RESPIRATORY DISEASES:

1.1 Introduction

In humans the anatomical features of the respiratory system include airways, lungs, and the respiratory muscles. Molecules of oxygen and carbon dioxide are passively exchanged, by diffusion, between the gaseous external environment and the blood. This exchange process occurs in the alveolar region of the lungs.

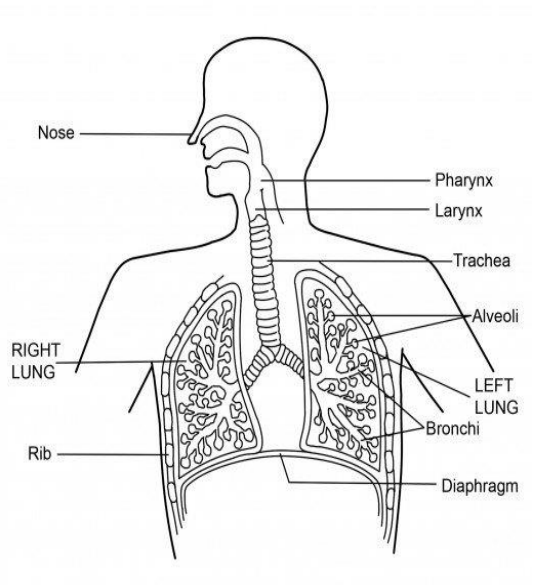
Respiratory disease is a medical term that encompasses pathological conditions affecting the organs and tissues that make gas exchange possible in higher organisms, and includes conditions of the upper respiratory tract, trachea, bronchi, bronchioles, alveoli, pleura and pleural cavity, and the nerves and muscles of breathing. Respiratory diseases range from mild and self-limiting, such as the common cold, to life-threatening entities like bacterial pneumonia, pulmonary embolism, and lung cancer.

The respiratory system can be subdivided into an upper respiratory tract and a lower respiratory tract based on anatomical features. The upper respiratory tract includes the nasal passages, pharynx and the larynx, while the lower respiratory tract is comprised of the trachea, the primary bronchi and lungs.

The respiratory tract is the site of an exceptionally large range of disorders for three main reasons:

i. it is exposed to the environment and therefore may be affected by inhaled organisms, dusts, or gases
ii. it possesses a large network of capillaries through which the entire output of the heart has to pass, which means that diseases that affect the small blood vessels are likely to affect the lung; and
iii. it may be the site of "sensitivity" or allergic phenomena that may profoundly affect function.

A structure of respiratory system



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1.2 Meaning of terms

- **Respiratory diseases** - It is a term that encompasses pathological conditions affecting the organs and tissues that make gas exchange possible in higher organisms.
- **Dyspnea -** shortness of breath

1.3 Types

Disorders of the respiratory system can be classified into four general areas:

i. **Obstructive conditions** (e.g., emphysema, bronchitis, asthma attacks)
ii. **Restrictive conditions** (e.g., fibrosis, sarcoidosis, alveolar damage, pleural effusion)
iii. **Vascular diseases** (e.g., pulmonary edema, pulmonary embolism, pulmonary hypertension)
iv. **Infectious, environmental and other "diseases**" (e.g., pneumonia, tuberculosis, asbestosis, particulate pollutants): Coughing is of major importance, as it is the body's main method to remove dust, mucus, saliva, and other debris from the lungs. Inability to cough can lead to infection. Deep breathing exercises may help keep finer structures of the lungs clear from particulate matter, etc.

1.4 Allergies

An allergic reaction begins in the immune system. Our immune system protects us from invading organisms that can cause illness. If you have an allergy, your immune system mistakes an otherwise harmless substance as an invader. This substance is called an allergen. The immune system overreacts to the allergen by producing Immunoglobulin E (IgE) antibodies. These antibodies travel to cells that release histamine and other chemicals, causing an allergic reaction.

Allergy Symptoms

An allergic reaction typically triggers symptoms in the nose, lungs, throat, sinuses, ears, lining of the stomach or on the skin. For some people, allergies can also trigger symptoms of asthma.

A number of different allergens are responsible for allergic reactions. The most common include pollen, dust, food, insect stings, animal dander, mold, medications/drugs and latex.

Respiratory allergy

Respiratory allergies are caused by proteins in the air that are inhaled and trigger airway inflammation. They may be due to specific allergic reactions, or more general reactions to irritants such as smoke and fumes in the indoor and outdoor environment that can aggravate allergy symptoms.

There are many sources of respiratory allergies; house dust contains various components such as dust mites, pet allergens, pollen and particulates that can trigger asthma and allergies. If humidity is too high, mould growth can occur, and the amount of mould spores containing allergens will increase. House dust mites thrive wherever it is hot and humid, especially in mattresses and bedding. Mite faeces are the main cause of allergies. Pet allergens usually come from proteins from animal skin, fur, urine and saliva. The allergens often sit on small particles that can stay aloft for a long time and thus spread over large areas.

The increase in allergic diseases may be related to climate change. A warmer climate leads to a longer pollen season and therefore an increased incidence of respiratory allergies. Pollen can cause cross-allergies because there are similar proteins in pollen and plant foods such as fruits, vegetables and nuts, which will also increase allergic reactions to food. Cross allergies, however, cause milder symptoms than primary allergies.

1.5 Upper respiratory tract infections

Upper respiratory tract infections (**URTI**) are illnesses caused by an acute infection which involves the upper respiratory tract including the nose, sinuses, pharynx, or larynx. This commonly includes nasal obstruction, sore throat, tonsillitis, pharyngitis, laryngitis, otitis media, and the common cold. Most infections are viral in nature and in other instances the cause is bacterial. Upper respiratory tract infections can also be fungal or helminth in origin, but these are far less common.

This hand-out will describe common cold. Students to discuss the other conditions (nasal obstruction, sore throat, tonsillitis, pharyngitis, laryngitis, otitis media, and the common cold)

1. **Common cold and flu (most common URT infection)**

Causes

Common cold is a viral infectious disease of the upper respiratory system, caused primarily by rhinoviruses and corona viruses whereas influenza is a contagious respiratory tract infection caused by one of three influenza viruses: A, B and C.

Signs

- Colds manifest slowly with cough, nasal congestion and sore throat, usually without fever.
- Flu comes on more suddenly with fever, sore muscles, fatigue and cough.

Medical management of cold and flu

1. **Vaccination** - Both inactivated and live, attenuated influenza vaccines are used worldwide according to WHO recommendations.

2. **Antibiotics**- they do not kill viruses and they should not be used for colds or flu. They can however treat bacterial complications such as sinus or ear infections.
3. **Antivirals** - There are several antiviral medications that can limit the course and duration of these infections and are specific to the viruses. They work by inhibiting viral replication rather than directly killing the viruses. They are generally avoided because of resistance problem.
4. **Anti-histamines** - Antihistamines can be used for symptoms such as runny nose, sneezing and itching. There are many formulas containing different drugs like diphenhydramine, loratidine etc. Precautions are necessary as most of these drugs cause drowsiness.

Nutritional considerations in cold and flu

- **Vitamin C** - Stimulates antibody response. Regular use can prevent colds before they happen. Eating plenty of fruits and vegetables that are loaded with vitamin C, such as citrus fruits, melons, berries, parsley, and bell peppers is helpful. Vitamin C acts as a mild natural antihistamine and supporting the function of white blood cells. Antihistamines reduce mucus secretion and inflammation in airways and sinuses, making it easier to breathe.
- **Vitamin A and/or beta carotene** strengthen the mucus membranes making them more resistant to infection. Vitamin A is a nutrient vital to the mucous membranes throughout the respiratory system during a cold or flu. It can be taken in the form of beta carotene, a precursor of vitamin A, in higher dosages.
- **Zinc** especially in the form of lozenges (cough drop, cough sweet (~~strepsils~~)) helps prevent viral replication in the throat by stimulating T-cell response. The lozenges should not be used for more than one week. Zinc can suppress the immune system if used for an extended period of time.

Antiseptic herbs inhibiting microbial growth

Thyme - It is antiseptic and an immune stimulant. Thyme warms and stimulates the lungs, expels mucus, and relieves congestion. It also helps deter bacterial, fungal, and viral infections

Peppermint leaf and oil - The major constituents are menthol and menthone. It promotes sweating, has antiviral properties. The peppermint has some antitussive effect also. It relieves pain, muscle spasms, reduce inflammation, clear congestion and helps indigestion

Garlic - Contains several helpful compounds, including allicin (chemical made when you crush raw garlic), one of the plant kingdom's most potent, broad-spectrum antibiotics. This herb's aromatic compounds are readily released from the lungs and respiratory tract, putting garlic's active ingredients right where they can be most effective against cold viruses.

Others include myrrh, sage, eucalyptus, ginseng among others.

1.6 Lower respiratory tract infections

Some of the most common respiratory Illnesses and Diseases

i. Pneumonia
ii. Asthma
iii. Chronic Obstructive Pulmonary Disease (COPD)
   - ✓ Chronic Bronchitis
   - ✓ Emphysema
iv. Lung Cancer
v. Tuberculosis
vi. Cystic Fibrosis/Bronchiectasis
vii. Pleural Effusion.

These conditions are discusses as follows:

1. **Pneumonia** (most common lower respiratory disease).

Pneumonia is defined as inflammation and consolidation of lung tissue in response to an infectious agent. Several organisms and disease conditions have been identified to infect or inflame the lungs. The epidemiology of the disease has changed due to changes in the microorganisms and modalities used to treat the condition. In the clinical setting there are various kinds of pneumonias, such as community-acquired pneumonia, which may be viral or bacterial; hospital-acquired pneumonia; pneumonia in an immune compromised host; ventilator associated pneumonia (VAP); and aspiration pneumonia. Approximately 50% of pneumonia cases are caused by viruses and tend to be less severe than those of bacterial origin. Pneumococcus (Streptococcus pneumoniae) is the most common cause of bacterial pneumonia. Aspiration pneumonia results when solid or liquid food passes into the lungs, causing infection. Prevention of pneumonia primarily includes maintenance of immune status and pneumococcal vaccination.

Treatment of pneumonia involves a combination of pharmacologic therapy (e.g., antibiotics), pulmonary rehabilitation, and maintenance of nutritional status. Protein energy malnutrition (PEM) is associated with involuntary weight loss, functional impairment and impaired immunity. Adequate nutritional status plays a critical role in the modulation of immune function.

Medical Nutrition Therapy in management of pneumonia

i. To preserve lean body mass and immune function
ii. Prevent unintentional weight loss
iii. Maintain nutrition status

Energy: Provide enough energy to maintain reasonable body weight. Increased energy may be needed for patients with infection, fever, or weight loss.

Protein: Provide enough prot ein to maintain visceral protein status and meet the demands of infection.

Fluid: Fluids are encouraged, unless contraindicated. From 3 to 3.5 liters of fluid per day has been recommended to liquefy secretions and help lower temperature in febrile patients (to be discussed in a later section of this module).

Specific nutrients and the immune system: several nutrients have been linked to the preservation and maintenance of immune function. Nutrients that have been identified include vitamins A, E, and B6, zinc, copper, selenium, the amino acids glutamine and arginine, and omega-3 fatty acids. These nutrients may play a key role in the immune function, leading to less of a risk of developing pneumonia. Supplementation is not warranted since there are no studies demonstrating a direct

cause and effect relationship with the incidence of pneumonia. However, it is recommended to increase consumption of foods that are rich in these nutrients.

2. Asthma

It is a chronic disorder that affects the airways and is characterized by bronchial hyper-reactivity, reversible airflow obstruction, and airway remodeling. Symptoms include periodic episodes of chest tightness, chest tightness, breathlessness, and wheezing. It is the result of a complex interaction between environmental exposures and genetics. When people are genetically susceptible, environmental factors exacerbate airway hyper-responsiveness, airway inflammation, and atopy (tendency to develop allergic reaction) that eventually leads to asthma.

Environmental factors that are linked to the development of asthma include indoor allergies (dust mites, animal allergies) and outdoor allergies (pollen and fungi). Increased risk of asthma development also has been linked to air pollution, tobacco smoke exposure, and small size at birth, respiratory infection, and lower socioeconomic status.

A higher than desirable BMI during childhood is also associated with a significant increase in the development of asthma.

Medical management;

- Routine monitoring of symptoms and lung functions
- Patient education
- Control of environmental triggers
- Pharmacotherapy – stepwise and tailored to meet individual patient needs. Quick relief (short-acting beta agonists – bronchodilators and steroids) and long term controller medication (inhaled long acting beta agonists and leukotriene modifiers) are used as therapy for asthma.

Medical nutrition therapy

Goals of nutrition therapy

- Correct energy and nutrient deficiencies and excesses in the diet.
- Address dietary triggers. GERD (Gastroesophageal reflux disease), food allergens and some specific food additives are the two most common dietary triggers.
- Monitoring food-drug interactions.

Modulation of antioxidant intake with nutritional supplementation has a beneficial effect on the severity and progression of asthma. Low blood carotenoid levels also have been linked with asthma. A diet rich in antioxidants and monounsaturated fats seems to have a protective effect on childhood asthma by counteracting oxidative stress.

In the childhood asthma prevention study omega-3 polyunsaturated fatty acid (PUFA) fish oil supplemented throughout childhood reduces wheezing. However, this effect does not continue into later childhood.

Supplementation of vitamin C and zinc also have been reported to improve asthma symptoms and lung function

In management of dietary triggers and GERD, a critical component of medical nutrition therapy for asthmatic patients is a diet free of known irritants such as spicy foods, caffeine, chocolate, and acidic foods. Limiting the intake of high fat foods and portion control can prevent gastric secretions, which exacerbate GERD.

Food allergens e.g. an immunoglobulin E-mediated reaction to a food protein can lead to bronchoconstriction. Completely avoiding the allergenic food protein is the only dietary treatment currently available for food allergies.
Some food additives used in the processing of foods such as potassium metasulfite and sodium sulfide, have been found to be a trigger for asthmatics.
Some asthma patients need maintenance oral steroids, and these patients are prone to develop drug-nutrient interaction problems.

3. Chronic Obstructive Pulmonary Disease

Chronic Obstructive Pulmonary Disease (COPD) refers to a group of conditions characterized by the persistent obstruction of airflow through the lungs i.e. in the main airways (**bronchi** and **bronchioles**) and air sacs (**alveoli**) of the normal respiratory system and reduced expiratory flow. As COPD progresses, the work of breathing increases to 10 to 20 times that of a person with normal lung function.
The two main types of COPD are **chronic bronchitis** and **emphysema,** and in many patients, these conditions may co-exist in varying degrees and are generally irreversible.

3.1 Chronic bronchitis is characterized by persistent inflammation and excessive secretions of mucus in the airways of the lungs, which may ultimately thicken and become too narrow for adequate mucus clearance. Chronic bronchitis is diagnosed when a chronic, productive cough persists for at least 3 months of the year for 2 consecutive years.

3.2 Emphysema is characterized by the breakdown of the lungs' elastic structure and destruction of the walls of the bronchioles and alveoli, changes that significantly reduce the surface area available for respiration. Emphysema is diagnosed on the basis of clinical signs and the results of lung function tests.

Both chronic bronchitis and emphysema are associated with: abnormal levels of oxygen and carbon dioxide in the blood and shortness of breath (**dyspnea**). COPD may eventually lead to respiratory or heart failure. COPD is a debilitating condition. Generally, dyspnea worsens as the disease progresses, resulting in dramatic reductions in physical activity and quality of life. Weight loss and wasting are common in the advanced stages of disease and may result from hypermetabolism, poor food intake, and the actions of various inflammatory proteins.

Causes of COPD

- Smoke from cigarettes is a major risk factor, along with that from biomass fuel used for cooking and heating in rural areas, occupational exposure as well as other forms of air pollution may also predispose an individual to COPD.
- Genetic factors - Alpha-1-antitrypsin deficiency. Individuals with this defect have inadequate blood levels of a plasma protein (alpha-1-antitrypsin) that normally inhibits the enzymatic breakdown of lung tissue.

Medical treatment of COPD

The primary objectives of COPD treatment are

- To prevent the disease from progressing and relieve major symptoms (dyspnea and coughing).

- Individuals with COPD are also encouraged to quit smoking to prevent disease progression and to get vaccinated against influenza and pneumonia to avoid complications
- For people with severe COPD, supplemental oxygen therapy (12 hours daily) can maintain normal oxygen levels in the blood and reduce mortality risk.
- Improve the quality of life

Nutrition therapy for COPD

Goals of MNT

- To correct malnutrition (which affects up to 60% of COPD patients) resulting from poor food intake and poor appetite.
- To promote the maintenance of a healthy body weight
- To prevent muscle wasting resulting from hyper-metabolism.

General nutrition care plan

Energy needs of COPD patients are usually raised due to hyper-metabolism (about 20 percent above normal - estimate normal caloric requirements of the patient using the Harris Benedict's Equation), which results from chronic inflammation and the increased workload of respiratory muscles. In addition, it has been proposed that patients with COPD may benefit from a high fat, moderate carbohydrate diet distributed as protein (15% to 20% of total calories), fat (30% to 45% of total calories) and carbohydrate (40% to 55% of total calories) so as to preserve a satisfactory **respiratory quotient (volume of CO_2 expired/volume of O_2 consumed)** from substrate metabolism use.

Weight management – since underweight COPD patients have higher mortality rates, encouraging adequate food intake is generally the main focus of the nutrition care plan. A high-kcalorie, high-protein diet may be helpful, but excessive energy intakes increase the amount of carbon dioxide produced and can increase respiratory stress. Conversely, excess body weight places an additional strain on the respiratory system, and so COPD patients who are overweight or obese may benefit from energy restriction and gradual weight reduction.

Decreased food intake - Food intake often declines as COPD progresses, although the causes of poor intake vary among patients. Dyspnea may interfere with chewing or swallowing. Physical changes in the lungs and diaphragm may reduce abdominal volume, leading to early satiety. Appetite may be reduced by medications, depression, or altered taste perception (which may be due to the use of bronchodilators or the mouth dryness caused by chronic mouth breathing). Some patients may become too disabled to shop or prepare food or may lack adequate support at home. The clinician must assess the unique needs of a COPD patient before proposing a nutrition care plan.

Some patients may benefit from eating small, energy dense and frequent meals spaced throughout the day rather than two or three large ones. The lower energy content of small meals reduces the carbon dioxide load, and the smaller meals may produce less abdominal discomfort and dyspnea. Some individuals may eat better if they receive supplemental oxygen at mealtimes. Consuming adequate fluids should be encouraged to help prevent the secretion of overly thick mucus; however, some patients should consume liquids between meals so as not to interfere with food intake.

Cigarette smoking – a combination of nutritional counselling and nicotine replacement seems to optimize success.

Oral supplements may be recommended as between-meal snacks to improve weight gain or endurance, but patients should be cautioned not to consume amounts that reduce energy intake at mealtime.

Pulmonary Formulas - Enteral formulas designed for use in COPD provide more kcalories from fat and fewer from carbohydrate than standard formulas. The ratio of carbon dioxide production to oxygen consumption is lower when fat is consumed.

Incorporating an exercise Program - Loss of muscle can be more readily prevented or reversed if the treatment plan includes an effective exercise program. With exercise, patients are likely to see improvements in their strength, endurance, and ability to perform activities of daily living. Both aerobic training and resistance exercise can be beneficial.

Energy requirements

Meeting energy needs can be difficult. For patients participating in pulmonary rehabilitation programs, energy requirements depend on the intensity and frequency of exercise therapy and can be increased or decreased. It is crucial to remember that energy balance and nitrogen balance are intertwined.

Preferably, indirect calorimetry should be used to determine energy needs and to prescribe and monitor the provision of sufficient, but not excessive calories. When energy equations are used for prediction of needs, increases for physiologic stress must be included. The energy requirements of most adult COPD patients range from 25 to 35 kcal/kg body weight. Caloric needs may vary significantly from one person to the next and even in the same individual over time depending on weight, coexisting disease processes, and nutritional deficits.

Fat

Omega-3 and omega-6 are PUFAs that are essential fatty acids. The simplest forms of these fatty acids are the omega-6 linoleic acid (LA) and alpha-linolenic acid (ALA). The body is unable to synthesize them, and they must be consumed in the human diet.
These fatty acids are de-saturated to form long chain omega-3 PUFAs or omega-6 PUFAs. Docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) and alpha-linolenic acid (ALA) are the major omega-3 PUFAs, and the major long-chain omega–6 fatty acids are linoleic acid (LA) and arachidonic acid (AA).

Protein

Sufficient protein of 1.2 to 1.5 g/kg of dry body weight is necessary to maintain or restore lung and muscle strength, as well as to promote immune function.

4. Lung cancer

Cancer is the growth of malignant tissue. It is the second leading cause of death, ranking just below cardiovascular diseases particularly in the United States. It is not a single disorder, but rather different kinds of malignant growths. The various types have different characteristics, occur in different locations in the body, progress differently, and require different treatments. Cancers especially those of the gastrointestinal (GI) tract and pancreas, can seriously impair nutrition status men than in women, although the incidence in men is falling as fewer men are smoking, while the

incidence in women is rising as the number of women smoking has increased. There are two main types of primary lung cancer:

- ✓ **Non-small cell lung cancer (NSCLC),** which accounts for 80% of cases.
- ✓ **Small cell lung cancer (SCLC),** which accounts for 20% of cases; this is more aggressive than NSCLC and can spread widely to other organs, including the brain.

The early stages of lung cancer do not usually produce symptoms, so the disease is generally at an advanced stage by the time it is diagnosed. It has one of the lowest survival outcomes of any cancer. Its symptoms are nonspecific and in most cases can be misdiagnosed as another form of respiratory disease.

Risk factors of lung cancer

- ✓ **Smoking** – cigarette smoking contributes to approximately 90% of lung cancers.
- ✓ **Poor diet** – especially that lacking in fruits and vegetables. Fruits and vegetables are a rich source of nutrients and phytochemicals with antioxidant activity, as these substances may prevent or reduce the oxidative reactions in cells that cause DNA damage. In addition, phytochemicals may inhibit carcinogen production in the body, enhance immune responses that protect against cancer development, or promote enzyme reactions that inactivate carcinogens. The B vitamin folate (provided by certain fruits and vegetables) functions in DNA synthesis and repair; thus, inadequate folate intakes may allow DNA damage to accumulate.
- ✓ **Exposure to industrial carcinogens and air pollutants** e.g. arsenic, chromium compounds, tobacco (secondary smokers).

Consequences of Lung Cancer

1. **Anorexia and reduced food intake** – it is a major contributor to weight loss usually associated with cancer. Factors such as mental stress, chronic nausea and early satiety due to flattening of the diaphragm, fatigue, pain, gastrointestinal obstructions and side effects of cancer therapies contribute largely to reduced food intake and anorexia.
2. **Cachexia -** The combined effects of a poor appetite, accelerated and abnormal metabolism, and the diversion of nutrients to support tumor growth result in a lower supply of energy and nutrients at a time when demands are high. **Cancer cachexia**— characterized by anorexia, weight loss, muscle wasting, anemia, and fatigue—develops in up to 50 percent of cancer patients and is responsible for as many as 20 percent of cancer deaths. Cachexia may be indicated by an involuntary weight loss of more than five percent of body weight; care must be taken not to overlook unintentional weight loss in patients who are overweight or obese. Unlike in starvation, nutrition intervention alone is unable to reverse cachexia.
3. **Taste alteration of the food due to medication and also due to chronic sputum production.**
4. **Dysphagia by external compression**. Palliative efforts will often aim to reopen the lumen of the oesophagus, which can be achieved by radiotherapy or placing a stent over the tumour. Alternatively, a different enteral feeding route can be established.

Medical management of lung cancer

A management plan for every patient diagnosed with lung cancer should be developed by a multidisciplinary team. Treatment options are determined by the type and stage of cancer and medical fitness, but may include surgery, chemotherapy, radiation, biological therapies or a combination of these.

There are many side effects associated with these treatments and nutritional compromises are pronounced in lung cancer.

MNT for lung cancer

As mentioned earlier, lung cancer patients will have multiple disease related symptoms, such as breathing difficulties, cough, pain, anorexia, fatigue and weight loss, that are likely to have an effect on nutritional status and overall quality of life. Different treatment options also have different nutritional implications.

Goals of MNT

- Treat the reversible causes of anorexia such as early satiety
- Evaluate the rate and severity of weight loss
- Treat the symptoms interfering with food intake: nausea and vomiting, dyspnea, mucositis, constipation, and pain
- Assess the use of appetite stimulants like megestrol acetate and Decadron (corticosteroids)
- Provide nutritional support (enteral or parenteral)

Energy

Patients should consume adequate calories that meet or exceed the resting energy expenditure. To achieve this, recommend for the patient to rest before meals and that they have small frequent meals that are high in fat, protein but low in carbohydrate. This is because of the higher respiratory quotient for carbohydrates compared to fats.

Proteins

Lung cancer patients may benefit from a high protein diet. This is because, metabolic changes that occur in cancer patients contribute to weight loss and nutrient depletion. **Cytokines,** released by both tumor cells and immune cells, induce an inflammatory and catabolic state. Cancer patients exhibit an increased rate of **protein turnover,** but reduced muscle protein synthesis. Muscle contributes amino acids for gluconeogenesis (glucose production), further depleting the body's supply of protein.

An intake of 1-1.6g per kg of body weight per day of proteins is considered adequate to preserve depletion of muscle tissue.

Fats

Supplementation with fish oils i.e.omega-3 fatty acids, has shown to increase response rates and offers clinical benefit to patients with NSCLC without affecting treatment toxicity.

Oral supplements

These should be in the ratio of fat: carbohydrate of 3:1. This is related to the respiratory quotient resulting in better tolerance by the patient.

Enteral and Parenteral Nutrition Support

Tube feedings or parenteral nutrition may be necessary for patients who are experiencing complications that interfere with food intake or have long-term or permanent gastrointestinal impairment. Patients with chronic dysphagia or oral mucositis (inflammation of oral mucosa, a complication of chemotherapy and radiation therapy) and may benefit from tube feeding. Parenteral nutrition is reserved for patients who have inadequate GI function, such as those with severe radiation enteritis (inflammation of the small intestines). Whenever possible, enteral nutrition is strongly preferred over parenteral nutrition, to preserve GI function and avoid infection.

5. Tuberculosis

Tuberculosis (TB) is an infectious bacterial disease mainly caused by *Mycobacterium tuberculosis.* However, it is a curable and preventable disease. Other causative agents of TB include

Mycobacterium bovis (transmitted through contaminated milk and milk products) and *Mycobacterium africanum.* TB is transmitted from person to person through vaporized droplets from the throat and lungs of people with active TB. Droplets generated through coughing, laughing, talking, sneezing, singing and spitting.
Tb is diagnosed by sputum smear microscopy followed by culture testing. Patients with active TB usually present with symptoms of persistent cough, fever, night sweats, dyspnoea, haemoptysis (coughing up blood), weight loss and chest pain.

There are two **clinical forms** of TB namely

- ✓ Pulmonary TB – within the lungs
- ✓ Extra pulmonary TB – TB outside the lungs

Pathophysiology of TB
Following TB exposure, healthy individuals mount a cell mediated immune response involving T cells, macrophages and cytokines, which usually controls the infection. The majority of individuals remain in this asymptomatic (latent) phase and only about 5-10% go on to develop active TB.

Risk factors for TB

a) Immune-suppression e.g. due to HIV and AIDS, malnutrition
b) Community and environmental factors e.g. poverty, smoking, poor housing, overcrowding, number of cases/contact interactions over time, incidence of infectious TB in the population etc.

Relationship between malnutrition and TB
Undernutrition (PEM) and micronutrient deficiencies leaves the body weak and leads to secondary immunodeficiency making the individual vulnerable to catching diseases, such as TB. Further, a weakened immunity can result in TB progressing from a latent to an active infection. On the other hand, the body of a person suffering from TB has an increased demand for energy, which often causes a TB patient to lose a significant amount of weight and this can worsen acute malnutrition.

Medical management of TB
Ideally, patients diagnosed with TB should be placed in respiratory isolation to prevent spread of infection. As soon as the diagnosis is established, treatment with four anti-TB medications - INH, rifampin, pyrazinamide and ethambutol - is started. Caution and constant patient observation and review is done since exposure to lower-than-therapeutic levels of anti-tuberculosis drugs is likely to cause selection of resistant strains of *Mycobacterium tuberculosis* and treatment failure. Correct management not only reduces risk of TB relapse but also prevents development of drug resistance. Appropriate drug dosage and length of treatment depends on patient's age, overall health, clinical form of TB, infection location and possible drug resistance.

Prevention with *Bacillus calmette-Guerin* (BCG).

NUTRITION IMPLICATIONS OF TB

a) Active TB is associated with weight loss, cachexia (wasting syndrome)**, and low serum concentration of leptin** (a hormone for mediating long-term regulation of energy balance, suppressing food intake and thereby inducing hormones. It is antagonistic to ghrelin)**.**

b) Food-nutrient interactions with anti-TBs

i) Isoniazid, a drug used in TB treatment may increase requirements for pyridoxine, folate, niacin (vitamin B_3) as well as magnesium and may lead to hepatitis, constipation, anaemia and fatigue. It can decrease the absorption of pyridoxine, calcium and vitamin D, and may react with bananas, beer, pickled fish, yeast and yogurt

- Avoid in malnourished individuals and others at increased risk for peripheral neuropathy. Supplement with 25-50 mg of pyridoxine and possibly B-complex if skin changes occur. Maintain adequate calcium and vitamin D intake. In addition, it can also result to hepatitis, nausea, abdominal pain and vomiting.

ii) Rifampicin, a TB drug may lead to gastrointestinal irritation, anaemia, jaundice, pancreatitis, altered taste and anorexia. It may also interfere with folate and vitamin B_{12}. It may increase metabolism of vitamin D. May need vitamin D supplement with long-term use.

iii) Ethabutol (Myambutol)
Myambutol: may decrease copper and zinc. Therefore increase foods high in Cu and Zn; daily multivitamin with may be necessary for long term use **Myambutol:**

iv) Pyrazinamide (Rifater) Drug may decrease the excretion of uric acid, leading to hyperuricemia and gout. Maintain adequate hydration and purine-restricted diet.

c) Micronutrient deficiencies - At the time of diagnosis, patients with active TB may have low levels of several micronutrients most notably vitamins C and E, retinol, zinc, iron and selenium. As mentioned above, the drug therapy initiated may also have adverse effects on the levels of micronutrients in the patient's body particularly vitamin D, vitamin B6.

d) Reduced food intake the excessive coughing associated with tuberculosis may lead to reduced food intake

MEDICAL NUTRITION THERAPY

Goals of MNT

- ✓ Maintain adequate hydration status
- ✓ Alleviate nutrient-drug interactions
- ✓ Maintain normal nutrition status
- ✓ Prevent muscle wasting and weight loss
- ✓ To decrease catabolism
- ✓ To manage anemia

Energy

Current energy recommendations are those for undernourished and catabolic patients, 35 to 40 kcal/kg of ideal body weight. For patients with any concomitant infections such as HIV, energy requirements increase by 20% to 30% to maintain body weight.

Protein

Protein is vital in preventing muscle tissue wastage and an intake of 15% of energy needs or 1.2 to 1.5 g/kg ideal body weight is recommended.

Micronutrients

A multivitamin and mineral supplement that provides 50% to 150% of the RDA is helpful, because TB patients have increased requirements that are impossible to meet with diet alone. Several micronutrients of concern include:

Vitamin B6
The standard procedure is to supplement adults with 25 mg of vitamin B6 per day to overcome this drug-nutrient interaction.

Iron
Iron therapy is only initiated for cases of identified iron deficiency. Otherwise, dietary approaches are employed through recommendation of iron rich foods e.g. beef, green leafy vegetables, eggs etc. this is because, evidence suggests that excess iron supplementation may be dangerous to TB patients.

- ✓ **Zinc**
- ✓ **Vitamin A**
- ✓ **Vitamin D calcium and phosphate**
- ✓ **Selenium**
- ✓ **Hypocholestrolemia**

6. Cystic fibrosis

Cystic fibrosis is an inherited disorder that causes severe damage to the lungs, digestive system and other organs in the body.
Cystic fibrosis affects the cells that produce mucus, sweat and digestive juices. These secreted fluids are normally thin and slippery. But in people with cystic fibrosis, a defective gene causes the secretions to become sticky and thick. Instead of acting as a lubricant, the secretions plug up tubes, ducts and passageways, especially in the lungs and pancreas.

Respiratory signs and symptoms
The thick and sticky mucus associated with cystic fibrosis clogs the tubes that carry air in and out of your lungs. This can cause signs and symptoms such as:

- A persistent cough that produces thick mucus (sputum)
- Wheezing
- Breathlessness
- Exercise intolerance
- Repeated lung infections
- Inflamed nasal passages or a stuffy nose

Respiratory system complications

- **Damaged airways (bronchiectasis).** Cystic fibrosis is one of the leading causes of bronchiectasis, a condition that damages the airways. This makes it harder to move air in and out of the lungs and clear mucus from the airways (bronchial tubes).
- **Chronic infections.** Thick mucus in the lungs and sinuses provides an ideal breeding ground for bacteria and fungi. People with cystic fibrosis may often have sinus infections, bronchitis or pneumonia.
- **Growths in the nose (nasal polyps).** Because the lining inside the nose is inflamed and swollen, it can develop soft, fleshy growths (polyps).

- **Coughing up blood (hemoptysis).** Over time, cystic fibrosis can cause thinning of the airway walls. As a result, teenagers and adults with cystic fibrosis may cough up blood.
- **Pneumothorax.** This condition, in which air collects in the space that separates the lungs from the chest wall, also is more common in older people with cystic fibrosis. Pneumothorax can cause chest pain and breathlessness.
- **Respiratory failure.** Over time, cystic fibrosis can damage lung tissue so badly that it no longer works. Lung function usually worsens gradually, and it eventually can become life-threatening.
- **Acute exacerbations.** People with cystic fibrosis may experience worsening of their respiratory symptoms, such as coughing and shortness of breath, for several days to weeks. This is called an acute exacerbation and requires treatment in the hospital.

7. Pleural effusion

A **pleural effusion** is an unusual amount of fluid around the lung. Many medical conditions can lead to it, so even though your pleural effusion may have to be drained, your doctor likely will target the treatment at whatever caused it. The pleura is a thin membrane that lines the surface of the lungs and the inside of the chest wall. When a person has a pleural effusion, fluid builds up in the space between the layers of the pleura. Normally, only teaspoons of watery fluid are in the pleural space, which allows lungs to move smoothly in the chest cavity when one breathe.

Causes

- ✓ **Leaking from other organs.** This usually happens if one has congestive heart failure, when the heart doesn't pump blood to the body properly. But it can also come from liver or kidney disease, when fluid builds up in the body and leaks into the pleural space.
- ✓ **Cancer.** Usually lung cancer is the problem, but other cancers that have spread to the lung or pleura can cause it, too.
- ✓ **Infections.** Some illnesses that lead to pleural effusion are pneumonia or tuberculosis.

Diet recommended in the treatment of pleural effusion (fluid on the lungs)

Restriction of fat intake may help in the treatment of chylous effusions, although management remains controversial. Ongoing drainage of these effusions can rapidly patients of fat and protein stores and lymphocytes. Limiting oral fat intake may slow the accumulation of chylous effusions in some patients. Total parenteral nutrition can preserve nutritional stores and limit accumulation of the chylous effusion but probably should be restricted to patients in whom definitive therapy for the underlying cause of the chylous effusion is possible.