DIETARY GUIDELINES & NUTRITION THERAPY FOR SPECIFIC DISEASES

A Publication by

Nutrition Division - Ministry of Health

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Preface

Nutrition is recognized as a major modifiable determinant of chronic diseases, with increasingly emerging supporting evidence that alterations in diet have strong effects, both positive and negative on health throughout life.

Medical nutrition therapy is an essential component of comprehensive health care. Individuals with variety of diseases and health conditions can improve their health and quality of life by applying appropriate treatment protocols combined with proper medical nutrition therapy. For some diseases such as diabetes, heart diseases and renal diseases, dietary management is equally important to medical management throughout all stages of the disease.

The policy of the Government is to provide health service to general public free of charge including drugs, ancillary services and meals for inward patients. The standards of healthcare delivery have improved over the years and in par with those standards, normal and therapeutic diets also need to be upgraded.

Although Sri Lanka has achieved satisfactory health indices in preventive as well as curative health care, dietary measures and appropriate nutrition therapy in patient management has not been improved to meet the optimum standards. Publishing this document "Disease Based Dietary Guidelines and Nutrition Therapy" will fill this gap in optimizing patient care. This publication will be a useful tool for many healthcare professionals to further enhance their knowledge and skills in on current nutrition therapy.

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Abbreviations

ACE	–	Angiotensin converting enzyme
BMI	–	Body Mass Index
BMR	–	Basal metabolic rate
CHD	–	Coronary heart disease
CKD	–	Chronic kidney diseases
CRF	–	Chronic renal failure
CVD	–	Cardiovascular disease
DHA	–	docosahexaenoic acid
EN	–	Enteral nutrition
EPA	–	Eicosapentaenoic acid
ESRD	–	End stage renal disease
GFR	–	Glomerular filtration rate
GI	–	Glycemic Index
GL	–	Glycemic Load
GRV	–	Gastric residual volume
HD	–	Haemodialysis
HDL	–	High density lipoprotein
HHD	–	Home haemodialysis
IC	–	Indirect calorimetry
ICU	–	Intensive care unit
IDPN	–	Intra dialytic parenteral nutrition
IU	–	International unit
LDL	–	Low density lipoprotein
MCT	–	Medium chain triglycerides

MSG – Monosodium glutamate

MUAC – Mid upper arm circumference

NG – Naso gastric

NJ – Naso–jejunal

PD – Peritonealdialysis

PEG – Percutaneous endoscopic gastrostomy

PICC – Peripherally inserted central catheter

PN – Parenteral nutrition

RDI – Recommended dietary intake

RNI – Reference nutrient intake

SLT – Speech language therapist

TB – Tuberculosis

TBSA – total body surface area

TC – Total cholesterol

TG – Triglycerides

TPN – Total parenteral nutrition

Contents

1 Dietary Guidelines & Nutrition Therapy for Diabetes

1. Introduction and Background

Diabetes is a chronic condition, marked by high levels of blood glucose. It is caused by deficient production of insulin or resistance to its action. In Type 1 diabetes, the body does not produce sufficient insulin. In Type 2 diabetes (the most common type) the body develops resistance to insulin action due to excess body fat. Type 2 diabetes occurs commonly without symptoms. Even after diagnosis, the majority of diabetics tend to not keep their blood glucose under control because they do not feel ill. However, the high blood glucose leads to many complications.

Diabetes-related complications include diabetic nephropathy, neuropathy, retinopathy and peripheral vascular disease. It also increases the risk of coronary heart disease and stroke. It can also lead to pregnancy-related complications, both for the mother and the fetus or new-born baby. All these can be prevented through proper diet and healthy lifestyle combined with medications prescribed as and when required.

Therefore understanding the basis of a diabetic diet and adhering to it as a family and community is extremely important. A diabetic diet should not be viewed as a restrictive diet that is prescribed for the sick. It must be viewed as a healthy diet appropriate for everyone to remain healthy.

The Goals of the diabetic diet

1. Achieve normal blood glucose either on dietary management alone or with oral medication and/or insulin administration. The calorie intake (diet) will be adjusted with medications/ insulin, exercise and other variables for this purpose.

2. As diabetics are more prone to cardiovascular disease, dietary management is vital – to prevent high blood pressure, high cholesterol and must be addressed at all times.

3. Proper weight management is essential while maintaining optimal blood glucose levels & an appropriate weight for height (Body Mass Index, BMI).

4. Prevention or delaying of other complications of diabetes.

2. Diet related and other issues

1. High blood sugar

Decreased production of insulin leads to high blood sugar levels.

2. Overweight and Obesity

Majority of diabetics are overweight or obese. Those who are overweight are more prone to the disease. It has been found that Asians develop diabetes with a BMI exceeding 25 kg/m^2 rather than 30 kg/m^2 observed among white Caucasians.

3. Underweight

Some diabetics are underweight or even emaciated at the time of diagnosis due to poor control of diabetes.

4. Atherosclerotic disease

Many diabetic patients develop atherosclerosis that blocks vital blood vessels at the time of diagnosis and remain prone to be affected with the disease.

5. Unhealthy life style

Most people develop diabetes because of their unhealthy diet and life style, stress and inadequate physical activity.

3. Standard dietary requirements

1 Carbohydrates should provide 55–60% of total daily calories (realistic goal is 50%).

2 Fats should provide 20–25% daily calorie intake, Mono unsaturated and poly unsaturated fatty acids specially omega 3 are preferred. Limit saturated fats to less than 7%.

3 Proteins should provide 15–20% of daily calories.

4 Dietary guidelines for diabetic patients

People with diabetes have the same nutritional needs as anyone else. But those who are overweight require reduction in carbohydrates to even as low as 33% which needs to be individualized.

4.1 Carbohydrate

4.1.1 Timing of meals

- Meals should not be skipped and 3 meals plus 2 snacks should be taken regularly.
- Include Carbohydrates in every meal and spread it evenly throughout the day as even distribution helps to prevent high and low fluctuations of blood glucose.
- Encourage eating at regular intervals which helps control hunger and prevents overeating at the next meal.

4.1.2 Quality of Carbohydrates

Select foods with complex carbohydrates & low glycemic index (GI) which have plenty of fibre, antioxidants and phytochemicals. Increased fibre intake by whole grains has been associated with improved insulin sensitivity.

- Rice preferably Parboiled or minimally milled, other whole grain cereals (corn, millet etc.) and legumes are preferred.
- Starchy vegetables and fruits can be used in limited quantity while non-starchy vegetables using freely.
- Whole grain cereals are preferred to whole grain flour as latter tends to increase blood sugar.
- Whole rice flour and whole wheat flour preparations are preferred to refined flour.
- Kurakkan flour has high GI and avoid overeating.

Refine sugars such as sugar, jaggery, treacle, sweets, cakes & biscuits sweetened drinks, fizzy drinks, cola drinks, energy drinks etc should be avoided as they can give rise a sudden increase of blood glucose levels, as well as excess energy intake could lead to overweight and obesity.

It is preferable to have tea without sugar; patients will gradually adapt to enjoy foods and drinks with low or no sugar.

4.1.3 Quantity of Carbohydrates

- An average Diabetic needs 1500-1800 of total calorie per day.
- However calorie requirement may vary depending upon age, sex, activity level and body weight.
- Fifty percent (50%) of total calories should come from carbohydrates. (800 calories = 200 grams of carbohydrates).

Patients with diabetes should control their carbohydrate intake for achieving normal blood sugar levels. Carbohydrate intake can be monitored by following methods

I. Food plate method

II. Carbohydrate counting or Meal exchange method

I. Food plate method

Food plate method is a convenient method of controlling carbohydrates. Patients can prepare his/her plate according to their own food choices while selecting variety.

Step 01

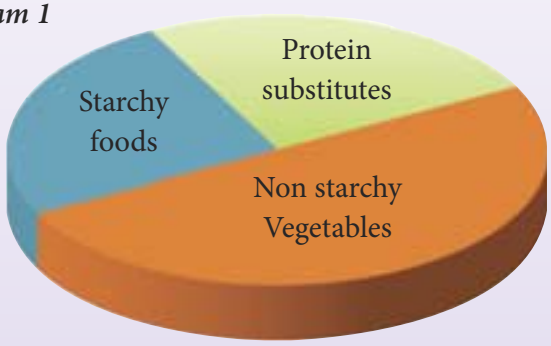
Mark an imaginary line on middle of the plate. Re-divide one side into half giving 3 sections as illustrated in diagram 1.

Step 02

Fill the largest section with non starchy vegetables.

e.g. greens, spinach, lettuce, cabbage, , carrot, beans, broccoli, cauliflower, tomato, onion, cucumber, beets, mushrooms, turnip (*rabu, nokhol)*, ladies finger and any other non starchy.

Diagram 1



Step 03

Place starchy foods in one of the small sections.

a. Whole grains, whole grain rice, other grains

b. Whole grain high fibre cereal preparations

c. Pulses & legumes

d. Starchy vegetables, jack fruit, bread fruit, potatoes, manioc, sweet potatoes & other yams

Step 04

Then on the other small section, place food sources of protein.

a. fish

b. chicken

c. eggs

d. lean cuts of meat ***e.g.*** meat, mutton etc.

Alternatively it also can be supplemented with soya and other pulses particularly for vegetarians.

Step 05

Drink 1-2 glasses of milk (non fat or low fat) a day.

Step 06

Half a cup of fruits can be eaten at each meal.

II. Carbohydrate counting or meal exchange method

Primary tool for managing blood glucose is carbohydrate counting. Balancing total carbohydrate intake with adequate physical activity and medicine constitute the main thrust of controlling blood sugar levels.

Combining carbohydrate counting with glycemic index may provide an additional benefit for achieving proper blood glucose (fine tuning).

This is a meal planning technique for managing blood glucose level. Prior to the counting of carbohydrates, patients should know the content of carbohydrates in one serving of a particular food.

- Select variety of starchy foods of your own choice and amount of each food can be counted using food table
- Patient can consume 45-60 grams of carbohydrates for each meal and total consumption for a day should be around 200 grams.
- A serving of carbohydrate is 15 grams.
- Amount of carbohydrate need per serving will vary with their activity level.
- While counting carbohydrates, ignore protein and fats of these foods.

Annex 01 & 02 *describe the practical way of using carbohydrate counting method*

Meal planning with Glycemic Index (GI)

- Response of food on blood glucose levels is known as Glycemic index. This is only a measure of carbohydrates.
- A food of GI of above 70 is considered high and foods below 55 have a favorably low GI and foods in between is considered as medium GI.
- Meal planning with Glycemic Index involves choosing foods with low or medium GI.
- Inclusion of low GI food and medium GI food in the diet helps reducing blood sugar. When consuming high GI food, their

quantity should be limited and can combine with a low GI food to have a medium GI quality.

e.g. rice & vegetable curries – rice is a medium or high GI food

vegetables are low GI foods

Annex 03: *Foods with low GI and Medium GI*

Method of food preparation and GI

- Food preparation also influences glycemic index. The more breakdown of starch structure delivers the higher glycemic Load.
- Therefore, minimally milled varieties of rice - brown rice and par boiled rice are better options than foods prepared from flour of whole rice or wheat – like *string hoppers, hoppers, pittu, noodles* and bread. Foods prepared from whole grain flours are better than foods of polished flour preparations.
    - Kurakkan flour is considered to be having high GI index, therefore diabetics should control quantity of kurakkan flour preparations such as kurakkan roti, thalapa, pittu etc.
- Limit the intake of added sugar or food or drinks with added sugar which can immediately spike blood sugar.

Glycemic Load (GL)

This is a measure of both type and amount of carbohydrate.

- In addition to GI value, potion size is also important in managing blood sugar levels.

- Large portions of a low GI food can also deliver a large glycemic load (GL) which increases blood glucose.
- Therefore diabetic patients have to consider the GI of food together with their portion size.
- As GI is estimated with a standard amount of carbohydrate load which may or may not be the normal serving size, glycemic load (GL) was introduced to apply the GI concept to the normal serving sizes of foods(edible portion).

Glycemic Load is calculated as,

$$\text{Glycemic Load} = \text{Glycemic index} \times \frac{\text{Amount of carbohydrate in the serving in grams}}{100}$$

Low GL	Medium GL	High GL
10 or less	11-19	20 or more

Desirable GL is Low or Medium. If high GL is eaten, it should be combine with a Low GI food.

e.g. if white rice (high GI, 87) / whole meal bread (high GI 70-82) is eaten with vegetables (low GI, < 10) in appropriate servings, the combination will fall within medium GI range.

4.2 Fat

Fats are calorie densed and should be consumed in moderation and further limited by those who are overweight.

Patients with diabetes are at a higher risk for coronary heart disease and other vascular diseases. Therefore the amount of food containing fat and oil should be restricted.

4.2.1 They should limit mainly the food containing saturated fats

- Choose only non fat or low fat dairy products
- Remove visible fat of meats and skin of chicken before cooking
- Choose only lean meats
- Limit butter, cheese and other saturated fats
- Use minimum oil for cooking or tempering
- Limit consumption of deep fried foods, which contains more hidden oils and trans fat
- Avoid foods containing transfat such as margerine, cookies, pastries and various bakery products etc.
- Use low fat or fat free cooking methods.

  e.g. Boiling, steaming, broiling, baking, roasting, grilling and as salads (raw)
- Using non stick pans and cooking sprays could help minimizing the amount of oil.
- Though coconut oil is a saturated oil, it mainly consists of small chain & medium chain fatty acids which tend to get easily burnt for energy. Therefore coconut oil can be consumed in moderation. As coconut oil delivers a minimal amount of trans fats, it can be used for deep frying purposes. However number of deep frying foods should be strictly limited to reduce total fat intake.

- Coconut / coconut milk - a family of 5 can use a coconut a day.

4.2.2 Include food containing healthy fat in diabetic diet as unsaturated fats are heart healthy and decrease insulin resistance.

- Fish – a good source of unsaturated oil ideally fatty fish like Tuna (*balaya, kelawalla),* sardinella sp. *(hurulla, kalawenna, sudaya*), mackeral (*bolla, kumbalawa*)
- Fruits – Avocado, Durian
- Nuts – cashew nuts, pea nuts, cottang, pumpkin seeds and gingelly
- Un saturated oils such as gingelly oil, sunflower, olive, canola and soya oil are preferable for cooking (tempering).

4.3. Protein

Patients with diabetes have the same protein requirement of normal people (0.7 – 1 g/Kg of body weight).

- Proteins from plant sources are healthier in diabetes as animal protein deliver more stress on kidneys. Eating excess protein may increase the risk of developing diabetic nephropathy.

  e.g. Pulses and legumes - grams, green grams, cowpea, dhal, and soya etc.

- 2–3 servings of foods rich in protein are recommended for a day. Proteins should provide 15-20% of daily calories (proportion of serving of plant protein to animal protein is 2 to 1).
- Fish is a healthy option for diabetes and a source of Omega3 fatty acids which is proven to have an antiinflammatory effect and it helps improving person's lipid profile.

- Skinless poultry is a safer option.
- Select only lean meat and remove visible fat. Limit red meat to once a week only.
- Two to three eggs can be consumed for a week. Eating only egg white is advisable for people with high risk of atherosclerotic heart diseases. Research warrants, that higher egg consumption associate with high risk of coronary heart disease among diabetics. Therefore egg consumption should be limited.

4.4 Milk

- Non fat or low fat milk is preferable for diabetics.
- Milk is a good source of calcium, vitamin A, D & B12. Two cups or two glasses (400ml) of milk will fulfill daily calcium requirement to a certain extent.
- Milk products such as non fat yoghurt, curd and cheese are good substitutes for milk. It is advisable to avoid cream layer (fat layer) of curd if eaten regularly.

4.5 Fruits

- Fruits play a significant role in diabetic diet as fruits contain a plenty of fibre and nutrients including vitamins, minerals, antioxidants and phytochemicals etc.
- Diabetics are advised to consume a minimum of **two to three portions of fruits every day**.
- Spreading the consumption of fruits throughout the day will avoid sudden increase in blood sugar levels. A medium size portion is considered safe.

- Fruits with a GI of 55 or lower enter the blood stream slowly and diabetics can be allowed to eat fair amount of these. Fruits such as mangoes, raisins, dates, watermelons, pineapples have medium to high GI. Therefore portion size of these fruits should be reduced.
- Fresh fruits are preferable to fruit juices as fruit juices give rise to sudden rise of blood sugar.
- Preserved fruit juice, dried fruits and canned fruits which may have added sugar are best avoided.
- Fruits can be used before fully ripened.

4.6 Vegetables

- Vegetables are an important component of diabetic diet because they are low in calories having high fibre & low GI .
- Diets rich in vegetables reduce the risk of chronic diseases & help to reduce the rate of absorption of sugars & lipids in the diet.
- Selecting a variety of vegetables preferably in different colours not only gives wide variety of nutrients including antioxidants and phytochemicals but also enhances pleasure of eating.

  e.g. **Greens** – all sorts of green leaves, green bean, wing bean (*dambala*) and ladies fingers etc.

  Red – beet root, tomatoes, red bell peppers, red onions, *red thampala, red mukunuwenna, red dambala etc.*

  Yellow – carrot, pumpkin, yellow sweet potato etc.

  Purple – purple cabbage, egg plant, *dandinala* etc.

  White – garlic, onions, leeks, mushrooms

Depending on the starch content, vegetables can be divided into two categories

1. Non-starchy vegetables
2. Starchy vegetables

Non-starchy vegetables

Non-starchy vegetables include green leaves, lettuce, cucumbers, spinach, tomatoes, carrots, ladies fingers, pea, wing beans, *pathola, vatakolu*, Bitter gouard etc.

A serving of 1½ cups of non-starchy vegetables gives you 15g of carbohydrate

3-5 servings of non starchy vegetables can be consumed for a day including 2-3 varieties.

Starchy vegetables

Starchy vegetables include jak fruit, bread fruit, potatoes, sweet potatoes, manioc, corn, different types of yams (*kiri ala, innala*), ash plantains, green peas etc.

Since starchy vegetables have approximately 15g of carbohydrate in half a cup, it can be consumed adding to the amount of carbohydrates consumed (carbohydrates counting).

4.7 Salt

Patients with or at risk of Cardiovascular disease (CVD), should reduce sodium intake to less than 1550 mg sodium/day, (that is ¾ tsp of salt) which is applicable for diabetics.

All diabetic patients can enjoy their meals provided they pay adequate attention to the amount of calories consumed as well as ensuring consuming foods with other nutrients including fibre.

2 Dietary Guidelines & Nutrition Therapy for Coronary Heart Disease (CHD)

1. Introduction and Background

Coronary heart disease (CHD) is caused by the narrowing or blockage of the arteries and vessels that provide oxygen and nutrients to the heart. The pathological process called atherosclerosis, which is the gradual buildup of fatty materials in the arteries inner linings. Complete blockage or clotting at a site where the blood supplies the heart can cause a heart attack.

Coronary heart disease is the commonest cause of death in Sri Lanka. The disease has several manifestations.

- Stable / unstable angina
- Myocardial infarction
- Sudden death
- Heart failure

2. Diet related and other issues

- A high intake of saturated fat increases low density lipoprotein (LDL) cholesterol and causing endothelial damage which is the starting point of atherosclerosis and it can trigger thrombosis.
- Poly unsaturated fats has a protective effect.
- Non rapid weight loss improves fibrinolytic activity
- Anti-inflammatory dietary components such as omega 3 fatty acids and dietary antioxidants may have a role in reducing injury to the coronary arteries
- Omega 3 fatty acids suppress platelet activation and formation of plaques
- Hyperhomocysteinemia may increase risk of thrombosis and arterial injury
- Lower homocystin levels by means of folic acids and other B vitamins may reduce CHD
- Obesity, hypertension, hyper triglyceridemia and type 2 diabetes increase the risk of CHD
- Replacing energy from saturated fatty acid with complex carbohydrates helps in the reduction of LDL- cholesterol and inturn reducing the CHD risk.

Multifactoral risk assessment and management is the best approach for reducing the CHD risk as correcting one risk factor alone may have little impact.

Modifiable risk factors for CHD

1. Smoking
2. hypertension greater than 140/90mmHg
3. low HDL of less than 40mg/dl

4. high LDL cholesterol in blood
5. presence of diabetes

un modifiable risk factors

1. age, for women – 45 and older
   for men – 55 and older
2. family history of premature coronary heart disease

There are other factors that enhance the risk

1. obesity and BMI greater than 30
2. physical inactivity
3. atherogenic diet or high consumption of foods with saturated fatty acids, trans fat or total fat content
4. stress
5. alcohol abuse

3. Standard Dietary Requirements

- Carbohydrates – 50%-60% of total calories
- Protein – approximately 20% of total calories
- Total fat – 20%-35% of total calories
- Saturated fat – less than 7% of total calories
- Transfat 1% of energy or below
- Polyunsaturated fat – up to 10% of total calories
- Monounsaturated fat – up to 20% of total calories
- Dietary cholesterol – less than 200mg each day
- 14 g of fibre per 1000 kcal of energy consumed

***(source:** The National Heart, Lung and Blood institute)*

4. Dietary Guidelines

Consistent focus of dietary guidelines is to reduce saturated fat, transfat and cholesterol intake as well as to increase dietary fibre consumption. Dietary guideline has recommended a dietary pattern that promotes the consumption of diets rich in fruits, vegetables, whole grains, low fat or non fat dairy products, fish, legumes, poultry and lean meats. This dietary pattern with low energy density and high nutrient density promotes weight control while meeting all nutrient needs.

4.1 Cereals

Carbohydrates are the building blocks of a heart-healthy diet. As complex carbohydrates provide definite health benefits, whole grains are preferable for patients with CHD.

Consumption of simple carbohydrates (sugars) can lead to or complicate diabetes and increase triglyceride levels, and there by increasing the risk of coronary heart disease. It is important for people with diabetes to control their intake of white bread, starchy foods (*string hoppers, hoppers, pittu etc.*) cakes, soft drinks and other simple carbohydrates.

Grain products to choose are: Whole grains such as red rice, par boiled rice, whole-wheat flour, whole-grain bread, legumes, *kurakkan, meneri*, high-fibre cereals with 5 or more grams of fibre a serving, whole-grain pasta, Oatmeal etc.

White refined flour, white bread, various high fat sweets, biscuits and bakery products are best avoided.

4.2 Fruits and Vegetables

Fruits & vegetables including legumes, cereals, pulses & whole grains are rich sources of dietary fibre, which helps to reduce the rate of absorption of fat and sugar as well as replaces high fat foods from the diet. Most of fruits, vegetables and whole grains too contain high level of antioxidants and phytochemicals which will prevent building up atheroma.

Thus, eating at least 5 varieties of fruits and vegetables a day in correct servings will help reduce the risk of heart diseases. Encourage the consumption of whole vegetables and fruits in place of juices.

Servings: fruits 2 -3 per day (1 serving = one medium size fruit)

Vegetables 3 – 5 per day (1 serving = 3 tbsp)

Potassium:

Intake of foods rich in potassium contributes reduction in blood pressure especially in individuals with high salt intake. Therefore including fruits and vegetables in the daily diet will help reduce the risk of heart disease as most of the fruits & vegetables are rich in potassium.

4.3 Protein Foods

High protein intakes (up to 24% of total energy intake) which include animal & plant proteins are associated with a significantly reduced risk of CHD.

Select protein sources with low fat content. Fish and poultry, lean meat, low/non-fat dairy products and eggs or egg whites are some of the best sources of protein.

Eat fish regularly, especially oily fish at least twice a week which not only reduces the risk of CHD but also improves the survival after a heart attack. Fish helps to regulate cardiac rhythm, reduce triglycerides and prevent forming of blood clots in the coronary arteries.

Fish consumption and supplementation with eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) is beneficial as it reduces coronary and total mortality.

The highest amounts of omega-3 fatty acids can be found in fish. *Salaya, hurulla, thondaya, bolla, kumbalawa* are good sources of omega 3 fatty acids in Sri Lanka.

Vegetarian sources – legumes, beans, peas and lentils etc. are also good sources of protein and contain less fat and no cholesterol, making them good substitutes for meat. Legumes like beans or lentils can be eaten at least 3 times a week.

Use lean cuts of meat and remove skin from poultry before cooking. Limit red meat & processed meats such as sausages, bacon that are high in saturated fat and sodium.

Select non fat or low fat milk (1%) and milk products.

Recent research reveals that higher consumption of eggs (upto 1 egg per day) is not associated with increased risk of coronary heart disease.

4.4 Fat

Introduction of therapeutic life style changes is an essential aspect of clinical management of heart disease. Cholesterol lowering diet accompanying with cholesterol lowering agents will help reduce risk of heart disease. Lowering LDL remains one of the main targets of the management.

Reducing total fat and saturated fat is helpful in reducing CHD. Limit eating foods with saturated fat, butter, cheese, whole milk & whole milk products, meat fat, hydrogenated margarines & shortening, lard, bacon fat, and coconut or palm oil. Replace them with mono and poly unsaturated fats, especially with omega 3 and omega 6 fatty acids.

Although coconut oil is a saturated oil, its chemical structure contains mostly medium and short chain fatty acids which may easily get burnt for energy. Therefore grated coconut, coconut milk can be used in recommended portions. One coconut a day is recommended for a family of 5. Coconut oil may be used sparingly.

Monounsaturated fats are the most desirable source of fat in the diet. Substituting monounsaturated fats for saturated fats will reduce both total and LDL cholesterol while sparing the reduction of high density lipoprotein (HDL) cholesterol.

Avocado, cashew, peanuts, pumpkin seeds, *kottang*, other nuts and olive oil, canola oil, are good sources.

Diets moderate in polyunsaturated fats are generally recommended. Soybean, gingelly, safflower, sunflower, corn oil and margarines prepared using unsaturated oils. Margarines should not be used for cooking food as heating of margarines may generate transfats.

Limit eating food with transfats which positively relate to the risk of CHD. Trans fats are formed by heating unsaturated oils. Therefore unsaturated oils should not be used for deep frying. Limit foods with partially hydrogenated oil, hydrogenated oil, stick margarine and shortening. Limit intake of fried foods, cakes, pies, rolls, pastries, patties and other bakery products. Foods containing transfat are solid at room temperature.

Plant sterols decreases absorption of cholesterol and thereby reduce blood cholesterol. Include foods with plant sterol in the diet. One can include plant sterols & stanols in the diet by consuming whole grains, nuts, seeds, fruits and vegetables in adequate quantities.

4.5 Salt

Reduction in sodium will help in reducing blood pressure and is helpful in reducing the risk of CHD. Advise patients to limit salt up to 1,500 milligrams of sodium (1/2 - 2/3 tsp of salt) per day. Patients should limit processed food, dry fish, salty confectionaries & biscuits as most of them contain very high levels of salt.

4.6 Sugar

Limit intake of sugar and foods containing refined sugar. Cut down on high sugar biscuits & beverages and foods with added sugars, such as soft drinks, sweets, candy, cakes, biscuits, cookies, artificial fruit drinks, ice cream, sweetened milk & yoghurt as well as honey & jaggery. Common forms of added sugars are sucrose, glucose, fructose, maltose, dextrose, corn syrups, concentrated fruit juice, and honey.

5. Other Measures

5.1 Alcohol

Although, moderate alcohol is known to lower the incidence of heart disease, consumption of alcohol is not advisable due to various other health effects associated with alcohol.

Drink in moderation means one drink for women and two drinks per day for men (A drink is 100 ml wine, 240 ml natural strength beer and 25 ml of spirits)

Using more than 3 units increases risk of mortality and other risks like stroke, high blood pressure and cardiomyopathy.

5.2 Physical activity

Excessive weight gain over time can result in obesity followed by diabetes, hyperlipidemia, hypertension, joint problems and a host of other debilitating diseases including heart disease.

Aim to consume 4-6 small meals and snacks daily. Avoid skipping meals and eating late at night for optimal weight maintenance.

Be physically active (***e.g.*** brisk walking, biking, or gardening) at least 30 minutes each day.

5.3 Obesity

Abdominal obesity (waist circumference >36" in men and > 32" in women is associated with increased risk of heart disease and diabetes) Decreased risk can be achieved by proper dietary measures and physical activity.

5.4 Diabetes

Diabetes has a 2 – 3 times higher risk of having atherosclerosis than normal. Controlling diabetes is needed to control serum lipid levels.

5.5 Smoking

Active or passive smoking is one of the major risk factors for coronary heart disease as it favours serum LDL levels to rise. Therefore cessation of smoking is a top priority as a preventive measure.

Micronutrients

Higher intake of fruits and vegetables has a protective role against coronary heart disease and stroke.

Inadequate intake of folic acid and to a lesser extent of vitamin B6 and vitamin B12 increases homocystein levels. In many studies, high homocystein levels have been associated with higher risks of coronary disease.

The value of vitamin E for the prevention of cardiovascular disease is contraversial. However in prospective observational studies reveal the use of vitamin E supplements at a dose of 400 IU per day has been associated with reduction of coronary heart disease.

In prospective studies, the daily use of a multivitamin has been associated with a lower risk of coronary disease and the incidence of stroke.

Studies have found a significant association between low vitamin D levels and cardiovascular disease risk. However vitamin D supplementation did not show any beneficial effect on stroke, death, myocardial infarction and blood pressure.

In a metaanalysis, it has been found that calcium supplementation with or without vitamin D resulted in a modest increase in stroke and myocardial infarction risk. Abrupt increase in serum calcium levels following supplementation may increase vascular calcification and risk of arterial thrombus formation.

A higher dietary intake of potassium rich foods is found to be associated with a 21% lower risk of stroke and a trend toward lower CHD risk.

Magnesium supplementation has a clinically significant effect on reducing blood pressure. Studies indicate that low serum magnesium levels contribute to the development of hypertension and atherosclerosis risk.

Myocardial Infarction

Patients with myocardial infarction may go to a stage of shock. Slowing of gastrointestinal functions is one of the adoptive mechanism of the body for the shock. Therefore during the period of shock, the patient should be kept fasting. Intravenous fluids can be given for maintaining fluid balance.

Once the patient recovers from shock, liquid diet can be started and gradually changed to a soft diet. Energy requirement will be around 1000 – 1200 kcal.

Small and frequent meals are safer as large meals may increase cardiac work load. When the patient is stable, dietary guidelines for coronary heart disease can be followed.

Heart Failure

Energy: energy requirement is increased due to the over work of heart and respiratory systems.

Fluid: sodium and water have to be restricted as fluid retention aggravate the condition.

Protein: 1 – 1.3 g per kg body weight of protein is recommended for maintenance of body and for body functions.

Quality of food: foods should be nutrient dense, easily digestible and comfortable to eat. Patient can have a period of proper rest before eating probably of one hour. Large meals should be avoided at all times. Instead, liquid formulas, nutrient dense preparations or foods in small quantity with increased frequency are preferred.

Vitamins & Minerals: Supplementation of water soluble vitamins and minerals are required as these can be lost through removal of excess fluid in the process of treatment.

(An example of daily dietary pattern including two therapeutic diet options and soluble fibre (add 5 to 10 g per day) for 2000 calorie goal is in ***annex 04)***

Dietary management of patients with CHD plays a major component of overall management. Caution should be exercised particularly in the initial stages and longterm dietary management is important in reducing relapses.

3 Dietary Guidelines & Nutrition Therapy for Hypertension

1. Introduction and Background

Hypertension is one of the main risk factors for coronary heart disease, renal disease and the greatest risk factor for stroke.

Unhealthy lifestyle with imbalanced eating habits significantly contribute to high blood pressure levels, even in middle age, when blood pressure levels typically rise as part of the ageing process. Whether or not medication is prescribed, the need to make dietary improvements (***e.g.*** follow a healthy low-fat diet) is at the top of the recommendations to reduce or prevent the onset of hypertension.

Increased risk of cardio vascular problems are associated with both systolic and diastolic high blood pressure. The higher the blood pressure, the greater the risk of atherosclerosis (clogging/hardening of the arteries), myocardial infarction and stroke.

2. Diet related and other issues

Factors that contribute to the development of hypertension are:

- Overweight and obesity
- Imbalanced diet
- Lack of physical activity
- Excess alcohol intake
- High salt intake
- Low intake of Potassium rich foods & low intake of other minerals, calcium & magnesium
- Stress

Obesity

Blood pressure increases with adiposity. It is proven that weight reduction helps in lowering of both systolic & diastolic blood pressure. Studies suggest that, in an overweight person, losing 10 percent of current weight has a positive effect in lowering blood pressure.

Physical Activity

Increasing the level of physical activity reduces both systolic and diastolic blood pressure in hypertensive individuals. Aerobic exercises are preferable. Aim for minimum of 30 minutes of exercises daily.

Diet

Healthy diet plan is an essential component in the management of high blood pressure. The nutritionally balanced diet should include plenty of fruits and vegetables, whole grains, one or two servings of low fat milk and modest amount of lean proteins, including fish and poultry. Red

meat, sugar containing sweets or beverages should be restricted. Milk should be limited to 1-2 servings of low fat milk. The diet should be rich in potassium, magnesium and calcium as well as protein and fibre.

Vegetarian diet is known to be associated with low blood pressure.

Alcohol

Regular heavy alcohol consumption is associated with high blood pressure. If total abstinence is not realistic, alcohol consumption should strictly be limited as follows. Men should consume no more than two drinks per day and women should consume no more than one drink per day. A drink is defined as 1 glass (240 ml) of beer, 100 ml of wine or 25 ml of spirits. People who drink alcohol, should increase their intake of water or other liquids to avoid dehydration as alcohol has a diuretic effect.

People who use alcohol regularly tends to gradually increase their intake (amount of alcohol) with time, due to the addictive quality of alcohol. Therefore abstinence from alcohol is the healthiest option for both hypertensive and non hypertensive patients.

Sodium (salt) intake

There is a proven positive relationship between salt intake and high blood pressure. Salt is mostly sodium, a mineral that occurs naturally in foods. Sodium is the substance that may cause one's blood pressure to increase. There are other sources of sodium present in food. Monosodium glutamate (MSG) is one such example of sodium added to food (common in Chinese food).

Accepted salt intake is below 5 g (< 1 tea spoon) of salt per day for a normal person (2300 mg sodium) where as for a hypertensive, this amount can be further reduced up to 2/3 teaspoon full (1500 mg of sodium). Patients should limit / avoid regular use of food containing high salt.

Patient should be encouraged to purchase low salt / sodium free / unsalted products instead of salty foods. Use of various condiments / herbs & spices (***e.g.*** *kurundu, sadikka, wasawasi, karapincha, ginger, curry powder, chilly, pepper etc.)* instead of too much salt for improving taste of various food / cooked items is encouraged.

Some examples for sodium rich foods are in ***annex 05***.

Potassium intake (K^+)

Blood pressure inversely relates with potassium intake. High intake of fruits and vegetables which has high content of K^+ is beneficial in lowering blood pressure.

Calcium & magnesium are known to be important for regulation of blood pressure but exact relationship is not clear.

3. Standard Dietary requirements

Diet plan for 2100 calorie intake

Carbohydrate	55% of calories
Protein	18% of calories
Total fat	27% of calories
Saturated fat	6% of calories
Cholesterol	150 mg
Fibre	30 g
Sodium	2,300 mg*
Calcium	1,250 mg
Magnesium	500 mg

** 1,500 mg sodium was a lower goal tested and found to be even better for lowering blood pressure*

Source *– DASH eating plan, U.S. Department of Health & Human Services*

4. Dietary guidelines

In a nutshell, the ideal diet plan to reduce blood pressure is a diet rich in fruits, vegetables, and low-fat dairy products, while low in saturated and trans-fats. It should also be low in cholesterol, high in fibre, potassium, calcium, and magnesium, and moderately high in protein. Hypertensive patients too need a well balanced diet with all six food groups.

1. Cereals
2. Fruits
3. Vegetables
4. Fish, meat, eggs & pulses
5. Milk & milk products
6. Nuts & oil seeds

4.1 Cereals

Average requirement of calories is 1200 – 1500 per day. Requirement of Calories may vary depending upon age, sex, activity level and other related diseases. According to calorie need, the required number of servings per day may vary. ***(annex 06***)

Weight management is very important in the prevention and management of hypertension. Consuming whole grains in recommended quantities and engage in physical activity on a regular basis will fullfill this target. Gradual weight gain can be prevented by decreasing foods with high calories and by increasing physical activity.

Meals should not be skipped. Three meals (with 2 snacks if necessary) can be taken for a day. Include carbohydrate containing food for every meal and spread it evenly. Ensure regularity in meal patterns.

4.2 Fruits and vegetables

Fruits and vegetables have a positively significant role in hypertension. They are naturally low in fat and have high content of fibre which favours control of hypertension due to their low calorie content. Fruits and vegetables are rich sources of antioxidants and are considered functional foods.

They are also rich in potassium which also helps in reducing high blood pressure.

Recommendation:

- 4 – 5 servings (400g) of both fruits & vegetables per day
- Choose a variety - for vegetables, select from all 5 sub groups (dark green vegetables, orange colour vegetables, legumes, starchy vegetables and other vegetables)

4.3 Protein

Vegetarian proteins like pulses and legumes are preferable for hypertensive patients as they contain high content of fibre with no cholesterol or saturated fats. Studies have indicated that consumption of soya significantly reduces both systolic and diastolic blood pressure.

Fish is a good source of protein for hypertensives as fish contains healthy fats including omega 3 fatty acids.

Skinless chicken and lean meats can be consumed. Hypertensive patients should limit their meat intake as meat contains unhealthy saturated fat.

Dairy: low-fat or non-fat milk & milk products are preferable to full fat.

4.4 Fats

Excess fat intake has also been associated with high blood pressure. Limiting daily fat intake up to 20% of calorie consumption, will help minimizing deteriorating blood pressure and associated complications. Dietary fat should be consumed through sources of polyunsaturated and mono unsaturated fatty acids such as fish, cashew & peanuts, avocado, kottang, pumpkin seeds and unsaturated oils. Saturated fat should contribute no more than 7 percent of daily calories, or approximately 16g (~ 1 tbsp), and should avoid sources of transfat completely. Trans fat is commonly found in processed foods, fried foods and commercially baked items which are prepared using unsaturated oils.

4.5 Fluids

An adult should drink about 6-8, 200 ml glasses of water a day (1.5–2L). In some cases however, excess intake of water is restricted especially in hypertensive persons with cardiac complications and heart failure.

5. Other measures

Blood pressure levels:

Normal	< 120/80 mmHg
Pre hypertension	120 – 139 / 80 – 89 mmHg
Hypertension	>= 140 / 90 mmHg

Source *- National Heart Lung and Blood Institute*

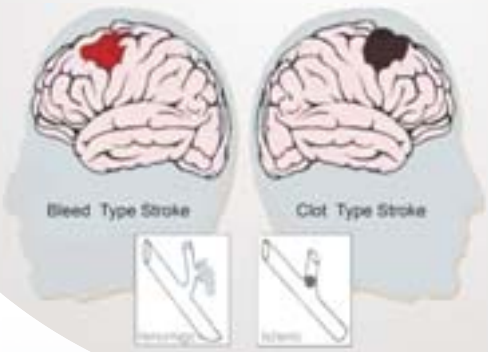
Both pre-hypertensive and hypertensive subjects should adjust their diet, exercise and lifestyle changes to reduce or prevent the onset of hypertension and reduce the risk of heart disease.

Lifestyle measures to prevent hypertension

- Reduce overweight & obesity and maintain normal weight for adults (body mass index 18.5-25 kg/m)
- Reduce salt intake to less than 1tsp/day, preferably ¾tsp/day. (< 5g salt or <2.4 g Na^+/day)
- Abstinence from alcohol
- Engage in routine physical activities (walking, brisk walking, running, climbing steps, gardening, cleaning etc.) for ≥ 30 minutes per day, ideally on most of days of the week but at least on three days of the week
- Consume at least five portions of fresh fruits and vegetables a day
- Reduce the intake of total and saturated fat include adequate mono and poly unsaturated fats

Hypertension is a common condition and diatery management is important in the prevention and control.

4 Dietary Guidelines & Nutrition Therapy for Stroke



1. Introduction and Background

Dietary management of patients with stroke is focused on reinforcing ongoing treatment that will also support patients' general health. Stroke patients who are on preventive therapy and rehabilitation will immensely benefit from a balanced diet which enhances both nutrition and prevention of repeated stroke.

The dietary plan should be tailor-made to suit individual patients.

A stroke most commonly occurs due to sudden interruption of blood supply to a particular area of brain, resulting in hypoxia and cell death. It can also occur due to haemmorage (bleeding) in to the brain from a ruptured blood vessel or by a thrombo-embolism.

Hence there are 2 types of strokes

1. Ischemic stroke (cerebral infarction) – due to thrombo-embolism
2. Hemorrhagic stroke – due to bleeding from a ruptured blood vessel

Risk factors for stroke

Hypertension

Smoking

Excessive alcohol intake

Diabetes

Arterial fibrillation

Heart disease

Hyperlipidemia

Advancing age

2. Diet related and other issues

Consequences of stroke which can affect food intake and nutritional status.

- **Motor deficit:**- muscle weakness of tongue, lips, cheeks etc. & lack of coordination of muscles of the mouth, tongue, throat may affect swallowing and chewing. If the muscles of upper limb are affected, patient cannot eat independently.
- **Sensory deficit:**- ability to smell or taste food will be affected reducing palatability.
- **Cognitive deficit:**- short attention span, problems of judgment & visual fields may affect food intake.
- Vision, hearing and speech problems too affect eating.
- **Depression:**- This is a common consequence of a stroke which can affect food intake.

3. Standard Dietary Requirements

Maintain weight within healthy limits .

Limit foods with a high content of saturated fat and cholesterol

Limit cholesterol to 300 milligrams (mg) a day for the general population, and 200 mg a day for those with heart disease or its risk factors.

Limit foods with transfatty acids.

Limit foods that are high in calories and/or low in nutritional quality.

Limit foods with high sugar/ salt.

Life style measures:

- Stop smoking. It doubles the risk
- Control hypertension and diabetes
- Regular exercise
- Weight management
- Increase intake of fruits and vegetables
- Reduce salt intake (preferably 1500 mg of sodium per day, ⅔ tsp)
- Limit excess alcohol
- Control other possible risk factors

4. Dietary Guidelines

Consuming adequate amounts of essential nutrients, coupled with energy intake to suit the energy expenditure, is essential to maintain health and to prevent or delay the development of cardiovascular disease, stroke, hypertension, and obesity. Provision of adequate nutrition is very important from the acute stage of stroke.

Acute Stage:

- Assess pre-morbid and current nutritional status and nutritional requirements.

  (Pre-morbid malnutrition is very common among elderly with strokes and results in increased mortality, increase susceptibility to infections such as pneumonia and increased gastrointestinal bleeding)

- Consider the individual's ability of receiving nutritional requirements.
- Formulate a nutrition plan in consultation with the patient, family members and the multi disciplinary team.
- Ensure nutritional adequacy by helping patient to restart normal eating habits as early as possible and by addressing persisting nutritional problems.
- Dietetic management of their underline diseases is very important. ***e.g.*** renal disease, diabetes, hypertension, hyperlipidemia etc.
- Eating difficulties, lack of attention, swallowing difficulties, reduced oral intake, altered eating speed should be compensated.
- All stroke patients should be assessed for risk of aspiration on admission.

In the rehabilitation phase

- Help the patient to have his/her normal eating habits.
- Ensure nutritional adequacy
- Manage existing nutritional problems
- Minimize the risk of repeated strokes
- Monitor dietary measures for other diseases- diabetes, hypertension, CHD, renal disease etc.

Dysphagia

At the onset, 25 – 50% patients are likely to have dysphagia. It increases risk of mortality and chest infection. All patients should be assessed for dysphagia using a validated tool by a trained professional. Gag reflex is not a good indicator as many healthy elderly may not have it.

- Eighty percent of patients with dysphagia improve within 2 – 4 weeks. Drugs should be prescribed in appropriate form. Many patients need a period of weaning from tube feeding.
- Speech language therapist (SLT) / appropriate expert should assess the patient and advice on safe swallow techniques and recommend consistency of solids and liquids (food). Patients with swallowing or chewing difficulties may need texture modified food.
- If oral feeding is contraindicated, alternative nutritional support should be considered.

  Early enteral feeding using naso gastric (NG) tube may reduce mortality.
- Patients with dysphagia can be given NG feeding. Intravenous fluid is needed even before starting NG feeding and need to continue until adequate volume is achieved.

  NG feeding is preferred to Percutaneous endoscopic gastrostomy (PEG) feeding.

  Chosen feeding route should be acceptable to the patient and relatives.

Tube feeding:

A stroke survivor may not be able to have his/her meals safely through the oral route or the intake may not be adequate for patients to meet the daily requirement.

Tube feeding can be used as a temporary measure or it may be a permanent feeding method for rest of the life. Proper training on administrating tube feeding and preparation of tube feeds should be given to the patient and /or his caretakers before leaving the hospital.

Foods for patients with swallowing difficulties,

- cook food until soft & tender
- cut food into smaller pieces or process using a blender / food processor
- use citrus fruits to induce saliva
- use food condiments or flavor enhances to overcome anorexia

  e.g. garlic, onion, pepper etc.
- eat & chew slowly using small bites

Other neurological impairments ***e.g.*** Communication problems, perception problems, attention problems, physiological problems, depression and anxiety may affect the food intake. Therefore they should be managed appropriately.

Other measures for secondary prevention

- *For patients with cognitive impairment (short attention span)*
  - give short sessions of dietary guidance
- *For patients with communication difficulty*
  - convey pictorially
- *For patients with impaired memory*
  - give written dietary recommendations
- *For patients with other physical and mental disability*
  - liase with family members

Speech language therapist/relevant expert should assess the patient through variety of tests and procedures to determine the texture of food and thinness of fluid, patient can consume.

- identify textures ranging from a puree to a regular consistency.
- liquids need to be thickened for some individuals to prevent aspiration.
- especially designed utensils can be used to drink or eat independently.

4.1 Cereals / Grains

In the acute phase, and in consequent rehabilitation, many patients need additional proteins and calories especially for accelerating healing. Various exercises/ physiotherapy increases calorie needs further.

Whole grains are considered as the major source of calories. Foods with whole grain rice and whole grain wheat - brown rice, *kurakkan, meneri*, whole grain bread, pasta and noodles provide complex carbohydrates, vitamins, minerals, and more fibre which controls absorption of cholesterol from the gut.

Foods high in starches and polysaccharides; (***e.g.*** bread, pasta, cereals, potatoes) are recommended over sugar (monosaccharides and disaccharides)

Choose 6 or more servings per day. Consumption of grains is associated with decreased risk of cardiovascular disease and stroke.

Because of appetite and feeding problems, it may be difficult to meet the requirements only through the diet.

4.2 Fruits and Vegetables

Consume a variety of fruits and vegetables throughout the day, both as meals and snacks; which helps to ensure adequate intake of micronutrients normally present in this food group. Choose 5 or more servings per day. Research indicates that high dietary intake of fruits and vegetables is protective against stroke and lower the risk by 30%.

To ensure an adequate fibre intake, whole fruits and vegetables are recommended in preferences to juices.

4.3 Protein Foods

- Include fat-free and non-fat dairy products, fish, legumes, poultry, and lean meats in the daily diet. Increase the consumption of fish. Eat at least two servings of fish per week. Studies have found that intake of fish is inversely related to the risk of stroke. Omega 3 fatty acids in oily fish have an anti-thrombogenic effect and possibly offer other cardio protective benefits.

4.4 Fats

During the acute phase, if the patient is having feeding difficulties or mal nutrition, patient should be liberalized from usual restrictions on fat. When the patient is stable, intake of total fat, saturated fat & trans fat should be limited.

Total fat intake less than or equal 30% of total energy is recommended. Saturated fat less than 10% and cholesterol less than 300 mg per day is recommended.

Foods with mono and poly unsaturated fatty acids should be substituted for saturated fats. Oils rich in saturated fats (palm oil, coconut oil) can be replaced with oils of mono and poly unsaturated fats (gingerly oil, soya oil olive oil, canola oil) etc.

For patients with elevated LDL levels, the upper limit is less than 7% of total energy for saturated fat and less than 200 mg of cholesterol per day is recommended.

Omega 3 fatty acid supplements - several studies indicated that a 20% reduction in overall mortality and a 45% reduction in sudden deaths were observed in subjects with pre-existing heart disease when 850mg of omega 3 fatty acids with or without vitamin E is given.

5. Other Measures

Salt – Reduce salt intake, as it can increase blood pressure. Avoid processed foods, which contain high salt. Salt intake should be limited to 2/3 tea spoon full of salt per day (1500mg of sodium). Substitute salt with other seasonings and flavorings.

Alcohol – Light to moderate consumption of alcohol may be protective against total and ischaemic stroke, nevertheless heavy alcohol increases the risk of stroke. If the patient consumes alcohol, he has to limit it (two drink for men and one drink for women per day).

High blood pressure is a leading risk factor for stroke, and should be checked regularly.

Weight management is essential for all patients with stroke, as their reduced food & fluid intake can result in malnutrition and it may lead to further weakness and loss of muscles, breakdown of skin leading to bed sores and further deterioration of his condition. Patients with overweight & obesity, gradual weight loss helps to lower blood pressure, minimize lipid abnormalities and prevent future strokes.

Physical activity is equally important as diet, for controlling blood sugar, lowering lipids and preventing future stroke episodes. Individual physical activity plan should be prepared taking the patient's disabilities into account with the guidance of experts (physiotherapist/ exercise physiologist/ specialized doctor for sports medicine).

Burning around 1,000 Calories each week – the equivalent of walking briskly for 30 minutes, five days a week – can lower the risk of developing a future stroke by 24 percent.

5 Dietary Guidelines & Nutrition Therapy dyslipidemia (hyperlipidemia)

1. Introduction and Background

Hyperlipidemia refers to elevated levels of lipids and cholesterol in the blood, and is also identified as dyslipidemia. Although elevated low density lipoprotein cholesterol (LDL) is thought to be the best indicator of atherosclerosis risk, dyslipidemia can also be described as elevated total cholesterol (TC) or triglycerides (TG), or low levels of high density lipoprotein cholesterol (HDL).

Cholesterol is a structural component of cell membrane and nerve sheaths. It is required for synthesis of steroids, adrenocortical hormones and bile acids. Triglyceride is required as an energy source.

A diet with less total fat, saturated fat and cholesterol is recommended as the first step in lowering serum cholesterol and /or triglyceride levels. High cholesterol and lipid levels in blood are associated with a higher risk of developing plaques in arteries leading to myocardial infarction and stroke.

Three major dietary factors that contribute to high levels of serum cholesterol including LDL cholesterol are,

1. high intake of saturated fat and transfat
2. high intake of dietary cholesterol
3. an imbalance of calorie intake and activity levels leading to obesity

Individuals with high triglycerides may also need to reduce foods high in sugar or refined carbohydrates and avoid alcohol. A high serum level of HDL is associated with decreased risk of heart disease.

Blood tests should be carried out for lipid profile after 9 – 12 hours of fasting.

ATP III Classification of LDL, Total, and HDL Cholesterol (mg/dL)

ATP III Guidelines At-A-Glance

LDL Cholesterol – Primary Target of Therapy

<100	Optimal (desirable)
100-129	Near optimal/above optimal
130-159	Borderline
160-189	High
>190	Very high

Total Cholesterol

<200	Desirable
200-239	Borderline
>240	High

HDL Cholesterol

<40	Low
>60	High (desirable)

2. Standard dietary requirements

- ☑ *Saturated Fat – less than 7% of total calories*
- ☑ *Transfat – less than 1 %*
- ☑ *Polyunsaturated Fat – up to 10% of total calories*
- ☑ *Monounsaturated Fat – up to 20% of total calories*
- ☑ *Total Fat – 25% - 35% of total calories*
- ☑ *Dietary Cholesterol – less than 200 milligrams a day*
- ☑ *Carbohydrates – 50% - 60% of total calories*
- ☑ *Protein – Approximately 20% of total calories*
- ☑ *Fibre – 20-30 grams per day*

(Source: New TLC guidelines: , The National Heart, Lung and Blood Institute's National Cholesterol Education Program (NCEP) Adult Treatment Panel (ATP III) guidelines for cholesterol reduction.)

3. Dietary guidelines

1. Total fat–

Total fat intake should be 25 – 35 % of total calories. (about 50 – 65 g of fat for a 1500 – 2000 calorie diet)

2. Saturated fatty acids–

Saturated fatty acids increase serum cholesterol and triglycerides. Cut down foods rich in saturated fats. ***e.g.*** meat fat (especially pork, beef & sausages), poultry fat, high fat dairy products(including cheese, butter, ice cream, whole milk) palm oil, palm kernel oil, deep fried foods and short eats.

Replace saturated fats with mono and poly unsaturated oils whereever possible.

3. Dietary cholesterol–

Dietary cholesterol increases serum cholesterol. Dietary cholesterol should be restricted to less than 200mg per day. Restricting portion sizes of animal meat, organ meat and egg yolk and switching from full fat dairy to non fat dairy will help reducing dietary intake of cholesterol. Sources of cholesterol are meat, organ meat, egg yolk and full fat dairy products (cheese, ice cream, milk).

4. Poly unsaturated fatty acids–

Polyunsaturated fatty acids have a cholesterol lowering effect. Poly unsaturated fatty acid intake up to 10% of total calories is associated with decrease in total cholesterol. Good sources are corn, sesame, soy & safflower oils, soybeans & grains.

Omega 3 fatty acid helps to lower the risk of coronary artery disease. Oily fish (like salmon, sardines, tuna, hurulla, herring, kumbalawa) is the best source of omega 3 fatty acids and two servings of oily fish per week (210g) or 30g daily is recommended. Fish oil supplements may be beneficial in lowering cholesterol (cardioprotective dose is 1g/day).

5. Monounsaturated fatty acids–

Monounsaturated fatty acids are known to lower LDL cholesterol. (It is recommended that 20% of total calories should be from monounsaturated fatty acids) Avacado, sesame, cashew nuts, peanuts, oils of canola, olive, sesame are good sources of monounsaturated fats.

6. Transfatty acids–

Transfatty acids are formed by the partial hydrogenation of vegetable oils and it tends to elevate LDL levels in the blood and also have other adverse health effects like decreasing HDL. Therefore foods with transfats such as savory snacks, cakes, cookies, crackers, pies, fried foods, margarines, shortenings should be avoided.

A good way to avoid transfat is to consume a balanced diet rich in fruits, vegetables, whole grains, lean sources of protein including pulses, fish, low-fat or fat-free dairy products and oily nuts.

7. Dietary fibre–

Dietary fibre intake should be increased up to 20 – 30g daily for adults, and of which 25% (~5–10 g) of fibre should be soluble. Soluble fibres can help lower LDL cholesterol by interfering with the absorption of dietary cholesterol. Sources of soluble fibre include legumes, grains, fruits (avocado, guava, passion fruit, mango, apples, oranges, banana, etc.) vegetables, pulses, (cowpea, gram, lentils) and various forms of nuts. Five or more servings of fruits and vegetables can provide recommended amount of dietary fibre daily.

8. Fruits and vegetables–

Antioxidants, vitamins B6, B12, C, beta-carotene and folic acid may have a positive role in preventing atherosclerosis. Recommended allowance of all major vitamins is generally accomplished through a well balanced diet. A diet comprising of all food groups including 3 – 5 servings of vegetables and 2 – 3 servings of fruits per day will full fill above requirements.

One serving of vegetables equals to 3 table spoons or ½ a cup of cooked vegetables or ½ a cup of raw salads. One serving of fruits equals to one medium size fruit or ½ a cup of fruit salads.

9. Weight management–

Weight reduction is associated with increased HDL cholesterol, decreased LDL cholesterol and triglyceride levels. Regular exercises is beneficial for weight control.

10. Plant stanols/sterols–

Plant sterols help to block absorption of cholesterol from gut and sterol / stanol esters impede billiary cholesterol reabsorption. This helps lowering LDL levels without affecting HDL levels.

3 servings of food containing plant stanols can result in 20% reduction in cholesterol. Sterols are present naturally in small quantities in many fruits, vegetables, nuts, seeds, cereals, legumes, vegetable oils, and other plant sources including wheat, corn, soy, fortified food & beverages.

4. Other measures

Alcohol:

Alcohol has a strong linear association to serum triglycerides and most patients using alcohol have high triglyceride levels. Alcohol should be avoided by individuals with high triglycerides. Cut down or limit alcohol intake to less than 3% of calories. Limit hard liquor intake to 50 ml a day, beer to 360 ml and wine to 150 ml a day.

Smoking:

Smoking cessation increases HDL cholesterol levels by 5% – 10%.

Salt (sodium):

Salt in excess amounts may cause fluid retention and hypertension. Therefore patients with hyperlipidemia should limit salt intake to less than 5 g (one teaspoon) per day.

Awareness and commitment are both essential factors in reducing unhealthy fats in the diet and no doubt helps many patients with hyperlipidemia.

6 Dietary Guidelines & Nutrition Therapy for Kidney (renal) disease

1. Introduction

Renal failure is a serious medical condition with direct consequences. In renal failure the functional status of kidney is in compromised to a varying extent. Renal failure can be a progressive disease (chronic) or a temporary one depending on the cause and available treatment option (acute). Acute renal failure is often reversible with no lasting damage.

1.1 Stages of Chronic Kidney Diseases (CKD)

Dietary management depends on the stage of the disease. There are 5 stages and it is based on decreasing glomerular filtration rate (GFR).

Stage	GFR	Description
1	90+	Normal kidney function
2	60 – 89+	mildly reduced kidney function
3	30 – 59+	moderately reduced Kidney function
4	15 – 29	severely reduced kidney function
5	14 or less	very severe or end stage kidney failure

Up to the stage III level, patient may not show the symptoms of the disease or patient may be able to manage the renal functions without accumulating excretory products like excess urea or Potassium in the blood. Therefore, patients in stage I, II or III may not need strict, dietary control than lowering their protein intake.

In stage IV and V, patients are in difficulty of maintaining a balance of electrolytes, minerals and fluids. They may be on drugs, which help improve urine output and phosphate binders to remove excess phosphate. Special renal diet is essential at this late stage to manage the disease, maintain electrolytes minerals, water balance and prevent further deterioration of the disease.

Dietary management not only varies with the stage of the disease but also with the condition of the patient (level of blood urea, potassium, calcium, phosphorous, oedema, volume of urine, protein urea etc.) It is essential to seek individual dietary advice from a nephrologist or a clinical renal diatitian in stage IV onwards, rather than following general renal dietary guidelines it self.

There are two types of diet for chronic kidney disease

1. A diet for progressive chronic renal failure
   (pre dialysis stage)
2. Diet for people on periodical dialysis whose kidneys have totally failed.
   (ESRD – End Stage Renal Disease)

2. Diet related and other issues:

a. Waste products and fluid build up in the body.

b. The amount of hormones produced by the kidneys fall which affects bones and blood cells.

c. Risk of rised blood pressure because of extra fluid and sodium accumulating in the blood stream.

d. Risk of vitamin deficiencies which can lead to anaemia, and weakness of bones,

e. Cholesterol and other fats in the blood can be high due to altered hormone levels.

f. Toxic substances can make the person ill.

g. May have loss of appetite

3. Standard dietary requirements of CKD patients

- In general, energy requirement of approximately 35 – 40 kcal per kg of ideal body weight is needed.
- The appropriate level of protein is selected based on the level of kidney disease, age and weight of the patient etc. An intake of 0.6–1.0 g of protein per Kg body weight per day is recommended.
- It is difficult to provide precise guideline as to when a low potassium diet should be implemented.
- A daily intake of Sodium should be less than 1 -3 g/ day (for end stage).
- Restricted dietary phosphates 30mmol per day.
- A daily allowance of fluid should be equal to 500ml of fluid plus the equivalent to the previous day's urine output (only in late stages).

4. Dietary Guideline for CKD patients

Patients with CKD also need a well balanced diet adjusted for the disease with all the food groups.

4.1 Carbohydrates

Energy requirement of 35 kcal/ kg per day is needed to maintain body weight and also for effective protein utilization whereas 30 kcal/kg is recommended for people over 60 years.

Calories from complex and simple carbohydrates should be included. Parboiled or under milled rice, bread, whole rice flour or whole wheat flour preparation, yams and tubers can be offered.

Whole grain cereals contain high amount of phosphate. When the patients phosphate level is too high, inspite of phosphate binders, whole grain should be substituted by a non bran cereal.

Quantity of carbohydrate or starchy food depends on,

a) patients BMI
b) other associated diseases like diabetes
c) level of the kidney disease

If the patient needs to cut down protein it can be replaced by calories from cereals, fruits and vegetables.

If BMI < 18.5 kg/m2, - increase calorie intake up to 2500 kcal. Encourage and active life style and physical activity.

If the patient is diabetic, control diabetes under medical supervision while increasing calorie intake.

If BMI between 18.5 – 25 kg/m2 - continue the amount of starchy food presently taking but should be followed up for any weight change. Ideal calorie intake will be around 2000 – 2500 kcal. Control diabetes if any under medical supervision. Engaging in moderate physical activity at least half an hour for a day, is necessary.

If BMI is above 25 kg/m2 - need to limit the carbohydrates (2000 kcal diet). Limit refined sugars and foods containing sugar

Encourage an active life style and/ or engage in moderate physical activity at least half an hour a day. Control diabetes under medical supervision.

4.2 Fat & Oil

Fat is a good source of energy. If patient is already of low BMI or malnourished, adding limited amount of oil will help improve body weight. Oil may help improve appetite. Many patients with CKD suffer from loss of appetite and around 20 – 30 % of calories can be taken from fat.

Additional fat in the form of monounsaturated and polyunsaturated fats are recommended since dislipidemia is prevalent in patients with CKD. Avocado, cashew, peanut, pumpkin seeds, gingelly, kottan and oils from gingelly, olive, and sunflower are good sources.

As some nuts may contain high level of potassium (***e.g.*** Avocado, cashew nut, peanuts), patients with end stage renal disease has to take dietary advice in this regard.

All patients with chronic renal disease should limit quantity of milk and other dairy products as they contain high amount of phosphates. Use low fat or non fat milk or milk products instead of whole milk.

Limit saturated fats like butter, some fat spreads and vegetable oils.

Avoid food containing high transfat.

Patients with chronic kidney disease are at higher risk of cardiovascular disease than general population. It has been observed that statins significantly decrease the risk of all cause and cardiovascular mortality in patients with CKD. All patients with CKD should target LDL levels of 100 mg/dl and triglyceride levels less than 150 mg/dl.

4.3 Protein

Protein is needed to maintain or build up muscles, aid in building resistance to infections and repair and replace body tissues. When proteins are brokendown, urea accumulates in the body, as kidney function declines. A low or moderate protein diet is usually recommended for the patients with CKD. The appropriate amount of

protein is determined considering the level of kidney disease, age and weight of the patient etc.

Evidence suggests that protein restriction early in the course of CKD due to glomerular damage may slow down the progression of the disease and delay the need to initiate dialysis therapy.

Diet with 50% of protein of high biological value (Meat, poultry, milk & milk products, eggs and fish) is encouraged to ensure provision of all the essential amino acids.

As plant proteins (Pulses and legumes) are lacking in some essential amino acids, protein requirement can be compensated by combining one or two plant sources or eating one plant source with rice. Plant protein sources are suitable for ESRD patients because of moderate to low protein content.

Carefully planned vegetarian diets containing soy and plant based products improve serum protein levels in diabetic nephropathy.

The daily urinary losses may be added in calculating daily allowance of protein. Increased protein needs due to catabolism from use of Glucocorticoids (steroids) or recent surgery may contraindicate limiting dietary protein.

Generally accepted levels of protein restriction for patients of CKD

stage I to III is – 0.75 g/kg bw per day
stage IV to V is – 0.6 g/kg bw

Once the dialysis is started, patient needs a high protein diet (8 – 10 ounces of high protein food each day) and 2g of protein per one kg of body weight is recommended.

4.4 Vitamins & Minerals

Restriction of protein and certain minerals in the diet of CKD patients automatically result in deficiency of vitamins. Therefore supplementation with critical vitamins & minerals is essential.

folic acid 1 mg/day

Pyridoxin -5 mg/day

Other B complex vitamins - use as RDA

Ascorbic acid 60 – 100 mg/day

Supplementation of active form of vitamin D (1, 25 dihydroxy cholicalciferol) is needed as conversion of vitamin D to active form is impaired.

Vitamin A can be accumulated during later stages of CKD and therefore should not be supplemented during the late stages of CKD.

As patients with advanced renal failure, tends to develop anaemia, pharmacological forms of erythropoietin (epoetin alfa) and iron supplements are recommended depending on iron status, in addition to the diet with iron rich food.

e.g. chicken, fish etc. (limit organ meat & red meat)

Iron fortified cereals

Lima and kidney bean

4.4.1 Salt (Sodium)

Salt is needed for many functions of the body such as regulating muscle and maintaining blood pressure. Healthy kidneys remove excess sodium in the urine.

As kidney function declines, sodium and fluids may accumulate in the body resulting swelling of body (oedema). Reduction of salt will help reduce oedema and water retention.

When patient's renal failure progresses to a GFR of about 10% of normal, sodium excretion falls and reducing salt intake to 1–3 g/day is recommended. If GFR is above 10% and if patient is free of oedema and hypertension an intake of less than 5g (one teaspoon) per day is allowed.

Foods should be limited

- Limit foods with added salt. Specially processed foods, potato chips, cheese, sauce, chutneys, pickles, savories, salted biscuits processed meat such as sausages, ham & bacon etc and salted nuts.
- Look for food labels for sodium levels (products less than 100mg of salt per serving) is considered safe.

Following specific preparations are preferred

1. Low sodium
2. No salt added
3. Sodium free
4. Sodium reduced
5. Unsalted

Use condiments, spices and herbs to improve the taste of food instead of salt.

e.g. Garlic, lemon, etc.

Amount of sodium

Daily sodium recommendation is determined by the patient's blood pressure, weight and level of the kidney function.

A daily intake of Sodium approximately 100mmol per Litre can be achieved.

As most of the patients with renal failure suffer from hypertension, measurement of blood pressure and serum sodium levels are important elements of sodium management.

4.4.2 Potassium (K)

Serum K levels can be high in severe renal failure and on dialysis. However, potassium intake should not be restricted routinely unless tests show high potassium levels, because potassium containing foods include many healthy foods. More over potassium is needed for proper functioning of nerves, muscles and heart. Very high potassium levels (6.5mmol/L or higher potassium) can lead to a cardiac arrest or cardiac arrhythmias.

Dietary potassium restriction may be necessary in later stages of CKD when GFR is significantly reduced (< 10 ml/min). Therefore, from this stage onwards patient should be individually monitored using their serum potassium levels. It has been noted that certain drugs may alter the serum potassium levels, angiotensin converting enzyme (ACE) inhibitors may exacerbate hyperkalemia in advanced renal insufficiency.

When serum K levels are greater than 5 mEq/ L, a potassium restricted diet of 2–3 g/day should be initiated.

As almost all the foods contain potassium, serving size determines whether foods are a low, moderate or high potassium level of food. A large serving of low potassium foods can become a high potassium food.

As potassium is water soluble, leaching (soaking) helps to remove considerable amount of potassium from the foods such as vegetables and yams. Vegetable should be peeled and cut into small pieces and placed in a large pot of water. (around 10 times of vegetables) After soaking preferably more than 2 hours, rinse vegetable with clean water. Patients on low potassium diet are advised to boil vegetables for 5–10 minutes using large amount of water and to discard water after cooking to further decrease the vegetable potassium content. Unfortunately, the process also decreases the water soluble vitamins. Therefore most renal patients need vitamin supplements.

Types of foods

Foods low in potassium (less than 125 mg per serving)

A serving is ½ cup unless otherwise noted. Eating more than 1 serving can make a lower potassium food into a higher potassium food.

Fruits	Vegetables	Other foods
	onion	rice
Pineapple (1-2 slices)	cabbage	noodles
Grapes (~ 10) Mandarin Orange	green beans lettuce	pasta bread & bread products (not whole grains)
Water melon (112mg in 100g)	cauliflower	egg (63mg in 50g)
Peaches, fresh (1 small)	radish	jelly
Plums (1 whole) Lemon (~1)	mushrooms, raw	cookies without nuts or chocolate
Mangosteen (4 medium)	eggplant	tea (no more than 2 cups)
Rambutan (4 medium)		coffee (no more than 1 cup)
	Carrots, cooked	pizza, cheese ⅛ of 12”
Strawberries (~5)	cucumber	carbonated beverages
apple juice, grape juice, pineapple juice		butter, jam

Foods moderate in potassium (125 – 225 mg per serving)

Persons restricting potassium should not include more than one or two servings from this list per day depending on their medical restrictions.

Vegetables	Fruits	Other foods
Beet	Pears	Yoghurt (155mg in 100g)
Okra	Apple juice (119mg in 100ml)	Ice cream, vanilla (116mg in ½ cup)
Leeks	Cherries	Cashew nuts (160mg in 28g)
Spring onions	Grape fruit	
Corn	Green peas	
Cucumber	Apple 1 (148mg in 138g)	
Mushrooms		
Onions		
Peppers		

Foods high in potassium (more than 200 mg per serving)

Patients on potassium restricted diets should avoid them or eat them sparingly.

Foods high in potassium

Fruits	Vegetables	Other foods
Avocado (450mg in 100g)	broccoli, cooked (216mg in 2 spear)	Bran /bran products
Banana (215mg in 60g)	carrots, raw (230mg in 72g)	chocolate, chocolate paste
Dried fruits	greens	milk, all types (349mg in 240ml)

Dates	spinach, cooked (233mg in 50g)	nuts & seeds
Mango (1 medium) (323mg in 207g)	tomatoes (237mg in 100g) & tomato products	
Orange (1 medium) (237mg in 131g) Orange juice	potatoes, white & sweet (200mg in 60g) French fries	malted milk drink (251mg in 3 tsp) dairy based desserts & desserts made with chocolate, nuts & banana
Papaya (360mg in 140g)	plantain, cooked (233mg in 50g)	lentils
Prunes, raisins	pumpkin	pulses (>400mg in 1 cup)
Pomegranate		All meats, poultry & fish

Source *– USDA data base*

4.4.3 Phosphorus

Although most of the phosphorus is found in the skeletal system of the body, a small propotion presents in the serum which is regulated by the kidneys. When the kidney function is deteriorated upto GFR 25-30ml per minute, phosphate retention occurs.

At this stage, kidney fails to activate vitamin D which lowers the absorption of calcium from bowels.

Hyperphosphatemia together with hypocalcemia stimulates increase production of parathyroid hormone resulting renal bone disease and soft tissue calcification in various places of the body including vascular calcification.

Majority of patients with CKD presents with complex lesions of bones including osteitis fibrosa and osteomalacia.

Restriction of dietary phosphorus prevents hyperparathyroidism.

Phosphorous levels can rise to a great extent. This can cause low calcium levels with demineralization of bones (thinning).

Renal bone disease can be a serious problem for long standing renal failure causing aches, pains and sometimes fractures. The aim is to prevent renal bone disease as treatment is complicated.

Control of serum phosphate level is essential for prevention and management of above condition.

Restriction of phosphate upto 800 – 1000 mg/ day is necessary for patients with stages 3 onwards when the serum phosphorus level is greater than 4.6 mg/ dl.

Phosphate intake can be reduced by limiting dairy products and consuming vegetable based low protien diet.

Aims of treatment

1. Restricting dietary phosphate
2. Prescribing phosphate binders for preventing absorption of phosphate.
3. Supplementing active form of vitamin D for prevention of hypocalcemia

- **Alfa calcidol or calcitriol**

These are active forms of vitamin D which is often short in renal failure as the kidney fail to process it.

- **Phosphate binders**

Phosphate binders help prevent excessive absorption of phosphate from the gut and thus keep the phosphate level lower. This can be taken at the right time with the food.

e.g. Calcium carbonate, Lanthanum carbonate, Sevelamer, Aluminium hydroxide, Magnesium carbonate.

Non calcium containing phosphate binders are prefered as too much calcium supplements can leads to calphylaxis.

Calcium suplements and vitamin D should be given for prevention of bone disease and to maintain the balance of calcium and phosphrus. Targeted blood phosphate level is 1.8 mmol/l

Foods high in phosphate

Every food item contains some phosphorus, therefore it is difficult to eliminate phosphorus from the diet. Generally foods high in protein (some meats, dairy products, beans, legumes, nuts and seeds) are high in phosphorus as well.

Foods high in Phosphates	Substitute
• Most dairy products, like milk, cheese, ice cream and yoghurt	• Non dairy wiped toppings, cream cheese, cottage cheese, mayonnaise, frozen sherbet
• Organ meats, sausages, hot dogs, sardines	• Fresh or frozen fish, chicken, eggs, beef, pork, lamb
• whole grain cereals – including whole grain bread, cereals, rice, crackers, pasta, and other cereals	• Refined grains including white bread, crackers, cereals, rice, pasta
• dried beans, peas, lentils	• Green beans
• quick breads, biscuits, muffin pan cakes, waffles	• Refined (white) dinner rolls, croissants,
• pumpkin, sweet potato, mushroom, broccoli, spinach	• Potato, beet, carrot, cabbage, cucumber, egg plant, tomato , lettuce, peppers, onions

• Peanuts, cola drinks, milk chocolates	• Ginger ale, lemon- lime soda, dark (plain) chocolates, pop corn, hard candy, jelly sweets, mints, chewing gum
• Soups made with higher phosphorus ingredients (milk, peas, beans, lentils)	• Soups made with lower phosphorus ingredients (broth or water based with other lower phosphorus ingredients) • Butter, margarine, mayonnaise, salad dressings, shortening or vegetable oils

Almost all patients with high phosphate levels need to take phosphate binders in addition to dietary management.

4.4.4 Calcium

- Serum calcium levels may not decrease until GFR 30 ml/ min. Calcium supplementation will be required in late stages of CKD.
- Foods rich in both calcium (primarily dairy products) as well as phosphorus should be avoided.
- Calcium carbonate or acetate may be used to increase calcium levels.
- **1.5 – 2 g of calcium – for CKD stages 3 & 4 and 1.5 – 1.8 g of calcium – for stages 4 & 5 (not yet on dialysis) is recommended**.

4.5 Fluid

Fluid intake should not be restricted until the later stage and for patients on dialysis.

As long as the urine out put essentially equals the daily fluid intake, fluid balance is maintained. When oedema is apparent, loop diuretics can be prescribed to increase sodium and water excretion. In the latter stages of CKD, amount of fluid required equals to the volume of urine out put plus 500 ml/ day.

Drinks and food with high fluid content is accounted for the daily allowance and the water content in other foodstuffs such as fruits and vegetables is not counted.

When the patient is in need of restricting water,

- should limit food with high water contents –soup, ice cream, grapes, melons, tomatoes, jelly, gravy, lettuce etc.
- use smaller cups or glasses
- avoid salty food
- stay cool on hot days

Proper dietary management of renal patient play a vital role in improving their quality of life and reducing morbidity. Daily assesments and tailor made dietary regime may be necessary in achieving better management.

7 Dietary Guidelines & Nutrition Therapy for CKD Patients on Dialysis (Heaomodialysis)

1. Introduction

Diet of patients on dialysis has to be closely and carefully monitored not only for achieving control of waste products but also for achieving good dialysis outcome. It is essential for dialysis patients to have the right amount of protein, calories, fluids, vitamins and minerals each day.

A well-balanced diet is necessary for them to stay fit as their kidneys are no longer functioning at its full capacity i.e. to get rid of the waste products and fluid

Chronic Kidney Disease patients on dialysis

The goals of medical nutrition therapy for patients with haemodialysis (HD) or peritonealdialysis (PD) are:

a) maintain protein equilibrium preventing negative nitrogen balance and excessive weight gain.

b) maintain serum potassium & sodium levels in an acceptable range.

c) fluid management preventing fluid overload or volume depletion.

d) manage serum calcium, phosphorus and parathyroid hormone levels to prevent osteodystrophy and metastatic calcifications.

e) receive adequate vitamins and minerals.

2. Diet related and other issues

- Malnutrition is very common in these patients and it is associated with increased morbidity and mortality
- Loss of amino acids during heaomodialysis and associated protein catabolism
- Loss of appetite which is aggravated by protein catabolism
- Poor quality dialysis is associated with loss of appetite and inability of excreting potassium, phosphorus and sodium
- Water retention

3. Standard dietary requirements

A Healthy Diet for a dialysis patient may have following characteristics:

- High energy requirement (30 – 35 kcal/kg BW) is needed for heamodialysis and moderate energy requirement (25–30 kcal/kg BW) is needed for peritoneal dialysis.
- adequate in protein- 1.2 g/kg BW per day for haemo dialysis patients and 1.2 - 1.3 g/kg BW for patients with home haemo dialysis (HHD) & peritoneal dialysis.
- low to moderate in potassium- no more than 2 – 3 g per day
- low in sodium- 2 – 3 g per day can be given
- low in phosphorus
- appropriate fluid balance

4. Dietary guidelines for patients on dialysis

4.1 Carbohydrates

Intake of calories should be adequate to maintain and achieve ideal body weight and to avoid utilizing protein for producing energy. Patients (HD & PD) need nutritional supplements to meet calorie and protein demand. Patients can eat as his desires from carbohydrate group unless there is an indication to restrict calories. ***e.g.*** Diabetes or obesity. 6 – 11 servings per day from this group are allowed. Whole grain cereals as well as non bran cereals, yams, pulses and other starchy foods can be used. As whole grain cereals (bran) contain high amount of phosphate whole grains can be replaced with non bran cereals for patients with very high phosphate levels.

Some patients on dialysis need to gain weight. Therefore patient may need to find ways to add additional calories to his diet. Vegetable oils-like olive oil, canola oil, and safflower oil- are good sources of calories. Use them generously in rice, noodles and other staples. Butter and margarines are rich in calories. But these fatty foods can trigger atherosclerosis. Use them less often.

4.2 Protein

Patient needs more protein foods than prior to dialysis. They should take adequate dietary protein without worsening uraemic syndrome. Loss of amino acids, catabolic stress of dialysis and low protein intake of pre dialysis period can contribute to low protein levels.

25% of the protein requirement at each meal is recommended

It is advisable to consume high quality protein (meat, fish, poultry, egg white) at every meal. Most dairy products such as yoghurt, milk and cheese also contain high-quality protein.

As most milk products are very high in phosphorus, intake of milk and milk products should be limited.

½ a cup of milk, 1 cup of yoghurt, 1 ounce of cheese or other dairy products low in phosphorus are desirable .

Right kind and correct amount of protein is vital for dialysis patients to stay healthy. Protein rich food contains phosphate. Therefore it is very important that dialysis patients take their phosphate binders with all their meals.

4.3 Fat

Recent research indicates that, there is a negative correlation between cholesterol levels and mortality of patients on dialysis. Therefore patients are advised to have more freedom for fat consumption exceeding their cut off levels of cholesterol.

Diet should be aimed at normalizing cholesterol levels without affecting overall protein and calorie intake.

Consume a diet rich in omega 3 fatty acids such as oily fish. However saturated fat should be limited due to the risk of heart disease.

Drug treatments for lipids can be initiated avoiding further restrictions to the diet. Oily nuts and fruits, unsaturated oils are the healthiest way to add fat to the diet.

4.4 Sodium & fluid

Though sodium intake is already restricted, it is one of the minerals removed during the dialysing process. Sodium requirement is decided by patient's blood pressure, weight and level of kidney function.

For patients on HD – 2–3 g of sodium per day with a fluid allowance of 1000 ml per day + the amount of urine out put is recommended.

However, exception is, patients who use concentrated dextrose should strictly limit sodium and water. **a sodium (Na) content less than 150 mg per serve** is desirable.

To limit sodium intake:

- Choose fresh, home-cooked food and meat
- Use "Salt Reduced" or "No Added Salt" products
- Avoid salty foods like:

  processed meat (bacon, sausages), smoked fish or smoked meats and canned fish

  salted biscuits, nuts and crisps

  packed or canned soups, packed sauces, most take-away foods
- A pinch of salt may be added at the table but not during cooking.

Dialysis patients can no longer excrete large quantities of fluid consumed. Excess fluid will be retained in the body resulting in overloading of the blood circulation. Symptoms such as shortness of breath, high blood pressure and swelling of the legs can occur. Thus, it is important that fluid intake is restricted.

Fluid levels can build up between dialysis sessions causing oedema. Excess fluid can affect blood pressure and cardian function. Fluid intake should be limited and dry weight should be maintained. Thirst can be reduced by cutting up salt intake. Use a smaller cup for drinking. Limit food with hidden water.

4.5 Vitamins & Minerals

- Patients who are on HD / PD, need supplement of folic acid (1 mg/day), pyridoxine (10 mg/day), other B complex vitamins (according to RDA) and ascorbic acid (60 -100 mg/day).

- Patients on dialysis also need active form of vitamin D. Intermittent or daily doses of oral calcitriol, doxercalciferol or paracalcitol can be used for PD & HD patients.
- IV doses can be used for HD patients during treatment. These can be used with calcimimetic medication.
- Iron supplementation is necessary for patients on HD or PD if they are receiving erythropoietin stimulating agents for anemia.

  Iron gluconate or iron sucrose can be given to patients on HD to achieve serum ferritin greater than 200 ng/ml or transferin greater than 20%.

4.5.1 Potassium

Patients on HD can be kept on diets containing 2–3 g of potassium / day (50 -75 mEq /day)

- When potassium levels are high, despite dietary counselling, dialysate potassium content may be lowered or sodium exchange begin added to the medication regime.
- When potassium levels are low, dietary potassium levels can be elevated or dialysate potassium content increased.
- For HHD patients, the diet is more liberal in potassium.

Since dialysis can only remove a limited amount of potassium, it is crucial to control the amount accumulated through patients' dietary intake. Potassium is found mainly in fruits and vegetables, with small quantities found in nuts, dry beans, dairy and meat products. It is important to avoid foods that are high in potassium and to take food that has low to moderate content.

Smaller portions of other high-potassium foods can also be consumed. For example, half a mango can be taken. Very small portions of oranges and melons can be used.

Food sources for potassium – refer dietary guidelines for kidney diseases *(page 51)*.

4.5.2 Phosphorus

High phosphorus foods have to be avoided. Pruritus is an early sign of phosphorus building up in the circulation. Dairy foods may be limited to 8 ounces (around 240 ml) per day.

If high phosphorus foods are taken phosphate binders should be taken with the food ***e.g.*** **milk/ yoghurt / cheese**

5. Other measures

Management of Malnutrition

- Nutrition dense supplements drinks in frequent intervals for patients with poor appetite may be helpful.
- NG or percutaneous endoscopic gastrostomy (PEG) feeding can be instituted for people very poor intake of food.
- Intra dialytic parenteral nutrition (IDPN) can be given during Heaomodialysis sessions via the venous return line from the dialysis machine back to the patients.
- Measures can be taken to improve appetite in consultation with nephrologists.

Selection of food and method of preparation can be chosen according to the patients choice. Adding food condiments, adding oils, frying, tempering, using appetizers. ***e.g.*** Lime juice, *Duru hodhi*. Using medicine to improve appetite ***e.g.*** metaclopropamide, Domperidone) and many more choices would be helpful.

8 Dietary Guidelines & Nutrition Therapy for Renal Transplantation

1. Introduction

Transplantation is the best alternative to replacement therapy. The length of time a transplant can survive varies from 1 year to more than 20 years.

Peri-operative adverse nutritional considerations

- Under nutrition and obesity both affect in renal transplant recipients. Death rates are significantly increased in transplant recipients with BMI lower than 18.5 kg/m^2.
- Obese recipients also have higher rates of delayed graft function, new onset diabetes, chronic graft failure and higher mortality rates.

If a patient with a transplanted kidney that is no longer functioning is considered as a patient with Chronic Renal Failure (CRF) and CRF diet is recommended. A well functioning graft enables the previous restricted dietary regimes to be relaxed.

2. Diet related and other issues

- Immuno suppressive agents can have adverse effects over patients nutritional status.
- Some medicines used after renal transplant increase the risk of hyperlipidemia.
- Hyperkalemia may persist in the immediate post operative period.
- There is a tendency to develop new onset diabetes and glucose intolerance. Therefore serum glucose levels should be closely monitored.

3. Standard dietary requirement

- Recommended calory requirement is 30-35 kcal /kg of dry body weight.
- Sufficient fluid (6–8 glasses) should be insured.
- Include high phosphorus foods like milk, yoghurt, cheese, legumes and whole grains.
- Protein intake should be relatively high, 1.3–1.5 g/kg per day is recommended for post operative period upto 6 weeks and 1g/Kg Per long term management.
- Potassium restriction is usually not needed after transplantation.
- Sodium or salt restriction is usually required right after transplantation.
- Include adequate sources of Calcium in the diet.

4. Dietary Guidelines after renal transplantation (Post-operative nutritional Considerations)

4.1 Calories

- Adequate calorie management is essential during this period as it helps to avoid using protein for energy production, but using it for promoting wound healing, resisting rejection and infections.
- Increased appetite due to steroids can be managed by counselling and using other dietary measures.

- Regular exercise is essential for weight management and to avoid unwanted weight gain which is usual in the first year of transplant
- Patients can develop hyperglycemia due to high dose of steroids and immunosuppressive drugs. In such circumstances they may need control of carbohydrates and use of oral hypoglycemic drugs or insulin.

  Need for hypoglycemic therapy may subside with time.

Sugar

Limiting sugar will be helpful in controlling weight gain or developing diabetes.

4.2 Protein

Protein catabolism at this stage may be due to surgical stress and due to high doses of steroids. Patient might also be depleted in protein due to prior restrictions.

With successful transplantation, protein 1 g/kg Bw per day is adequate for long term management.

In the first six weeks, protein intake should be relatively high to recover from surgery. Corticosteroids (Prednisolne) may contribute to muscle break down.

4.3 Fat

Abnormalities of fat are frequently common among transplanted patients. For long term management, control of total fat and saturated fat while substituting monounsaturated & poly unsaturated fats is the basis of management.

4.4 Vitamins & Minerals

Renal vitamin preparations can be used temporarily for the post transplant patient especially if patient shows signs of rejection.

Iron supplementation can be given for anaemic patients.

Potassium

Potassium restriction is usually not needed after transplantation. Some people develop high potassium levels at early post-operative period in spite of good kidney function. Restriction of dietary potassium is needed only for these patients for a certain period. It is generally safe to gradually liberalize potassium intake unless such a complication

Hypophosphataemia

Phosphorus level may fall too low shortly after transplantation and include high phosphorus foods like milk, yoghurt, cheese, legumes and whole grains. Additional supplementation may be needed to overcome Hypophosphataemia.

Calcium

Long term use of steroids/Prednisilone can contribute to osteoporosis. Include adequate sources of Calcium in the diet (the equivalent of 4 glasses of milk each day, etc or a Calcium supplement is necessary.)

Sodium or salt

Restriction of salt required right after transplantation to minimize fluid retention and help control blood pressure. Salt intake of 3g (¾ tea spoon) per day is reasonable. Salty foods should be avoided. Patients have to limit sodium intake further, if they have sodium & fluid retention due to steroid therapy.

4.5 Fluids

Fluids can be used liberally unless rejection of transplanted kidney is evident.

As kidney function improves, patient becomes polyuric. Therefore patient needs to drink plenty of fluid. This may be very difficult for a patient who has been restricting fluid for many years. Intravenous therapy may be an option to avoid dehydration. Urine volume normalizes with time. Around 2L of fluid should be included daily.

5. Other measures

Long term nutritional consideration

Weight Gain

Excessive weight can be a serious problem after transplantation and can contribute to hypertension, hyperlipidemia & diabetes.

Following measures are helpful in preventing obesity/ overweight.

1. Avoid eating food with excess calories - high fat, high sugar.
2. Engage in routine physical activity - walking (brisk), home gardening.
3. Regular exercise - swimming, cycling, jogging etc.

Hyperlipidemia

Around 25% of post transplant patients may develop hyperlipidemia. This can lead to cardiovascular and cerebrovascular complications. 40% of deaths following transplant are due to cardiovascular disease. Cholesterol lowering diet would benefit.

Some medicines increase the risk of hyperlipidemia. Exercise, limiting total fat intake specially saturated and transfats would be beneficial.

Opportunistic infections

Patients may contract opportunistic infections over gastro intestinal tract especially mouth and throat, due to immunosuppressive treatment they undergo. These infections should be identified and treated accordingly. Opportunistic infections can also affect food intake.

Alcohol

It is advisable to avoid alcohol and alcoholic beverages especially during early post transplant period.

Food Safety All the precautions should be taken to avoid infections as the patients are on immunosuppressants.

Variety of foods covering all six food groups

Patient can gradually enjoy a wide variety of foods from each food group which will help receiving required nutrients.

Appetite

Appetite usually improves as biochemical indices become normal. There is a risk of overweight and obesity following transplant and early dietary management will help maintain patients BMI within normal limits.

* Patients taking cyclosporine should avoid grapefruit or related products.

Patients with good graft function

Low fat healthy diet is appropriate(including all food groups).

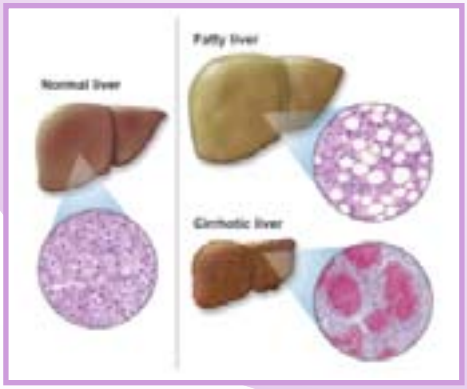
High protein intakes should be discouraged, to avoid protein induced hyperfiltration.

Protein intake of 1g/Kg body weight is the ideal.

Patients with declining graft function

These patients should be periodically observed and manage the progress of renal failure. When patient is in chronic renal failure, CRF diet is in need.

9 Dietary Guidelines & Nutrition Therapy
Liver Disease



1. Introduction and Background

Chronic liver disease can be caused by a variety of etiology such as Non alcoholic fatty liver disease, chronic viral hepatitis and alcohol. Progressive and chronic hepato cellular damage over many years results in cirrhosis which is a state of irreversible liver damage. Proper nutrition therapy and management will improve their survival. Good nutritional status will also increase the survival after liver transplantation in patients with chronic liver disease. Malnutrition is seen in 20% of compensated cirrhosis patients and 60% of decompensated cirrhosis patients. Dietary plan depending on their nutritional status is best formulated by a team of care givers including a physician, a dietician/nutritionist and the relatives.

Stages of the disease

1. Compensated cirrhosis:-

   Patient may not be symptomatic with up to 80% of liver being damaged.

2. Decompensated cirrhosis:-

   In this type of patients, symptoms of liver disease such as oedema, jaundice and fatigue are evident.

2. Diet related and other issues

- **Protein energy malnutrition** is a recognized complication and has an important role in prognosis of the disease. There is a direct correlation between the progression of liver disease and the severity of malnutrition

- **Changes in energy metabolism**
  - Circulating level of catabolic hormones are increased which are not degraded by the liver.
  - Resistance to anabolic hormones, insulin and growth factor is developed. This results in reduced storage of post prandial glucose. Depleted glycogen stores result in an increased rate of gluconeogenesis from body proteins.
  - Catabolism of muscles further contributes to malnutrition
  - Nocturnal fat metabolism is increased.

- **Increased requirements for protein and energy**

  Energy demand is high due to increased protein break down and low protein synthesis.

- **Poor food intake**

  Anorexia (contribute by a prescribed low salt diet)

  Generalized weakness and fatigue

Nausea, vomiting (due to liver diseases)

Early satiety due to ascites

Drowsiness due to encephalopathy

Altered taste due to micronutrient deficiencies

Mal-absorption

Gastrointestinal bleeding

Psychological manifestations of illness (depression)

⁂ **Nutritional Assessment**

Although comprehensive nutritional assessment is necessary for every patient, evaluation is difficult with common parameters due to the nature of the disease.

Weight: Dry weight should be calculated as many patients are having oedema or ascites

Dry weight = wet weight - estimated weight of ascites & or oedema

Height: can be measured except in bedridden patients.

Dietary intake: can be measured by recall method.

Clinical observation: muscle wasting, loss of subcutaneous fat, micronutrient deficiencies, presence of ascites, oedema or jaundice

Mid upper arm circumference (MUAC): This is one of the most useful and reliable method. Measurement of MUAC, triceps skin fold thickness and midarm muscle circumference can be used to differentiate both fat loss and muscle wasting.

Micronutrient deficiencies: can be diagnosed clinically or bio chemically.

Grip strength: is highly sensitive and reflects muscle function.

Nutritional assessment of fulminant hepatic failure

In conscious patients – full assessment is similar to that of chronic liver disease.

In unconscious patients – nutrition assessment is limited. Previous records, information from relatives and clinical assessment will help.

3. Standard dietary requirements

All requirements are based on patients dry weight.

Patients dry weight can be taken using records.

– Patients weight before developing ascites /oedema.

– Weight after drainage of ascites.

Calculations of energy and protein requirements are useful for maintenance of nutritional status.

Energy requirement:

Patients with cirrhosis may need more calories.

In compensated liver disease – 25–35 kcal/kg/day

In decompensated liver disease – 25–45 kcal/kg/day

Taking stress factor into account paves way for catering to patients daily requirements including additional energy.

add 400 – 1000 kcal /day to estimated requirement.

Monitoring of nutritional status will reveal the adequacy of nutritional support.

Energy can be increased when it is indicated.

If ascities is present – 30% stress factor would be enough. Patients with multiple symptoms may suit a 40% stress factor. Nutritional status can be reviewed by dry weight, Mid Upper Arm Circumference or hand grip.

Protein: Protein requirement is more than or equal to 1.8g protein per kg dry body weight.

Patients with cirrhosis need considerably higher minimal daily protein intake of around 60g to maintain nitrogen balance in contrast to 35g needed by healthy individuals. Therefore contrary to the popular belief that liver patients need low protein diets they need high protein diets to improve lean tissue mass. However very high level of protein (e.g.100g a day) is best avoided in acute liver failure and decompensated cirrhosis. Protein restriction is not beneficial in patients with hepatic encephalopathy.

In compensated liver disease –	1.2 – 1.3 g/kg/day
In decompensated liver disease –	1.5 – 2 g/kg/day
In post transplant	1.5 – 2 g/kg/day
Acute (fulminent) liver failure	1.2 – 1.5 g/kg/day

Fat: Attempts should be made to keep the fat intake around 25% of total calories.

- Loss of appetite, nausea and vomiting can lead to severe weight loss, as well as shortage of vitamins, minerals calcium, magnesium and zinc.
- Demand of B vitamins is increased.

4. Dietary guidelines

The ideal diet for cirrhosis is a heart-healthy diet or one that is low in fat and adequate in protein rich foods, high in fruits, vegetables and whole grains. Patient should maintain a normal weight as well.

- Patients with liver disease can tolerate a normal diet and do not require severe dietary restrictions.
- 4–7 small meals per day compared to 3 main meals a day will avoid subsequent muscle catabolism.
- Patients who are unable to meet the demand, may need sip feeds.
- Patients who cannot meet their nutritional requirements with diet and oral supplements, enteral nutrition is considered.
- **Nasogastric feeding** is recommended. It is important to ensure both energy and calorie requirements are met. High protein & energy feeds are useful.(1.5 kcal/ml & 7.5 g protein /100 ml)
- Enteral nutrition improves nutritional status, liver function, reduces complications and helps prolong survival

Nasojejunal feeding :

- Can be used for patients with high volume ascitis, early satiety, nausea, vomiting. reduced gut mortality and poor absorption encephalopathy.
- Nasojejunal feed delivers food into the small bowel overcoming above problems.
- Together with continuous oral feeds majority or entire nutritional requirement can be met by this method.

Carbohydrates:

Most of the calories should be delivered through carbohydrates, present in grains, vegetables and fruits. The grains must be whole grains such as brown rice and wholegrain bread.

Protein:

Take an adequate, but not excessive amount of proteins. It's known that plant based proteins (such as Dhal & beans, lentils & soy foods) and dairy sources (including eggs, milk & yoghurt) are better tolerated by

these patients. However these patients can consume non-plant based protein containing food without a problem (fish, meat, poultry).

Fat:

An increased fat intake, in patients with impaired liver function can aggravate the hepatic inflammation and fibrosis.

Patients with cirrhosis often experience difficulty of digesting and absorption of fat resulting in steatorrhea. Therefore modification of dietary fat is required. Reducing the dietary fat up to 25% of calories recommended. As medium chain triglycerides (MCT) does not require bile for absorption foods containing MCT such as coconut oil may be used in place of other fats.

Refrain from eating foods that contain excess amount of fat. It's advisable to consume a significant proportion of fat from omega–3 fatty acids.

Micronutrients:

Patients with hepatic failure are usually deficient in many vitamins and minerals .Magnesium depletion and zinc deficiency are common at later stages and Thiamine deficiency is common among alcoholic cirrhosis. Deficiency of fat soluble vitamins is observed in patients with steatorrhea due to cholestasis, bile salt deficiency and in alcohol abusers. Vitamin D deficiency leading to osteoporosis is common in these patients. Night blindness due to Vitamin A deficiency is also well recognized. Micro nutrient supplementation specially covering up above groups would be appropriate.

5. Other measures

Salt restriction:

Assess the individual salt intake. Eating less sodium may help prevent fluid build up in patient's abdomen (ascites) and legs. **Salt restriction is recommended only if the patient is having ankle oedema or ascites**.

- Cook with less salt
- Limit packaged foods and restaurant foods with high salt.
- Encourage to have foods with no added salt – ***e.g.*** natural foods
- Salt substitutes are best discouraged as they can be high in potassium and will prevent adoption of the individual to a low salt diet.
- Use low sodium spices to add flavour.

Nutritional management of ascitis:

The lower the sodium intake, the faster ascitis resolves.

There are many considerations in the instigation of low sodium diet.

1. nutritional status, appetite
2. degree of ascitis
3. whether diuretic therapy is started
4. motivation of the patient & social support

If the patient is already malnourished or having loss of appetite, low sodium diet is better avoided. If ascitis and oedema responds to diuretics, low salt diet can be postponed. Patients with high ascitis inspite of high dose of diuretics require a low salt diet.

Prokinetic agents can be used for encouraging regular stomach emptying (for both oral & tube feeding). Most patients need oral supplements to fulfill nutritional requirements. Liquid restriction can be indicated by medical team for some patients.

Alcohol:

Alcohol is highly toxic to the liver. Individuals with liver disease should abstain from alcohol completely.

10 Dietary Guidelines & Nutrition Therapy for patients with burns

1. Introduction and Background

Severe burns cause extensive tissue damage and a hypermetabolic state. Therefore patients with major burns are required to have a diet high in calories and protein for promoting wound healing and maintaining their weight. Additional vitamins and minerals are also needed to help repair tissue damage.

Death due to extensive burns is almost certain if the patient losses more than 20% of his preburn weight. Mortality can be increased by respiratory failure due to smoke inhalation.

Effective nutritional therapy is very important for patients with burn injuries. Because of the physiological and metabolic alterations that accompany traumatic injury, nutritional therapy should be initiated at the time of admission to minimize hyper metabolic response, which facilitates proper medical and surgical management. Mode of nutritional therapy depends on the nature and severity of burns and the response of the

treatment. Nutritional management changes with the patient's clinical condition throughout the hospital stay.

Patients should be put on high protein and high energy diet. Oral drinks and diet should be promoted as early as possible.

During the acute phase, nutritional status further deteriorates due to various inflammatory processes, as this catabolic state triggers body protein breakdown, diminishing the body cell mass.

Monitoring and preserving of body cell mass and specifically, skeletal mass is the primary target of nutrition therapy.

Goals of nutritional management

1. To promote optimal wound healing and rapid recovery from burn injuries.
2. To minimize risk of complications including infections during the treatment period.
3. To achieve and maintain optimal nutritional status.

Objectives of nutritional management

1. maintain body weight within 5% to 10% of pre burn weight
2. prevent micro-nutrient deficiency
3. minimize hyperglycemia
4. minimize hypertriglyceridemia

Patients at risk

1. Patients with 20% or more of total body surface area (TBSA) burnt
2. Children with greater than 10% of BSA burns
3. People on therapeutic diets.
4. Burns of special regions - face, perineum, hands, feet

5. Inhalation injury
6. Circumferential burns
7. Any full thickness burns

All patients with burns should undergo a nutritional assessment within 24 – 48 hours of injury. Feeding should be started via enteral route within 6 – 18 hours after the burn injury.

Nutritional assessment:-

Nutritional assessment is a dynamic and continuous process.

1. Preinjury height, weight and clinical history including pre existing medical conditions serve as the basis for the patients initial nutritional assessment.
2. Patients with existing malnutrition should be quickly identified as they are at the greatest risk. They may need nutritional rehabilitation before further surgical treatment or prior to discharge.
3. Factors related to the burn injury may also affect the patient's ability to receive and utilize nutrients. These factors include severity, percentage of total burn surface area, location of wound, pain control, pyrexia, gender, age and other complications such as inhalation injury and organ dysfunction.
4. Special dietary needs should be identified. ***e.g.*** food allergy, therapeutic diets.
5. Patient's dietary preferences/food choices should be taken in to account especially for children, teenagers and elders

Nutrition Assessment tools:-

- Most of the nutrition assessment tools available are of limited use due to the consequences of the inflammatory process.

- Body weight is affected by expansion of extracellular water following burns, however once the patient is stable, dry weight can be taken for assessment.
- Though serum albumin levels are of no use in the acute phase, it can be used as the acute phase response subsides.
- A gradual increase in pre-albumin occurs when nutritional intake is adequate.

On going awareness:

A nutrition expert should constantly provide education and support to the patient, staff and care providers throughout all phases of recovery.

Management of less severe burns:

- Adults with burns less than 20% body surface area (BSA) may be able to meet their requirements orally.
- They are encouraged to drink and eat as soon as possible.
- A high protein, high energy diet should be offered.
- Intake should be monitored and the diet reviewed as recovery takes place.
- Enteral feeds may be needed if oral intake is inadequate
- Adults with burns involving face, air way or hands may need closer nutritional monitoring to ensure their ability to eat and drink.

Management of severe burns:

Aggressive nutrition therapy

It is essential to start aggressive nutrition therapy for patients with following features. Aggressive nutrition therapy aims to preserve lean body mass, promote wound healing and acceptance of skin graft and to promote immune competence.

- more than 20% BSA full thickness burn
- Pre injury malnutrition
- Septic complications
- Pulmonary damage
- more than 10% weight loss

Fluid requirement:-

Minor burn injuries (< 15% body surface area, (BSA) in adults and <10% BSA in children) may not require IV fluids.

In major burns, intravenous fluids should be given in order to maintain correct blood volume, blood pressure and urine out put.

Fluid requirement increases for patients with inhalation pulmonary injury.

- commence fluid replacement and calculate the requirement from the time of injury, preferably insert IV line through uninvolved skin.
- insert a urinary catheter if burnt area is more than 15% BSA or if there is a pereneal burn

Feeding:-

Depending on the severity of the patient, affected area and other complications, following feeding method options could be applied.

1. oral feeding
2. tube feeding
3. parenteral feeding

Starting oral or enteral tube feeding within few hours of the burn (within 4 -6 hours) is very important as it decreases the risk of paralytic ileus and thereby developing sepsis of gut origin.

Although oral nutrition is encouraged, people with severe burn injuries, especially young children (>15% BSA deep partial thickness or full

thickness burns) often require tube feeding due to the difficulties of achieving nutrition goals only with oral intake.

Nasoduodanal or nasojejunal at early post burn, is advantageous over nasogasric feeding as it (former) reduces abdominal distension, aspiration and nausea.

Advantages of utilizing enteral route as opposed to the parenteral route include improved nitrogen balance, reduced hypermetabolic response, reduced immunological complications and mortality.

The parenteral route does not provide adequate nutrition to the gut and is associated with higher rate of complications.

Adults with 20% or more BSA burnt, should have naso enteric feed via a fine bore tube and appropriate enteral feed preferably delivered in a continuous delivery mode over 24 hours.

Guidelines for tube feed, for burns:

- nutrient dense (***e.g.*** 1.2 – 2 kcal/ml)
- high protein (NPC : N ratio 100- 120 :1)
- low fat (25 – 30% of energy)
- fibre free (in the acute phase)

NPC - non protein calorie

N - nitrogen

Indications for discontinuation of tube feeding –

When the patient is able to take 70% of their dietary requirement orally, patient can be put on a trial of 3 days while 70% of patients diet is given orally during day time, rest of the 30% of requirement can be offered enterally only at night. If the process is successful, feeding tubes can be removed while patient is kept under observation. If patient's food intake is not satisfactory during the observation period, tube should be re-introduced.

Parenteral nutrition

Due to the difficulties of implementation, maintaining and the risk of potential septic and embolic complications of parenteral nutrition, tube feeding is always preferable and parenteral nutrition is limited to patients who do not tolerate enteral feeding only. Overfeeding of parenteral nutrition will result metabolic complications

Guidelines for appropriate total parenteral nutrition (TPN) should be followed.

Glucose – Glucose can not be utilised above a rate of approximately 5mg/kg/min.

Glucose should supply 50% of calories.

Lipid – 20-30% of calories from fat has protein sparing effects and minimises the problems associated with high glucose loads. Using a total parenteral nutrition (TPN) solution containing lipid also ensures supply of essential fatty acids required for wound healing.

Nitrogen – The maximum daily level of Nitrogen provision in patients with severe catabolism is approximately 0.3g/kg.

2. Standard dietary requirements

Carbohydrate – requirement of calories should be calculated using calorimetry method or standard formulas.

Protein – High protein delivery of 1.5-3.0 g/kg body weight/day or 20-25% of total energy is required from protein.

Fat – Fat should constitute **no more than 25-30% as total daily energy requirement** (but in fact 15-20% of non-protein energy as fat is optimal).

3. Dietary guidelines

A high-calorie, high-protein diet is needed to meet the higher demand of a patient with burns.

Carbohydrates:-

Patients with severe burns need to consume large amounts of calories to compensate for the increased metabolism. Calorie needs vary depending on the size of the wound and severity. Consuming carbohydrates allows body to use protein for muscle-building rather than energy for wound-healing.

High energy requirement of patients with burns is due to hypermetabolic response associated with severe burn injury. Current management of burns has resulted in some reduction in the metabolic response (due to pain killers etc.) and care must be taken to avoid over feeding.

Indirect Calorimetry (IC) is considered the gold standard for estimating energy requirements, as nutrition management can be individualized and matched to energy expenditure.

Access to IC is limited and there is no clinical evidence on the superiority of IC over formulae in the management.

There are variety of formulae designed to estimate energy requirements of patients with burns.

Requirement of calories for all patients:

= **25 kcal/kg actual BW + 40 kcal / %TBSA burn**

= 25 calories *x* kilogram of usual body weight + 40 calories *x* percent of total body surface area burned, with a maximum TBSA of 50 percent.

EER = BMR X I F X AF

where EER – estimated energy requirement
BMR – basal metabolic rate
IF – Injury factor
AF – activity factor

IF, Injury factor as follows:

Up to 10% burn – 1.0 - 1.1
10 -25 % burn – 1.1 - 1.3
25 – 90 % burn – 1.2 - 1.7
AF, activity factor – for bed bound immobile – 1.1
Bed bound mobile / sitting – 1.15 - 1.2
Mobile on ward – 1.25

For intensive care setting:

For spontaneously breathing patients:

EEE (kcal) = 629 – 11(A)+ 25(W) – 609(O)

where EEE = estimated energy expenditure;
A = age in yrs,
W = weight in kg,
O = presence of obesity > 30% above IBW: 0 = absent; 1 = present

Ventilator-dependent patients:

EEE (kcal) = 1784 – 11A + 5W + 244G + 239T + 804B

where A = age in yrs,
W = weight in kg,
G = gender: 0=female, 1=male,
T = diagnosis of trauma: 0=absent; 1=present,
B = diagnosis of burn: 0=absent, 1=present.

(Source **- Clinical Practice Guidelines, Nutrition Burn Patient Management**
NSW Statewide Burn Injury Service)

Carbohydrate food choices for a burn patient may include cereal, rice, bread, pasta, crackers, potatoes, beans, sugar, peas, corn, fruits and juice.

The recommendation is eight or more servings of carbohydrate foods.

Energy requirement should not exceed twice basal metabolic rate (BMR)

- Energy needs of burns patients have been reduced due to advances of burn care.
- Patient should not be over-fed as it can cause hyperglycemia, hepatic fat deposition and respiratory insufficiency.

Current recommendation is that carbohydrate infusion should not exceed 5 to 7 mg per kilogram per minute or1800 to 2200 carbohydrate calories per day.

Burn injury in children

Age 0–1 yr:	k cal /day = 2100 kcal/m^2BSA + 1000 kcal / m^2BSA burned
Age 1–12 yrs:	kcal/day = 1800 kcal/m^2BSA + 1300 kcal / m^2BSA burned
Age 12yrs or more:	kcal/day = 1500 kcal/m^2BSA + 1500 kcal / m^2BSA burned

BSA can be calculated as = weight (kg) x height (cm) x 0.6242

Protein:-

Patients with burns require additional protein to replace losses and support tissue growth for wound healing. Requirements further increase due to sepsis. Therefore high protein diet providing approximately 20% of calories from protein has been associated with reduced mortality and morbidity.

Increased protein breakdown, proteolysis of muscles and protein oxidation increases demand for proteins.

High protein delivery of 1.5-3.0 g/kg ideal body weight/day or 20-25% of total energy is required from protein for burn patients.

(***annex 07*** – amount of protein in grams in commonly used protein rich food)

Non nitrogen calorie ratio should be maintained between 150:1 and 100:1 according to the percentage of total body surface area(TBSA).

% burn	protein/kgBwt/d	NPC: N ratio
< 15	1.0-1.5	150:1
15-30	1.5	120:1
31-49	1.5-2.0	100:1
50+	2.0-2.3	100:1

Biologicaly high quality proteins are preferred because it has all the essential amino acids such as eggs, meat, poultry, fish, and dairy. Nuts, seed and soy are also good protein sources.

Patients need to eat at least 3 servings of high biological value protein foods daily. One serving should be approximately 60 g of weight.

Patients should take at least 2 cups of whole milk a day. If milk is not tolerated, lactose free milk is an alternative. Other dairy foods, such as ice cream, cheese and yoghurt, are also good sources of protein and calories.

A suitable feed should have energy nitrogen ratio of

100-120 :1 for shock burns &

100- 150: 1 for non shock burns.

For

< 1 year	use the reference nutrient intake (RNI) for protein
1 – 3 years	2-3 g / kg / day
> 3 yrs & adolescents	1.5 – 2.5 g / kg / day

Fat:-

Fat is needed in the diet after burns in order to provide essential fatty acids and additional calories. Fat should constitute no more than 25 – 30% as energy, but in fact 15 -20 % of non protein energy as fat is optimal.

- Inclusion of various oily nuts and unsaturated oils in the diet would be important for patients with burns as they are in increased demand for essential fatty acids.
- Avocado is a good source of unsaturated fat.
- Consuming oily fish-a source of omega 3 fatty acid helps fast recovery and wound healing
- Adding butter, margarin or coconut oil to the food will not only help fulfilling high calorie demand but also improved apetite.

Micronutrients:-

Provision of at least recommended dietary intake (RDI) of micro nutrients especially known to be associated with healing and immune function (vitamin A,C,E, some B vitamins, Zn, selenium and copper) is very important. Vitamin D Synthesis is impaired in the skin of burn patients both acute and long term. Therefore recommended dietery allowance of Vitamin D is 400IU per day. Recent research indicates that supplementation of fish oil and glutamine may benefit.

Vitamin and mineral needs are five to 10 times higher in burn patients. Additional supplementation with vitamin A and vitamin C will help in wound healing and collagen synthesis.

Micronutrients can be given as enteral feeds. Include various foods from six food groups in the diet. Fruits and vegetables are important sources for micronutrients, and five servings a day are recommended.

1. Requirements for B group vitamins increase proportionately to energy requirements.

2. Vitamin C needed for collagen synthesis. Daily intake 300 – 1000 mg/day.

3. Vitamin A deficiency can cause stress ulcers of gut and delay wound healing.

4. Iron & zinc – help recover from burn wounds. Iron carries oxygen to the cells, which is important for cell regeneration. care should be taken with iron supplements as it increases the risk of infection and mortality.

5. Trace elements especially, zinc and copper is essential. Zinc functions similarly to proteins as it assists in tissue repair and wound healing.

4. Other measures

- If a patient with burns is unable to meet his needs through diet only, nutritional supplements can provide additional calories, protein, vitamins and minerals.
- Enteral tube feeds should be administered by pump infusion using undiluted formula.
- Enteral feeding should continue until only small areas are left to heal.
- Overnight tube feeding is often useful in the transition period.
- Parenteral feeding carries the risk of septicemia and is difficult to find an access due to burns.
- Patients with paralytic ileus may have to be put on total parenteral nutrition.
- Lipid free regimes should be discouraged.

Overfeeding the patients can cause serious complications such as hyperglycaemia, fatty liver, and respiratory insufficiency.

In septic burns, there are problems with absorption due to ischemia of the gut. Therefore overfeeding and excess calory should be avoided in these patients.

Increasing caloric energy beyond 1.2 x resting energy expenditure results in increased fat mass without changes in lean body mass.

Hence there is no rationale for feeding at intakes greater than estimated energy requirements.

Nutritionally dense high protein & high calaory foods should be included in the diet. In addition to the standard commercial supplements, food items can be prepared using following-

Milk, curd, eggs, fish, meat, yoghurt, pulses, wattalappan, banana (*Anamalu*), avocado, milk shakes, sesame products (*thala guli*), products of ulundu (*ulundu wade, itly,* etc.) brown rice cunji/porridge with added milk, thriposha or similar home made preperations.

Proper diet and hydration have a critical role in patients with burns. It is imperative that health care workers pay due attention to this area while instituting appropriate clinical management measures.

11

Dietary Guidelines & Nutrition Therapy

Nutrition management of critically ill patients (Patients in Intensive Care Units)

1. Introduction

These guidelines may be used for nutritional support in adult patients in critical care units of Sri Lanka. In this chapter, enteral feeding refers to non-volitional delivery of nutrients via a tube into the gastrointestinal tract, and parenteral feeding refers to aseptic intravenous delivery of sufficient nutrients where adequate alimentary delivery of nutrients is not possible.

Critically ill patients are in a catabolic state induced by severe disease and appropriate nutritional support should be initiated as early as possible, in all patients admitted to the critical care unit unless indicated otherwise. Starvation and underfeeding in critical care patients are associated with increased morbidity and mortality.

Nutritional support can be provided by enteral or/and parenteral routes, enteral being the preferred one.

It is important in patients who are malnourished and those who are at the risk of malnutrition. (Annex 8)

During a critical illness, in addition to catabolic stress, there is an increased inflammatory response leading to increased nutritional requirement. Also there is an altered gut morphology and function, causing impaired digestion and absorption.

Poor nutrition in critically ill patient causes decreased immunity, decreased respiratory muscle function and a reduced respiratory capacity, ventilator associated pneumonia, difficult weaning off ventilator and poor wound healing.

Assessment of Nutritional Status

Traditional nutritional assessment tools are not validated for use in the critical care setting. The assessment usually include

- Evaluation of weight loss
- Previous nutrient intake
- Level of disease severity
- Co-morbid conditions
- Function of the gastrointestinal tract
- Serum Albumin level
- Daily nitrogen balance (Annex 9)

Calculation of Energy &Nutrient requirement (Annex 9)

Though there are several formulae and methods available to calculate the energy & nitrogen requirement for nutritional support, they are not validated for the use in critical care patient and they are cumbersome to use.

Practical approach for calculation of energy & nutrient requirement:-

Energy	**20–30 kcal/kg/day***
Carbohydrate	**50–55% of total calorie intake**
Lipid	**30–35% of total calorie intake**
Protein	**1.2–1.5g/kg/day****

**ASPEN 2009*

***extra losses should be replaced; but should not exceed 2g/kg/day;*

ESTABLISHING ENTERAL FEEDING IN ICU SETTING

Enteral Nutrition is preferred as it

- maintains gut integrity by maintaining tight junctions between intraepithelial cells, stimulating blood flow and inducing release of trophic endogenous agents
- modulates stress and systemic immune response
- attenuates disease severity
- can be used as a conduit for the delivery of immune modulating agents
- is an effective means of stress ulcer prophylaxis

Enteral feeding should be started **within 24-48 hours** following admission if volitional intake is unlikely within 3 days.

- The patient is haemodynamically stable (MAP> 60mmHg, stable on low doses of pressor agents)
- There is a functioning gastrointestinal tract

Presence or absence of bowel sounds or evidence of passage of flatus/stool is not required for the initiation of enteral feeding in the critical care setting. Enteral nutrition promotes gut motility and as long as the patient is haemodynamically stable, it is safe to feed through mild to moderate ileus. [11]

Access Techniques

1. Gastric Feeding
2. Small bowel feeding - if there is high risk of aspiration or intolerance to gastric feeding

Gastrointestinal access for up to 4-6 weeks is usually achieved using a orogastric/nasogastric (NG) or naso-jejunal (NJ) tube, although placement of a percutaneous gastrostomy or jejunostomy should be considered sooner if feeding is likely to be prolonged (more than 6 weeks).

Most enteral feeds are given in to the stomach to allow the use of hypertonic feeds, higher feeding rates & bolus feeding.

Large bore feeding tubes should be avoided as they irritate the nose, pharynx & oesophagus and increase the risk of gastric reflux & aspiration. They are used initially to facilitate measurement of gastric residual volume and changed to a finer bore feeding tube once enteral feeding is established.

How to place a nasogastric tube is outlined in annex 10.

Administration of Feeds

Modes of administration could be either one of the following.

- Bolus feeds - administration of 200-400ml of feeds through a feeding tube over 15-60 minutes at regular intervals. A 50ml

syringe can be used with or without a plunger, for feeding. This technique may cause bloating, diarrhoea & "dumping syndrome".

- Intermittent feeds - moderate rates of feeding via either gravity or pumps. Depending on patient's needs, a break in feeding of 6 hours or more is recommended.
- Continuous feeds– prevent diarrhoea/dumping in some patients but results in higher intragastric pH levels than bolus feeding which can promote bacterial growth.

What to give enterally?

Presently the enteral feeds are prepared locally for each patient in the critical care unit.

Refer to the chart of nutritional values of food items when prescribing the enteral feeds. (Annex 11)

There are commercially available enteral formulations which can be used on their own to provide most of the total nutritional requirement of a critically ill patient, even though these may not be freely available in the state sector.

Such commercially available fortified milk formula may be added as appropriate when available.

If the relatives are requested/allowed to bring feeds (***e.g.*** soup), they should be advised on what to add and how to prepare.

Prescribe a multivitamin to be added to the feed (Should not be added to a hot feed).

If available, always consider polymeric preparations for enteral feeding. However in a situation of proven or suspected intestinal malabsorption, a

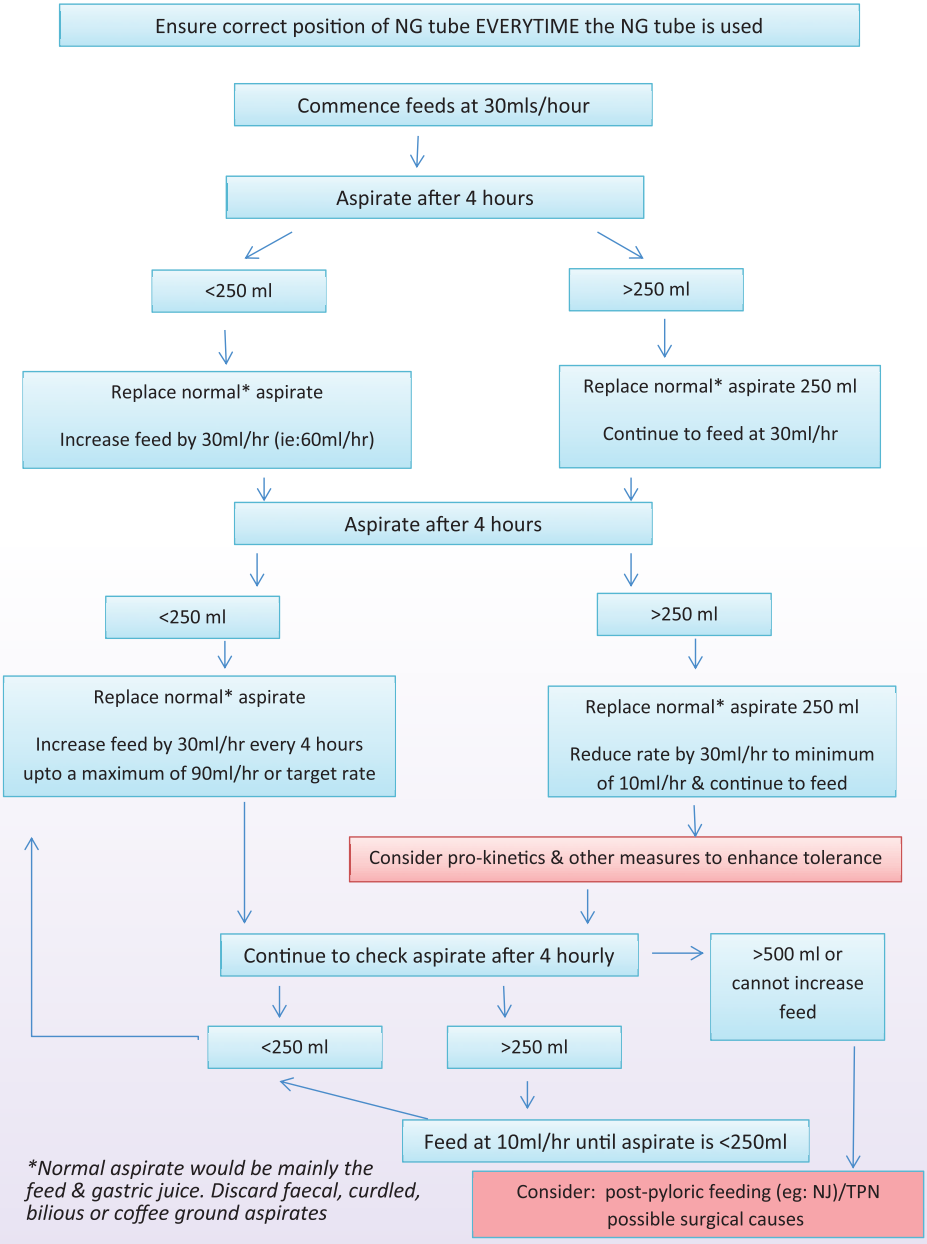
semi-elimental enteral feed may be introduced in patients with severe or persistent diarrhoea associated with the administration of a polymeric feed.

Preparation of the enteral formula (feed) should be done in a clean environment using hygienic technique by a trained personnel (nurse/ pharmacist).

Purified water (boiled cooled water) or sterile water should be used for irrigation/flushes, reconstitution of formula & dilution of medication.

Sterile gloves should be used when handling and administering enteral feeds and all efforts must be taken to minimize contamination.

SUGGESTED ALGORITHM FOR ESTABLISHING ENTERAL FEEDING ON ICU



**Normal aspirate would be mainly the feed & gastric juice. Discard faecal, curdled, bilious or coffee ground aspirates*

Practice Recommendations:

- Evaluate all enterally fed patients for risk of aspiration
- Ensure that the feeding tube is in the proper position before initiating feeding [20] and everytime the patient is fed.
- Keep the head of the bed elevated at 30-45 degrees at all times during the administration of enteral feeding.
- When possible, use a large-bore tube only for the first 1-2 days of enteral feeding (as there is an increased risk of sinusitis & discomfort with large bore tubes) & evaluate the gastric residual volume (GRV) using a 50ml syringe.
- Check GRV every 4 hours during the first 48 hours for gastrically fed patients. Once the enteral feeding goal rate is achieved and/or the large bore tube is replaced with a softer small bore feeding tube, GRV monitoring may be reduced to every 6-8 hours in non-critically ill patients. However, every 4 hour measurements are prudent in critically ill patients.
- If the GRV is > 250ml after a second gastric residual check, a pro-motility agent should be considered in adult patients if there are no contraindications. Discontinue pro-motility agents after 24-48 hours if ineffective and they should not be used routinely.
    - Metoclopramide 10mg IV tds
    - Erythromycin 150-250mg IV oral qds
- A GRV of >500ml persistently should result in holding or reducing the enteral nutrition (EN) temporarily & re-assessing the patient's tolerance.

- Tolerance can be enhanced by minimising sedation, reducing opiate use, maintaining serum potassium within normal limits, especially avoiding hypokalaemia and controlling hyperglycaemia.
- Chlorhexidine mouth wash should be used thrice a day to prevent ventilator associated pneumonia.
- Consider post pyloric feeding, when the GRV consistently remains >500ml.
- Increase feed only as tolerated, observing any signs of vomiting, nausea, regurgitation & abdominal discomfort/distension.
- For GRV 200 – 500 ml, implement measures to reduce risk of aspiration.

  Factors that increase risk of aspiration are:

  – Patient with endotracheal tube
  – Patient on mechanical ventilation
  – Age >70 years
  – Reduced level of consciousness
  – Patient position
  – Transport out of intensive care unit (ICU)
  – Poor nursing care
  – Poor oral health
  – Use of bolus intermittent feeding
- Blue food colouring should not be used as a monitor for aspiration.[11]
- Once a maximum rate of 90 ml/hour or the target rate has been achieved, continue at this rate & feed over 20-22 hours & rest the gastro-intestinal tract for 2-4 hours. If insulin

administration is needed, it is safer and more practical to administer feeding continuously over 24 hours

- Blood glucose level should be monitored a minimum of every 4 hours for 48 hours, aiming for less than 10mmol/L, twice daily thereafter, unless otherwise indicated. If blood glucose level is > 10mmol/L, commence a sliding scale insulin regime.

- If the feed is stopped for a procedure or for any other reason, continue to monitor blood glucose levels and review the insulin regime.

- Efforts should be taken to minimise the time period the patient is kept nil by mouth for diagnostic tests and procedures to prevent inadequate delivery of nutrients and prolonged periods of ileus.

- Check the serum sodium levels & if it is >145mmol/l look for possible causes e.g dehydration, high sodium content in medication. If sodium level is above 150mmol/l, use low salt feeds.

- Additional fluids may be required. Flush the NG tube with 30-50mls sterile water before & after feeds and before and after any medication.

- Change the giving set of an open system every 24 hours and in a closed system, 24-48 hours or as per manufacturer's guideline

- Any signs of intolerance should be closely scrutinised for possible early signs of gut ischemia (a rare complication occurring in <1 %); signs to be observed are,
  - Abdominal distension
  - Abdominal pain
  - Increasing nasogastric tube output or gastric residual volume

- Decreased passage of stool & flatus
- Hypoactive bowel sounds
- Increasing metabolic acidosis and/or base deficit

Enteral feeding should not be stopped for gastric residual volumes <500 ml in the absence of other signs of intolerance.

ESTABLISHING PARENTERAL NUTRITION IN ICU

Consider whether parenteral nutrition (PN) is appropriate. **Do not start PN until enteral feeding has been tried for at least 5 days or unless it is contraindicated.**

Indications for PN:

- If enteral feeding is not feasible for 7 days
- If target enteral nutrition (EN) was not achieved after 7 days, as supplementary to EN
- Should consider in patients who are malnourished or at risk of malnutrition and meet following criteria,[26] (Annex 8)
  - Inadequate or unsafe oral and/ or enteral nutritional intake
  - Non-functional, inaccessible or perforated gastrointestinal (GI) tract
- If a patient is expected to undergo major upper GI surgery and EN is not feasible, PN should be started–
  - If the patient is malnourished, start PN 5-7 days prior to surgery & continue to the post operative period
  - If the EN cannot be initiated before 7 days after surgery.

For people who are not severely ill or injured, nor at risk of refeeding syndrome (Annex 8) the suggested nutritional prescription for total intake should provide the following.

Energy	**20-30 kcal/kg/day**
Protein	**1.2-1.5 g/kg/day (0.12-0.24g Nitrogen/kg/d)**
Fluids	**30-35 ml/kg/day**
Vitamin B	**100-300mg/day** *for 3 days if patient is alcohol dependant*
Multivitamin **Trace elements**	**Once daily – in appropriate doses**
K+*	**1-2 mmol/kg/day**
Phosphates*	**0.3-0.6mmol/kg/d** *not available in SL at the time of publication of this guideline*
Mg++*	**0.2 mmol/kg/day**
**should be guided by the serum level*	

CALCULATION OF PARENTERAL NUTRITION FOR A 70 kg PATIENT

1. CALCULATE ENERGY REQUIREMENT

20-30 kcal/kg/d*

Eg: 70 x 30 = 2100 kcal/d

*refer appendix 10 for the most appropriate daily requirement for the patient

2. CALCULATE CARBOHYDRATE

CARBOHYDRATE = 50 - 55% (minimum of 2g/kg/day)[11]; 2100 x 50% = 1150 kcal

Carbohydrate 1g produces 4 kcal

50% dextrose contains 500g in 1000ml; ie 1ml = 0.5g

Daily 50% dextrose requirement = (1150 ÷ 4) ÷ 0.5 = 575 ml

3. CALCULATE FAT

About 30% of calories to be supplied by fat

Eg: 2100 x 30% = 630 kcal

1g of fat produces 9 kcal

10% Lipofundin contains 100g of lipids in 1000ml; 1ml = 0.1g

Daily 10% Lipofundin requirement = (630 ÷ 9) ÷ 0.1 = 700 ml

Consider Energy provided by Propofol; 10% Propofol provides 1.1kcal/ml as fat

4. CALCULATE PROTEIN REQUIREMENT

1.2–1.5g protein per kg per day; 1.2x70=84g

10% aminoplasmin contain 100g of protein per 1000ml; 1ml=0.1g

Daily 10% aminoplasmin requirement= (1.2x70)÷0.1 = 840 ml

5. FLUID REQUIREMENT

30-35ml/kg/day

= 35 x 70 = 2450 ml/day

Consider the volume of fluid given as infusions

MINERALS* *(Refer page 14)*

	Daily requirement/kg	For a 70kg adult
K+	1-2 mmol	140 mmol
Mg++	0.2 mmol	14 mmol
Phosphates	0.3-0.6 mmol	21 mmol

Should be guided by the monitoring of serum level

FINAL PRESCRIPTION FOR 24 HOURS

- **10% Lipofundin - 630 ml**
- **50% Dextrose -575 ml**
- **10% Aminoplasmin - 700ml**
- **KCl - 140 mmol**
- **MgSO4 - 14 mmol**
- **the balance fluid requirement to be prescribed as an appropriate intravenous fluid**

**Electrolyte/ vitamin & mineral requirements*

Providing **micronutrients** (Glutamine/ Fish Oil/Anti-oxidants) as well as inclusion of full range of **trace elements & vitamins** is an integral part of nutritional support.

Thiamine & Vitamin C deficits pose special risks. Thiamine supplements (100-300mg/daily) should be provided in the first three days to patients with possible deficiency and for patients with alcohol abuse as thiamine deficiency is more common among the critically ill.

Access for Parenteral Nutrition

Centrally administered PN could be via a centrally placed (internal jugular vein or subclavian vein) or peripherally placed (PICC) central venous catheter and **a lumen should be dedicated** in a multi lumen catheter. Femoral CVC should be avoided as the risk of infection is higher with them.

Tunnelling of subclavian catheter or a PICC is recommended if PN is likely to be needed for a long term (> 30 days).

Administration via peripheral venous catheter may be done in patients who need short term PN and those who have no other need for central line. The mixture should be of low osmolarity (<850 mOsm/l).But viscid solutions like lipid emulsions cannot be given peripherally. Though not available in the state sector, there are commercially available preparations for peripheral PN.

Mode of delivery

Continuous administration of PN should be used as the preferred method of infusion in severely ill patient who require PN.

Cyclical delivery of PN should be considered when using a peripheral venous cannula.

Monitoring

PARAMETER	DAILY	THRICE A WEEK	WEEKLY	PRN
Weight	Initially		✓	
Catheter site	✓			
Glucose	Initially	✓		
Electrolytes	Initially	✓		
PO_4^{--} /Mg++/Ca++ /BUN/Cr		Initially	✓	✓
Triglycerides			✓	✓
Total Bilirubin/ LFT		Initially	✓	✓
Temperature	✓			
FBC	✓			
Hb/HCT	✓			
Lymphocyte count	✓			✓

- Complications
  - GI tract related (fatty liver/ cholestasis/ GI atrophy/ Refeeding syndrome)
  - Vascular access related (catheter related sepsis)
  - Metabolic (hyper & hypoglycaemia/ electrolyte imbalances/ pre-renal azotemia)
  - Fluid overload
- Highlight the start of each 24 hour feed period.
- Giving sets must be clearly labelled (date & time) and changed every 24 hours.

- Check the expiry date of the parenteral feed being delivered.
- Monitor blood glucose levels. Aim for <10mmol/L blood glucose levels.
- If the feed is stopped for a procedure or for any period of time, continue to monitor blood glucose levels & review insulin regime
- In a patient stabilised on PN, periodically repeated efforts should be made to initiate EN. As tolerance improves, volume of EN calories should be increased and PN calories supplied decreased

NUTRITION GUIDE IN SPECIAL CIRCUMSTANCES

Pulmonary Failure

- Speciality high lipid low carbohydrate formulations designed to manipulate the respiratory quotient and reduce CO_2 production is not recommended for routine use in ICU patients with acute respiratory failure.
- Avoid total caloric provision that exceeds energy requirements, as CO_2 production increases significantly with lipogenesis.
- Fluid restricted calorically dense formulations should be considered for patients with acute respiratory failure.[2]

Renal Failure

- Should be placed on standard enteral formulations, and standard ICU recommendations for protein and calorie provisions should be followed. If significant electrolyte abnormalities exist or develop, a speciality formulation designed for renal failure may be considered. i.e. Speciality formulations lower in certain electrolytes than standard products may be beneficial in the ICU patient with ARF.

- Patients receiving haemodialysis or continuous renal replacement therapy should receive increased protein, up to a maximum of 2.5g/kg/day.[2]

Hepatic Failure

- Traditional assessment tools should be used with caution in patients with cirrhosis and hepatic failure, as these tools are less accurate and less reliable due to complications.
- Energy needs in critically ill patients with liver disease are highly variable and are difficult to estimate using simple equations.
- EN is the preferred route of nutrition therapy in ICU patients with acute / chronic liver disease. EN improves nutrition status, reduces complications, and prolongs survival in liver disease patients and recommended as the optimal route of nutrient delivery.
- Proteins should not be restricted as a management strategy to reduce risk of developing hepatic encephalopathy. Protein requirements for the patient with hepatic failure should be determined in the same manner as for the general ICU patients.
- Branched chain amino acid formulations should be reserved for the rare encephalopathic patient who is refractory to standard treatment with luminal acting antibiotics and lactulose.[2]

Pancreatitis

- Patients with acute pancreatitis should be evaluated for disease severity on admission.
- Patients with severe acute pancreatitis should have a naso-enteric tube placed and EN initiated as soon as fluid volume resuscitation is completed. These patients have minimal chance of establishing oral feeds within 7 days.

- Patients with severe acute pancreatitis will have improved outcome when provided early EN. These patients may be fed enterally by the gastric or jejunal route.
- In patients with severe acute pancreatitis, tolerance to EN may be enhanced by
  - Early initiation of EN
  - Displacing the level of infusion of EN more distally in the GI tract
  - Changing the content of the EN delivered from intact protein to small peptides and fat free elemental formulation.
  - Switching from bolus to continuous infusion.
- For patients with severe acute pancreatitis when EN is not feasible, use of PN should be considered. PN should not be initiated until after the first 5 days of hospitalization during which period EN should be attempted repeatedly.[2]

Sepsis

- Starting calculated amount of nutrition before haemodynamic stability may be harmful.
- In very severe sepsis, it is difficult to determine,
  - benefit of very early EN
  - appropriate amount
  - nature of nitrogen supply
  - the risk benefit ratio of lipids
- Modern metabolic approach in septic patients,
  - Immune modulating enteral formulations used for appropriate patient populations[11]
  - prevention of gut failure in stress
- Arginine and omega-3-fatty acids need further investigations

Simple guideline

- Restriction of energy supply both in carbohydrate and lipids - < 1000kcal/day for 2-3 days.
- Cautious increase in nitrogen supply above 0.20g/kg/day
- Adequate supply of magnesium and phosphorous, trace elements – zinc, selenium, Vitamins – E, K

Obese patient

- In critically ill obese patient, permissive underfeeding or hypocaloric feeding with enteral nutrition is recommended.
- For BMI >30, the goal should not exceed 60%-70% of the target energy requirement or 11-14 kcal/kg actual body weight per day (22-25 kcal/kg ideal body weight per day).
- Proteins should be provided in a range of

  ≥2g/kg ideal body weight per day for BMI 30-40

  ≥2.5g/kg ideal body weight per day BMI ≥40

Nutrition therapy in end of life situations

- Specialised nutrition therapy is not obligatory in cases of end of life situations.
- Decision to provide nutrition therapy should be based on effective patient/family communication, realistic goals and respect for patient autonomy.[2]

12 Dietary Guidelines & Nutrition Therapy for Tuberculosis

1. Introduction & Background

Tuberculosis (TB) is an infectious disease caused by a bacteria mycobacterium tuberculosis. The disease mainly affects lungs but it also can affect bones, bowels and brain etc. The disease is common among low socio economic groups with poor ventilation, overcrowding, poor exposure to sunlight etc.

It is a significant health problem with an incidence of 10,000 patients per year in Sri Lanka. Malnourished people are more vulnerable to be infected with TB and on the other hand when they are infected with the disease, they become further malnourished, sometimes becomes emaciated / cachetic. Lean muscle mass and fat layer are equally affected. Improvement of patient's nutritional status with proper treatment ensures fast recovery.

Decrease survival and delayed response for treatment were observed in TB patients with accompanying malnutrition. Before the discovery of chemotherapy, TB patients were treated with frequent feeds of fruit juices and fresh milk which indicates the importance of nutritional management of TB.

2. Diet related and other issues

- At the time of the diagnosis, majority of TB patients are undernourished.
- Wasting is common due to higher protein catabolism.
- These patients have a high nutrition demand due to active infection.
- The situation is aggravated by associated loss of appetite due to both infection and multiple drug treatment.
- High prevalence of anemia is seen in a significant proportion of patients with TB.

3. Standard dietary requirements

- In general, additional 200–300 kcal per day is required. (approximately 35–40 kcal per kg of ideal body weight)
- An intake of 1.2–1.5 g of protein per Kg body weight per day or 15% of energy of total daily intake or approximately 75–100g of protien will be sufficient for a day.
  - The patients who are underweight, 1.7g of protein per Kg body weight per day is required while those who are overweight requires 1g per Kg body weight per day.
- The requirement of Iron and calcium of this patient is considered to be higher than that of a normal individual.
- Requirement of all micronutrients particularly Selenium, Zinc, Copper, Potassium and Manganese is also increased, in order to initiate and enhance the immune response.
- Vitamins specially A, C, E and B complex requirement rises during the active infection.

4. Dietary Guideline for TB patients

TB patient needs a well balanced diet with all the food groups. As most patients are underweight or wasted at the time of diagnosis, they need to have a prompt correction of nutritional deficiencies.

Recovery of the weight loss can be achieved by increasing the intake of food with correct food balance, using the calorie dense foods (***e.g.*** adding more oil or butter) and protein rich foods with increased frequency.

For very ill patients who are severely malnourised a high energy diet would be very useful specially if they are on enteral feeds.

An assessment of BMI at the first visit and a regular follow up is mandatory, particularly for patients with weight loss. This will serve as an indicator of the progress as well.

Cereals:

- Cereal based high energy diet is recommended to meet the higher energy demand.
  - Parboiled or minimally milled rice, whole flour preparations, whole meal bread, other cereals & yams may be used as the staple.

Protein rich foods:

TB diet should be rich in protein as it is essential for immune response, including healing process. They need extra protein of high quality.

Complete proteins provide the best option; such as eggs, milk, meat and other animal proteins. Offer a variety of protein rich food including fish, beans, pulses, eggs and meat.

Eggs – eggs have high quality proteins: it is recommended to have at least one egg a day with other animal sources or/and plant proteins.

– If other animal sources of protein are scarce in the diet, the patient can have 2 – 3 eggs per day during the period of recovery. Patients with atherosclerotic diseases and diabetes can use only 2 – 3 eggs per week.

Pulses & legumes - are preferred to be included in the daily diet as they are rich in proteins, fibre and micronutrients, including iron & Zn which will encourage the healing process. Fibre will help regular bowel movements as patients are more prone to constipate.

- Sprouted pulses are beneficial because of additional amount of vitamin C and bioavailability of iron.
- Soya, soya products and other legumes are also recommended specially for vegetarians.
- Combining pulses with the cereals enhance the quality of proteins
- As some pulses and legumes lack in some amino acids, mixing of two varieties improves the quality of the protein.

Milk & milk products

- Milk is rich in Calcium and plays a major role in improving immunity which helps speedy recovery. Milk is a good source of retinol and this is particularly advantageous in TB patients as the conversion of beta carotene to retinol is affected.
- Fresh cow's milk with non fat or low fat milk is preferable
- Patients with lactose intolerance can use yoghurt, curd, lactose free milk etc
- Those who cannot consume milk can choose non-dairy items that are rich in calcium. ***e.g.*** Soya milk
- 3 glasses (1 glass = 200 ml) of milk per day (morning, afternoon and evening) or equivalent milk products are recommended.

Fruits and Vegetables

Fruits and vegetables play a very important role in TB diet as micronutrients are very important for recovery.

- Offer a variety of fruits and vegetables especially rich in potassium and vitamin c needed for curing the disease.
- Fresh fruits are preferable to fruit juice.
- Eat variety of vegetables daily, including dark green leaves, legumes, yellow color varieties of fruits & starchy vegetables.

Recommended fruits:

Oranges, pineapples, water melon, papaya, banana, avocado, lemon, lime, pomegranates, grapes, guava, passion fruit, custard apple and many more.

Recommended vegetables:

Bottle guard, tomato, potato, pumpkin, spinach, beans, drumstick leaves, kathurumurunga leaves, carrot etc.

Fat and Oils

Adding oily nuts or small amount of oil (preferably unsaturated) to their diet will fasten the recovery of malnutrition and hence the recovery of the disease.

- Daily energy requirement can be supplemented with fat containing food not exceeding the recommended 20 – 30 % of energy requirement.
- Consume fat containing fruits and nuts daily, as they contain mono and poly unsaturated fatty acids which boost immune response.

e.g. Avocado, cashew nuts, peanuts

4. Other measures

- The patient should take complete rest – both mind and body. Any type of stress may delay recovery.
- Should spend most of the time in the open air and should sleep in a well-ventilated room. Fresh air is important in curing the disease.
- Exposure to sunshine is also essential as the tubercle bacilli are rapidly killed by sunlight
- Avoid smoking tobacco and live in smoke free environment.
- Use of alcohol should always be discouraged.

Measures to improve appetite

- Food should be prepared according to the patient's wishes and preferences which will improve appetite.
- Provide variety of foods (variation in the diet) and apply different cooking methods.

e.g. Tempering, backing, frying, salads, eating raw food, fruits in juice, shakes, smoothies.

- Spices and food condiments can be used appropriately to improve the taste and palatability.
- If loss of appetite is severe, traditional appetizers like lemon, lime or *Lunudehi, Rasam, cungee, duru hodi (thambum hodi*) can be used before meals.
- If the patient has a poor appetite, 6 small meals should be offered instead of 3 larg meals per day.

13 Dietary Guidelines & Nutrition Therapy
Management of Surgical patients

It is difficult to generalize the nutritional management of surgical patients due to the complexity and range of surgical procedures along with the diversity of patients. Nutritional management is different from elective to emergency surgery. Type and duration of surgery influence the speed of post operative recovery.

Pre operative malnutrition is a recognized cause of post operative morbidity and mortality. It is also associated with higher risk of post operative complications such as poor wound healing, impaired immuno competence, reduced cardiac and respiratory function, delayed recovery, increased duration of intensive care and hospital stay. Therefore appropriate dietary management has been shown to be an important correlate.

Objectives of nutritional support:-

- Enhance wound healing
- Reduce postoperative complications
- Shorten the period of convalescence

Nutritional management can be categorized to 3 stages.

Preoperative

Peri operative (peri operative includes pre, intra and immediate)

Postoperative

Preoperative nutritional management

Many patients awaiting surgery are already malnourished due to a variety of reasons.

- inadequacy of nutritional intake
- underlying pathology related to the surgery
- malabsorption, diarrhoea, nausea & vomiting
- causes of excessive nutrient loss
- increased metabolic needs
- any other pathology

Nutrition assessment:-

All surgical patients should be screened on admission for nutritional status and reviewed weekly.

A comprehensive nutrition assessment should be conducted by a nutrition expert or a physician. It is essential to determine any pre-existing nutritional deficiencies and develop appropriate interventions for correction.

A comprehensive nutrition assessment includes, complete medical history and examination, weight history, bio medical tests (laboratory values), anthropometry (BMI, triceps skin fold thickness, mid arm circumference, height, weight, age, sex etc).

Patient should be investigated for following conditions

- loss of appetite
- nausea /vomiting
- malabsorption
- protein losing enteropathy
- protein losing kidney disease
- metabolic disease
- liver disease
- any other condition that affects nutrition status

Bio medical investigations

1. complete blood count including serum haemoglobin status
2. blood sugar levels
3. lipid, liver & renal profile
4. indices of protein synthesis

a. serum albumin

b. serum prealbumin

c. serum retinol binding protein level

As half life of pre albumin and retinol binding proteins are shorter than that of albumin, former two are better indicators of recent nutritional deficit.

In order to develop simple reliable and reproducible screening tools, these parameters are often computed in scores, to grade the severity of malnutrition. ***e.g.***

1. NRI – Nutritional Risk Index
2. NRS – Nutritional Risk Score – this is a validated screening tool. (officially recommended by the European society of parenteral and enteral nutrition). It is based on the degree of malnutrition as defined by weight loss, food intake and BMI as well as on the severity of disease.
3. Mini nutritional assessment
4. Subjective global index (SGI)
5. Malnutrition universal screening tool (MUST)

Active nutritional support is required for following categories of patients those who are at risk. It can be offered by oral nutritional supplements or enteral feeding.

If NRS is >= 3 or at least one of the following.

Patients with unintentional weight loss within last 3 months of >10% body weight

BMI <20 kg/ m^2 with unintentional weight loss of > 5% body weight within the previous 3 -6 months is also predictive of malnutrition

BMI <18.5 kg/m^2

subjective global assessment grade C

serum albumin <30 g /L

elderly patients (>70 years)

For these patients any major surgical procedure should be postponed until nutritional deficiencies are attended to.

Most patients with gastrointestinal cancers have severe malnutrition preoperatively and their immunological functions are compromised. Prolonged postoperative fasting and insufficient oral food intake may worsen pre existing malnutrition. Hence there is an increased risk of post operative complications, these patients should under go appropriate pre operative and peri operative nutrition therapy prior to major onchological surgery.

Nutritionally stable patients

Nutrition management is helpful in achieving successful surgical out comes even for well nourished patients. Perioperative nutrition support positively influences the postoperative out come. Enhanced recovery programs should be developed for such patients minimizing preoperative fasting period and maximizing nutrition imputs.

Surgical constraints on nutritional intake

Inappropriate dietary restrictions

Nil by mouth for tests

Excessive preoperative fasting

Prolonged use of nutritionally inadequate clear fluids

Increased requirements for healing after major surgery

Early satiety with delayed gastric emptying

Nutrition therapy

The role of preoperative nutritional therapy is to improve undernutrition before surgery and postoperative nutrition aims at maintaining optimum nutritional status in the catabolic period after surgery.

Timing: Conventional enteral nutritional support is recommended for 10 – 14 days prior to major surgery in patients with severe nutritional risk. Immuno nutrition is administered for 5 -7 days prior to surgery to all cancer patients in order to improve immune function.

Immuno nutrition significantly reduces post operative complications like infections, length of hospital stay and mortality. Immuno nutrition basically contains a combination of glutamine, arginine, n-3 fatty acids RNA etc. When each component of immuno nutrition was given separately results doubtful.

Perioperative considerations

Prolonged overnight fasting has been the tradition and the rationale behind perioperative fasting is to reduce the risk of regurgitation and aspiration. Currently the period of fasting before surgery has been shortened to 2 hours before surgery for clear fluids (such as water, tea, coffee, plain fruit juices) and 6 hours for easily digested solids. The same recommendations apply for children and pregnant women who are not in labour.

Guidelines of American Society of Anaesthesiologists (ASA 1999) allows –

- consumption of clear fluids including fruit juices without pulp up to 2 hours before surgery
- a light breakfast 6 hours before procedure (***e.g.*** tea & toast) and or a normal meal 8 hours before

Physiological stress caused by surgical trauma causes transient rise in catacholamines results in energy expenditure and protein mobilization. Delay in post operative feeding with preoperative starvation causes significant negative nitrogen balance. Protein depletion results in loss of lean body mass and reduce muscle strength with increased risk of cardio respiratory impairment & impaired immunity (risk of infections)

Postoperative considerations

Commencing enteral or oral feeding within 24 hours of surgery is associated with optimum clinical out come. Early enteral feeding after surgery, reduces the risk of anastamotic dehiscence, pneumonia, wound infection and intra abdominal abscess, irrespective of type of surgery.

Intestinal permeability increases and impairs barrier function, post operatively. Therefore gut has a modulatory role in inflammatory and immune responses.

Early feeding after surgery:-

Post operative feeding within 6 – 12 hours helps to reduce post operative complications thus reduces intensive care and length of hospital stay.

Normal oral food intake or nutrition through feeding tube should be started within first 24 hours.

Optimal duration of nutrition therapy-

Post operative oral nutrition supplements for 8 weeks in malnourished patients enhances recovery of nutritional status and quality of life.

Absence of bowel sounds is not a contraindication for feeding. Bowel sounds are heard from the stomach and the large intestine. The motility of the small bowel which starts functioning in 6hrs is the critical factor.

Any surgery requiring handling of intestines impair motility. Metaclopromide can be used soon after surgery for delayed gastric emptying.

Typical stepwise introduction of enteral feeding overcomes the motility issue.

Route of administration

Nutritional support with or without regular diet can be administered in three ways

1. orally
2. enterally through a feeding tube
3. parenterally

Enteral route should always be the preferred choice unless intestinal obstruction, severe shock or intestinal ischemia is present.

Post surgical management

Requirement of energy depends on degree of trauma and other clinical factors. Major surgery, drain losses and sepsis increase energy and protein requirements.

- 25 -35 kcal/kg/day of energy with 0.8 -1.5 g/ kg/day of protein is recommended for initiation.

Quality protein sources are important in post surgical diet in order to prevent malnutrition as well as to build new tissue, repair wounds and to preserve muscle texture.It also helps the immune system to combat infections. ***e.g.*** fish, lean meats, skinless chicken,cheese, yoghurt, whole eggs and vegetarian sources like beans, dhal etc.

- Fluid requirement is 30 – 35 ml/kg/day. Additional fluid should be added if patient is having fever, drain losses & stoma losses.

Nutrition Assessment can be done with by biochemistry or anthropometry.

Postoperative hyperglycemia should be managed using insulin therapy as postoperative insulin resistance and hyperglycemia aggravate the inflammatory response. Tight glycemic control using sliding scale insulin therapy (if available) improves outcome

Wound Healing

Nutritional intervention is very important for wound healing. Dietetic goal is to consider quality and density of food rather than quantity.

- Nutrition assessment should be done at the beginning.
- If enhanced normal feeding fails to correct malnutrition, protein and energy rich supplements should be given
- If normal oral feeding with supplements fail to correct nutrition deficiencies, tube feeding has to be considered.
- If the patient is diabetic, management of diabetes is essential

Energy:-

Correction of malnutrition is an essential component of wound healing. An underweight patient has higher chance of developing pressure sores as the patient has reduced the fat layer subcutaneous and if immobile.

Protein:-

Protein deficiency affects wound healing (fibroblastic response), new blood vessels formation, collagen synthesis and wound remodeling processes. Protein goal is 1 – 1.5 g/kg/day. Sufficient intake of dietary protein optimizes wound healing. Specific amino acids may influence healing. ***e.g.*** Arginine, Proline

Research evidence suggests that glutamine supplementation helps in extensive burns by reducing systemic infections and mortality.

Fatty acids:-

Deficiency of dietary fat will inhibit tissue repair and wound healing. Omega 3 fatty acids may be beneficial both pre-operatively and post operatively

Micronutrients:-

Antioxidents, Vitamin A, C, E, Zinc, selenium, molybdenum and magnesium can potentially enhance wound healing.

Inclusion of foods from six food groups in the diet will help to combat most of the micro nutrient requirements. Consumption of plenty of fruit and vegetables (minimum of five) helps receiving not only micro nutrients but also antioxydants and phytochemicals which are naturaly present in plants.

A multivitamin preparation with RDA levels may be useful if requirements cannot be reached by diet alone. Iron deficiency anaemia impairs wound healing.

Functional Nutrients

Glutamin

Adding glutamine to otherwise depleted formulae is beneficial but not for standard or immuno enhancing enteral feeds.

Immuno enhancing nutritional formulae (IEN) are considered beneficial. They usually contain arginine, glutamine, nucleotides, omega 3 fish oils, antioxidants and micronutrients.

Fish oils

Patients should consume oily fish atleast twice a week (total of 210g).

Oral supplements with fish oil may be beneficial.

Role of nutrients in wound healing

Nutrient	Function
Protein	Synthesis of new tissues
Fat & carbohydrate	Fatty acids and cell membrane synthesis carbohydrate & fat prevents using proteins for energy
Vitamin A	Improves cell mediated immunity antioxidant effect fibroplasia & epithelialisation improves collagen synthesis & cross linkage
Vitamin B complex	co-enzymes for energy metabolism cofactor for collagen deposition/cross linkage white blood cell/ antibody formation
Vitamin C	protection of metalloenzymes from oxidation Neutrophill superoxide production Proline & lysine hydroxylation Collagen sysnthesis, collagen cross linkage Angiogenesis
Vitamin E	Quenches free radical production prevents oxidation of membrane poly unsaturated fatty acids
Vitamin K	Coagulation
Iron	Prevents anaemia Optomises tissue perfusion Promotes collagen systhesis

Contd....

Nutrient	Function
Zinc	Cofactor in enzyme systems For cell proliferation Membrane stabilization Protein synthesis Protein, fat and carbohydrate metabolism
Copper	Covalent cross linkage of collagen fibrils (wound maturation)
Manganese	Cofactor in metallenzymes
Selenium	Incorporated in glutathione peroxidase enzyme to protect cell from hydrogen peroxide damage

14 Dietary Guidelines & Nutrition Therapy for Dysphagia

1. Introduction

Difficulty of swallowing food and water carries a high risk of aspiration and can even be fatal. It also can contribute to chest infections, lung abscess and pneumonia. Food intake may be inadequate affecting both quality and quantity, leading to undernutrition. Fear of chocking can lead to food avertions and panic attacks.

There are multiple causes for dysphagia. Some of these are listed here.

- Oesophageal stricture, cancers of head, neck or oesophagial areas
- Cancer treatment including radiotherapy to head and neck area
- Pharyngeal pouch
- Injury or surgery to the tongue, lips, mouth or jaw
- Severe infections of the mouth or throat such as oral thrush or ulcers
- Neurological
- Stroke, Parkinson's disease, motor neurone disease, head injury, multiple sclerosis
- Cerebral palsy, Dementia
- Drug induced dysphagia due to (psychotrophic drugs) and psychological causes

Multidisciplinary team is needed for assessment and management of dysphagia.

Aims of management

1. assess the nature of the swallowing problem
2. determine a safe and adequate feeding route
3. determine the appropriate texture and consistency of orally consumed food and fluids
4. ensure all nutritional needs are met
5. educate the patient, caretakers and other members of care team
6. ensure continuity of care

1. Assessment of swallowing problem

a simple assessment of swallowing problem can be done using a validated protocol administered by a trained personnel. If the above assessment is impractical, radiological examination of swallowing process can be done. Suspected patients should be sent to language and speech therapist/ related experts.

2. Determine a safe and adequate route

If the oral route is not safe, other options can be used.

Nasogastric, surgical gastrotomy, PEG (Percutaneous endoscopic gastrostomy) and parenteral nutrition.

3. If the oral route is chosen, appropriate texture and consistency of food and fluids have to be determined. Speech language therapist will guide this in collaboration with nutrition experts. Food may range from liquid form to normal diet.

Liquid or pureed diets are appropriate for patients with mechanical dysphagia while with oropharyngeal disorders, risk of aspiration increases with thinned and fluid foods.

The consistency of foods and liquids need to be modified to achieve the best control of dysphagia.

4. Other measures

Cold or stimulating foods can be used for patients with delayed triggering of the pharyngeal swallow. Best posture for eating and appropriate utensils has to be identified.

5. Ensure that nutritional requirements are adequately met covering all food groups. The total quantity consumed may be insufficient. Due to the constraints of texture modification, patients may have to limit their intake of variety or quantity. Patients appetite will be affected by texture modification. Based on periodical nutritional and dietary assessment, dietary guidance should be given to overcome all above problems.

6. Ensure that fluid needs are met

7. Educate the patient and caregivers

8. Regular assessment of dysphagia is essential as dysphagia can be improved or deteriorated with time, depending on the causative factors.

9. Ensure continuity of care after discharging from hospital.

Sample Menus

Sample menu for compensated liver disease

Assuming 50 kg person,

Energy needs	–	25 - 35 kcal/ kg body weight 30 x 50	= 1500 kcal
Protein needs	–	1.2 g/kgbw 1.2 x 50	= 60 g
Fat needs	–	25% of total calorie 0.25 x 1500 = 375 kcal	= 41.6 g
CHO needs			= 221.25 g

Sample menu:

Morning tea/milk 1 cup (200 ml)

Breakfast	Morning snack	Lunch	Evening snack	Dinner
Rice 2 cups Dhal curry 3 tbsp Pol sambol 2 tbsp Egg boiled 1 Papaw 100 g	Cream cracker 1 Orange juice 1 cup	Rice 2 cups Vegetables 2-3 + greens Fish 30 g Yoghurt 1	Gingelly 1 (thala guli) Milk 1 cup	Bread 3 slices Boiled vegetables Fish curry 30 g Butter 2 tsp Banana 1

Approximate amounts of carbohydrate, protein and fat grams in particular food

food	Carbohydrates /g	Protein / g	Fat /g
Rice 4 cups	120	12	-
Bread 3 slices	45	9	-
Dhal 3 tbsp	7.5	3	-
Egg 1	-	6	5
Papaw 100 g	10	-	-
Pol sambol 2 tbsp	4	-	10
Fish 30 x 2 g	-	14	-
Butter 2 tsp	-	-	10
Milk 2 cups	20	14	13
Banana 1	15	-	-
Cream cracker 1	6	-	-
Yoghurt 1	4.5	3.5	3
Total	**232**	**61.5**	**41**
Calorie from each nutrient	232 x 4 = 928 cal	61.5 x 4 = 246 cal	41 x 9 = 369 cal
Total	**= 1543 cal**		

Sample menu for chronic kidney disease (CKD)

Assuming non diabetic, 50 kg person in stage I - III

Energy needs – 35 - 40 kcal/ kg body weight
35 x 50 = 1750 kcal

Protein needs – 0.75 g/kgbw
0.75 x 50 = 37.5 g

Fat needs – 20% - 30% of total calorie
0.25 x 1750 = 437.5 kcal = 48.6 g

CHO needs 1750 – (437.5 + 150)/4 = 290.6 g

Salt: for stage I – III - 5 g per day
Stage IV – V - 2 – 4 g per day

Potassium: not restricted unless otherwise recommended by a doctor

Sample menu:

Breakfast	Morning snack	Lunch	Evening snack	Dinner
Rice 1½ cups Vegetables 2 curries	Cream cracker 2 Lime juice 1 cup	Rice 2 cups Vegetables 2-3 + greens Fish 30 g	1 piece of chocolate cake (~ 30 g) Non fat milk 1 cup (200 ml)	Boiled 8 string hoppers 1 egg with curry Pol sambol 2 tbsp
Papaya 100 g		Pine apple 2 slices		Apple small 1

Approximate amounts of carbohydrate, protein and fat grams in particular food

Total = 1811.5 cal

Annex 01

Carbohydrate counting method

Using carbohydrate counting and food exchange method, following food items can be exchanged within the meals in a day

If the total calorie requirement is 1500 – 1800 kcal/day, and out of that 800 calories should be from carbohydrates (50% calories)

800 calorie = 200 g of carbohydrate

200 g of carbohydrate can be taken from 13-15 number of servings. Each serving is 15g.

Energy sources can be divided throughout the day as follows:

For a day

Example 1:

	Breakfast	**Lunch**	**Dinner**	**Total carbohydrate servings**
Cooked rice	1 cup	1 cup	1 cup	6
Cooked vegetables	1 ½ cups	1 ½ cups	1 ½ cups	3
Fruits	1 banana	½ cup fruit salad	½ apple	2
Milk	1 cup		1 cup (afternoon)	2

Food for snack	180 ml sugar free yoghurt (morning/ afternoon snack)	1
	Total servings	**14**

Example 2:

	Breakfast	Lunch	Dinner	Total carbohydrate servings
Cooked rice Pasta	1 cup	1 cup	1 cup }	6
Cooked vegetables	1 ½ cups	1 ½ cups	1 ½ cups	3
Fruits	1 banana	1 cup yoghurt	½ cup papaw	2
Milk	1 cup		1 cup (afternoon)	2

Food for snack	1 cream cracker & tea 1 cup(morning)	snack	1 ½
	1 oz pea nuts (afternoon snack)		½
	Total servings		**15**

Annex 02

List of some foods containing 15 grams of Carbohydrates per serving

Starches		
Rice white or brown, cooked rice ~ 60 g	–	½ cup (200 ml cup)
Bread, ~ 30 g	–	1 slice
Bread products	–	1 oz
Pasta, cereals cooked	–	½ cup
Hamburger bun, ~ 30 g	–	½
Dried beans, peas, lentils cooked	–	½ cup
Idly, small, ~ 30 g	–	1
Dosai, ~ 40 g, 10" diameter	–	1
Chapatti, ~ 25g, 6" wide	–	1
Ready to eat unsweetened cereals	–	1 cup
Snack foods	–	¾ - 1 oz
Sweets & desserts		
Crackers	–	2
Brownie or cake without frosting ~ 2 inch square	–	1
Syrup, jam, jelly, sugar or honey	–	1 tbsp
Ice cream or sherbet	–	½ cup
Cookies	–	2 small
Vegetables		
Cooked vegetables	–	1 ½ cups
(Carrots, cabbage, egg plant, vetakolu, cucumber, mushrooms, okra, spinach etc)		
Cooked starchy vegetables	–	½ cup
(corn, mashed potatoes, sweet potato, lentils etc.)		
corn on the cob, 6-inch	–	1
potato, baked or boiled, ~ 3 oz	–	1 small
Sweet potato ~ 2 oz	–	1 small
Raw vegetables or salads	–	1 cup

Fruits – each item on the list contains about 15 grams of carbohydrates and 60 calories

Fresh fruit ~ 120 g	– 1 small
Fruit juice	– ½ cup (240 ml cup)
Dried fruit	– ¼ cup
Apple, banana, orange,pear	– 1 small
Mango	– ½
Pear	– ½ large or 1 small
Grape fruit	– ½ (large)
Papaya, pineapple	– 1 cup
Pomegranate	– ½ cup
grapes, small	– 17
water melon, cubes	– 1 ½ cup
Tangerine oranges, small	– 2 fruits
Dried fruit	– ¼ cup
dates, prunes	– 3 medium
raisins	– 2 tbsp
Fruit juice	– ½ cup
Milk (one exchange contains 12 g of CHO)	
Skim, low fat	– 1 cup (240 ml)
Yoghurt, non fat/low fat	– 2 cups (180 ml)
Diet cheese	– 1 ½ oz (50g)
Regular cheese	– 1 oz (30g)
Curd	– 1 cup

Reference:
Exchange list for meal planning, The American Diabetes Association and American Dietetic Association

Annex 03

Foods with Glycemic Index (compared to Glucose GI =100)

Low GI Foods (< 55)	Medium GI Foods (55 – 70)	High GI Foods (> 70)
Breakfast cereals all bran 42	Pineapple 59	White rice 87
Skimmed milk 32	Mango 60	Corn flakes 81
Milk full fat 27	Potato crisps 54	French fries 75
Yoghurt 36	Beet root 64	Doughnuts 76
Soy milk 44	Sweet potato 54	Potato backed 76
Cowpea boiled 42	Macaroni & cheese 64	Mashed potato 73
Chick peas 28	Basmathi rice 58	Dated dried 103
Lentils red 26	Red kekulu 63	Pizza 80
Mung bean 31	White kekulu 68	White bread 71–83
Soy beans 18	Samba 66	Whole meal bread 70 – 82
Baked beans 48	Heel bath (white kekulu) 52	White flour 70
Chicken nuggets 46	Pittu kurakkan flour 59–68	Pittu wheat flour 69–81
Sausages 28	Pancake 67	Pittu rice flour 72–82
Cashew nuts 22	Pastry 59	Hoppers 84–96
Pea nuts 14	Coca cola 58	Water melon 72
Spaghetti 41	Cordial orange 66	Honey 73
Roti wheat flour 49–58	Ice cream 61	
Roti Atta flour 44–57	Table sugar (sucrose) 68	
Grape fruit 25	Cream cracker 65	
Grapes 46		
Oranges 42		
Apple , Pears 38		
Banana – kolikuttu, ambul 42 – 49		
Banana –anamalu 45–55		
Banana – sini 45–58		
Apple juice unsweetened 40		
Orange juice unsweetened 50		

Smoothie drink 34
Chocolate cake 38
Sponge cake plain 46
Malted milk powder in full fat cow milk 45
Milo dissolved in full fat cow milk 36
Carrot uncooked 49
Cucumber, eggplant, cauliflower, broccoli, green beans, lettuce, avocado < 15
Tomato, spinach, cabbage 6

S – International table of glycemic index & glycemic load values 2002, university of Sri Jayawardenapura & university of Wayamba.

Annex 04

An example of daily dietary pattern for theraputic life style changes recommended dietary goals 2000 calories

Food Groups	Daily servings	Serving sizes
Cereals	7	1 slice bread (25-30g) 1 oz dry cereal* ½ cup cooked rice, pasta, or cereal
Vegetables	5	1 cup raw leafy vegetable ½ cup cut-up raw or cooked vegetable
Fruits	4	1 medium fruit ¼ cup dried fruit ½ cup fresh, frozen, or canned fruit ½ cup fruit juice
Fat-free or low-fat milk and milk products	2 – 3	1 cup milk 1 cup yoghurt 1½ oz cheese
Leanmeats, poultry, and fish	<=5 oz per day	1 oz cooked meats, poultry, or fish 1 egg
Nuts, seeds, and legumes	Counted in vegetable servings	⅓ cup (1½ oz) 2 Tbsp peanut butter 2 Tbsp or ½ oz seeds ½ cup dry beans or peas
Fats and oils	Amount depends on daily calorie level	1 tsp vegetable oil
Sweets and added sugar	No recommendation	

* Equals ½ to 1¼ cups, depending on cereal type.

Source : *A Scientific Statement From the American Heart Association Nutrition Committee - Diet and Lifestyle Recommendations Revision 2006*

Annex 05

Sodium rich Foods

These foods typically have a high sodium content. In order not to exceed the RDA, either avoid them altogether, or choose low-sodium varieties.

- Salt (Avoid extra salt in food and table)
- **Sauces**: Soy sauce, salad dressing, baking powder, baking soda, barbecue sauce, ketchup, garlic salt, mustard, onion salt, seasoned salts like lemon pepper, stock cubes, meat tenderizer, and monosodium glutamate (MSG).
- **Meats**: smoked or cured meats (containing sodium-nitrite) such as ham, bacon, hot dogs, corned beef, processed, prepackaged meats, and sausages.
- **Soup**: Regular canned soups, instant soups, soup cubes.
- **Salted Snacks**: Salted chips, nuts, popcorn, corn chips, peanuts, tipy tip etc.
- **Canned and Salt preserved foods:** pickles, yeast extracts, lunudehi, dried fish (karawala), papadam, canned fish.
- **Dairy**: Most cheese spreads and cheeses, margarine, Butter,
- **Cereals**: ready to eat cereals, cornflakes, noodles, fast foods etc.
- **Ready-to-Eat**: instant noodles, macaroni and cheese, and some frozen dinners and pizza.
- **Drinks**: saccharin-flavored soda, soda, Carbonated beverages.
- **Bakery Products** like biscuits, cakes, pastries, chocolates, bread, bun etc.

Annex 06

Required number of servings for hypertensive diet

Food Groups	Daily servings	Serving sizes
Grains*	6 – 8	1 slice bread 1 oz dry cereal† ½ cup cooked rice, pasta, or cereal
Vegetables	4 – 5	1 cup raw leafy vegetable ½ cup cut-up raw or cooked vegetable
Fruits	4 – 5	1 medium fruit ¼ cup dried fruit ½ cup fresh, frozen, or canned fruit ½ cup fruit juice
Lean meats, poultry, and fish	6 or less	1 oz cooked meats, poultry, or fish 1 egg
Fat-free or low-fat	2 – 3	1 cup milk or yoghurt milk and milk products 1 ½ oz cheese
Nuts, seeds, and legumes	4 – 5 per week	⅓ cup or 1 ½ oz nuts 2 Tbsp or ½ oz seeds ½ cup cooked legumes (dry beans and peas)
Sweets and added sugar	5 or fewer servings Per week	

* Whole grains are recommended for most grain servings as a good source of fibre and nutrients.

† Serving sizes vary between ½ cup and 1¼ cups, depending on cereal type.
Check the product's Nutrition Facts label.
Cup -240 ml cup

Source : DASH eating plan, U.S. Department of Health & Human Services- based on 2000kcal per day

Annex 07

Amount of protein in particular food

Food Item	Protein/g Average
rice cooked, 1 cup, 130 - 140 g	4
bread , 1 slice, 25 - 30g	2
egg 1, ~50 g	6
fish, 1 oz ~ 30 g	6 - 7
meat 1 oz , ~ 30g	8 - 9
fresh milk, 1 cup, 200 ml	6 - 7
fresh milk, 1 cup, 240 ml	8
milk powder, 2 tbsp ~30 g	7 - 8
milk powder 1 tbsp	4
milk powder non fat, 2 tbsp ~30 g	10 - 11
dhal boiled, (3 tbsp) ~ 100g	8 - 9
kadala boiled, 1 cup, ~ 125 - 130 g	10 - 11
cowpea boiled, 1 cup, 125 -130 g	10 - 11
mung boiled, 1 cup, 125 -130 g	9 - 10
soya beans boiled, 1 cup, 150 g	18 - 20
TVP cooked ½ cup	11
cheese, 1 oz , ~ 30 g	7
yoghurt, 100 g	4
curd, 100 g	3
ice cream, regular , 100 g	4
pea nuts, 1 oz ~ 28 g	7
Sesame seeds 1 oz, ~28 g	7

Annex 08

Definition of malnourished & at risk of malnutrition and refeeding syndrome

Malnourished - defined by any of the following.

- A BMI of < 18.5Kg/m^2
- Unintentional weight loss greater than 10% within the last 3-6 months
- A BMI of < 20Kg/m^2 and unintentional weight loss greater than 5% within the last 3-6 months

At risk of malnutrition, defined as those who have

- Eaten little or nothing for > 5 days or are likely to eat little or nothing for 5 days or longer
- A poor absorptive capacity and or high nutrient loss and/or increased nutritional needs from causes such as catabolism

REFEEDING SYNDROME

Chronically malnourished patients are at risk of refeeding syndrome and giving too much too soon to these patients can lead to

- Severe hypophosphotaemia
- Fluid balance abnormalities
- Hypokalaemia
- Hypomagnesaemia
- Altered glucose metabolism
- Vitamin deficiency

Patients at risk of developing refeeding problems

A.) Patients has one or more of the following

- o BMI < 16kg/m^2
- o Unintentional weight loss >15% within the last 3-6 months
- o Little or no nutritional intake for > 10 days
- o Low level of potassium/ phosphate/magnesium prior to feeding

OR

B.) Patients have 2 or more of the following

- o BMI < 18.5kg/m^2
- o Unintentional weight loss >10% within the last 3-6 months
- o Little or no nutritional intake for >5 days
- o History of alcohol abuse or drugs including insulin/ chemotherapy/antacids & diuretics

Annex 09

Calculation of energy & nutrient requirement

Consider energy provision from propofol, dextrose infusions etc when calculations are done.

- **Calculation of Energy Requirement**

  1. Indirect calorimetry – less practical in ICUs
  2. Harris Benedict formulae (may be less accurate in ICU patients) – Resting energy expenditure (REE)

Men	66.5 + (13.7 x W) + (5 x H) - (6.8 x A) kcal/day
Women	655 + (9.6 x W) + (1.7 x H) - (4.7 x A) kcal/day

W- weight in kg H- height in cm A- age in years

REE needs to be multiplied by the stress level

	Surgery	Starvation	Trauma	Sepsis	Severe Burn
Multiplication factor	1.2	0.85	1.35	1.6	2.1

3. In ventilated critically ill patients – Faisy equation

Energy Expenditure (kJ/day) = (8 x W) + (15 x H) + (32 x MV) + (94 x BT) - 4834

MV = Minute Ventilation in l/min
BT = Body Temperature in centigrades
1 kcal = 4.184KJ

In practice, a pragmatic estimation of energy requirements:

= 20-30 kcal/kg/day

10% added energy needs for every degree above >37C

Nitrogen (N) balance

- N Balance = (protein intake (g) /day /6.25) – (urinary N g/day) + (skin & stool loss g/day)

- Skin & stool loss = 2- 4 g/day
- Urinary N = (urinary urea (g/24hrs) / 2.14) + 2 to 4g.

(Urinary N should be measured in a 24hr urine collection but in emergency a 4 hour collection may suffice. Exact determination of the duration and volume of the urine collection is crucial for accurate calculation of N balance)

Annex 10

Placement of a nasogastric or orogastric feeding tube

- Explain the procedure to the patient if conscious
- **Always use a radio opaque tubes in ICU patients (if available)**
- Orogastric tubes are preferred for patients with head or maxillofacial injury
- Mark the tube at a distance equal to that from xiphisternum to the nose via the ear lobe (50-60cm)
- Lubricate the tube externally with gel or water
- Check nasal patency (if possible) by "sniff" with each nostril occluded in turn. Clear nostril can be sprayed with lignocaine to minimize discomfort
- Sit patient upright with the head level. Slide tube gently backwards along the floor of the clear nostril until visible at the back of the pharynx (10-15cm)
- If the patient is co-operative, ask them to take a mouthful of water & then advance the tube (5-10cm) as they swallow
- Repeat the water swallow/advance until the preset mark on the tube reaches the nostril
- Withdraw the tube at any stage if the patient is distressed/coughing or cyanosed
- If there is difficulty in passing the tube, ask the patient to tilt the head forwards or turn it to one side. Never push the tube against resistance
- Check position of the NG tube
    i) pH testing-pH 5.5 or less (if PH testing strips are available)
    ii) X-ray –
    iii) checking the position of the tube by injecting air through it & listening for bubbles with a stethoscope is unreliable(2)

- Documentation – Size of the tube

  Length at entry/ length from entry point to end of the tube (external tube length)

  Method/s used to confirm the position
- Check & document pH & external tube length, at least twice per 24 hours and if continuous feeds are being given, during the rest period.

Annex 11

Proximate energy & nutrient contents of common food items used in Sri Lanka

(Amounts are per 100g of edible portion)

Name of foodstuff	Energy (Kcal)	Protein (g)	Carbohydrate (g)	Fat (g)
Cereals				
Rice, parboiled	349	8.5	77.4	0.6
Whole grain	346	11.8	71.2	1.5
Wheat flour	341	12.1	69.4	1.7
Roots & Tubers				
Onion, Red	59	1.8	12.6	0.1
Onion, Bombay	50	1.2	11.1	0.1
Potato	97	1.6	22.6	0.1
Pulses & Legumes				
Cowpea	328	24.1	54.5	1.0
Dhal, Red	348	25.1	59.0	0.7
Dhal, Yellow	385	22.3	57.6	1.7
Soybean	482	43.2	20.9	19.5
Leafy Vegetables				
Cabbage	27	1.8	4.6	0.1
Carrot leaves	77	5.1	18.1	0.5
Gotukola	37	2.1	6.0	0.5
Kankun	28	2.9	3.1	0.4
Mukunuwanna	73	5.0	11.6	0.7
Lettuce	21	2.1	2.5	0.8
Kola Gova	48	5.1	5.9	0.4
Spinach	26	2.0	2.9	0.7

Name of foodstuff	Energy (Kcal)	Protein (g)	Carbohydrate (g)	Fat (g)
Vegetable/Fruits				
Breadfruit	113	1.5	26.0	0.4
Brinjal	24	1.4	4.0	0.3
Mango	44	0.7	10.1	0.1
Papaya	27	0.7	5.7	0.2
Pumpkin	25	1.4	4.6	0.1
Ripe Tomato	20	0.9	3.6	0.2
Apple	59	0.2	18.4	0.5
Avocado Pear	215	1.7	0.8	22.8
Banana, ripe	116	1.2	27.2	0.8
Grapes, blue	58	0.6	13.1	0.4
Grapes, pale green	71	0.5	16.5	0.3
Guava	51	0.9	11.2	0.3
Lemon	57	1.0	11.1	0.9
Lime	59	1.5	10.9	1.0
Mango, ripe	74	0.6	16.9	0.4
Orange juice	9	0.2	1.9	0.1
Papaya, ripe	32	0.6	7.2	0.1
Passion fruit	54	0.9	12.4	0.1
Pineapple	46	0.4	10.8	0.1
Wood apple	134	7.1	18.1	3.7

Name of foodstuff	Energy (Kcal)	Protein (g)	Carbohydrate (g)	Fat (g)
Milk & Milk Products				
Milk, Buffalo	117	4.3	5.0	8.8
Milk, Cow's	67	3.2	4.4	4.1
Milk, powdered, whole, cow's	496	25.8	38.0	26.7
Butter	729	---	---	81
Cheese	348	24.1	6.8	25.1
Curd	60	8.1	3.0	4.0
Ice cream	140	4.0	28.8	3.5
Yoghurt	90	3.6	17.6	0.8
Fish & Other sea foods				
Anguluva	91	19.3	---	1.0
Atavalla	121	20.0	---	4.2
Balaya	105	21.0	---	2.0
Halmassa (fresh)	164	19.3	0.2	9.6
Halmassa (dried)	408	48.1	0.3	23.9
Kiri Mora	112	18.0	---	4.0
Meat & Poultry				
Beef	262	10.0	---	14.0
Goat liver	107	20.0	---	3.0
Goat meat	118	21.4	---	3.6
Turkey	268	20.1	---	20.2
Egg, hen	178	13.3	---	13.8
Egg white, hen	52	10.7	1.1	0.2
Egg yolk, hen	336	16.8	---	29.0

Name of foodstuff	Energy (Kcal)	Protein (g)	Carbohydrate (g)	Fat (g)
Fats & Oil				
Coconut milk (prepared without water)	430	3.4	11.9	41.0
Coconut oil	883	---	---	99.9
Cod liver oil	930	---	---	90.9
Ghee, cow	900	---	---	100.0
Margarine	70.5	---	---	85.0
Olive oil	980	---	---	99.9
Soybean oil	883	---	---	99.9
Miscellaneous				
Bee's honey	319	0.3	79.5	---
Jaggery (cane)	383	0.4	95.0	0.1
Jaggery (coconut)	340	1.0	83.5	0.2
Jam	260	0.4	69.0	---
Sugar (brown)	389	0.2	97.0	---
Sugar (white)	400	---	100.0	---
Leaves dried (Tea)	293	24.5	58.8	2.8

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