent oxidation or damage of cells by free radicals

Pre-Pregnancy Nutrition

It refers to the nutrition of before conception and pregnancy and it's very important

An optimal level of nutrition during the preconception period ensures that a woman begins pregnancy with all the necessary nutritional stores to produce substances required to maintain a healthy pregnancy and support the developing embryo/foetus. Poor maternal nutritional status prior and during pregnancy has been associated with low birth weight; less than 2500g, intra-uterus growth retardation, premature birth etc

Pre-pregnancy nutrition influences a woman's ability to conceive, determines foetus growth and development, and determines size of foetus as well as the health of a mother.

A woman planning to conceive should ensure optimal nutrition at least 1 year prior to conception and throughout the early months of pregnancy.

Risk Factors with Nutrition Implications

The following factors are related to altered fertility in men and women:

- Nutritional Factors:
 - o Weight loss > 10-15 %of normal weight
 - o Inadequate antioxidant status (selenium, Vit. C & E)
 - o Inadequate body fat
 - o Excessive body fat, especially central fat
 - o Extreme levels of exercise
 - o High alcohol intake
 - o Celiac disease(related to altered action of androgens, delayed sexual maturation, amenorrhea, miscarriages)
- Endocrine disorders (e.g Hypothyroidism)
- Structural abnormality of the respiratory system
- Chromosomal abnormalities in sperm and eggs
- Severe psychological stress
- Infection (STI)
- Diabetes, cancer and other disorders
- Some Medications

Factors Related to Altered Fertility in Women

- Recent oral contraceptives use (within 2 months)
- Anorexia nervosa, bulimia nervosa
- Vegan diets
- Age > 35 yrs
- Metabolic syndrome
- Pelvic Inflammatory disease (PID)
- Endometriosis
- Polycystic ovary syndrome
- Poor iron stores

Factors Related to Altered Fertility in Men

- Inadequate zinc status
- Heavy metal exposure(lead, mercury)
- Halogens exposure

- Sperm defects
- Steroid abuse
- High intake of soy foods

Functions of Nutrients in Pre-conception

Antioxidants: Vitamin E, Vitamin E, Vitamin C, beta-carotene and selenium

Antioxidants are needed to protect cells of the reproductive system eggs and sperm from free radicals, which can damage sperm cell DNA.

In women, free radicals can damage the egg and interfere with implantation.

Zinc status and fertility in men:

Zinc has the following functions in male fertility:

- Reducing oxidative stress
- Sperm maturation
- Testosterone synthesis

Low zinc status is related to lower sperm quality, lower sperm concentration, and abnormal sperm shapes.

Zinc supplementation alone or combined with Vitamin C and E has been found to improve sperm quality.

Preconception Iron status, Fertility and pregnancy Outcomes:

Iron deficiency prior to pregnancy increases the risk of iron-deficiency anemia during pregnancy.

Infants born to such women will also have low iron stores.

Iron deficiency before pregnancy is also related to increased cases of preterm delivery.

Women who intend to conceive should build their iron stores before pregnancy. It is easier and more efficient.

Alcohol and Fertility:

Alcohol consumption before and during pregnancy is harmful to the foetus and has been associated with foetal abnormalities. It affects fertility by interfering with estrogen and testosterone levels, testicular function and disrupting the menstrual cycle.

Alcohol consumption of over 10 drinks per week has been related to about 66% reduction in probability of conception.

Consumption of 7 or more drinks per week has been associated with a doubling the risk of infertility in women over the age of 30.

Contraceptive Use and Nutritional Status

There are different types of birth control products for women used today. They include injections, implants, oral contraceptives and patches. They have various side effects, which include nutritional side effects such as: elevated blood lipids, glucose intolerance, micronutrient deficiencies, weight gain e.t.c.

Nutrition-Related Effects of Contraceptives		
<i>Oral Contraceptives</i>	<i>Contraceptive Implants</i>	<i>Contraceptive Injections (Depo-Provera)</i>
<ul style="list-style-type: none"> • Increased blood levels of HDL • Increased triglycerides and LDL • Increased risk of blood clots, cervical cancer and cardiovascular disease • Decreased blood levels of Vitamin B12 and B6 • Increased blood levels of copper 	<ul style="list-style-type: none"> • Weight Gain 	<ul style="list-style-type: none"> • Weight gain • Increased blood levels of LDL cholesterol • Increased insulin levels • Decreased blood levels of HDL cholesterol • Decreased bone density

Importance of Pre-Conception Care

- Optimal nutrition before conception ensures the woman begins the pregnancy with a good store of nutrients in her tissues so that the needs of the fetus can be met without affecting her health.
- Adequate nutritional stores are also required to support optimal development and maintenance of the foetus. Deficiencies of nutrients e.g. Folate, iron, calcium and Vitamin D during the preconception period can have detrimental effects on the growing embryo.
- Reduces risk of complications during delivery.
- Improves pregnancy outcomes.
- Reduces infant and maternal mortality.

9.3.3.3 Self-Assessment

1. Discuss the nutrition-related effects of contraceptives
2. Discuss effect of malnutrition on fertility
3. Which one of the following nutrients is not an antioxidant?
 - A. Vitamin C
 - B. Vitamin E
 - C. Iron
 - D. Selenium
4. Which one of the following is not a nutritional factor associated with altered fertility?
 - A. Recent oral contraceptives use
 - B. Anorexia nervosa, bulimia nervosa
 - C. Vegan diets
 - D. Poor iron stores
5. Indicate whether the following statements are true or false about pre-conception nutrition?
 - A. In women, free radicals can damage the egg and interfere with implantation.
 - B. Low zinc status is related to lower sperm quality, lower sperm concentration, and abnormal sperm shapes.
 - C. Alcohol consumption before and during pregnancy is harmful to the foetus and has been associated with foetal abnormalities

9.3.3.4 Tools, Equipment, Supplies and Materials

- Text books
- Nutrition care manuals
- Text books
- Computers with internet
- Library and resource centre
- WHO guidelines
- MOH policies and guidelines
- Ministry of Education
- Skills lab
- LCD projectors, video clips, charts and other teaching aids
- Invitation of competent expertise

9.3.3.5 References

Brown, J. E. (2016). Nutrition through the life cycle. Cengage Learning.

Coutts, A. (2000). Nutrition and the life cycle 1: maternal nutrition and pregnancy. *British journal of nursing*, 9(17), 1133-1138.

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9.3.4 Learning Outcome 3: Demonstrate knowledge in nutrition during Pregnancy Learning Activities

9.3.4.1 Learning Activities

Learning Activities	Special instructions
i) Identify terminologies during pregnancy	➤ Define terminologies related to pregnancy
ii) Identify the <i>stages of pregnancy</i> and describe their nutrition implications	➤ Demonstrate knowledge of the stages of pregnancy
iii) Identified and describe complications during each stage of pregnancy	➤ Manage nutrition-related complications in pregnancy
iv) Identify and describe nutrition needs during pregnancy	➤ Calculate individual nutrient needs in pregnancy
v) Identify and describe prenatal care services and other interventions for pregnant women	➤ Advice on prenatal care services ➤ Demonstrate knowledge of WHO/ UNICEF policies and guidelines on prenatal care services and interventions

9.3.4.2 Information sheet

Definitions

Preterm: An infant born before 37 weeks are over.

Prenatal care: Health care provided for a pregnant woman until delivery.

Gestational diabetes: Glucose intolerance in pregnant women who have are not diabetic.

Nutrition in Pregnancy

Pregnancy outcome is significantly affected by nutritional status of the mother, before and during pregnancy. Her body should be capable of conception, carrying the pregnancy to term and successful delivery, all which depend on food intake and utilization. During pregnancy, the mother has increased energy and nutrient needs to support growth and development of the foetus and support maternal tissue.

Nutritional deficiencies during this critical stage in the lifespan can cause harmful effects on the foetus or cause complications during pregnancy and/or delivery.

Pregnant women should therefore be keen to furnish their bodies with the required energy and nutrients throughout the pregnancy.

Physiological Changes that Occur During Pregnancy

During pregnancy many changes occur in the body of a pregnant woman and cause more changes of all the mothers' body systems. They also influence nutrition requirements and their use in the body.

Altered metabolism:

- The BMR increases by the fourth month of gestation and increases 15-20% above normal level by term.
- This increase reflects increased oxygen demand of the fetus and maternal tissues therefore the calorie requirement also increases. In addition to increased metabolic rates, the metabolism of nutrients is also altered.
- Fat becomes the major source of maternal fuel
- Decrease in insulin efficiency particularly at the later part of pregnancy as a compensatory mechanism to increase glucose availability thus gestational diabetes. (resolves after birth).

Weight gain:

- Women may lose weight in the first trimester due to vomiting and nausea. Adequate weight gain is essential for foetal growth and the desired weight gain is based upon pre-pregnancy weight using BMI. On average a healthy well-nourished woman should gain approximately 12-15 kg. Underweight are advised to gain more to avoid:
 - o Preterm
 - o Low birth weight
 - o Small for gestational age babies.

Recommended Pregnancy Weight Gain by BMI

Pregnancy state (if pregnancy weight was):	Recommended weight gain in kg
Normal	11.5-16.0
Underweight	12.5-18.0
Overweight	7-11.5
Obese	5-9.0

Change in Blood Volume:

There is an increase total blood plasma volume of approximately 33% above the normal level and may increase to 50% by the end of pregnancy.

This increase enables the blood to circulate through the placenta to carry nutrients to the foetus and also to remove the metabolic wastes. The increase in blood plasma exceeds increase in RBC's resulting to hemodilution or physiologic anemia of pregnancy. This occurs during the 2nd and 3rd trimester when there is the largest rise in blood plasma volume. The concentration of albumin and most nutrients is also lower during pregnancy due to hemodilution. Minor edema may occur but considered normal if not accompanied by hypertension and proteinuria.

Gastro Intestinal Changes:

Increased progesterone production slows the gastro intestinal motility.

There is a slowed passage of food through the GIT, which enhances absorption of nutrients

Decreased motility and crowding of the abdomen with foetus causes Esophageal reflux, and therefore heart burn and constipation.

Intestinal secretions e.g. HCl are decreased, reducing gastric acidity and reducing iron and calcium absorption.

Renal Changes:

Renal flow increases by 75% and glomerular filtration rate by 50% . Glucose, amino acids and water soluble vitamins may be excreted at a higher rate. The kidney is not able to adjust completely and as a result the nutrients to be absorbed are excreted. The ability to excrete H₂O is lowered and therefore presence of mild edema.

Hormonal changes:

There's increased secretion of hormones which ensure maintenance of pregnancy and prepare the mother for development of fetus .These include:

- Progesterone
- Estrogen
- Lactogen
- Prolactin
- Oxytocin.

Changes in hormones influences nutrients requirement because different hormones perform different functions during pregnancy.

Stages of Pregnancy

A normal pregnancy lasts between 38 – 40 weeks and is divided into 3 periods referred to as trimesters.

1st trimester:

Foetal development starts at this trimester with the fertilization of an ovum by a sperm, forming a zygote (a fertilized ovum).

During the week after fertilization, the fertilized egg grows into a microscopic ball of cells (blastocyst), which implants on the wall of the uterus.

It then develops into an embryo, attached to a placenta and surrounded by fluid-filled membranes

This implantation triggers a series of hormonal and physical changes in the mother's body.

The first trimester is marked by rapid changes for both the mother and the baby.

The baby's brain, spinal cord and other organs begin to form, and baby's heart begins to beat.

Baby's fingers and toes even begin to take shape.

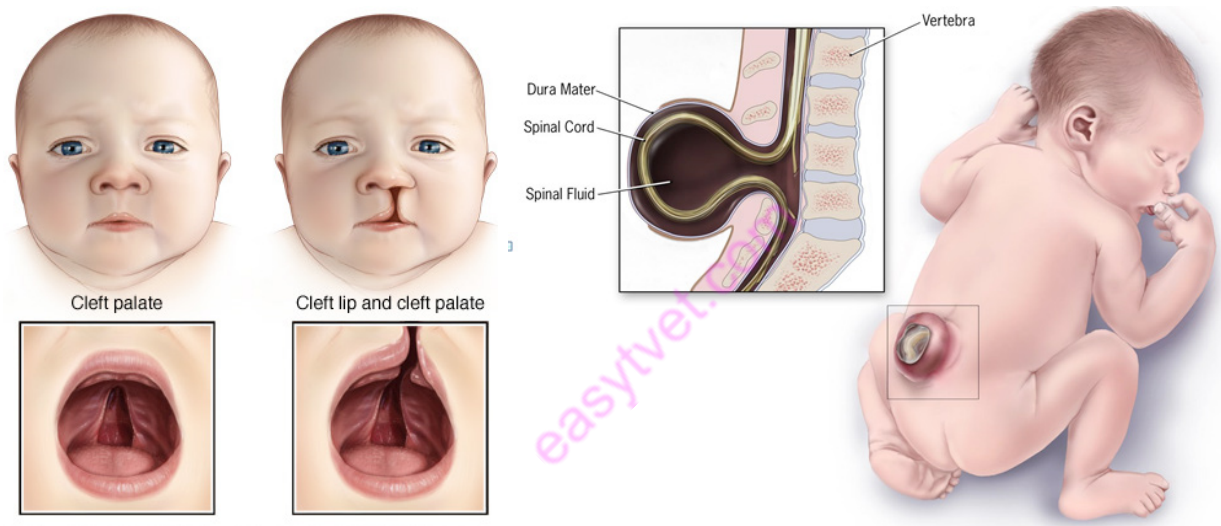
This is the beginning of the critical period of development and any injury caused by nutritional deficiencies, medication, drug abuse, radiation, trauma and other factors can interfere with the specific phases of growth in progress.

It is a time of intense rapid cell division and events scheduled for this time can only occur then and not later.

At the end of the 8th week after fertilization, the embryo is considered a fetus.

In this trimester, nutrient deficiency can cause defects such as cleft palate, missing limbs and neural tube defects. This can produce major defects in the CNS causing serious disabilities and even infant death.

Neural tube defects include Spina bifida, which is characterized by incomplete closure of the spinal column. It is also accompanied by varied abnormalities and is associated with Folate deficiency.



Cleft lip and palate

Spina bifida

2nd Trimester:

During this trimester the fetus has arms, hands, fingers, feet and the toes.

It also has ears and also begins to form the tooth sockets in its jaw.

The developing organs continue to grow and mature and at this stage the heartbeat can be felt.

Most of the bones are distinct throughout the body and the foetus starts looking like an infant.

The fetus can suck their thumb and kick at this stage.

3rd Trimester:

The seventh, eighth, and ninth months are the third and final trimester of pregnancy.

Babies weigh about 2 1/4 pounds by the start of the third trimester.

They can blink their eyes which now have lashes.

Their wrinkled skin is starting to smooth out as they put on baby fat.

They're also developing fingernails, toenails, and hair and adding billions of neurons to their brain. The baby will spend his or her final weeks putting on weight.

At full term, the average baby is more than 19 inches long and weighs nearly 7 pounds

Complications during Pregnancy

1. Nausea and vomiting

Pregnant women may experience nausea and vomiting in the first trimester. Sensitivity to food appearance, texture and smell is blamed on hormonal changes in pregnancy. This leads to loss of nutrients and they need to compensate by consuming extra nutrients and calories. Severe vomiting may lead to dehydration, which is harmful to the mother and the foetus.

How to manage Nausea and Vomiting:

- Eat dry toast or crackers
- Arise slowly
- Chew gum
- Eat small, frequent meals
- Avoid foods with offensive odors
- When nauseated, do not drink water, milk, coffee or tea

2. Constipation

Pregnant women may also experience constipation. Hormones that support pregnancy alter intestinal muscle tone and increases food transit time. Also, the growing foetus exerts pressure on the intestinal organs. These two changes cause pregnant women to experience constipation, which causes bloating and abdominal discomfort.

Constipation can be relieved by;

- Eating foods high in fiber (fruits, vegetables and whole-grain cereals)
- Exercise regularly
- Drink at least 8 glasses of liquids a day
- Respond promptly to the urge to defecate
- Use laxatives only as prescribed by a physician

3. Heart burn

Heartburn results from relaxation of intestinal muscles, including the lower esophageal sphincter, allowing stomach acid to flow back into the esophagus. The growing foetus also exerts pressure on the stomach, forcing its contents into the esophagus. This causes a burning sensation.

Constipation may be relieved by:

- Eating small, frequent meals
- Drinks liquids between meals
- Avoid spicy or greasy foods
- Chew food thoroughly
- Sit up while eating; elevate the head while sleeping
- Wait an hour after eating before lying down or exercising

4. Gestational Diabetes

1 in 14 pregnant women who does not have diabetes develops gestational diabetes, a glucose intolerance that develops during pregnancy. It is characterized by high blood glucose levels. The condition resolves after pregnancy but some women develop Type 2 diabetes, especially if they're overweight. With appropriate nutritional care and adequate follow up, harmful effects can be prevented.

The most common consequences of gestational diabetes are complications during labor and delivery and a high infant birth weight.

Birth defects associated with gestational diabetes include;

- Heart damage
- Limb deformities
- Neural tube defects.

Diet and moderate exercise may control gestational diabetes, but if blood glucose fails to normalize, insulin or other drugs may be used.

Women with gestational diabetes are advised to limit weight gain and maintain normal blood glucose levels.

5. Pre-eclampsia:

Condition characterized by high blood pressure, proteinuria and fluid retention. The edema seen in preeclampsia is whole-body fluid retention, different from normal localized edema that develops in pregnancy.

The placenta may separate from the uterus, leading to premature birth.

Pre-eclampsia often occurs after 20 weeks gestation.

6. Pre-term delivery:

Preterm birth is when a baby is born too early, before 37 weeks of pregnancy have been completed. The infants are born with various complications such as poor lung development.

Preterm may be caused by factors such as preeclampsia, chronic medical conditions, drug abuse, multiple gestation, and abnormal rupture of the uterus.

Nutrient Needs during Pregnancy

Protein and Energy Needs in Pregnancy

State	Trimester/ Period	Energy requirements	Protein requirements
Pregnancy	First trimester	36-40kcal/kg/day	0.8-1.0g/kg/d
		+150kcal/day	+0.7g/day
	Second trimester	+300kcal/day	+3.3g/day
	Third trimester	+300kcal/day	6g/day
Adolescent in pregnancy		40-43 kcal/kg/d	1.5g/kg/day add extra as per the trimester
Lactation	First 6mths then decrease gradually	+505kcal/day	+17.5g/day for the first 6mths of lactation +13g/day for next six months and 11g/day thereafter
	*Underweight women	+675kcal/day	+21g/day

Micronutrient requirement in pregnancy

Nutrient	Adult women	Pregnant women	Lactating mothers
Vitamin A (µg RE)	500	800	850
Vitamin D (µg)	5	5	5
Vitamin E (mg α-TE)	8	10	12
Vitamin K (µg)	65	55	55
Vitamin C (mg)	45	55	95
Vitamin B ₁ (mg)	1.1	1.4	1.5
Vitamin B ₂ (mg)	1.1	1.4	1.6
Niacin (mg NE)	14	18	17
Vitamin B ₆ (mg)	1.3	1.9	2.0
Folate (µg)	400	600	500
Vitamin (B ₁₂)	2.4	2.6	2.8
Calcium (mg)	1000	1200	1000
Phosphorus (mg)	800	1200	1200
Magnesium (mg)	280	320	355
Iron (mg)	15	30	15
Zinc (mg)	12	15	19
Iodine (µg)	150	200	200
Selenium (µg)	26	30	42

Prenatal Care Services

WHO estimates that over two-thirds of pregnant women in Africa (69 percent) have at least one Ante Natal Care (ANC) contact during pregnancy.

Essential interventions in ANC include:

- Identification and management of obstetric complications such as pre-eclampsia,
- Tetanus immunization
- Intermittent preventive treatment for malaria during pregnancy (IPTp)
- Identification and management of infections including HIV, syphilis and other sexually transmitted infections (STIs Importance of prenatal care).

ANC is also an opportunity to promote the use of skilled attendance at birth and healthy behaviors such as breastfeeding, early postnatal care, and family planning for optimal pregnancy spacing.

Components of ANC

- Registration
- History taking
- Obstetric examination
- Clinical service / treating minor ailments
- Health education
- Immunization

9.3.4.3 Self-Assessment

1. Identify physiological changes that take place during pregnancy
2. Identify the components of ANC
3. Discuss the nutritional management of heart burn in pregnancy
4. The following are consequences of poor weight gain during pregnancy except:
 - A. Preterm delivery
 - B. Low birth weight
 - C. Neuro tube defects
 - D. Small for gestational age babies
5. ____ is a condition characterized by high blood pressure, proteinuria and fluid retention
 - A. Gestational diabetes
 - B. Pre-eclampsia
 - C. Placenta Previa
 - D. Intrauterine growth retardation

6. Which one of the following is a component of Antenatal Care
 - A. Registration
 - B. Obstetric examination
 - C. Health education
 - D. All the above
7. Which one of the following is not advisable for pregnant mothers experiencing heart burn?
 - A. Eating small, frequent meals
 - B. Drinks liquids with meals
 - C. Avoid spicy or greasy foods
 - D. Sit up while eating; elevate the head while sleeping
8. Which of the following is not true about gestational diabetes?
 - A. All pregnant women suffer from gestational diabetes
 - B. The condition resolves after pregnancy
 - C. Some women develop Type 2 diabetes after gestational diabetes, especially if they're overweight.
 - D. With appropriate nutritional care and adequate follow up, harmful effects can be prevented.

9.3.4.4 Tools, Equipment, Supplies and Materials

- Food models
- Charts
- Manuals
- Text books
- Nutrition care manuals
- Text books
- Computers with internet
- Library and resource centre
- WHO guidelines
- MOH policies and guidelines
- Skills lab
- LCD projectors, video clips, charts and other teaching aids
- Invitation of competent expertise

9.3.4.5 References

- Coutts, A. (2000). Nutrition and the life cycle 1: maternal nutrition and pregnancy. *British journal of nursing*, 9(17), 1133-1138.
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9.3.5 Learning Outcome 4: Demonstrate knowledge in nutrition during Lactation

9.3.5.1 Learning Activities

Learning Activities	Special instructions
i) Identify terminologies during lactation as per the existing policies and guideline	➤ Define terminologies used in lactation
ii) Identify and describe postnatal care services and other interventions for lactating women as per WHO/UNICEF policies and guidelines	➤ Provide nutrition education ➤ Teach food hygiene and safety ➤ Provide support for lactating mothers
iii) Identify and describe breast feeding indicators and strategies as per WHO/UNICEF policies and guidelines	➤ Demonstrate knowledge of WHO/UNICEF guidelines on breastfeeding
iv) Identify and describe nutrition needs during lactation as per the RDAs for macro and micronutrients	➤ Calculate nutrition requirements during lactation

9.3.5.1 Information sheet

Definitions

Exclusive breastfeeding: Feeding an infant with nothing but breast milk for the first six months of life, except ORS, drops and syrups (vitamins, minerals and medicines).

Colostrum: The first type of milk produced by the mammary glands after birth, which is usually rich in antibodies

Human milk is the perfect food for infants until the age of six months. It contains adequate energy and proteins needed to support growth and development at this crucial stage in the lifespan.

Other liquids or foods can introduce source of infection and contamination, can also lower the quantity of the nutrients and may also cause a premature disruption of milk production.

The Milk Let- Down Reflex

It is an important brain-breast connection referred to as the let-down reflex is necessary. Suckling by the infant sends signal to the mother's brain which then sends a signal to the pituitary glands.

The anterior pituitary secretes the hormone prolactin which stimulates the synthesis of milk in the breast.

The posterior pituitary produces the hormone oxytocin, which causes contraction of the smooth muscle cells that are in the alveoli and ducts of the mammary glands. This causes the milk ducts to contract so that milk is released and ejected from the breast.

This process can be inhibited by tension, nervousness and fatigue.

Once lactation is established, milk production continues with suckling several times a day. When suckling stops, milk production diminishes.

Components of Breast Milk

1. Carbohydrates

Breast milk contains carbohydrates. The main being lactose, which provides over 40% of calories

Importance of lactose in breastmilk:

- Facilitates absorption of Ca & Mg
- Favors the absorption & retention of nitrogen
- Increases the acidic environment in the intestines, which stimulates the growth of gut bacteria.
- Provides galactose, important for nerve sheath synthesis.(brain development)

2. Proteins:

The amount of protein in breastmilk is less than in cows' milk, but this quantity is beneficial because it places less stress on the infant's immature kidneys to excrete urea, the major byproduct of protein metabolism. Much of the protein in breastmilk is whey protein, which is efficiently digested and absorbed. Approximately 60-80% of all protein in human milk is whey protein.

3. Lipids:

Breast milk provides approximately 50-58% of total calories in cow milk, yet the lipids in human milk are easily digested because of fat-digesting enzymes contained in breast milk. It contains essential fatty acids, such as linoleic acid & linolenic acid as well as their longer chain derivatives arachidonic acid and DHA. DHA is the most abundant fatty acid in the brain & is also present in the retina of the eye, contributing to neural and visual development.

4. Vitamins:

All vitamins needed for growth and health of infant are supplied in breast milk. However, some vitamin content in breast milk varies with the mother's diet. E.g Vitamin D

Human milk contains enough Vitamin A & Vitamin B6

5. Minerals

Breast milk contains enough minerals to support adequate growth & development. These minerals are in just enough amounts, and so cannot burden the immature infant kidneys.

Babies are born with a reserve of iron, which comes from their mother's blood while they are in the womb. For the first 6 months of life, breastfed babies will get what they need from their mother's milk. Although human milk is low in Iron, 50% is absorbed.

Zinc absorption is better from breast milk than cow's milk.

Breast milk is low in sodium compared to cow's milk.

Cow's milk contains as much Ca, 6 times as much Phosphorous, two times as much Fluorine & 3 times as much Sodium as breast milk.

Variables Affecting Breast Milk Composition

The composition of breast milk constantly changes due to:

1. Stage of lactation (colostrum, transitional milk, mature milk)

Colostrum:

It is higher in proteins, minerals and Sodium than mature milk. It is however lower in sugar, fat and calories. Colostrum is rich in antibodies and anti-infective factors that protect infants against various gastro intestinal infections.

Transitional Milk:

Colostrum begins to change to transitional milk about the 3rd – 6th day after delivery and at this stage protein decreases while carbohydrates and fat increases.

Mature Milk:

By the 10th day the mature milk is stable.

2. Maternal diet

The content of some minerals, total fat and cholesterol is not significantly affected by maternal diet. The content of other nutrients e.g. calcium are maintained at the expense of maternal tissues when maternal intake is inadequate.

The vitamin content declines as a result of inadequate maternal intake especially the Vitamin B, A, C and D.

3. Duration of the Feed

Foremilk is significantly lower in fat than hind milk. The increase in fat content is a physiological mechanism designed to provide satiety and also to signal the infant to stop feeding.

Mothers are encouraged to breastfeed the infant for longer so they benefit from the richer hind milk.

Advantages of Breastfeeding

- Breast milk contains all the nutrients needed by infant & in correct proportions to promote optimal growth.
- Contains immunological factors found in colostrum which contribute antibodies which help infants fight infection.
- Provides a sense of security for the child (bonding)
- There's less risk of contamination because breast milk isn't exposed to the external environment.
- Reduces the likelihood of allergic reactions since there are no foreign substances being introduced
- Helps the uterus to contract

- Reduces the risk of developing breast cancer
- Delays ovulation, when suckling is consistent; it is a birth control method.
- Saves money; economical
- Helps conserve iron stores
- Helps mother go back to pre-conception weight (fat accumulated is used)

Contraindications of Breastfeeding

- Mothers who have active untreated tuberculosis
- Mother is taking some medication that can pass through breast milk and adversely affect the infant e.g TB medication, chemotherapy drugs
- When the infant has diseases such as galactocaemia; cannot metabolize galactose or Phenylketonuria (PKU)-when infant cannot handle the amount of phenylalanine found in breast milk.

Nutritional Needs during Lactation

- During lactation nursing mothers tend to feel thirstier, owing to the fact that part of their water consumption is utilized by the body for the formation of milk. Increase water intake by one quarter per day to provide a total of 2.5 to 3 quarters per day
- Increase calorie consumption to about 2500 calories per day
- Encourage consumption of healthy foods rich in nutrients
- Encourage lactating mothers to eat more protein rich foods
- Provide small frequent meals
- Avoid smoking tobacco and consumption of alcohol
- Consult a physician/doctor before taking any kind of medication
- Provide folic acid and iron supplements

Nutrients (unit of measure/day)	Acceptable micronutrients distribution range (AMDR)		
	Adult women	Pregnancy	Lactation
Vitamin A (mcg)	400-600	500-700	800-1,000
Vitamin B6 (mg)	1.1-1.3	1.6-1.9	1.7-2
Vitamin B12 (mcg)	2-2.4	2.2-2.6	2.4-2.8
Vitamin C (mg)	60-85	70-100	90-130
Thiamin (mg)	0.9-1.1	1.2-1.4	1.2-1.4
Riboflavin (mg)	1.1-1.3	1.4-1.7	1.5-1.8
Niacin (mg)	14-18	17-22	17-22
Folic acid (mcg)	320-400	520-600	450-500
Vitamin D (mcg)	10-15	10-15	10-15
Vitamin E (mg)	12	12	15
Vitamin K (mcg)	140	140	140
Calcium (mg)	800-1,000	800-1,000	800-1,000
Phosphorus (mg)	580-700	580-700	580-700
Magnesium (mg)	170-240	170-240	170-240
Iron (mg)	10-18	22-27	8-11
Zinc (mg)	7-8	9-11	10-13
Copper (mg)	0.7-0.9	0.9-1.2	1.2-1.6
Selenium (mcg)	45-55	45-55	59-70
Iodine (mcg)	150	220	290

Micronutrient Requirement in Lactation

Practices Incompatible with Lactation

1. Caffeine:

Should be restricted or used in moderation because it is passed to the baby in breast milk. It causes the baby to be irritable and wakeful; too much interferes with bioavailability of iron from breast milk

2. Alcohol:

May alter the flavor of breast milk and cause infant to reject breast milk

Infants metabolize alcohol inefficiently and even lower doses have enough potential to suppress their feeding behavior.

Alcohol may also reduce breast milk production by inhibiting oxytocin

3. Some Medication:

Some medicines are contraindicated, either because they suppress lactation or because

they are secreted into breast milk and can harm the infant. Mother should consult before taking any drug, including herbal supplements

4. Illicit drugs:

Drug abuse poses harm to the physical & emotional health of the mother and the infant. Breast milk can deliver high doses of illicit drugs to cause irritability, tremors, hallucinations & even death in infants

5. Smoking:

Smoking reduces breast milk volume and nicotine affects the smell and flavor of breast milk.

9.3.5.3 Self-Assessment

1. Discuss the nutritional composition of breast milk
2. Outline the importance of colostrum
3. Discuss the variable that affect the composition of breast milk
4. Indicate whether the following statements are true or false
 - A. The milk let-down reflex can be inhibited by tension, nervousness and fatigue
 - B. The amount of protein in breastmilk is less than in cows' milk
 - C. Babies are born with a reserve of iron that lasts them 9 months
 - D. Mothers who have active untreated tuberculosis should not breastfeed
 - E. Caffeine can be taken liberally during lactation as it does not affect the baby

9.3.5.4 Tools, Equipment, Supplies and Materials

- Food charts
- Food models
- Food samples
- Text books
- Nutrition care manuals
- Text books
- Computers with internet
- Library and resource centre
- WHO policies and guidelines
- MOH policies and guidelines
- Skills lab

- LCD projectors, video clips, charts and other teaching aids
- Invitation of competent expertise

9.3.5.5 References

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9.3.6 Learning Outcome 5: Demonstrate knowledge in nutrition during Infancy (0-24 months)

9.3.6.1 Learning Activities

Learning Activities	Special instructions
i) Identify nutrition related terminologies in infancy	➤ Define terminologies related to infancy
ii) Describe nutrition requirements for infants 0-6 months/breast feeding indicators	➤ Identify breastfeeding indicators
iii) Describe breast feeding in vulnerable situations and in the context of HIV and AIDS	➤ Demonstrate knowledge of breastfeeding in vulnerable groups and HIV/AIDS
iv) Identify and describe initiatives to promote good breast feeding practices	<ul style="list-style-type: none"> ➤ Identify good breastfeeding practices ➤ Guide mothers on proper breastfeeding practices
v) Identify and describe nutrition requirements and need of infants 0-6 months	➤ Determine nutritional requirements of infants
vi) Describe nutrition requirements and feeding of infants 9 months to 11 months	<ul style="list-style-type: none"> ➤ Calculate nutrition requirements and feeding of infants 9 months ➤ Demonstrate knowledge of complementary feeding
vii) Describe nutrition requirements and feeding of infants 12 months to 24 months as per MOH, WHO/UNICEF policies and guidelines	➤ Determine nutrition requirements and feeding of infant 12 months to 24 months

9.3.6.2 Information sheet

Infant: A baby between 0 and 1 year old

Complementary feeding: Type of feeding given to infants at 6 months when breast milk alone is no longer sufficient to meet the nutritional needs.

Nutrition during the 1st year of life has long term consequences which affect health throughout life.

Growth, development & maturation occur more rapidly than any other time and adequate feeding achieves normal physical & mental development.

Nutritional deficiency effects on the infant's health will depend on when the deficiency occurs and how long it lasts. If deficiency occurs within the critical period, the consequences may be permanent.

The success of early child feeding depends on:

- The choice of feeding method
- The timing
- Pattern of introducing solid foods

Developmental Milestones in Infancy

- Infants lose weight during the 1st few days of life but the birth weight is usually regained by the 7th-10th days of life; body water decreases throughout infancy.
- They double their birth weight by the time they're 4-6 months and triple by 1yr.
- By the end of the 1st year, the growth rate slows considerably.
- They increase their length by 50% during the 1st year of life
- Total body fat increases rapidly for the first 9 months after which the rate of fat gain tappers off for the rest of the childhood.
- The newborn has a functional but physiologically immature kidney- that increases in size and the stomach capacity increases from 10-20Mls at birth to 200mls by 1yr
- Although gastric secretion of pepsin remains low (during the first 3 months) the enzymatic activity is sufficient to digest the milk protein the infant ingests normally
- Lactase activity reaches adult levels by birth whereas pancreatic amylase remains low for the 1st 6 months. (If an infant is fed on starch earlier, increased activity of salivary amylase & digestion in the colon may compensate for the low pancreatic amylase)

Infant Feeding Options

- Breastfeeding
- Infant formula
- Wet nursing
- Heat-treated animal milk
- Milk banks (breast milk)

Nutrition Requirements for Infants

The nutrient needs of the infants are determined by:

- The rate of growth
- Energy expended in activity
- Basal metabolic needs
- The interaction of nutrients consumed

Nutritional Requirements of Infants

Energy requirements:

Age	Energy Requirement per Day
0-3 months	100-120kcal/kg
3-6 months	110-115kcal/kg
6-12 months	90-110 kcal/kg

Careful monitoring of energy & nutrient intakes should be done in the event of weight reduction, failure to gain weight, weight loss or failing growth, which could signify malnutrition or undetected disease.

Protein

2g-2.2 g/kg body weight is adequate for tissue growth. Proteins should provide 30-40% of calories per day. This is adequately provided in breast milk

Requirements are based on the composition of human milk, with the assumption that breast milk is 100% utilised and that breast milk is adequate for the first 6 months.

In the 2nd 6 months of life, the diet should be supplemented with high quality proteins.

Inadequate intake of proteins can result from:

- excessive dilution of milk formula
- deprivation due to poverty
- food allergies
- Extreme vegetarian food patterns.

Carbohydrates

Should supply 30-60% of energy intake

37 % of the calories in breast milk and 40-50% of calories in commercial formula are derived from lactose

Fluid

Requirements are determined by the amount of losses from the skin, lungs, faeces and urine and a small amount needed for growth.

Human milk supplies water in amounts adequate under ordinary conditions, but additional water may be necessary if the weather is hot & humid or due to other losses like diarrhea.

Breastfeeding in HIV/ AIDS

The most appropriate infant feeding option for an HIV-infected mother should continue to depend

on her individual circumstances, including her health status and the local situation, but should take greater consideration of the health services available and the counselling and support she is likely to receive.

Exclusive breastfeeding is recommended for HIV-infected women for the first six months of life unless replacement feeding is acceptable, feasible, affordable, sustainable and safe for them and their infants before that time.

When replacement feeding is acceptable, feasible, affordable, sustainable and safe, avoidance of all breastfeeding by HIV-infected women is recommended.

At six months, if replacement feeding is still not acceptable, feasible, affordable, sustainable and safe, continuation of breastfeeding with additional complementary foods is recommended, while the mother and baby continue to be regularly assessed. All breastfeeding should stop once a nutritionally adequate and safe diet without breast milk can be provided.

Whatever the feeding decision, health services should follow up all HIV exposed infants, and continue to offer infant feeding counselling and support, particularly at key points when feeding decisions may be reconsidered, such as the time of early infant diagnosis and at six months of age

Breastfeeding mothers of infants and young children who are known to be HIV infected should be strongly encouraged to continue breastfeeding.

Initiatives to Promote Good Breastfeeding Practices

The World Health Organization (WHO) recommends the following steps to successful breastfeeding:

Critical Management Procedures

1.
 - a) Comply fully with the International Code of Marketing of Breast-milk Substitutes and relevant World Health Assembly resolutions.
 - b) Have a written infant feeding policy that is routinely communicated to staff and parents.
 - c) Establish ongoing monitoring and data-management systems.
2. Ensure that staff has sufficient knowledge, competence and skills to support breastfeeding.

Key Clinical Practices

3. Discuss the importance and management of breastfeeding with pregnant women and their families.
4. Facilitate immediate and uninterrupted skin-to-skin contact and support mothers to initiate breastfeeding as soon as possible after birth.
5. Support mothers to initiate and maintain breastfeeding and manage common difficulties.
6. Do not provide breastfed newborns any food or fluids other than breast milk, unless medically indicated.
7. Enable mothers and their infants to remain together and to practise rooming-in 24 hours a day.

8. Support mothers to recognize and respond to their infants' cues for feeding.
9. Counsel mothers on the use and risks of feeding bottles, teats and pacifiers.
10. Coordinate discharge so that parents and their infants have timely access to ongoing support and care.

Substantial evidence has indicated that following the Ten Steps improves breastfeeding rates significantly. The steps are to be implemented by facilities providing maternity and newborn services.

Complementary Feeding

Exclusive breastfeeding is recommended for the 1st 6 months of an infant's life. At 6 months, other foods should be introduced to meet increased energy needs and supply adequate nutrients necessary for optimal growth and development at this crucial stage. Complementary feeding should not replace breast feeding. Breast milk remains the primary source of nutrition for the infant.

Guiding Principles for Appropriate Complementary Feeding

- Introduce one type of food at a time and monitor for any allergic reactions for between 2-7 days
- Vary the textures so that the child can get used to variety of food textures
- Meal time environment should be free from distractions
- Start with small serving sizes and increase amount gradually
- Start with feeding two times a day and increase the frequency as tolerated
- Progress from pureed food to mashed then to soft textured food
- Ensure baby is ready for solid foods before introducing any.

Physical Signs That Infant Is Ready For Solid Foods:

- Baby can support his neck or sit up well without support.
- Baby has lost the tongue-thrust reflex; does not automatically push solids out of his mouth with his tongue.
- Baby is ready and willing to chew.
- Baby is developing a pincer grasp, where he picks up food or other objects between thumb and forefinger.
- Baby is eager to participate in mealtime and may try to grab food and put it in his mouth.

Infants should be kept away from the following foods, seeing as they pose health and safety risk:

- Sticky foods e.g. Jelly, chewing gum; could easily choke
- Raw vegetables; risk of contamination, choking

- Honey- contains spores of bacterium, clostridium botulinum which causes botulism.
- Hard and crunchy foods e.g pop corn
- Nuts and seeds

9.3.6.3 Self-Assessment

1. List the infant feeding options
2. Discuss the nutritional requirements in infancy
3. Outline the advantages of breastfeeding
4. The following are signs that a baby is ready for solid foods except:
 - A. Baby can support his neck or sit up well without support.
 - B. Baby has lost the tongue-thrust reflex;
 - C. Baby is developing a pincer grasp,
 - D. Baby is eager cries a lot
5. Indicate whether the following statements are true or false about infant feeding:
 - A. Honey should be used to sweeten baby food
 - B. Breastfeeding should stop as soon complementary feeding starts
 - C. In exclusive breastfeeding, the child is given breast milk and water for six complete months
 - D. Infants should be fed raw vegetable to prevent constipation

9.3.6.4 Tools, Equipment, Supplies and Materials

- Textbooks
- Food models
- MOH. WHO/UNICEF Policy and guidelines
- Text books
- Nutrition care manuals
- Text books
- Computers with internet
- Library and resource centre
- WHO guidelines
- MOH policies and guidelines
- Ministry of Education

- Skills lab
- LCD projectors, video clips, charts and other teaching aids
- Invitation of competent expertise

9.3.6.5 References

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9.3.7 Learning Outcome 6: Demonstrate knowledge in nutrition for preschoolers (25-59 months)

9.3.7.1 Learning Activities

Learning Activities	Special instructions
i) Identify nutrition related terminologies for pre-schoolers	➤ Define terminologies related to nutrition for pre-schoolers
ii) Describe developmental milestones for pre-schoolers	➤ Describe developmental milestones for pre-schoolers
iii) Identify and describe nutrition vulnerability for pre-schoolers	➤ Identify vulnerable children among pre-schoolers
iv) Identify and describe nutrition requirements for pre-school children	➤ Calculate nutritional requirements of pre-schoolers

9.3.7.2 Information sheet

Growth is slow but steady at this stage. There is a constant increase in food intake and the child is more active. Height and weight vary greatly due to genetic and environmental influences

In spite of relatively slow growth nutrition plays an important role in:

- Furnishing the energy requirements for the vigorous activities during this age
- Enhance resistance to infection
- Provides building materials for growth
- Provide adequate nutrients stores that assist in adolescent growth.

Factors that influence feeding habits in preschoolers & school-going children include:

- **Family environment/parental influence:** the parents have the last chance to influence food choices for their children. They do this by controlling the availability of different food.
- **Family type and status:** The family's socioeconomic status determines food availability and utilization in the household. Those who are poor will be more vulnerable to multiple stresses including poor nutritional status and this can be due to lack of money for food and poor child care
- **Media:** Pre-schoolers are generally influenced by media especially advertisement and this influences the food preferences of a child. TV & internet access can also encourage inactivity, passive use of leisure time and snacking and all these can result to obesity.

- **Illness/diseases:** ill children have increased nutrient needs and limited food intake. Bacterial or acute viral infections take a short time but require an increase in intake of fluid, proteins. Chronic conditions like asthma and congenital heart diseases may make it difficult to feed. Children will therefore have to adjust to amount of food recommended.

Nutritional Requirements

Age	RDA Calories	RDA proteins
0-3 months	100-120kcl/kg	2.2g/kg
3-6 months	110-115kcl/kg	2.2g/kg
6-12 months	90-110kcl/kg	2.0g/kg
1-3 years	100-105kcl/kg	1.8g/kg
4-5 years	85-100kcl/kg	1.5g/kg

Energy and protein requirements for pre-schoolers

Nutrient	1-3yrs	4-6yrs	7-9yrs
Energy (kcal)	1300	1800	2400
Protein (g)	16	24	28
Vitamin A ($\mu\text{g RE}$)	400	500	700
Vitamin D (μg)	5	5	5
Vitamin E (mg $\alpha\text{-TE}$)	6	7	7
Vitamin K (μg)	15	20	25
Vitamin C (mg)	30	30	35
Vitamin B ₁ (mg)	0.5	0.6	0.9
Vitamin B ₂ (mg)	0.5	0.6	0.9
Niacin (mg NE)	6	8	12
Vitamin B ₆ (mg)	0.5	0.6	1.0
Folate ($\mu\text{gaffe/day}$)	160	200	300
Vitamin (B ₁₂)	0.9	1.2	1.8
Calcium (mg)	500	600	700
Phosphorus (mg)	800	800	800
Magnesium (mg)	60	70	100
Iron (mg)	10	10	10
Zinc (mg)	10	10	10
Iodine (μg)	75	110	100
Selenium (μg)	17	21	21

Micronutrient needs of pre-schoolers

9.3.7.3 Self-Assessment

1. Identify factors that determine feeding habits of preschoolers
2. Describe the developmental milestones for pre-schoolers
3. Which one of the following is not a role of nutrition for pre-schoolers?

- A. Furnishing the energy requirements for the vigorous activities during this age
 - B. Enhance resistance to infection
 - C. Provide adequate nutrients stores that assist in adolescent growth.
 - D. All the above
4. Indicate whether the following statements are true about nutrition for pre-schoolers:
- A. Growth in this stage is faster than during infancy
 - B. Ill children may have increased nutrient needs
 - C. Good feeding habits should begin to be inculcated at pre-school age
 - D. There is a high risk of child obesity if a pre-schooler is not physically active

9.3.7.4 Tools, Equipment, Supplies and Materials

- Manuals
- Food models
- Charts
- Text books
- Nutrition care manuals
- Text books
- Computers with internet
- Library and resource centre
- WHO guidelines
- MOH policies and guidelines
- Ministry of Education
- Skills lab
- LCD projectors, video clips, charts and other teaching aids
- Invitation of competent expertise

9.3.7.5 References

1. Roberts, S., & Heyman, M. B. (2011). *Feeding your child for lifelong health: birth through age six*. Bantam.
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3. Haddad, L., Bhattarai, S., Immink, M., & Kumar, S. (1996). *Managing interactions between household food security and preschooler health*. Intl Food Policy Res Inst.

9.3.8 Learning Outcome 7: Demonstrate knowledge in nutrition for pre-adolescents (6years-12 years)

9.3.8.1 Learning Activities

Learning Activities	Special instructions
i) Identify nutrition related terminologies for pre-adolescents	
ii) Describe developmental milestones	<ul style="list-style-type: none"> ➤ Identify pre-adolescent developmental milestones ➤ Determine nutrition vulnerabilities for pre-adolescents
iii) Identify and describe Nutrition vulnerabilities for pre-adolescents	<ul style="list-style-type: none"> ➤ Identify vulnerable pre-adolescents
iv) Identify and describe nutrition requirements for pre-adolescents	<ul style="list-style-type: none"> ➤ Demonstrate knowledge of pre-adolescent nutritional requirements

9.3.8.2 Information Sheet

Children at this age are often school-going children and so their nutritional requirements will differ from preschoolers. They are more active and actively growing and developing. Their bodies therefore need to be furnished with adequate energy and nutrients.

Pre-adolescents rarely develop severe malnutrition because:

- They are growing more slowly
- They can eat more food at one meal since their stomach capacity has increased
- They are more resistant to many infections
- They can demand for food when hungry
- They are able to get a share of the family meal since they feed faster.
- In the rural setting they collect and eat some wild fruits.

However, undernutrition can still occur if:

- The child was under nourished when they were younger
- If the child is a poor eater
- If there are restrictions; religion, allergies
- When there are parasite infections
- When they consume a lot of low nutritive value snacks

Common nutrition problems for these children include:

- Overweight & obesity
- Anaemia
- Poor dental health
- Allergies
- Parasite infestation
- Protein Energy Malnutrition (PEM)

Nutrition Requirements for Pre-adolescents

Nutrient	1-3yrs	4-6yrs	7-9yrs
Energy (kcal)	1300	1800	2400
Protein (g)	16	24	28
Vitamin A ($\mu\text{g RE}$)	400	500	700
Vitamin D (μg)	5	5	5
Vitamin E (mg α -TE)	6	7	7
Vitamin K (μg)	15	20	25
Vitamin C (mg)	30	30	35
Vitamin B ₁ (mg)	0.5	0.6	0.9
Vitamin B ₂ (mg)	0.5	0.6	0.9
Niacin (mg NE)	6	8	12
Vitamin B ₆ (mg)	0.5	0.6	1.0
Folate ($\mu\text{gaffe/day}$)	160	200	300
Vitamin (B ₁₂)	0.9	1.2	1.8
Calcium (mg)	500	600	700
Phosphorus (mg)	800	800	800
Magnesium (mg)	60	70	100
Iron (mg)	10	10	10
Zinc (mg)	10	10	10
Iodine (μg)	75	110	100
Selenium (μg)	17	21	21

Micronutrient requirement for pre-adolescents

9.3.8.3 Self-Assessment

1. Discuss the nutritional requirement of pre-adolescents
2. The following nutritional and health problems are common in pre-adolescents except:
 - A. Anaemia
 - B. Poor dental health
 - C. Protein Energy Malnutrition (PEM)
 - D. Type 2 diabetes

3. Indicate whether the following statements are true or false about pre-adolescent nutrition:
 - A. They can eat more food at one meal since their stomach capacity has increased
 - B. They are less resistant to many infections than the pre-schoolers
 - C. A pre-adolescent child is at risk of malnutrition if they were under nourished when they were younger

9.3.8.4 Tools, Equipment, Supplies and Materials

1. Food charts
2. Food models
3. Food samples
4. Text books
5. Nutrition care manuals
6. Text books
7. Computers with internet
8. Library and resource centre
9. WHO guidelines
10. MOH policies and guidelines
11. Ministry of Education
12. Skills lab
13. LCD projectors, video clips, charts and other teaching aids
14. Invitation of competent expertise

9.3.7.5 References

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9.3.9 Learning Outcome 8: Demonstrate knowledge in nutrition for adolescents (13years-19 years)

9.3.9.1 Learning Activities

Learning Activities	Special instructions
i) Identify nutrition related terminologies for adolescents	➤ Define related terminologies
ii) Describe developmental changes in adolescence resource materials	➤ Identify developmental changes in boys and girls
iii) Identify and describe nutrition vulnerabilities for adolescents are	➤ Identify vulnerable adolescents
iv) Identify and describe nutrition requirements for adolescents	➤ Determine nutritional requirements of adolescents
v) Identify and describe factors influencing dietary practices and food choices	➤ Demonstrate knowledge of factors influencing dietary practices and food choices of adolescents

9.3.9.2 Information Sheet

Definition

Adolescence; a period of transition from childhood to adulthood and is accompanied by a series of psychological, physical, biochemical and even physiological changes

Menarche: Onset of menstruation

The progress changes in adolescence are characterized by an orderly sequence but there are variations between sexes and even between individuals in timing, intensity of changes and deviation of the process.

Body Changes in Adolescence	
Boys	Girls
• Increase in size and strength of muscles	• Onset of menarche
• Voice changes	• Breast enlargement
• Broadening of chest	• More fat deposit compared to muscle mass in boys
• Appearance of pubic hair	• Less bone growth compared to boys

<ul style="list-style-type: none"> • Increase in sweat production& development of body odor 	<ul style="list-style-type: none"> • Appearance of pubic hair
<ul style="list-style-type: none"> • Rapid height acquisition (“growth spurt”) 	

Nutrients Requirements

They are higher than at any other time with exception of pregnancy and lactation. Nutrient needs will vary depending on :

- the rate of growth
- body size
- physical activity

Adolescents 10-18yrs		
Nutrient	Male	Female
Energy (kcal)	2500	2150
Protein (g)	0.9	0.9
Vitamin A (µg RE)	600	600
Vitamin D (µg)	5	5
Vitamin E (mg α-TE)	10	7.5
Vitamin K (µg)	35-65	35-65
Vitamin C (mg)	40	40
Vitamin B ₁ (mg)	1.2	1.1
Vitamin B ₂ (mg)	1.3	1.0
Niacin (mg NE)	16	16
Vitamin B ₆ (mg)	1.3	1.2
Folate (µgDFE/day)	400	400
Vitamin (B ₁₂)	2.4	2.4
Calcium (mg)	1300	1300
Phosphorus (mg)	1200	1200
Magnesium (mg)	250	250
Iron (mg)	12	15
Zinc (mg)	15	12
Iodine (µg)	110	100
Selenium (µg)	34	26

Adolescence nutrition requirements

Factors Influencing Food Intake in Adolescents

- Body image
- Family
- Peers
- Media e.g. TV, magazine, social media
- Family financial status
- Nutrition knowledge

Nutritional & Health Problems Common in Adolescence

- Anemia
- Eating disorders such as Anorexia nervosa
- Complications of early pregnancy
- Obesity

Anorexia nervosa

- o An eating disorder involving a physiological loss or denial of appetite and self starvation related to a distorted ideas on body image.
- o People suffering from this disorder think they are 'fat' and have intense fear for obesity.
- o Can be caused by pressure to maintain a certain weight, look attractive or competent on a job or
- o Seeking acceptance from peers.

Effects of Anorexia Nervosa

- Lowered body temperature because of loss of fat insulation
- Slower BMR due to a reduction in synthesis of thyroid hormone.
- Decreased heart rate due to the slower metabolism; this leads to fatigue and fainting
- Leads to iron deficiency anaemia
- Leads to a low white blood cell count and leads to risk of or rise in infections
- Loss of hair
- Leads to constipation

Bulimia Nervosa

- Eating disorder in which large quantities of food is eaten at one time (binge eating) and then purged from the body by vomiting or use of laxatives and other means
- It is seen in older adolescents who seek to maintain a normal weight.

- It's also characterized by strict dieting, taking diuretics and hyper gymnasia to retain normal weight & body shape.
- People with this disorder are difficult to identify because they keep their purge behavior secret and their symptoms are not obvious.
- Leads to loss of menstrual periods (amenorrhea)

Effects of Bulimia Nervosa

- Iron deficiency anemia
- Can alter body temperature
- Lower immunity because of inadequate intake
- Lead to constipation due to overuse of laxatives
- Dehydration and electrolyte imbalance
- Repeated exposure of teeth to acids in vomiting cause demineralization making the teeth painful and sensitive to acid heat and cold. This may eventually lead to teeth decay, erosion of tooth and cause teeth to fall out.
- It can cause gastric dilation with an increased risk of rupture and this can cause death.

9.3.9.3 Self-Assessment

1. Discuss the nutritional requirements in adolescents
2. Which one of the following is not true about anorexia nervosa?
 - A. Anorexics have a distorted perception of their weight where they think they are overweight
 - B. It is often caused by the need to fit into societal and peer expectations
 - C. It can lead to amenorrhea
 - D. Anorexics are able to keep a normal weight
3. Which one of the following is not a sign of adolescence in girls?
 - A. Onset of menarche
 - B. Breast enlargement
 - C. Chest broadens
 - D. Appearance of pubic hair
4. Which one of the following is not a common nutritional & health problems in Adolescence
 - A. Anemia
 - B. Eating disorders such as Anorexia nervosa

- C. Complications of ageing
 - D. Obesity
5. Which one of the following is not a factor that determines food intake in adolescents:
- A. Body image
 - B. Sarcopenia
 - C. Peers
 - D. Media
6. The following are factors that determine nutrient intake in adolescents except:
- A. The rate of growth
 - B. Body size
 - C. Self esteem
 - D. Physical activity

9.3.9.4 Tools, Equipment, Supplies and Materials

- Food charts
- Food models
- Food samples
- Text books
- Nutrition care manuals
- Text books
- Computers with internet
- Library and resource centre
- WHO guidelines
- MOH policies and guidelines
- Ministry of Education
- Skills lab
- LCD projectors, video clips, charts and other teaching aids
- Invitation of competent expertise

9.3.9.5 References

Brown, J. E. (2016). Nutrition through the life cycle. Cengage Learning.

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9.3.10 Learning Outcome 9: Demonstrate knowledge in nutrition for adults (20years-60 years)

9.3.10.1 Learning Activities

Learning Activities	Special instructions
i) Identify nutrition related terminologies in adulthood	➤ Define terminology related to adulthood
ii) Identify and describe nutrition vulnerabilities and habits with nutrition implication	➤ Identify vulnerable adults
iii) Describe nutrition requirements for early adulthood (20-40 years)	➤ Determine nutritional requirements of early adulthood (20-40 years)
iv) Describe nutrition requirements for mid adulthood (40 years-60 years)	➤ Calculate nutritional requirements for mid-adulthood (20-40 years)

9.3.10.2 Information Sheet

Definitions

Adulthood: the period in the human lifespan in which full physical and intellectual maturity have been attained. Adulthood is commonly thought of as beginning at age 20 or 21 years.

In psychology, adulthood is defined as a period of optimum mental functioning when the individual's intellectual, emotional, and social capabilities are at their peak to meet the demands of **career, marriage, and children.**

Stages of Adulthood

- Early adulthood – 20s to 30s
- Middle adulthood - 40s to 50s
- Older adulthood - 60s to 70s
- Oldest adulthood - 80s and 90s

In early adulthood our physical abilities are at their peak, including muscle strength, sensory abilities, and cardiac functioning. The aging process also begins during early adulthood and is characterized by changes in skin, vision, and reproductive capability.

Aging speeds up during middle adulthood and is characterized by:

- Decline in vision
- Hearing
- Immune-system functioning
- End of reproductive capability for women, known as menopause.

Since majority of growth and development is complete at adulthood, the objectives of nutrition change to:

- Maintaining good health and an active lifestyle
- Preventing diet-related diseases, such as cardiovascular disease, hypertension and Type 2 diabetes.

Nutritional Requirements

Growth is no longer energy demanding in adulthood and basal metabolic rate (BMR) is relatively constant among population groups of a given age and gender.

Habitual physical activity and body weight are the main determinants for the diversity in energy requirements for adult population with different lifestyles. Women bear children during these years. For women, the recommended dietary allowance for energy is 2200 kcal daily and for men, 2900 kcal.

Recommended Kilocalorie Intake For Adults With Different Nutrition Status.

BMI	SEDENTARY	MODERATE	ACTIVE
Overweight	20 – 25 kcal/kg	25-30 kcal/kg	30-35 kcal/kg
Normal	25-30 kcal/kg	30-35 kcal/kg	35-40 kcal/kg
Underweight	30-35 kcal/kg	35-40 kcal/kg	40-45kcal/kg

Source: WHO/FAO (2002)

- Carbohydrates; 45%-65% of kcals
- Protein; 10%-35%
- Total fat; 20%-35%

Nutrient	Adult women	Adult men
Vitamin A (µg RE)	500	600
Vitamin D (µg)	5 (19-50) 10 (50+)	5 (19-50) 10 (50+)
Vitamin E (mg α-TE)	7.5	10
Vitamin K (µg)	55	65
Vitamin C (mg)	45	45
Vitamin B ₁ (mg)	1.1	1.2
Vitamin B ₂ (mg)	1.1	1.3
Niacin (mg NE)	14	16
Vitamin B ₆ (mg)	1.3(19-50) 1.7 (50+)	1.3 (19-50) 1.5 (50+)
Folate (µg)	400	400
Vitamin (B ₁₂)	2.4	2.4
Calcium (mg)	1000	1000
Phosphorus (mg)	800	800
Magnesium (mg)	220	260
Iron (mg)	15	29
Zinc (mg)	12	14
Iodine (µg)	110	130
Selenium (µg)	26	34

Mineral and Vitamins Requirement for adults FAO/WHO (2001)

Factors Influencing Dietary intake in Adults

- Biological determinants such as hunger, appetite, and taste
- Economic determinants such as cost, income, availability
- Physical determinants such as access,
- Social determinants such as culture, family, peers and meal patterns
- Psychological determinants such as mood, stress and guilt
- Attitudes, beliefs and knowledge about food

Common Nutrition and Health Problems in Adulthood

- Overweight and obesity
- Alcoholism
- Mental illnesses e.g depression
- Communicable diseases
- Chronic Non-communicable diseases e.g Cardiovascular diseases (like heart attacks and stroke), Cancer, Chronic respiratory diseases (such as chronic obstructed pulmonary disease and asthma) Diabetes.

9.3.10.3 Self-Assessment

1. Outline the stages of adulthood
2. Discuss the nutritional requirements in adulthood
3. Identify factors that influence food choice in adulthood
4. Indicate whether the following statements are true or false about adult nutrition:
 - A. Growth is energy demanding in adulthood
 - B. Basal metabolic rate (BMR) is relatively constant among population groups of a given age and gender.
 - C. Women of menopausal age are at risk of osteoporosis
 - D. The main objectives of nutrition in adulthood are maintaining good health and an active lifestyle and preventing diet-related diseases
 - E. Habitual physical activity and body weight are the main determinants for the diversity in energy requirements for adult population with different lifestyles

9.3.10.4 Tools, Equipment, Supplies and Materials

- Food charts
- Food models
- Food samples
- Text books
- Nutrition care manuals
- Text books
- Computers with internet
- Library and resource centre
- WHO guidelines
- MOH policies and guidelines
- Ministry of Education
- Skills lab
- LCD projectors, video clips, charts and other teaching aids
- Invitation of competent expertise

9.3.10.5 References

1. Brown, J. E. (2016). Nutrition through the life cycle. Cengage Learning
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9.3.11 Learning Outcome 10: Demonstrate knowledge in nutrition for older persons/geriatric nutrition (60years and above)

9.3.11.1 Learning Activities

Learning Activities	Special instructions
i) Identified nutrition related terminologies for older persons	➤ Define terminologies related to nutrition in old age
ii) Identify, describe and demonstrate nutrition assessment for the older persons	➤ Conduct nutrition assessment for elderly people
iii) Describe physiological, psychosocial and economic changes for older persons	➤ Determine physiological, psychosocial and economic changes for older persons.
iv) Describe and demonstrate meal planning for the older person	➤ Plan meals for older persons
v) Identify and describe nutrition requirements for the older persons	➤ Determine nutritional requirements of elderly people
vi) Identify and describe nutrient drug interactions for the older persons	➤ Interpret interactions between drugs and nutrients
vii) Identify and describe interventions for the older persons in Kenya	➤ Apply existing interventions for older persons in Kenya

9.3.11.2 Information sheet

Elderly persons are one of the groups of people who are vulnerable to malnutrition. Aging may affect their food access and utilization, which determines their nutritional status and health. An in-depth understanding of the process of ageing and its effects on an individual's life is helpful in meal planning for elderly people.

The elderly are classified into:

Young old	65 -75 years
Old old	75 – 85 years
Oldest old	> 85 years

Factors that Determine Nutritional Needs of Elderly People

- Existing health problem
- Individual level of activity,
- Energy expenditure and caloric requirement

- Ability to access, prepare, ingest and digest food
- Personal food preferences
- Medication

As people age, they experience several changes that influence their nutrition and health status. These changes include:

a) Psychosocial Changes:

Ageing persons may experience psychological problems such as depression, memory impairment, loneliness and social isolation.

All of these may affect appetite and therefore they may not meet their nutritional requirements.

b) Physiological Changes

As the ageing process continues body composition changes as fat replaces muscle, known as sarcopenia. Because of decline in lean body mass, BMR declines by 5% and so the total Kcal needs drop. Body water also decreases along with a decline in lean body mass.

c) Gastrointestinal Changes

Gastrointestinal changes in the elderly include:

- Digestive hormones and enzymes decrease
- Lactase production decreases thus lactose is not digested.
- Intestinal mucosa deteriorates
- Hypochlorhydria , which affects protein digestion
- Pernicious anemia due to impaired vitamin B12 absorption.
- Gastric emptying time increases.
- Constipation also becomes a common problem because of increase in gastric emptying time due to overuse of laxatives, less fluids and inactivity.

d) Musculoskeletal Changes:

There is a progressive drop in bone mass which starts when people are in middle adulthood.

It accelerates in women during menopause making the skeleton more vulnerable to fractures and osteoporosis. Adequate intake of calcium and vitamin D is recommended to help keep the bones intact.

e) Decrease in sense of taste and smell

Also a common problem among the elderly

Use stronger seasoning to make food tastier, substitute some foods with others, change preparation methods.

f) Dental changes:

Some experience total loss of teeth while others, teeth might be painful due to gum diseases. This affects diet/nutrient intake. They can wear dentures, modify the consistency of food e.g. pureed, depending with elderly nutrient needs.

g) Loss of sense of thirst:

This is due to diminished activity of ADH and aldosterone. Therefore total body water is likely to reduce and they become dehydrated. Recommendation is 1ml/kcal (approx. 2liters/day).

h) Cardiovascular changes

There's increase in blood pressure especially women over 80years. Increase in serum cholesterol mostly in overweight. Organs decline in function e.g. liver, kidney, pancreas etc

i) Immune system changes

Immune system declines or operates less efficiently with age thus lessens ability to fight infections. Provide enough protein, vitamin C, Zinc etc.

Nutritional Requirements for the Elderly

Energy: Requirements reduce with age by about 5% per decade.

Proteins: Needs are the same as those of other adults or may increase due to lower absorption and chronic diseases.

RDA is 0.8 g/kg bd wt.

Fats: Reduce fat to less than 30% total Kcal/day

Vitamin D: The elderly shl'd consume Vitamin D fortified foods which provide significant Vitamin D.

Calcium: The recommendations for Vitamin D & Calcium are higher for older people. Requirement is 1200-1500mg/day

Iron: They're likely to suffer from iron-deficiency anaemia due to low dietary intake, chronic blood loss from diseases, poor iron absorption due to reduced stomach acid secretion and antacid use.

Indicators of Poor Nutrition Among the Elderly

- Significant weight loss , greater than 4% in one year.
- Low BMI or high BMI
- Significant change in functional status as measured by activities in daily living
- Anorexia
- Significant decrease in food intake
- Significant changes in cognitive function
- Significant medical and social life events

Nutrients for Which the Elderly May need Supplementation

- Calcium
- Vitamin B12
- Zinc
- Vitamin C

Interventions for Older Persons in Kenya

The National Policy for Older Persons and Ageing was enacted by Parliament in February 2009. It recognizes older persons as significant members of the society. Their rights must be respected, protected and promoted. The policy addresses the unique challenges faced by older persons in the population.

The Constitution (2010), in the Bill of Rights recognize the rights of older persons. It states that the state shall take measures to ensure the rights of older persons are recognized and:

- a) To fully participate in the affairs of the society
- b) To pursue their personal development
- c) To live dignity and respect and be free from abuse
- d) To receive reasonable care and assistance from their families and the State

The National Policy for Older Persons and Ageing seeks to:

- a) Facilitate the provision of reasonable care and assistance to Older Persons by family and the state;
- b) Promote collaboration and partnerships among key stakeholders for the effective implementation of this policy;
- c) Promote the participation of Older Persons in development processes;
- d) Enhance and facilitate Older Persons to pursue their personal development;
- e) Create a favourable environment that enables Older Persons to live in dignity;
- f) Protect the Older Persons from abuse

Other legal frameworks that provides for the welfare of the elderly are;

- The National Hospital Insurance Fund (NHIF) Act
- Pensions Act
- The National Social Security Fund (NSSF) Act
- Kenya Vision 2030

9.3.11.3 Self-Assessment

1. Identify changes that occur for the elderly and how they affect nutrition
2. Discuss the existing interventions for the elderly in Kenya
3. The following are nutrients for which the elderly may need supplementation except:
 - A. Calcium
 - B. Vitamin B12
 - C. Zinc
 - D. Vitamin B1
4. Which one of the following is a gastrointestinal change seen in older adults?
 - A. Osteoporosis
 - B. Depression
 - C. Alcohol abuse
 - D. Intestinal mucosa deteriorates
5. The following are indicators of poor nutrition in the elderly except:
 - A. Significant weight loss , greater than 4% in one year.
 - B. Anorexia
 - C. Significant increase in food intake
 - D. Significant changes in cognitive function
6. Loss of sense of thirst in the elderly is due to diminished activity of _____
 - A. Oestrogen and antidiuretic hormone
 - B. Adrenaline and oestrogen
 - C. Antidiuretic hormone and aldosterone
 - D. Adrenaline and aldosterone

7. Supplementation with ____ may help increase the sense of taste in elderly persons.
- A. Calcium
 - B. Zinc
 - C. Vitamin C
 - D. Niacin

9.3.11.4 Tools, Equipment, Supplies and Materials

- Food charts
- Food models
- Food samples
- Text books
- Nutrition care manuals
- Text books
- Computers with internet
- Library and resource centre
- WHO guidelines
- MOH policies and guidelines
- Skills lab
- LCD projectors, video clips, charts and other teaching aids
- Invitation of competent expertise

9.3.11.5 References

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