

# **PERFORM DIETETICS OPERATIONS**

## **17.1 Introduction of the Unit of Learning / Unit of Competency**

This unit specifies the competencies required to manage nutrition and dietetic services. It includes: diet modifications, enteral and parenteral nutrition, surgery, trauma and burns management, and palliative and hospice care and drug nutrient interactions.

## **17.2 Performance Standard**

By the end of this unit of learning/competency, the trainee should demonstrate ability to design normal hospital diet which meets nutritional requirements for different clients as per workplace procedures and resource materials; carry out diet modification in line with resource materials and workplace procedures, determine routes of administration and monitoring of enteral feeding as per resource materials, client's condition and policies and guidelines; recommend, calculate nutrient requirements in and monitor parenteral feeding in line with resource materials, policies and guidelines; provide nutritional management in surgery, trauma and burn as per SOPs, resource materials, policies and guidelines; provide palliative and hospice care based on resource materials, policies and guidelines; offer nutritional support and advise clients on drug-nutrient interactions in line with resource materials, policies and guidelines.

## **17.3 Learning Outcomes**

### **17.3.1 List of the Learning Outcomes**

- i) Identify terminologies in dietetics
- ii) Demonstrate understanding of modified diets in the management of non-communicable and communicable diseases
- iii) Demonstrate understanding in the management of malnutrition and micronutrient deficiencies of public health concerns
- iv) Demonstrate understanding in enteral nutrition
- v) Demonstrate understanding in parenteral nutrition
- vi) Demonstrate understanding in nutritional management of surgery, trauma, and burn
- vii) Demonstrate understanding of palliative and hospice care
- viii) Demonstrate understanding in nutrient drug interactions

## 17.3.2 Learning Outcome 1: Identify terminologies in dietetics

### 17.3.2.1 Learning Activities

Learning activity	Special instructions
i) Demonstrate ability to describe terminologies in dietetics	
ii) Describe normal and modified diets	<ul style="list-style-type: none"><li>➤ Differentiate between normal hospital diets and modified diets</li><li>➤ Apply the knowledge of therapeutic/modified diets in nutrition care</li></ul>

### 17.3.2.2 Information Sheet

#### Terminologies under dietetics

- **Dietetics:** It is the interpretation and communication of the science of nutrition; it helps people make informed and practical choices about food and lifestyle in both health and disease
- **Nutritional care:** It is the application of the art and science of nutrition in helping people select or obtain food from the primary purpose of nourishing their bodies in health or disease throughout their lifecycle
- **Therapeutic diets:** It is a diet that is modified from a normal diet to meet the requirements of the ill/ sick individual.
- **Normal diet:** it consists of any and all foods eaten by the person in health. It satisfies the nutritional needs of most patients and serves as the basis for planning modified diets.
- **Diet modification:** It refers to the action of adjusting a normal diet to change its consistency/texture, flavor and nutrient contents.
- **Food allergy:** refers an adverse immune response to a food protein.

#### Description of normal and modified diets

Normal and therapeutic diets are planned to maintain or restore good nutrition in the patient. In manual diets or hospitals, the normal diet may be designed as;

1. **Regular diet-** This diet is designed to provide adequate nutrition for promotion of optimal health. This diet is used when there are no required diet modifications or restrictions. It is the foundation of all other diets. Individual requirements for specific nutrients may vary based on age, sex, height, weight, activity level, and different physiological states.

Characteristics: foods from the basic food groups are included with the addition of other foods to provide essential nutrients

**Food guide for the regular diet**

Food groups	Major nutrients	Servings	One serving equivalent
Cereals and starchy foods	Carbohydrates *Thiamine, Iron, Niacin  (Refined cereals are poor sources of thiamine- vit. B1)	6-11	1 slice of bread  ½ cup cooked cereal, pasta or rice  ¾ to 1 cup potatoes, green bananas  1 pancake (5 inches diameter x ¼ inches thick)  3 biscuits/crackers (1½ inches cube)
Milk and milk products	Calcium, Riboflavin (vit. B2), protein, fat	2-4	1 cup fresh milk, fermented milk or yoghurt  45g cheese  ¾ cup dairy ice cream
Meat or substitutes	Protein, niacin, iron, thiamine	2-3	60-90 g cooked fish, meat, chicken, eggs  1-1½ cups of dried beans or peas  4 tbsp peanut butter
Fruits and vegetables	Vitamin A Vitamin C Vitamin K	2 good sources of vitamin C  2 good sources of vitamin A	1 piece whole fruit  ½ cup cooked vegetables  ½ cup fruit or juice  1 cup green leafy vegetables/ chopped raw vegetables
Fats and sugars	Vitamins A, D, E, K, Fat, Carbohydrates	As needed to meet energy needs. Fat- 25%-35% of total calories	Vegetable oil, margarine, butter, cream, salad dressings, mayonnaise, sweets, sugar, honey
Water		6-8 glasses	250ml

2. House diet

3. Normal/full diet

In morbidity, nutritional homeostasis is altered. This creates special nutritional needs necessitating nutritional modification. Modified diets are normal diet qualitatively or quantitatively altered as per patients'/clients' special needs and in line with the general principles of meal planning.

## Principles of diet modification

The six principles of diet modification are;

1. **Adequacy:** An adequate diet provides the human body with energy and nutrients for optimal growth, maintenance and repair of tissue, cells and organs. Water, carbohydrates, fats, proteins, vitamins and some minerals comprise the six nutrient classes relied upon for performance of essential functions and activities. These nutrients must be replaced through diet to keep the body working efficiently. An adequate diet includes foods containing proper amounts of these nutrients to prevent deficiencies, anemia, headaches, fatigue and general weakness.
2. **Balance:** A balanced diet includes foods containing sufficient amounts of each class of nutrients. For example, while milk is a good source of calcium and fish provides necessary iron and protein, the two are not enough alone. Other essential vitamins, carbohydrates and fats are found in whole grains, vegetables and fruits. The U.S. Department of Agriculture provides a great blueprint for a balanced diet with its five food groups -- grains, proteins, vegetables, fruit and dairy. Consuming the proper amount of servings from each category ensures a well-proportioned diet.
3. **Calorie control:** Once you know what to eat, the next factor is how much. It is possible to eat healthy foods and still overindulge. Therefore, a reasonable calorie allowance must be established. The amount of energy the body receives from incoming food needs to match the amount of energy needed for the body to sustain its biological and physiological activities. In other words, input needs to match output. An imbalance leads to weight loss or gain.
4. **Density:** Eating well without overeating is often challenging. One must select foods that pack the most nutrients into the least amount of calories. For example, 1 ounce of cheese and 1 cup of fat-free milk contain the same amount of calcium. While both foods are adequate sources of calcium, the milk is more calcium-dense than the cheese because you get the same amount of calcium with one-half the calories and no fat. In another example, calorie allowance is not a useful tool by number alone. Although a bowl of grapes and a can of soda contain roughly the same number of calories, the grapes contain far more nutrients than the cola. Designing a nutritionally sound diet requires proper “budgeting” of calories and nutrients so that you eat less while supporting good health.
5. **Moderation:** **Socrates once said «Everything in moderation; nothing in excess.» Though over 2,500 years old, this adage still holds true. Those who place severe restrictions on what they can or cannot eat often find it difficult to stick to a pattern of sensible eating. Depriving yourself of foods rich in fat and sugar is not necessary. When eaten on occasion, these treats are not detrimental to your health and often provide enough enjoyment to keep one motivated to continue healthy eating practices.**
6. **Variety:** It’s possible for a diet to have all the aforementioned characteristics, but still lack variety. While some people are creatures of habit and don’t mind eating the same meals every day, most of us crave a wide array of choices and tastes. Good nutrition does not have to be boring. The USDA’s food groups allow you to receive the proper nutrients while having a great selection of foods to pick and choose from. After all, variety is the spice of life.

## Food allergies or food intolerances

Sometimes people become sick from eating a particular food, because they cannot properly process or digest the food, or because they have a true allergic (immune) reaction to the food. Food allergies and food intolerance are sometimes confused with each other, but they are quite different in terms of their origin, symptoms and treatment.

### Food allergies

To protect us from illness & disease our immune systems are continuously trying to lessen the damage presented by substances called **antigens**. Antigens are part of proteins that our bodies recognize as dangerous and takes steps to neutralize. Antigens can be found almost anywhere there is protein in foods or microorganisms like bacteria.

There are two types of food allergies;

- Immediate
- Delayed allergic reaction

They are distinct from other adverse responses to food such as food intolerance, pharmacological reactions and toxin-mediated reactions. The protein in food is the most common allergic component. This occurs when the body's immune system mistakenly identifies a protein as harmful. Some proteins or fragments of proteins are resistant to digestion and those that are not broken down in the digestive process are tagged by the immunoglobulinE(igE).

When the body identifies a food as harmful, the immune system sends white blood cells to attack, it does so by producing antibodies directed against that food. The next time the food is consumed, the body mounts an immune response with the release of histamine and other chemicals that trigger allergic symptoms.

Food allergy symptoms can include:

- Skin rash
- Hives
- Swelling of the tongue and throat
- Itchy skin
- Chest pain
- Breathing problems including asthma
- Vomiting or diarrhea
- Abdominal pain and cramping

Severe allergic reactions may result in a drop in blood pressure, loss of consciousness, or even death.

The main allergic responses include; dermatitis, gastrointestinal and respiratory distress. Other responses can be life-threatening like anaphylactic responses and they need immediate medical attention.

Foods that cause allergy include peanuts, milk (mostly in children), eggs, tree nuts (like walnuts and pecans), soy, wheat, fish (mostly in adults), and shellfish (mostly in adults).

### **Treatment of food allergies**

Immunotherapy; avoidance, in which the allergic person avoids all forms of contact with the food to which they are allergic.

### **Food intolerance**

Food intolerance is a digestive system response rather than an immune system response. It occurs when something in food irritates a person's digestive system or when a person is unable to properly digest, or break down, the food. A common type of food intolerance is lactose intolerance. Persons with lactose intolerance lack an enzyme (called lactase) needed to digest the milk sugar (called lactose).

They can develop gas, bloating, and abdominal pain when they consume milk products. If an individual thinks they may have either food allergy or food intolerance, keep a diary of the foods eaten and any symptoms experienced. A food diary can help the doctor establish the correct diagnosis.

Common symptoms of food intolerance include:

- Nausea
- Stomach pain
- Gas, cramps or bloating
- Vomiting
- Heartburn
- Diarrhoea
- Headaches
- Irritability or nervousness

### **17.3.2.3 Self-Assessment**

1. Define the following terms;
  - A. Dietetics
  - B. Diet modification
  - C. Therapeutic diets
2. The sickness which people experience after eating a particular food because they cannot digest food is called \_\_\_\_\_
  - A. Food allergy
  - B. Autoimmune reaction
  - C. Food intolerance
  - D. Bloating

3. One serving of cereals for regular diet is equivalent to all of the following except;
  - A. 1 pancake
  - B. 1 cup cooked rice
  - C. 1 slice of bread
  - D. 3 biscuits
4. A \_\_\_\_\_ can help the doctor establish the correct cause of food allergy or food intolerance
  - A. Diet history
  - B. Food diary
  - C. Direct observation
  - D. 24-hour recall
5. Differentiate between food intolerance and food allergy
6. Explain how food allergies are treated
7. Giving a relevant example, identify the symptoms of food intolerance

#### **17.3.2.4 Tools, Equipment, Supplies and Materials**

- WHO guidelines
- MOH policies and guidelines
- Ministry of Education
- Skills lab
- Projectors, video clips, charts and other teaching aids
- Stationery
- Food exchange lists
- Food guide pyramid
- Invitation of competent expertise
- Computers with internet
- Library and resource centre

#### **17.3.2.5 References**

Moore M. C., 2008. Mosby's Pocket Guide to Nutritional Assessment and Care. Mosby.

Mahan, L.K., & Escott-Stump, S. (2008). Krause's Food & Nutrition Therapy (12th ed.). Philadelphia: Saunders.

Kenya National Clinical Nutrition and Dietetics Manual, MOH 2010

Elia, M., Ljungqvist, O., Stratton, R. J., & Lanham-New, S. A. (2013). *Clinical Nutrition* (2nd ed.). Hoboken, NJ: John Wiley & Sons.

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### 17.3.3 Learning Outcome 2: **Demonstrate understanding of modified diets in the management of non-communicable and communicable diseases**

#### 17.3.3.1 Learning Activities

Learning activity	Special instructions
i) Describe diet modifications in the management of non-communicable disorders.	<ul style="list-style-type: none"> <li>• Recommend a therapeutic diet for patients with different non-communicable diseases</li> <li>• Calculate the nutritional requirements of different patients suffering non communicable diseases</li> </ul>
ii) Describe diet modification in the management of communicable disorders	<ul style="list-style-type: none"> <li>• Recommend a therapeutic diet for patients with different communicable diseases</li> <li>• Calculate the nutritional requirements of different patients suffering communicable diseases</li> </ul>
iii) Produce modified diets	<ul style="list-style-type: none"> <li>• Prepare therapeutic diet for patients with different diseases</li> <li>• Determine the frequency and quantity of food to be given per feed.</li> <li>• Monitor patient's response to the diet and document in the patient's file</li> </ul>

#### 17.3.3.2 Information Sheet

**Therapeutic diet:** A meal plan that controls the intake of certain foods or nutrients.

**Hyperlipidemia:** Elevated plasma lipids

**Hyperlipoproteinemia:** Elevated plasma lipoproteins.

#### Therapeutic diets

A **therapeutic diet** is part of the treatment of a medical condition and are normally prescribed by a nutritionist or a physician. A therapeutic diet is usually a modification of a regular diet. It is modified or tailored to meet the nutrition needs of a particular person.

Therapeutic diets are modified for:

- Nutrients
- Texture



## **Purpose of therapeutic diets**

Many health conditions are caused in part by what you eat. As such treating or preventing these conditions may involve a change in diet or a special diet, often called therapeutic diet. With therapeutic diet you add or limit certain foods to improve a specific health condition

## **Significance of therapeutic diet**

Therapeutic diets are special diets designated for people with certain medical conditions. A therapeutic diet is used to help a medical condition from a nutritional perspective. Changes in diet can help or even relieve some medical conditions.

## **Conditions for therapeutic diets**

Some of the conditions that can benefit from a therapeutic diet include;

- Cardiovascular diseases such as coronary artery disease, hypertension, and heart attack and stroke
- Diabetes can also benefit from a therapeutic diet
- People with gastrointestinal diseases such as crohns disease, ulcerative colitis and celiac disease
- People with food allergies can also benefit from therapeutic diets.

## **Importance of therapeutic diets**

Therapeutic diets are very important in the practice of nutrition and dietetics for the following reasons;

- To maintain nutritional status
- To restore nutritional status
- To correct nutritional status
- To decrease weight for weight control
- To provide extra calories for weight gain
- To balance amount of carbohydrates, fats and protein for control of diabetes
- To provide a greater amount of nutrient such as protein
- To decrease amount of a nutrient such as sodium
- To exclude foods due to allergies or food intolerance
- To provide texture modifications due to problems with chewing and or swallowing.

## **Factors to consider when modifying a diet include;**

- Disease symptoms
- Severity of the symptom or disease (condition of the patient)

- Nutritional status of the patients
- Metabolic changes involved
- Physiological state

### Therapeutic modification of normal diet:

#### A. MODIFICATION IN CONSISTENCY

##### 1. Clear liquid diet

###### Purpose

This is a diet modified to provide oral fluids to prevent dehydration and relieve thirst, small amounts of electrolytes and calories in a form that requires minimal digestion and stimulation of the gastrointestinal tract. It is indicated for short term use (24hrs to 48hrs as indicated in table X. Nutritionally depleted patients should receive additional nutritional support through use of nutritionally complete minimal residue supplements or parenteral nutrition.

###### *Indication and characteristics for clear liquid diet*

Diet	Indications	Characteristics of the diet
<ul style="list-style-type: none"> <li>• E.g. Black tea, broth, strained fruit/ vegetable juices etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Pre- and Post-operation,</li> <li>• As a transition from intravenous feeding to a full liquid diet,</li> <li>• When other liquids and solid foods are not tolerated,</li> <li>• During bowel preparation prior to diagnostic visualization or surgery</li> <li>• In the initial recovery phase after abdominal surgery</li> </ul>	<ul style="list-style-type: none"> <li>• Composed of water and carbohydrates.</li> <li>• Clear liquid at room temperature</li> <li>• Leaves minimal amount of residue in the Gastrointestinal (GI) tract.</li> <li>• Provides approximately 400-500kcal, 5-10g proteins, 100-120g CHO and no fat.</li> <li>• Should be of low concentration</li> <li>• Milk and milk drinks are omitted</li> <li>• Improve energy level by addition of sugar</li> <li>• Are nutritionally inadequate in all nutrients.</li> </ul>

###### *Food guide for clear liquid diets*

Foods	Allowed	Avoid
Milk	None	All
Eggs	None	All
Fruit juice	Clear fruit juices such as apple, grape or strained fruit juices such as oranges, lemonade, grape fruit, tangerine, pineapple	All other fruits with pulp

Soups	Clear broth, bouillon (fat free)	All others
Beverages	Carbonated and non-carbonated beverages, coffee, tea, decaffeinated coffee	All others
Miscellaneous	Sugar, syrup, plain or flavored gelatin, iodized salt	All others

### *Calorie content of selected clear liquids*

Food item	Measure	Weight in gm	Energy in Kcals
Orange juice (fresh)	1 cup	240 gm	110
Lemon juice	1 tbsp	15 gm	4
Lime juice	1 tbsp	15 gm	4
Cocacola	240 ml	240 gm	110
Ginger ale	240 ml	240 gm	85
Pepsi cola	240 ml	240 gm	110
Gelatin	½ cup	-	71
Sugar	2tsp	11 gm	40
Honey	1 tbsp	21 gm	65

### *Nutrition adequacy*

This diet is nutritionally inadequate in calories, protein and all nutrients. It should not be used for more than four days

## **2. Full Liquid diet**

### *Purpose*

The full liquid diet is designed to provide nourishment in liquid form and facilitate digestion and optimal utilization of nutrients in acutely ill patients who are unable to chew or swallow certain foods. The diet is often used as a transition between the clear liquid diet and a soft regular diet. Patients with hypercholesterolemia full liquid diet to be modified to have low fat by substituting high saturated fats with low fat dairy products and polyunsaturated fats and oils. Increasing protein and caloric value of full liquid diet becomes necessary when the diet is used for a period extending over 2-3 weeks. The Table below provides indications for and characteristics of full liquid diet.

### *Indications and characteristics of full liquid diet*

Diet	Indications	Characteristics of the diet
<ul style="list-style-type: none"> <li>Soft desserts from milk and eggs,</li> <li>Pureed and strained soups, ice creams, milk or yoghurt, etc.</li> </ul>	<ul style="list-style-type: none"> <li>For post-operative patients</li> <li>For acutely ill patients or those with oesophageal/GIT disorders and cannot tolerate solid foods</li> <li>Following surgery of the face-neck area or dental or jaw wiring</li> </ul>	<ul style="list-style-type: none"> <li>Foods should be liquid at room temperature</li> <li>Free from condiments and spices</li> <li>Provides between 1500-2000kcal/day</li> <li>Large percentage is milk based foods; lactose intolerant individuals need special consideration.</li> <li>The diet may be inadequate in micronutrients and fibre</li> </ul>

### *Food guide for full liquid diet*

Food group	Allowed	Avoid
Milk and milk products (3 or more servings )	Milk, milk drinks, plain yoghurt, fermented milks	Any not tolerated
Meat and substitutes (2-3 servings daily)	Blended strained meat added to broth or cream soup, strained legumes, eggs in milk drinks, eggs in custard egg	All others Raw eggs or unpasteurized eggs if not tolerated
Cereals and starch foods (4 or more servings)	Gruel made from refined cooked cereal, strained or pureed with potatoes added to soup	All others
Fruits/vegetables 2 or more servings of fruit juice daily including 1 serving of citrus juice 2 or more servings of vegetable daily	All fruit juices are tolerated  All blended strained vegetables in soup, all vegetable juices	None  All others
Soups	Broth, bouillon (fat free) and strained cream soups made from foods allowed	All others
Fats	Butter, margarine, vegetable oils, cream in cream soups	All others
Sweets/deserts	Honey, syrup, sugar, custard, gelatin, plain ice-cream, fruit juices	All others

Beverages	Coffee, tea, cocoa, decaffeinated coffee, carbonated and non-carbonated beverages, high protein, high calorie fluid supplements	None
Miscellaneous	Salt (iodized), flavourings, herbs, spices as tolerated	All others

Milk based foods constitute a large percentage of the full liquid diet. Therefore, lactose intolerance is sometimes observed in certain individuals e.g. after surgery involving the GI tract, cases of protein energy malnutrition etc. Lactose hydrolysed milks or lactose free products may be used for such cases.

The full liquid diet can be modified to be low in fat for individuals with hypercholesterolemia by substituting low fat dairy products and polyunsaturated fats and oils for those high in saturated fats. Further adjustments may be necessary to meet the needs of patients with diabetes, renal diseases and other diseases.

### **Nutritional adequacy**

This diet may be inadequate in iron, niacin, folic acid, ascorbic acid, vitamin A, dietary fibre, proteins and calories. They therefore may require supplementation in long term use

### **3. Thick liquid diet**

This diet is moderately low in cellulose and connective tissue to facilitate easy digestion. Tender foods are used to prepare the diet. Most raw fruits and vegetables, coarse breads, cereals, tough meats and nuts are eliminated. Fried and highly seasoned foods are omitted.

### **Purpose of the diet**

The blended liquid diet is designed to provide adequate calories, protein and fluid for the patients who are unable to chew, swallow or digest solid foods. The diet prescription should be individualized to meet medical condition and tolerance. Patients with wired jaws may use a syringe, spoon, or straw to facilitate passage of liquid through openings in the teeth, depending on the physician's recommendation. Frequent feedings (six to eight feeds per day) facilitate ingestion of adequate calories and proteins. Depending on individual choice and tolerance, the diet can be used to provide adequate nutrients. Some patients experience palatability problems or may have difficulty consuming adequate volume of liquids, they may be unable to meet nutrient and fluid needs. In such situations supplementation may be necessary. Blended foods should be used immediately but can be refrigerated up to 48hrs or frozen immediately after blending to prevent growth of harmful bacteria. The following Table provides indications for and characteristics of thick liquid diet.

### Indications and characteristics of thick liquid diet

Diet	Indications	Characteristics of the diet
	<ul style="list-style-type: none"> <li>• After oral surgery or plastic surgery of the face or neck area with chewing or swallowing dysfunctions</li> <li>• For acutely ill patients and those with oral, esophageal or stomach disorders who are unable to tolerate solid foods due to stricture or anatomical irregularities</li> <li>• Those progressing from full liquid to a general diet.</li> <li>• Patients who are too weak to tolerate a general diet.</li> <li>• Those whose dentition is too poor to handle foods in a general diet.</li> <li>• Those for whom a light diet has been indicated e.g. post operative</li> </ul>	<ul style="list-style-type: none"> <li>• Fluids and food blended to a liquid form</li> <li>• Viscosity ranges from the thickness of fruit juice to that of cream soup</li> <li>• All liquids can be used to blend foods. However, nutrient dense liquids with similar or little flavor are preferable. Use of broth, gravy, vegetable juices, cream soups, cheese and tomato sauces, milk and fruit juices is recommended</li> <li>• Multivitamin and mineral supplementation is recommended</li> </ul>

### 4. Complete Blenderized /Soft Or Light Diet

This diet is designed to provide nutrients for patients unable to physiologically tolerate a general diet in which mechanical ease in eating, digestion or both are desired. The diet should be individualized based on the type of illness or surgery and the patient's appetite, chewing and swallowing ability and food tolerance. The table below shows indication for and characteristics of soft diet.

#### Indication and characteristics of soft diet

Diet	Indications	Characteristics of the diet
<ul style="list-style-type: none"> <li>• Fruit juices or cooked fruits,</li> <li>• Well-cooked cereals, strained if necessary;</li> <li>• Fresh spinach</li> <li>• Amaranth (<i>Terere</i>);</li> <li>• Pumpkin leaves;</li> <li>• Managu</li> <li>• Strained peas;</li> <li>• Potatoes, baked, boiled, or mashed.</li> <li>• Fats: butter, thin cream.</li> </ul>	<ul style="list-style-type: none"> <li>• Post-operative patients</li> <li>• Patients with mild gastro intestinal problems</li> <li>• Non-surgical patients whose dentition is too weak or whose dentition is inadequate to handle a general diet</li> <li>• For transition from thick liquid to a general diet</li> </ul>	<ul style="list-style-type: none"> <li>• Moderately low in cellulose and connective tissues</li> <li>• Tender foods</li> <li>• Fluids and solid foods may be lightly seasoned</li> <li>• Food texture ranges from smooth and creamy to moderately crispy</li> <li>• Most raw fruits and vegetables, course breads and cereals gas producing foods and tough meats are eliminated</li> </ul>

<ul style="list-style-type: none"> <li>• Milk: plain, in scrambled egg, in cream soups, in simple desserts.</li> <li>• Eggs: soft-cooked, omelettes, custards. Simple desserts; custards, ice cream, gelatine desserts,</li> <li>• Cooked fruits or cereal puddings</li> </ul>		<ul style="list-style-type: none"> <li>• Fried and highly seasoned foods, strong smelling foods should be omitted</li> </ul>
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Patients who are unable to chew or swallow hard or coarse food need a light diet.

***Food guide for light diet***

Food group	Foods recommended	Foods excluded
Milk and milk products	All milk and milk products	Those not tolerated
Vegetables	All vegetable juices, cooked vegetables as tolerated, lettuce in small amounts, salads made from allowed foods	Raw vegetables, dried peas and beans, corn, gas-forming vegetables such as broccoli, Brussels sprouts, cabbages, onions, cauliflower, cucumber, green pepper and turnips.
Fruits 2 or more servings/day One vitamin C rich source	All fruit juices, cooked or canned fruit. Avocado, banana, pawpaw, grape fruit and orange sections without membrane	Fresh or dried berries and figs
Breads and cereals 4 or more servings per day  Other starch foods	Whole grain flour products or enriched breads and cereals  Potatoes, rice, spaghetti, macaroni, other pastas and other starches as tolerated.	Coarse cereals such as bran, seeds in or on breads and crackers, bread or bread products with nuts or dried fruits, potato chips, fried potatoes, wild rice

Meat or substitutes 180 gm or more per day (3 servings per day)	All lean, tender meats, poultry, fish and shell fish, eggs, milk, cheeses, smooth peanut butter, soybean and other meat substitutes	Highly seasoned or smoked meats, poultry, fish, luncheon, meats, frankfurters, sausages, strong flavoured cheeses, and chunky peanut butter
Fats	All fats and oils, butter or fortified margarine, mild salad dressings such as mayonnaise, vinegar and oil	Highly seasoned salad dressings
Soups		Those not tolerated
Sweets and desserts		All sweets and desserts containing nuts, coconut, or fruits not allowed, fried pastries such as doughnuts

## B. MODIFICATION IN FIBRE CONTENT;

Fiber is the portion of carbohydrates not capable of being digested by enzymes in the human digestive tract, thus contributing to increased fecal output. There are two types of fiber; soluble and insoluble fiber. Diseases affecting digestive system generally require modification in fiber content. This can be high or low fiber diet.

### 1. High fiber diet

This diet contains large amounts of fiber that cannot be digested. Fiber increases the frequency and volume of stools while decreasing transit time through the gastro-intestinal tract. This promotes frequent bowel movement and results in softer stools. The recommended fiber intake for women aged 50 years and below is 21-25g/day and for men aged 50 years and below is 30-38g/day. Men over 50 years should consume at least 30g/day while women above 50 years should consume 21g/day.

#### Purpose

The diet is designed to prevent constipation and slow development of hemorrhoids, reduce colonic pressure and prevent segmentation. The diet also reduces serum cholesterol levels by decreasing absorption of lipids, reduces transit time and can be used to control- glucose absorption for diabetic patients and overweight clients. Dietary fiber reduces the risk of cancer of the colon and rectum. The table below shows the indications for and characteristics of high fiber diet



### *Indications and characteristics of high fibre diet*

Diet	Indications	Characteristics of the diet
	<ul style="list-style-type: none"><li>• Gastro-intestinal disorders</li><li>• Diverticular disease: high</li><li>• Cardiovascular disease (hypercholesterolemia):</li><li>• Cancer prevention:</li><li>• Diabetes mellitus:</li><li>• Weight reduction:</li></ul>	<ul style="list-style-type: none"><li>• High in complex carbohydrates</li><li>• Has less of refined cereals</li></ul>

It should however be noted that Intake of excessive dietary fiber may bind and interfere with absorption of calcium, copper, iron, magnesium, selenium and zinc. This results in their deficiency. Therefore, excessive intake of dietary fiber is not recommended for children and malnourished adults.

### **2. Low fibre diet or fibre restricted diet**

This diet is composed of foods containing low amounts of fiber which leave relatively little residue for formation of fecal matter. Residue is the dietary elements that are not absorbed and the total post digestive luminal contents present following digestion. The diet excludes certain raw fruits, raw vegetables, whole grains and nuts high in fiber and meats high in connective tissue. The diet is modified to meet the clients caloric, protein, fat as well as vitamins and minerals requirements.

#### **Purpose of the diet**

The fiber (low residue) restricted diet is designed to prevent blockage of an inflamed gastrointestinal tract and reduce the frequency and volume of fecal output while prolonging intestinal transit time. The table below shows indications for and characteristics of fiber restricted diet

### *Indications and characteristics for fibre restricted diet*

Diet	Indications	Characteristics of the diet
	<ul style="list-style-type: none"><li>• Gastro-intestinal disorders colitis, colostomy</li><li>• Inflammatory bowel disease, diarrhea, hemorrhoids, etc</li><li>• Acute phase of diverticulosis</li><li>• Ulcerative colitis in initial stage</li><li>• Partial intestinal obstruction</li><li>• Pre and post-operative periods of the large bowels</li><li>• convalescents from surgery, trauma or other illnesses before returning to the regular diet</li><li>• Post - perennial suturing</li></ul>	<ul style="list-style-type: none"><li>• Low in complex carbohydrates</li><li>• Has refined cereals and grains</li><li>• Legumes, seeds and whole nuts should be omitted</li></ul>

**Food guide for fibre restricted diet**

Food group	Allowed	Avoid
Milk and milk products	Limit up to 2 cups daily, whole skim evaporated or powdered milk ,chocolate milk and milk drinks	If not tolerated
Meat and meat substitutes  Legumes  Eggs	Tender lean meats, chicken, fish, liver, cottage cheese  Smooth peanut butter  Any	Meat with tough connective tissue, corned beef, luncheon meats, spiced or smoke meat or fish, strong cheese, sausage, frankfauters, samosas, mutura (African sausage), omena (sardines), fried meat.
Starchy foods and cereals	White potato, macaroni, spaghetti, white rice, refined cereals, cream of wheat, cream of rice, dry cereals such as rice, refined bread, toasts, rolls, refined crackers, smooth wimbi porridge, refined maize meal porridge	Potato skins, whole grain maize, whole grain rice, wild rice, whole grain breads or cereals containing seeds, nuts or bran, sweet potatoes.
Vegetables	Tender cooked carrots, green beans, egg plants, mushrooms, spinach, tomato juice, vegetable juice	Raw vegetables, other cooked vegetables such as cabbages, unless tolerated, corn, celery, leeks, onions, peppers, stewed tomatoes, French beans.
Fruits	Ripe bananas or citrus sections, strained fruit juices, plums, pears only if peeled, cooked and canned fruits, avocado	All other raw fruits, skinned or canned fruit if not tolerated, cooked prunes
Desserts	Any plain dessert with allowed ingredients; cake pie, ice cream, custard, pudding	All desserts containing: coconut, spices, fruits, nuts or seeds
Sweets	Jelly, syrup, sugar, honey and hard candy, plain creams, jam without seeds and skins	Jams, preserves and marmalades with seeds and skins; sweets with nuts, fruits and coconut
Beverages	Weak coffee, tea, carbonated beverages, decaffeinated coffee, cereal beverages as tolerated.	Any other if not tolerated
Miscellaneous	Salt, mild spices and herbs as tolerated	Pepper, mustard, vinegar, lemon juice, meat sauce and soy sauce unless tolerated

## C. MODIFICATION IN ENERGY

### 1. High energy diet

High energy diet is recommended to provide an energy value above the total energy requirement per day in order to provide for regeneration of glycogen stores and spare protein for tissue regeneration.

#### Purpose

Energy dense foods are used to avoid complication of bulky diet. For effective metabolism, an extra of 500kcal of the RDA is recommended per day. If there is poor appetite small servings of highly reinforced foods should be given. The diet may be modified in consistency and flavor according to specific needs. Excessive amounts of low calorie foods, fried foods or others which may interfere with appetite are avoided. Indications for and characteristics of the high energy diet is as shown in the table below.

#### *Indications and characteristics of high energy diet*

Diet	Indications	Characteristics of the diet
Energy dense foods include butter, sugar, honey and ghee which are added to the normal diet to increase energy content	<ul style="list-style-type: none"><li>• Hyperthyroidism</li><li>• wasting</li><li>• Typhoid</li><li>• Malaria</li><li>• HIV/AIDS</li><li>• All cases of prolonged degenerative illnesses</li></ul>	<ul style="list-style-type: none"><li>• Increased kilocalorie energy 35-40kcal/kg/day in adults</li></ul>

#### Food guide for high fibre diet

Food group	Foods recommended
Cereals and starches	Whole wheat bread and chapattis, millet and sorghum porridge or ugali, maize, oatmeal, brown rice, wheat germ and whole wheat flour, sesame seeds etc
Meat and meat substitutes	Meat, chicken, fish, eggs, beans, nuts, cowpeas, peas, pigeon-peas etc
Fruits and vegetables	Pineapples, oranges, bananas, passion-fruits, pawpaw fruits with skin: mangoes, peas, plums, guavas, grapes, wild fruits etc Raw vegetables: cauliflower, tomato, lettuce, carrots, onions, cucumber, celery, parsley etc. cooked vegetables: cabbage, spinach, kales, French-beans, cowpeas leaves, locally-available vegetables, broccoli, mushrooms etc
Fats	Butter, cooking fat, margarine, cream, salad-oil, salad dressing etc

Miscellaneous	Soups: vegetable soup, bean soup etc Desserts and sweets: fruit salad and puddings. Others: popcorn, pumpkin seeds etc
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## 2. Calorie restricted diet

These diets are prescribed for weight reduction. The recommended kilocalorie level is 20-25kcal/kg/day. The diet should comprise of complex carbohydrates and should provide 50-60% of the total calories. Fats should provide <30% of the total calorie.

### Purpose

To provide adequate nutrition, maintain desirable body weight, maintain normal glucose and lipid levels and to prevent, delay and treat diabetic related complications. The Table below shows the indications for and characteristics of calorie restricted diet

### *Indications and characteristics of calorie restricted diet*

Diet	Indications	Characteristics of the diet
<ul style="list-style-type: none"> <li>• Vegetables,</li> <li>• Carbohydrates</li> </ul>	<ul style="list-style-type: none"> <li>• Overweight and obesity</li> <li>• Hypertension with excess weight</li> <li>• Hyper lipidemia</li> <li>• Diabetes mellitus with excessive weight</li> <li>• Gout</li> <li>• Gall bladder diseases preceding surgery</li> </ul>	<ul style="list-style-type: none"> <li>• The diet should provide 20-25kcal/kg Bodyweight/day</li> <li>• Complex carbohydrates</li> <li>• High in dietary fiber</li> <li>• Proteins should be within the DRI</li> </ul>

### *Food guide for calorie restricted diet*

Groups	Nutrients	Tips to reduce calorie intake
Milk and milk products: 2 servings daily 1 serving=240 mls milk or 15 gm cheese or 2 cups cottage cheese	Calcium, protein, phosphorus, riboflavin, vitamin D	Use low fat or skim milk, cheese made from skim milk. Reduce the portion sizes of ice-cream and other milk type desserts

Meat and substitutes 2 servings daily 1 serving=60 to 90gm meat, poultry, fish or 1 egg or ½ cup dried legumes	Protein, calcium, phosphorus, iron, vitamin B1 (Thiamine) vitamin B2 (Riboflavin), Niacin, vitaminB12, vitaminA	Trim fat from meat before cooking, boil, roast or grill meats ,avoid gravies, sauces and fried or boiled meats  Use more fish,poultry and less meats .Reduce portion sizes
Cereals and starchy foods 4 servings daily 1 serving = 1 slice bread or ½ roll or ½ cup rice, spaghetti, macaroni, ugali mashed potatoes, matoke (green bananas), 1/2chapati,6 inch diameter	B vitamins, iron	Choose whole grain breads and avoid cereals  Boil rice or spaghetti and do not add butter or margarine  Use plain bread and pastries
Fruits and vegetables 4 servings daily (1 serving of a good source of vitamin C ,and 1 serving of a good source of vitamin A 2 servings from other fruits and vegetables)	Vitamin C, vitamin A, vitamin E, iron, potassium	Add no butter, margarine or cream in sauces; use broth or other spices for flavouring. Use low calorie dense or vinegar or lemon for salad dressing; fruit for dessert use freshly packed fruits rather than using syrup packed fruits
Others  Sugars  Fats	Energy  Vitamins A, D, E, K and energy	Use fewer fats in form of salad oil as dressing, butter, margarine, ghee and sauces, oils. Avoid sugary foods and drinks

## Dietary management in haemodialysis

### *Purpose*

The diet for a patient on Haemodialysis is aimed at:

- Maintaining optimal nutrition to preserve ideal body weight
- Treating abnormal body biochemistry and symptoms of uraemia

The abnormalities in biochemistry and the physical signs vary from person to person and with the type of renal disease present.

## Characteristics

This diet is designed to provide sufficient proteins for tissue building and adequate calories for energy and sparing proteins in the body from being broken down.

Approximately 65-75% of the allowed protein should be High Biological Value (HBV). To be best utilized by the body, this HBV protein should be spread throughout the day. Snacks eaten between meals should be high in calories. Fluids, sodium and potassium are restricted, except in special circumstances as indicated in the table on daily dietary recommendations for adult patients on Haemodialysis. Vitamins and minerals require supplementation.

### *Daily dietary recommendations for adult patients on Haemodialysis*

Nutrient	Remarks
Protein; Maintenance 1.0-1.2g/kg between* Repletion 1.3-1.4g/kg between* 65-75% Protein of HBV	<ul style="list-style-type: none"> <li>• Protein allowance increased to maintain ideal body weight</li> <li>• Protein requirements should be calculated based on body weight</li> <li>• The increased protein allowance aims at maintaining nitrogen equilibrium and replacing the amino acids and protein lost in the dialysate during treatment(6-10gm/kg amino acids per one single Haemodialysis)</li> </ul>
Calories; Maintenance 35kcal/kg between Repletion 40-50kcal/kg between Reduction 25-30kcal/kg between	<ul style="list-style-type: none"> <li>• 85% calories supply should be from carbohydrates and fats. These nutrients have a protein – sparing effect</li> <li>• Overweight patients should lose weight, as obesity may interfere with access to the veins</li> </ul>
Sodium 2-3g	<ul style="list-style-type: none"> <li>• Dietary sodium is restricted to help control fluid retention and hypertension</li> <li>• Sodium needs on Haemodialysis are judged by the state of blood pressure and the amount of fluid gained between dialysis</li> <li>• Hypotension due to salt depression will require increased sodium intake</li> </ul>
Potassium: 1.5-3g/day No restriction with urine output of 1000ml/day	<ul style="list-style-type: none"> <li>• Potassium is restricted to prevent hyperkalaemia</li> <li>• Hypokalaemia may lead to cardiac arrest</li> <li>• In case of hypokalaemia, potassium supplementation required</li> </ul>
Phosphorus; 1200mg/day	<ul style="list-style-type: none"> <li>• Dietary phosphates are restricted in the Haemodialysis patient</li> <li>• When phosphate binders are used they may cause constipation. A stool softener or a diet high in fibre should be prescribed</li> </ul>

Calcium 500-1000mg/day	<ul style="list-style-type: none"> <li>Supplementation of calcium and vitamin D is necessary since there is reduced intestinal absorption of calcium due to lack of active form of vitamin D</li> </ul>
Fluids 24 hours urine output +500mls per day	<ul style="list-style-type: none"> <li>The calculated fluid intake would prevent severe urine overloading</li> <li>Fluid intake should be increased in the event of hot weather or severe and persistent pyrexia (fever, diarrhoea or vomiting)</li> </ul>
Vitamin;B1,B2,B6 VitaminB1 Thiamine 1.5mg/day Vitamin B2, Riboflavin 1.8mg/day Niacin 20mg/day VitaminB6, Pyridoxine 5-10mg/day Folic Acid 1mg/day vitaminC100mg/day vitaminB12,Pantothenic acid5mg/day	<ul style="list-style-type: none"> <li>Water soluble vitamins are dialyzable</li> <li>Restriction of potassium containing foods leads to deficiency of water soluble vitamins</li> <li>These require supplementation</li> </ul>
Iron: 10mg men/women 18mg fertile women (child bearing age)	<p>Although the main cause of anemia is deficient production of erythropoietin due to kidney failure;</p> <ul style="list-style-type: none"> <li>Iron depletion is common in uremic patients due to bleeding tendency or occult gastrointestinal blood loss</li> <li>Some blood is also lost with each Haemodialysis treatment and blood tests</li> <li>Iron supplementation is therefore necessary</li> </ul>

## Diabetic diet

### Purpose

- Provide adequate nutrition
- Maintain desirable body weight
- Maintain normal blood glucose and lipid levels
- Prevent, delay and treat diabetic related complications

### Characteristics

This is a normal diet which should be individualized according to the patient's specific needs such as lifestyle, body weight, type of diabetes, food tolerances, medications, nutrition needs etc.

The general guidelines for distribution of calories are as follows;

### ***Carbohydrates***

50-60% of the total calories be provided by the carbohydrates with emphasis on complex carbohydrates and foods high in natural and dietary fiber.

There should be an even distribution of carbohydrates throughout the day.

Simple carbohydrates (sugars) are discouraged but could be carefully incorporated in the diet

### ***Proteins***

12-15% of the total calories should be provided by proteins or 0.8 gm/kg body weight per day for adults. Higher levels are desirable given the risk of accelerating nephropathy.

### ***Fibre***

A daily consumption of 25 gm of diet fibre for each 1000 kcal is recommended.

### ***Fats***

≤ 30% of the calories should be provided by fats with emphasis on a reduced saturated fat intake (10%) and increased unsaturated fat intake.

Vitamins and minerals

The diet should supply adequate amount of vitamins and minerals

### **General information**

Adequate control of diabetes depends on various factors e.g.:

- Control of caloric intake to achieve and maintain desirable body weight. The caloric allowance of patients of normal weight should range from 30-35 kcal/kg BW per day; 20-25 Kcal/kg BW/ day for patients with excess weight and 40-45 Kcal/kg BW/day for underweight patients
- Increased intake of dietary fibre to lower post prandial blood glucose level and alter insulin requirements. Dietary fibre also promotes satiety and assist in weight loss among other benefits.
- Meal patterns should be based on individual's lifestyle e.g, physical activities, eating habits, exercise etc
- Meal and snacks should follow a regular time schedule although lifestyles and level of activities may alter meal patterns
- Controlled exercise matched with meals could improve plasma lipids and increase insulin sensitivity. To avoid hypoglycaemia in persons with Insulin dependent diabetes mellitus (IDDM) consumption of foods supplying about 15 gm of carbohydrates is recommended 30 minutes-1 hour before moderate exercise
- The glycemic index used to qualify and compare the two 2 hour glycemic response of individual foods is unreliable. However it may be used as adjunct to the food exchange system in meal planning.
- It is recommended that sodium intake for diabetics may be limited to 6 gm per day and further restriction to 2-3 g per day for diabetic patients with hypertension or renal failure



- Use of alcoholic beverages is not recommended as this may result in hyperglycaemia especially if meals are missed or delayed. Alcohol may also cause unwanted weight gain; however, if alcohol is desired, moderate amounts could be worked into the patient's meal plans and should not exceed two equivalents of alcohol once or twice weekly.

One equivalent of alcohol is;

360ml light beer

120ml wine

It is worthwhile to note that alcohol should not be consumed on an empty stomach.

It should be ingested in combination with a meal.

### Meal planning

Diabetic meal patterns are best planned using the food exchange approach has been proved easier for patients to comprehend.

#### *Diabetic diet patterns with total food exchanges.*

Food group	Kcal 800	Kcal 1000	Kcal 1200	Kcal 1500	Kcal 1800	Kcal 2000	Kcal 2200	Kcal 2500	Kcal 3000
Milk	1	2	2	2	2	2	2	3	4
Vegetables	2	2	2	2	2	3	3	3	5
Fruits	2	2	3	3	3	4	4	4	6
Starch	3	4	5	7	9	10	12	13	14
Meat	4	4	4	6	7	7	7	8	9
Fat	0	1	2	2	3	4	5	6	8

#### *Nutrient composition of diets in table*

Nutrient	Kcal 800	Kcal 1015	Kcal 1201	Kcal 1509	Kcal 1789	Kcal 2003	Kcal 2210	Kcal 2498
Carbohydrates (g)	97	124	154	184	214	249	279	306
Protein (g)	49	60	63	83	96	101	107	125
Fat (g)	24	31	37	49	61	67	74	86

#### *Composition of diabetes exchanges*

Exchange	Approximate measure	Weight (g)	Protein (g)	Fat (g)	Carbohydrate (g)	Calories
Milk	1 cup	240	8	Trace	12	90
No fat						
1% milk	1 cup	240	8	2	12	100
2% milk	1 cup	240	8	5	12	120
Whole milk	1 cup	240	8	8	12	150

Meat or substitute						
Low fat	1 oz	30	7	3	-	55
Medium fat	1 oz	30	7	5	-	75
High fat	1 oz	30	7	8	-	100
Bread or starch	1 slice (other items vary)	25	2	trace	15	70
vegetable	½ cup	100	-	-	5	25
fruit	varies	varies	-	-	15	60
fat	1 teaspoon (other item vary)	5	-	5	-	45

### *Diabetic diet in special conditions*

Condition/diet	Special dietary needs	Comments
Pregnancy	<p>Caloric requirements;</p> <p>1<sup>st</sup> trimester same as in ordinary situation</p> <p>2<sup>nd</sup>-3<sup>rd</sup> trimester 30-38 kcal/kg 1BW</p> <p>Protein requirement;</p> <p>20-25% of the total calories or 2gm/kg, BW</p> <p>Obese pregnant diabetics:</p> <p>Sever dicting should be avoided.</p> <p>Restrict energy intake to 1200-1800 kcal daily</p>	<p>Allow 3 meals per day and 3 snacks with insulin therapy</p> <p>Without insulin, allow 3 meals and 1-3 snacks per day</p>
Lactation	Nutritional requirements are same as for non-diabetic lactating mother	Monitor blood glucose closely and adjust insulin accordingly to hypoglycaemia
Paediatrics	<p>0-1/2 year old:</p> <p>Calories: 115kcal/kg</p> <p>Protein: 2.2gm/kg</p> <p>1/2-1 year old:</p> <p>Calories: 105kcal/kg</p> <p>Protein: 2gm/kg</p> <p>1 year old and above:</p> <p>Calories: 1000+100kcal(age) or years</p> <p>Protein: 1.8gm/kg</p>	<p>Modify consistency for developmental age.</p> <p>Give adequate calories allow normal growth.</p> <p>3 meals and at least 2-3 snacks are desirable</p>

Protein restricted	Protein levels of less than 60gm/day with caloric requirements greater than 2000kcal/day necessitate an increased percentage of fat and carbohydrate above the diabetic diet standard	Calories from fat may be increased from 30-35%
Liquid diets	Clear liquids: Minimal calories are provided by this diet Full liquid diet: Calories provided as carbohydrates, protein and fats in percentages similar to that of the standard diet	Diet is nutritionally inadequate. Advance to full liquid diet as quickly as possible
Tube feedings	Tube feeding mixtures should be prepared with the standard nutrient composition for diabetic diet in mind	Closely study the composition of commercial and other tube feeding mixtures
In illness	Encourage frequent intake of nutritious fluids(1-1/2cup per hour)and aim at15gm carbohydrate every half,hour in easily digestible forms such as sweetened liquids or soft foods e.g.porridge with milk,fruit juices,potato purce, soft cereal	Blood sugar often elevated therefore,monitor closely
Hypoglycaemia (insulin shock)	As first aid give: 15gm (60kcal)of rapid acting carbohydrate,e.g 3sweets 1 glass soda 4 teaspoons sugar 3 teaspoons glucose etc. Follow up with some food within 30 minutes after symptoms subside i.e,1bread and 1 protein e.g1bread and 1 glass of milk or 1 cup uji made with milk	Encourage patients to adhere to diet and drug dosage instructions  Advise patients to always carry some sweets and sugar to avert symptoms while they are still mild
Restricted fibre	Omit tough meats,raw fruits and raw vegetables,whole grain,seeds,nuts,bran and spicy foods	Use this only during acute stages of inflammatory bowel syndromes because fibre is an important component of the diabetic diet

## Nutritional adequacy

### D. MODIFICATION IN ONE OR MORE NUTRIENTS

#### 1. Fat restricted diet

The diet is designed to restrict fat intake for patients who experience symptoms of nutrient losses when high fat foods are eaten. A fat restricted diet limits the amount of fat you can consume each day and may be prescribed conditions that make it difficult for the body to digest fat. Provision of fat restricted diet will minimize the unpleasant side effects of fat malabsorption such as diarrhea, gas and cramping. The table below shows indications for and characteristics of fat restricted diet.

#### *Indications and characteristics of fat restricted diet*

Diet	Indications	Characteristics of the diet
	<ul style="list-style-type: none"><li>• Gall bladder diseases</li><li>• Biliary tract and lymphatic system</li><li>• Hepatic cirrhosis (liver cirrhosis)</li><li>• Pancreatic insufficiency</li><li>• Malabsorption syndromes</li><li>• Intestinal resections</li><li>• Overweight and obesity</li><li>• Cardiovascular diseases (CVDs)</li><li>• bloating, diarrhoea, steatorrhea</li></ul>	<ul style="list-style-type: none"><li>• The diet provides overall fat between 25-50g/kg/day</li><li>• This diet is tailored to provide &lt;30% of total calorie and &lt; 10% saturated fat acids. Levels of restriction are as follows:<ul style="list-style-type: none"><li>• Mild restriction-25-30% of total calories</li><li>• Moderate restriction-20-25% of total calories</li><li>• Severe restriction-15-20% of total calories</li></ul></li><li>• The base of the diet should be composed of grains, vegetables and fruits</li><li>• Meat fish, poultry and eggs should be limited to 180g per day</li></ul>

#### *Recommended levels of fat restriction in different conditions*

Condition	Fat levels per day	Comment
Gallbladder disease	40-60 g or 25% of total calories	Fat restriction is continued until symptoms subside or after surgical intervention. The diet may be used for a short time after surgery until inflammation subsides.
Pancreatitis	40-50 g	With small frequent meals
Pancreatic insufficiency	50-70 g	
Cirrhosis	30-40 g	
Intestinal malabsorption	Less than 30 g	

Low fat diet is not designed to alter the cholesterol content or the ratio of polyunsaturated to saturated fats

***Food list for fat restricted diet***

<b>Food groups</b>	<b>Allow</b>	<b>Avoid</b>
Milk and milk products	Skim milk mala/yoghurt made from skim evaporated milk	Whole milk, 2% milk, condensed milk, mala/yoghurt made from whole milk, and beverages made from whole milk.
Meat and substitutes Meat, fish, poultry	Lean meats, fish, chicken without skin	Fried or fatty meats, fish, chicken, bacon, corned beef, luncheon meats, sausage, oil, packed fish peanut butter, mincemeat with greater than 20% fat
Eggs 1=30gm meat	Egg white as desired 1 boiled or poached	Fried egg, egg prepared with milk or cream
Cheese 30gm=30gm meat	Low fat or skim milk cheese Low fat cottage cheese	All others
Legumes 1/2cup=30gm meat	Dried beans or peas, lentils, green grams	Sometimes may not be tolerated
nuts		all
Vegetables 1/2cup=25gm	2 or more servings All kinds raw or cooked, 1 good source of vitamin A prepared without fat	Strong flavoured vegetable like cabbage, cucumber, cauliflower, onions, Green pepper, sometimes not tolerated Fried vegetables
Fruits	2 or more servings All kinds raw or cooked, 1 good source of vitamin C, such as citrus fruits	Avocado, coconut, sometimes not well tolerated
Cereals and starchy foods 1 or more servings	White or sweet potato, rice, macaroni, uji, etc. prepared without fat	All fried or creamed starchy foods
Fats 3 servings daily 1 serving=1 Teaspoon(5gm)	3 teaspoons only of fat or oil daily	Any in excess of 3 teaspoons
Soups	Fat free broth or vegetable soup, soup made with skim milk	Commercial soups. Soups prepared with cream, or whole milk

miscellaneous	Salt, pepper, spices flavouring, fat free gravy	Gravies, cream, sauces, cocoa, chocolate, popcorn, buttered coconut, excessive amounts of spices and seasonings
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### **Adequacy**

It is possible to meet nutrient requirements on this diet, but depending on how long you follow it and how much fat you can digest a supplement may be recommended and provided that the types and amounts of food suggested are included each day. Patients with prolonged stearrhoea or diarrhea may develop vitamin or mineral deficiencies. Vitamin A, D, E and K are fat soluble which means they need fats to be absorbed and this requires advice from the nutritionist/dietitian or doctor. The requirements for iron may not be met in the case of steatorrhea which decrease iron absorption. When fat is severely restricted, protein intake may be limited since most protein foods also contain fat. A fat restricted diet may not meet the patient's energy needs, because many calorie dense foods are omitted. Medium chain triglycerides are useful to increase the energy intake of patients who cannot ingest and absorb sufficient sources of energy.

### **DIETARY MANAGEMENT OF HYPERLIPOPROTEINEMIA**

Plasma lipids consist of cholesterol, cholesterol esters, phospholipids and triglycerides. These plasma lipids circulate as fat-protein complexes called lipoproteins.

### **Purpose of this diet**

These diets are designed to control serum lipids. They are used in amangement of ;

- Hyperlipdaemia
- Coronary heart disease
- Arteriosclerosis
- Artherosclerosis

### ***Characteristics***

The total fat content of this diet may be controlled to provide 35-40% of the total calories. Foods high in cholesterol and saturated fats are restricted or omitted. Fatty meat, fatty meat product, visible animal fat, dairy fat and other saturated fats are excluded. Egg yolk, organ meat and cheese are restricted and may be substituted for each other. The total cholesterol intake is restricted to 300-500 mg per day or less. Limited amount of polyunsaturated fats are essential and need to be incorporated into the diet. These are primarily of vegetable sources such as sunflower, corn and cotton seed oil.

Emphasis is laid on lean meat, fish, skinless poultry, low fat dairy products and polyunsaturated margarines.

There are five major classifications of plasma lipoproteins. Thus:

1. Chylomicrons: They consist of a core of triglycerides coated with phospholipids and proteins.
2. Very Low Density Lipoproteins (VLDL), which contain mainly triglycerides and little proteins.
3. Low Density Lipoproteins (LDL), which contain mainly cholesterol, some triglycerides and proteins
4. High density lipoproteins(HDL), which contain high concentrations of proteins, some cholesterol and low concentrations of triglycerides
5. Intermediate Density Lipoproteins (IDL): these are VLDL remnants.

The total serum cholesterol is used to predict the risk of coronary heart disease for people of all ages. However, the ratio of the total serum cholesterol to HDL and that of LDL to HDL and that of LDL to HDL are more accurate risk measures for people above 55 years old.

Table A illustrates the total serum cholesterol levels associated with different degrees of risk for different age groups. Tables B and C illustrate the degree of risk associated with different ratios of cholesterol, LDL and HDL.

**Table A: Total serum cholesterol measurements in Mg/dl**

Age	Moderate risk	High risk
2-19 years	>170	>185
20-29 years	>200	>220
30-39 years	>220	>240
>40 years	>240	>260

**Table B: Ratios of cholesterol to High Density Lipids (HDL)**

Ratio	Level of risk
5.0	High risk
4.5 or more	Cause for concern
3.5	½ Standard risk

**Table C: Low Density Lipids to High Density Lipids Ratio in Men over 50-70 years**

Ratio	Level of risk
1.0	Half the average risk
3.6	Average risk
6.3	Two times average risk
8.0	Three times average risk

## 2. Sodium restricted

Sodium is a mineral that naturally occurs in some foods. However it can also added to food in form of salt to help preserve them and add flavor. Limit sodium intake to less than 3000mg per day. RDI should be limited to 2400mg

3000mg (130mEq) -Eliminate or eat sparingly processed foods and beverages such as fast foods, salad dressings, smoked and salted meats. Omit 2000mg (87mEq)-prepared foods high in sodium do not allow salt in preparation of food or table.

1000 (45mEq) eliminate processed foods and prepared foods and beverages high in sodium. Omit many frozen foods and fast foods. Limit milk and milk products to 16oz per day. Do not allow any salt in food preparation or table use. This meal plan used in the inpatient setting for a short term basis

500 (22mEq) omit processed or canned foods high in sodium. Omit vegetables containing high amounts of natural sodium limit milk to 16 oz daily and meat to 5 oz daily and meat products. Use low sodium bread and distilled water for cooking where available.

Allow up to ¼ tsp table salt in cooking or at the table

### Purpose

The purpose of a low sodium diet is to aid control of blood pressure (BP) in salt sensitive people and to promote the loss of excessive fluids in edema and assist and manage hypertension. The table below shows the indications for and characteristics of low sodium diet.

### *Indications and characteristics of low sodium diet*

Diet	Indications	Characteristics of the diet
<ul style="list-style-type: none"> <li>Unprocessed foods and beverages</li> <li>Low sodium bread</li> </ul>	<ul style="list-style-type: none"> <li>Impaired liver functions</li> <li>Cardiovascular diseases</li> <li>Severe cardiac failure</li> <li>Acute and chronic renal diseases</li> </ul>	<ul style="list-style-type: none"> <li>A diet low in processed foods and beverages</li> <li>Diet should be low in canned foods, margarine, cheeses, and salad dressings.</li> </ul>

### Nutritional adequacy

## 3. Low protein

A low protein diet is temporarily indicated/ prescribed to avoid breakdown of tissue protein which can lead to undesirable levels of nitrogen constituents in the blood. It is essential that the calorie intake from carbohydrates be sufficient to avoid excessive breakdown of tissue protein. Low protein may range from (0.6g-0.8g/kg/day). Indications and characteristics of the diet are as shown in the following Table.



### *Indications and characteristics of low protein diet*

Diet	Indications	Characteristics of the diet
	<ul style="list-style-type: none"><li>• Hepatic coma</li><li>• Acute and chronic renal failure</li><li>• Liver cirrhosis</li><li>• Acute and chronic glomerulonephritis</li></ul>	<ul style="list-style-type: none"><li>• Low biological value protein can be used during this time.</li><li>• The amount can be reduced to 20-35gms per day.</li></ul>

### **4. High protein-high calorie diet**

This diet is tailored to provide higher amounts of calorie and protein than usual diet. It is prescribed where tissue regeneration is required. Its purpose is to help heal wounds, maintain or increase weight, promote growth, decrease respiratory complications, resist or fight infections and support the immune system. For a high protein diet, adequate energy from carbohydrates and fats must be supplied.

#### **Purpose**

The diet is designed to maintain a positive nitrogen balance, promote normal osmotic pressure, promote body tissue repair, prevent excessive muscle atrophy in chronic disease states and build or repair worn out tissues of severely malnourished individuals. This diet can also be used to meet increased energy and protein demands during illness, during certain periods like pregnancy and lactation. The table below shows indication for and characteristics of the diet.

### *Indications and characteristics of high protein-high calorie diet*

Diet	Indications	Characteristics of the diet
	<ul style="list-style-type: none"><li>• Febrile conditions</li><li>• Cancer</li><li>• Wounds</li><li>• Burns</li><li>• Tissue injuries and trauma</li><li>• After surgery</li><li>• Acute and chronic fever e.g. TB, Malaria and Typhoid.</li><li>• Certain physiological alteration - pregnancy and lactation/infancy</li></ul>	<ul style="list-style-type: none"><li>• The diet must provide adequate protein carbohydrates ratio of (2:1).</li><li>• The diet should provide i.e.35-40kcal/kg body weight/day 1.5-2.0g/kg body weight/day</li><li>• Consist more of high biological value protein</li></ul>

## 5. Bland diet

This is a diet modified to avoid irritation of any kind to the alimentary tract. Such diets are chemically, mechanically and thermally modified. In bland diet, strong spices, stimulants and strongly flavored vegetables and fruits that irritates should be avoided. The food should be served at room temperature.

## 6. Exclusion of certain foods from the diet in allergic conditions, increasing frequency of feeding

In allergic conditions certain specific foods to which the individual is extremely allergic should be excluded from the diet. Some people are allergic to protein foods like milk, eggs, peanut, soya and seafood.

## OTHER THERAPEUTIC DIETS

### Aldosterone test diet

Aldosterone is the adrenal cortex hormone that regulates water and electrolyte balance (sodium and potassium). The aldosterone test is performed to aid in the diagnosis of primary and secondary aldosteronism. All dietary sodium and potassium prescriptions are eliminated. The patient should consume a normal dietary intake of sodium (at least 110 milliequivalents) and potassium (50 milliequivalents) during the testing period.

### Hydroxyproline test diet

The test diet is required in the determination of hydroxyproline in the urine in which reflects collagen metabolism. Hydroxyproline is an index of bone collagen turn over and metabolic activity of the bone associated with medication, growth hormone and certain disease states e.g( pagets disease, hyperparathyroidism). This diet is used 24 hours prior to and during the 24 hour urine collection. After the test period, the previous diet is resumed unless ordered otherwise.

Food which are excluded:

Gelatin and gelatin containing foods such as:

- Meat
- Fish
- Ice cream
- Puddings
- Whipped topping
- Salad dressing
- Soft candy

## LOW SEROTONIN TEST DIET

### 5-Hydroxy Indole Acetic Acid)

### (5-HIAA)

Serotonin is a derivative of the amino acid tryptophan. This compound is formed predominantly in the argentaffin cells of the gastrointestinal tract. It is excreted in large amounts by patients

with metastatic carcinoid syndrome. A metabolite of serotonin (5-HIAA) may be elevated in the urine of patients with carcinoid syndrome.

Therefore, the urinary determinations of 5-HIAA is the most useful means for diagnosis of carcinoid tumors.

Foods with high serotonin content interfere with determination and invalidates results.

The following items may need to be avoided prior to 5-Hydroxy Indole Acetic Acid (5-HIAA) urine collections:

- Tomatoes and tomato products
- Bananas
- Pineapples
- Pears
- Plantain
- Passion fruit
- Apricots
- Chocolate
- Coffee
- Ice cream
- Broad beans
- Red plums
- Avocado
- Peanut oils
- Pawpaw
- Nuts
- Egg plant
- Vanilla
- Tea

### **FAT FREE TEST DIET**

This diet is used prior to gall bladder radiological examination. it provides food with no fat content such as fruit gelatin, skim milk, bread and cereal products , sugar products, coffee and tea . lean meats or cottage cheese may be allowed. Give test diet at the evening meal prior to the examination.

#### **Approximate values**

Carbohydrates	60gm
Protein	33gm.
Fat	10gm.
Calories	386Kcal.

#### **Sample menu**

- Fat free broth
- Canned fruit plate with cottage cheese
- Toast
- Plain gelatin
- Coffee or tea
- Skimmed milk
- Sugar, lemon, salt

## LOW CALCIUM TEST DIET

This test is used chiefly for metabolic studies, as a means of diagnosis, as treatment in conjunction with surgical removal of parathyroid adenoma, or as a medical treatment when operation is delayed or contra-indicated. The low calcium test diet should be ingested for a period of 2 or 3 days before starting to collect urine for analysis.

### Approximate values

Carbohydrate	191gm.
Protein	60gm
Fat	75gm
Calcium	120gm
Phosphorus	1795gm
Magnesium	200
Calories	1895 Kcal

### FOODS ALLOWED

**Meat;** beef, lamb, veal or chicken (plainly prepared)

**Beverages;** coffee or tea made with distilled water

Distilled water for drinking

**Fruits;** bananas, peaches, apple sauce, water melon, orange juice

**Vegetables;** corn, peas, cauliflower, beets, asparagus, tomatoes, Brussel sprouts.

**Fats;** butter, bacon

**Miscellaneous;** sugar

**Note:** *All other foods must be avoided*

### 2.3.3.3 Self-Assessment

1. Define therapeutic diet
2. Hyperlipidemia is \_\_\_\_\_
  - A. Elevated lipids in urine
  - B. Reduced plasma lipids
  - C. Elevated plasma lipoproteins
  - D. Elevated plasma lipids

3. The following foods are recommended for use in light diet except
  - A. Fresh or dried berries and figs
  - B. All vegetable juices
  - C. Milk and milk products
  - D. Whole grain flour products
4. Intake of excessive dietary fiber may
  - A. Bind and interfere with absorption of calcium, copper, iron, magnesium, selenium and zinc
  - B. Help relieve diarrhoea
  - C. Interfere with appetite
  - D. Improve skin texture
5. A diabetic diet should contain proteins amounting to \_\_\_\_\_ of total calories
  - A. 12-15%
  - B. 25-30%
  - C. 50-60%
  - D. 35-45%
6. Identify the conditions that can benefit from a therapeutic diet
7. Describe the principles of diet modification
8. Describe the purpose, characteristics and indications for the following modified diets;
  - A. Bland diet
  - B. High calorie high protein diet
  - C. Low protein diet
  - D. Calcium test diet

### ***17.3.3.3 Tools, Equipment, Supplies and Materials***

- Food exchange lists
- Reference manual
- Stationery (Pen, paper, referral notes, file)
- Calculator
- WHO guidelines
- MOH policies and guidelines
- Ministry of Education
- Skills lab

- Projectors, video clips, charts and other teaching aids
- Food guide pyramid
- Invitation of competent expertise
- Computers with internet
- Library and resource centre

### ***17.3.3.5 References***

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### 17.3.4 Learning Outcome 3: Demonstrate understanding in the management of malnutrition and micronutrient deficiencies of public health concerns

#### 17.3.4.1 Learning Activities

Learning activity	Special instructions
i) Describe management of <i>SAM</i> and <i>MAM</i>	<ul style="list-style-type: none"> <li>Identify the patients who are candidates for SAM and MAM</li> <li>Determine the admission and discharge criteria</li> <li>Carry out monitoring of patient on SAM and MAM</li> <li>Document the process and outcomes in relevant documents</li> </ul>
ii) Describe management of overweight and other eating disorders	<ul style="list-style-type: none"> <li>Manage eating disorders such as binge eating, anorexia nervosa and bulimia nervosa</li> <li>Modify diets for weight management</li> </ul>
iii) Discuss roles of nutrient supplements and fortified foods in the management of micronutrient deficiencies of public health concerns	<ul style="list-style-type: none"> <li>Advise client on nutrient supplements</li> <li>Prescribe nutrient supplements to specific clients</li> <li>Monitor nutrient supplements on clients</li> </ul>

#### 17.3.4.2 Information Sheet

##### Definitions

##### *Protein energy malnutrition*

**Chronic malnutrition:** a type of malnutrition which occurs over an extended time period, right from conception, and is determined by a person's degree of stunting i.e. when a child has not reached his/her expected height for a given age

**Acute malnutrition:** a type of malnutrition that occurs within short period of food shortage (e.g. during emergencies) and is determined by patient's degree of wasting

**Obesity:** defined as a state of adiposity in which the body fat is above the ideal i.e. when the individual's body weight is 20% more than the normal body weight or when the BMI is more than 30kg/m<sup>2</sup>.

## Categories of malnutrition

There are two categories of malnutrition;

a. **Acute malnutrition:** categorized into; Moderate Acute Malnutrition (MAM) and Severe Acute Malnutrition (SAM), determined by the patient's degree of wasting.

b. **Chronic malnutrition:** determined by a patient's degree of stunting, i.e. when a child has not reached his or her expected height for a given age.

## Protein Energy Malnutrition (PEM)

This refers to the form of malnutrition where there is inadequate protein intake. It is known as protein calorie malnutrition (PCM)

There are 4 main types of PEM;

- Kwashiorkor: protein deficiency
- Marasmus: energy deficiency
- Marasmic kwashiorkor: combination of chronic energy deficiency and chronic or acute protein deficiency
- Failure to thrive(FTT)

## PEM in developing countries

The prevalence of PEM is so high in developing countries due to;

- Lack of food and clean water
- Infections
- Poor sanitation
- Social unrest

These could also lead to low birth weight (LBW). Among the developing countries are Asia and Africa

## PEM in Africa is related to;

- The high birth rate
- Overused soil, drought and desertification
- Poverty
- Political instability(war & displacement).
- Subsistence farming
- Pests and diseases destroy crops
- Low protein diet

## Risk factors for PEM

a) Morbidity factors;

- Malnutrition is strongly associated with morbidity factors.
- Children who have recently suffered/ are suffering from diseases such as malaria, acute respiratory infections (pneumonia, colds, running nose, congested chest etc) are most likely to suffer from PEM.



- HIV/AIDS is also a threat
- b) mother's educational level
- Mothers of higher educational levels have low percentage of their children getting PEM due to better finances, in giving adequate food and accessing health services
- c) Household size
- A larger household has more mouths to feed
  - Research shows that in low socio-economic households there is a risk of PEM for children <5yrs

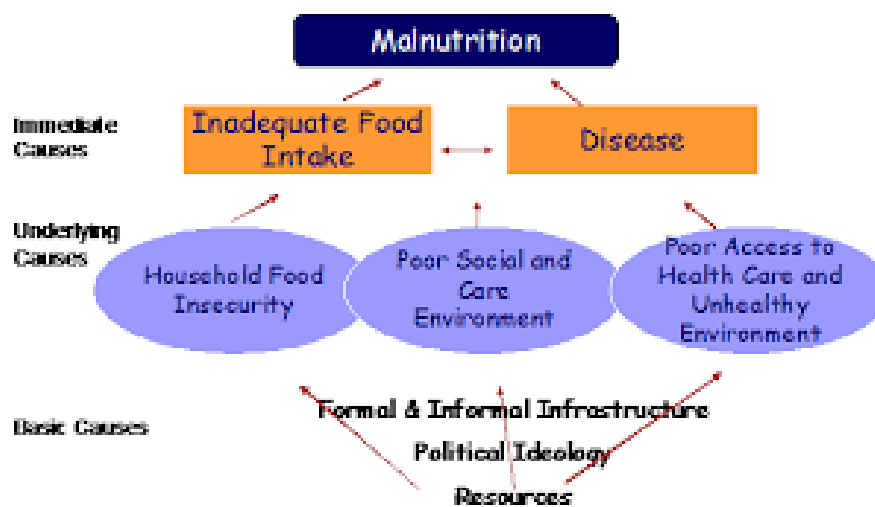
**Individuals at risk of malnutrition include;**

- Elderly people, especially those who are hospitalized or in long-term institutional care
- Individuals who are socially isolated
- People on low incomes (poor people)
- People with chronic eating disorders, such as bulimia or anorexia nervosa
- People convalescing after a serious illness or condition.

**Causes of malnutrition**

Based on UNICEF'S conceptual framework, the causes are categorized into three;

- Immediate causes
- Underlying causes
- Basic causes



*UNICEF's conceptual framework*

Kwashiorkor



- ▶ Bi-lateral pitting edema (fluid accumulation)
- ▶ Loss of appetite
- ▶ Brittle thinning hair
- ▶ Hair color change
- ▶ Apathetic and irritable
- ▶ Face may seem swollen
- ▶ High risk of death

Marasmus



- ▶ Severe weight loss and wasting
- ▶ Ribs prominent
- ▶ Limbs emaciated
- ▶ Muscle wasting
- ▶ May have good appetite

Characteristics of Kwashiorkor and Marasmus

## PATHOPHYSIOLOGY OF MALNUTRITION

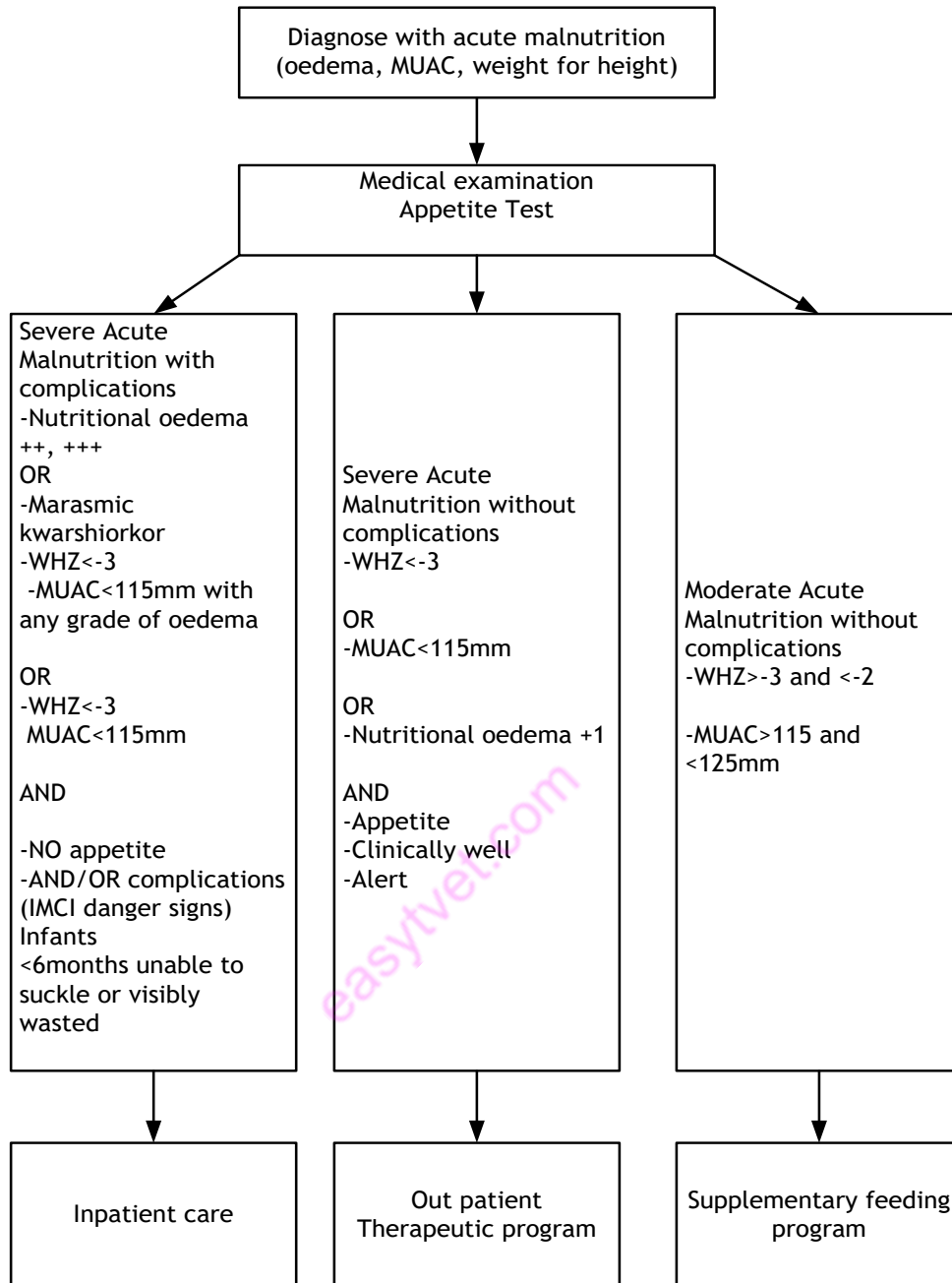
Malnutrition result in profound metabolic, physiological and anatomical changes. All physiological processes are altered due to acute malnutrition and all body organs slow down in order to survive on the limited macro and micronutrient intake a condition refered to as reductive adaptation. These include:

- Reduced metabolic rate
- Impaired protein synthesis and metabolism
- Impaired liver function
- Impaired kidney function
- Impaired immunity
- Impaired electrolyte balance

## Diagnosis and Triage

Various categories of acute malnutrition will require different nutrition therapies (management). The following figure provides an algorithm for diagnosis and triage of acute malnutrition.

## Algorithm for Diagnosis and Triage of Acute Malnutrition



## NUTRITIONAL MANAGEMENT

The aim of nutritional management is:

- To correct nutritional imbalances
- Restoration of patho-physiological function

## **SAM With Medical Complications**

Severely malnourished patients with complications are usually rehabilitated in three phases namely: cautious feeding phase, transition phase and catch up (Rehabilitation) phase. The three phases encompass ten (10) step approaches as outlined below:

### ***Stabilization Phase (Cautious Feeding)***

1. Treatment/prevention of hypoglycaemia
2. Treatment/prevention of hypothermia
3. Treatment/prevention of dehydration
4. Correcting electrolyte imbalance
5. Treatment/prevention of infection
6. Correcting micronutrient deficiencies
7. Starting cautious feeding

### ***Transition and Catch up Phase***

8. Achieving catch-up growth
9. Providing sensory stimulation and emotional support
10. Preparing for follow-up after recovery

### **Stabilization Phase (Cautious Feeding)**

The aim of this phase is to stabilize the patient both medically and nutritionally. It usually takes 2 to 3 days. In this phase a cautious approach is required because of the child's fragile physiological state and reduced homeostatic capacity. Feeding should be started as soon as possible after admission and should be designed to provide just sufficient energy and protein to maintain basic physiological processes. The essential features of feeding in the stabilization phases are:

- Small, frequent feeds of low osmolarity and low lactose
- Oral or nasogastric (NG) feeds
- 100 Kcal/ kg/day
- 1-1.5 protein/kg/day
- 130 ml/kg/day of feed (100 ml/kg/day if the child has severe edema)
- If the child is breastfed, encourage to continue breastfeeding but give the prescribed amounts of starter formula to make sure the child's needs are met.

The suggested starter formula and feeding schedules (see below) are designed to meet these targets. Milk-based formulas such as starter F-75 containing 75 Kcal/100 ml and 0.9 g protein/100 will be satisfactory for most children. Give from cup; dropper or syringe may be used to feed very weak children. All patients must be kept warm to prevent hypothermia (for infants, kangaroo method is encouraged).

- On admission, if the patient is alert give 5 ml/kg of 10% glucose to prevent hypoglycemia and feed with F-75 at 130 ml/kg/day every 3 hrs
- If patient has generalized edema (grade 3 or +++) give 100ml/kg/day of F-75 every 3 hours
- If the patient is losing consciousness, give 50ml (5 – 10ml/kg) of sugar-water by NG tube immediately. When consciousness is regained, give milk feed frequently
- On admission, if the patient is unconscious, give sugar water by NG tube. Give glucose as a single intravenous injection (5ml/kg of sterile 10% glucose solution)
- If the patient is dehydrated, rehydrate using Resomal at 5ml/kg every 30 minutes while monitoring for two hours. Start feeding after two hours of successful rehydration. Alternate feeds every hour with Resomal up to 10 hours
- If the patient has severe anemia, transfuse for 3 hours with close monitoring. Feeding using F-75 should start 2 hours after transfusion
- Feeding should be encouraged and monitored after every feed, If the patient is not taking sufficient amount (less than 75%), has pneumonia with rapid respiration rate, mouth lesions, cleft palate or other physical deformity or disturbance of consciousness a naso-gastric tube should be used to feed at 130 ml/kg/day
- Vitamin A should be provided as per IMAM guidelines

**NB:** When feeding on F-75, monitoring is important and especially for night feeds to ensure that the patient has adequate intake. Iron supplementation is contraindicated in this phase and should be delayed until the patient moves to Phase 2.

### Transition Phase

The ONLY change in the diet when transferring from Phase 1 to Transition Phase is that F75 is replaced by either F100 or equivalent made-up milk. The number of feeds, the timing, and the volume of the diet remains exactly the same in Transition Phase as in Phase 1 (130ml/kg/day).

The purpose of transition phase is to move the patient to a more energy dense food (F-100) in preparation for rapid weight gain. During this phase minimal weight gain can be expected (6g/kg/day) and lasts for 2 days. Criteria for transition phase include: a patient regaining appetite (No NG tube/finishes all prescribed feed), medically stable and losing edema.

- Give 130ml/kg/day of F-100 five to six feeds a day
- Feed amounts should be strictly controlled and no more should be given
- If the child is breastfeeding, encourage and continue breastfeeding on demand
- Close monitoring on patients adaptation to the feed is important

**NB:** In case there is increase/development of oedema, loss of appetite, development of medical complication, re-feeding diarrhoea, tense abdominal distension, and signs of fluid overload or rapid increase in liver size transfer immediately to Phase 1.

## Rehabilitation Phase (Achieving Catch-Up Growth)

In Phase 2, the main objective is to achieve catch-up growth and resolve micronutrient deficiencies. As the patients are recovering, the frequency of meals and some of the routine surveillance is less frequent as in Phase 1 and Transition Phase. A vigorous approach to feeding is required to achieve very high intakes and rapid weight gain of  $>10\text{g/kg/day}$ . F-100 is used at  $130\text{ml/kg/day}$  and  $2.9\text{ g protein/100mls}$ . Modified porridges or modified family foods can also be used provided they have comparable energy and protein concentrations.

Readiness to enter the rehabilitation phase is signaled by a return of appetite i.e. a patient is able to finish all prescribed feed in transition phase usually about one week after admission.

- The volume of milk is increased from  $130\text{ml/kg/day}$  to  $200\text{ml/kg/day}$  (equivalent to  $200\text{kcal/kg/day}$ ).
- The frequency is reduced to 5 feeds a day
- If the child remains hungry after completing a feed, more milk can be offered
- Either F100 or RUTF can be given, or a combination of both.

## Iron

Iron is given in this phase usually by adding an iron tablet into the milk. Crush an iron tablet and add to  $4\text{mls}$  of water and mix well (Iron Solution).

For one sachet of F100 (makes  $2.4$  litres of F100), add one (1) crushed tablet of ferrous sulphate ( $200\text{mg}$ ) in the  $4\text{mls}$  of water (Iron Solution).

- If using locally made-up formulas add iron solution as above to the milk
- If the patient is on RUTF, do not give additional iron as it already contains the necessary iron.

## Preparing Patient For Discharge

During this phase the patient should be prepared for eventual discharge. After a clinical team has ascertained that the patient is ready for discharge, specific criteria for discharging clients with appropriate follow up action should be followed as outlined in IMAM guideline.

NB: severely and moderately malnourished patients without medical complications can be managed as outpatient by following specified guidelines outlined in the National guideline on Integrated Management of Acute Malnutrition (IMAM)

## Obesity In Adults

Defined as a state of adiposity in which the body fat is above the ideal i.e. when the individual's body weight is  $20\%$  more than the normal body weight or when the BMI is more than  $30\text{kg/m}^2$ . The normal body weight of a person depends on age, sex, height and body frame. Obesity is a chronic disorder of excessive accumulation of fat in the body, whereas overweight refer to the excess amount of body weight in all tissues.

## **Risk Factors**

- Genetics
- Sedentary Lifestyle
- Dietary

## **Causes**

- Energy imbalance between calories consumed and those that are expended
- A shift in diet towards increased intake of energy-dense foods high in fat and sugar but low in vitamins, minerals and other micronutrients
- A trend towards decreased physical activity due the increasingly sedentary nature of many forms of work, changing modes of transport and increasing urbanization

## **Management Of Obesity**

Aim of nutritional management is to:

- Achieve and maintain ideal body weight by bringing about gradual weight loss
- Correct fault food habits

### *Management*

- Control total energy intake based on individual assessment by limiting energy intake from total fat and simple sugars.

NB: A maximum reduction of 1000kcal daily is required to lose about 1kg a week and a reduction of 500kcal daily brings about a weight loss of about half a kg a week. Drastic reduction of calorie intake is however not advisable. Put the client on a weight reduction diet regime of 30-25kcal/kg /day.

- High fiber, restricted fat diets based on individual assessment is recommended
- Offer nutrition education and counseling to the clients with emphasis on weight management, fad diets and other unhealthy practices in weight control
- Recommend suitable exercise program and encourage physical activity for gradual weight loss

### **17.3.4.3 Self-Assessment**

1. Define the following terms;

- A. Malnutrition
- B. Underweight
- C. Obesity

2. State whether the following statements are true or false about management of SAM
  - A. On admission, if the patient is unconscious, give sugar water by NG tube
  - B. If the patient has severe anemia, administer blood builders
  - C. On admission, if the patient is alert give 5 ml/kg of 10% glucose
  - D. Avoid giving the patient any vitamin A supplement
3. During the transition phase of management of malnutrition, the patient's diet should be \_\_\_\_\_
  - A. 130 ml/kg/day of F75
  - B. 130 ml/kg/day of F100
  - C. 200 ml/kg/day of F75
  - D. 200 ml/kg/day of F100
4. Which of the following nutrients should be provided as a supplement during management of malnutrition?
  - A. Vitamin E
  - B. Iodine
  - C. Iron
  - D. Protein
5. Describe the FOUR factors that influence nutrition.
6. Describe the causes of malnutrition using UNICEF's conceptual framework.
7. Explain the risk factors and clinical signs of malnutrition.

#### ***17.3.4.4 Tools, Equipment, Supplies and Materials***

- Reference materials
- Clinical guidelines
- IMAM Guidelines
- WHO guidelines
- MOH policies and guidelines
- Ministry of Education
- Skills lab
- Projectors, video clips, charts and other teaching aids
- Stationery



- Food exchange lists
- Food guide pyramid
- Invitation of competent expertise
- Computers with internet
- Library and resource centre

#### ***17.3.4.5 References***

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## 17.3.5 Learning Outcome 4: Demonstrate understanding in enteral nutrition

### 17.3.5.1 Learning Activities

Learning activity	Special instructions
i) Identify and describe terminologies in enteral nutrition	<ul style="list-style-type: none"><li>➤ Define the terms used in dietetics;<ul style="list-style-type: none"><li>○ Enteral nutrition</li><li>○ Refeeding syndrome</li><li>○ Nutrient adequacy</li><li>○ Bolus feeding</li></ul></li></ul>
ii) Identify and describe tube feeding/enteral nutrition routes	<ul style="list-style-type: none"><li>➤ Identify the routes through which enteral feeds can be administered</li></ul>
iii) Identify and describe types of enteral formulas	<ul style="list-style-type: none"><li>➤ Formulate special feeds for enteral nutrition</li><li>➤ Administer enteral feeds</li><li>➤ Monitor the patient during tube feeding</li><li>➤ Record any complications experienced during parenteral feeding</li><li>➤ Identify and manage complications of enteral feeding</li></ul>

### 17.3.5.2 Information Sheet

#### Definition of terms

**Enteral nutrition** refers to a way of providing nutrition to the patients who are unable to consume an adequate oral intake but have at least a partially functional GI tract.

**Bolus feeding:** infusion of up to 500 ml of enteral formula into the stomach over 5 to 20 minutes, usually with a large bore syringe catheter a fine tube that can be threaded into the lumen of a blood vessel for infusion of fluids or withdrawal of blood central parenteral nutrition (CPN) vein, usually the superior vena cava continuous drip infusion enteral formula administration into the gastrointestinal tract via pump, usually over 8 to 24 hours per day

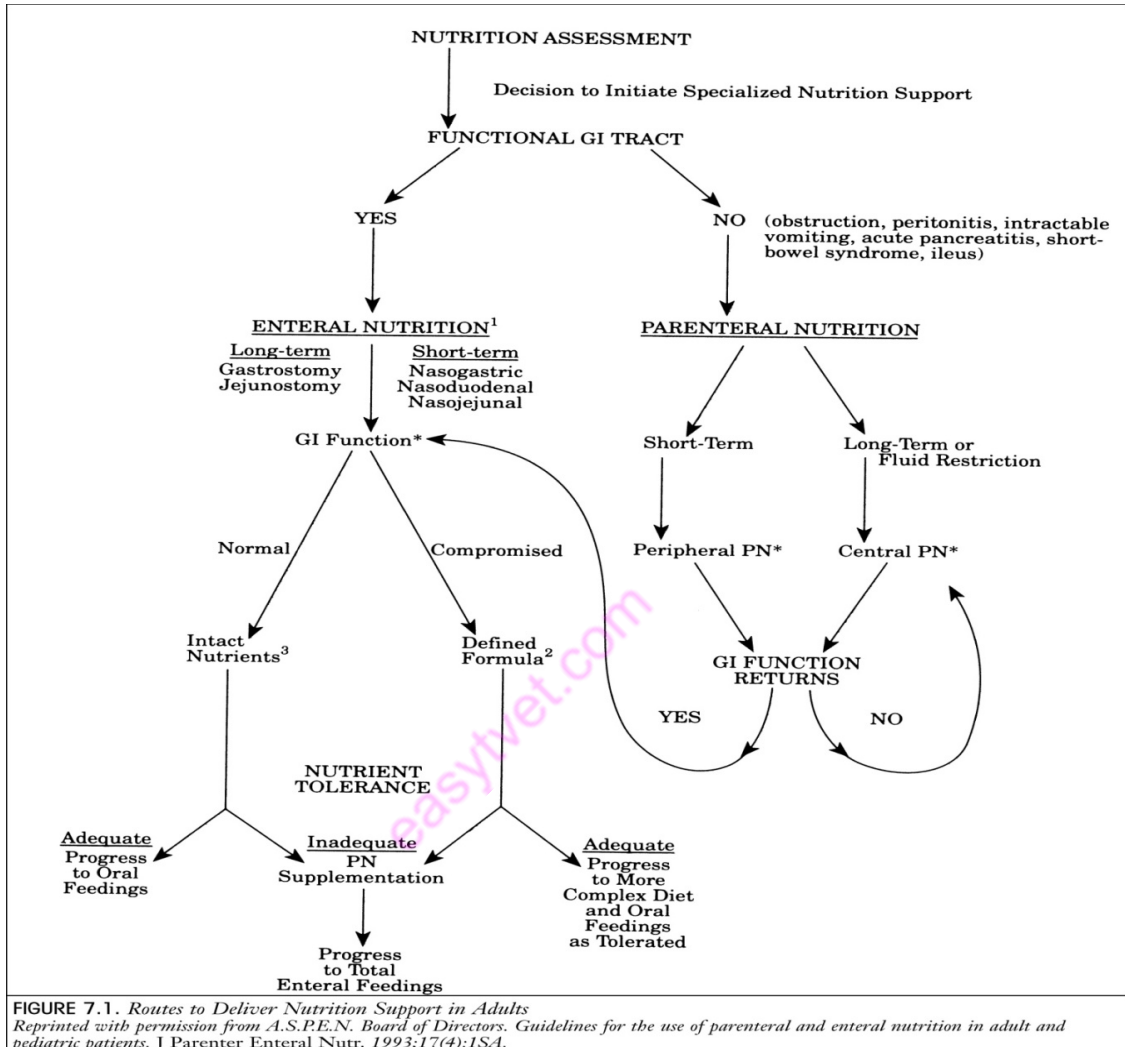
**Refeeding syndrome:** low serum levels of potassium, magnesium, and phosphorus with severe, potentially lethal outcome that results from the too-rapid infusion of substrates, particularly carbohydrate, into the plasma with the consequent release of insulin and shift of electrolytes into the intracellular space as glucose moves into the cells for oxidation and there is reduction in salt and water excretion

**Nutrient adequacy:** A result of consumption of sufficient amount of all essential nutrient and energy to meet individual requirements

## TYPES OF PATIENT FEEDING

### Enteral and Parenteral Nutrition

This refers to the provision of food and nutrients to the patient when the conventional feeding methods are not adequate or cannot meet nutrition needs. These include Enteral and parenteral nutrition. Selection of the mode of feeding is dependent upon several factors.



*Choice of route of nutrition administration Adopted from JPEN 1993; 17 (4): 1SA.*

### Enteral Nutrition

Enteral nutrition is a way of providing nutrition to the patients who are unable to consume an adequate oral intake but have at least a partially functional GI tract. Enteral nutrition may augment the diet or may be the sole source of nutrition. It is recommended for patients who have problems chewing, swallowing, prolonged lack of appetite, an obstruction, a fistula or altered motility in the upper GIT; are in coma or have very high nutrient needs.

Enteral feeds are

- Standard formula
- Hydrolyzed formula.

## Tube Feeding

This is the delivering of food by tube in to the stomach or intestine. It is indicated whenever oral feeding is impossible or not allowed.

### *Tube feeding routes*

The decision regarding the type of feeding route/tube depends on the patient's medical status and the anticipated length of time that the tube feeding will be required.

Mechanically inserted tubes;

- Nasogastric tubes where by a feeding tube is pushed through the nose into the stomach
- Orogastric tubes whereby a feeding tube is pushed through the mouth into the stomach
- Nasoduodenal tubes – the tube is pushed through the nose past the pylorus into the duodenum
- Naso-jejunal tube – the tube is passed during the endoscopy from the nose past the pylorus into the jejunum

Surgically inserted tubes

- Oesophagostomy: A surgical opening is made at the lower neck through which a feeding tube is inserted to the stomach
- Gastrostomy: A surgical opening is made directly into the stomach
- Jejunostomy : A surgical opening is made into the jejunum
- Figure below illustrates different routes of enteral nutrition administration.

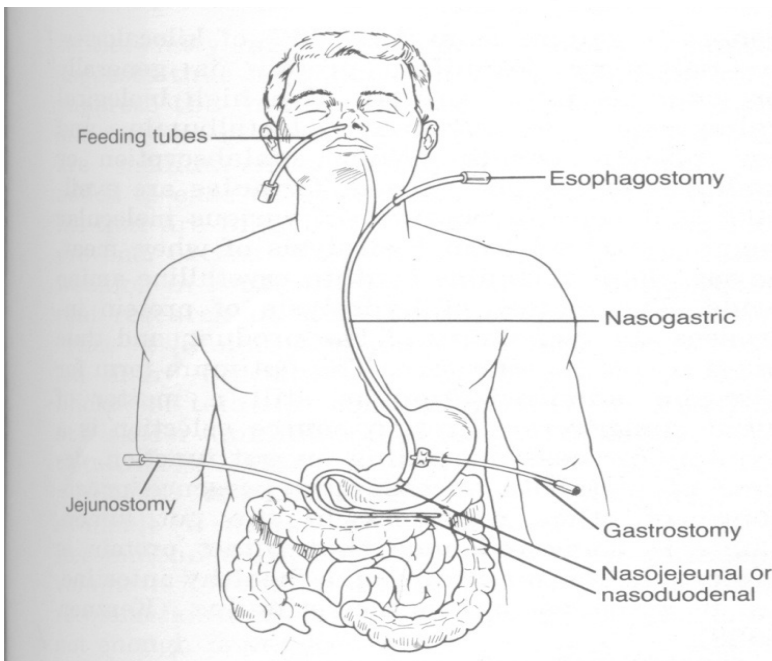


Figure X: Different routes of enteral nutrition administration (Draw if possible)

### Advantages of Enteral nutrition

- i) There is a stimulation of GI hormones and consequent regulated metabolism and utilization of nutrients.
- ii) It ensures adequate nutrient supply to the mucosal wall, and protection against atrophy of intestinal Villi.
- iii) It offers physiological protection against ulcers due to its buffering effect from gastric acids.

### Disadvantages of enteral formulas

- i) GI, metabolic, and mechanical complications—tube migration; increased risk of bacterial contamination; tube obstruction; pneumothorax
- ii) Costs more than oral diets (not necessarily)
- iii) Less “palatable/normal”: patient/family resistance
- iv) Labor-intensive assessment, administration, tube patency and site care, monitoring

### Administration of enteral feeds

The administration of enteral feeds should start slowly by giving 1 litre in day one and 2 litres in day two as the patient is being closely monitored. The formula should also be stopped slowly (reduce rate by half every 1-2 hours or switch to dextrose IV. For the cyclic mode, give 12 to 18 hours perday.

### Methods of administration of enteral feeds

Method	Administration	Remarks
Bolus feeding	Initially – 50ml then increase gradually up to a maximum of 250 to 400ml over approximately 30 minutes, 3 to 4 hourly daily (in 24 hrs)	<ul style="list-style-type: none"><li>• Most appropriate when feeding in to the stomach</li><li>• Check aspirate before each feeding</li><li>• Feeds may poorly tolerated causing nausea, vomiting, diarrhea, cramping or aspiration</li></ul>
Intermittent slow gravity feeding.	400 – 500ml infused by gravity over approximately 20 -30 minutes to 1 hr. 3 to 4 hourly daily (in 24 hrs)	<ul style="list-style-type: none"><li>• Patient retains freedom of movements in between feeds</li><li>• Improved tolerance of feeds</li></ul>
Continuous	Total volume of feed required is slowly administered; approximately 100ml/hour over 18 – 24hrs	<ul style="list-style-type: none"><li>• Most suitable when feeding in to the duodenum or jejunum where elemental diets are most appropriate</li><li>• May also be suitable for feeding in to the stomach</li><li>• Method may slow peristalsis</li><li>• Feeds are better tolerated</li></ul>

## Tube feeding instructions

- Tube feeding should be used at room temperatures, cold mixtures can cause diarrhea
- Ensure proper placement of tube and feed at slow constant rate
- Prescribed intervals and volumes of feeding should be adhered to
- Care should be taken to ensure that the tube feeds meet the patient's nutrient requirements
- Prepared mixture should be well covered, properly labeled including time of preparation and stored in a refrigerator for up to 24 hours
- In the absence of refrigeration, quantities lasting only six to twelve hours should be prepared
- All feeding equipment should be cleaned before and after each feed
- Shake/stir well before use

## Complications of tube feeding

Commonly seen complications can be classified into: gastro-intestinal, mechanical, metabolic, and pulmonary. The table below provides a summary of the complications alongside prevention/management strategies.

Gastro intestinal complications	Prevention/management
Diarrhea	<ul style="list-style-type: none"> <li>• Slow feeding rate</li> <li>• Supplemental fluid and electrolytes</li> <li>• Use lactose free formula</li> <li>• Prevent formula contamination</li> <li>• Consider different formula</li> <li>• Check antibiotic/drug therapy</li> <li>• Check flow rate of feed</li> <li>• Consider Enteral nutrition with added fiber</li> <li>• Use ant diarrheal agent</li> <li>• Check osmolarity of feeds (&lt; 500mosl/l recommended)</li> </ul>
Constipation	<ul style="list-style-type: none"> <li>• Give supplemental fluid.</li> <li>• Check if fiber inadequate or excessive</li> <li>• Check physical activity</li> </ul>
Nausea or vomiting	<ul style="list-style-type: none"> <li>• Reduce flow rate</li> <li>• Discontinue feeding until underlying condition is managed</li> <li>• Change to polymeric feeds if on elemental diet</li> <li>• Check gastric emptying and review narcotic medications, initiate low fat diet, reduce flow rate</li> </ul>

Malabsorption/Mal-digestion	<ul style="list-style-type: none"> <li>Identify the cause (crohn's disease, radiation enteritis, HIV, pancreatic insufficiency etc)</li> <li>Select appropriate Enteral product</li> <li>PN may be necessary in selected patients</li> </ul>
Abdominal distension	<ul style="list-style-type: none"> <li>Assess the cause</li> <li>Check feed temperature (give at room temperature)</li> <li>Do not give rapid formula administration</li> </ul>
<b>Medical complications of tube feeding</b>	
<b>Mechanical complications</b>	<b>Prevention/management</b>
Tube placement	<ul style="list-style-type: none"> <li>To be placed by trained personnel using defined protocol to reduce complications</li> </ul>
Feeding tube	<ul style="list-style-type: none"> <li>Use small bore feeding tube to minimize upper airway problems</li> </ul>
Tube clogging	<ul style="list-style-type: none"> <li>Select appropriate tube size</li> <li>Flash with water</li> <li>Dilute formula with water</li> </ul>
Dislocation of tube	<ul style="list-style-type: none"> <li>Ascertain tube placement before each feed</li> <li>Clearly mark tube at insertion</li> </ul>
Nasopharyngeal irritation	<ul style="list-style-type: none"> <li>Use small lumen tube.</li> <li>Use pliable tube</li> </ul>
Esophageal erosion	<ul style="list-style-type: none"> <li>Discontinue tube feeding</li> <li>Recommend parenteral nutrition</li> </ul>
<b>Metabolic complications</b>	<b>Prevention/management</b>
(Fluid and electrolyte imbalance, trace element, vitamin and mineral deficiencies, essential fatty acid deficiencies)	<ul style="list-style-type: none"> <li>Check adequacy of daily nutrient supply of macro and micronutrients during EN.</li> <li>Check possibility of Malabsorption</li> </ul>
Hyperglycemia	<ul style="list-style-type: none"> <li>Reduce flow rate.</li> <li>Give oral hypoglycemic agents or insulin.</li> <li>Change formula</li> </ul>
Tube feeding syndrome	<ul style="list-style-type: none"> <li>Reduce protein intake or increase water intake.</li> <li>For conscious patients education and counseling is needed</li> </ul>
Hypernatremia (dehydration)	<ul style="list-style-type: none"> <li>Increased water intake and reduce sodium</li> <li>Replace sodium losses</li> </ul>
Hyponatremia (over-hydration)	<ul style="list-style-type: none"> <li>Replace sodium losses</li> <li>Re-asses nutrient requirement, check volume administration, change to nutrient dense formula</li> </ul>

Pulmonary complications	Prevention/management
Pulmonary aspiration	<ul style="list-style-type: none"> <li>• Incline head of bed 30<sup>0</sup> – 45<sup>0</sup> during feeding 1 hr after feeding.</li> <li>• Check tube placement.</li> <li>• Monitor symptoms of gastric reflux.</li> <li>• Check abdominal distension.</li> <li>• Check residual volumes before feeds.</li> <li>• Change to jejunal feeding.</li> <li>• Reduce volume of feed.</li> <li>• Change from bolus to continuous feeding</li> </ul>

### Monitoring tube fed patient

Monitoring tube fed patients targets to find out two things;

- Hydration status
- Nutritional response

The following activities should be applied and also those summarized in the Table below;

- Weight (at least 3 times/week)
- Signs/symptoms of edema (daily)
- Signs/symptoms of dehydration (daily)
- Fluid I/O (daily)
- Adequacy of intake (at least 2x weekly)
- Nitrogen balance: becoming less common (weekly, if appropriate)
- Serum electrolytes, BUN, creatinine (2 –3 x weekly)
- Serum glucose, calcium, magnesium, phosphorus (weekly or as ordered)
- Stool output and consistency (daily).

### *Checklist for monitoring patients recently placed on tube feeding*

Action	Check
1. Before starting a new feeding	<ul style="list-style-type: none"> <li>• Complete a nutrition assessment</li> <li>• Check tube placement</li> </ul>
2. Before each intermittent feeding:	<ul style="list-style-type: none"> <li>• Check gastric residual</li> <li>• Check gravity drip rate when applicable</li> </ul>
3. Every half hour	<ul style="list-style-type: none"> <li>• Check pump drip rate, when applicable</li> </ul>
4. Every hour	<ul style="list-style-type: none"> <li>• Check vital signs, including blood pressure, temperature, pulse, and respiration</li> </ul>
5. Every 4 hours	



6. Every 6 hours	<ul style="list-style-type: none"> <li>• Check blood glucose, monitoring blood glucose can be discontinued after 48hrs if test results are consistently negative in a non-diabetic client</li> </ul>
7. Every 4 to 6 hours of continuous feeding	<ul style="list-style-type: none"> <li>• Check gastric residual</li> </ul>
8. Every 8 hours	<ul style="list-style-type: none"> <li>• Check intake and output</li> <li>• Check specific gravity of urine</li> <li>• Check tube placement</li> <li>• Chart clients total intake of, acceptance of, and tolerance to tube feeding</li> </ul>
9. Every day	<ul style="list-style-type: none"> <li>• Weigh clients where applicable</li> <li>• Check electrolytes and BUN when needed</li> <li>• Clean feeding equipment</li> <li>• Check all laboratory equipment</li> </ul>
10. Every 7 to 10 days	<ul style="list-style-type: none"> <li>• Check all laboratory Findings</li> <li>• Re-assess nutrition status</li> </ul>
11. As needed	<ul style="list-style-type: none"> <li>• Observe client for any undesirable responses to tube feeding; for example delayed gastric emptying, nausea, vomiting, and diarrhea</li> <li>• Check nitrogen balance</li> <li>• Check laboratory data</li> <li>• Chart significant details</li> </ul>

## TYPES OF ENTERAL NUTRITION FORMULA

There are various types of enteral feeds available as ready to use or powdered mixes specifically designed to meet the needs of the patient. The formulas are commonly categorized by the complexity of the proteins they contain. There are two major types of Enteral feeds namely: standard and hydrolyzed.

### Standard Formulas

These are also known as polymeric or intact formula. They are made from whole proteins as found in the diet (e.g. eggs, meat) or protein isolates [semi-purified high biological value proteins that have been extracted from milk, soybean or eggs]. Because they contain whole complex molecules of protein, carbohydrate and fat, standard formulas are used for patients who have normal digestive and absorptive capacity. They come in variety such as standard, high protein, high calorie and disease specific.

## Hydrolyzed Formulas

Partially hydrolyzed formulas contain proteins that are partially digested into small peptides. Completely hydrolyzed formulas are commonly known as elemental formula and they contain protein in its simplest form; free amino acids. Hydrolyzed formulas also provide other nutrients in simpler forms that require little or no digestion e.g. very low fat in form of medium-chain triglycerides (MCT). Hydrolyzed formulas are meant for patients with impaired digestion or absorption such as people with inflammatory bowel syndrome, short gut syndrome and pancreatic disorders.

## Indications for Enteral Nutrition

During periods of decreased oral intake, anticipated less than 50% of required nutrient intake orally for 7-10 days as seen in severe dysphasia (difficulty swallowing), metabolic stress, major bowel resections, low-output fistulas and coma. Neurological disorders and psychological conditions.

- Malnourished patients expected to be unable to eat > 5 days
- Normally nourished patients expected to be unable to eat >5 days
- Adaptive phase of short bowel syndrome
- Following severe trauma or burns

## Contraindications

- Intestinal obstruction that prohibits use of intestine
- Paralytic illness
- Intractable vomiting
- Peritonitis
- Severe diarrhea
- High output fistulas between the GI tract and the skin
- Severe acute pancreatitis
- Inability to gain access
- Aggressive therapy not warranted.

## Formula selection

The suitability of a feeding formula should be evaluated based on

- a) Functional status of GI tract
- b) Physical characteristics of formula (osmolality, fiber content, caloric density, viscosity)
- c) Macronutrient ratios
- d) Digestion and absorption capability of patient.

- e) Specific metabolic needs
- f) Contribution of the feeding to fluid and electrolyte needs or restriction
- g) Cost effectiveness

**Factors to consider when choosing an enteral formula**

- Gastrointestinal function

The type of carbohydrate, protein, fat and fiber in the diet are related to the patient’s digestive and absorptive capacity

- Caloric and protein content of the formula
- Ability of the formula taken in the amounts tolerated, to meet the patient’s nutritional requirements
- Sodium, potassium, magnesium and phosphorus content of the formula esp. for patients with cardiopulmonary, hepatic or renal failure
- Viscosity of the formula related to tube size and method of feeding

**Determining nutrient requirements**

The type of formula, volume and hence the total nutrient required are determined by the patients physiological condition. Several equations are available for estimating nutrient requirements of patients depending on their clinical condition.

The calorie to nitrogen ratio should be >150:1 (1g nitrogen is equivalent to 6.25g protein). If the C: N ratio is less than 200:1, then the protein supplied by such a feed will be inadequate for critically ill patients.

**Determination of estimated daily fluid allowance**

In order to meet the nutrient needs of a patient, the nutritionist/dietician needs to calculate the kcal, protein, fluid and nutrient needs according to age, sex, medical status. After the calculations, appropriate formula is selected based on nutritional needs, feeding route and GI function. Usually, enteral feeds are usually administered in fluid state and it is imperative to know the amount of fluids each patient should get (See Table below).

**Methods of estimating daily fluid allowance**

Basis of estimation	Calculation
<u>Body weight</u> <b>Adults</b> <ul style="list-style-type: none"> <li>• Young active :16 – 30 years</li> <li>• Average: 25 – 55 years</li> <li>• Older: 55 – 65 years</li> <li>• Elderly:&gt; 65 years</li> </ul>	<ul style="list-style-type: none"> <li>• 40 ml/kg</li> <li>• 32 ml/kg</li> <li>• 30 ml/kg</li> <li>• 25 ml/kg</li> </ul>

<b>Children</b>	
<ul style="list-style-type: none"> <li>• 1 – 10kg</li> <li>• 11 – 20kg</li> <li>• 21kg or more</li> <li>• Energy intake</li> <li>• Nitrogen plus energy intake</li> </ul>	<ul style="list-style-type: none"> <li>• 100 ml/kg.</li> <li>• An additional 50ml per each kg &gt; 10kg.</li> <li>• An additional 25ml per each kg &gt; 20kg</li> <li>• 1 ml per Kcal.</li> <li>• 100 ml/g nitrogen intake plus 1 ml per Kcal*</li> </ul>

### How to determine energy and protein requirements

Kcal/ml x ml given = kcal

% protein x kcal = kcal as protein

Kcal as protein x 1 g/4 kcal = g protein

- Example: Patient drinks 200 cc of a 15.3% protein product that has 1 kcal/ml

1 kcal/ml x 200 ml = 200 kcal

0.153 % protein x 200 kcal = 30.6 kcal

30.6 kcal x 1g protein/4 kcal = 7.65 g protein

### Water

Increase fluids as tolerated to compensate for losses due to:

- Fever or environmental temp
- Increased urine output
- Diarrhea/vomiting
- Draining wounds
- Ostomy output, fistulas
- Increased fiber intake, concentrated or high-protein formulas

### Classification of enteral formulas

Enteral formula	Sub-category	characteristics	Indications
Polymeric	Standard	Similar to average diet.	Normal digestion
	High nitrogen	Protein > 15% of total Kcal.	Catabolism Wound healing
	Calorie dense	2 Kcal/ml	Fluid restriction Volume intolerance Electrolyte abnormalities
	Fiber containing	Fiber 5 – 15/l	Regulation of bowel function

Monomer	Partially hydrolyzed elemental peptide based	One or more nutrients are hydrolyzed, composition varies.	Impaired digestive and absorptive capacity
Disease specific	Renal	Whole protein with modified electrolyte content in a caloric dense formula.	Renal failure
	Hepatic	High BCAA, low AA,	Hepatic encephalopathy
	Pulmonary	High % of calories from fat.	ARDS
	Diabetic	Low carbohydrate	Diabetes mellitus
Immune enhancing Formulas	Critically ill	Arginine*, glutamine, Omega-3 fatty acids, anti-oxidants	Critically ill.

## Nutrient composition of enteral formulas

### *Proteins*

In case of burns, injury, after surgery and in severe malnutrition, large quantities of proteins (100-200gm) should be administered. Average patient suffering from other diseases will need 60-70g of protein. Administer protein diet to those with hepatic coma

### *Fat*

Should be administered in form of emulsions

### *Carbohydrates*

Sources such as glucose, cane sugar and dextri-maltose can be used

About 300-500g should be administered daily depending on the patient's calorie needs

### *Fluid*

Daily requirements for an adult are about 2500-3000ml and are easily provided

### *Electrolytes*

Added into food depending on the needs of the patient e.g. chloride, potassium chloride etc

### *Vitamins*

Daily requirements should be given in the food

### *Calories*

An average adult patient will require 1500-2000kcal every day. After surgical operation, injury, burns, in severe protein-calorie malnutrition, provision of 3000kcal may be necessary to meet the increased demand. If adequate calories are not supplied, wasting of body muscle will take place.

### Enteral Nutrition Feeds

Products Name	Composition-100g Powder	Indications	Manufacturer
Infant feeding formulas 1. Prenan*	CHO-55.9% mainly Lactose and maltodextrin PRO-14.4% mainly protein and casein. FAT-24.0% MCT, milk fat, corn oil, soybean oil	For low birth weight, premature or light for date babies when breast milk is not available	Nestle
2. Nan*	CHO-56.2% PRO-12.5% FAT-27.7%	For infants of normal birth weight[mature, normal for date]when breast milk is not available	Nestle Kenya Limited
3. SMA*	CHO-55.4% PRO-11.4% FAT-27.7% corn oil, soyn oil, coconut oil	For infants and low birth weight light for date babies when breast milk is not adequate or not available	Wyeth
Lactose free infant formulas 1. Alsoy	CHO-55.4% mainly maltodextrin PRO-14.0% soy protein isolate FAT-25% palm, soya and coconut oils	For infants and adults when lactose or cows milk should be avoided	Wyeth
2. Nursoy	CHO-52% corn syrup solids PRO-41% soy protein isolate FAT-27% blend of vegetable oils	For infants and adults when lactose or cow milk should be avoided	Wyeth
3. Isomil	CHO-50% corn syrup, sucrose PRO-15.6% soy protein isolate FAT-28.1%	For infants and adults when lactose or cow milk should be avoided	Ross labs
4. Prosobee	CHO-40% glucose polymer and corn syrup solids PRO-12% soy isolate FAT-48% soy oil, coconut oil	For infants and adults when lactose or cow milk should be avoided	Mead Johnson

High protein powder supplement 1. Full cream powder milk	CHO-37.4% PRO-25% FAT-28%	A protein carolic supplement that can be inco-oporated in liquid or solid diets	Nestle KCC
2. Dried skimmed milk powder[DSM]	CHO-54% PRO-36.4% FAT-1%	A protein carolic supplement useful where low fat diet is required	KCC
3. Sustagen	CHO-68% corn syrup solids, glucose, lactose PRO-24% Non-fat milk, Whole milk caseinate FAT-8% Milk fat	Controlled fat diets	Mead Johnson
4. Pregestmil	CHO-54% glucose and tapioca starch PRO-11% Hydrolysed casein and amino acids FAT-35% corn oil MCT oil	For oral or tube feedings. Useful in malabsorption and low fat modified diets	Lederle Labs
5. Gevral	CHO-6.7% Lactose, sucrose PRO-17.1% Calcium caseinate FAT-0.6%	Useful in high protein, low carolic low fat, low residual diets	Laderle Labs
6. Forceval	CHO-30% Protein-55% FAT-1% Calories per 100g-366 Keal	A protein, vitamin and mineral supplement ideal for high protein diets, low fat diets and cases of malabsorption useful for patients allergic to lactalbumins	Unigreg Limited
Nutritionally Complete Liquid Diets 1. Fresubin	CHO-13.8g=55% of Total Kcals PRO-3.8g=15% of total Kcals FAT-3.4g=30% of Total Kcals Energy-100Kcal/100 ml	Nutritionally complete liquid diet for total or supplemental feeding, tube feeding or oral feeding Low in lactose	Freseinius

2. Fresubin Isofibre	CHO-17g=54.6 of total kcals PRO-7.5g=15.1% of total kcals FAT-68g=30.3% of total kcals Energy-1 kcal per ml	High caloric formula suitable for tube or oral feeding especially where energy intake is increased, where fluid is restricted and for fat malabsorption	Fresenius
3. Fresubin Diebetic	CHO-12g=53% of total kcals PRO-3.4g-15% of total kcals FAT-3.2g=32% of total kcals Fibre-1.5g per 100 ml[90 kcal]	Nutritionally complete feed for oral or tube feeding in diebetics	Fresenius
4. Ensure [with fibre]	CHO-58% of total kcals PRO-15% of total kcals FAT-30% of total kcals	Nutritionally complete feed for oral or tube feeding as a total diet or supplemental diet Lactose free fibre	Abott
5. Ensure [Nutritional powder]	. CHO-61.5g=54% of total kcal PRO-15.8g=14% of total kcal FAT-15.8g=32% of total kcal Energy=100kcal per 100ml	Nutritionally complete feed for oral or tube feeding as a total or supplement diet Lactose free feed, low ion cholesterol and sodium	Abott

## CASE STUDY

Sam a 67 year old man weighing 55kgs and 167cm tall presents with a four month history of post prandial vomiting, inability to swallow solids and liquid and can only swallow saliva. He also has dysphagia and complains of weight loss.

1. Which type of feed is appropriate for Sam
2. Prepare a feeding chart which is suitable for Sam's condition.
3. Determine the energy and protein requirements in Sam's enteral nutrition.



### ***17.3.5.3 Self-Assessment***

1. Define the following terms;
  - A. Nutrient adequacy
  - B. Refeeding syndrome
  - C. Bolus feeding
2. The provision of food and nutrients to the patient when the conventional feeding methods are not adequate or cannot meet nutrition needs is \_\_\_\_\_
  - A. Bolus feeding
  - B. Parenteral feeding
  - C. Enteral feeding
  - D. Nutrition support
3. \_\_\_\_\_ is a method of tube feeding whereby the tube is passed during the endoscopy from the nose past the pylorus into the jejunum.
  - A. Nasojejunal tube
  - B. Nasoduodenal tube
  - C. Orogastric tube
  - D. Nasogastric tubes
4. The following statements about continuous feeding method of enteral nutrition except;
  - A. It is most suitable when feeding in to the duodenum or jejunum where elemental diets are most appropriate
  - B. It may be suitable for feeding in to the stomach
  - C. Method may increase peristalsis
  - D. Feeds are better tolerated
5. State the types of tube feeding.
6. Describe enteral nutrition.
7. Discuss the factors to consider when selecting an enteral formula.
8. Classify enteral nutrition based on different categories of patients.
9. Discuss the indications and contraindications of enteral formula.
10. Differentiate between standard and hydrolysed formulas.

### ***17.3.5.4 Equipment and materials used in enteral feeding***

There are several enteral nutrition delivery systems which include both open and closed delivery systems

- Feed preparation equipment for kitchen made feeds and powder feeds include measuring jars and cups and spoons, mixing bowls, blender, flask, sterile water

- Ready to hang (RTH) feeds: giving sets for gravity or giving sets for the pump system, Enteral feeding pumps, dual port connector and a feeding bag where applicable
- Liquid diets in easy bags: giving sets (gravity or pump), feeding pump and/or dual port connector where applicable
- Feed delivery equipment; funnel especially in gastrotomy and Jejunostomy for controlling viscous flow, syringe for naso-gastric bolus or intermittent feeding and the feeding tubes where applicable
- WHO guidelines
- MOH policies and guidelines
- Ministry of Education
- Skills lab
- Projectors, video clips, charts and other teaching aids
- Stationery
- Food exchange lists
- Food guide pyramid
- Invitation of competent expertise
- Computers with internet
- Library and resource centre

**NB:** Feeding pump is recommended as it eases feeding workload because it flows without constant supervision, enhances accuracy, hygiene and sanitation.

#### **17.3.5.4 References**

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## 17.3.6 Learning Outcome 5: Demonstrate understanding in parenteral nutrition

### 17.3.6.2 Learning Activities

Learning activity	Special instructions
i) Identify and describe terminologies in parenteral nutrition	<ul style="list-style-type: none"> <li>➤ Explain the terms used in nutrition support               <ul style="list-style-type: none"> <li>○ Parenteral</li> <li>○ Infusion</li> <li>○ Rate of infusion</li> <li>○ Total parenteral nutrition (TPN)</li> <li>○ Peripheral parenteral nutrition (PPN)</li> </ul> </li> </ul>
ii) Identify and describe parenteral nutrition routes	<ul style="list-style-type: none"> <li>➤ Identify the routes through which parenteral feeds can be administered</li> </ul>
iii) Identify and describe administration of parenteral nutrition	<ul style="list-style-type: none"> <li>➤ Formulate special feeds for parenteral nutrition</li> <li>➤ Administer special feeds used in parenteral nutrition</li> </ul>
iv) Identify and describe complications of parenteral nutrition and their nutritional management	<ul style="list-style-type: none"> <li>➤ Monitor the patient during parenteral feeding</li> <li>➤ Record any complications experienced during parenteral feeding</li> <li>➤ Manage contingencies during parenteral feeding</li> </ul>

### 17.3.6.2 Information Sheet

#### Meaning of terms in parenteral nutrition

- **Nutrition:** The ingestion and utilization of food by which growth, repair, and maintenance of activities in the body are accomplished
- **Parenteral nutrition** is the continuous infusion of a hyperosmolar solution containing carbohydrates, proteins, fat, and other necessary nutrients through an intravenous route
- **Infusion:** the introducing of a solution such as glucose especially into a vein
- **Rate of infusion:** refers to the desired rate at which a solution should be administered to achieve a steady state of a fixed dose which has been demonstrated to be therapeutically effective
- **Total parenteral nutrition (TPN):** a method of feeding that bypasses the gastrointestinal tract whereby fluids are given into a vein to provide most of the nutrients the body needs

- **Peripheral parenteral nutrition (PPN):** refers to the administration of nutritional solution into veins outside the Superior Vena Cava.
- **Peripheral vein:** a vein that is near the surface of the skin.

### **Parenteral nutrition**

This refers to nutrition directly into the systemic circulation, bypassing the gastro-intestinal tract (GIT) and the first circulation through the liver. Parenteral nutrition is used when the enteral route is unable to provide or sustain sufficient caloric intake. The primary objective of parenteral nutrition is to maintain or improve the nutritional and metabolic status of patients who have temporary or permanent intestinal failure.

### **Characteristics of parenteral nutrition**

- Patients on TPN (Total Parenteral Nutrition) have similar requirements as enterally fed patients
- The six major nutrients covered are: carbohydrates, proteins, fats, vitamins, minerals and water
- Feeds must provide adequate calories
- Nutrient form must be specialized for infusion into blood count prior to digestion
- Standardized concentration may be modified to suit individual requirements

### **Indications for Parenteral Nutrition**

Patients who are candidates for parenteral nutrition cannot eat adequately to maintain their nutrient stores. These patients are already, or have the potential of becoming malnourished.

Peripheral Parenteral Nutrition (PPN) may be used in selected patients to provide partial or total nutrition support for up to 2 weeks in patients who cannot ingest or absorb oral or enteral tube delivered nutrients or when central-vein parenteral nutrition is not feasible.

### **Parenteral nutrition (PN) support**

EN is contraindicated or the intestinal tract has severely diminished function due to underlying disease or treatment. Specific applicable conditions are as follows:

- Paralytic ileus
- Mesenteric ischemia
- Small bowel obstruction
- GI fistula except when Enteral access may be placed distal to the fistula or volume of output (<200 mL/d) supports a trial of EN
- Diseases of the small intestine
- Intractable vomiting/diarrhea
- Massive small bowel resection

- Trauma
- Inflammatory Bowel Disease
- Enterocolitis (AIDS, chemotherapy, radiotherapy)
- Pancreatitis
- Burns
- Cancer
- Immaturity (premature babies).

As occurs in postoperative nutrition support, the exact duration of starvation that can be tolerated without increased morbidity is unknown. It has been suggested that wound healing would be impaired if PN is not started 5–10 days. This is for postoperative patients unable to eat or tolerate enteral feeding.

The patient's clinical condition is considered in the decision to withhold or withdraw therapy. Conditions where nutrition support is poorly tolerated and should be withheld until the condition improves are severe hyperglycemia, azotemia, encephalopathy and hyperosmolarity and severe fluid and electrolyte disturbances.

### **Contraindications**

- Functional GIT
- Existence of an advanced terminal condition for which aggressive therapy is not provided

### **Parenteral nutrition in infants**

Very preterm infants, who often have relatively delayed gastric emptying and intestinal peristalsis, may be slow to tolerate the introduction of gastric tube feeds. These infants may need intravenous nutrition while enteral nutrition is being established or when enteral nutrition is not possible—for example, because of respiratory instability, feed intolerance, or serious gastrointestinal disease. It is necessary when parenteral feeding is indicated for longer than 2 weeks, peripheral venous access is limited, nutrient needs are large, or fluid restriction is required, and the benefits of PN support outweigh the risks. Patient has failed Enteral Nutrition (EN) trial with appropriate tube placement (post-pyloric).

Examples of feeds for pediatrics:

- Protein source: Amino venous
- CHO source: dextrose
- LIPIDS (Fat) source: Lipovenous 10%

Total parenteral nutrition consists of a glucose and amino acid solution with electrolytes, minerals, and vitamins, plus fat as the principal non-protein energy source. Bloodstream infection is the most common important complication of parenteral nutrition use. Delivery of the solution via a central venous catheter rather than a peripheral catheter is not associated with a higher risk of infection. Extravasation injury is a major concern when parenteral nutrition is

given via a peripheral cannula. Subcutaneous infiltration of a hypertonic and irritant solution can cause local skin ulceration, secondary infection, and scarring. Extravasation injury may occur when a peripheral cannula is used to deliver the parenteral nutrition solution.

### **Routes of administration of parenteral nutrition**

Intravenous solutions can be provided in different ways. The methods used depend on the person's immediate medical and nutrient needs, nutrition status and anticipated length of time on IV nutrition support. They include:

- Peripheral Parenteral Nutrition (PPN)
- Central Parenteral Nutrition (TPN)

The general decisions to use PPN instead of CPN are based on comparative energy demands and anticipated time of use.

### **Peripheral Parenteral Nutrition**

This refers to use of peripheral veins to provide a solution that meet nutrient needs for infusion. It has lower dextrose (5% to 10% final concentration) and amino acid (5% final concentration) concentration than CPN. It may provide full or partial nutritional requirements to patients.

PPN can be administered in to peripheral veins if solutions used have osmolarity below 800 - 900mosm/l for a brief period of less than 14 days. Short catheters (cannulas) and mid-way catheters are normally used. However, PPN administration is possible for several weeks with fine bore catheter.

PPN may be used in patients with mild or moderate malnutrition to provide partial or total nutrition support when they are not able to ingest adequate calories orally or enterally or when central vein PN is not feasible.

All in one admixture are highly recommended compared to the single bottle system during PPN.

### **Central Parenteral Nutrition (CPN)**

CPN is often referred to as "Total Parenteral Nutrition" since the entire nutrient needs of the patient may be delivered by this route. It requires a central venous system for long term infusions.

The sites mainly used are the Vena jugularis external, Vena jugularis internal, Vena subclavia, Vena cephalica and Vena basilica for solutions with osmolarity above 800 - 900 mosm/l.

Peripherally Inserted Central Catheters (PICC) for short - and long term infusions are possible. Implantable system for central venous access (Ports) Lasts for years after implantation and patients may go on TPN for years with the catheters being changed every 5 - 10 years. Central Parenteral Nutrition is complete nutrition similar to physiological nutrition and can be provided for unlimited period (weeks to years). PN can be used in hospitalized patients and those who have returned home or are in assisted living, extended care facilities or nursing homes.

## Access routes for parenteral nutrition include:

### a. Peripheral Access Routes

One of the easiest and safest ways to access the vascular system is to place a cannula into a peripheral vessel. The adequacy of the vein limits the use of the peripheral system for infusion. Catheter tips that are located in a peripheral vessel are not appropriate for the infusion of PN formulas  $> 900$  mosm/L.

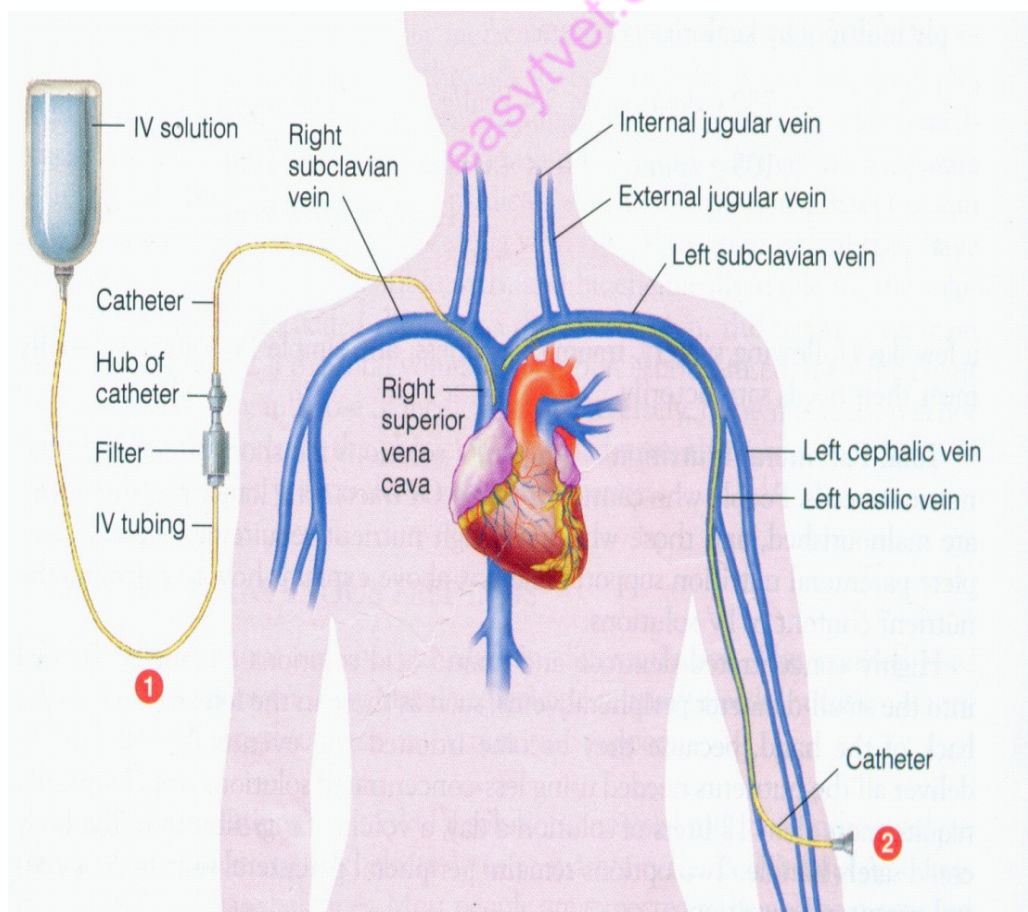
The indications for peripheral infusion are short-term access needs. Specially formulated PN may be administered by peripheral access. These solutions are based on a decreased dextrose concentration and osmolarity and have been reported to be used for short-term therapies ( $< 10$ – $14$  days) when fluid restriction is not necessary.

The leading complication associated with peripheral access is peripheral venous thrombophlebitis. The hallmark symptoms of infusion phlebitis (an inflammation of the cannulated vein) are pain, erythema, tenderness or a palpable cord. Peripheral devices have the lowest risk of catheter related infections.

### b. Central Venous Access

Central venous access is defined as a catheter whose distal tip lies in the distal vena cava or right atrium. The most common sites of venipuncture for central access include the subclavian, jugular, femoral, cephalic, and basilic veins.

The figure below illustrates administration of PN through the sub-clavian vein.



*Administration of parenteral nutrition through sub clavian vein*

## Calculating the nutrient content of Intra Venous (IV) formulas

The energy/nutrient requirements of patients on parenteral nutrition comprises of a complete nutrition similar to physiological nutrition. These requirements can be calculated using several different available formulas and no standard prescription provides an answer for all patients. Nutrient requirements are also adjusted at all times to suit the patient's current medical or surgical condition. One of the standard parenteral nutrition regime that is suited for 80% of patients and calculated as per the kilogram body weight is as shown in the table below:

### *Nutrient requirements for IV formulas*

Nutrients	Requirements
Amino acids	1 - 1.5g
Energy (as fat and glucose) 25 - 30 kcal (NPE - Non Protein Energy)of which glucose	3 - 5g (>2g/kg, <7g/kg)
Fat (LCT)	1- 2g (<0.3g/kg, <3g/kg)
Vitamins and trace elements	Basic needs
Water and electrolytes	Basic needs

#### **Note:**

Protein Energy (NPE): Stand for energy from carbohydrate and fat only, excluding the energy from protein. The protein requirements are then calculated separately as per the patient's body weight.

The proportion of carbohydrate to fat is then calculated at a proportion of 70: 30 or 50: 50 depending on the patient's condition. This means that 70% of the NPE will be the required energy from Carbohydrate and 30% of NPE will be the required energy from fat.

Total energy (TE) requirements can also be calculated from e.g. the Harris Benedict Equation (HBE) or any other equation or formulas available. The ratio of energy to nitrogen is then calculated as follows:

Calorie nitrogen ratio – An adequate energy provision is necessary to support the use of protein for anabolism. The recommended non-protein calorie nitrogen ratio (C: N) for the different conditions is calculated as shown in the table X below.

Conditions	Calorie: Nitrogen Ratio (gN)
For normal body maintenance	300:1
Stressful conditions	150:1
Renal failure	250: 1
PPN	70:1
Children	300:1



The percentage of nutrient requirements can also be calculated from the TE as follows:

- 50 – 60% of the TE from Carbohydrate
- 15 – 20% of TE from Protein
- 25 - 30% of TE from FAT

### **Precautions in Parenteral Nutrition**

Osmolarity – ensure appropriate osmolarity is infused via the appropriate veins to avoid thrombosis and small blood vessel damage. E.g. osmolarity > 900 should be administered centrally.

### **Calculation of the osmolarity of parenteral nutrition solutions**

Multiply the grams of dextrose per liter by 5 mosm/g

Example: 50g of dextrose x 5 = 250mOsm/L

Multiply the grams of protein per liter by 10 mosm/g

Example: 30g of protein x 10 = 300mOsm/L

Fat is isotonic and does not contribute to osmolarity

Electrolytes further add to osmolarity for example: 1 mosm/me of individual electrolyte additive

Total osmolarity is then derived from the sum of the osmolarity of all nutrients infused

- **Infusion rate** – always check label and package inserts. The maximum infusion rate recommended for specific solutions should not be exceeded in order to avoid complications
- Vital signs should be monitored daily
- Discontinuation should also be gradual to avoid hypoglycemia
- Infuse parallel, it is best to infuse parallel. If parallel infusion is not possible then infuse directly
- First carbohydrates with electrolytes, second amino-acid with electrolytes, third fat

### **Examples of parenteral nutritional formulations:**

You can have confidence in IV solutions if you know what they contain. The basic thing to remember is that the percentage of a substance in solution tells you how many grams of that substance are present in 100mL e.g. a 5% dextrose solution contains 5g of dextrose per 100 ml; a 3.5% amino acid solution contains 3.5g of amino acids per 100ml. A 0.9% normal saline solution contains 0.9g of NaCl per 100mL. Table A shows examples of parenteral formula feeds. Table B on the other hand, shows pediatric parenteral nutrition formulations.

**Table A: Examples of parenteral formula feeds**

<b>Amino acid solutions</b>	<b>Features</b>	<b>Presentation</b>
<p>Standard Amino Acids</p> <ul style="list-style-type: none"> <li>• 5% (50g AA/L)</li> <li>• 10% (100g AA/L)</li> <li>• 15% (150g AA/L)</li> </ul>	<p>These are standard Amino acids for parenteral nutrition which contain WHO recommended ratio for essential and non essential amino acids and may contain electrolytes or may be electrolyte free</p> <p>Essential nitrogen balance</p>	<p>200ml,500ml and 1000ml bottles</p>
Special Amino Acids	May be balanced AA solution containing Glutamine and tyrosine , Arginine	200ml, 500ml bottle
Special Amino Acids	Disease specific formulation containing AA glutamine	50ml, 100ml, 200ml bottles
<p>Special AA for Hepatic insufficiency</p> <ul style="list-style-type: none"> <li>• 8% (80g AA/L)</li> </ul>	<p>These are disease specific formulations. Specially designed to compensate the AA disorders in hepatic insufficiency, rich in BCAA and quite low in AAA.</p>	200ml, 500ml bottles
<p>Special AA for renal insufficiency</p> <ul style="list-style-type: none"> <li>• 7% (70g AA/L)</li> <li>• 10% (100g AA/L)</li> </ul>	<p>Adapted to the metabolic AA disorder in renal failure and contains a balanced profile of EAA and NEAA and the dipeptide glycyl-tyrosine</p> <p>Well balanced AA pattern specifically designed for infants (preterm, new born, babies) and young children.</p> <p>Contains EAA and NEAA similar to human breast milk.</p> <p>Contains taurine an EAA for neonates</p>	200ml, 250ml and 500ml bottles
<b>Carbohydrates solutions</b>	<b>Features</b>	<b>Presentation</b>
<ul style="list-style-type: none"> <li>• 5% (50g /L)</li> <li>• 6% (60g/ L)</li> <li>• 10% (100g/L)</li> <li>• 20% (200g/L)</li> <li>• 25% (250g/L)</li> <li>• 50% (500g/L)</li> </ul>	<p>These carbohydrate feeds mainly contain glucose but some may contain xylitol and or sorbital</p>	<p>50ml, 100ml, 500ml, 1000mls bags or bottles</p>
Solutions with both Carbohydrate and Amino acids.	<p>These parenteral nutrition solutions contain both carbohydrate and amino acid including electrolytes and may be administered peripherally. e.g.</p> <ol style="list-style-type: none"> <li>1) 3% AA and 6% carbohydrate plus electrolytes.</li> <li>2) 5% AA and 5% sorbital.</li> </ol>	200ml, 500ml, 1000ml bottle
<b>Lipid Emulsions</b>	<b>Features</b>	<b>Presentation</b>

<ul style="list-style-type: none"> <li>• 10%</li> <li>• 20%</li> <li>• 30%</li> <li>• 20% MCT-LCT</li> </ul>	<p>These are lipid emulsions for parenteral nutrition with different special functions</p> <p>different lipid formulations may contain the following:</p> <ul style="list-style-type: none"> <li>• contains soybean oil (LCT) rich in EFA</li> <li>• contain EFA, MCFA &amp; LCFA</li> <li>• contain mixture of MCT and LCT</li> <li>• Rapid clearance and energy production preference fuel in conditions like carnitine</li> <li>• Isotonic</li> <li>• Mean globule size similar to chylomicrons</li> </ul>	200ml, 250ml and 500ml bottle or bag
Lipid Emulsion (fish oil)	<ul style="list-style-type: none"> <li>• Contain fish oil</li> <li>• Rich in EPA and DHA</li> <li>• Has anti-inflammatory and immunomodulatory effect</li> </ul>	50ml and 100ml bottles
<b>All in One</b>	<b>Features</b>	<b>Presentation</b>
<b>All in One Parenteral Nutrition formulations</b>	<p>Three (triple) chamber bags with separate compartments for amino acids, fat and a combination of glucose or sorbital and electrolytes for central or peripheral parenteral Nutrition, depending on the osmolarity and specifications.</p> <p>Vitamins and minerals are added into the bag prior to infusion.</p>	1000ml, 1500ml, 2000ml, 2500ml. bags
Two chamber bags	<p>Two chamber bags with separate compartments for amino acid and glucose with or without electrolytes.</p> <p>Other nutrients may be added i.e. fat, vitamins, trace elements as per the specifications</p>	1000ml, 1500ml, 2000ml bags

<p><b>Vitamins</b></p> <ul style="list-style-type: none"> <li>• 9 water soluble vitamins</li> <li>• 4 fat soluble vitamins</li> </ul>	<p>Contains all the water soluble and or fat soluble vitamin based on international recommendations.</p> <p>These are added into the parenteral nutrition product prior to infusion, once daily.</p> <p>Water soluble vitamins to be added into water base products e.g. Dextrose, amino acids or the all in One PN bags but <b>NOT</b> to be added into the single bottle of fat emulsion.</p> <p>The fat soluble vitamins can only be added into the fat emulsion bottle or the All in One PN bags</p> <p>follow instructions as specified</p>	<p>10ml vials</p> <p>10ml ampules.</p>
<p><b>Trace elements</b></p>	<p>Trace element in adults for parenteral nutrition based on international recommendations e.g. zinc, copper, chromium, manganese, selenium.</p>	<p>10ml ampoule</p> <p>1ml, 3ml, 10ml vials</p>

**Table B: Paediatric parenteral nutritional formulations**

Feed	Composition per 10 0mls	Presentation
<p>Special AA for pediatrics</p> <p>6.5% (65g AA/l)</p> <p>7% (70g AA/L)</p> <p>10% (100g AA/L)</p>	<ul style="list-style-type: none"> <li>• Well balanced AA pattern specifically designed for infants (preterm, new born, babies) and young children</li> <li>• Contains EAA and NEAA</li> <li>• Similar to human breast milk</li> <li>• Contains taurine an EAA for neonates</li> </ul>	<p>100ml, 250ml and 500ml bottles.</p> <p>Dosage: As per the child's age, weight and recommendations</p>
<p>Special Amino acids for hepatic and renal failure</p>	<ul style="list-style-type: none"> <li>• As above for children above 6 months of age</li> </ul>	<p>As above</p> <p>Dosage: As per the child's age, weight and recommendations</p>
<p>Carbohydrate solutions</p> <p>(presentations as Above for adults)</p>	<ul style="list-style-type: none"> <li>• The carbohydrate solutions mainly contain glucose</li> </ul>	<p>100ml, 500ml bottles</p> <p>Dosage: As per the child's age, weight and recommendations</p>
<p>Lipid emulsions</p>	<ul style="list-style-type: none"> <li>• As Adults</li> <li>• Dosage: As per the child's age, weight and recommendations</li> </ul>	<p>100ml bottles</p>

Vitamins: Water soluble vitamins	<ul style="list-style-type: none"> <li>• As Adults</li> <li>• Dosage: As per the child's age, weight</li> <li>• Requirements will be calculated as per the child's weight</li> </ul>	10ml vial
Fat soluble vitamins for infants	<ul style="list-style-type: none"> <li>• A multivitamin preparation of lipid soluble vitamins for parenteral nutrition for infants</li> </ul>	10ml ampoule Dosage: As per the child's age, weight and recommendations
Trace elements for children	<ul style="list-style-type: none"> <li>• Trace element additive for children in parenteral nutrition based on international recommendations, to meet the basal requirements of trace elements during intravenous nutrition in infants and children</li> </ul>	10ml vial Dosage: As per the child's age, weight and recommendations

Current formulations in the market have the three chamber bags for peripheral and central parenteral infusion.

### Vitamin requirements in Parenteral Nutrition

It is recommended that all adult/pediatrics PN patients, be supplemented daily with a standard multivitamin package. Table X below provides the standard vitamin package/requirement for parenteral nutrition.

Vitamins	Daily Requirements
B1	3.0 mg
B2	3.6 mg
Niacin	40.0 mg
Pantothenic Acid	15.0 mg
B6	4.0 mg
Biotin	60,0 mg
Folacin Acid	400.0 mg
B12	5.0 mg
C	100.0 mg
A	3,300 IU
D	200 IU
E	10 IU
K	300-500 mg

Source: AMA Recommendation, JPEN 1979

## DETERMINING TRACE ELEMENT REQUIREMENTS

The trace elements zinc, copper, chromium, manganese, iodine, iron, and selenium must be provided in PN to prevent clinical deficiency. It is recommended that all adult PN patients be supplemented daily with a standard trace element package as shown in the table below.

### *Recommendations for trace elements in parenteral nutrition*

Adult patients	mg/day	μmol/day
Chromium (Cr)	0.010-0.015	0.19-0.29
Cobalt (Co)		
Copper (Cu)	0.5-1.5	8-24
Fluorine (F)	1-3	53-158
Iron (Fe)	1-2	18-36
Iodine (I)	0.1-0.2	0.79-1.6
Manganese (Mn)	0.15-0.8	2.7- 15
Molybdenum (Mo)	0.015-0.030	0.16-0.31
Selenium (Se)	0.03-0.06	0.38-0.76
Zinc (Zn)	2.5-4.0	38-61

### Administration of parenteral nutrition

Parenteral Nutrition feeds can be administered in the following forms:

- i) **Single bottle system:** These are single products/bottles providing either one of amino acid solution, dextrose solution or lipid emulsions or vitamins or trace elements or a combination of Amino acid and dextrose. The single bottle system may also contain electrolytes.
- ii) **All in One (AIO) admixtures:** These formulations may be prepared as a single product by the hospital pharmacist or industrial admixtures. The industrial admixtures are mixed up at the factory and delivered to the hospital. Refrigeration is required and they have a short shelf life.
- iii) **Chamber bags:** Two and three chamber bags. These AIO parenteral nutrition feeds have a much longer shelf life and are mixed prior to administration.

### Monitoring of parenteral Nutrition

This is necessary to assess whether the regimen is suitable for the patient and also to confirm and, if necessary correct the prescribed regime. To prevent possible complications, for example, catheter related complications and metabolic related complications

Be careful to check:

- The general condition of the patient
- Patient's daily body weight - bed weighing scales may be practical to check body weight daily at the same time.

- Nitrogen balance
- Fat elimination - check fat tolerance test and plasma triglycerides
- Blood electrolytes - including phosphate
- Blood glucose
- Micronutrients in the long-term parenteral nutrition patients

## **COMPLICATIONS OF PARENTERAL NUTRITION**

These complications are mainly divided into two main categories as follows:

- Catheter related complications which involve:
  - Occlusion of the catheter
  - Catheter blockage (check the type, diameter, period of use)
  - Catheter related infections - these infections may come from the skin or systemic circulation (gram negative organisms and fungi)
  - Catheter related sepsis - there is need to use antiseptic techniques at all times
- Metabolic Complications
- Hepatobiliary or Gastrointestinal complications
- Abnormal liver function (caused by underlying diseases, i.e. sepsis, malignancy, IBD, pre-existing liver disease) bacterial overgrowth in the intestines, biliary sludge and gallstones. Steatosis which may be caused by sole infusion of dextrose as an energy source without fat emulsions or excessive glucose load (above or equals to 7g of glucose/kg/day). Sole glucose infusion without fat may also cause essential fatty acid deficiency (EFAD).

### ***Macronutrient Complications***

These are risks associated with underfeeding or overfeeding:

- Hyperglycemia - several factors may cause hyperglycemia including overfeeding
- Hypoglycemia - this may occur mainly if weaning off parenteral nutrition is not done appropriately or if there is excess insulin administration
- Azotemia can result from dehydration, excessive and/or inadequate non protein calories. Omission of fat emulsions during PN may cause EFAD
- Too much infusion may cause hyperlipidemia.

### ***Micronutrient Related Complications***

- Fluid imbalance (Dehydration from osmotic diuresis, fluid overload)
- Electrolyte imbalance
- Vitamin, mineral and trace elements deficiency may only occur

The above complications can greatly be reduced and avoided if there is a multi-disciplinary nutrition team with experienced clinicians available to insert the central feeding catheters, designated nurses to care for the catheters, and an experienced registered dietician to prescribe the right parenteral nutrition formulation and make the necessary follow ups, monitoring and necessary adjustments. The table below shows complications of total parenteral nutrition.

**Complications of total parenteral nutrition**

Catheter related complications	Metabolic complications
<ul style="list-style-type: none"> <li>• Bacteraemia (staphylococcal)</li> <li>• Invasive fungal infection</li> <li>• Thrombosis</li> <li>• Extravasation injuries</li> <li>• Cardiac tamponade</li> </ul>	<ul style="list-style-type: none"> <li>• Cholestatic jaundice</li> <li>• Hyperglycaemia or glycosuria</li> <li>• Vitamin deficiencies or excesses</li> <li>• Hyperammonaemia</li> </ul>

**CASE STUDY**

1. Tony is a 37 year old man who weighs 58 kg and is 157cm tall. He has recently undergone gastric bypass surgery. He is currently on parenteral nutrition support. Calculate his nutrient requirements in light of;
  - A. Amino acids
  - B. Glucose
  - C. Fat

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**17.3.6.3 Self-Assessment**

1. Define the following terms
  - A. Parenteral nutrition
  - B. Rate of infusion
2. Intravenous solutions
 

A. Rarely contain vitamins	B. Usually contain cellulose
C. Are usually given after surgery	D. Provide 2,000 calories per day
3. \_\_\_\_\_ is a major concern when parenteral nutrition is given via a peripheral cannula.
 

A. Refeeding Syndrome	B. Thrombosis
C. Enterocolitis	D. Extravasation Injury
4. The general decisions to use PPN instead of CPN are based on
  - A. The general status of the patients
  - B. The medical condition of the patient



- C. The availability of resources
  - D. Comparative energy demands and anticipated time of use.
5. One should ensure appropriate osmolarity is infused via the appropriate veins to avoid
    - A. Thrombosis and small blood vessel damage
    - B. Abnormal liver function
    - C. Hyperglycemia
    - D. Occlusion of the catheter
  6. Differentiate between total parenteral nutrition (TPN) and peripheral parenteral nutrition (PPN).
  7. Identify the characteristics of and indications for parenteral nutrition.
  8. Describe the access routes for parenteral nutrition.
  9. Discuss the forms in which parenteral nutrition can be administered.
  10. Discuss how monitoring can be done on the parenteral nutrition administration.
  11. Discuss the complications of parenteral nutrition.

#### ***17.3.6.4 Tools, Equipment, Supplies and Materials***

- Stationery
- Reference materials
- Clinical guidelines
- Calculator
- Parenteral nutrition formulas
- WHO guidelines
- MOH policies and guidelines
- Ministry of Education
- Skills lab
- Projectors, video clips, charts and other teaching aids
- Stationery
- Food exchange lists
- Food guide pyramid
- Invitation of competent expertise
- Computers with internet
- Library and resource centre

### **17.3.6.5 References**

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## 17.3.7 Learning outcome 6: Demonstrate understanding in nutritional management of surgery, trauma, and burn

### 17.3.7.1 Learning Activities

Learning activity	Special instructions
i) Identify and describe terminologie	<ul style="list-style-type: none"> <li>• Demonstrate ability to define the terms               <ul style="list-style-type: none"> <li>o Surgery</li> <li>o Trauma</li> <li>o Burn</li> <li>o Preoperative nutrition</li> <li>o Postoperative nutrition</li> </ul> </li> </ul>
ii) Identify and describe burns pathophysiology and their nutritional management	<ul style="list-style-type: none"> <li>• Describe the pathophysiology of burns</li> <li>• Classify burns</li> <li>• Determine nutritional requirements during burns</li> <li>• Offer nutritional management of burn patients               <ul style="list-style-type: none"> <li>o Formulate diets for burns</li> </ul> </li> </ul>
iii) Identify and describe surgery nutrition implications of surgery and management <ul style="list-style-type: none"> <li>• Nutritional management in severe trauma</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate ability to determine nutritional implications of surgery</li> <li>• Provide nutritional support in surgery</li> <li>• Perform diet formulations for surgery patients               <ul style="list-style-type: none"> <li>o Pre-operative nutrition</li> <li>o Post-operative nutrition</li> </ul> </li> </ul>

### 17.3.7.2 Information Sheet

#### Meaning of terms in surgery, trauma and burns

**Surgery:** the treatment of injuries or disorders of the body by incision or manipulation especially with instruments

**Trauma:** physical injury experienced after a surgical procedure

**Burns:** a result of the effects of thermal injury on the skin and other tissues

**Preoperative nutrition:** nutrition therapy provided before surgery which aims at meeting surgery demands

**Postoperative nutrition:** nutrition therapy provided after surgery which aims at replenishing surgery-induced physiological losses.

## BURNS

Major burns result in severe trauma. Human skin can tolerate temperatures up to 42-44°C (107-111° F) but above these, the higher the temperature the more severe the tissue destruction

Below 45°C (113° F), resulting changes are reversible but >45°C, protein damage exceeds the capacity of the cell to repair. A burn injury occurs as a result of destruction of the skin from direct or indirect thermal force. Burns are caused by exposure to heat, electric current, radiation or chemical. Scald burns result from exposure to moist heat (steam or hot fluids) and involve superficial. When a patient suffers from burn injuries the energy requirements can sometimes increase to as much as 100% above resting energy expenditure, depending on the extent of the burn (Total Burnt Surface Area - TBSA) and depth of the injury (degree of burns).

### Causes

Burns can result from several causes. They include; fire, chemicals, contact with hot liquids, sunburn, electricity or lightning, prolonged exposure to hot liquids

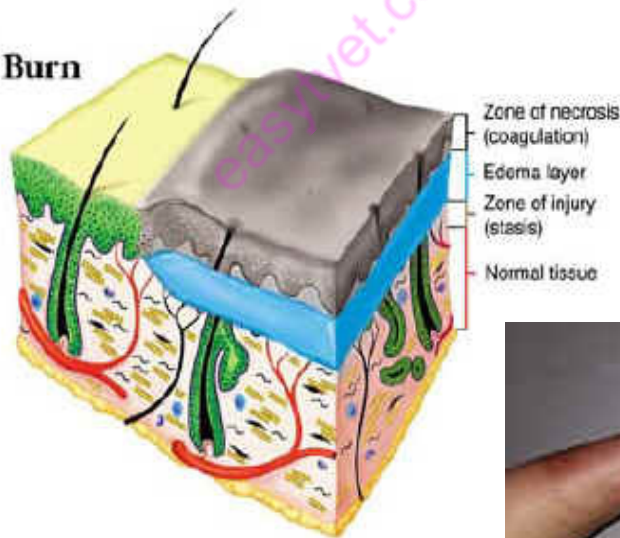
### Degree and extent of burns

- The depth of the burn wounds affects its healing process. Burns are classified by degree;
  - *1<sup>st</sup> degree*: erythema (redness of the skin). Cell necrosis above the basal layer of the epidermis can regenerate new skin tissue.

### Superficial Dermal Burn

#### Characteristics

1. Necrosis confined to upper third of dermis
2. Zone of necrosis lifted off viable wound by edema
3. Small zone of injury

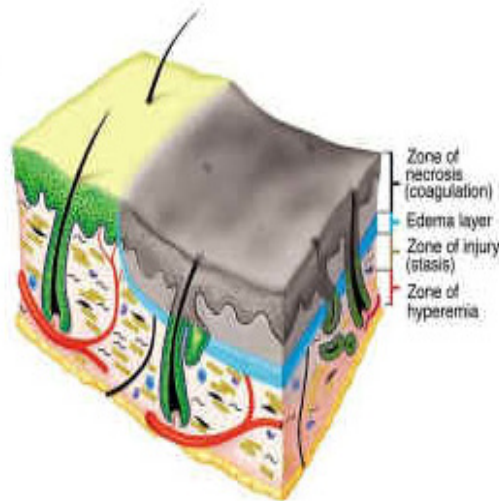


- *2<sup>nd</sup> degree*: erythema and blistering, necrosis within the dermis

### Mid-Dermal Burn

#### Characteristics

1. Necrosis to mid-dermis
2. Large zone of injury (potential conversion)
3. Eschar separated from viable tissue by edema layer

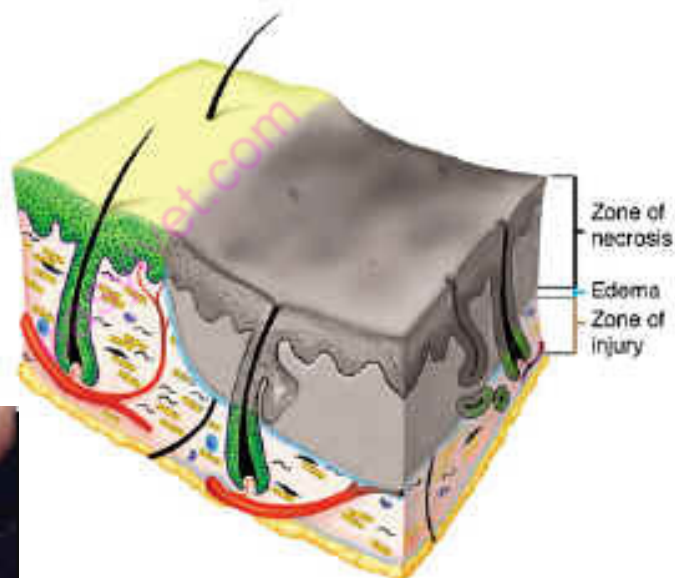


- *3<sup>rd</sup> degree*: a full thickness skin loss including the fat layer.

### Deep Dermal Burn

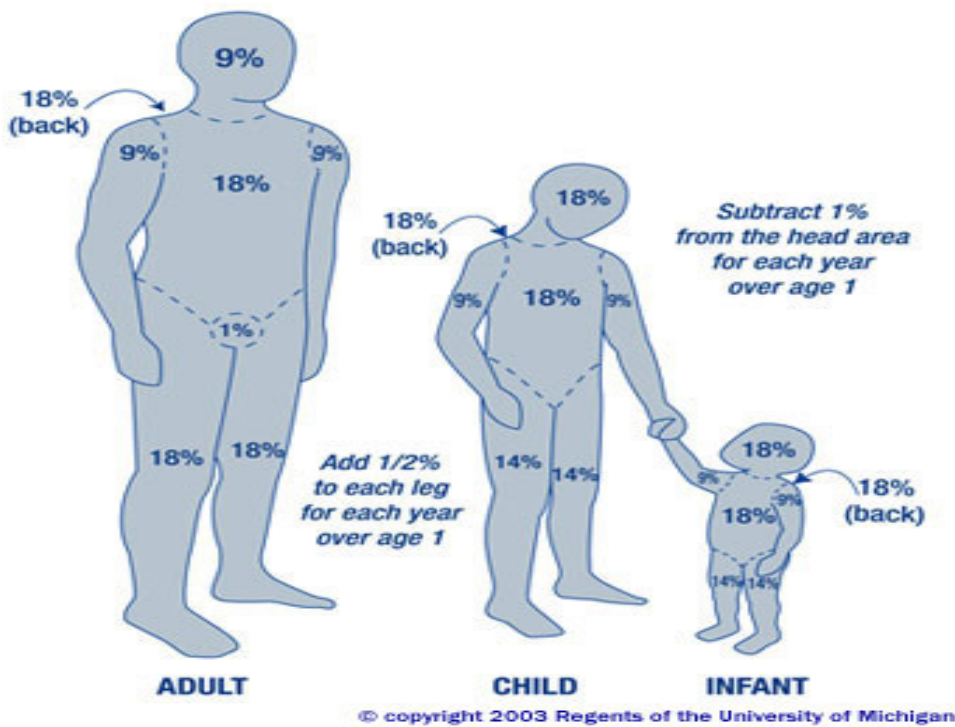
#### Characteristics

1. Necrosis involving majority of skin layers
2. Zone of necrosis adherent to zone of injury
3. Smaller edema layer



- Extensive full thickness burns require skin grafting.
- When the burn injury exceeds 15 to 20% of the total body surface area (TBSA), it results in systemic disturbances, including a major stress response, impaired immunity and extensive fluid redistribution
- 2<sup>nd</sup> & 3<sup>rd</sup> degree burns covering 15-20% or more of total body surface or 10% in children and elderly persons usually cause extensive fluid loss and require phototherapy.

- Burns of severe depths covering more than 50% of the body surface area are often fatal especially in infants and older persons.



#### Immediate ‘ebb’ or shock period

- During the first 12-24 hours following injury, patients with major burns require rapid replacement of lost fluid and electrolytes.
- The inflammatory process associated with injury increases permeability of the vascular endothelium (glucose free, balanced electrolyte solutions are used).
- A massive flooding edema occurs at the burnt site during the first hours to about the 2nd day

#### Following ‘flow’ or recovery period

- After about 48-72 hours, tissue fluids & electrolytes are gradually reabsorbed into the general circulation and excess fluid is excreted.
- The patient returns to the pre-injury weight by the end of the first week. Fluid balance is gradually re-established and patterns of massive tissue loss reversed.
- There is sudden diuresis (careful check of fluid intake and output is essential with constant checks for signs of hydration or over-hydration)

#### Secondary feeding period

- Towards the end of the first burn week, adequate bowel function returns and a vigorous feeding must ensue.
- The nutritional needs are high.

## **Implications of burns**

- Catabolism of trauma
- Anorexia
- Generalized discomfort and depression
- Heat lost
- Demand of tissue regeneration
- Malnutrition
- Wasting and weight loss
- Failure to feed
- Loss of fluids and electrolytes
- Infections
- Anemia

## **Special concerns for burn patients**

- Burn patients have all typical characteristics of hypermetabolic state and nitrogen losses exceed any other type of stress or trauma
- Hyper metabolism increase with size of the burnt area peaking up to 2 to 2.5 times above the normal metabolic rate for burns involving as much as 40% of the body surface
- When the skin surface is destroyed, the body's first line of defense against infection is lost
- Loss of skin also results in increased water and heat loss. The larger the burnt area the greater the loss of water vapor and heat
- Approximately 2.5-4l/day of water vapor may be lost from a major burnt wound
- The burnt surface allows leakage of a protein rich fluid containing approximately two thirds as much proteins as plasma
- Burn patients do not feed well because of pain, generalized discomfort and depression
- Many are anorexic and unable to consume a sufficient amount of kilocalories to satisfy energy requirements
- Large amounts of waste products (such as nitrogen and potassium) must be excreted by the kidney- fluids are required to keep these in solutions
- Curling ulcer or acute ulceration of the stomach or duodenum is frequently observed in burn patients-large amount of vitamin A can reduce incidence of stress ulcer.

## **Aims of Nutritional Management**

- Achieving and maintaining optimum body weight
- Replacement of fluids and electrolytes to maintain circulatory volume and prevent renal failure
- Promote wound healing
- Prevent infection and rapid or severe weight loss
- Attain normal hydration status and electrolyte balance

## **Dietary Management**

For burn patients a high protein high calorie diet is vital for faster recovery. In adults and children TBSA of more than 10%, protein should comprise 20% of the total caloric requirement. TBSA 1% to 10%, protein should provide 15% of the total caloric requirements. For children younger than 1 year of age, a conservative recommendation of 3g to 4g protein /kg can be given because of infant's inability to tolerate high renal solute loads. Excessive high protein intake could result in azotemia, Hyperammonaemia, or acidosis. The energy and protein needs of both adult and children burn patients is determined using the Curreri formula (1979).

### **Adults**

Energy Needs: Daily calorie requirements = [24kcal x kg usual body weight] + [40 kcal x TBSA {% burn}]

Where: TBSA stands for the total % burn

Protein Needs: Daily protein requirement = [1g x body weight] + [3g x TBSA].

### **Children**

Daily calorie requirement

= [60kcal x kg usual body weight] + [35kcal x TBSA]

Daily protein requirement

= [3g x Kg. Usual Body weight] + [1g x TBSA]

### **Nutrient Delivery**

Nutrient could be delivered either through oral, enteral, or parenteral routes

#### **Enteral**

Continuous enteral feeding with or without oral intake is indicated for patients who are unable to meet a minimum of 75% Kcal and protein requirements via oral diets; for nocturnal tube feeding; for patients on ventilation and those with adequate bowel function.

Pediatric patients; For pediatric patients starting hourly feed should be 1ml to 2ml kg/day and the volume should be increased gradually to 5ml to 15ml every 8, 12, or 24 hrs depending on the patient's tolerance.

Adult patients; For adult patients start with 10ml to 40ml per hour depending on patient tolerance. Then increase volume gradually with 20ml to 25ml every 8, 12 or 24 hours depending on patient tolerance. Free water requirements can be met by intermittent prescribed water flushes.

NB: Check residual gastric volume every 4 hours when gastric feedings are given. If the residual is more than 1.5times the hourly rate, the enterable feeding should be stopped and parenteral feeding initiated.



## **Parenteral**

Parenteral nutrition should be administered when the gastrointestinal function is not functional. It should be tailored to the nutrient recommendations.

**Adult patients;** For adult patients administer hypertonic solutions by infusion pump at 40ml/hr at the beginning. Then increase the rate by 20ml to 40ml every 8 to 12hrs as tolerated until energy, protein and fluid requirements are attained

**Pediatric Patients;** For pediatric patients, initiate infusion of dextrose at a concentration of 10% and advance this as tolerated to a maximum of 20% dextrose concentration. Alternatively infuse 20% dextrose at a rate of one half of maintenance fluid for 12 hours and then advance to full maintenance fluids as tolerated

**Note:** For patients on tube feeding and/or parenteral nutrition in non intensive care carefully monitor the following parameters daily: intake and output, urine sugar/acetone, blood glucose and consistency of bowel movements. For those patients in intensive care receiving parenteral feeds, tube feeding or both, the following parameters should be monitored closely on daily basis: sodium, potassium, BUN, creatinine, blood glucose, Hb, hematocrit, intake and output, urine sugar/acetone and consistency of bowel movement.

## **Surgery; nutrition implications of surgery, pre-surgery nutrition, post surgery nutrition, nutrition support in various surgical conditions, rehabilitation post surgery**

### **Surgery**

Surgery like any other injury to the body elicits a series of reactions including release of stress hormones and inflammatory mediators i.e. cytokines. This release of mediators to the circulation has a major impact on body metabolism. They cause catabolism of glycogen, fat and proteins with release of glucose free fatty acids and amino acids into the circulation so that substrate are diverted from their normal purposes e.g. physical activities to the task of healing and immune response. For optimal rehabilitation and wound healing the body needs to be in anabolic state. Measures to reduce stress of surgery can minimize catabolism and support anabolism throughout surgical treatment and allow patients to recover substantially better and faster even after major surgical operation.

### **Goal of nutritional management**

To enhance recovery of patients after surgery

### **Objectives**

- To avoid long periods of pre operative fasting
- To re establish oral feeding as early as possible after surgery
- To integrate nutrition into overall managements of patients
- To control metabolic processes

## Preoperative nutrition care

- Encourage patients who do not meet their energy needs from normal foods to take oral nutrition supplements during the preoperative periods
- Administer preoperative enteral nutrition preferably before admission to the hospital
- Ensure the stomach is empty. It is important to empty the stomach at the time of operation to avoid the danger of aspiration during the induction of anesthesia or upon awakening
- Use a chemically defined or elemental liquid diet with minimal residue pre-operatively for patients with nutritional risks
- Patients who are scheduled to undergo surgery and who are considered to have no specific risk for aspiration may drink clear fluids until 2 hrs before anesthesia. Solids foods are allowed until 6 hrs before anesthesia.
- For elective cases, no food is allowed by mouth (nil by mouth) for at least six hours before surgery
- Low fiber foods should be administered orally, a liquid diet for 2 – 3 days preceding surgery

## Postoperative nutrition care

The aim of postoperative nutrition care is to reduce nutritional deficiencies that ordinarily develop in untreated patients during the period of post operation. Note;

- Length of nil by mouth after surgery may be influenced by the patients pre-existing nutritional status, severity of operative stress and the nature and severity of the illness
- If the period of post operative starvation is expected to be longer than one week, parenteral nutrition support maybe beneficial even for a mildly malnourished individual
- Introduction of solid foods depends on condition of the GI tract, oral feeding is often delayed for the first 24 – 48hrs following surgery to await the return of the bowel sounds or passage of flatus
- Initiate normal food intake or enteral feeding earlier after gastro intestinal surgery
- Oral intake including clear liquids can be initiated within hours after surgery to most patients undergoing colon resections
- Oral intake should be adopted to individual tolerance and to the type of surgery carried out
- Apply tube feeding in patients whom early oral nutrition cannot be initiated with special regard to those undergoing major head and neck or gastrointestinal surgery for cancer.

## Severe trauma

For patients with obvious under-nutrition at the time of surgery and for whom oral intake will be inadequate (<60%) for more than 10 days;

- Initiate tube feeding for patients in need within 24 hours after surgery

- Start tube feeding with a low flow rate ( e.g. 10ml/hr to maximum of 20ml/hr) due to limited intestinal tolerance
- It may take 5-7 days to reach the target intake and this is not considered harmful
- Reassess nutritional status regularly during the stay in the hospital and if necessary continue nutritional support after discharge in patients who have received nutritional support preoperatively
- Progress over a period of several meals from clear liquids, and finally to solid foods.

### CASE STUDY

Betty is a 5 year old girl who really loves playing. One evening, when she was playing with her brother, Betty's clothes caught fire. Before she could be rescued, she had already sustained 42% burns and mostly at 2<sup>nd</sup> degree. At the time of the accident, Betty weighed 17kg.

- Calculate the amount of energy required for Betty's diet
- Calculate the protein requirements for Betty
- Explain why Betty's protein intake should be increased

### 17.3.7.3 Self-Assessment

- Define the following terms;
  - Trauma
  - Burn
  - Surgery
- Continuous enteral feeding with or without oral intake is indicated for burn patients who
  - Have >20% tbsa
  - Are unable to meet a minimum of 75% kcal and protein requirements via oral diets
  - Cannot tolerate parenteral nutrition
  - Has normal hydration status
- Indicate whether the following statements about postoperative nutrition care are **true** or **false**
  - Chemically defined or elemental liquid diet with minimal residue pre-operatively for patients with nutritional risks should be used
  - Patients who are scheduled to undergo surgery and who are considered to have no specific risk for aspiration
  - For elective cases, no food is allowed by mouth (nil by mouth) for at least one hour before surgery
  - Patients who do not meet their energy needs from normal foods should be put on parenteral nutrition
- Design a preoperative nutrition care plan for a surgery patient.

5. Explain the special concerns for burn patients regarding their nutrition status.
6. Discuss how you would handle surgical patients with under-nutrition and for whom oral intake will be inadequate.
7. Identify the implications of burns on the patients.

#### ***17.3.7.4 Tools, Equipment, Supplies and Materials***

- Stationery
- Reference materials
- Clinical guidelines
- WHO guidelines
- MOH policies and guidelines
- Ministry of Education
- Skills lab
- Projectors, video clips, charts and other teaching aids
- Stationery
- Food exchange lists
- Food guide pyramid
- Invitation of competent expertise
- Computers with internet
- Library and resource centre

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## 17.3.8 Learning outcome 7: Demonstrate understanding of palliative and hospice care

### 17.3.8.1 Learning Activities

Learning activity	Special instructions
i) Identify and describe terminologies in palliative and hospice care	<ul style="list-style-type: none"><li>➤ Define the various terms in palliative and hospice care<ul style="list-style-type: none"><li>○ Hospice</li><li>○ Hospice care</li><li>○ Nutrition support</li></ul></li></ul>
ii) Identify and describe nutrition support during palliative and hospice care as per resource materials, policies and guidelines	<ul style="list-style-type: none"><li>➤ Provide nutrition support for the palliative and hospice patients</li></ul>

### 17.3.8.2 Information Sheet

#### Definitions

**Hospice:** a special concept of care designed to provide comfort and support to patients and their families when a life-limiting illness no longer responds to cure-oriented treatments

**Palliative care:** specialized medical care focused on identifying and relieving the pain and other symptoms of a serious illness.

**Nutrition support:** refers to enteral or parenteral provision of calories, protein, electrolytes, vitamins, minerals, trace elements, and fluids.

#### Hospice

The hospice team collectively focuses on the care of the patient with a unique focus on his or her individual wishes. At the moment, hospice care includes;

- Physical care
- Psychosocial care
- Spiritual care
- Emotional care

#### Palliative care

The goal of palliative care is to improve quality of life for such patients at any stage of illness regardless of current treatment plans, and it is tailored to the needs of the patient and the family.

This kind of care focuses more on the quality of life rather than curing disease. When a cure or control is not possible and death is likely, palliative care (comfort measures) is offered.

The goals are to relieve pain and physical symptoms; alleviate isolation, anxiety and fear; and help those with cancer maintain independence as long as possible. Patients may be eligible for hospice care, either in an inpatient unit or at home. Hydration needs are usually met, and pain control is attempted. Patients are made as comfortable as possible in the dying process. Generally with palliative care, nutrition support is not initiated.

### **Nutrition support during palliative and hospice care.**

Nutrition support aims at meeting nutrient needs of the patient during palliative care hence improving their quality of life. Acute critical illness is usually characterized by catabolism exceeding anabolism leading to excess weight loss. However, with better management of underlying conditions and pain, calorie consumption can be reduced significantly.

A major barrier to providing nutrition support for patient's on palliative care is stigma experienced by these patients. Many people have misconception that end of life care is too expensive. Since the purpose of palliative care is to allow patients to die with dignity and minimal suffering while maintaining control and support for families, nutrition support should also be included to complete care.

Palliative care encourages the alleviation of physical symptoms, anxiety, and fear while attempting to maintain the patient's ability to function independently. Hospice home care programs allow the patient to stay at home and delay or avoid hospital admission. Quality of life is the critical component. A dietitian's intervention may benefit the patient and family as they adjust to issues related to the approaching death. Families who might be accustomed to a modified diet should be reassured if they are uncomfortable about easing dietary restrictions. Ongoing communication and explanations to the family are important and helpful.

### **Barriers to providing nutrition support**

- Misconception that nutrition support for the terminally ill is not beneficial
- Lack of clinical benefit to palliative care patients
- Nutrition support may cause complications that may add to the burden of patient.

### **Benefits of nutrition support for terminally ill**

- Reduces physical deterioration
- Improves quality of life for the terminally ill
- Prevents emotional effects of a feeling like one is starving the patient to death
- Improves nutrient intake and fluid status.

### **Home enteral nutrition**

Enteral nutrition may be done at home. Orders that specify protocols for administration and monitoring will be written by a provider or dietitian. Most protocols require the prescriber to indicate the formula for feeding, strength, how quickly to feed, and delivery method. Delivery methods include the following: gravity controlled and pump assisted.

Gravity controlled feeding refers to any feeding method that uses manually controlled devices to deliver a feeding which is almost always a gastric feeding. This may include a continuous gravity feeding that is manually controlled with a feeding bag and a roller clamp to help control the rate; and intermittent gravity feeding where 200-300 mL are delivered over 30-60 minutes every 4-6 hours; and, a bolus feeding where a specific volume of feeding is infusing via bag or a syringe rapidly over several minutes, usually at a rate of about 60 mL/minute.

Pump assisted feeding utilizes an electric pump device to more precisely control the rate of delivery in patients who are at a higher risk of inadvertently getting formula in their lungs, sensitive to volume, have delayed gastric emptying or are being fed into the small intestine.

Choice of the delivery methods for a particular person depends on the type of enteral access device as well as the person's individual needs. Water flushes should be administered to prevent clogging and ensure adequate hydration.

Feeding tubes should be flushed with water before and after medication delivery and before and after every feeding or every 4 hours during continuous feeding.

Often a dietitian, nurse or home care company will teach the patient how to prepare, administer, and monitor tube feeds. In addition, a home care company may be available to explain the supply options available and help to arrange for home supplies and equipment.

### **17.3.8.3 Self-Assessment**

1. Define the following terms;
  - A. Nutrition support
  - B. Palliative care
  - C. Hospice care
2. The goal of palliative care is \_\_\_\_\_
  - A. To improve quality of life for such patients at any stage of illness regardless of current treatment plans
  - B. To assure a good prognosis for the patients on palliative care
  - C. To eliminate pain entirely
  - D. To treat and cure the disease
3. Gravity feeding includes the following except?
  - A. Continuous gravity feeding
  - B. Intermittent gravity feeding
  - C. Oral feeding
  - D. Bolus feeding
4. Identify the challenges associated with implementation of nutrition support for the terminally ill.
5. Describe home enteral nutrition support of the palliative care.
6. How would a palliative care patient benefit from nutrition support?

#### **17.3.8.4 Tools, Equipment, Supplies and Materials**

- Food pump
- Stationery
- Reference materials
- Clinical guidelines
- WHO guidelines
- MOH policies and guidelines
- Ministry of Education
- Skills lab
- Projectors, video clips, charts and other teaching aids
- Food exchange lists
- Food guide pyramid
- Invitation of competent expertise
- Computers with internet
- Library and resource centre
- Feeding bag and roller clamp

#### **17.3.8.5 References**

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## 17.3.9 Learning outcome 8: Demonstrate understanding in nutrient drug interactions

### 17.3.9.1 Learning Activities

Learning activity	Special instructions
i) Identify and describe terminologies in nutrient drug interactions	<ul style="list-style-type: none"><li>➤ Define the terms;<ul style="list-style-type: none"><li>○ Pharmacodynamics</li><li>○ Pharmacokinetics</li><li>○ Pharmacogenomics</li><li>○ Food drug interaction</li></ul></li></ul>
ii) Identify and describe specific drug nutrient interactions with nutrition implications	<ul style="list-style-type: none"><li>➤ Demonstrate understanding pharmacokinetics and pharmacodynamics</li><li>➤ Demonstrate ability to prevent adverse effects of nutrient-drug interactions</li><li>➤ Demonstrate the ability to advice on drug nutrient interaction</li></ul>

### 17.3.9.2 Information Sheet

#### Meaning of terms in nutrient drug interactions

- **Pharmacodynamics:** the study of the physiologic and biochemical effects of a drug or combination of drugs
- **Pharmacogenomics** the study of genetically determined variations that are revealed solely by the effects of drugs in the body
- **Pharmacokinetics** the movement of a drug through the body by absorption, distribution, metabolism, and excretion
- **Food-drug interaction** a broad term that includes drug-nutrient interactions and the effect of a medication on nutritional status
- **Absorption** the process of movement of a drug from the site of administration into the systemic circulation
- **Drug-nutrient interaction** the result of the action between a drug and a nutrient that would not happen with the nutrient or the drug alone.

## **DRUG-NUTRIENT INTERACTIONS**

A nutrient-drug interaction may impact the body in several ways. Certain foods can affect the rate at which the body uses a medication. A drug will not work as well if a certain nutrient in a food speeds up or slows down its absorption.

### **Drugs and nutrition**

Drugs taken either on prescription or as self-medication can directly or indirectly affect the nutrition status of the patient. On the other hand, food constituents can influence the action of a drug. The result of the two-way interaction may bring about malnutrition or compromised performance of the drug. The negative impact of such an interaction may be aggravated by pathophysiological state of the victim.

The effect of drug - food interaction are physical, nerve or chemical mediated and involve various mechanisms as outlined below.

### **Effects of drug to nutrition**

#### **Alteration or inhibition of taste and odor perception**

Penicillin-based antibiotics, metronidazole (amoebicide), allopurinol (antigout), chloroquine (antimalarial) and many others produce bitter or varying degrees of bad taste in the mouth.

Potassium iodide and other halogen containing salts cause unpleasant after taste that make feeding undesirable

#### **Inhibition or excessive stimulation of secretions**

Atropine drugs like (hyoscine spasmolytic) inhibits secretion in the gastrointestinal tract (GIT). This interferes with food lubrication and digestion. Aspirin (antipyretic analgesic) lowers gut PH steeply and causes physical corrosion of the mucosa. The victim suffers severe epigastric irritation and depressed appetite.

### **Function of a drug**

A drug is taken to prevent or treat sickness and disease. It is important to know what happens in the body when a drug is taken in order to better understand the interaction between nutrients and drugs. The action of a drug taken orally generally occurs in four steps: (1) the drug dissolves in the stomach, (2) the drug is absorbed into the blood and moves via the blood to the area of the body that needs it, (3) the body reacts to the medicine, and (4) the body gets rid of the drug by way of detoxifying it either in the kidney, liver, or both.

### **Adverse effects of nutrient-drug interactions**

Some drugs may affect the absorption of nutrients, while some foods—for example, those containing caffeine—can amplify or modify the effects of certain drugs. Taking drugs with hot beverages could also make them less effective. Short- or long-term instances of nutrient-drug interactions may be life threatening. A nutrient-drug interaction may also impact the nutritional status of the body. Nutrient-drug interactions can occur with both prescription and over-the-counter medicine.

## **Impact of food on effectiveness of a drug**

Medication has ingredients, just as food does, that allow it to function correctly when taken in order to help the body in some way. A food may interfere with the effectiveness of a drug if the food interacts with the ingredients in the medication, preventing the drug from working properly. Either nutrients in food may delay absorption into the body or speed up elimination from the body, either or which can impact a drug's effectiveness. For example, the acidic ingredients in fruit juices are capable of decreasing the power of antibiotics such as penicillin. Tetracycline, another infection-fighting drug, is impacted by the consumption of dairy products. Many medications that are taken to fight depression can be dangerous if mixed with beverages or foods that consist of tyramine, which is found in items such as beer, red wine, and some cheeses.

Food can also impact the effectiveness of a drug due to the way it is consumed. Generally, medicine is to be taken at the same time food is eaten. This is because the medicine may upset the stomach if the stomach is empty. However, sometimes taking a drug at the same time that food is eaten can interfere with the way the medicine is absorbed by the body.

## **Impact of drug-nutrient interaction on nutritional status**

A drug has the capacity of interfering with a person's nutritional status. Appetite may be stimulated by a certain drug, resulting in an increase in nutrient intake due to more food being eaten. However, drugs may also cause a decrease in appetite, leading to a decrease in nutrient intake. In this case, a drug could possibly cause a nutritional deficiency. Nutritional status may also be impacted by a drug's effect on the three main nutrients: carbohydrates, fat, and protein. A drug may speed up or slow down the breakdown of these three nutrients, which are essential to the body's functioning. When a drug affects the absorption of nutrients from food into the body, less energy is available to be used by the body. The impact of the nutrient-drug interaction may vary according to the medicine taken, the dose of the medicine given, and the form taken (e.g., pill, liquid).

## **The elderly and nutrient-drug interactions**

Elderly persons are at a significant risk for nutrient-drug interactions. This population often takes the highest amount of medications, and with the use of multiple drugs, certain problems may exist. A loss of appetite, a reduced sense of taste and smell, and swallowing problems all may result from medication use in elderly people.

Malnutrition is a common problem among older adults. Therefore, nutritional status may be already impacted by decreased nutrient intake. This may only worsen the effect of a possible nutrient-drug interaction. Elderly people who take many drugs on a routine basis for long periods are at greatest risk of nutrient depletion and nutritional deficiencies.

A nutrient-drug interaction may impact the body in several ways. Certain foods can affect the rate at which the body uses a medication. A drug will not work as well if a certain nutrient in a food speeds up or slows down its utilization.

## **Drug and food intake**

- Some drugs alter the appetite especially amphetamines reducing nutrient intake
- Methotrexate drugs interferes with taste or smell and may cause mouth sores and inflammation
- Digitalis can induce nausea and vomiting hence leading to nutrient loss
- Phenobarbital can cause dry mouth
- Cyclophosphamide induces mucosal ulcers

## **Drugs and nutrient absorption**

- Antacids can interfere with iron absorption by changing the acidity of the digestive tract
- Climetidine can improve fat absorption by altering digestive juices
- Laxatives speed motility of the digestive tract causing malabsorption of many nutrients
- Neomycin may reduce lipase activity hence interfering with fat digestion
- Chemotherapy drugs can damage mucosal cells thereby affecting nutrient absorption
- Some antacids bind phosphorus hence hindering its' absorption.

## **Drugs and nutrients interaction**

- Acting as structural analogs e.g. anticoagulants and vitamin K
- Competing with each other for metabolic enzyme systems e.g. phenobarbital and folate
- Altering enzyme activity and contributing pharmacological active substance e.g. monoamine oxidase inhibitors and tyramine.

## **Drugs and nutrient excretion**

- Some diuretics increase the excretion of sodium and potassium
- Aspirin displaces folate from its' plasma protein carrier hence affecting its' excretion
- Some drugs inhibit or stimulate excessive secretions
- Atropine drugs (e.g. hyoscine spasmolytic) inhibit secretions in the gastrointestinal tract. Interfering with food lubrication and digestion
- Aspirin (antipyretic analgesic) lowers the gut PH steeply and causes physical corrosion of the mucosal lining. Patients with ulcers should not use aspirin.

## **Alteration of nutrient biotransformation and bioavailability**

- Tetracycline inhibit protein synthesis while chloramphenicol (antibiotic) and amphotericin B antifungal) are potent catabolic agents

- Insulin (antidiabetic) and certain anabolic steroids promote protein synthesis
- Carbohydrate biotransformation is interfered with by glucagon which demolishes glycogen reserves in the liver
- Sulphonamides (anti-infective) produce hypoglycemia as a side effect by enhancing insulin production
- Chlorpromazine (antipsychotic) promotes lipid synthesis while carbamazepine (anticonvulsant) stimulates its breakdown
- Fat soluble vitamins are mopped up by drugs formulated with mineral oils and are rendered unavailable for beneficial biotransformation.

### **Chemical reactions**

- Minerals in dairy products (calcium, magnesium, iron) combine with tetracycline to form insoluble complexes of no nutritional value. Tetracycline causes severe nausea and vomiting that makes food repulsive
- Aluminum-containing antacids bind phosphates from the body thus reducing ATP energy reserves. The client becomes weak and disoriented.

### **Effects of food on drugs**

- Pyridoxine in food blocks the effects of levodopa used in the treatment of parkinsonism
- Foods rich in dopamine (cheese, chicken, liver, red wine, bread, beans etc) cause hypertensive crisis and life threatening cerebrovascular accidents when taken alongside certain antidepressants; procarbazine and isoniazid
- Alcohol when taken with metronidazole, chloramphenicol or nitrofurantoin cause disulfiram reactions
- Alcohol produces prolonged hypoglycemic effects when taken with insulin and oral hypoglycemic agents
- Some foods e.g. candy can change the acidity of the gastrointestinal tract thereby causing the slow acting asthma medication to dissolve too quickly
- Foods that stimulate secretion of digestive juices increases absorption of some drugs e.g. griseofulvin
- Aspirin is absorbed more slowly when taken with food
- Vitamin C can alter urinary PH and limit the excretion of aspirin.

### **Avoiding drug-nutrient interactions**

Drug-food interactions which are a potential threat to good nutrition should be avoided at all costs, unless the benefit expected outweighs the potential risk. Ensure the following;

- Take drugs at correct dose and frequency to reduce the severity of the side effects
- Take a gut-irritating drug with or after meals to reduce the chances of discomfort
- Drug administration and meal times may be staggered to avoid unintended interactions

- A drug likely to interact unfavorably with food may be given parenterally
- A drug causing epigastric pain may be given likewise or rectally or as a necessary
- Taking syrup or a liquid drug may prevent prolonged stay of the drug in the gastrointestinal tract hence reducing chances of interaction with food
- If taking phenelzine drug (antidepressant) abstain from eating liver.

### Benefits of minimizing drug interactions

- Medications achieve their intended effects.
- Patients do not discontinue their drug.
- The need for additional medication is minimized.
- Fewer caloric or nutrient supplements are required.
- Adverse side effects are avoided.
- Optimal nutritional status is preserved.
- Accidents and injuries are avoided.
- Disease complications are minimized.
- The cost of health care services is reduced.
- There is less professional liability.
- Licensing agency requirements are met

The table below shows common drug nutrient interactions:

### Common drug nutrient interactions

Therapeutic Class	Drug	Nutrient Interaction
Alcohols	Ethanol	Reduced absorption of fat, retinol, thiamin, cobalamin and folate; impaired utilization and storage of retinol; increased urinary excretion of zinc and magnesium.
Analgesics	Aspirin	Increased urinary excretion of ascorbic acid; may cause GI bleeding and subsequent iron deficiency; increased folate and vitamin D requirements.
Antacids	Al or Ca containing	Reduced iron, copper, phosphate and magnesium absorption.
Antibiotics	Penicillin's Amino glycosides Chloramphenicol	Increased urinary excretion of amino acids; reduced intestinal vitamin K and cobalamin synthesis; possible malabsorption of fat, cobalamin, calcium, magnesium and carotenoids.
Anticoagulants	Coumadin	Vitamin K decreases & tocopherol increases drug effect.

Anticonvulsants	Phenobarbital Phenytoin	Folate antagonists; Increased vitamin D, vitamin K and pyridoxine requirements; Impaired vitamin D metabolism leading to hypomagnesaemia, hypocalcemia and hypophosphatemia.
Antidepressants	Imipramine	May induce riboflavin deficiency; increased appetite.
Antihypertensive	Hydralazine	Pyridoxine antagonist; increased urinary excretion of manganese and pyridoxine.
Antimalarials	Pyrimethamine Sulfadoxine	Folate antagonists.
Antineoplastics	Methotrexate	Folate antagonist; may impair fat, calcium, cobalamin, lactose, folate and carotene absorption.
Antitubercular	Isoniazid	Accelerated metabolism of pyridoxine - subsequent pyridoxine deficiency blocks conversion of tryptophan to niacin leading to niacin deficiency; reduced calcium absorption; reduced conversion of Vitamin D by the liver.
Antiulcer	Cimetidine	Impaired cobalamin absorption.
Cardiac Glycosides	Digoxin  Hydrocortisone Prednisone Dexamethasone	Increased urinary excretion of calcium, magnesium and zinc, Anorexia.  Reduced calcium and phosphate absorption; increased urinary calcium, potassium, ascorbic acid, and zinc and nitrogen excretion. Increased pyridoxine and vitamin D metabolic requirements.
Diuretics	Furosemide Thiazides Spironolactone	Increased urinary potassium, sodium, and chloride, magnesium, zinc and iodine excretion; reduced calcium excretion leading to hypercalcemia and hypophosphatemia with Thiazides, increased calcium excretion with furosemide. Increased urinary sodium and chloride; reduced urinary potassium excretion.
Hypocholesterolemic Agents	Cholestyramine Colestipol	Reduced absorption of fat, fat soluble vitamins, calcium, cobalamin, and folate.
Laxatives	Bisacodyl Phenolphthalein Mineral Oil	Abuse leads to general malabsorption, steatorrhea and dehydration. Malabsorption of fat soluble vitamins, electrolytes, calcium.
Oral Contraceptives	Conjugated estrogens Ethinyl estradiol Mestranol	Increased folic acid & possibly pyridoxine & ascorbic acid requirements; reduced calcium excretion, altered tryptophan metabolism.
Stimulants	Caffeine	Increased urinary calcium excretion.

## ANTIRETROVIRAL DRUGS AND FOOD RECOMMENDATIONS

To reduce unfavorable food –drug interactions special food recommendations are given for various ARV drugs, as shown in the table below;

### *ARV Drugs and Food Interactions*

Drug	Food recommendation
Efavirenz	Can be taken without regard to meals Avoid high fat meals and alcohol and st john’s wort
Nevirapine	Can be taken without regard to meals. avoid st john’s wort
Lamivudine	Can be taken without regard to meals. Avoid alcohol
Stavudine	Can be taken without regard to meals. Avoid alcohol
Zidovudine	<ul style="list-style-type: none"> <li>• Take without food</li> <li>• If it causes nausea and vomiting take with low fat meal</li> <li>• May require Zinc and copper supplementation</li> <li>• Avoid alcohol</li> </ul>
Abacavir	Can be taken without regard to meals. Avoid alcohol
Didanosine	<ul style="list-style-type: none"> <li>• Take on an empty stomach (30 minutes before or 2 hours after eating)</li> <li>• Take with water only (food reduces its’ absorption)</li> <li>• Avoid alcohol, Grape fruit juice, Antacids containing aluminum or magnesium</li> </ul>
Tenofovir	Take with a meal. Avoid alcohol
Indinavir	<ul style="list-style-type: none"> <li>• Take on an empty stomach (1 hour before or two hours after a meal or with a light non-fat meal</li> <li>• Take with plenty of water to avoid kidney problems-at least 1.5 liters of fluids daily to prevent kidney stones</li> <li>• Avoid grape fruits and st john’s wort</li> </ul>
Lopinavir	<ul style="list-style-type: none"> <li>• Take with food</li> <li>• Should be taken with a moderate fat meal for better absorption</li> <li>• Avoid john’s wort</li> </ul>
Nelfinavir	<ul style="list-style-type: none"> <li>• Take with food</li> <li>• High fat food preferred for better absorption</li> <li>• Avoid john’s wort</li> </ul>
Saquinavir	<ul style="list-style-type: none"> <li>• Take with a meal or light snack</li> <li>• Take within 2 hours of a high fat meal</li> <li>• Avoid john’s wort garlic and supplements</li> </ul>



<ul style="list-style-type: none"> <li>• Sulfonamides,</li> <li>• Sulfamethoxazole,</li> <li>• Cotrimoxazole, antibiotics for treating/prophylaxis for pneumonia and toxoplasmosis.</li> </ul>	<ul style="list-style-type: none"> <li>• Take with food</li> <li>• Take on an empty stomach, one hour before or two hours after meals</li> <li>• Avoid alcohol</li> </ul>
Isoniazid	<ul style="list-style-type: none"> <li>• One hour before or two hours after meals</li> <li>• Supplement with 50mg pyridoxine in all TB/HIV pts (to prevent peripheral neuropathy and anaemia)</li> </ul>

### 17.3.9.3 Self-Assessment

1. Define the following terms
  - A. Food-drug interaction
  - B. Drug-nutrient interaction
  - C. Pharmacokinetics
2. Antidiabetics \_\_\_\_\_
  - A. Inhibit protein synthesis
  - B. Are potent catabolic agents
  - C. Promote protein synthesis
  - D. Boost the appetite
3. Analgesics affect nutrients in the following ways except
  - A. Increased urinary excretion of amino acids
  - B. Increased urinary excretion of ascorbic acid
  - C. may cause GI bleeding and subsequent iron deficiency
  - D. Increased folate and vitamin D requirements.
4. Stavudine should be \_\_\_\_\_
  - A. Accompanied with zinc and copper supplementation
  - B. Taken with water only
  - C. Taken on an empty stomach
  - D. Taken without regard to meals
4. Discuss the impact of food on effectiveness of a drug.
5. Describe the impact of drugs in food intake.
6. Using relevant examples discuss how drugs influence nutrient excretion.

7. What are some of the effects of food on drugs?
8. Outline the benefits of minimizing drug interactions .

#### ***17.3.9.4 Tools, Equipment, Supplies and Materials***

- Stationery
- Reference materials
- Clinical guidelines
- WHO guidelines
- MOH policies and guidelines
- Ministry of Education
- Skills lab
- Projectors, video clips, charts and other teaching aids
- Food exchange lists
- Food guide pyramid
- Invitation of competent expertise
- Computers with internet
- Library and resource centre

#### ***17.3.9.5 References***

Moore M. C., 2008. Mosby's Pocket Guide to Nutritional Assessment and Care. Mosby.

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