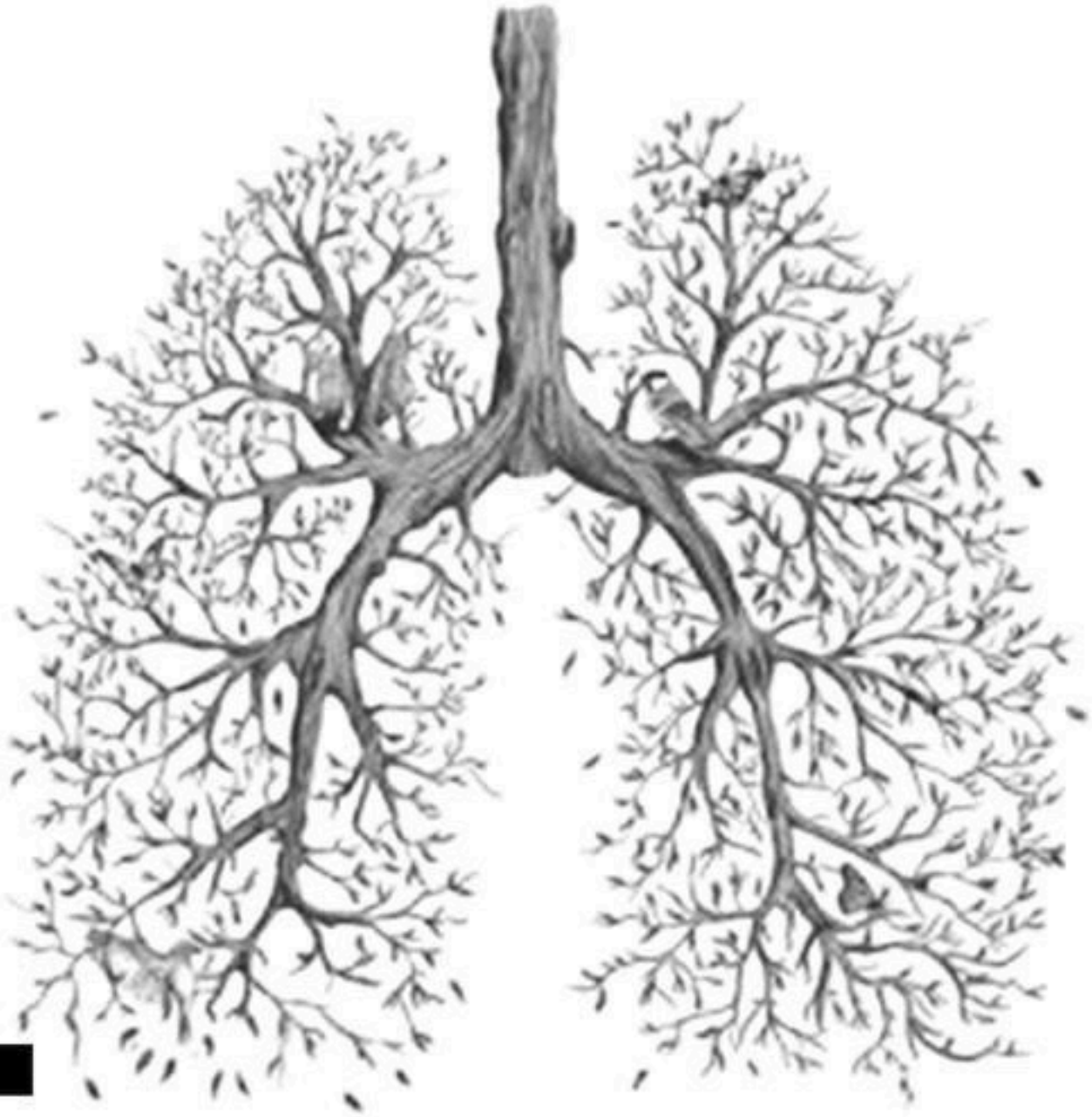




# Community Medicine



Slides

Sheet

Slide #: 18

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Date:



# Medical Nutrition Therapy for Cancer

Krause's *Food  
& Nutrition Therapy*



# Cancer

- Cancer: known as a malignant tumor or malignant neoplasm, is a group of diseases involving abnormal cell growth with the potential to invade or spread to other parts of the body. Not all tumors are cancerous; benign tumors do not spread to other parts of the body. Possible signs and symptoms include: a new lump, abnormal bleeding, a prolonged cough, unexplained weight loss, and a change in bowel movements. While these symptoms may indicate cancer they may also occur due to other issues. There are over 100 different known cancers that affect humans.

# Six characteristics of cancer have been proposed:

- self-sufficiency in growth signalling
- insensitivity to anti-growth signals
- evasion of **apoptosis**
- enabling of a limitless replicative potential
- induction and sustainment of **angiogenesis**  
(Angiogenesis is the physiological process through which new blood vessels form from pre-existing vessels)
- activation of **metastasis** and invasion of tissue



# EVASION OF APOPTOSIS BY THE CANCER CELLS

- *Evasion of apoptosis is one of the hall marks of cancer. Apoptosis is the programmed cell death that ensures the removal of old and genetically altered cells that can not be repaired. So the process is very important for continued preservation of genetic information in all body cells. Cancer cells acquire the overwhelming ability to evade apoptosis, thereby the genetic mutations necessary for carcinogenic phenotype start accumulating. The cancer cell thus becomes immortalized, this genetically mutated, immortalized cell then divides and reproduces genetically mutated daughter cells, and thus tumorigenesis develops.*

## Causes of cancer

- The great majority of cancers, some 90–95% of cases, are due to environmental factors. The remaining 5–10% are due to inherited genetics. Environmental, as used by cancer researchers, means any cause that is not inherited genetically, such as lifestyle, economic and behavioral factors, and not merely pollution. Common environmental factors that contribute to cancer death include tobacco (25–30%), diet and obesity (30–35%), infections (15–20%), radiation (both ionizing and non-ionizing, up to 10%), stress, lack of physical activity, and environmental pollutants



# Causes of cancer cont'd

- Tobacco use is the cause of about 22% of cancer deaths. Another 10% is due to obesity, a poor diet, lack of physical activity, and drinking alcohol. Other factors include certain infections, exposure to ionizing radiation, and environmental pollutants.
- In the developing world nearly 20% of cancers are due to infections such as hepatitis B, hepatitis C, and human papillomavirus. These factors act, at least partly, by changing the genes of a cell. Typically many such genetic changes are required before cancer develops. Approximately 5–10% of cancers are due to genetic defects inherited from a person's parents. Cancer can be detected by certain signs and symptoms or screening tests. It is then typically further investigated by medical imaging and confirmed by biopsy.

## Causes of cancer cont'd

- Chemicals: Tobacco smoking causes 90% of lung cancer.
- Alcohol causes 10 % of cancer in males and 3% of cancer in females.
- Cancer related to substance exposure at work causes 2% -20% such as:

Mesothelioma of the lung (lung cancer) from inhaling asbestos fibers in the job.

Leukemia from exposure to benzene at work.

Diet: Aflatoxin B1 a frequent food contaminant causes liver cancer.

High salt diet causes gastric cancer.



# Cancer Screening

- Cancer screening is currently not possible for many types of cancers, and even when tests are available, they may not be recommended for everyone. *Universal screening* or *mass screening* involves screening everyone. *Selective screening* identifies people who are known to be at higher risk of developing cancer, such as people with a family history of cancer. Several factors are considered to determine whether the benefits of screening outweigh the risks and the costs of screening. These factors include:
  - Possible harms from the screening test: for example, X-ray images involve exposure to potentially harmful ionizing radiation.
  - The likelihood of the test correctly identifying cancer.
  - The likelihood of cancer being present: Screening is not normally useful for rare cancers.
  - Possible harms from follow-up procedures.
  - Whether suitable treatment is available.
  - Whether early detection improves treatment outcomes.
  - Whether the cancer will ever need treatment.
  - Whether the test is acceptable to the people: If a screening test is too burdensome (for example, being extremely painful), then people will refuse to participate.
  - Cost of the test

# Cancer

- Abnormal cell division and reproduction that can spread throughout the body
- Three stages of cancer development:
  - Initiation
  - Promotion
  - Tumor progression, includes metastasis
- Response to treatment is complete, partial, stable, or progressive



# Stages of Tumor Development

The growth of a tumor from a single genetically altered cell is a stepwise progression. The process described below is applicable for a solid tumor such as a carcinoma or a sarcoma. Blood cell tumors go through a similar process but since the cells float freely, they are not limited to one location in the body.

- **Hyperplasia**- The altered cell divides in an uncontrolled manner leading to an excess of cells in that region of the tissue. The cells have a normal appearance but there are too many of them!
- **Dysplasia**- Additional genetic changes in the hyperplastic cells lead to increasingly abnormal growth. The cells and the tissue no longer look normal. The cells and the tissue may become

## Stages of Tumor Development

- Carcinoma *in situ*- Additional changes make the cells and tissues appear even more abnormal. The cells are now spread over a larger area and the region of the tissue involved primarily contains altered cells. The cells often 'regress' or become more primitive in their capabilities. An example would be a liver cell that no longer makes liver-specific proteins. Cells of this type are said to be de-differentiated or anaplastic. A key facet of *in situ* growths is that the cells are contained within the initial location and have not yet crossed the basal lamina to invade other tissues. Cancers of this type are often totally curable by surgery since the abnormal cells are all in one location.





## Stages of Tumor Development cont'd

Tumors of this type have not yet invaded neighboring tissue. Based on information about patients with similar growths and microscopic examination, these growths are often considered to have the *potential* to become invasive and are treated as malignant growths.

- Cancer (Malignant tumors)- These tumors have the ability to invade surrounding tissues and/or spread (metastasize) to areas outside the local tissue. These metastatic tumors are the most dangerous and account for a large percentage of cancer deaths.

# Cancer prevalence in Jordan

- Cancer causes 14% of all deaths in Jordan. The incidence of cancer in Jordan from over the 10-year period (1996-2005) were 33 661 cases of cancer. The average crude incidence rate was 66.2 per 100 000 for males and 70.0 per 100 000 for females (age-standardized rates: 119 per 100 000 adult males and 116 per 100 000 adult females). The 5 most frequently reported cancers among adult males were: lung (10.6%), colorectal (9.8%), leukaemia (9.3%), urinary and bladder (8.6%) and prostate (7.4%). For adult females these were: breast (32.0%), colorectal (9.0%), leukaemia (6.7%), thyroid (4.9%) and corpus uteri (4.6%). Cancer rates have changed little since 1996.



## Cancer prevalence globally:

- In 2012 about 14.1 million new cases of cancer occurred globally. It caused about 8.2 million deaths or 14.6% of all human deaths. The most common types of cancer in males are: lung cancer, prostate cancer, colorectal cancer, and stomach cancer.
- The most common types of cancer in females are: breast cancer, colorectal cancer, lung cancer, and cervical cancer.

# Cancer Staging

- Cancer staging is a process used by doctors to describe the severity of cancer in a specific patient. One of the most commonly used staging systems is called the TNM system, which stages cancer based upon tumor formation (T), lymph node involvement (N) and presence of metastasis (M),

There are five stages of cancer by TNM system:

- Stage 0 (in situ)
- Stage I
- Stage II
- Stage III
- Stage IV



# Nutrition in the Etiology of Cancer

- Nutrition may modify carcinogenic process at any stage: carcinogen metabolism, cellular and host defense, cell differentiation, and tumor growth
- Nutrition is adversely affected by cancer itself, treatment (radiation therapy, chemotherapy, and surgery), and current health and nutritional status
- One third of all cancer deaths attributed to diet, nutrition, and lifestyle behaviors such as poor diet, physical inactivity, overweight and obesity, and alcohol use; another third related to cigarette and tobacco use

# Nutrition in the Etiology of Cancer– cont'd

- Complex relationship
- Dietary carcinogens: naturally occurring and added in food preparation and preservation
- Inhibitors of carcinogenesis: antioxidants, phytochemicals
- Enhancers of carcinogenesis
- Latency period between initiation and promotion



# Types of Epidemiologic Studies of Cancer

## **Case Control Studies**

The diets of individuals with cancer are compared with those of cancer-free controls matched for age, sex, and other key factors.

## **Cohort Studies**

The diets of different groups of subjects are determined before cancer onset, and the incidences of developing cancers in each group are compared.

## **Cross-sectional Studies**

The diets of different groups of subjects are compared, using the same measures at a single point in time.

# Energy Intake, Body Weight, Obesity, and Physical Activity

- Energy restriction inhibits cancer and extends life span in animals
- Positive associations between overweight and cancers of the breast, endometrium, kidney, colon, prostate, and others
- Overweight increases risk of cancer recurrence and decreases survival
- Physical activity is inversely associated with cancer



# Nutrition and Cancer Etiology

- Fat
- Protein
- Soy and phytoestrogens
- Carbohydrates: fiber, sugars, and glycemic index
- Fruits and vegetables
- Nonnutritive sweeteners

# Nutrition and Cancer Etiology– cont'd

- Alcohol
- Coffee and tea
- Methods of food preparation and preservation
- Cancer chemoprevention
- Cancer prevention recommendations: nutrition and physical activity
- Nutrition and physical activity recommendations for cancer survivors



# Color Code System of Vegetables and Fruits

Color	Phytochemical	Vegetables and Fruits
Red	Lycopene	Tomatoes and tomato products, pink grapefruit, watermelon
Red/purple	Anthocyanins, polyphenols	Berries, grapes, red wine, prunes
Orange	$\alpha$ -, $\beta$ -carotene	Carrots, mangoes, pumpkin
Orange/yellow	$\beta$ -cryptoxanthin, flavonoids	Cantaloupe, peaches, oranges, papaya, nectarines
Yellow/green	Lutein, zeaxanthin	Spinach, avocado, honeydew, collard and turnip greens
Green	Sulforaphanes, indoles	Cabbage, broccoli, Brussels sprouts, cauliflower
White/green	Allyl sulphides	Leeks, onion, garlic, chives

Data from Heber D: Vegetables, fruits and phytoestrogens in the prevention of diseases, *F Postgrad Med* 50:145, 2004.

# Guidelines for Cancer Prevention

1. Choose a diet rich in a variety of plant-based foods.
2. Eat plenty of vegetables and fruits.
3. Maintain a healthy weight and be physically active.
4. Drink alcohol only in moderation, if at all.
5. Select foods low in fat and salt.
6. Prepare and store food safely.

And always remember . . . Do not use tobacco in any form.

From American Institute for Cancer Research: *Simple steps to prevent cancer*, Washington, DC, 2000, AICR.



# Cancer Prevention

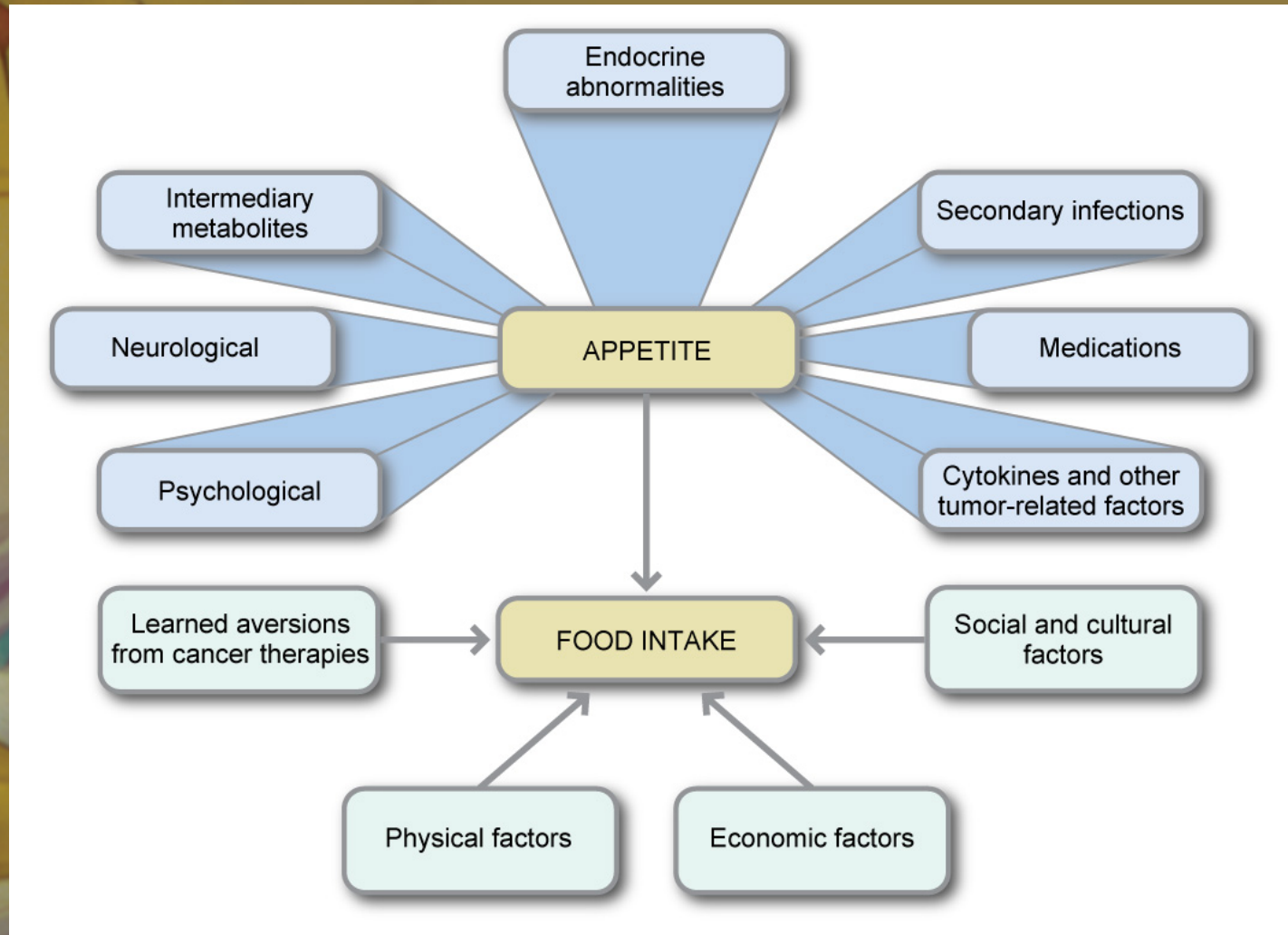
- Many cancers can be prevented by not smoking, maintaining a healthy weight, not drinking too much alcohol, eating plenty of vegetables, fruits and whole grains, being vaccinated against certain infectious diseases, not eating too much red meat, and avoiding too much exposure to sunlight.
- Early detection through screening is useful for cervical and colorectal cancer. The benefits of screening in breast cancer are controversial.

# Nutritional Implications of Cancer

- Adverse nutritional effects of cancer compounded by treatment
- Even small weight loss (<5% body weight) before treatment adversely affect prognosis



# Factors That Affect Appetite



# Cancer Cachexia

- Progressive weight loss
- Anorexia
- Generalized wasting and weakness
- Immunosuppression
- Altered BMR
- Abnormalities in fluid and energy metabolism
- Mediated via cytokines, including tumor necrosis factor (TNF $\alpha$  and TNF $\beta$ ), cachectin, interleukin-1, interleukin-6, and interferon- $\alpha$



# Metabolism and Tumor Growth

- Energy needs are variable
- Protein, fat, and carbohydrate: tumors exert consistent demand for glucose
- Nutrition support preserves lean body mass; also benefits malignancy
- Hypercalcemia
- Fluid and electrolyte imbalances
- Enzyme activities and endocrine functions
- Loss of appetite and sensory changes

# Nutritional Care of Adults

- Goals: prevent or reverse nutrient deficiencies, preserve lean body mass, minimize nutrition-related side effects, maximize quality of life
- Nutritional screening and risk assessment
- Body weight
- Antioxidants

# Energy and Protein Requirements

## ■ Energy

- Standardized equations, indirect calorimetry

## ■ Protein

- Consider degree of malnutrition, extent of disease, degree of stress, ability to metabolize and use protein



# Daily Protein Requirements for Patients with Cancer

RDA for adults: 0.8 g/kg

Normal maintenance: 0.8 to 1 g/kg

Nonstressed cancer patient: 1 to 1.2 g/kg

Hypercatabolic cancer patient: 1.2 to 1.6 g/kg

Severely stressed cancer patient: 1.5 to 2.5 g/kg

Hematopoietic stem cell transplant patient: 1.5 to 2 g/kg

Data from Charuhas PM et al: Medical nutrition therapy in bone marrow transplantation: energy, protein, micronutrient, and fluid requirement. In Elliott L et al, editors: *The clinical guide to oncology nutrition*, ed 2, Chicago, 2006, American Dietetic Association.

# Fluid and Micronutrient Requirements

## ■ Fluid

- Body surface area:  $1500 \text{ mL/m}^2$  or  $\text{BSA} \times 1500 \text{ mL}$
- Daily requirements method: 1 mL fluid per 1 kcal of estimated needs
- Holliday-Seger method:  $>20 \text{ kg}$  of body weight = 1500 mL + 20 mL/kg for each kg  $>20 \text{ kg}$
- Age based method:  $<55$  year of age – 30 to 40 mL/kg, 55 to 65 years of age – 30 mL/kg,  $>65$  years of age – 25 mL/kg

## ■ Micronutrients

- High-dose supplements common
- Pre-existing deficiencies
- Recommend supplement with 100% DRI

# Cancer Treatment and Nutritional Implications

## ■ Chemotherapy

- Anemia, fatigue, nausea, vomiting, loss of appetite, mucositis, changes in taste and smell, xerostomia, dysphagia, diarrhea, constipation

## ■ Immunotherapy

- Fatigue, chills, fever, flu-like symptoms, decreased food intake

## ■ Radiation therapy

- Fatigue, loss of appetite, skin changes, and site-specific effects



# Cancer Treatment and Nutritional Implications–cont'd

- Hematopoietic stem cell transplantation
  - Nausea, vomiting, anorexia, dysgeusia, stomatitis, oral and esophageal mucositis, fatigue, and diarrhea
  - Dietary precautions with neutropenia
  - Graft versus host disease (GVHD)
  - Sinusoidal obstructive syndrome (SOS)
- Surgery
  - Fatigue, pain, loss of appetite

# Management of Nutrition

## Impact Symptoms

- Determining routes of nutritional therapy
- Oral nutritional management strategies
- Management of chemotherapy-induced nausea and vomiting
- Pharmaceutical management of anorexia-cachexia syndrome
- Enteral nutrition
- Parenteral nutrition
- Rehabilitation and physical therapy
- Palliative care for advanced cancer

# Nutritional Care of Children

- Families and caregivers often have extreme preoccupation with eating and weight
- Creativity in feeding
- Enteral nutrition support
- Individualize requirements
- Requirements for growth and development



# Focal Points

- Nutrition plays an important role throughout the continuum of cancer care—from helping to reduce cancer risk, to caring for patients undergoing cancer treatment, to promoting healthy lifestyles for cancer survivors.
- Patients have different needs and challenges with regard to their nutrition management, and providing individualized nutritional guidance is an essential component of their care.
- Prompt and appropriate nutrition management may help to improve patients' tolerance of treatment, minimize nutrition impact symptoms, and maximize quality of life.
- Cancer patients should be encouraged to actively participate in their care and to communicate with their health care providers.
- When patients are inundated with nutrition-related CAM therapy choices, food and professionals can provide sound guidance for informed decision making.