



HIV/ AIDS and Nutrition

Blank Page 2

1

Overview of HIV/AIDS

Development of HIV and Progression to AIDS

It may take up to 6 months for antibodies to HIV to be detectable in blood after infection with the virus.

The immune system has different types of cells that protect the body from infection. One type of these specialized cells is the subset of lymphocytes – the T-cells. HIV infection is caused by the human immunodeficiency virus, a retrovirus that has an affinity for these T-cells. The virus infects these cells by binding to a protein receptor – CD4 – on the cell surface. CD4 receptors are also found on the surface of monocytes/macrophages and these can also be infected with the virus.

Once inside the host cell, the virus uses the enzyme, reverse transcriptase, to transcribe its RNA into DNA, which then integrates into the host nucleus. A protease enzyme reconstructs the virus that then buds from the cell, becoming free to infect other immune cells. During the course of HIV infection, the virus continues to replicate and infect CD4 plus lymphocytes and other immune cells.

It may take up to 6 months for antibodies to HIV to be detectable in blood after infection with the virus. Once detected, a measurable amount of the virus in the blood may stay stable for a long period of time. This set point is different for each person. Over time, the immune system becomes progressively weaker, and the infected individual develops Acquired Immunodeficiency Syndrome (AIDS). Table 1.1 shows the clinical stages of the infec-

tion to AIDS. Persons with AIDS become susceptible to a wide range of opportunistic infections.

**TABLE I.1: WHO STAGING SYSTEM FOR HIV INFECTION
AND DISEASE IN ADULTS AND ADOLESCENTS**

Clinical Stage	Clinical Description	Performance Scale
I	Asymptomatic Persistent generalized lymphadenopathy	1: Normal activity
II	Weight loss <10% Minor symptoms and infections	2: Normal activity
III	Weight loss >10% Symptomatic Diarrhoea/ fever >1 month	3: Bedridden <50% of days/month
IV	Symptomatic AIDS-Wasting syndrome Severe opportunistic infections	4: Bedridden >50% of days/month

Indicators of HIV Infection

HIV seropositivity and disease progression are determined by several blood tests. These include:

- *Enzyme-linked Immunosorbent Assay (ELISA)*, which looks for antibodies to HIV, and will indicate whether the person is HIV positive or negative;
- *Western Blot (WB)*, which also looks for antibodies. This test is much more accurate than the ELISA and is used to confirm a positive ELISA;
- *Polymerase Chain Reaction (PCR)*, which measures the presence of HIV in the blood;
- *Viral load*, which measures the amount of virus in a specific volume of blood. Viral load has prognostic value for disease progression in that the higher the viral load, the greater the risk for clinical deterioration.
- *CD4 cell count*, which measures the level of CD4 plus lymphocytes in the blood, reflecting the strength of the immune system. It is widely used as a marker of HIV disease progression. Treatment decisions are usually based on CD4 cell counts.

Transmission of HIV

An infected person transmits HIV to an uninfected person through direct contact with infected body fluids such as semen, vaginal secretions, blood, and breast milk. The most common modes of transmission are unprotected sex, contaminated needles or blood, perinatal transmission and breastfeeding.

The symptom associated with opportunistic infections include fever, night sweats, mouth sores and rashes.

Clinical Manifestations of HIV Disease

Initially, during primary or acute infection, individuals may experience a seroconversion illness, which induces flu-like symptoms due to extremely high virologic load. As the immune system responds to this infectious agent, the viral load decreases and the HIV-positive person will go through a protracted asymptomatic period, often up to ten years. During the asymptomatic period, the infected person may feel well, and is sometimes unaware of the HIV-positive status.

As the disease progresses, symptoms such as generalized malaise, weight loss, fatigue, and chronic diarrhoea may be experienced. As the immune system weakens, the infected person becomes susceptible to opportunistic infections that cause illness and debilitation. Eventually, the HIV-infected person may die of complications arising from opportunistic illness(es) and not AIDS itself. Respiratory disorders are the most prevalent opportunistic infections. The symptoms associated with opportunistic infections include fever, night sweats, mouth sores and rashes.

Socioeconomic Implications of HIV/AIDS

HIV/AIDS can affect the nutritional status of the individual from a socioeconomic perspective thereby affecting household food security. According to the United Nations Sub-Committee on Nutrition (2001), "Household food security is defined as the ability of the household to secure, either from its own production or through

purchases, adequate food to meet the dietary needs of the members so they can lead a healthy and active life."

In households affected by HIV infection, a portion of family resources must be diverted from acquiring food to meeting medical costs. Additionally, with the illness of an adult, the household loses a working member. This situation further decreases access to food and other resources. Thus, not only does the HIV-infected person become malnourished, but the nutritional well-being of the entire household declines. HIV/AIDS can therefore have a devastating effect on household food security.



*Nutritional
Implications of
HIV/AIDS*

Blank page – Page 8

2

Nutritional Implications of HIV/AIDS

The importance of nutrition when there is infection with HIV is twofold. Optimal nutritional status helps to protect and maintain a healthy immune system that can delay disease progression. On the other hand, a key component of nutrition therapy is dietary modification that is crucial for managing the nutrition-related complications of the disease thereby assisting with the treatment of malnutrition.

Malnutrition and HIV /AIDS

Malnutrition is any condition caused by deficient or excess energy and/or nutrient intake, or an imbalance of nutrients. Malnutrition with HIV/AIDS is usually due to deficiencies and is a frequent complication of HIV infection. Malnutrition affects individuals at any stage of the disease.

Causes of Malnutrition

The aetiology of malnutrition is complex with a myriad of contributing factors that may be experienced singly or more typically in clusters during the course of HIV disease. The main factors include:

- inadequate oral dietary/nutrient intake
- increased/excessive nutrient losses
- increased energy and nutrient requirements
- metabolic abnormalities
- drug-food interactions

- increased nutritional demands of pregnancy, lactation and childhood
- other considerations

A brief description of these factors follows.

Inadequate oral dietary/nutrient intake

Inadequate dietary intake has the most severe impact on nutritional status and tends to be the driving force in HIV-associated muscle wasting. Profound loss of appetite is prevalent, difficult to treat, and results in both macro and micronutrient deficiencies. Gastrointestinal complications such as nausea, delayed gastric emptying and early satiety may severely limit intake, and malabsorption generates negative feedback to the appetite centre with the presence of unabsorbed nutrients in the small intestine. Oral complications such as candidiasis, herpes, dental problems and dysguesia result in pain and lack of interest in food. Oesophageal infections cause pain and dysphagia.

Increased/excessive nutrient losses

Nutrient malabsorption is possible even in persons who are asymptomatic. Individuals with diarrhoea are at risk of carbohydrate, fat and micronutrient malabsorption as well as electrolyte depletion. Vomiting also induces nutrient and electrolyte losses, and persons who experience night sweats and fever may develop dehydration and electrolyte imbalance.

Increased energy and nutrient requirements

Nutrient requirements for PLWHA differ from the requirements of persons who are not infected. As the infection progresses, energy requirements are different for the distinct phases of HIV infection. Energy requirements are elevated with high viral load, fever, opportunistic infection, the need for weight gain and the increased energy cost of breathing in respiratory infections. In resource-limited settings, WHO recommends that energy intake should be increased by 10% for asymptomatic HIV-infected individuals, with a 20-30% increase during the symptomatic phase or if there is opportunistic infection.

During the symptomatic phase, energy requirements for children increase by 20-30% if there is no weight loss, and by 50-100% if there is weight loss. Although

recommended levels may not be achievable during periods of acute infection or illness, intake should be increased to the extent possible during the recovery phase aiming for the maximum achievable up to 30% above normal intake during the acute phase.

According to the World Health Organization (WHO), protein requirements remain the same as for the healthy non-HIV-infected person, that is, 12% to 15% of total energy intake. However, since energy requirements are higher, protein intake should increase proportionately with efforts to increase energy intake. On the other hand, there is the view that requirements are consistently elevated to provide substrate for immune cell replication (the acute phase response) lean body mass maintenance as well as during periods of septicemia when protein needs are dramatically elevated to attenuate hypercatabolism of somatic protein stores.

The WHO advises that micronutrient requirements are usually the same as for healthy non-HIV-infected individuals but these could be increased if deficiencies are apparent. Note that PLWHA have numerous risk factors for developing micronutrient deficiencies.

Metabolic abnormalities

Metabolic abnormalities, including hypercortisolaemia, protein catabolism, hypo-gonadism, and dysregulation of fatty acid metabolism have been implicated in HIV-associated wasting. Many of these changes are induced by cytokines and in particular the tumor necrosis factor which have been found to be elevated with HIV infection.

Increased nutritional demands of pregnancy, lactation and childhood

It is well established that the health of the infant is dependent on the nutritional health of the mother. Pregnant women who are infected with HIV are at increased nutritional risk that may have a negative impact on the birth outcome. In addition to the extra energy and nutrient requirements due to HIV infection, pregnant and lactating women need to consume extra energy, protein and micronutrients due to their condition.

Note that PLWHA have numerous risk factors for developing micronutrient deficiencies.

Similarly, HIV-infected children are at significant risk of growth failure due to their high metabolic and nutritional demands for growth. The consequences of malnutrition among infants and children can be devastating, resulting in growth retardation, increased susceptibility to infection, delayed development, decreased functional capacity and mortality.

Drug-food interactions

Many HIV-infected persons are required to take daily doses of a number of medicines including anti-retrovirals (ARVs). Each drug has known nutrition-related side effects (see Chapter 7). In-depth knowledge of the drugs commonly used by these individuals, and management of the side effects are critical for drug efficacy and optimal nutrition. Individuals should be encouraged to adhere to their regimen since missing doses gives the virus the opportunity to copy itself, grow and mutate thus leading to drug resistance to possibly all the drugs in the same group and fewer options for fighting HIV.

Other considerations

HIV-infected individuals may experience co-morbidities such as tuberculosis, gastrointestinal, hepatic or renal disease. These conditions have nutritional implications. In addition, individuals who are disadvantaged for socioeconomic or cultural reasons may have difficulty maintaining good nutritional status.

Key Points

1. **Regardless of their HIV status, all persons need to obtain adequate nutrition by consuming healthy, balanced diets.**
2. **Additional energy intake should be in conjunction with the consumption of a nutrient-dense diet.**
3. **Nutrient requirements for PLWHA should take into account any pre-existing malnutrition. Higher levels of intake may be required to compensate for deficiencies.**
4. **Macro and/or micronutrient deficiencies have independent deleterious effects on immunity. Susceptibility to opportunistic infections increases and the effectiveness of, and tolerance to medications and other therapies is reduced.**
5. **ARV and other medications can interact with food and nutrients. This may require specific food and nutrition responses to minimize negative effects on nutritional status, medication efficacy, and adherence to medication.**

Manifestations of Malnutrition

The underlying significant clinical problems in the pathogenesis of malnutrition in HIV are associated with starvation and/or cachexia. These are manifested as weight loss, muscle wasting, and/or micronutrient deficiencies.

- *Weight loss* remains a significant, and the most visible, complication throughout the course of HIV disease. Weight loss results from the depletion of both adipose and lean tissue, and may in part be dictated by the severity of illness and initial body composition before weight loss. Fat loss could be more prominent among persons with a greater percentage of body fat at baseline. Unintentional weight loss of as little as 5% has been associated with increased morbidity and mortality.

Weight loss remains a significant, and the most visible, complication throughout the course of HIV disease.

Weight loss can be either acute or chronic. Acute/rapid weight loss is usually indicative of the presence of opportunistic infection(s), whereas chronic/slow weight loss is usually linked to gastrointestinal disease or a high viral load. Among women weight loss consists of proportionately more body fat, whereas men are likely to lose more lean tissue.

- *HIV-associated wasting* is linked to disease progression caused by decreased dietary intake, poor nutrient absorption and altered metabolism. Classical wasting is more likely to occur in the context of virologic or immunologic failure, a secondary infection, or clinically significant diarrhoea or anorexia. Part of the weight lost during wasting is fat, but more important is the loss of muscle/lean body mass (LBM)/body cell mass (BCM). The loss of such tissue can be progressive and may not be reflected in weight changes even with asymptomatic HIV infection.
- *Wasting Syndrome* (WS) has been classified by the Centers for Disease Control and Prevention (CDC) as an AIDS-defining illness with specific diagnostic criteria. These are:
 - involuntary weight loss of >10% of baseline weight in the presence of unexplained chronic diarrhoea with at least 2 loose stools daily for >30 days, or
 - intermittent or constant fever for >30 days.

There is a proposal for a revised definition for HIV-associated wasting to differentiate it from Wasting Syndrome. This definition includes temporal factors, degrees of severity and body composition considerations as follows:

- Weight loss > 10% within 6 months
- Weight loss > 5% within 3 months
- Weight loss > 3% within 1 month
- Body Mass Index < 20
- Loss of 5% of Body Cell Mass

In this Manual, wasting refers to the classical HIV-associated wasting and not wasting syndrome according to the CDC definition.

Micronutrient deficiencies are common due to inadequate intake, malabsorption, metabolic aberration and increased turnover. In addition, low serum levels of vitamins and minerals may be associated with increased rate of disease progression and risk of mortality. The incidence of micronutrient deficiency increases with declining CD4 cell count, but this may occur in asymptomatic individuals including those who are eating well. It is still to be determined whether micronutrient deficits have a causal effect on disease progression and mortality, or are markers for disease progression.

Effects of Malnutrition

Both HIV/AIDS and malnutrition have similar negative effects on immune function. These include:

- depressed levels of T-cell lymphocytes
- inverted T-cell helper-suppressor ratio
- decreased lymphokine production, and
- decreased T-cell activity and natural killer cell function.

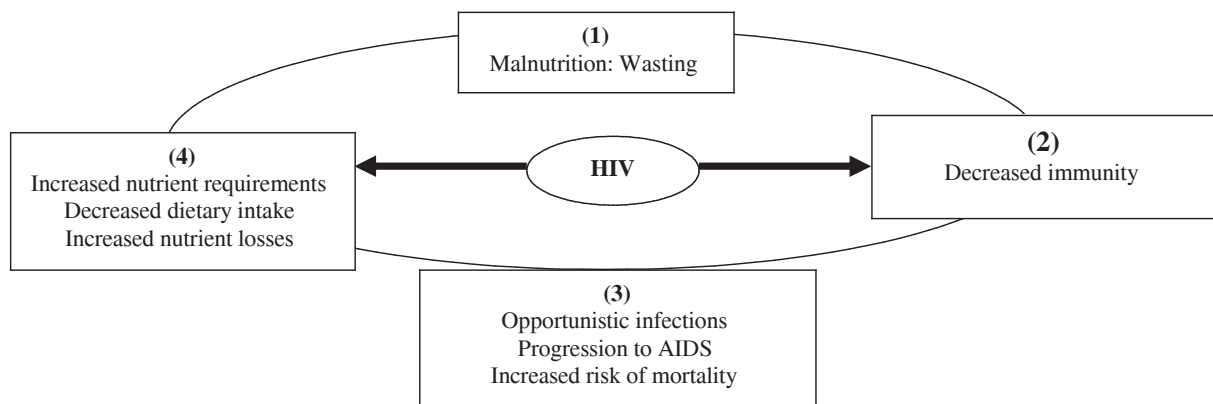
This phenomenon, whereby nutritional complications further weaken a compromised immune system, may induce a downward spiral with more rapid disease progression. Malnutrition that occurs due to starvation associated with HIV/AIDS, induces metabolic adaptation, whereby basal metabolic rate decreases to conserve energy, nitrogen is conserved to preserve lean tissue, and

lipid is preferentially oxidized for energy. Repletion of lean and adipose tissue can be achieved with re-feeding in the course of simple starvation.

Another effect of malnutrition is cachexia, which is associated with sepsis, neoplasm and trauma. In contrast to starvation, cachexia results in an increased metabolic rate and degradation of somatic proteins to provide substrate for the acute phase response. Re-feeding tends to deposit primarily adipose tissue with little gain in lean body mass.

The following figure shows the cyclical relationship between malnutrition and HIV/AIDS:

FIGURE 1: CYCLICAL RELATIONSHIP BETWEEN MALNUTRITION AND HIV/AIDS



- HIV can independently have a deleterious effect on the immune system (**box 2**) and dietary intake, nutrient requirements and nutrient losses (**box 4**).
- A depressed immune system (**box 2**) makes the seropositive person more susceptible to opportunistic infections (**box 3**). If untreated, the risk of mortality increases. Over time the infection naturally progresses to AIDS.
- Opportunistic infections (**box 3**) contributes to increased nutrient requirements (**box 4**), but often there is decreased dietary intake and increased nutrient losses.
- The above conditions result in a state of malnutrition (**box 1**), and the cycle continues.


In addition to the aforementioned clinical implications, the malnourished individual experiences greater debilitation, with loss of independence and decreased ability to perform the activities of daily living. Ultimately there is a greater need for medical care and home support.

Prevention of Malnutrition

Because of the high risk of nutritional complications, early nutrition intervention should be an integral component of health care for HIV-infected individuals. Nutrition screening, assessment and intervention, implemented in a timely manner, could improve health outcomes by preventing the downward spiral in nutritional status with HIV infection. In addition, HIV-infected persons should have the benefit of nutrition and lifestyle counselling with a view to optimizing nutrient intake, preventing food borne infection and improving overall health. Guidelines for Nutritional Consultation are presented in *Appendix 2*.

Key Points

- 1. Evaluation of weight and nutritional status should be included in the initial and subsequent evaluation of HIV infected persons.**
- 2. It is critically important to identify and characterize early risk factors for wasting in HIV-infected persons because of the severe impact of wasting on disease progression and functional capacity.**
- 3. It cannot be assumed that treatment with potent ARV will ameliorate nutritional deficiencies.**
- 4. It is critical to distinguish between voluntary and involuntary weight loss and changes in fat distribution so that appropriate management strategies can be applied.**
- 5. Education on appropriate nutritional practices, exercise and the importance of maintaining energy balance should be emphasized.**
- 6. Nutritional status is often directly related to socioeconomic conditions that need to be recognized as an important determinant of overall nutritional status, including growth in children.**



3

Nutritional Management of Adults with HIV/AIDS

Blank page – Page 18

3

Nutritional Management of Adults with HIV/AIDS

Nutritional management should be integral to the medical care of all HIV-infected persons who may be at nutritional risk at any point in their illness. It is therefore important to identify those adults who are at nutritional risk.

Identifying Adults at Nutritional Risk

There are a number of approaches that can be used to identify persons at nutritional risk. These include specific conditions, nutrition screening, classification of conditions by category of risk and subjective global assessment.

Specific Conditions

The following situations contribute to the nutritional risk of adults:

- severe malnutrition
- weight loss, particularly loss of lean tissue
- anorexia and oral/gastrointestinal symptoms
- inability to eat food secondary to complicated medical regimens or fatigue
- opportunistic infections
- food and drug interactions
- development of hyperglycaemia and lipid abnormalities
- fear of developing fat-redistribution syndrome

- chemical dependency, and
- socioeconomic factors

Ideally, all infected persons should have access to the services of a dietetic professional, but given the current limited resources in the Caribbean, persons should be screened for nutritional risk.

Nutrition Screening

The initial encounter with any newly diagnosed HIV-positive individual should include nutrition screening using an appropriate screening tool that can be completed by, ideally, a health care worker. However, in some situations, the PLWHA, a lay caregiver, or a community worker may complete this exercise. The screening tool should be developed by the dietetics professional who should monitor and evaluate its usage. Samples of screening tools for use with PLWHA are given in **Appendix 1.2** and **Appendix 1.3**.

Another approach to screening is presented in **Table 3.1**. This tool allows for categorizing the individual's risk level as either low, moderate or high, based on consideration of multiple factors that could compromise nutritional status. If the level of risk is moderate or high, a timely referral to a dietetic professional is necessary for a comprehensive or thorough nutrition assessment, individualized intervention and development of an appropriate care plan. The outcome of screening should trigger referral to a nutrition and dietetic professional. In some cases nutrition screening can result in referral to a food assistance program or other relevant support services. Nutrition screening precedes the comprehensive nutrition assessment.

Classification of Conditions by Category of Risk

The following table lists specific conditions according to the level of risk and suggests the frequency for an encounter with a dietitian.

TABLE 3.1: CLASSIFICATION OF CONDITIONS BY CATEGORY OF RISK

High Risk (Visit with dietitian monthly)	Moderate Risk (Visit with dietitian at least once per 3 months)	Low Risk (Visit with dietitian as necessary)
<ul style="list-style-type: none"> * Clinical Stage III or IV * Poorly controlled diabetes mellitus * Pregnancy * Infants receiving replacement feed * Poor growth, lack of weight gain, or failure to thrive (infants and children) * BMI <18.5 for adults * > 10% unintentional weight loss over 4-6 months * > 5% unintentional weight loss within 4 weeks or in conjunction with: <ul style="list-style-type: none"> - chronic oral or esophageal thrush - dental problems - dysphagia - chronic nausea or vomiting - chronic diarrhoea * Severely dysfunctional psychosocial situation, especially in children 	<ul style="list-style-type: none"> • Clinical Stage II or III • Obesity • Evidence of body fat redistribution • Elevated cholesterol (>200 mg/dL) or triglycerides (>250 mg/dL), or HDL cholesterol <100mg/dL) • Osteoporosis • Diabetes mellitus, controlled or newly diagnosed • Hypertension • Evidence of hyper- vitaminoses or excessive supplement intake • Inappropriate use of diet pills, laxatives or other OTC medications • Substance abuse in the recovery phase • Possible food-drug-nutrient interactions • Food allergies and intolerance • Single medical co-morbidity • Oral thrush • Eating disorder • Evidence of sedentary lifestyle or exercising excessively • Unstable psychosocial situation especially in children 	<ul style="list-style-type: none"> • Clinical Stage I • Stable weight • Appropriate weight gain, growth, and weight-for-height in infants and children • Adequate balanced diet • Normal levels of cholesterol, triglycerides, albumin and glucose • Stable HIV disease with no intercurrent infections • Regular exercise regimen • Normal hepatic and renal function • Psychosocial issues stable, especially in children

Subjective Global Assessment

The **Subjective Global Assessment (SGA)** can also be used for screening to identify persons at nutrition risk, quantify the degree of risk and determine who requires a more detailed assessment. A sample protocol is presented in **Appendix 1.1**

Nutrition Care

Nutrition care is the specific type of diet therapy that is best suited for the HIV-infected individual for the purpose of disease management and ultimately medical care. Such contribution uses the systematic, problem-solving, cyclical process that begins when data is gathered about the individual's present nutritional status, diet adequacy and contributory factors, followed by the collective interpretation of such data, and thereafter identification of risk factors for impending nutritional complications that should be addressed. Nutrition care process and medical nutrition therapy are related but not the same. The latter refers more specifically to the course of treatment required.

Goal of Nutrition Care

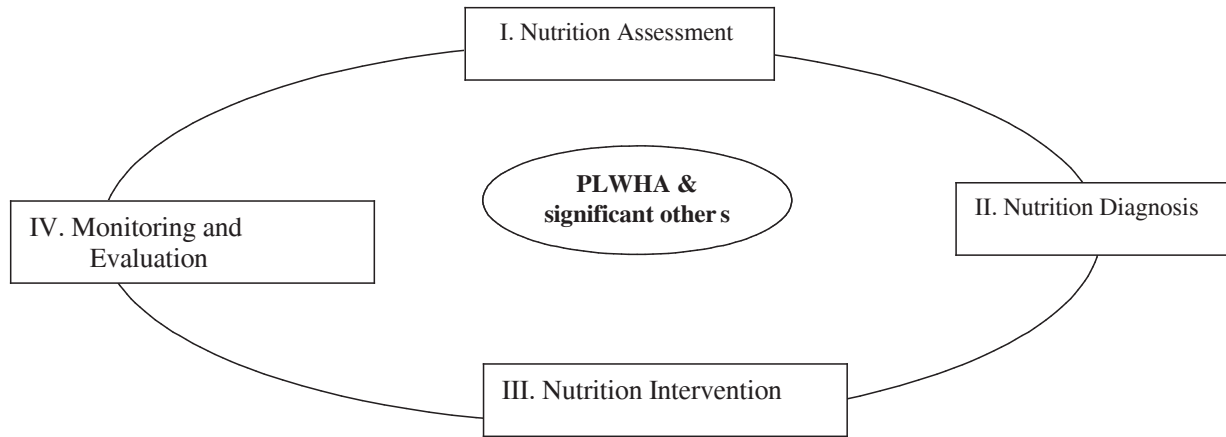
The goal of nutritional care is to optimize overall nutritional status of the PLWHA while empowering him/her to be committed to his/her health.

Phases of Nutrition Care

The phases of nutrition care or the nutrition care process include four distinct but synergistic steps: nutrition assessment, nutrition diagnosis, nutrition intervention, monitoring and evaluation. These are detailed as follows:

Anthropometry is used to estimate body energy stores and protein mass by muscle and subcutaneous fat using noninvasive and inexpensive external requirements.

FIGURE 3.1: PHASES OF NUTRITION CARE/NUTRITION CARE PROCESS



I. Nutrition Assessment

Nutrition assessment is the first phase of the nutrition care process. The goals of assessment are:

- to gather information about current nutritional status and adequacy of the diet
- to identify risk factors for impending nutritional complications.

Nutrition assessment provides the basis for goal setting, the rationale for the development of an appropriate individualized nutrition care plan, and establishes the reference by which the efficacy of nutrition intervention can be evaluated during follow-up/evaluation sessions. A sample Nutrition Assessment form is given in **Appendix 1.4**.

The components of a comprehensive nutrition assessment should include measures of body composition of fat and LBM, biochemical assessment of serum proteins and micronutrients, clinical assessment of co-morbid conditions that affect nutritional status and dietary intake assessment. "ABCD" is a convenient mnemonic to remember the components of assessment:

- A. Anthropometric and Body Composition Assessment
- B. Biochemical Assessment

- C. Clinical (physical examination, and medical history) Assessment
- D. Dietary Assessment

No individual parameter relates exclusively to nutritional status and they must all be evaluated in the context of all aspects of health care.

A. Anthropometric and Body Composition Assessment

Anthropometry is used to estimate body energy stores and protein mass by evaluating muscle and subcutaneous fat using noninvasive and inexpensive external measurements. These evaluations assist with screening for nutritional risk as well as characterizing body composition, growth and monitoring long-term nutritional status.

With HIV disease, anthropometry has some limitations, such as less accurate measures of total body fat in persons with lipodystrophy and in the presence of short-term illness, there may be an increase in tissue fluid along with a decrease in cellular mass. Nevertheless, the most critical anthropometric measurements are baseline weight and height.

Measures of body composition identify depletion of LBM or BCM that is associated with increased mortality in PLWHA more than the disease itself. Therefore, body composition, and not only weight loss, is an important determinant of nutritional status and risk of mortality.

(i) Anthropometric Assessment: Weight

Body weight gives an indication of overall fat and muscle stores. Weight should be taken at each clinic visit, preferably by the same person using the same accurately calibrated scale and standardized procedures. Serial weight measurement is an important tool in the detection of wasting but does not identify dramatic losses in BCM.

Recording of weight history, percentage of usual weight and weight change over time is essential and should be practiced. Calculation of BMI allows for comparing the individual with accepted standards. An abrupt decline in BMI may be indicative of progression to AIDS.

Standardized procedures for measuring adult weight are outlined in **Appendix 3.1 Anthropometry: Procedures for Taking Adult Weight.**

Although use of actual body weight (ABW), or current body weight (CBW) is recommended, weight status can be assessed by using either usual weight (UBW) or ideal weight (IBW) for height. ABW/CBW is the measurement obtained at the time of assessment. This may be influenced by changes in fluid status. UBW may be more useful if the individual can provide this data. This will allow for establishing weight changes by comparing ABW with UBW.

Evaluating Weight Status

Weight status can be evaluated in terms of (a) actual/current weight or (b) weight history:

All Infected persons should be screened for nutritional risk.

(a) Actual Weight:

Although body mass index (BMI) is widely used to evaluate actual weight, two other methods, % IBW and HAMWI Method can be used.

- Body Mass Index (BMI) or Quetelet Index evaluates actual weight (kg) for height² (m²). BMI is calculated when the client's Weight (Kg) is divided by Height² (m)². This is usually written as:

$$\frac{\text{Weight (kg)}}{\text{Height (m)}^2} = \text{BMI}$$

BMI has been correlated with morbidity and mortality, but does not identify changes in LBM or BCM.

BMI	Interpretation
18.5	Underweight
18.5-24.99	Normal/Healthy
> 25	Overweight
25.0-29.99	- Pre obese
30.0-34.99	-Obese Class I
35.0-39.99	-Obese Class II
≥ 40	- Obese Class III

People living with HIV, especially those on anti-retroviral medication, may experience obesity, an added health risk. When BMI falls under 20 according to the proposed criteria to define HIV-associated wasting, health risk is also increased.

- % IBW: ABW can be compared to IBW and monitored as follows:

$$\frac{\text{Actual Body Weight}}{\text{Ideal Body Weight}} \times 100 = \% \text{ IBW}$$

- *HAMWI Method*: This is a quick method for determining ideal weight for height as outlined below:

TABLE 3.2: HAMWI METHOD

(b) Weight History

Sex	Metric Measurement	Imperial Measurement
Men	48.18 kg for the first 150 cm) + 1.1 kg per cm over 150 cm (OR -1.1 kg per cm under 150 cm)	106 lb for the first 5 ft. + 6 lb per inch over 5 ft. (OR - 6 lb per inch under 5 ft.)
Women	45.45 kg for 150 cm + 0.91 kg per cm over 150 cm (OR -0.91 kg per cm under 150 cm)	100 lb for the first 5 ft. + 5 lb per inch over 5 ft. (OR - 5 lb per inch under 5 ft.)
<p>Large-framed persons: add 10% to the above calculation Small-framed persons: minus 10% from the above calculation</p> <p>Frame size can be estimated using wrist circumference, or elbow breadth measurement outlined in <i>Appendix 3.2 and 3.3</i> respectively.</p>		

Weight history evaluates trends over time and may provide a more accurate evaluation of health status appropriate for the PLWHA. When evaluating an HIV-infected person's nutritional status, it may be better to use the reported UBW although it is important to monitor their weight as compared to IBW.

Unintentional weight loss is sometimes the first symptom of HIV infection. Weight loss reflects the inability to meet nutritional needs and thus may

indicate nutritional risk. The percentage of weight loss reflects the extent and severity of the nutritional deficit.

Weight loss/change can be evaluated by a) % weight change/loss or by (b) % UBW using either of the respective formula that follows. Guidelines for interpreting the result are presented.

$$(a) \frac{\text{Usual body weight} - \text{Actual body weight}}{\text{Usual body weight}} \times 100\% = \% \text{ Weight Loss/Change}$$

Interpretation: Clinically significant and indicative of increased risk of morbidity and mortality is a loss of 3% within 1 month; 5% within 3 months or 10% within 6 months.

$$(b) \frac{\text{Actual Body Weight}}{\text{Usual Body Weight}} \times 100 = \% \text{ UBW}$$

Interpretation: 85 to 95% UBW is indicative of mild depletion; 75 to 84% UBW is indicative of moderate depletion and < 75% UBW is indicative of severe depletion.

(ii) *Anthropometric Assessment: Height*

Like weight, height/stature should be measured using a standardized method rather than self-reported data that may be inaccurate. **Appendix 3.4 Anthropometry: Procedures for Taking Adult Height** outlines standardized procedures for measuring standing height. Alternatives for persons who are unable to stand include (i) sitting height, or crown-rump length, though this is less accurate than standing height; (ii) crown-heel length or recumbent bed height, which is about 3.68 cm more than standing height and (iii) knee height. This is used with persons who are bedfast, confined to a wheelchair, or have curvature of the spine. This method is useful with the elderly. Supine knee height is considered to be more accurate than seated knee height. Procedures for taking knee height measurement are outlined in **Appendix 3.5 Anthropometry:**

Alternative Approach - Taking Knee height Measurement. A nomogram can also be used to estimate stature from knee height - **Appendix 3.6.**

(iii) Body Composition Assessment

Body composition can be measured in a variety of ways. Two useful and common methods are (a) *Skinfold Measurements* and, where available, (b) *Bioelectrical Impedance Analysis (BIA)*.

(a) Skinfold Measurements

Body fat and lean mass can be evaluated using standardized calipers and a measuring tape. This widely used technique assumes that subcutaneous fat is representative of total body fat. To quickly and simply estimate subcutaneous fat and lean body mass, measure mid arm circumference (MAC) and triceps skinfold thickness (TSF).

MAC measures bone, fat, fluid, and muscle and reflects changes in fluid, fat and muscle status of the upper arm. TSF estimates the amount of subcutaneous adipose tissue in the mid-arm, with the assumption that this measurement reflects total body fat stores. Another skinfold measurement is the mid arm muscle area (MAMA) that assesses muscle and bone content of the upper arm, correcting for subcutaneous fat. MAMA is sensitive to changes in lean tissue, and reflects total body muscle mass. The formula is as follows:

$$\text{MAMA} = \frac{[\text{MAC (cm)} - (\pi \times \text{TSF (cm)})]^2}{4 \pi}$$

Interpretation of mid-arm assessment:

Mid-arm circumference and triceps skinfold thickness can be compared to NHANES I and II data and Nutrition Canada reference tables for percentiles. Midarm indices below the 5th percentile, or declining percentiles indicate nutritional risk with potential for progressive wasting.

(b) Bioelectrical Impedance Analysis (BIA)

BIA estimates whole body fat, LBM, total (intra- and extra-cellular) body water and extracellular fluid. BIA assessments have limitations in that measurements are influenced by fluid shifts in acute infection, body

position and time spent in the supine position. BIA cannot diagnose abnormalities due to fat redistribution as seen with lipodystrophy syndrome. However, BIA provides important information

Key Points

1. **Standardized methods of anthropometric measurements recorded regularly help determine whether energy and protein needs are being met. Remember that weight loss, reduced body fat and reduced body mass are early signs of deterioration of nutrition status in PLWHA.**
2. **Anthropometric measurements provide an inexpensive and non-invasive means to monitor long-term nutritional status, characterize body fat deposition, and assist in screening for nutritional risk.**
3. **Body composition should be assessed at baseline and regular intervals for early identification of body cell mass wasting and to enhance nutritional intervention strategies. Body composition analysis yields the best results when the serial measurements are done over time.**

when monitoring weight changes and is considered a practical clinical tool for body composition assessment.

B. Biochemical Assessment

Biochemical assessment includes laboratory measurements of serum protein, micronutrient levels and lipids as well as immunological parameters. Visceral protein measurements are the most helpful laboratory indicators of nutritional status although malabsorption, liver disease, and the use of steroids can affect levels of visceral protein.

Some specific laboratory tests are included on page 3.3,

Other laboratory tests suggested as being useful include fasting glucose and lipid profile, BUN, electrolytes, liver enzymes, zinc, vitamin B12, iron, ferritin, CBC which gives information on the total number of white

TABLE 3.3: LABORATORY MEASUREMENTS, SPECIFIC TESTS, DESCRIPTION AND VALUES

Laboratory Measurements	Specific Tests & Description	Values			
Serum Proteins (measures of visceral protein status)	<i>Pre-albumin</i> : sensitive indicator especially in acute energy protein malnutrition; more sensitive than albumin or transferrin for showing effectiveness of medical nutrition therapy.	Nutritional Status			
		Malnutrition			
		Normal	Mild	Mod.	Severe
		>150 mg/L	100-149	50-99	<50
		<i>To convert mg/L to mg/dL, multiply mg/L by 0.1</i>			
	<i>Albumin</i> : most widely used indicator of depletion and predictor of nutritional status; a useful indicator of nutritional risk if considered within the context of other clinical factors. Infection and oedema can decrease the level; dehydration can increase the level giving a false -negative value	Malnutrition			
		Normal	Mild	Mod.	Severe
		35-50 g/L	28-34	21-27	<21
		<i>To convert g/L to g/dL, multiply g/L by 0.1</i>			
		<i>Transferrin</i> : a shorter half-life than albumin; a carrier protein for iron; more sensitive marker of nutritional status especially in acute EPM	Malnutrition		
Normal	Mild		Mod.	Severe	
>2 g/L	1.5-2		1-1.49	<1	
<i>To convert g/L to g/dL, multiply g/L by 100</i>					
Iron	Haemoglobin		83.0 - 97.5 g/L		
	MCV	114 - 143 g/L			
Electrolytes	Sodium	135-145 mmol/L			
	Potassium	3.5-5.0 mmol/L			
Immunological parameters	CD4 (cells/mm ³)	>500 Normal 200-500 moderate suppression <200 severe suppression (AIDS)			
	Viral Load (copies/mL)	Undetectable or <50 copies/mL is the goal of ARV			

Source: Hickney, M.S. *Handbook of Enteral, Parenteral and ARC/AIDS Nutritional Therapy*, Chicago, 1992.

and red blood cells present, and TLC which gives an estimate of cell-mediated immune function. Note that in untreated advanced HIV infection triglyceride (TG) values are increased as a normal immune scavenger function and cholesterol levels are decreased because of altered liver metabolism. Very low levels may contribute to increased morbidity and mortality. In some persons, ARV may cause an increase in both TG and cholesterol. Dietary intervention may have limited efficacy.

Key Points

1. Malnutrition, medications and illness may alter biochemical values due to metabolic alterations and the acute phase response to infection.
2. Laboratory values need to be interpreted with caution.

Biochemical assessment includes laboratory measurements of serum protein, micronutrient levels and lipids as well as immunological parameters.

C. Clinical Assessment

Usually conducted by a physician, clinical assessment includes a physical examination and medical history to identify signs of, or contributors to, malnutrition. Key areas include physical appearance, evaluation of opportunistic infections and co-morbid conditions, occurrence of gastrointestinal distress, diarrhoea or mal-absorption, medications, use of nutritional or herbal supplements and functional status. A review of the documentation in the medical record will provide the necessary information to facilitate the nutrition assessment.

Physical Examination

Physical examination identifies physical signs of nutritional deficit and possible nutrient deficiencies. These are summarized in Table 3.4.

TABLE 3.4: PHYSICAL CHARACTERISTICS OF NORMAL AND, MALNOURISHED CONDITIONS WITH POSSIBLE NUTRIENT DEFICIENCY

Characteristics of Normal Appearance	Characteristics of Malnutrition	Possible Nutrient Deficiency
<p>Hair Shiny</p> <p>Not easily pluckable</p> <p>Normal distribution</p>	<p>Dry, dull</p> <p>Alopecia (baldness)</p> <p>Brittle</p> <p>Early graying</p>	<p>Protein, energy, or essential fatty acid deficiency (EFA);</p> <p>Protein, zinc, or biotin</p> <p>Protein, energy, or copper</p> <p>Vitamin B₁₂</p>
<p>Face Uniform Not swollen</p>	<p>Fullness</p> <p>Puffy</p> <p>Cheeks drawn in</p>	<p>Protein</p> <p>Protein, energy</p> <p>Protein, energy</p>
<p>Eyes Bright, clear, shiny Membranes moist, pink No broken vessels</p>	<p>Corneal or conjunctival dryness</p> <p>Conjunctival pallor</p> <p>Corneal vascularization</p> <p>Bilateral redness and fissuring of eyelid corners</p>	<p>Vitamin A</p> <p>Iron, folic acid</p> <p>Riboflavin, vitamin B-complex;</p> <p>Riboflavin, vitamin B-complex, Vitamin B₁₂</p>
<p>Lips Pink, moist, smooth</p>	<p>Angular stomatitis</p> <p>Cheilosis (chapping, fissuring)</p>	<p>Niacin, riboflavin, iron, vitamin B₁₂</p>
<p>Tongue Taste buds over dorsum and sides of tongue Pink, moist, smooth</p>	<p>Magenta, painful, edema</p> <p>Scarlet, painful, smooth pallor</p> <p>Papillary atrophy</p> <p>Papillary hypertrophy</p> <p>Fissuring, edema</p> <p>Taste changes</p> <p>Glossitis</p>	<p>Riboflavin, biotin</p> <p>Niacin, folic acid, vitamin biotin, iron, vitamin B₁₂</p> <p>Iron, folic acid, vitamin B₁₂, niacin, riboflavin</p> <p>Niacin, riboflavin, vitamin B₁₂,</p> <p>Niacin</p> <p>Zinc, vitamin A</p> <p>Iron, vitamin B₁₂, folic acid, niacin, riboflavin, Pyridoxine, vitamin B₆</p>
<p>Gums and teeth : Gums are pink, moist, smooth 32 teeth, white, shiny</p>	<p>Bleeding, receding</p> <p>Gingivitis, stomatitis</p> <p>Fluorosis</p> <p>Carious</p>	<p>Vitamin C</p> <p>Folic acid, vitamin B₁₂</p> <p>excess fluoride</p> <p>protein, energy, fluoride</p>

TABLE 3.4: PHYSICAL CHARACTERISTICS OF NORMAL AND, MALNOURISHED CONDITIONS WITH POSSIBLE NUTRIENT DEFICIENCY (cont'd)

Characteristics of Normal Appearance	Characteristics of Malnutrition	Possible Nutrient Deficiency
<i>Skin</i> Smooth No rashes, swelling, or scales	Xerosis (dryness) Scaly dermatitis Follicular hyperkeratosis Delayed wound healing Santhoma (yellowish papules) Decubitus ulcers Dermatitis herpetiformis	Vitamin A, EFA, zinc Riboflavin, biotin, zinc, EFA Vitamin A, EFA Zinc, protein, vitamin C Elevated cholesterol Zinc, protein, vitamin C Gluten enteropathy
<i>Nails</i> Firm, pink	Koilonychia (spoons nails) Egg shell nails Blue lunula	Iron, chromium Vitamin A Copper excess
<i>Musculoskeletal</i> Good tone with some fat Normal movement	Wasting Tenderness Reduced strength Bone pain Dowager s hump Bowed legs, pigeon chest	Protein, energy, thiamin Thiamin, selenium Protein, energy, calcium, sodium, vitamin D, potassium Vitamin D, calcium phosphate Calcium, vitamin D Vitamin D, calcium
<i>Neurological</i> Psychologically stable Normal reflexes	Depression Confusion Dementia Sensory neuropathy Tetany	Pyridoxine, zinc, niacin, vitamin B ₁₂ Thiamin, niacin, vitamin B ₁₂ Niacin, vitamin B ₁₂ Vitamin B ₁₂ , vitamin B-complex, vitamin E Calcium, magnesium
<i>Abdomen:</i> Symmetrical, flat	Distention Flatus	Protein, energy Lactose intolerance, low fiber

Adapted with permission from McDonald, JJE. "A Pocket Guide to Physical Examination and Nutritional Assessment" Toronto, Ontario: WB Saunders of Canada 1994.

Medical History

A medical history provides information about symptoms and co-morbidities that may impact on nutritional status. The following should be investigated with a view to evaluating nutritional implications:

- Opportunistic infections
- Concurrent disease (e.g. tuberculosis, hepatic, renal, diabetes, gastro-intestinal, neoplasm)
- Mental health problems
- Medication profile

TABLE 3.5: MANIFESTATION OF HIV INFECTIONS WITH NUTRITIONAL IMPLICATIONS

Type of Organism	Malignancies/ CD4 count (cells/mm ³)	Body Site Affected	Manifestation
	Kaposi's sarcoma (300-500)	50% of patients with KS lesions of the skin may have involvement of the GI tract, including hard and soft palate, small intestine, stomach, and liver	Odynophagia, dysphagia, abdominal pain, nausea, vomiting, obstruction, bleeding, and rarely, diarrhoea
	Non-Hodgkin's lymphoma (0-500)	GI tract	Nausea, vomiting, dysphagia, hematemesis, lower GI tract bleeding, obstruction, abdominal pain, diarrhoea
<i>Fungi</i>	<i>Candida albicans</i> (0-200)	Oral and esophageal involvement with dense plaque of exudate	Dysgeusia, dysphagia, decreased salivation, burning, odynophagia, nausea, upper GI bleeding
	<i>Coccidioidomycosis</i>	Meningitis, flu-like symptoms, multi-organ system involvement	Cough, fever, fatigue, anorexia, weight loss
	<i>Cryptococcus</i> (50-100)	Meninges	Fever, nausea, dementia, vomiting
	<i>Histoplasmosis</i> (50-100)	Lung, bone marrow, liver, spleen	Fever, weight loss, dysphagia
<i>Viruses</i>	<i>Cytomegalovirus</i> CMV) (0-100)	Ulcerative lesions in entire GI tract	Esophagitis, gastritis, enteritis, colitis, proctitis, watery or bloody diarrhoea, biliary disease, organ perforation
	<i>Epstein-Barr virus</i> (EBV)	Tongue	Oral hairy leukoplakia
	<i>Herpes simplex virus</i> (200-500)	Lesions of oral cavity, esophagus	Odynophagia, dysphagia, proctitis, esophagitis, pain, constipation

TABLE 3.5: MANIFESTATION OF HIV INFECTIONS WITH NUTRITIONAL IMPLICATIONS (cont'd)

Type of Organism	Malignancies/ CD4 count (cells/mm ³)	Body Site Affected	Manifestation
Protozoa	<i>Cryptosporidium</i> spp (50-100)	Entire GI tract, especially microvilli of small intestine and biliary tract	Profuse and watery diarrhoea, lactose intolerance, nausea, malabsorption, steatorrhea, abdominal pain, cholecystitis, pancreatitis, vomiting, dehydration, electrolyte depletion, malnutrition
	<i>Giardia lamblia</i> (0-200)	Small intestine	Nausea, bloating, abdominal cramps, diarrhoea, fever, anorexia, vomiting
	<i>Isospora belli</i>	Microvilli of small intestine	Often unable to distinguish from <i>Cryptosporidium</i> spp; diarrhoea, bloody diarrhoea, steatorrhea, abdominal pain, fever, anorexia, vomiting
	<i>Pneumocystis carinii</i> (PCP) (100-200)	Lungs	Dyspnea, fever, weight loss, coughing, pneumonia
	<i>Toxoplasma gondii</i> (50-100)	Encephalitis	Fever, dementia
Bacteria	<i>Campylobacter jejuni</i>	Large and small intestine	Abdominal pain, fever, bloody diarrhoea
	<i>Clostridium difficile</i>	Large and small intestine	Colitis, severe diarrhoea
	<i>Mycobacterium avium</i> complex (MAC) (0-50)	Intestine, liver, spleen, lymph nodes, bone marrow	Fever, weight loss, cachexia, malaise, diarrhoea, steatorrhea, malabsorption, pain in abdomen (late stage)
	<i>Salmonellae</i>	Large intestine	Abdominal pain, fever, cramping, bacteremia, high propensity for recurrence
	<i>Shigella</i>	Large intestine	Abdominal pain, fever, cramping, tenesmus, bloody diarrhoea, high propensity for recurrence

Reprinted from *The Manual of Clinical Dietetics*. American Dietetic Association. 6th edition. 2000:589-608.

D. Dietary Assessment

The Dietary component of nutrition assessment examines adequacy of the diet for macro and micro nutrient composition and identifies factors that may affect intake. It includes diet history, assessment of dietary intake and social history.

The goal of dietary assessment is to prevent loss of weight and LBM, and to determine measures that may improve the overall health of the PLWHA.

Assessment of Dietary Intake

There are a number of methods to assess dietary intake. Each approach has its advantages and disadvantages - see Table 3.6. However, a diet history and 24-hour recall can provide good estimates of dietary intake for baseline assessment. The following considerations should be explored during an initial nutrition assessment and periodically thereafter to obtain an historical perspective:

- Current dietary intake
- Usual eating pattern
- Changes in appetite
- Gastrointestinal complications
- Chewing and swallowing problems
- Fatigue
- Food intolerance, allergies or restrictions
- Body image concerns or eating disorders
- Ability to acquire and prepare food
- Use of food programs
- Use of micronutrient supplements or herbal therapies
- Activity level, exercise, ability to perform activities of daily living
- Substance use (alcohol, tobacco, drugs)

In addition to assessment using ABC and D, a Psychosocial History will provide information about social and economic factors that influence the PLWHA's ability to maintain adequate nutritional intake. It can be used to evaluate the following factors in terms of impact on nutritional well-being.

**TABLE 3.6: DIETARY INTAKE ASSESSMENT METHODS:
PROCESS, ADVANTAGES AND DISADVANTAGES**

Assessment Methods and Description	Process	Advantages	Disadvantages
24 hour recall - <i>a record of foods eaten by a person for one 24-hour period</i>	Person recounts all foods and beverages taken during the previous 24 hours.	Is quick, fairly easy, practical and simple to administer.	<ul style="list-style-type: none"> *Provides data only for 1 day; *Does not provide enough information to allow accurate generalizations about an individual's usual intake; *Relies on the person's memory and ability to describe foods and servings accurately; *Requires a skilled interviewer.
Usual intake – <i>record of a typical daily intake</i>	Person reports the typical daily diet.	<ul style="list-style-type: none"> *Is quick and practical; *Captures the usual intake; *Can be cross-referenced with the 24 hour recall to provide more accurate information; *Helps the assessor to verify food habits. 	<ul style="list-style-type: none"> *Person with wide daily variations may have difficulty answering general questions; *May not reflect fluctuations in intake; *Relies on the memory of the person; *Requires a skilled interviewer.
Food records – <i>A log of all food eaten over a period of several days or weeks; may include information such as mood, when, where and with whom the food was / is eaten; sometimes referred to as a food diary.</i>	<p>Person records food intake for a specified period of time; provides a more accurate estimate of intake.</p> <p>The number of days is stipulated on an individual basis but usually can vary from 3 to 7 days.</p>	Helps the assessor and record keeper to analyze food behaviours especially those with negative consequences, and suggest solutions.	<ul style="list-style-type: none"> *Burden on the person is high; *Relies on the commitment of the person to complete the task; *May result in changed eating behaviour during the period.

TABLE 3.6: DIETARY INTAKE ASSESSMENT METHODS: PROCESS, ADVANTAGES AND DISADVANTAGES (cont'd)

Assessment Methods and Description	Process	Advantages	Disadvantages
<p>Food frequency checklist- <i>Ascertains how often an individual eats a specific type of food per day, week, or month using a list of foods or types of foods; gives an overview of usual dietary intake.</i></p>	<p>Person is asked to indicate how often a particular food is consumed from the listing of foods provided.</p>	<p>Helps to pinpoint food groups, and therefore nutrients, that may be excessive or deficient; usually appropriate for population surveys.</p>	<p>Not recommended for individual dietary assessment.</p>
<p>Observation of food intake – (conventionally called “calorie count”, and can be extended to nutrient intake analysis) <i>A record of the kinds and quantities of foods received and left on the plate.</i></p>	<p>Food is measured before plating and leftovers are measured, sometimes subjectively, after eating.</p>	<p>Usually used to generate an estimate of energy and protein intake.</p>	<p>Requires skill with observing and measuring.</p>

- Socioeconomic status, which affects housing and ability to acquire and store food
- Social isolation, depression
- Substance use by the PLWHA or family members
- Cultural or religious practices which affect dietary intake
- Living arrangements, family dynamics
- Physical or mental capability to prepare food

Since all HIV-positive persons should receive nutritional assessment, the following table identifies a suggested minimal nutrition assessment for these individuals.

TABLE 3.7: SUGGESTED MINIMAL NUTRITION ASSESSMENT FOR HIV-POSITIVE PERSONS

History	<ul style="list-style-type: none"> • Premorbid weight, that is, usual weight before infection • Weight history since being infected with HIV • Amount of regular exercise and/or weight training • Presence of opportunistic infections, fever and diarrhoea • History of eating disorders • Social and financial issues affecting food availability and accessibility • Dietary history and current intake • Use of alcohol or other drugs
Measurements	<ul style="list-style-type: none"> • Weight • Height • Body mass index
Laboratory	<ul style="list-style-type: none"> • CBC • Electrolytes • Serum albumin • Fasting lipid profile if on Ant i-retroviral therapy • Vitamin B₁₂ level • Fasting glucose

Key Points

1. A baseline nutrition assessment should be conducted soon after a diagnosis of HIV is confirmed.
2. Follow-up assessments for asymptomatic persons should be conducted once or twice a year, and 2-6 times a year for the symptomatic person or one with a diagnosis of AIDS.
3. Given that each case is unique, more frequent monitoring may be required for some persons.
4. National guidelines can help to determine who needs counselling and how aggressive this should be.

II. Nutrition Diagnosis

Nutrition diagnosis, for example "undesirable weight gain," is not the same as medical diagnosis "HIV-positive". Nutrition diagnosis involves identifying and labeling an actual occurrence, risk of, or potential for developing a nutritional problem that the nutrition/dietetic professional is responsible for treating independently. Analyzing the assessment data and arriving at nutrition diagnosis (es) provide a link to setting realistic and measurable expected outcomes, choosing appropriate interventions and tracking progress toward attaining the expected outcomes.

III. Nutrition Intervention

Timely nutrition intervention is crucial to the course and outcome of HIV infection. Early intervention during asymptomatic HIV infection is essential to enhance the person's response to medication and other therapies, support immune function, help prevent opportunistic infections and/or delay disease progression.

Having completed the assessment and diagnostic steps, a course of action needs to be decided upon and implemented with the involvement of the PLWHA and significant other(s). Goal setting for self management is critical along with other facets of care.

The goals of nutrition intervention are to optimize overall nutritional status and to empower the PLWHA to be committed to and take responsibility for his/her health. Intervention strategies aim to optimize dietary intake, prevent or treat nutrient deficiencies, maintain weight and body cell mass, ameliorate symptoms, minimize the side effects of medications, support the immune system, enhance the quality of life and prolong life. Nutrition care planning, nutrition education and counselling are common and invaluable strategies that can be employed during the intervention phase of the nutrition care process.

■ Nutrition Care Planning

Nutrition care planning includes estimating nutritional requirements to tailor to the individual's needs.

Estimating Nutritional Requirements

The Dietary component of nutrition assessment examines adequacy of the diet for macro and micro nutrient composition and identifies factors that may affect intake.

Energy Requirements

Energy requirements are highly variable and depend on clinical condition, metabolic rate, activity level and viral load. In asymptomatic HIV infection, resting energy expenditure is slightly elevated but total energy expenditure is not always increased correspondingly due to a compensatory response with decreased physical activity. Fever, septicemia and the need for weight gain incur a significant increase in kilocalorie requirements.

In severely malnourished individuals, energy requirements are initially depressed to provide metabolic support and prevent re-feeding complications, followed by incremental increases in kilocalories for nutritional rehabilitation.

Energy requirements are also reduced to promote weight loss in obese individuals. The following estimates are based on actual body weight, except for obese PLWHA, for whom adjusted body weight should be used.

Adjusted body weight = 0.25 (actual body weight - ideal body weight) + ideal body weight

Estimating energy requirements for adults

Asymptomatic, stable weight:	30-35 kcal/kg/24hr
Need to gain weight:	35-40 kcal/kg/24hr
Acute infection:	40-50 kcal/kg/24hr
Severely malnourished:	20 kcal/kg/24hr to start with gradual increase
Need to lose weight:	20-25 kcal/kg/24hr

Alternatively, the **Harris Benedict Equation (HBE)** can be used to estimate energy requirements. This method has the added advantage of including weight, height and age in the calculations.

Harris Benedict Equation (HBE)

Male: $66.5 + [13.75W(\text{kg})] + [5.0H(\text{cm})] - [6.78A(\text{years})]$

Female: $655 + [9.56W(\text{kg})] + [1.85H(\text{cm})] - [4.68A(\text{years})]$

Multiply by an activity factor of 1.1-1.75 and a stress factor of 1.0-1.75

Protein Requirements

There is huge variation in individual protein requirements, dependent mainly on clinical status. Protein is required to provide substrate for immune cell replication, synthesis of acute phase proteins, and lean body mass maintenance. With acute infection, protein requirements are dramatically elevated to attenuate hypercatabolism of somatic proteins.

The following estimates of protein requirements are based on body weight. It is essential to concurrently meet energy requirements in order to spare protein.

- **Clinically stable:** 1.0-1.5 g/kg/24hr
- **Severe infection, fever:** 1.5-2.0 g/kg/24hr

Alternatively, the WHO recommendations for resource-limited settings may be used whereby protein is calculated as 12% to 15% of total energy requirements.

Fluid Requirements

It is essential that fluid requirements are met in conjunction with other nutrients. Fluid requirements are elevated in the presence of diarrhoea, vomiting, open wounds, fever and night sweats. Patients who experience gastrointestinal symptoms or loss of appetite typically decrease fluid as well as food intake. Fluid sources that contain calories are often preferred over water to increase overall caloric intake.

To estimate fluid requirements, either of the following calculations can be used:

- 30-40 ml/kg dry body weight or
- 1 ml per kilocalorie of total energy

Micronutrient Requirements

Micronutrient supplementation remains controversial in the scientific community because of the lack of consensus on an appropriate mode of supplementation. Definitive proof of efficacy is difficult to obtain because of the complex interactions among nutrients, the immune system, gastrointestinal function and viral replication.

**It is essential
that fluid
requirements
are met in
conjunction
with other
nutrients**

Although adverse consequences have been found in deficient states, there is no evidence that prophylactic micronutrient supplementation will improve clinical outcome or mortality risk. However, micronutrient therapy is widely advocated, and may be one avenue of empowerment for persons living with HIV/AIDS to gain control over their health.

In Canada and the United States, Dietary Reference Intakes (DRI) have been set by an expert panel to include minimum requirements for a healthy population as well as safe Upper Tolerable Limits (UTL). It is important that the UTL be taken into consideration when recommending any supplementation regimen.

Given the high risk of micronutrient deficiencies, and the prevalence of inadequate dietary intake, HIV-positive individuals may benefit from a broad-spectrum multivitamin-mineral once a day. For patients who manifest specific nutrient deficiencies, it is prudent to provide therapeutic doses of those vitamins or minerals until serum levels are normalized.

Individuals with hepatic or renal dysfunction should exercise extreme caution with micronutrient supplementation.

■ Asymptomatic HIV+Persons

For persons who are asymptomatic HIV+, nutritional therapy is largely preventative with emphasis on maintaining health, avoiding nutrient deficiencies and avoiding food or water borne illness. Guidelines for healthy eating for the general population provide a sound foundation upon which to build nutrition care plans.

Healthy Eating

A nutrient dense diet using a variety of foods is recommended. Such a diet will be nutritionally adequate if a sufficient quantity of food is consumed. The following guidelines for healthy eating for persons with HIV will be useful:

- Use staple foods as the mainstay of the diet and as the primary source of energy;
- Use fruits and vegetables generously;
- Use legumes often, and as tolerated;

- Use food from animals generously but as tolerated;
- Use fats and oils moderately but as tolerated.

Note that the usual population guidelines to choose foods in small to moderate amounts from the Food from Animals, and Fats and Oils Caribbean food groups do not apply.

Many PLWHA need a high protein, high energy diet and these food groups are good sources of protein and energy respectively.

Soon after diagnosis, referral to a health care professional who is familiar with strategies for nutrition support is highly recommended. It is easier to prevent malnutrition than reverse it. Counselling sessions should include:

- Discussions about nutrient-dense foods, energy, protein and micronutrient requirements as well as the quality of fat, the use of sugar and high-sugar containing foods in the context of HIV/AIDS.
- Addressing any nutrition-related complications (e.g. diarrhoea, anorexia, weight loss).
- Discussions to ensure that the individual understands the basic principles of food safety with regard to purchasing, handling, preparing and storing of foods.
- Promotion of exercise and physical activity as tolerated to maintain lean body mass.

A qualified dietitian can conduct a comprehensive nutritional assessment, and along with the client, develop an appropriate nutrition care plan, engaging the individual and significant other(s) in the necessary counselling process.

Note that the usual population guidelines to choose foods in small to moderate amounts from the Food from Animals, and Fats and Oils Caribbean food groups do not apply .

Key Points

- 1. Weight loss is associated with more rapid disease progression and mortality.**
- 2. Undernourished individuals experience greater debilitation, with loss of independence and ability to perform everyday tasks.**
- 3. Because malnutrition is a common complication of HIV infection, all persons living with HIV need to be instructed in healthy eating practices and supported in their ability to make healthier choices.**
- 4. The cost of malnutrition with the increased need for medical care, hospitalization and home support is high.**

Planning Healthy Diets

In the Caribbean, foods are categorized into six food groups based on the main nutrients contributed by the foods, availability in the region, cultural food habits and beliefs. This grouping of foods is a simple and practical guide that individuals can use daily as they aim for variety and healthy eating. It can be used by and for everyone from about age 6 months throughout the life cycle, regardless of cultural circumstances. In the practice of medical nutrition therapy, it even forms the basis for modifying diets for specific disease conditions.

The Six Caribbean Food Groups (Appendix 8) are:

- Staples (provisions and cereal-based products)
- Legumes and Nuts (dried peas, beans and nuts)
- Vegetables (yellow, dark green leafy and non-starchy)
- Fruits (including fruit juices)
- Food from Animals (meats, poultry, seafood and dairy products)
- Fats and Oils

Because of the similarity of nutrients in each group, foods can be exchanged within the same group. Selecting combinations of food from different food groups is known as the "Multimix Principle." This helps families to make appropriate choices for their diet to be more nutritious.

Nutrients are the basic components needed by the body to maintain healthy cells, tissues and organs. Nutrients are dependent upon each other for absorption and function. A healthy diet, based on the six food groups, will provide carbohydrates, protein, calories, fats, vitamins, minerals and antioxidants. An additional vitamin/mineral supplement may be recommended. Dietary modifications need to be individualized according to need, and may include strategies such as fat restriction, high calorie diet, or addition of liquid food supplements such as those listed in **Appendix 5**.

Exercise

Coupled with healthy eating is the need to balance food intake with physical activity to help maintain a healthy weight. The importance of exercise is often overlooked among PLWHA. However, regular exercise, especially resistance training, has been found to assist with building lean body mass. This is important given the propensity to progressively lose body cell mass over time. Patients who exercise are stronger and better able to manage the activities of daily living independently.

■ **Symptomatic HIV+Persons**

Early, aggressive nutrition intervention is warranted because malnutrition is associated with adverse outcomes and nutrition support may improve the course of HIV disease. Nutrition therapy should be implemented in a step-wise progression at the first signs of nutritional deficit (e.g. unintentional weight loss of 5% of usual body weight in 1 month).

Planning the Diet

When planning diets for persons infected with HIV, it is necessary to ensure that the required nutrients are supplied to keep the immune system functioning optimally. **Table 3.8** summarizes the key nutrients that will be of benefit to the immune system. Some of these are highlighted in the following table.

High Energy, High Protein Diet

The purpose of a high energy, high protein diet is to provide kilocalories and protein in excess of usual requirements. This diet is indicated to prevent or

treat malnutrition, to promote weight gain and repletion of somatic protein and to attenuate the hyper-metabolic, hypercatabolic effects of opportunistic infections.

In order to increase energy content of the diet, fat intake is usually increased to 35% or more. This strategy must be implemented with caution as HIV-infected persons sometimes do not tolerate high fat food due to gastrointestinal complications. Lactose intolerance is also common in patients with diarrhoea which precludes the liberal use of milk products, especially skim milk powder.

TABLE 3.8: NUTRIENTS FOR THE IMMUNE SYSTEM

Nutrient	Purpose	Examples of Food Sources
Proteins	Provide substrate for lean body mass, organ tissue, immune cell replication, acute phase response	<p><i>Food from animals:</i> meats including organ meats like liver, kidney, heart, tripe, rabbit, “wild” meat, poultry (chicken/fowl, duck) fish, eggs and dairy products (milk, milk powder, buttermilk, yoghurt).</p> <p><i>Some plant foods</i> such as peanut and peanut butter and other nuts; legumes like pigeon peas, channa/chick peas, red/kidney beans, lentils, split peas, black eye peas, soya beans and so on; tofu.</p>
<p>Vitamins help to support the immune system and keep the lining of the lungs and the gut healthy. This makes it more difficult for germs to enter the body and cause infections. Fresh fruits and vegetables and pure fruit juices (not fruit-flavoured drinks) are the best sources of a number of vitamins. Overcooking destroys vitamins and vegetables lose their vitamins if they are soaked in water for a long time. Legumes also lose their vitamins if baking soda is added to the water during soaking.</p>		
Vitamin A	<p>Growth and function of T and B cells for immunity; keeps the linings of the skin, lungs and gut healthy.</p> <p><i>(During infections, there is an increased loss of Vitamin A from the body)</i></p>	<p>Dark green, yellow, orange and red fruits and vegetables:</p> <ul style="list-style-type: none"> • Spinach, broccoli, calaloo / dasheen leaves, green/sweet/bell peppers, other “greens”. • Pumpkin, squash, carrots, paw paw/papaya, cantaloupe, mangoes • Beets <p>Other foods: liver, butter, fortified margarine, cheese, eggs, yellow sweet potatoes</p>
Vitamin B₆	<p>Maintains a healthy immune and nervous system; helps to make red blood cells. <i>(Lost with some medicines used in the treatment of tuberculosis)</i></p>	<p>Meat, fish, chicken, watermelon, corn, broccoli, green leafy vegetables, white beans, potatoes, whole grain cereals, corn, nuts, avocados.</p>

TABLE 3.8: NUTRIENTS FOR THE IMMUNE SYSTEM (cont'd)

Nutrient	Purpose	Examples of Food Sources
<i>Vitamin C</i>	Helps with recovery from infections; helps with iron absorption	Citrus fruits: oranges, grapefruit , lemon, portugals, tangerines, ortaniques; other fruits like guavas, mangoes, West Indian/ garden cherries; Vegetables like tomatoes, cabbage, broccoli, green/sweet/bell peppers.
Minerals – are an important group of micronutrients that have a variety of metabolic functions. Minerals yield no energy in the human body, but they help to regulate the release of energy. Two minerals for special mention are:		
<i>Selenium</i>	Helps to activate the available T-cells. Helps regenerate glutathione, a major intracellular antioxidant.	<i>Whole grain foods</i> like whole wheat bread, bran flakes; <i>dairy products</i> like milk, yoghurt and cheese; <i>protein-rich foods</i> like meat, seafood, liver, poultry and eggs; legumes – dried beans, nuts and peanut butter.
<i>Zinc</i>	Reinforces the immune system; helps with digestion; carries Vitamin A; important for growth, taste acuity.	Meats, fish, poultry shellfish, whole grain cereals, beans, peanuts, eggs, milk and other dairy products.
<p>Flavonoids and phytosterols are natural substances found in fruits and vegetables, but are not nutrients. They are now known to play an important role in helping the immune system and in the prevention of cancer and other diseases.</p> <p>- <i>Flavonoids</i> are found in citrus fruits, apples, berries, red grapes (also grape juice), carrots, onions, broccoli, cabbage, cauliflower, Brussels sprouts, peppers and green and black tea.</p> <p>- <i>Phytosterols</i> are found in a large number of foods, so eating a verity of fruits and vegetables will ensure a good intake. Seafood, peas, nuts, sunflower seeds, sesame seeds and whole grains are particularly good sources.</p>		

To increase dietary intake, small frequent feedings of high calorie, high protein foods are required starting at the moment of awakening. Too often, meals are missed, especially in the morning thus passing up an opportunity for nourishment.

PLWHA who have a poor appetite should be advised to eat on a schedule rather than according to hunger. The assistance of family members or other support people should be enlisted to ensure that food is available and the individual is reminded to eat at regular intervals. Each meal and snack should ideally contain a portion of protein-rich foods as most patients will require at least 5 servings per day in order to meet their requirements.

To increase calories

- The most important strategy is to eat at least five times per day, or every three hours during waking hours. If PLWHA wake in the night they should have a snack.
- Individuals should be counselled to choose a variety of nutrient dense foods as often as possible, for example "creole soup," high calorie porridge. (See Recipe ideas "Healthy Eating for Better Living - A Caribbean Handbook").
- Fluids should contain calories. Juice, milk and commercial nutritional supplements are preferred over water.
- Reduced-fat products should be limited unless there is fat intolerance. Valuable calories from fat are obtained in dairy products, fried foods, nuts, and added fats and oils. These should be added to the diet incrementally to enhance tolerance.

To increase protein

- Economic constraints are often the limiting factor when implementing a high protein diet.
- Dairy products, meats, fish, poultry and eggs provide the most concentrated source of protein per serving. Other important sources include nuts, seeds, wheat gluten, and legumes, especially soy products.
- Usual foods can be fortified by adding skim milk powder, eggs, cheese, nuts or seeds, or commercial high-protein powder.

Appetite Stimulants

In some cases, persistent anorexia can be remedied with the use of appetite stimulants. Artificially stimulating the appetite will improve nutritional intake which positively impacts overall health status. The PLWHA feels better and the normal hunger and appetite mechanisms can improve substantially. Two commonly used medications that stimulate appetite are:

- *Megestrol acetate* (*Megace*®) is an effective appetite stimulant for the treatment of severe anorexia in HIV-infected persons. Weight gain is primarily fat and fluid with little accretion of lean tissue, and Megace therapy has been associated with declining testosterone and with increased blood glucose. However, nutrient intake increases which ultimately improves well-being. The usual dose for

HIV/AIDS is 400-800 mg as an oral suspension once daily. Because of potential adverse effects, Megace should not be used over a long period.

- *Marinol* increases appetite and decreases nausea but does not always induce weight gain. The side effects include somnolence and impaired thinking ability, which some individuals find unacceptable. The usual dose is 2.5 mg twice daily (BID) at lunch and dinner. If not tolerated this can be decreased to 2.5 mg daily at bedtime.

Enteral Nutrition Support

The goals of nutrition support are to meet anticipated nutrient needs using the appropriate modality, to correct malnutrition, to maintain or replete lean body mass, to preserve gut function and to maintain psychosocial well being.

Enteral nutrition provides specialized formula via a feeding tube to the gastrointestinal tract, and should be considered for persons who are unable to meet nutritional needs orally.

Enteral feeds are contraindicated when there is an indication for bowel rest, a non-functional small intestine, or mechanical obstruction of the gastrointestinal tract.

Methods of Enteral Nutrition Support

Selection of the feeding method depends on the anticipated duration of support, clinical factors and the goals of treatment. Whenever possible, the stomach is the preferred route for tube feeding because it serves as a reservoir which slows intestinal transit and allows for enhanced osmotic regulation. Enteral feeds are provided by one of the following methods:

Nasogastric: A nasogastric tube feeding is recommended for short term feeding, and should be promptly implemented for nutritional repletion of malnourished individuals during hospital admissions. Nasogastric feeding tube placement may be contraindicated in the presence of esophageal lesions, emesis, and severe gastroesophageal reflux.

Gastrostomy: A percutaneous endoscopic gastrostomy (PEG) feeding tube is placed for long term tube feeding and/or home enteral nutrition.

Jejunostomy: In cases of recurrent emesis or gastroesophageal reflux, which incur a high risk of aspiration, a gastro-jejunostomy or jejunostomy feeding tube may be more appropriate.

Formula Selection

Formula selection is based on gut function, feeding method, nutritional requirements and tolerance. Formulas may be polymeric, elemental, specialized or modular.

Examples of these formulas are included in **Appendix 4: Selected Nutritional Supplements**.

Polymeric formulas contain intact protein, fats and carbohydrates that require normal digestive and absorptive capacity. They contain vitamins, minerals, trace elements, and fibre. Each brand of formula designates a specific volume to meet recommended dietary intakes. Formulas are lactose-free and vary in energy, protein, and fat content, as well as osmolality. Patients with HIV infection often tolerate polymeric formulas as long as they are isotonic.

Elemental formulas contain nutrients in readily digestible form such as peptides and amino acids, mono and disaccharides, and medium chain triglycerides. They are low residue, lactose free and hypertonic. They are used for patients with compromised digestive and absorptive capacity and in certain cases may preclude the use of parenteral nutrition.

Specialized formulas have been developed to meet the needs of specific disease conditions. In most cases these are not required and nutrient requirements can be met with standard formulas.

Modular formulas provide protein, carbohydrate or lipids as a single nutrient to modify the nutrient content of standard formulas.

Initiating Enteral Feeding

In HIV infections, enteral feeds are initiated and monitored in the same way as for other patients who require this support. Full-strength isotonic formula is the preferred initial feed in order to maximize nutrient intake. The rate at which feeds are started depends on clinical status and gastrointestinal function. Feeding rate is then increased incrementally every 4 to 8 hours, until the required amount of formula is provided.

Administration of Enteral Feeding

Enteral feedings can be administered as continuous, cyclical, intermittent or as a bolus feed.

Continuous tube feeds are delivered over 16-24 hours at a steady rate, either by gravity feeds or a feeding pump. This method has the highest tolerability and is most suitable for critically ill patients or those with gastrointestinal symptoms. Continuous feeds are required when the formula is delivered to the duodenum or jejunum.

Cyclic feeds are also delivered at a steady rate, but the rate is increased and the feeding period is reduced to 8-16 hours. Feeds are typically provided overnight with a feeding pump while the patient sleeps. This method allows for increased mobility and oral intake throughout the day. Patients often prefer this method because daily activities are not interrupted.

Intermittent feeds are provided throughout the day at specific intervals at a fairly fast rate over 30 minutes to 2 hours. They may be delivered by gravity or pump. This method is suitable for patients who can tolerate the faster rate of delivery but are not candidates for overnight feeds.

Bolus feeds are rapidly administered with a syringe into the stomach. The usefulness of this method of administration is limited by volume restrictions and poor tolerance.

Complications of Enteral Feeding

Enteral feeding may result in any of the associated conditions identified in Table 3.9 that also lists the possible causes and suggestions.

**TABLE 3.9: COMPLICATIONS OF ENTERAL FEEDING,
POSSIBLE CAUSES AND SOLUTIONS**

Complication	Possible Causes	Suggested Solutions
Bacterial contamination of formula	<ul style="list-style-type: none"> • Home-made formula may use contaminated ingredients • Commercial formula is not handled properly • Formula at room temperature too long • Contaminated equipment 	<ul style="list-style-type: none"> • Avoid home-made feeds • Use aseptic technique when handling commercial formula • Use sterile water to reconstitute powdered formula • Consider using a closed delivery system • Do not hang formula longer than 6 hours • Change delivery equipment every 3-5 days.
Nausea and vomiting	<ul style="list-style-type: none"> • Osmolality of formula • Delayed gastric emptying • Fat intolerance • Contaminated feeds • HIV-related causes 	<ul style="list-style-type: none"> • Use isotonic feeds • Start with dilute formula • Try formula higher in MCT • Ensure aseptic technique Discuss with health care team, slow rate of delivery, try continuous feeds.
Abdominal bloating and cramps	<ul style="list-style-type: none"> • Osmolality of formula • Delivery too fast • HIV medications 	<ul style="list-style-type: none"> • Use isotonic formula and slow rate of delivery • Time medications and feeds so medications are not given on an empty stomach.
Diarrhoea	<ul style="list-style-type: none"> • Osmolality of formula • Delivery too fast • Post pyloric feeding • Hypoalbuminemia • HIV-enteropathy 	<ul style="list-style-type: none"> • Use isotonic formula or dilute formula • Slow rate of delivery • Use continuous feeds • Add portion of feeds as fibre - containing formula • Try elemental formula
Constipation	<ul style="list-style-type: none"> • Dehydration • Low amount of fibre in enteral formula • Medications 	<ul style="list-style-type: none"> • Ensure adequate hydration • Use fibre-containing formula

■ Total Parenteral Nutrition (TPN) Support

Parenteral nutrition refers to nutritional support provided by an intravenous route. Access may be a peripheral vein or central vein. Peripheral venous access is usually used for short term support and limits the volume of fluids and nutrients that can be delivered.

Whenever possible, enteral nutrition is preferred in order to provide nutrients to the gut and maintain the intestinal barrier.

Indications for Parenteral Nutrition

Parenteral nutrition is used in cases of gut failure or severe gastrointestinal disease. Catheter-related sepsis is a significant risk in immunocompromised patients. In HIV/AIDS, TPN will induce weight gain, the composition of which depends on the underlying etiology of the malnutrition. Septic patients tend to gain primarily fat whereas those with malabsorption or inadequate dietary intake gain more body cell mass.

It is possible that this modality may not be widely available throughout the Region. However, it is an option that should be pursued when necessary.

Components of Parenteral Nutrition

The solution for parenteral nutrition consists of nutrients in their simple form, namely dextrose, amino acids, lipids and micronutrients.

Dextrose is the monosaccharide that provides the major source of non-protein energy. Each gram of dextrose in parenteral solution provides 3.4 kilocalories or 14.2 kilojoules. Carbohydrate should be provided in adequate amounts to spare protein, but not in excess as this may cause hyperglycemia, fatty liver or other complications. The recommended rate of dextrose infusion should not exceed 4 to 5 mg/kg/minute.

Amino acids provide protein to maintain nitrogen balance and prevent degradation of somatic proteins. Protein requirements are calculated based on clinical condition and goals of treatment. Amino acid solutions provide 4 kilocalories per gram or 18.1 kilojoules per gram.

Parenteral lipid emulsions provide a concentrated source of energy and essential fatty acids. They may be used in conjunction with carbohydrate and amino acid

solutions or alone for caloric enhancement. The energy content of lipid emulsions depends on the formulation. ten percent yields 1.1 kilocalorie per mL; 20% yields 2.0 kilocalories per mL; 30% yields 3.0 kilocalories per mL. There is some evidence that parenteral lipids may have a negative effect on immunity. In patients with HIV infection lipids should not exceed 30% of total energy intake or 1 g/kg/day. Hyperlipidemia may also develop if lipids are not cleared. Thus serum lipids should be monitored at baseline and regular intervals thereafter.

Micronutrients and electrolytes are provided as standardized components of parenteral solutions. These may be modified according to the needs of the patient.

■ Anabolic Therapy

Nutrition support will usually result in weight gain, but for some PLWHA, classified as non-responders, there is evidence of an anabolic block, whereby the regained weight is composed of a disproportionately high amount of body fat with limited accretion of lean tissue. This phenomenon can be identified with body composition analysis. Thus, although re-feeding is always necessary, it is not always sufficient for some individuals. In cases where lean tissue gains are insufficient, an anabolic agent may be required such as testosterone replacement. Other anabolic therapies that have shown favorable results include *Oxandrin*, *Decadurabolan*, and *Recombinant Growth Hormone*.

■ Palliative Care

When AIDS patients become terminally ill and medical care becomes mainly palliative, not curative, the nutrition care plan should reflect the overall goals of care. Nutritional therapy is directed to alleviating symptoms and providing comfort. Nutrition support should be considered to improve quality of life if the patient, caregivers and medical team agree to this intervention.

■ Common Dietary Problems

During the course of treatment and care, many dietary problems can arise. Strategies to help alleviate common problems are addressed in Section 3, Chapter 4.

■ Pregnancy, Lactation and HIV

Pregnancy, lactation, and HIV disease engender physiologic stress, with increased nutritional needs for energy, protein and micronutrients. It is well recognized that the nutritional health of a pregnant woman influences pregnancy outcome. Nutritional

status has even greater implications for the HIV-infected woman who is at higher risk of premature delivery and having a low birth weight infant.

Low birth weight infants have an increased incidence of infant mortality as well as medical and developmental complications. Other risk factors, such as pregnancy during adolescence, substance use, opportunistic infection, low pre-pregnancy weight and inadequate gestational weight gain impose further risks of a poor pregnancy outcome.

Moreover, vitamin A deficiency has been associated with poor pregnancy outcome and increased risk of perinatal HIV transmission.

Pregnant HIV-positive women should be referred early in pregnancy to a dietitian or other suitable health care professional for counselling to optimize nutritional status and improve pregnancy outcome. It is essential to assess complementary therapy use, as mega-doses of vitamins and some herbal preparations are contraindicated in pregnancy.

Weight Gain in Pregnancy

Recommended weight gain based on pre-pregnancy weight:

- Underweight (BMI <18.5): 12.5-18.0 kg
- Healthy weight (BMI 18.5-24.9): 11.5-16.0 kg
- Overweight (BMI >25): 7.0-11.5 kg

Nutritional Requirements

According to the Recommended Dietary Allowances for use in the Caribbean, the following requirements for pregnancy/lactation are in addition to the requirements for HIV+ women:

- 4v Additional 285 kilocalories per day to support fetal growth and development
- Additional 6 grams protein per day
- Prenatal multivitamin-mineral daily (to include at least 0.4 mg folic acid)
- Other micronutrient supplements as needed (e.g. iron, calcium)

Lactation: additional 500 kcal per day and 11 grams of protein

- Vitamin A:

Maternal vitamin A deficiency is associated with increased risk of vertical HIV transmission to the infant. However, there is little evidence that vitamin A supplementation of the pregnant woman reduces the risk of HIV infection to the infant. Moreover, high doses of vitamin A can be teratogenic. Should supplementation be necessary, the following WHO guidelines can be used.

TABLE 3.10: VITAMIN A SUPPLEMENTATION IN AREAS OF ENDEMIC DEFICIENCY

Time	Women	Infants born to HIV - infected Women
At Delivery	200,000 IU at delivery or during the safe infertile period	50,000 IU at birth
Post partum period	Low dose not exceeding 10,000 IU per day or 25,000 IU per week	3 doses of 50,000 IU administered over the first 6 months of life

Iron deficiency anaemia:

Iron deficiency anemia is highly prevalent in pregnant women throughout the world. Anemia is associated with increased risk of maternal and fetal morbidity and mortality, as well as intrauterine growth failure. Iron status should be assessed and deficiency should be treated. WHO recommend that women receive 60 mg iron during 6 months of pregnancy and 120 mg per day to treat severe anaemia.

Folate deficiency:

Folate deficiency causes megaloblastic anemia and is associated with risk of neural tube defects in the infant (e.g. spina bifida). WHO recommends 0.4 mg folate supplement daily.

■ Dietary Strategies

Nutrition counselling should be provided and should include strategies for maximizing nutrient intake with a high calorie, high protein diet with appropriate micronutrient supplementation. Guidance should be sought from a professional dietitian.

Oral liquid nutritional supplements (see **Appendix 4**) may be required to augment dietary intake in order to meet predicted nutrient requirements. Products are selected depending on the goals of treatment, gastrointestinal symptoms, patient acceptability, availability and affordability.

■ **Nutrition Interventions for Complications Associated with Highly Active Antiretroviral Therapy (HAART)**

During the course of HIV/AIDS, complications related to antiretroviral therapy may develop. These include fat redistribution syndrome (lipodystrophy), dyslipidaemia, abnormal glucose tolerance and osteoporosis. Each of these is described along with the associated nutritional therapy.

Fat Redistribution Syndrome

A constellation of morphologic changes, involving deposition of adipose tissue, have been identified in patients on HAART. Depletion of subcutaneous adipose tissue (SAT) may occur in the face, legs, arms, abdomen, and buttocks. In some cases, there is also loss of the deep fat (functional fat), especially in the face. Deep fat depletion, which may cause painful chewing and limited facial mobility, appears to be most difficult to reverse. A substantial number of PLWHA will experience an increase in abdominal girth due to accumulation of visceral adipose tissue (VAT), sometimes in conjunction with lipoatrophy of SAT (but not always). Some individuals will develop a dorso-cervical fat pad (buffalo hump) or bilateral symmetrical lipomatosis and women tend to experience breast hypertrophy. Changes in body shape often occur in the context of significant viral suppression and immune reconstitution. These can have a detrimental effect on self-esteem and quality of life. In extreme cases PLWHA may elect to discontinue life-saving therapy in an attempt to restore normal body morphology.

Nutritional therapy for fat redistribution syndrome

Lipoatrophy: Diet and exercise have not been efficacious in treating lipoatrophy. However, persons with facial lipoatrophy should be advised that weight loss often intensifies facial wasting. Improved plastic surgery techniques to reduce the characteristic wasted appearance are of benefit those patients who have the financial

resources. However, these procedures are not without risk and the results are sometimes disappointing.

Visceral adipose accumulation: Recent studies have shown that intra-abdominal fat accumulation with increased abdominal girth can be improved by achieving ideal body weight, aerobic exercise, and a diet low in simple carbohydrates and fats and high in fibre. Other manifestations of fat accumulation are not improved by diet or exercise.

Dyslipidaemia

Patients on HAART may develop abnormal serum lipids, including hyper-cholesterolaemia, hypertriglyceridaemia and decreased HDL cholesterol, which predisposes them to increased risk of cardiovascular disease and pancreatitis.

Nutritional therapy for dyslipidaemia

PLWHA with hyperlipidaemia should reduce their intake of total fat, especially saturated and trans-fatty acids, salt and dietary cholesterol. Overweight individuals should lose weight and all PLWHA should maintain a regular aerobic exercise regimen. Those with hypertriglyceridaemia should also limit simple carbohydrates, avoid alcohol altogether, and quit smoking because it dramatically increases the risk of cardiovascular disease. Supplementation with omega-3 fatty acids may enhance dietary efforts to lower triglycerides. Although lipid parameters may not completely normalize, PLWHA may be spared the addition of further medications to an already high pill burden. It is essential to consider dietary strategies within the context of HIV disease, maintaining adequate energy and protein intake to prevent weight loss in susceptible individuals.

Abnormal Glucose Tolerance

Abnormal glucose tolerance has been associated with HAART, especially protease inhibitors. Studies have shown that fasting glucose may be normal but 1 hour and 2 hour glucose tolerance tests are elevated. The aetiology is not clearly defined although insulin resistance appears to be the underlying mechanism. PLWHA with a family history of diabetes may be at increased risk of developing abnormal glucose tolerance. The first line of therapy for hyperglycemia is diet and exercise.

Nutritional therapy for abnormal glucose tolerance

PLWHA should be counselled to consume consistent, mixed meals (protein, carbohydrate and fat) at regular intervals throughout the day, to limit simple carbohydrates and increase fibre intake. Aerobic exercise facilitates glycaemic control, especially after a meal.

Osteoporosis

Loss of bone mineral density has emerged as a significant problem for HIV-infected men and women. The risk factors for developing osteopenia or osteoporosis include genetic predisposition, being underweight, having low lean body mass, not achieving potential peak bone mass density, having an accelerated rate of bone loss, low calcium intake, vitamin D deficiency, inadequate or excessive protein intake, heavy alcohol use, low physical activity, smoking, male or female hypogonadism, malabsorption, or amenorrhea/ menopause.

The aetiology of bone loss in HIV infection is unclear but studies have shown increased rates of bone turnover, disturbance of calcium and vitamin D metabolism, suppression of osteoblast formation, and negative effects of high levels of cytokines. Many HIV-infected persons have multiple risk factors for bone loss regardless of HIV infection. The development of osteopenia or osteoporosis results in increased bone fragility and susceptibility to fractures which further debilitates already vulnerable patients.

Nutritional therapy for bone mineral density

Nutrition is one of the most modifiable factors in the development and maintenance of bone mass. People with normal bone density require 1000-1500 mg of elemental calcium, 400-800 IU of vitamin D, 320-420 mg magnesium and 1.0-1.5 g/kg protein. Those with low bone mineral density require 1500-2000 mg elemental calcium and 800-1200 IU vitamin D. Other nutrients such as vitamin K, vitamin C and zinc are also essential for bone formation but the benefits of supplementation are unproven. Smoking, alcohol, excess salt and caffeine have also been implicated in loss of bone mineral density.

Body weight and lean body mass should be maintained in the ideal range. The importance of weight-bearing exercise cannot be overstated. Not only does exercise stimulate bone formation, but individuals who exercise are stronger, and are less susceptible to falls.

Diarrhoea and malabsorption should be treated to enhance absorption of necessary nutrients. Osteoporosis treatment is provided according to standard medical therapy guidelines.

■ Nutrition Counselling with HIV/AIDS

Nutrition counselling is a structured process that helps people understand and learn about their dietary habits or behaviours as part of their total lifestyle and environment. The basis for nutrition counselling is data obtained from the interview, evaluation of the data, nutritional status and the need for change.

The goal of nutrition counselling is to:

- enable personal decision-making and choices to support desirable nutritional behaviours for better health and quality of life.

Using the basic skills of listening, learning, building confidence and giving support, the healthcare practitioner should use the counselling process as an opportunity for building a trusting relationship with the PLWHA, the family or caregivers especially in view of the stigmatization and isolation often experienced by the PLWHA because of the diagnosis.

An HIV diagnosis is shocking and frightening, and patients may feel overwhelmed by their emerging health care needs. Nutrition may be one avenue where they can gain some control over their lives if the dietary strategies are presented in a positive, hopeful and manageable manner.

During counselling, the client should be allowed to prioritize his/her issues according to the urgency of specific nutrition concerns ranging from healthy eating guidelines to symptom management or treatment of the side effects of medications. Engaging the client in goal-setting and development of the nutrition care plan will enhance adherence to recommendations and facilitate positive health outcomes. At the end of each session, the client should leave with specific tasks that he/she is motivated, willing and able to do to achieve his/her goals.

It is extremely important that health care practitioners maintain the strictest code of confidentiality during and after the conduct of all counselling sessions, and respond in a non-judgmental and empathic manner. Information about the client should not be shared unless he/she gives permission.

IV. Monitoring and Evaluation

Monitoring is the review and measurement of the individual's status at a scheduled follow-up time with regard to nutrition diagnosis, interventions (plans and goals) and outcomes. **Evaluation** is the systematic comparison of current findings with previous status, intervention goals, or a reference standard. This process provides an opportunity to adjust the nutrition care plan if the clinical status changes or other nutrition issues emerge as priorities, or if the individual cannot meet previous goals.

Purpose: To determine the degree to which progress is being made and goals of nutrition care are being met.

How: Appropriate outcome indicators relevant to diagnosis and intervention strategies are recorded and measured. Such data can be used later to develop an Outcomes Management System that will evaluate the effectiveness and efficiency of the entire process.

Components of monitoring and evaluation include three distinct but interrelated processes:

Monitor progress:

- check individual's understanding and compliance with plan
- determine if intervention is being implemented as agreed or prescribed
- provide evidence that intervention strategy(ies) reflect/does not reflect change in behaviour or status
- identify other positive or negative outcomes
- gather information to support reasons for lack of progress
- support conclusions with evidence

Measure outcomes:

- select outcome indicators relevant to nutrition diagnosis, signs or symptoms, nutrition goals, medical diagnosis and outcomes
- use standardized indicators to increase validity and reliability of measurements of change

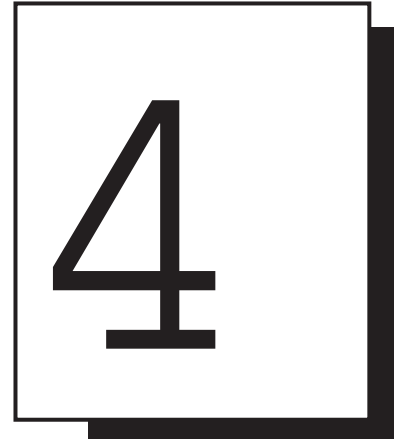
Evaluate outcomes:

- compare current findings with previous status, intervention goals, and/or reference standards.

Key Points

1. Timely nutrition screening and assessment with effective nutrition intervention can facilitate access to adequate dietary intake thus influencing health outcomes.
2. The spectrum of nutritional intervention includes ensuring basic education on healthy eating, identifying common practices and diseases that usually require nutrition intervention or counseling, and assessing conditions that are specific to, and span the spectrum of HIV disease that can affect morbidity and mortality, if not addressed in a timely manner.
3. Each encounter of the nutrition counselling process should provide the PLWHA, the family or caregivers, with the necessary information for them to make informed choices about dietary strategies that will help with maintaining optimal nutritional health.
4. Client should be guided to create specific goals stated positively in terms of food behaviours.
5. During the asymptomatic stage, counselling should include information for performing self-screening and monitoring of weight. It is important that the principle of good nutrition status for improving the quality of life and increasing the life span be embraced.
6. Establish a helping relationship during counselling. Demonstrate care and understanding.
7. As a counsellor, you are helping or guiding the client to cope better and to decide what is best for himself/herself. The client is the problem solver/decision maker.

Blank page – Page 64



*Nutritional
Management
of Infants and
Children with
HIV/AIDS*

Blank page – Page 66

4

Mother-to-Child Transmission

Transmission of HIV during Pregnancy and Lactation

HIV is transmitted from mother to child across the placenta, during the intra-partum period or through breast milk. The risk of vertical transmission is decreased significantly with the use of anti-retroviral therapy for the mother during pregnancy and at the time of delivery, and for the infant in the early postpartum period. The fact that HIV is transmitted via breast milk may complicate infant feeding recommendations in some settings and impact negatively on efforts to improve breastfeeding prevalence rates in countries and regionally. Exclusive breastfeeding during the first 3 months may not increase the risk of vertical transmission to the same degree as early mixed feeding. Because breast milk is well tolerated, the gastrointestinal barrier of the infant remains intact, preventing entry of the virus.

Partial/mixed breastfeeding, (whether cow's milk, tea, or cereal), has been associated with an additional risk of HIV transmission from mother to child. Mixed feeding can cause irritation to the intestinal wall thus making it more permeable to the virus. Therefore, women who choose to breastfeed should be advised to provide breast milk exclusively for approximately 3 months and then change completely to replacement feeding. In resource-poor situations, replacement feeding may not be a safe alternative to exclusive breastfeeding for the first six months. **It is important not to recommend mixed feeding.**

WHO Position about Feeding Options

The nutritional and immunologic benefits of breast milk are well proven and overall, efforts must be intensified to protect, promote and support

breastfeeding within countries. However, WHO supports the right of HIV-infected women to choose a safe alternative (replacement feeds) to breastfeeding, if they are fully informed regarding feeding options, risks and benefits. WHO recommends, "when replacement feeding is acceptable, feasible, affordable, sustainable, and safe, avoidance of all breast feeding is recommended for HIV-infected mothers. To minimize HIV transmission risk, breastfeeding should be discontinued as soon as feasible, taking into account local circumstances, the individual woman's situation and the risks of replacement feeding."

The Caribbean Situation

Various Caribbean countries have developed and adopted a policy that discourages HIV+ mothers from breastfeeding as a measure to stem mothers transmission (MTCT) of the HIV. This is supported by the fact that the virus is transmitted via breastmilk, even though exclusive breastfeeding during the first 3 months may not increase the risk of vertical transmission of the virus.

Feeding Options

Replacement Feeds

Acceptable replacement feeds include commercial infant formulas, heat-treated breast milk, and animal milks from cows or goats but these must be modified, **Appendix 5: Modifying Adult Milks for Infant Feeding**, to decrease the renal solute load and provide adequate carbohydrate to cater for the needs of the infant. Vitamin/mineral supplements should be given to infants fed on home-prepared formula because the feed may not provide sufficient micronutrients, especially iron, zinc, vitamin A, C and folic acid. It is essential that commercial and homemade formulas be made correctly to provide adequate nutrition with minimal gastrointestinal symptoms. Infants fed breastmilk substitutes should be fed on demand requiring approximately 750 ml of feeds per day in the initial postnatal period. Tea, juice, and cereals are not suitable foods for replacement feeding.

Heat-treated Breastmilk

Breast milk can be expressed and either pasteurized (heated to 62.5°C for 30 minutes) or boiled briefly and cooled. Thereafter the milk must be refrigerated immediately in sterile containers to prevent bacterial contamination. This heat-treating process

may be more practical in a hospital setting. The process kills the virus but it can also destroy the anti-infective properties that are unique to breast milk. To convert °C to °F or vice versa, the following is provided:

- °C to °F: $(^{\circ}\text{C}) (1.8) + 32$ thus $(62.5) (1.8) + 32 = 144.5^{\circ}\text{F}$
- °F to °C: $(^{\circ}\text{F} - 32) / 1.8 = ^{\circ}\text{C}$ thus $(144-32)/1.8 = 112/1.8 = 62^{\circ}\text{C}$

Wet Nursing

Using a "wet nurse" to breastfeed an infant is not an option that is generally culturally acceptable in the Caribbean. However, should such a person be used, she must be HIV- negative and be committed to safe sexual habits, otherwise there is the risk of transmitting the virus if the wet nurse becomes HIV-infected. Remember that a single HIV test is not sufficient to ensure that the wet nurse is not infected as she could still be in the process of seroconverting.

Complementary Feeding

Energy and nutrient dense feeds should be recommended from about 6 months of age. Mixing breast milk with complementary feeds could introduce infections to the developing infant, and can thus increase the risk if HIV and other illnesses.

Key Points

1. All HIV-infected mothers should receive counselling to guide them to make the best decision about the feeding options that will prevent mother to child transmission.
2. Mixing breastmilk with replacement feeds can increase the risk of HIV infection.
3. It is important to ensure that the replacement feed mixture is nutritionally adequate for the infant and that hygienic conditions prevail during mixing and such an environment is maintained.
4. Generally, energy and nutrient-dense complementary feeds should not be introduced before the infant is about six months old.

Blank page – Page 70



*Nutritional
Management of
the HIV-
Infected Infant
or Child*

Blank page – Page 72

5

Nutritional Management of the HIV-Infected Infant or Child

HIV infection occurs in infants born to HIV-infected mothers when the human immunodeficiency virus is transmitted from the mother to the infant. All of these infants will have maternal antibodies to the virus until they are approximately 18 months old at which time they sero-revert to HIV antibody-negative. HIV-infected children will continue to be positive for antibodies as well as the PCR test, and will have detectable virus with subsequent decline in immune functions.

Nutritional Risk Factors for Infants and Children

HIV-infected children are at higher risk of malnutrition and failure to thrive. The outcome of malnutrition can be devastating, resulting in growth retardation, increased susceptibility to infection and decreased functional capacity.

Many factors that contribute to growth failure have nutritional implications. Some of these factors are:

- Inadequate food intake occurs due to poor appetite, early satiety and a high degree of selectivity around food choices.
- Abdominal pain and nausea, common side effects of medications, decrease appetite and interest in food.
- Feeding difficulties in infancy include uncoordinated suck/swallow/breathe reflex, poor suck and/or formula intolerance.

- Introduction of solid foods with antiretroviral medications mixed into them often leads to food aversions and food refusal.
- Increased nutrient intakes are required for catch-up growth and to ameliorate the hypermetabolic/hypercatabolic effects of fever and opportunistic infection.
- Dyslipidaemia, peripheral lipoatrophy and visceral adipose accumulation may develop due to highly active antiretroviral therapy.
- Disordered eating patterns result in deranged eating habits or self-limiting intake.
- Gastrointestinal complications induce nutrient losses via emesis, diarrhoea and malabsorption.
- Dysguesia (altered taste), caused by malnutrition, medications, or HIV infection, decreases interest in feeding.
- Encephalopathy may result in regression of feeding ability with limited food tolerance.
- The feeding relationship between caregiver and child often becomes distorted due to difficulties feeding a child with HIV disease.
- Socioeconomic factors such as poverty and substance use by parents affect access to food.
- Illness of a parent compromises the ability of the parent to implement nutritional recommendations.

Because of the myriad complications experienced by HIV-infected children, nutrition therapy is an important adjunct to medical therapy in the treatment of HIV disease.

Nutrition Care

Goal of Nutrition Care

Adequate nutrition is especially important for young children to ensure that they grow properly as well as have sufficient nutrients to boost their immune system and fight infection.

Nutrition Care Process

The approach to nutrition care in the management of the HIV-infected child is the same process as used for managing the adult: **nutrition assessment** which includes evaluation of anthropometric and body composition, biochemical, clinical and dietary parameters using techniques appropriate for children; **nutrition diagnosis; nutrition intervention; monitoring and evaluation.**

HIV-infected children are at higher risk of malnutrition and failure to thrive

I. Nutrition Assessment

A. Anthropometric and Body Composition Assessment

Anthropometric Assessment

Anthropometric assessment of HIV-infected children should include serial measurements of weight and recumbent length/height, which are sensitive of nutritional status. In children, the three most commonly used anthropometric indices are *weight for age, weight for height, and length/height for age.*

Tracking trends over time facilitates early identification of growth failure, an indicator of nutritional deficit. Weight is a good index of acute and chronic nutritional status. Weight and height/length should be taken at each visit using standardized methods. Measurements can be plotted on the CDC/NCHS growth charts using the appropriate *weight for age, height for age and weight for height* charts. Alternatively, Caribbean Growth Charts are available for plotting weight for age (0 to 5 years), and *weight for height* (0 to 23 months), and (24 to 59 months) for either boys or girls. The Caribbean Growth Charts were developed based on NCHS/ WHO Standards.

Weight

Weight measurement is the most fundamental of indexes for assessing nutritional status. Weight is affected early and more so than length/height when undernutrition or overnutrition exists. Weight gain is

decreased when there is calorie deficit or output is excessive but growth in stature is delayed when protein intake is inadequate or if a calorie deficit exists for an extended period.

Weight measurements must be taken using standardized procedures (see **Appendix 6.1**) and evaluated in two ways: *weight for age* and *weight for height*.

Weight for Age

Weight for Age compares the child to reference data for weight attained at any given age and is stated in terms of percentile. It is:

- a short-term marker of growth;
- affected by acute nutritional stress or illness;
- an indicator of acute malnutrition (wasting) but cannot distinguish between stunting (chronic malnutrition) and wasting because height is not considered.

Nutritional status can be estimated using this formula:

$$\frac{\text{Actual Weight}}{\text{50th percentile weight/height}} \times 100 = \text{acute nutritional status}$$

Interpretation: Results can be used to determine the severity of malnutrition as follows:

Nutritional Status	Acute	Chronic
Normal/Healthy	>90%	>95%
Mild	81-90%	90-95%
Moderate	70-80%	85-89%
Severe	<70%	<85%

Weight for Height

Weight for Height compares appropriateness of the child's weight to his/her own height, that is, body mass (weight) is compared to own stature. It is independent of age until puberty, and can be used to distinguish between stunting (chronic malnutrition) and wasting (acute malnutrition).

Weight for height:

- is an indicator of present nutritional status
- can be plotted on a graph appropriate for age, that is up to 5 years of age, or
- measurements can be used to calculate body mass index depending on the age of the child.

Body Mass Index (BMI) or Quetelet Index is an indicator that can be used with children between 2 to 19 years old, to assess weight for height status. BMI growth charts (CDC, 2000) have been developed for interpreting measurements for this age group. Note that the adult BMI formula and charts **DO NOT** apply for the age group.

Weight Change

Recent change in weight (loss or gain) is also important since this is an indicator of acute nutritional problems. Weight change can be evaluated as follows:

$$\frac{\text{Actual Weight} - \text{Usual Weight}}{\text{Usual Weight}} \times 100 = \% \text{ Change}$$

Weight loss is significant when:

- > 2% in 1 week
- > 5% in 1 month
- > 7.5 % in 3 months
- > 10% in 6 months

Length/Height for Age

Length is measured in relation to age. It is a measure of linear growth and an indicator of past/chronic nutritional status and stunting especially in early childhood. Standardized procedures for measuring children's length are detailed in **Appendix 6.2**. Supine length should be measured for infants until about age 2 and thereafter standing height can be measured.

Interpretation

Below the 5th percentile = severe deficit

Between 5th and 10th percentile = evaluate further

Chronic nutritional status can be estimated using this formula:

$$\frac{\text{Actual Height}}{50^{\text{th}} \text{ Percentile height/age}} \times 100 = \text{Chronic nutritional status}$$

Nutritional Status	Acute	Chronic
Normal/Healthy	>90%	>95%
Mild	81-90%	90-95%
Moderate	70-80%	85-89%
Severe	<70%	<85%

Body Composition Assessment

Mid-arm circumference, subscapular and triceps skinfolds, and mid-arm muscle circumference/area in children >1 year of age reflect fat and lean body mass stores. Children may also experience morphologic changes as a result of lipodystrophy, including loss of subcutaneous adipose tissue, facial wasting, and visceral fat accumulation. Body composition measurements may be useful in identifying changes over time.

B. Biochemical Assessment

Biochemical assessment in children includes laboratory measurements similar to those used for adults. The nutritional implications of the values must be considered in the context of other parameters of nutritional assessment.

Biochemical assessment may include the following:

- CD4 cell count and viral load
- Serum Prealbumin and/or Albumin, liver enzymes, Blood Urea Nitrogen (BUN), creatinine, electrolytes and Complete Blood Count (CBC).
- Children on antiretroviral therapy should also have fasting total cholesterol, triglycerides, HDL/LDL cholesterol, and blood glucose measured.
- ART including nucleosides, especially zidovudine, causes macrocytic anemia which should be differentiated from anemia due to iron, folate or B₁₂ deficiency.

C. Clinical Assessment

Clinical assessment parameters specific to children include detailed medical history and physical examination.

Medical History

- Special consideration should be given to the presence of gastrointestinal disease or opportunistic infections, dental health, development, neurological complications and behavioural issues.
- Infant nutritional status and feeding ability will be affected by the nutritional health of the mother during pregnancy, substance (e.g. drugs, alcohol, tobacco) use during pregnancy, birth weight and perinatal complications.

Physical Examination

- Clinical evidence of nutrient deficiencies – **see Table 3.4**
- Evidence of failure to thrive such as low stores of adipose or lean body mass, short stature, or loss of weight or height percentiles.
- Evidence of delayed development.

D. Dietary Assessment

Dietary assessment in children reviews diet history, assesses current dietary intake and factors affecting such intake, and identifies risks for nutritional problems.

Key areas that should be explored in taking the diet history and intake are:

- Appetite, expression of hunger and satiety, taste changes
- Frequency, type, and amount of foods and fluids taken
- Duration of meals and feeding dynamics between child and caregiver
- Feeding ability and tolerance; use of feeding aids
- Food allergies
- Appropriateness of infant diet and preparation of infant formula
- Use of proper food and water safety techniques
- Quality of diet and food security
- Food-medication interactions
- Use of complementary and alternative medicines
- Physical activity.

As with adults, numerous psychosocial issues influence nutritional intake and food security. Consider the following issues:

- Socioeconomic status which affects housing and ability to acquire and store food
- The social and physical environment of the home and school
- Evidence of depression or social isolation
- Illness or death of parents or caregivers
- Substance use/abuse by the child/adolescent or family members
- Cultural or religious practices which affect dietary intake
- Living arrangements, family dynamics
- Community resources utilized.

II. Nutrition Diagnosis

As for adults, nutrition diagnosis requires analysis of data obtained during assessment and results in identification of situations that require intervention.

III. Nutrition Intervention

Children are especially vulnerable to malnutrition and its cascading adverse consequences. Almost all malnourished children initially have poor appetites. Patience is needed to encourage consumption of feed using cup and spoon, and holding the child securely in a sitting position in the caregiver's lap. If the child is too weak, a dropper or syringe can be used. Feeding bottles can be a source of further infection and should be thoroughly cleaned and sanitized, especially for use in severely immunocompromised children. Dietary modifications to increase nutrient density of the child's diet should be implemented.

Goals of Therapy

The goals of therapy are:

- to maintain normal growth and development
- to prevent nutrient deficits
- to support the immune system
- to enhance quality of life.

Step-Wise Approach to Intervention

Therapeutic intervention is implemented in a step-wise fashion for children who require nutritional support beyond the usual dietary intake:

Children are especially vulnerable to malnutrition and its cascading adverse consequences

1. Polymeric oral liquid nutritional supplements or modular calorie supplements may be recommended **see Appendix 4.**
2. If children experience weight loss, lack of weight gain, delayed height velocity, or crossing of percentiles on a paediatric growth chart and the situation is not resolved with diet or oral supplements, a feeding tube may be required. A percutaneous endoscopic gastrostomy (PEG) is the preferred method of providing involuntary feeds as tube feeding is expected to be long term.

Formula selection depends on the feeding modality, the goals of treatment and the clinical picture. **see – Chapter 3 –Enteral Nutrition Support.**

3. Children with poor nutritional status who are hospitalized with acute illness and severe gastrointestinal symptoms should be considered for total parenteral nutrition (TPN).

Determining Nutritional Requirements

Nutritional requirements depend on clinical picture, growth parameters, as well as past and present nutritional status. Energy and protein requirements can be determined based on whether the child is asymptomatic or symptomatic.

Asymptomatic HIV-infection: Energy requirements vary for asymptomatic children depending on current nutritional status as well as weight and growth trends. Children displaying good nutritional status and appropriate growth with no symptoms may well be able to meet energy needs with the RDA for age. Those who require catch-up growth or nutritional rehabilitation may require up to 50% more kilocalories.

Energy needs can be calculated as follows:

Minimum: Wt (kg) at 50th percentile for actual height X RDA (kcal/kg) for age

Maximum: Wt (kg) for age at 50th percentile for actual height X RDA (kcal/kg) for age

If a child is ill with fever or sepsis, then kcal need to be increased further:

- 12% for each degree Centigrade (7% for each degree Fahrenheit) rise in fever
- 25% for acute diarrhoea; and 60% for sepsis

Symptomatic, failure to thrive: Energy requirements are elevated to facilitate accelerated weight gain and linear growth. To achieve catch-up growth, energy intakes for children experiencing weight loss need to be increased by 50% to 100% over established requirements for otherwise healthy uninfected children.

To calculate energy requirements for catch-up growth:

$$\text{Energy} = \frac{\text{RDA (kcal/kg/day) for age} \times \text{IBW (kg) (weight for age at 50th percentile)}}{\text{Actual body weight (kg)}}$$

Protein requirements are based on a need to support the immune system and prevent wasting. Intake may need to be increased to 1.5 to 2 times the RDA for age. If intake reaches > 4g/kg, renal function (BUN and creatinine) should be monitored.

To calculate protein requirements for catch-up growth:

$$\text{Protein} = \frac{\text{RDA (grams/kg/day) for age} \times \text{IBW (kg) (weight for age at 50th percentile)}}{\text{Current/Actual body weight (kg)}}$$

Dietary Modifications

Increasing kilocalories for Formula-fed infants

Severely undernourished children are unable to tolerate usual amounts of dietary protein, fat and sodium, thus, feeds should be low in these nutrients and high in carbohydrate. The concentration of replacement infant formula should be increased in a step-wise fashion to 75 kcal/100 ml (acute phase) to maximum 100 kcal/100 ml during the rehabilitation phase after appetite has returned (WHO). Formula that is hyper-concentrated must be monitored carefully for tolerance and progress. Other options include fortification of formula with carbohydrate polymers or fatty acid supplements.

Increasing kilocalories for Breastfed infants

If expressed breast milk is used, it should be fortified or changed to hypercaloric concentration with carbohydrate polymers or fatty acid supplements.

Increasing kilocalories for Children

- Use added dietary fat as tolerated.
- Use full cream milk and other full fat dairy products; gravy, sauces, and added fats.
- Use commercial liquid nutritional supplements.
- Fortify foods with full cream milk powder.
- Avoid overloading intestine, kidneys and liver. Offer small, frequent feeds every 2, 3 or 4 hours day and night.

Strategies for Selected Situations

The following strategies are suggested as well as those presented in **Chapter 4**.

■ **Poor appetite, food refusal**

Strategies to address the above include:

- Ensure symptoms or neurological impediments are treated.
- Provide small frequent feeds and snacks.
- Make every bite count with nutrient dense foods.
- Take advantage of times of day when appetite is better.
- Provide regularly scheduled meals and snacks. Discourage non-stop snacking.
- Limit time spent on meals to 45 minutes and to 20 minutes for snacks.
- Give small portions.
- Reinforce/reward small efforts.
- Ensure meal times and family dynamics support a positive attitude towards eating.

■ **Diarrhoea**

Strategies to address the above situation include:

Infants

- Ensure that formula is not over-concentrated.
- Consider the use of lactose-free formulas.

- For unresponsive diarrhoea with possible malabsorption, try elemental infant formula.
- Use commercial or WHO rehydration products.

Children

- Avoid fluids high in concentrated sugar (e.g. sweetened fruit juice), as these may induce osmotic diarrhoea.
- Increase soluble fibre to slow intestinal transit and reduce foods high in insoluble fibre.
- Provide small frequent meals.
- For unresponsive diarrhoea, provide a low residue, low-fat, lactose-free diet. Elemental nutritional supplements may be beneficial if accepted by the child.
- Replace fluids and electrolytes.

■ Nausea and/or Vomiting

Strategies to address the above include:

- Medications should be taken with food to minimize nausea.
- Avoid high fat or sweet foods and cooking odours.
- Bland, dry, salty and cold foods are often better tolerated,
- Give beverages between meals.
- Encourage the child to eat slowly, sitting up.
- Replace fluids and electrolytes if vomiting is present.
- Consider the use of anti-emetic medication.

■ Lactose Intolerance

Lactose restriction can result in the elimination of many important foods. Ensure that this is a confirmed diagnosis. Monitor dietary intake and make adjustments as necessary. Supplementation of calcium may be necessary.

■ Neurological Impairment

Children are at risk of encephalopathy, and this may induce regression of feeding abilities. Children who were proficient at eating table foods and cup-drinking may

revert to needing bottles, puréed foods and feeding assistance. Feeding ability is more closely linked to developmental age than chronological age.

■ Illness of Parent or Caregiver

Children are particularly vulnerable in a household with HIV-infected adults as they are dependent for feeding and care. Food security may be threatened by medical expenses and limited resources. Sick parents may not have the energy to provide adequate nutrition for an HIV-infected child with exceptional needs. It is important to ensure that the family has the capability to follow dietary recommendations and to seek appropriate support within their community where possible.

Children are particularly vulnerable in a household with HIV-infected adults as they are dependent for feeding and care.

■ Food and Water Safety

Ensure that the caregivers understand the basic principles of food and water safety, which includes the preparation of infant formula.

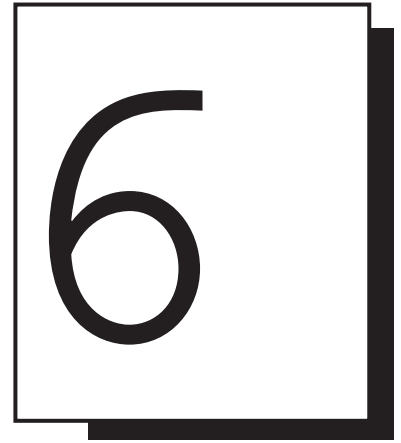
IV. Monitoring and Evaluation

Monitor weight gain and growth patterns with incremental growth charts in order to determine whether any further modifications are needed in energy intake. Body composition and nutrition assessment parameters are also useful to monitor nutrition adequacy.

Key Points

1. Early nutritional assessment, regular monitoring and reassessment of HIV-infected children facilitate early intervention using strategies to achieve nutritional goals thereby helping to improve the quality of life.
2. Nutritional care should be ongoing.
3. Involvement of caregivers is essential to the attainment of nutritional goals.

Blank page – Page 86



*Managing
Nutrition and
Food-Related
Problems*

Blank page – Page 88

6

Managing Nutrition and Food-Related Problems

Nutritional Strategies For Common Dietary Problems

During the course of HIV/AIDS, infected persons may experience any of a variety of symptoms that could interfere with dietary intake and ultimately nutritional status. This chapter addresses these conditions and the strategies that can be applied to improve intake when the respective conditions prevail.

Anorexia

Loss of appetite is common and can be multifactorial in origin.

Loss of appetite is common and can be multifactorial in origin. Factors such as depression, lack of resources, weakness, fever, medication side-effects and addictions can be implicated. The individual's medical, social and diet histories should provide information that will help with choosing strategies from the following that will support increased intake:

- Consume small, frequent meals at regular intervals.
- Use high calorie supplements – see **Appendix 4**.
- Make every bite count with calorie and protein-dense foods. (see **ideas for Recipes in “Healthy Eating for Better Living: A Caribbean Handbook”**).
- Eat a few mouthfuls even if not hungry.
- Eat on schedule rather than relying on hunger cues.

- Enhance the eating environment. Relax, share meals with friends, and eat favourite foods.
- Use community or family supports such as meal delivery where available, home-help or assistance with shopping, cooking, and cleaning up.
- Consider appetite stimulants such as Megace[®], or even social and environmental supports such as fresh air, exercise or friends.
- Take a multivitamin and mineral supplement.

Abnormal taste sensations or loss of taste acuity is frequent in HIV infected individuals.

Constipation

A high-fibre diet, high fluid intake and exercise will help to alleviate constipation. Increase fibre slowly and gradually as a sudden increase in fibre can cause cramping and/or gas.

Good high fibre choices are:

- Whole wheat breads and cereals, corn and foods made with high-fibre items
- Cooked dried peas or beans
- Starchy fruits, roots and tubers (provisions)
- Fruits and vegetables. Note that prunes are a good source of fibre and contain a natural laxative.

Diarrhoea and Malabsorption

Rapid transit time of food through the GI tract may result in nutrient losses. Dietary strategies that decrease stimulation to the bowel and that delay transit time are indicated. Replace loss of fluids and electrolytes with low osmolality fluids and salty foods or electrolyte replacement drinks such as Gatorade[®] or Pedialyte[®] or WHO rehydration formula – see **Appendix 7**.

Helpful strategies are:

- Avoid high fat foods, sugar, alcohol, caffeine and insoluble fibre (bran).

- Try small, frequent meals.
- Soluble fibre, such as oats, provisions, legumes and Metamucil® slow intestinal transit.
- Probiotics may be helpful (e.g. acidophilus, bifidus). Yoghurt containing live culture is a good source of probiotics.
- Some foods which may be tolerated are: cereals, pasta, bread, porridge, plain cookies, tapioca/sago pudding, eggs, lean meat, poultry (without skin), baked or steamed fish, flavoured gelatin (jello), canned fruit, banana, cooked carrots, squash, yams, potato, liquid nutritional supplements such as Boost® or Ensure®.
- Add high potassium foods such as bananas, potatoes or other provisions.
- 10-30 g/day of glutamine powder can be an effective treatment for diarrhoea in adults.
- 1000 mg/day of calcium may help to alleviate diarrhoea.
- High doses of vitamin C or magnesium and some herbal medicines can worsen diarrhoea.
- Clove tonic taken several times daily may help - add 10 cloves to 1 cup green tea. Simmer to reduce to ½ cup and then take by spoon throughout the day.
- Home-made rehydration drink – to one cup of pure orange juice add 3 cups of water and ½ teaspoon of salt.
- Rice porridge may help: cook 1 cup of white rice in 6 cups of water or broth for one hour. Eat a small amount several times a day.

Lactose Intolerance

This may occur during bouts of diarrhoea necessitating restriction of milk. Low lactose dairy products such as hard cheeses are usually tolerated as are lactose reduced milk, soymilk and yogurt. Trials of taking milk with meals or reducing size of milk portion may increase tolerance depending on the degree of lactase deficiency.

Steatorrhoea or Fat Malabsorption

Fat malabsorption can be diagnosed through a lab test but is more generally identified by the individual noticing greasy, floating, greenish stools. A fat reduced diet (less than 50 g/day) is generally indicated. Individual tolerance should be monitored

and the level of fat restriction adjusted if symptoms persist. A diet with less than 25 g fat/day may be necessary. Prolonged diarrhea or steatorrhea may lead to nutrient deficiencies, including calcium, iron, magnesium, potassium, zinc, fat-soluble vitamins and vitamin B₁₂.

Medium chain triglycerides (MCT's) may be substituted for some fat in the diet because these are more easily absorbed than long chain fatty acids when intestinal surface area is altered or reduced.

For persons who need to gain weight or require nutritional repletion, supplemental feedings of elemental formula or lower osmolality formula high in MCT's may be used (see **Appendix 4**). In some cases Pancreatic Enzyme replacement may be prescribed.

More about MCT's

- MCT oil does not contain essential fatty acids. Therefore at least 3% of calories as linoleic acid need to be provided by adding up to 10 g/day vegetable seed oils (soy, corn, sunflower, safflower, or margarine blended with vegetable oils).
- Coconut oil is a good natural source of MCT's.
- MCT oil may be added to juices, salads, dressings, vegetables or sauces.
- MCT oil has a low smoke point: 65 - 75 degrees C and should not be used at high temperatures.
- MCT oil is contra-indicated in people with hepatic insufficiency and those who are prone to ketosis and acidosis, such as insulin-dependent diabetics.
- Introduce MCT oil slowly and gradually increase to desired level in the diet to reduce side-effects such as nausea, vomiting, abdominal pain, distension and diarrhoea. Use water-miscible forms of the fat-soluble vitamins.

Nausea and Vomiting

Many medications cause nausea, as can infection, GI disorders and malignancies. Medications are generally less likely to cause nausea if taken with a meal. Nausea can have a significant effect on nutritional intake. Dietary modifications to improve food tolerance may allow some persons to continue their antiviral medications and are well worth the effort.

- Small frequent bland meals are best tolerated.
- Foods that are salty, low in sugar and fat, dry and cold are generally better choices. These include dry crackers/salt or soda biscuits, cookies, dry cereal, dry toast, sandwiches, fruits and vegetables, plain potatoes, yams, plantain, skinned, broiled or baked chicken or bland fish, plain cheese or yogurt.
- Avoid strong odors, spicy foods and gastric irritants such as coffee and alcohol.
- Fluids may be better tolerated between rather than with meals.
- Replace fluids and electrolytes lost by emesis. Try popsicles, diluted juices, flat carbonated drink, ginger tea, soup, broth.
- Anti-emetic medications can be used.
- Ginger in tea, candied or in tablets may decrease nausea.

Early Satiety

It can be frustrating to the individual and to the caregiver when appetite fails after only the first couple of bites. Try to:

- Eat small, frequent meals and snacks.
- Eat every 2-3 hours.
- Divide the meal in half and freeze a portion for another time.
- Choose nutrient rich foods, not calorie free foods or drinks.
- Eat slowly and chew food well.
- Avoid high fat foods that take a long time to digest.

Dysgeusia

Abnormal taste sensations or loss of taste acuity is frequent in HIV infected individuals. Malnourished persons are most susceptible to loss of taste perception due to decreased capacity for taste receptor turnover, resulting in fewer taste receptors. Medications frequently cause abnormal taste sensations, such as persistent sweet, metallic or bitter taste. Chewing food well and moving it all around in the mouth stimulates the most taste receptors and also cleans the mouth of lingering medication residue.

Any of these strategies can be helpful:

- Enhance food flavor with marinades, sauces, salt and spices to increase taste acuity and mask unpleasant flavors. Soy sauce is a good example.
- Chocolate and vanilla are effective taste and smell stimulants; use them in stronger than normal applications.
- Eat protein foods cold or at room temperature.
- Sugar masks a salty taste; salt masks sweet; sour decreases metallic taste.
- Recommend sugar free candy and gum to get rid of bitter taste.
- Use of plastic utensils can minimize a metallic taste.

Gingivitis

Inflammation, swelling and bleeding gums may accompany stomatitis or be a result of mouth or upper respiratory infections. Xerostomia can also contribute to gingivitis.

- Ensure good dental hygiene.
- Rinse with warm salty water or dilute hydrogen peroxide. Do not swallow hydrogen peroxide (refer to **Table 6.1** on mouth rinses).

Mouth Soreness, Stomatitis and Oesophagitis

The mouth and throat are common targets for certain opportunistic infections, particularly Candida and Herpes. Sores may develop which can make eating very painful. Fissuring at the angles of the mouth can be caused by riboflavin, iron or pyridoxine deficiency or by herpes infection. Generally, soft and non-acidic foods are better accepted.

- Avoid citrus fruits and tomato products. Try milder nectars, apple juice and milk drinks.
- Avoid salty, spicy, coarse or dry foods. Choose soft, bland, non-irritating foods such as oatmeal, cornmeal, pasta, avocado, soups, mashed yams, custards, puddings, bananas, and fish.
- Moisten food with butter, cream, sauces and gravies if tolerated.
- Cold or room temperature foods may feel best.

- If it hurts, don't eat it. If necessary, blend or purée food. Use a straw to drink liquids.
- Rinse the mouth many times daily with warm salt water or other rinses listed below. Soda water can also be used.
- Avoid smoking and alcohol as these are irritating to the inflamed tissue.
- Keep lips moist with lip balm. Sucking on popsicles or ice cubes made from juice may help to numb the pain.
- Candida thrives on sugar. Clean the mouth and throat of the residual sugars with cold boiled water used in any of the following four recipes:

TABLE 6.1: HOME-MADE MOUTH RINSES

	Ingredient	Water
1	¼ tsp. salt	1 cup
2	¼ tsp. baking soda	1 cup
3	¼ tsp. Glycerin	1 cup
4	1 Tbsp. 3% hydrogen peroxide	1 cup

Xerostomia

A lack of saliva can make eating less appealing and can increase the risk of cavities and mouth sores. Artificial saliva substitutes (Moi-stir®, Zero-Lube®) can be tried. Fluid intake of 1.5 - 2 liters daily is recommended. Try these recommendations:

- Offer ice or frozen juice chips.
- Moisten foods. Dry or hard foods can be softened in milk or soup.
- Carry a spray bottle with rinses in it (mentioned above) and mist often.
- Brush teeth often using a toothbrush with gentle/soft bristles.
- Suck on sugarless gum or candy.
- Do not use commercial mouthwashes as they may irritate tender tissues.
- Avoid alcohol and tobacco.
- Use lip balm.

Dysphagia

People with swallowing disorders are at risk for aspiration pneumonia, decreased intake due to fear of choking or aspiration and weight loss. Warning signs are:

- Coughing and choking at meals
- Drooling
- "Gurgly" voice after eating or drinking
- Muscle weakness in the face and mouth
- Holding or "pocketing" food in the mouth
- Eating very slowly
- Reflux of food from the nose or mouth after trying to swallow
- Repeated swallows for one bite of food
- Complaints that food catches in the throat.

An assessment of the extent of the problem can be done with the physician, dietitian and other health professionals, such as speech therapist and physiotherapist. Changes in texture of the diet may be indicated, i.e. minced or puréed and thickened fluids. Adding a commercial thickener can thicken fluids. This can be done at home or in the hospital. Soups can be thickened with instant potato flakes or pureed vegetables. Foods at hotter or cooler than body temperature may give more stimuli to swallow and may be better tolerated. Correct eating posture is important.

Fatigue

Fatigue can be a major obstacle to buying food, preparing meals and eating. Check for anemia and other causes, and try any of the following:

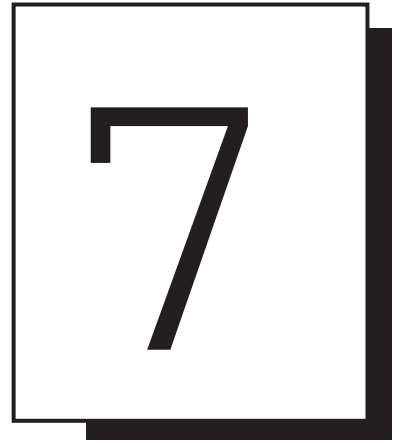
- Suggest community and family supports, such as grocery delivery, home care services, volunteers, and community feeding programmes.
- Liquid nutritional supplements, such as Ensure[®], Resource[®] or homemade blender drinks are useful.
- Simplify meal preparation by using ready-to-eat foods and disposable dishes.
- Suggest preparing extra foods when the patient is well and freeze some for low energy days.

Fever

Fever increases energy, fluid and electrolyte requirements. Calorie needs may be increased by as much as 30-50%. Fluids should contain calories and electrolytes.

- Suggest soups, juices, milk, and commercial supplements.
- Eat 5 meals per day.

Blank page – Page 98



Drug-Food Interactions

Blank page – Page 62

7

Drug-Food Interactions

Interactions between antiretroviral therapy (ART), food and nutrition can affect the efficacy of the drug(s), nutrition status of the PLWHA, and adherence to drug regimens. Drug-food interactions consist of the effects of food on medication efficacy, the effects of medication on nutrient utilization and the effects of medication side effects on food consumption.

Drugs

Antiretroviral (ARV) medications are potent drugs that can drastically decrease replication of the human immunodeficiency virus and significantly slow the progression of the disease. ARV medications do not kill the virus nor cure HIV. ARV may not be required by all PLWHA at all stages of the disease. Most often they are prescribed when the virus has begun to significantly damage the immune system.

There are two main classes and three types of commonly and widely used ARV.

TABLE 7.1: CLASSES AND TYPES OF ANTI-RETROVIRALS

Class	Type	Examples of Drugs (Generic name)
Reverse Transcriptase Inhibitors	Non-nucleoside reverse transcriptase inhibitors (NNRTI or “non-nucs”)	nevirapine, efavirenz
	Nucleoside/nucleotide reverse transcriptase inhibitors (NRTI or “nucs”) – also called nucleoside analogues	abacavir, lamivudine (3TC), zidovudine (AZT), didanosine (DDI), stavudine (D4T), tenofovir
Protease Inhibitors	Protease Inhibitors (PI)	indinavir, ritonavir, nelfinavir, saquinavir, lopinavir, kaletra

ARV medications slow the progression of the disease by a variety of mechanisms. HIV needs certain proteins and chemicals supplied by the host/infected person in order to replicate itself. Reverse transcriptase inhibitors operate early in the HIV life cycle to stop viral replication. Reverse transcriptase is an essential enzyme that helps the single stranded RNA convert to the double stranded DNA.

Nucleoside Reverse Transcriptase Inhibitors (NRTI) bind onto the reverse transcriptase enzyme and prevent the enzyme from transcribing viral RNA to host DNA (CD4 T cells).

Nucleotide Reverse Transcriptase Inhibitor – only one drug in this class to date - is very similar to NRTI.

Non-nucleoside Reverse Transcriptase Inhibitors (NNRTI) also block reverse transcriptase, but slightly differently to NRTI, and block HIV from taking over CD4 T cells.

Protease Inhibitors operate later in the cycle of HIV. They block the functioning of the enzyme protease that is involved in viral assembly and keep the infected CD4 T cells from making active copies and releasing them into the blood.

Highly active anti-retroviral therapy (HAART) employs a combination of at least 3 medications, usually from different classes, to obtain maximum viral suppression. Known also as combination therapy (CT), drug efficacy is optimized and the chances of drug resistance are reduced.

PLWHA often take other drugs to treat opportunistic infections and possibly other common diseases or conditions. Nutrition is a critical factor in the safety and efficacy of many medications. As a nutrition counselor, it is important to be familiar with the client's regimen. During the counseling process, he/she should be encouraged to adhere to his/her regimen so as to minimize any opportunity for the development of drug resistance.

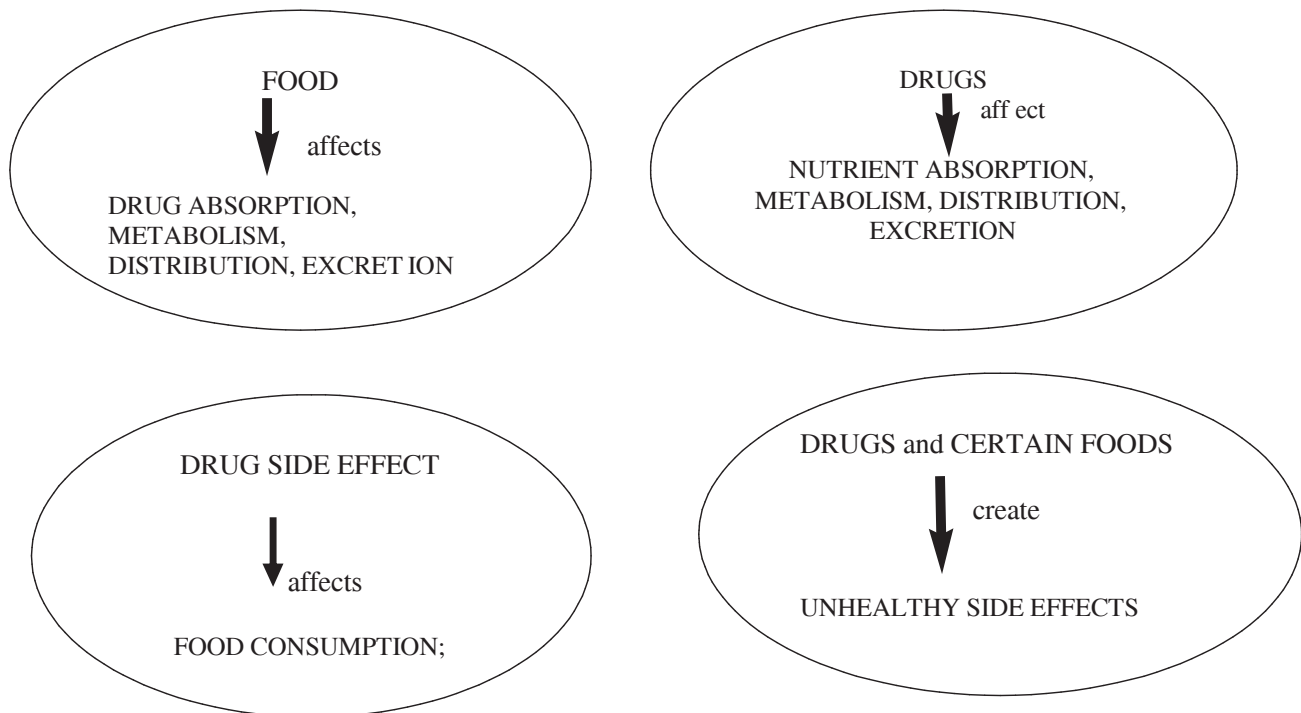
Drug Absorption

Medications are absorbed in the small intestine and metabolized in the liver by the cytochrome P450 enzyme system. There are numerous isoforms of this enzyme system, which can be induced or inhibited by nutrients, other drugs and herbs. How these are affected influences the levels of medication in the blood.

The Cmax of a medication is the maximum plasma concentration of a drug and the Cmin is the minimum concentration when the plasma levels are lowest, usually just before the next dose. The area under the curve (AUC) measures exposure to a drug during the full dosing interval and is often used to determine whether a drug is working. The Cmax is associated with severity of adverse effects and the Cmin predicts the efficacy of a drug.

Drug-food Interactions

The virus can develop resistance to antiretroviral medications. Therefore it is of critical importance that they be taken properly with complete adherence. ARV, like other drugs can interact with food and nutrition in many ways resulting in both positive and negative outcomes. Four main types of interactions can occur as shown in **Figure 7.1**.

FIGURE 7.1: INTERACTIONS BETWEEN DRUGS, FOOD AND NUTRITION

Source: Food and Nutrition Technical Assistance Project. Technical Note # 7. August 2003

Dietary measures can either improve or decrease absorption as well as utilization of the medications, because of the potential for drug-nutrient interaction at various sites. Food can affect the bioavailability of a medication by changing gastric acidity, increasing or decreasing intestinal transit time, or by changing levels of metabolizing enzymes in the liver. ARV-food management should be drug specific. **Table 7.2** and **Table 7.3** give some indications of the possible nutrition-related side effects that can result from different groups of drugs. Some of the side effects are more common than others. Nevertheless, they all require nutritional management. **Chapter 6** gives detailed recommendations to help with managing some of the common side effects.

TABLE 7.2: NUTRITION-RELATED SIDE EFFECTS OF DRUGS BY GROUPINGS

Groupings	Possible Nutrition -related Side Effects
Anti-bacterials (sometimes referred to as antibiotics)	<ul style="list-style-type: none"> • Dry mouth • Sore mouth • Nausea • Vomiting • Diarrhoea • Constipation • Taste changes • Thrush • Abdominal pain • Loss of appetite • Problems swallowing
Anti-cancer	<ul style="list-style-type: none"> • Loss of appetite • Sore mouth and throat • Nausea • Vomiting • Weight loss • Abdominal cramps/pain • Constipation • Swelling of gums • Irritation of the stomach • Altered taste • Difficulty swallowing • Thirst
Anti-fungal	<ul style="list-style-type: none"> • Loss of appetite • Nausea • Vomiting • Metallic taste • Weight loss • Diarrhoea • Cramping • Stomach pain • Increased thirst • Dry mouth and taste changes • Cough • Fatigue/tiredness
Anti-HIV	<ul style="list-style-type: none"> • Weight gain • Nausea • Vomiting • Abdominal pain • Diarrhoea • Taste changes • Increased or decreased appetite • Constipation • Fatigue/tiredness
Anti-viral	<ul style="list-style-type: none"> • Nausea • Vomiting • Metallic taste • Mild diarrhoea

TABLE 7.3: DIETARY RECOMMENDATIONS FOR SIDE EFFECTS OF ANTI-RETROVIRAL MEDICATIONS

Class of ARV	Medications	Side Effects	Dietary Recommendations
Nucleoside Reverse Transcriptase Inhibitors (NRTI)	Zidovudine Retrovir (AZT)	Nausea, vomiting, taste changes, fatigue, abdominal pain, appetite changes (increased or decreased), anaemia, constipation, weight gain	Take with food to decrease nausea. High fat foods decrease absorption. <i>Avoid alcohol.</i>
	Lamivudine (3TC, Epivir)	Nausea, vomiting, abdominal cramps, diarrhoea	Food has no effect but taking with food can decrease side effects. <i>Avoid alcohol.</i>
	Combivir (3TC/AZT)	Similar to AZT or 3TC alone	Take with food to decrease nausea
	Didanosine (DDI, Videx)	Pancreatitis, nausea, diarrhea, stomatitis, dry mouth, flatulence, decreased taste acuity	Take on an empty stomach 1 hour before or 2 hours after a meal. Taking with food reduces absorption. <i>Avoid alcohol.</i> Do not take with juice, antacids or supplements that contain Aluminum or Magnesium.
	Abacavir (Ziagen, ABC)	Anorexia, nausea, vomiting, abdominal pain, diarrhoea, anaemia, weakness and insomnia. May slightly increase glycaemia.	No effect of food but taking with food can decrease side effects. Alcohol increases AUC. <i>Avoid alcohol.</i>
	Trizivir (ABC, 3TC, AZT)	See individual profiles.	Take with low fat meal. <i>Avoid alcohol.</i>
	Stavudine (D4T, Zerit)	Anorexia, stomatitis, nausea, vomiting, abdominal pain, diarrhoea, chills/fever. May increase risk of lipodystrophy.	Food has no effect but taking with food may decrease side-effects. <i>Avoid alcohol.</i>

TABLE 7.3: DIETARY RECOMMENDATIONS FOR SIDE EFFECTS OF ANTI-RETROVIRAL MEDICATIONS (cont'd)

Class of ARV	Medications	Side Effects	Dietary Recommendations
Non-Nucleoside Reverse Transcriptase Inhibitors (NNRTI's)	Nevirapine (Viramune NVP)	Stomatitis, nausea, vomiting, abdominal pain, fever, headache, fatigue, drowsiness, high risk of hepatotoxicity	Food has no effect. <i>Avoid alcohol.</i> Avoid St. John's Wort.
	Efavirenz (Sustiva, EFV)	Nausea, vomiting, abdominal pain, flatulence, diarrhoea, elevated blood cholesterol and triglycerides, anorexia, flatulence	Take with a low fat meal; a high fat meal reduces absorption; take at bedtime; <i>Avoid alcohol.</i>
	Delavirdine	Dry mouth, stomatitis, taste changes, tongue edema, bleeding gums, dysphagia, gastritis, GI bleeding, colitis, diarrhoea, dyspepsia, constipation.	Food has no effect; antacids can decrease absorption.
Protease Inhibitors	Indinavir (Crixivan, IDV)	Nausea, vomiting, abdominal pain, fatigue, diarrhoea, dry mouth, taste changes, sore throat. May increase risk of lipodystrophy	Take on an empty stomach at least 1 hr before or 2 hrs. after a meal or with a low -fat (3 grams), low -protein snack (6 grams) 300 kcal Avoid grapefruit juice. Drink at least 1.5 litres fluid daily.
	Indinavir with Ritonavir	See individual profiles	Food has little effect. Take with food to decrease side effects.
	Saquinavir (Invirase, Fortovase, SQV)	Nausea, diarrhoea, abdominal pain, mouth ulceration, taste changes, diarrhoea, constipation, flatulence. May increase risk of lipodystrophy.	High fat foods increase AUC; take within 2 hours of a high-fat and high-calcium meal. Take with meal or light snack. <i>Avoid alcohol.</i> Grapefruit juice will increase drug concentration. Avoid St John's Wort
	Ritonavir (Norvir RTV)	Nausea, diarrhoea, vomiting, muscle weakness, taste changes	Take with food to decrease side effects. <i>Avoid alcohol.</i> Avoid St John's Wort.
	Nelfinavir (Viracept, NFV)	Diarrhoea, flatulence, lactose intolerance, nausea, abdominal pain	Take with food that includes protein. Avoid bowel irritants.
	Kaletra (Lopinavir/ Ritonavir)	Nausea, abdominal pain, diarrhoea	Take with high fat meal.
Nucleotide Reverse Transcriptase Inhibitor	Tenofovir (Viread TDF)	Abdominal pain, headache, fatigue, dizziness	Take with meals to increase AUC and bioavailability.

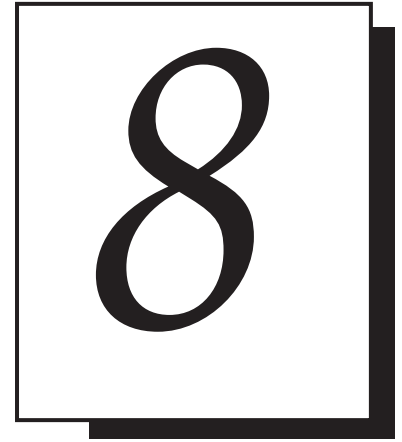
Combination Drug Therapy

Multiple drug usage/combination therapy warrants consideration of the different interactions. Drug and food timetables need to be arranged with the PLWHA. Some food interactions of combination drug therapy (CT) are different from those of the individual drug, for example the PI indinavir with a high energy, high-fat, high protein meal reduces its absorption, but when taken with the PI ritonavir, the food has no effect on its absorption and it may be taken with or without food. In addition, drugs for opportunistic infections and other conditions may require consideration when planning management of drug and food consumption.

Drug-drug interactions arising from prescribed, over-the-counter or traditional therapies should be evaluated especially since the content of traditional therapies is unknown.

Key Points

- 1. Managing the interactions between ARVs, food and nutrition can significantly influence the success of ART. This is a critical factor in the extent to which the therapy is effective in slowing the progression of HIV /AIDS and improving the quality of life.**
- 2. Appropriate dietary changes can help to manage certain ARV side effects and reduce the impact the side effects can have on nutritional status. Failure to be drug-specific when managing ARV-food interactions may result in non-adherence and thus contribute to a decline in health.**
- 3. Information about drug-food interactions continues to evolve. It is therefore important to remain informed.**
- 4. ARVs can improve the health of the PLWHA but they can also create additional food and nutrition needs and constraints. Adequate dietary intake can be challenging.**
- 5. Non-adherence to drug regimen gives the virus the opportunity to copy itself, grow and mutate leading to drug resistance and fewer options for fighting HIV.**



*Food and
Water
Safety*

Blank page - Page 110

8

Food and Water Safety

Avoiding infection from food or water borne pathogens is of utmost importance for HIV-infected persons. Immuno-compromised individuals can acquire infectious organisms by eating undercooked or contaminated foods or drinking untreated water. Food either supports growth or serves as a passive carrier of the infectious microorganisms or toxins.

The symptoms of food or water-borne infection include diarrhoea, nausea and vomiting, which in some cases can be life-threatening. Diarrhoea is a common clinical feature of symptomatic HIV infection and is usually the most significant manifestation. It is challenging to treat and it may contribute to wasting and malnutrition if treatment is not timely and effective.

A number of food and water borne microorganisms have been identified as aetiological agents in gastrointestinal infections in HIV-infected persons including *Giardia lamblia*, *Entamoeba histolytica*, *Cryptosporidium*, *Salmonella*, *Shigella*, *Listeria*, *Yersinia* and *Camphylobactor*.

Persons with CD4 cell counts below 200/mm³ are particularly vulnerable due to immune suppression. Early in HIV infection PLWHA and their families should be counselled to adopt safe food handling practices and to use water from a safe source. Caregivers of infants should understand the basic principles of food and water safety, including the preparation of infant formula.

Food Safety Precautions

HIV-infected persons and their caregivers should ensure clean/safe food handling techniques are used at all times. Fruits and vegetables should be washed well or peeled.

Immuno-compromised individuals can acquire infectious organisms by eating under-cooked or contaminated foods or drinking untreated water.

- Hands should be washed before, during and after food handling.
- Work surfaces should be clean. A sanitizing solution can be mixed using 1 tablespoon of bleach:1 litre of water and this can be sprayed onto the surfaces. Washing cloths should be changed daily.
- Avoid cross contamination of foods. Uncooked meats should not come in contact with other foods. Wash hands, cutting boards, counters and cooking utensils thoroughly after contact with uncooked foods. Ideally separate cutting boards are recommended for meats and non-meat products.
- Thaw frozen foods in the refrigerator, microwave or cold water changed every 30 minutes. Cook immediately after thawing. Do not refreeze thawed foods.
- All meats, poultry, eggs and seafood should be cooked well to a safe temperature to destroy infectious micro-organisms. Cook eggs until whites and yolks are firm. Fish and shellfish until opaque. Fish should flake easily with a fork. Raw or undercooked foods are prohibited.
- Foods should be kept hot at a temperature greater than 140°F/60°C or cold at a temperature less than 40°F/4°C. Bacteria grow rapidly in this danger zone. Whether raw or cooked, foods should not be left at room temperature for more than 2 hours (1 hour in weather 90°F/32°C or above).
- Chill/refrigerate leftovers immediately or within the above time frame. Use within 3 days. Any suspicious foods should be thrown out.
- Reheat leftovers thoroughly (165°F/74°C if a food thermometer is available) until very hot. Allow sauces, soups and gravies to come to a boil.
- Eating out – order foods that have been thoroughly cooked and ensure that they are very hot.

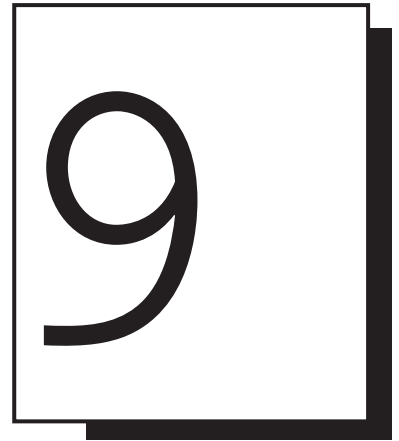
- Only pasteurized milk and dairy products should be used as *Salmonella* can be present in unpasteurized milk.
- Soft cheeses like Brie or Camembert should be avoided. Ready-to-eat foods such as hot dogs and "deli" cold cuts/sausages should be reheated well. These may contain *Listeria*.
- Persons should understand and apply the basic guidelines for procuring foods, such as looking for bruises, expiry date, presence of moulds, or dented cans.

Water Safety Precautions

- *Cryptosporidiosis*, *microsporidiosis* and *giardia infection* are typical water-borne illnesses. These can be avoided by using treated water. HIV-infected persons;
 - ❖ should not use water directly from lakes, rivers, ponds, springs or the rain
 - ❖ should avoid swimming in water that may be contaminated with human or animal waste
 - ❖ should avoid swallowing water when swimming
- Chlorination of municipal water systems will destroy *giardia* but not *cryptosporidium*. Immune suppressed individuals should take further measures to ensure a safe water supply by using one of these 3 options:
 - ❖ Water should be boiled rapidly for one minute to eliminate *cryptosporidia*.
 - ❖ Bottled water can be used if it has been treated by distillation or reverse osmosis.
 - ❖ Water can be filtered with a one micron filter that will filter out *cryptosporidia*.
- Bottled or canned soft drinks, commercially packaged noncarbonated drinks and juices that do not require refrigeration until after opening are safe to drink.
- Fruit juice or drinks reconstituted with water from a safe source is permitted.
- Reconstituted fruit juice or drinks as usually sold in retail outlets or by roadside vendors may not be safe to use since the water source may be questionable.

Key Points

- 1. Knowledge and practice of safe food handling techniques are essential for HIV-infected persons.**
- 2. Prevention of food and waterborne illness is critical to decrease risk of associated infections.**
- 3. Emphasis should be placed on proper selection and storage of foods, adequate cooking of foods from animals, avoiding cross contamination of raw and cooked foods.**
- 4. Keep a sanitary kitchen environment.**
- 5. Practice proper personal hygiene.**
- 6. Use clean water from safe sources.**



*Other
Issues*

Blank page – Page 116

9

Other Issues

Micronutrient Therapy

Aside from a multivitamin-mineral, which should be considered for HIV-infected persons, supplementation regimens should be individualized based on clinical condition, measured deficiencies, and economic situation. The therapeutic effect and dosing requirements have yet to be determined but some patients will decide to self-administer these supplements. The World Health Organization recommends that micronutrient needs for HIV-infected people in resource-limited settings is the same as the healthy population, but that a pre-existing state of malnutrition must be considered. Given the myriad nutritional problems experienced by PLWHA and the prevalence of micronutrient deficiencies, a multivitamin might be a prudent intervention.

Antioxidants: Studies show an increase in oxidative stress in HIV. Oxidative stress contributes to disease pathogenesis by damaging cell structures, increasing the inflammatory response, increasing viral replication via the NFκB pathway, and inducing apoptosis of immune cells. There is a concomitant decline in endogenous antioxidant production, notably glutathione, as well as a decreased intake of dietary sources. Although there remains no consensus regarding the use of antioxidant supplements, in clinical practice vitamins C and E are widely recommended, as they are relatively inexpensive and non-toxic. Suggested doses are 500-1000 mg of vitamin C and 400-800 IU vitamin E per day). For vitamin C the upper tolerable limit (UTL) is 2000mg daily and for vitamin E the UTL is 1000 mg (1100 IU) daily.

Vitamin B Complex: Epidemiological studies suggest that B vitamins are protective in terms of slowing disease progression. Patients with a history of acute infection, fever, alcohol use, and malnutrition are at particular risk of deficiency, and should consider a B complex supplement.

Vitamin B₁₂: A deficiency of this vitamin causes megaloblastic anaemia and has been linked to neuropathy, decreased cognition, increased disease progression, and increased risk of mortality. The primary contributing factors are malabsorption due to gastric hypochlorhydria and intestinal disease, as well as increased turnover. Serum levels of vitamin B₁₂ do not accurately reflect functionality or tissue stores, which limits the reliability of testing and makes it more difficult to determine the appropriateness of supplementation. Persons with low serum levels, advanced disease, neuropathy, declining cognition, and prolonged gastrointestinal complications should be considered for vitamin B₁₂ supplementation. The repletion dose of vitamin B₁₂ is oral supplementation of 1000-2000 µg daily or 30-100 µg by intramuscular injection for 5-10 days.

Selenium: Research has shown that selenium deficiency is associated with increased risk of mortality and has been associated with wasting syndrome and possibly viral load. Whether selenium deficiency has a causal role in mortality or is a marker of disease progression remains to be determined. However, at this stage it is prudent to prevent, or at the very least, correct, abnormally low serum levels. It should be noted that functional tests (e.g., glutathione peroxidase) more accurately reflect selenium status, but serum levels have been widely used to assess selenium status in HIV disease. Selenium is toxic in high doses, but 100-200 µg per day is thought to be a safe and adequate dose to prevent deficiency. The UTL is 400 µg daily.

Zinc: Zinc deficiency, a common occurrence in HIV infection, is profoundly immunosuppressive, is associated with an increased risk of mortality, and has a negative impact on taste acuity, wound healing and growth. Zinc supplementation remains highly controversial, as high intakes are also immunosuppressive. The level of zinc intake that causes declining immune function is unknown. The amount of zinc found in a multivitamin-mineral is safe and adequate unless there is a measured deficiency. To correct zinc deficiency, prescribe 25-50 mg elemental zinc three times daily. The UTL is 40 mg daily.

Vitamin A: Deficiency is common in resource-poor settings, injection drug users and malabsorptive disorders. Deficiency compromises the integrity of the epithelial

barrier, increases the risk of opportunistic infection and increases the risk of vertical transmission. Deficiency prophylaxis will be obtained with the use of a daily multivitamin supplement. Doses higher than 20,000 IU per day should not be taken without documented evidence of vitamin A deficiency. Persons with compromised liver function should not take doses greater than 5000 IU vitamin A per day (the usual amount in a multivitamin). The UTL is 10,000 IU daily.

Supplementation regimens should be individualized based on clinical condition, measured deficiencies, and economic situation.

Iron: Iron deficiency anaemia is common in impoverished populations due mainly to inadequate intake. The main symptom of iron deficiency is fatigue with reduced functional capacity. Individuals with AIDS may develop anaemia of chronic disease. Iron deficiency also has negative effects on lymphocytes, natural killer cells and neutrophils. However, excess iron is also problematic as iron provides an important substrate for bacterial growth. PLWHA on antiretroviral therapy, especially zidovudine, may have decreased serum haemoglobin with elevated MCV (mean corpuscular volume). It should not be assumed, however, that low haemoglobin is due to ART and confirmatory studies including, serum ferritin, folate and vitamin B₁₂ should be performed. Iron supplements should be prescribed on the basis of iron deficiency anemia. The UTL is 45 mg daily.

Many other foods, nutrients and herbal remedies are promoted as having antiviral and immune enhancing properties. Health care professionals should investigate which therapies patients are already taking or plan to start taking and counsel accordingly.

Complementary and Alternative Medicine

Complementary and alternative medicines (CAM) include mind and body therapies that are practiced outside of conventional medicine. CAM may be used in conjunction with or instead of allopathic medicines. These practices are common among people living with HIV/AIDS in order to have a more holistic approach to healing.

PLWHA often seek to minimize side effects, enhance quality of life and delay disease progression. In some cases CAM offers the only available medicine for treatment of HIV infection and symptoms.

PLWHA often receive information from friends and may not be well informed about the rationale for taking the therapy, possible toxicities, or interactions with their antiretroviral medication. However, exploring CAM may be an avenue of empowerment for persons with HIV/AIDS as they endeavour to gain more control of their health. Clinicians can help patients to make sound choices even with the limited scientific information available.

Individuals exploring the use of CAM should be well informed by a suitably qualified practitioner about the following:

- The potential benefits for their particular situation.
- How the therapy will work.
- Possible side effects or negative interactions with their conventional medicines.
- What type of commitment they have to make to the treatment, whether the treatment is regularly available, and what they have to do to acquire it.
- The cost of therapy and whether they can afford it.

They should be very cautious about the following:

- Therapists that discourage them from consulting other health care professionals, or negate other information or practices.
- Practitioners who advise them to discontinue life-saving conventional medicine in favour of CAM.
- Products or practices that 'cure' a whole range of illnesses.
- Practitioners who are not qualified.
- Products that are unjustifiably expensive with no rationale given for the high cost.
- Products or therapies that have 'secret' properties.

Appendices, Glossary & References

Blank page – Page 122

– Appendix 1.2 –

SAMPLE SIMPLIFIED NUTRITION SCREENING FORM

Basic Anthropometry: Height: _____ Weight: _____

Weight change: lost 10 lb/4.5 kg or more in the last 6 months

Dietary Problems (tick all that apply)

- | | |
|--|---|
| <input type="checkbox"/> Poor appetite | <input type="checkbox"/> Difficulty chewing |
| <input type="checkbox"/> Difficulty swallowing | <input type="checkbox"/> Pain in mouth, teeth or gums |
| <input type="checkbox"/> Gastrointestinal problems | <input type="checkbox"/> Unable to obtain or prepare food |
| <input type="checkbox"/> Consumes more than 1 alcoholic drink/day (female) | |
| <input type="checkbox"/> Consumes more than 2 alcoholic drinks/day (male) | |

Living Conditions (tick all that apply)

- | | |
|--|--|
| <input type="checkbox"/> Income level is low | <input type="checkbox"/> Lives alone |
| <input type="checkbox"/> Is homebound | <input type="checkbox"/> Limited cooking equipment |
| <input type="checkbox"/> No refrigerator | |

Functional Status (tick all that apply)

- | | |
|--|--|
| <input type="checkbox"/> Cooking assistance needed | <input type="checkbox"/> Feeding assistance needed |
| <input type="checkbox"/> Assistance needed to buy food | <input type="checkbox"/> > 50% of time in bed |

Evaluation: One or more check marks may be indicative of nutritional risk. Refer patient for further assessment.

– Appendix 1.3 –

SAMPLE NUTRITION SCREENING FORM

Adapted with Permission from AIDS PROJECT LOS ANGELES

1. My current height is ____feet____ins/_____cm and my current weight is____lbs/kg.
My usual weight is____lbs/kg. In the last six months without trying to, I have: Lost
 Gained
 No Change
2. I have teeth or mouth problems that make it hard for me to eat.
3. I eat less than 3 times a day. Yes No
4. In the last month I have skipped meals because I did not have enough food to eat. Yes No
5. I have a place to cook. Yes No
6. I have a place to keep my foods cold. Yes No
7. I often have/experience one or more of the following (please circle all that apply):
- | | | |
|--------------|---------------------------|--|
| a. Diarrhoea | e. Vomiting | i. Ulcer or stomach problems |
| b. Nausea | f. No/poor appetite | j. Change in how things smell or taste |
| c. Heartburn | g. Eating less than usual | k. Constipation |
| d. Bloating | h. Feeling tired | |
8. I have one or more of the following (please circle all that apply):
- | | | |
|---------------------------|-----------------------------------|-----------------------------|
| a. Heart Disease | f. Diabetes or High Blood Sugar | k. Kidney Disease |
| b. High Cholesterol | g. Depression or Anxiety | l. Cancer |
| c. High Triglycerides | h. Hepatitis and/or Liver Disease | m. Anabolic Steroid Therapy |
| d. Wasting or Weight Loss | i. Pancreas Problems | n. Allergies: |
| e. High Blood Pressure | j. Tuberculosis (TB) | |
9. I follow a special/modified diet (example: for diabetes, kidney problems, low fat, low carbohydrate or vegetarian, etc.) Please describe: _____

10. I give permission to share the information with my HIV primary care provider.
My provider is: _____
Name: _____ Sex: M F Today's Date: _____ Reg.# _____
Date of Birth: _____ Phone: _____ Okay to leave a message? Yes No

Instruction: If any one of the "yes" above is checked, refer for nutrition assessment.

– Appendix 1.4 –

SAMPLE: NUTRITION ASSESSMENT FORM – ADULTS

Patient: Name: _____ D.O.B. _____ Sex _____
 Address _____ Phone _____

N.O.K.: Name _____ Relationship _____
 Address _____ Phone _____

Pt's Comment/complaint: _____

Anthropometric: Ht _____ cm Wt _____ kg Waist Circ: _____ cm Hip Circ: _____ cm MAC: _____ cm TSF: _____ mm
 Frame size: S [] M [] L [] Recent Wt change? No [] Yes [] Other _____

Biochemical: CD4 _____; Viral Load _____; Hb _____; MCV _____; Tot Prot _____; Alb _____; HDL/LDL _____/_____; Trig _____
 Glucose _____ BUN _____ Na _____ K _____ Cl _____ Other _____

Clinical: Oral/facial _____
 Skin: _____
 Constipation/diarrhoea _____ Other GI Problems: (except those listed under dietary) _____
 Other _____

Medication: Rx _____ OTC _____

Dietary: Appetite _____; Food aversions/Allergies _____; Taste changes _____; Satiety _____
 Chewing/swallowing _____; Supplements: Nutritional _____; Herbal _____; MVI _____
 Caloric intake _____; Fluid intake _____ cups; # meals/day _____; #Snacks/day _____; Meals eaten: At home _____ Away _____

Lifestyle: Smoking _____; Alcohol intake _____; Physical activity/Exercise _____; Sleep/rest (hours) _____

Social/General: Employment Status _____ Literacy _____
 Housing: Lives alone no [] yes [] Comment _____
 Water source _____ Food storage facilities _____

Other _____

NUTRITIONAL STATUS: BMI _____ MAMC _____ Visceral _____ Somatic _____ GI _____ DNI _____
 Intake _____ Habits _____ Other _____

NUTRIENT REQUIREMENT: Cal _____ Kcal; Prot _____ gm/day; Carb _____ gm/day; Fat _____ gm/day; Fluid _____ L/day; Other _____

RECOMMENDATIONS: _____

COUNSELLING ISSUES: _____

INTERVENTION: _____

NEXT APPOINTMENT: _____

SEEN BY _____ *Signature - Registered Dietitian* **Print name:** _____ **Date:** _____

Prepared by Deon Bent, R.D. in collaboration with Caribbean Food and Nutrition Institute, 2004

– *Appendix 1.4* (cont d)

DIETARY RECALL: (Select- Usual/Current)

--	--

GUIDELINES FOR NUTRITIONAL CONSULTATION

Indications for Referral to a Dietitian

- Diagnosis of HIV infection.
- Nutrition screening indicates nutritional risk.
- Symptomatic infection: oral/esophageal, gastrointestinal, anorexia.
- Weight changes: unintentional weight loss, rapid excess weight gain.
- Nutritional deficit: inadequate dietary intake, abnormal serum levels of proteins, vitamins, minerals or electrolytes.
- Highly active antiretroviral therapy (HAART): management of side effects and food-drug interactions.
- Socioeconomic factors: limited food access, inadequate housing.
- Dyslipidemia.
- Impaired glucose tolerance.
- Co-existing medical condition with nutritional implications.
- Pregnant.
- Paediatric
- Client requests consult for nutritional assessment or counselling.

Patient Profile	Referral Guidelines
New HIV diagnosis: asymptomatic	Within 6 months
New HIV diagnosis: symptomatic	Within 1 month
Asymptomatic HIV	Every 6- 12 months
Symptomatic HIV/AIDS	Every 2-6 months
Initiation of HAART with food interactions	At time of HAART initiation
Pregnant	Every 2-4 weeks
Paediatric	Every 1-3 months
Hyperlipidaemia, hyperglycaemia, osteopenia	Within 1 month

ANTHROPOMETRY: PROCEDURES FOR TAKING ADULT WEIGHT

Equipment: A standing scale, preferably beam balance, or where available and necessary, a chair or a bed scale.

Procedures:

The healthcare practitioner should:

1. Ensure that the scale is reading zero scale before client is asked to stand on it.
2. Ask client to remove all heavy clothing, accessories, and personal items from pockets.
3. Ask client to take off his/her shoes
4. Ask client to stand on the middle of the scale, look straight ahead, steady self, remain upright with arms hanging at the sides.
5. Stand to face the client
6. Slide weight along calibrated measurement bar(s) until indicator stabilizes
7. Read weight within nearest $\frac{1}{4}$ lb or 0.1 kg. after the indicator has stabilized.
8. Ask person to step off scale.
9. Document weight, and inform client.

Taking Weight in Special Situations

If the person has an amputation, the missing body part must be accounted for, and subtracted from the standard reference body weight to arrive at the adjusted body weight of the amputee. The following guidelines can be used for adjusting body weight of amputees:

- | | | | |
|--------------------|------------|--------------------|------------|
| • Hand | 0.7 % loss | • Lower arm + hand | 2.3 % loss |
| • Entire arm | 5.0 % loss | • Foot | 1.5 % loss |
| • Lower leg + foot | 5.9 % loss | • Entire leg | 16.0% loss |

ANTHROPOMETRY: USING WRIST CIRCUMFERENCE TO ESTIMATE FRAME SIZE

Equipment: A measuring tape .

Procedures:

1. Measure the circumference of the person's wrist around the smallest part of the wrist distal to the styloid process of the ulna and radius (toward the fingers).
2. Record measurement and use in this formula :

$$\text{Frame Size (r)} = \frac{\text{Height (cm)}}{\text{Wrist circumference (cm)}}$$

3. Compare the product (r) with one of the following:

<u>Frame Size</u>	<u>Men</u>	<u>Women</u>
Small	≥ 10.4	≥ 11.0
Medium	9.6 – 10.4	10.1 – 11.0
Large	≤ 9.6	≤ 10.1

Source: Grant, J.P.: *Handbook of Total Parenteral Nutrition*, Philadelphia, W.B. Saunders Company, 1980, p.15

ANTHROPOMETRY: ELBOW BREADTH TO ESTIMATE FRAME SIZE

1. Ask individual to flex elbow at 90°.
2. Measure the distance between the epicondyles of the humerus with the caliper blades pointing upwards.
3. Compare the distance to the above standard values to interpret frame size.

ANTHROPOMETRY: PROCEDURES FOR TAKING ADULT HEIGHT

Equipment: Beam balance scale with attached stadiometer (preferred) OR a standing height board with tape and moveable headboard, OR non-stretch tape.

Procedures

The healthcare practitioner should ask the individual to:

1. Take off shoes, hair accessories or any other item that can interfere with height measurement.
2. Stand on the scale with feet flat on floor or foot-piece with both heels comfortable close together and touching the base. Shoulders should be relaxed and arms hanging along the sides of the body.
3. Keep eyes looking forward and head straight so that ears and eyes are in a straight line.
4. Keep knees straight and heels anchored to the base (scale of floor).

The healthcare practitioner

- i. Slides the horizontal bar of stadiometer down to firmly touch the crown of the person's head and reads the measurement to the nearest centimeter.
- ii. Documents the reading in the individual's record.

Alternatively, if a scale is not used, ask the individual to stand against a smooth straight surface, for example a wall without a baseboard, with heels, buttocks/bottom, shoulder blades and head touching the wall.

The healthcare practitioner:

- (a) Points shorter edge of ruler to touch the wall, and rests the ruler firmly on the crown of the individual's head.
- (b) Makes a small mark on the wall to indicate the person's height.
- (c) Asks the person to move away from the wall.
- (d) Measures the distance from the floor to the mark with a tape.
- (e) Reads the measurement to the nearest centimeter.
- (f) Documents the measurement in the individual's record.

ANTHROPOMETRY: ALTERNATIVE APPROACH– TAKING KNEE HEIGHT MEASUREMENTS

Equipment: knee height calipers.

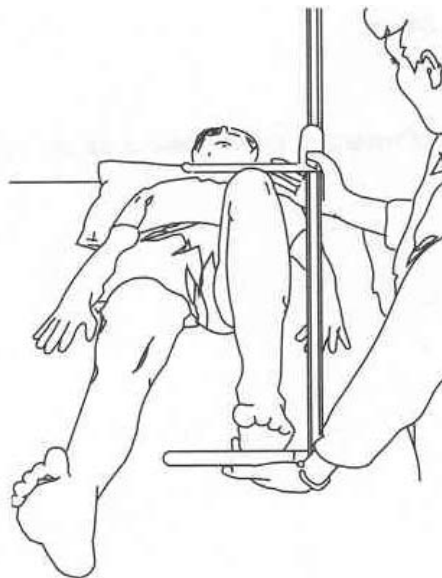
Procedures:

1. Ask individual to lie in a supine position and bend right knee at 90°. Place one blade of the caliper under the heel of the left foot flexed at 90°.
2. Place second blade of the caliper over the anterior surface of the thigh, proximal to the patella. Ensure that the caliper is parallel to the tibia.
3. Record the distance in centimeters and use accordingly in one of the following equations:

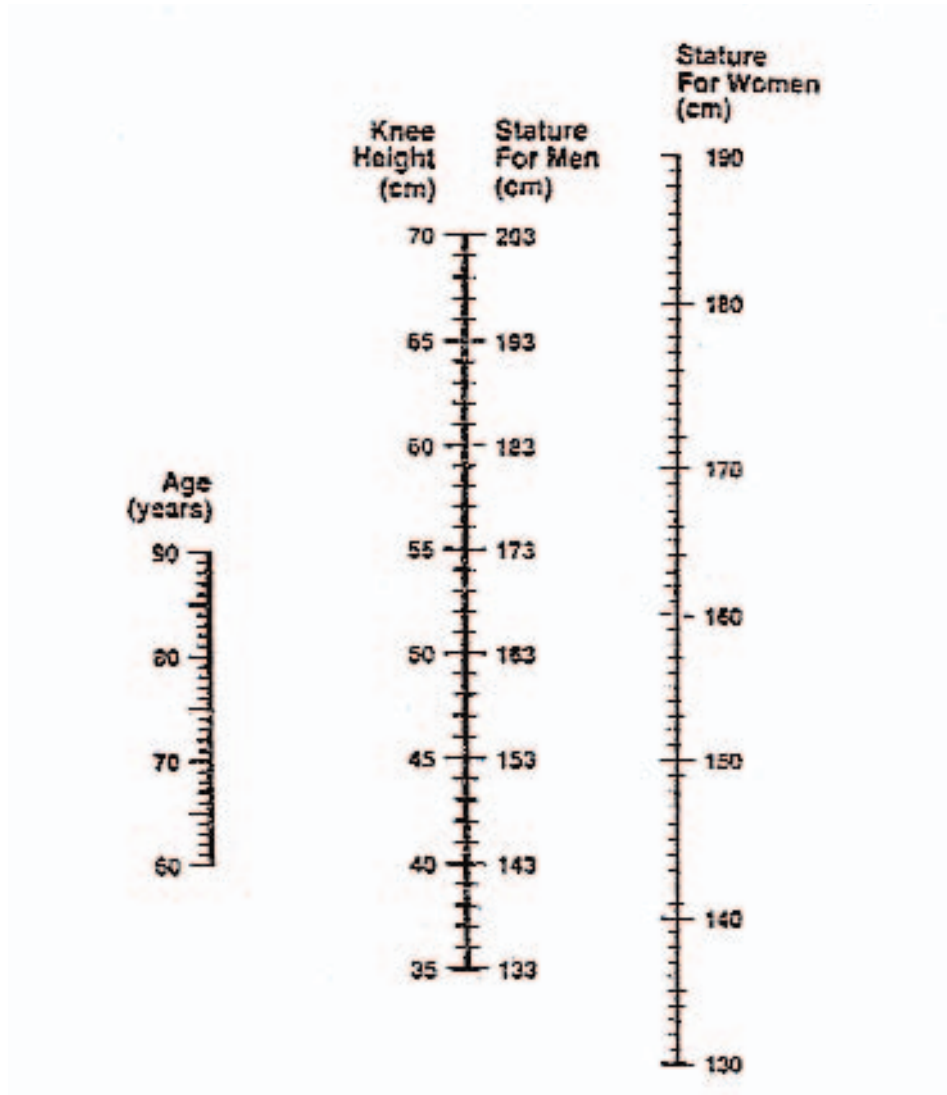
Men: Height in cm = $64.19 - (0.04 \times \text{age in years}) + (2.02 \times \text{knee height cm})$

Women: Height in cm = $84.88 - (0.24 \times \text{age in years}) + (1.83 \times \text{knee height in cm})$

This estimated stature value can be used in indexes to estimate basal energy expenditure.



NOMOGRAM FOR ESTIMATING STATURE FROM KNEE HEIGHT



Source: "Pocket Resource for Nutrition Assessment" Kathleen C. Nieder, Editor, Consultant Dietitians in Health Care Facilities, 5th Edition, 2001

SELECTED NUTRITIONAL SUPPLEMENTS

Oral Liquid Nutritional Supplements

1. For High Calorie, High Protein Diets

Standard formula with 1 kcal/mL are the first choice for weight gain with no other complications. These products are polymeric, containing intact protein, and require a functioning gastrointestinal tract. Acceptance and tolerance are variable as these products are not isotonic, and tend to be very sweet with a mild chemical taste. Taste fatigue can be a problem and strategies to enhance flavour and decrease off tastes may improve long-term acceptance. These include chilling or freezing the drinks, using a straw to avoid unpleasant smells, adding flavour enhancers such as vanilla, instant coffee, or fruit. Examples include the following formulas:

- Ensure®
- Resource®
- Boost®

Hypercaloric formulas provide 1.5 kcal/mL. Although these provide additional calories and protein they must be used with caution due to the high osmolality. Examples include the following formulas:

- Boost Plus Calories®
- Ensure Plus®
- Resource 2.0®

2. Specialized Oral Supplements

Specialized formulas may be used for specific conditions such as gastrointestinal symptoms, glucose intolerance, and elevated protein requirements. Examples include the following formulas:

- Ensure High Protein® for increased protein needs, glucose intolerance
- Nutren® for gastrointestinal symptoms as this product contains 25% of the fat as MCT
- Peptamen® is a semi-elemental, peptide-based formula used for severe diarrhoea and malabsorption.
- Vital® and Vivonex® are elemental amino acid based formulas for intestinal disease and malabsorption.

3. *For Enteral Feeds*

Some oral liquid nutritional products may also be used for enteral feeding if they meet specific criteria in their formulation. Many of these are not well tolerated by HIV-infected patients because they have high osmolality. For improved tolerance choose products that are isotonic, which are generally unflavoured and not suitable for oral supplementation.

Examples of oral liquid nutritional supplements that may be used for tube feeding include the following:

- Ensure®
- Resource®
- Nutren®
- Peptamen®

Isotonic nutritional products developed specifically for tube feeding are not suitable for oral supplementation. Examples include the following:

- Osmolyte HN®
- Jevity®
- Isocal, Isocal HN®, Isocal with Fibre®
- Isosource®, Isosource HN®, Isosource VCHN®

Elemental enteral formulas have high osmolality due to the presence of free amino acids. These are used in cases of gastrointestinal disease and malabsorption. They are usually initiated in a diluted form to build tolerance. Examples include the following:

- Criticare HN®
- Vital HN®
- Tolorex®
- Vivonex®

4. *Modular Formula*

Kilocalories, protein and fats may be added to foods, oral liquid nutritional supplements, tube feeding formulas and infant formulas. Examples include the following products:

- Polycose® calorie supplement
- Caloreen® calorie supplement
- MCT oil
- ProMod® protein supplement

MODIFYING ADULT MILKS FOR INFANT FEEDING

Fresh cow's or goat's milk

80 ml liquid full cream/whole milk

40 ml cooled, boiled water

8 g sugar

Yield: 120 ml prepared formula

Evaporated milk

32 ml evaporated milk

48 ml cooled, boiled water to make 80 ml full strength milk

40 ml water

8 g sugar

Yield: 120 ml prepared formula

Powdered full-cream milk

10 g full cream powdered milk

80 ml cooled, boiled water to make 80 ml full strength milk

40 ml water

8 g sugar

Yield: 120 ml prepared formula

Micronutrient supplements should be given with any of these home-prepared formulas

Source: WHO/UNICEF/UNAIDS, HIV and Infant Feeding Counselling: A Training Course.

ANTHROPOMETRY CHILDREN: MEASURING CHILDREN'S WEIGHT

Equipment

A leveled, well calibrated platform scale with a beam and moveable weights

Procedures

1. Ensure that the scale is reading zero before use.
2. Ask caregiver to remove shoes, sneakers and as much clothing as possible, preferably limited to light indoor clothing.
3. Usher child to stand still in the centre of the platform ensuring that body weight is evenly distributed between both feet.
4. Slide moveable weight(s) until lever balances.
5. Read weight to the nearest 0.1 kg. or 100 g.

For children who cannot stand on a beam balance scale, a chair or bed scale may be used if available. Alternatively, the child may be held by a caregiver, weight taken, and the caregiver's weight is subtracted after. This method must be noted in the medical record.

ANTHROPOMETRY CHILDREN: MEASURING RECUMBENT LENGTH

Requirements:

Two persons.

Equipment:

Measuring board.

Procedures:

1. Place child in a supine position on a recumbent length table or measuring board with crown of head touching the stationary, vertical headboard.
2. Ensure that shoulders and buttocks are flat against the table top, with shoulders and hips aligned at right angles to the long axis of the body.
3. Extend legs gently at the hips and keep knees flat against the table top with the arms resting against the sides of the trunk.
4. Ensure that legs remain flat on the table.
5. Hold the child's head with the line of vision aligned perpendicular to the plane of the measuring surface.
6. Shift the movable board against the heels and read measurement to the nearest 0.1 cm.

Recumbent length is used until the child is able to stand on a scale . From this time, standing height is measured.

**COMPOSITION OF ORAL REHYDRATION
SALTS SOLUTION FOR SEVERELY
MALNOURISHED CHILDREN**

<i>Concentration (mmol/L)</i>	<i>Component</i>
125	<i>Glucose</i>
45	<i>Sodium</i>
40	<i>Potassium</i>
70	<i>Chloride</i>
7	<i>Citrate</i>
3	<i>Magnesium</i>
0.3	<i>Zinc</i>
0.045	<i>Copper</i>
300	Osmolarity

SIX CARIBBEAN FOOD GROUPS



Blank Page - Page 142

Glossary

Word	What it means
Acquired Immunodeficiency Syndrome (AIDS)	A secondary immunodeficiency disease that results from infection with the human immunodeficiency virus.
Alternative medicine (Complementary medicine)	Mind or body therapy that is practiced instead of conventional medicine. Examples include healing touch, acupuncture, nutrition and herbal or homeopathic medicine.
Antigen	A foreign protein present in the blood that stimulates an antibody response.
Anti-retroviral therapy	Drugs that prevent replication of retroviruses, in this case the human immunodeficiency virus.
Apoptosis	Programmed cell death that takes place in normal cells by nuclear fragmentation. It is an active, selective and tightly regulated process.
Area under the curve	Measure of exposure to a drug during the full dosing interval. This determines the efficacy of the drug.
Body cell mass	Metabolically active protein including somatic protein and visceral protein pool.
Breastmilk Substitute	Any food used for infant feeding as a replacement or supplement to breast milk.
Cachexia	Weight loss, wasting of muscle, loss of appetite and general debility that can occur during a chronic disease.
CD4	The site on the T helper cells to which HIV binds itself. CD4 cell count is a measure of immune function.
Candidiasis	An opportunistic fungal infection that usually occurs in the mouth, esophagus, vagina or skin.

Word	What it means
Cryptosporidium	A parasite that infects the intestines causing severe, protracted diarrhea, often resulting in dehydration and malnutrition.
Dysgeusia	Altered taste.
Dysphagia	Difficulty swallowing.
Encephalopathy	Any disease or disorder of the structure or function of the brain.
Evaluation	Systematic comparison of current findings with previous status, intervention goals or a reference standard.
Exclusive breastfeeding	Giving the infant only breast milk on demand. No other food item, including water, is offered.
Gastrostomy tube	A feeding tube that is placed in the stomach to provide nutrition. The tube is placed surgically or with percutaneous endoscopic gastrostomy.
Highly Active Antiretroviral Therapy (HAART)	Antiretroviral therapy that combines medications, usually at least 3 different drugs, to achieve suppression of viral replication.
Human Immunodeficiency Virus (HIV)	The virus that causes acquired immuno-deficiency syndrome (AIDS).
Immunocompromised (immune suppressed)	The immune system has declined to the point where it can no longer mount an effective defense against pathogens
Incidence	The frequency of occurrence of any event or condition over a period of time and in relation to the population in which it occurs.
Lymphocytes	A parasite that infects the intestines causing severe, protracted diarrhoea, often resulting in dehydration and malnutrition.

Word	What it means
Jejunostomy	A feeding tube that is placed in the jejunum. This may be placed directly through the abdominal wall or as an extension from a gastrostomy feeding tube.
Malnutrition	Any condition caused by deficient or excess energy and nutrient intake, or by an imbalance of nutrients.
Monitoring	Review and measurement of individual's status at selected times to determine the degree to which progress is being made and nutrition goals are being achieved.
NFKB pathway	Nuclear factor kappa B (NFKB) is a cellular transcription factor that is involved in replication of the human immunodeficiency virus.
Nutrition assessment	Gathering information about diet adequacy and nutrition status, evaluating parameters and identifying risks for impending nutrition complications.
Nutrition diagnosis	Identifying and labeling actual occurrences and risk of or potential for developing a nutrition problem.
Nutrition intervention	Strategies applied to address nutrition issues; includes both food-based approaches, micronutrient supplementation and behaviour change strategies.
Opportunistic Infection	An infection that occurs when the immune system cannot mount a defense.
Oxidative stress	The production of reactive oxygen species is greater than the available antioxidant defense.
Percentile	The rank position of an individual on a given reference distribution, stated in terms of what percentage of the group the individual equals or exceeds the reference population of children of the same age.
Prevalence	The total number of cases of a disease in a population at a given time.

Word	What it means
Resistance Training	Exercise program in which exercises are performed with progressively increasing weights and repetitions.
Retrovirus	A virus that transcribes its RNA to the hosts DNA using the enzyme reverse transcriptase.
Somatic proteins	Skeletal muscle proteins.
Stadiometer	A device that is used to measure standing height. It includes a vertical 'ruler' with a right angled head board.
Starvation	Prolonged absence of nutrients to the body.
Viral load	A measure of the amount of HIV in the blood.
Wasting	Depletion of body cell mass.
Wasting Syndrome	Involuntary weight loss of more than 10% of baseline body weight in the presence of unexplained chronic diarrhoea, or intermittent or constant fever for more than 30 days.

References

1. Fields-Gardner C, Rhodes SS, Thomson, CA. A clinical guide to nutrition in HIV and Aids. Chicago: American Dietetic Association; 1997.
2. National Center for Infectious Diseases Division of HIV/AIDS. 1993 Revised classification system for HIV infection. Washington (DC): U. S. Government Printing Office; 1992 Dec. Report No. 41(RR-17). [cited 1992 Dec]. Available from <http://www.cdc.gov/epo/mmwr/preview/mmurhtm/ooo118871.htm>
3. Orlander H, Daisy J, Camara B, eds. Guidelines for the clinical management of HIV disease. Trinidad: Caribbean Epidemiological Centre; 2000.
4. Food and Nutrition Technical Assistance (FANTA). Food and nutrition implications of antiretroviral therapy in resource limited settings. 2003; Report No. 7.
5. Peabody D. British Columbia therapeutic nutrition guidelines. British Columbia: Centre for Excellence in HIV/AIDS; 1999.
6. United Nations Administrative Committee on Coordination, Sub-Committee on Nutrition. Nutrition and HIV/AIDS. 28th Session: 2001 Apr 6; Kenya.
7. Kotler DP. Nutritional alterations associated with HIV infections. JAIDS. 2000; 25 (Suppl): 81-87.
8. Position of the Canadian Dietetic Association and the American Dietetic Association: nutrition intervention in the care of persons with Human Immunodeficiency Virus infection. JCDA. 1994 Fall; 53(3): 129-35.
9. Watson RR. Nutrients and foods in AIDS. Fl.: CRC Press; 1998.
10. Bahl SM, Hickson JF. Nutritional care for HIV-positive persons: a manual for individuals and their caregivers. Fl.: CRC Press; 1995.
11. Keusch GT, Donald MT. Malnutrition in AIDS. Medical Clinics of North America. 1993 Jul; 77(4): 795-813.
12. Keusch G. Nutrition and immunity from A to Z. Nutrition Reviews. 1998 Jan; 56(1): S2-25.
13. Bargaleh BT. Nutrition: a cofactor in HIV disease. JADA. 1994 Sept; 94(9): 1018-1022.
14. Gorbach S. Interactions between nutrition and infection with Human Immunodeficiency virus. Nutrition Reviews. 1993 Aug; 51(8): 226-234.

15. Woodward B. Protein, calories and immune deficiencies. *Nutrition Reviews*. 1998 Jan; 56(1 Suppl): S84-104.
16. Cunningham-Rundles S. Analytical methods for evaluation of immune response in nutrient intervention. *Nutrition Reviews*. 1998 Jan; 56(1 Suppl): S27-37.
17. Schwenk A. Clinical risk factors for malnutrition in HIV-1infected patients. *AIDS*. 1993; 7: 1213-19.
18. Gallagher CR. Malnutrition and clinical outcomes: the case for medical nutrition therapy. *JADA*. 1996; 96: 361-69.
19. Task Force on Nutrition Support in AIDS. Guidelines for nutrition support in AIDS. *AIDS Patient Care*. 1989 Aug; 32-37.
20. Nemechek PM. Treatment guidelines for HIV-associated wasting. *Mayo Clin Proc*. 2000; 75: 386-94.
21. Polsky B et al. HIV-associated wasting in the HAART era: guidelines for assessment, diagnosis, and treatment. *AIDS Patient Care STDS*. 2001 Aug; 15(8): 411-23.
22. Mann M. Improved pharmacologic interventions for wasting: an overview and lessons learned. *J. Nutr*. 1999 Jan; 129(1 Suppl): 282-9.
23. Bristian BR. Dietary treatment in secondary wasting and cachexia. *J. Nutr*. 1999 Jan; 129(1 Suppl): 290-294.
24. Testa MA. The impact of AIDS-associated wasting on quality of life: qualitative issues of measurement and evaluation. *J. Nutr*. 1999 Jan; 129(1 Suppl): 282-289.
25. Macallan DC. Wasting in HIV infection and AIDS. *J. Nutr*. 1999 Jan; 129(1 Suppl): 238-42.
26. Lecker SH. Muscle protein breakdown and the critical role of the ubiquitin-proteasome pathway in normal and disease states. *J. Nutr*. 1999 Jan; 129 (1 Suppl): 227-37.
27. Kotler DP. Wasting syndrome: nutritional support in HIV infection. *AIDS Res and Hum Retroviruses*. 1994; 10(8): 931-4.
28. Kotler D. Prediction of body cell mass, fat-free mass, and total body water with bioelectrical impedance analysis: effect of race, sex and disease. *AJCN*. 1996 Sept; 64(3 Suppl): 489S-97.
29. Kotler DP. Nutrition wasting in HIV infection. 1997. [Cited 2002 Oct]. Available from: <http://www.healthcg.com>.
30. Kotler, DP. Metabolism/wasting/nutrition. Are you addressing your patients' nutritional health yet? Geneva: Int AIDS Congress; 1998. Available from <http://www.healthcg.com>.
31. Kotler DP. Metabolism/wasting/nutrition: from eradication to lipodystrophy. Geneva: Int AIDS Congress; 1998. [Cited 2002 Oct]. Available from: <http://www.healthcg.com>.

32. Kotler, DP. HIV wasting: diagnostic and pathogenic considerations. 1998. [Cited 2002 Oct]. Available from: <http://www.healthcg.com>, October, 2002.
33. Grunfeld C. Resting energy expenditure, caloric intake, and short-term weight change in human immunodeficiency virus infection and the acquired immunodeficiency syndrome. *AJCN*. 1992; 55: 455-60.
34. Grunfeld C. The role of the cytokines, interferon alpha and tumor necrosis factor in the hypertriglyceridemia and wasting of AIDS. *J. Nutr.* 1992; 122: 749-53.
35. Grunfeld C, Kotler D. Pathophysiology of the AIDS wasting syndrome. *AIDS Clin, Rev.* 1992; 224:191-224.
36. Thiebaut D. Weight loss >10% and body mass index as predictors of survival after AIDS diagnosis in the Aquitaine cohort, France 1985-1997. Abstract No. 42360 Geneva: Int AIDS Congress; 1998.
37. Bjarnason I. Intestinal inflammation, ideal structure and function in HIV. *AIDS*. Oct 1996; 10(2):1385-9.
38. Gillen S. Malabsorption and mucosal abnormalities of the small intestine in the acquired immunodeficiency syndrome. *Annals of Int Med.* 1985; 102:619-22.
39. Kotler DP. Enteropathy associated with the acquired immunodeficiency syndrome. *Annals of Int Med.* 1984; 101:421-8.
40. Chlebowski R. Nutritional status, gastrointestinal dysfunction, and survival in patients with AIDS. *Am. J of Gastroenterology.* 1989; 10(84): 1288-92
41. Craig CB. Decreased fat and nitrogen losses in patients with AIDS receiving medium-chain- triglyceride-enriched formula vs those receiving long-chain-triglyceride-containing formula. *JADA.* June 1997; 97(6):605-11
42. Carlson S. Physiologic response to a protein, carbohydrate, fat meal in patients with human immunodeficiency virus who underwent small intestinal. enteropathy as characterized by a kinetic model of D-xylose absorption. *JPEN.* Jan-Feb 1998; 22(1):27-30
43. Gelas P. Effect of parenteral medium-and long-chain triglycerides on lymphocyte subpopulations and functions in patients with acquired immunodeficiency syndrome: a prospective study. *JPEN.* Mar-Apr 1998; 22(2):67-71
44. Fields-Gardner C. Preliminary investigation of enteric-coated pancrelipase therapy in HIV+ patients with chronic diarrhea. 1998 World AIDS Congress. Abstract No. 60391.
45. Mulligan K. Cross-Sectional and longitudinal evaluation of body composition in men with HIV infection. *J. Acquir Immune Defic Syndr Hum Retrovirol.* 1997 May 1;15(1):43-48.
46. Paton NI. Longitudinal changes in body composition measured with a variety of methods in patients with AIDS. *J. Acquir Immun Defic Syndr Hum Retrovirol.* 1997 Feb 1; 14(2):119- 27.

47. Paton NI. Bioelectrical impedance analysis in human immunodeficiency virus-infected patients: comparison of single frequency with multifrequency, spectroscopy and other novel approaches. *Nutrition*. 1998 Sept; 14(9):658-66.
48. Pencharz P, Azcue M. Use of bioelectrical impedance analysis measurements in the clinical management of malnutrition. *AJCN*. 1996; 64S:485-8.
49. Ott M. Bioelectrical impedance analysis as a predictor of survival in patients with human immunodeficiency virus infection. *J. Acquir Immun Defic Syndr Hum. Retrovirol*. 1995 May 1; 9(1):20-25.
50. Ott M. Early changes of body composition in human immunodeficiency virus-infected patients: tetrapolar impedance analysis indicates significant malnutrition. *AJCN*. 1993; 57:15-9.
51. American Dietetic Association. *Manual of clinical dietetics: enteral nutrition*. 6th ed. Chicago: Yale University Press; 2000, p.589-608.
52. Muir B, Dobbs J, Dobbs C. Subjective Global Assessment in HIV-infected patients. *Journal of the Association of Nurses in AIDS Care*. 1996; Jul-Aug; 7(4): 83-87.
53. American Dietetic Association. *Manual of Clinical Dietetics: adult nutrition assessment*. 6th ed. Chicago: Yale University Press; 2000, p. 3-38.
54. Gibson RS. *Principles of nutritional assessment*. London : Oxford University Press; 1990.
55. Muir B, Dobbs J, Dobbs C. Subjective Global Assessment in HIV-infected patients. *Journal of the Association of Nurses in AIDS Care*. 1996 Jul-Aug.
56. World Health Organization. *Nutrient requirements for people living with HIV/AIDS*. Report of a technical consultation. Geneva: 2003.
57. Food and Nutrition Technical Assistance Project. *HIV/AIDS: a guide for nutrition, care and support*. Washington (DC): Academy for Educational Development; 2001.
58. Shevitz A. Resting energy expenditure in the HAART era. *The AIDS Reader*. 2000; 10(9):539-44.
59. Mulligan K, Bloch AS. Energy expenditure and protein metabolism in human immunodeficiency virus infection and cancer cachexia. *Semin Oncol*. 1998 Apr; 25(2S): 82-91.
60. Grinspoon S. Determinants of increased energy expenditure in HIV-infected women. *AJCN*. 1998Sept; 68(3):720-5.
61. Murahainen N. Protein intake is associated with body cell mass in weight stable HIV positive men with CD4<200 cell/mm³. Abstract No. 42339. Geneva: International AIDS Congress; 1998.
62. Slusarczyk R. The influence of the Human Immunodeficiency Virus on resting energy expenditure. *JAIDS* 1994; 7(10): 1025-27.
63. Kotler D. Preservation of short-term energy balance in clinically stable patients with AIDS. *AJCN*. 1990; 51:7-13.

-
64. Suttman U. Resting energy expenditure and weight loss in human immunodeficiency virus-infected patients. *Metabolism*. 1993 Sept; 42(9): 1173-9.
 65. Selberg O. Effect of increased protein intake and nutritional status on wholebody protein metabolism of AIDS patients with weight loss. *Metabolism*. 1995 Sept; 44(9): 1159-65.
 66. Isasac-Renton J. Giardia and Cryptosporidium study Jan-Dec 1998: report to the greater Vancouver Regional District. Feb 1999, Vancouver, Canada.
 67. Antony MA. Infectious diarrhoea in patients with AIDS. *Dig Dis Sci*. 1988;33:1141-46.
 68. Connolly GM. Investigation of seemingly pathogen-negative diarrhoea in patients infected with HIV1. *Gut*. 1990; 31:886-89.
 69. Kotler D. Small intestinal injury and parasitic diseases in AIDS. *Ann Intern Med*. 1990;13:444-49.
 70. Smith PD. Intestinal infections in patients with the Acquired Immunodeficiency Syndrome (AIDS): etiology and response to therapy. *Ann Intern med*. 1988; 108(3):328-33.
 71. Agin D. Effects of whey protein and resistance exercise on body cell mass, muscle strength, and quality of life in women with HIV/AIDS. 2001 Dec 7; 15(18): 2431-2440.
 72. Tenzif S. A study of the effectiveness of regular exercise on lean body mass and body cell mass in people living with HIV/AIDS. International Conference on Nutrition and HIV. Poster. 1999 April.
 73. Roubenoff R. Effect of a single bout of acute exercise on plasma human immunodeficiency virus RNA levels. *J. Appl Physiol*. 1999 April; 86(4):1197-201.
 74. Roubenoff R. Feasibility of increasing lean body mass in HIV-infected adults using progressive resistance training. Abstract No. 42357 Geneva: International AIDS Congress, 1998.
 75. Evans, W.J. Exercise and the treatment of wasting: aging and human immunodeficiency virus infection. *Semin Oncol*. 1998 April; 2(S6):112-22.
 76. Phillips A et al. A comprehensive guide for the care of persons with HIV disease: rehabilitation services, module 7. Toronto: Wesley Central Hospital; 1998.
 77. Kotler DP. Metabolism/wasting/nutrition: are you addressing your patients' nutritional health yet? Geneva: International AIDS Congress; 1998. Available from: <http://www.healthcg.com> October, 2002.
 78. Canadian Pharmacists Association. Compendium of Pharmaceuticals and Specialties. 35th ed. Canada: International Press Publications; 2002.
 79. Pronskey ZM. HIV medications food interactions. Food-Medications Interactions. 2001 Pottstown, Pennsylvania.
 80. American Dietetic Association. Enteral nutrition: manual of clinical dietetics. 6th ed. Chicago: Yale University Press; 2000, p.589-608.

81. American Dietetic Association. Parenteral nutrition: manual of clinical dietetics, 6th ed. Chicago: Yale University Press; 2000, p.619-635.
82. American Dietetic Association. Long-chain-triglyceride-restricted, medium-chain triglyceride diet: manual of clinical dietetics. 6th ed. Yale University Press; 2000, p. 726- 728.
83. Rombeau J, Caldwell M. Clinical nutrition: enteral and tube feeding. WB Saunders Company. 1990
84. Kotler D. Comparison of total parenteral nutrition and an oral, semi-elemental diet on body composition, physical function, and nutrition-related costs in patients with malabsorption due to acquired immunodeficiency syndrome. JPEN 1998; 22(3):120-125
85. Kotler D. Enteral alimentation and repletion of body cell mass in malnourished patients with acquired immunodeficiency syndrome. AJCN 1991; 53:149-54.
86. Smith L, Mullen J. Nutritional assessment and indications for nutritional support. Surg Clin of NA, 1991; 71(3):449-57.
87. Aron JM. Towards rational nutritional support of the Human Immunodeficiency Virus- infected patient. JPEN 1991; 15(2):121-2.
88. Cuff P. Aggressive nutrition support in AIDS. Top Clin Nutr 1992; 7(2):37-45.
89. Kotler D. Nutritional effects and support in the patient with acquired immunodeficiency syndrome. J. of Nutr 1992; 122:723-27.
90. Rombeau, John and Caldwell, Michael. Clinical Nutrition: Enteral and Tube Feeding. WB Saunders Company, 1990.
91. Collins E. Psychosocial impact of the lipodystrophy syndrome in HIV infection. The AIDS Reader 2000;10(9):546-551. September, 2002. Available from: www.medscape.com.
92. Kotler D. Lipodystrophy: Return of the splitters. [cited 2000 Sept]. Available from:www.medscape.com.
93. Chang E. The effects of antiretroviral protease inhibitors on serum lipid levels in HIV- infected patients. JADA. 2001 June; 101(6):687-689.
94. Carr A. A syndrome of peripheral lipodystrophy, hyperlipidemia and insulin resistance in patients receiving HIV protease inhibitors. AIDS. May 7 1998; 12(7):F51-8.
95. Pavia A. What have we learned about lipodystrophy, high cholesterol, diabetes, and long term consequences of protease inhibitors? 12th International AIDS Conference Coverage. 2002 Sept. Available from: <http://www.AIDS 98>.
96. Hirsch M, Klibnski A. Editorial response: what price progress? Psuedo-Cushings syndrome associated with antiretroviral therapy in patients with human immunodeficiency virus infection. Clin Infec Dis. 1998 July; 27:73-5.
97. Frayn K. Kingman MS. Dietary sugars and lipid metabolism in humans. AJCN. 1995; 62S:250-63.

-
98. Carr A. Osteopenia in HIV-infected men: association with asymptomatic lactic acidemia and lower weight pre-antiretroviral therapy. *AIDS* 2001; 15:703-709.
 99. McDermott A. Effect of highly active antiretroviral therapy on fat, lean, and bone mass in HIV-seropositive men and women. *Am J. Clin Nutr.* 2001; 74:679-86.
 100. Aukrust P. Decreased bone formative and enhanced resorptive markers in human-immunodeficiency virus infection: indication of normalization of the bone-remodeling process during highly active antiretroviral therapy. *J. Clin Endocrinol Metab.* 1999 Jan; 84(1):145-50.
 101. Ilich J. Nutrition in bone health revisited: a story beyond calcium. *J. Am Coll Nutr.* 2000; 19(6):715-37.
 102. Guthrie J. Risk factors for osteoporosis: a review. *Medscape Women's Health.* 2000; 5(4).
 103. World Health Organization. Nutrient requirements for people living with HIV/AIDS. Report of a technical consultation. Geneva, May 2003.
 104. Health Canada. Nutrition for a healthy pregnancy: National guidelines for the childbearing years. Ottawa: Health Canada; 1999.
 105. United Nations Administrative Committee on Coordination, Sub-Committee on Nutrition. Nutrition and HIV/AIDS. 28th session, Kenya. April 6, 2001.
 106. Nduati R. Effect of breastfeeding and formula feeding on transmission of HIV-1: a randomized clinical trial. *JAMA.* 2000; 283:1167-74.
 107. Semba R. Maternal vitamin A deficiency and mother-to-child transmission of HIV-1. *The Lancet.* 1994; 343:1593-7.
 108. Nicoll A. Infant feeding policy and practice in the presence of HIV-1 infection. *AIDS.* 1995; 9:107-119.
 109. The Pediatric Nutrition Practice Group, American Dietetic Association. Pediatric manual of clinical dietetics, 2nd ed. Chicago: Yale University Press; 2003.
 110. Arpadi S. Application of bio impedance analysis for estimating body composition in prepubertal children infected with human immunodeficiency virus type I. *J. Pediatr.* 1996, Nov; 129(5):755-57.
 111. Wedekind C. Lipodystrophy syndrome in children infected with human immunodeficiency virus. *Pharmacotherapy.* 2001; 21(7):861-66.
 112. Heller L. Nutritional support for children with HIV/AIDS. *The AIDS Reader.* 2000; 10(2): 109-114.
 113. American Dietetic Association. Pediatric nutrition assessment manual of clinical dietetics. 6th ed. Chicago: Yale University Press, 2000, p.39-66.
 114. American Dietetic Association. Nutrition management of HIV Infection and AIDS: pediatric manual of clinical dietetics. 2nd ed. Chicago: Yale University Press; 2003, p.307- 316.
 115. World Health Organization. Physical status: the use and interpretation of anthropometry. Geneva: WHO; 1995.

116. World Health Organization. Nutrient requirements for people living with HIV/AIDS. Geneva: WHO; 2003.
117. Periquet B. Micronutrient levels in HIV-1-infected children. *AIDS*. 1995;9:887-93.
118. Henderson R. Resting energy expenditure and body composition in children with HIV infection. *J Acquir Immune Defic Hum Retrovirol*. 1998 Oct 1;19(2):1507.
119. Caribbean Food and Nutrition Institute. Guidelines for young child feeding in the Caribbean. Kingston, Jamaica: CFNI, 1999.
120. World Health Organization. Management of severe malnutrition: a manual for physicians and other senior health workers. Geneva: WHO; 1999.
121. Food and Nutrition Technical Assistance (FANTA) Project. HIV/AIDS: a guide for nutrition care and support. 2001 Sept. Available from: <http://www.fantaproject.org>.
122. Food and Nutrition Technical Assistance (FANTA) Project. Food and nutrition implications of antiretroviral therapy in resource limited settings. Washington (DC): [?]; 2003. (Technical Note No. 7).
123. Canadian Pharmacists Association. Compendium of Pharmaceuticals and Specialties. 35th ed. Canada: International Press Publications; 2000.
124. Pronskey Z. HIV medications food interactions. Pottstown, Pa.: Food-Medications Interactions; 2001.
125. Castleman T. Food and nutrition implications of antiretroviral therapy in resource limited settings. [Draft]. Washington (DC): FANTA; 2003.
126. Fawzi W. Micronutrients and human immunodeficiency virus Type 1 disease progression among adults and children. *Clin Inf Dis* 2003; 37:S112-116.
127. Tang A and Smit E. Selected vitamins in HIV infection: a review. *Aids Pt Care*. 1998; 12(4):263-273.
128. Tang A, Graham A.M. Effects of micronutrient intake on survival in human immunodeficiency virus type 1 infection. *Am. J. Epidemiol*. 1996, June 15; 143(12) 1244- 56.
129. Tang A, Graham A.M. Dietary micronutrient intake and risk of progression to acquired immunodeficiency syndrome (AIDS) in human immunodeficiency virus type 1 (HIV-1)- infected homosexual men. *Am J. of Epidemiol*. 1993; 138(11): 937-51.
130. Tang A. Association between serum vitamin A and E levels and HIV-1 disease progression. *AIDS*. 1997 Apr;11(5):613-20.
131. Gorbach SL, Knox T. Interactions between nutrition and infection with human immunodeficiency virus. *Nutr Rev*. 1993 Aug; 51(8):226-35.
132. Kubena, K. Nutrition and the immune system: A review of nutrient-nutrient interactions. *JADA* 1996 Nov; 96(11):1156-64.

133. Baum M, Graham AM, Kirby AJ. Micronutrients and HIV-1 disease progression. *AIDS* 1995;9:1051-6.
134. Baum M, Shor-Posner G. Micronutrient status in relationship to mortality in HIV-1 disease. *Nutr Rev.* Jan 1998; 56(1S):135-9.
135. Baum M. High risk of HIV-related mortality is associated with selenium efficiency J. *Acquir Immune Defic Syndr Hum Retrovirol.* 1997 Aug 15;15(5):370-4.
136. Baum, M. Zinc deficiency profoundly increases risk for HIV-1 related mortality. *Int AIDS Congress, Geneva, 1998.* (Abstract No. 42337).
137. Fawzi W. Randomized trial of effects of vitamin supplementation on pregnancy outcomes and T cell counts in HIV-infected women in Tanzania. *Lancet.* 1998; 351:1477-82.
138. Dworkin BM. Selenium deficiency in HIV infection and the acquired immunodeficiency syndrome (AIDS). *Chem Biol Interact.* 1994 June; 91(2-3):181-8 .
139. Dworkin BM. Abnormalities of blood selenium and glutathione peroxidase activity in patients with acquired immunodeficiency syndrome and Aids-related complex. *Biol Trace Elements Res.* 1988; 15:167-77.
140. Dworkin BM. Selenium deficiency in the acquired immunodeficiency syndrome. *JPEN.* 1986 Jul-Aug; 10(4): 405-7.
141. Olmstead L. Selenium supplementation of symptomatic human immunodeficiency virus infected patients. *Biol Trace Elements Res.* 1989; 20:59-65.
142. Makropoulos V. Selenium-mediated inhibition of transcription factor NF-kappa B and HIV- 1 LTR promoter activity. *Arch Toxicol(abstract).* 1996; 70(5):277-83.
143. GREPO. Antioxidant status and lipid peroxidation in patients infected with HIV. *Chem Biol. Interact(abstract).* 1994 Jun; 91(203):165-180.
144. Sappey C. Stimulation of glutathione peroxidase activity decreases HIV type 1 activation after oxidative stress. *AIDS Res and Hum Retrovirus(abstract).* 1994 Nov; 10(11):1451-61.
145. Hori K. Selenium supplementation suppresses tumor necrosis factor alpha induced human immunodeficiency virus type 1 replication in vitro. *AIDS Res Hum Retrovirus(abstract).* 1997 Oct 10; 13(15):1325-32.
146. Look MP. Serum selenium, plasma glutathione (GSH) and erythrocyte glutathione peroxidase (GSH-Px)-levels in asymptomatic versus symptomatic human immunodeficiency virus-1 (HIV-1)-infection. *Eur. J. Clin. Nutr(abstract).* 1997 Apr; 51(4): 266-72.
147. Breux JP. Selenium deficiency in HIV-infected patients. *International Conference on AIDS.* 1996. (Abstract No. Mo. B. 1395).
148. Tassie JM. Selenium (SE), vitamin A (VA), vitamin E (VE) serum depletions are correlated with weight loss and not with CD4-cell depletion or AIDS status. *International Conference on AIDS.* 1997. (Abstract No. We. B. 3261).

149. Delmas-Beauvieux MC. The enzymatic antioxidant system in blood and glutathione status in human immunodeficiency virus (HIV)-infected patients: effects of supplementation with selenium or beta-carotene. *AJCN*. 1996 Jul; 64(1):101-7.
150. Chandra RK. Excessive intake of zinc impairs immune responses. *JAMA*. 1984 Sept 21;252(11):1443-7.
151. Chandra RK. Zinc and immunity. *Nutr*. 1994; 10(1):79-80.
152. Falutz J. Zinc as a cofactor in human immunodeficiency virus-induced immunosuppression. *JAMA*. 1988 May 20; 259(19):2850-1.
153. Failla M, Robin GH. Is low copper status immunosuppressive? *Nutr Rev*. 1998 Jan; 56(1S):59-63.
154. Fraker P, King L. Changes in regulation of lymphopoiesis and myelopoiesis in the zinc-deficient mouse. *Nutr Rev*. 1998 Jan;56(1Suppl) S65-9.
155. Hong L. Plasma zinc, copper and mortality in HIV-1 infected homosexual men. *Int AIDS Congress, Geneva, 1998*. (Abstract No.12118).
156. Fabris N. AIDS, zinc deficiency, and thymic hormone failure. *JAMA*. 1988 Feb 12; 259(6):839-40.
157. Schmidt, K. Antioxidant vitamins and B-carotene: effects on immunocompetence. *AJCN* 1991; 53S: 383-5.
158. Semba R. The role of vitamin A and related retinoids in immune function. *Nutr Rev*. 1998 Jan; 56(1S):38-48.
159. Nimmagadda A. The significance of vitamin A and carotenoid status in persons infected by the human immunodeficiency virus. *Clin Inf Dis*. 1998; 26(3): 711-8.
160. Hathcock J. Evaluation of vitamin A toxicity. *AJCN*. 1990; 52:183-202.
161. Jolly PE. Vitamin A depletion in HIV infection and AIDS. *AIDS*. 1996;10(1):114.
162. Wang Y, Watson, R. Potential therapeutics of vitamin E (tocopherol) in AIDS and HIV. *Drugs*. 1994; 48(3): 327-38.
163. Tang A. Low serum vitamin B12 concentrations are associated with faster human immunodeficiency virus type 1 (HIV-1) disease and progression. *J. Nutr*. 1997 Feb; 127(2):345-51.
164. Shah D. Biochemical measurements of specific B-group vitamins in a cohort of HIV positive and negative injection drug users. *Int AIDS Congress, Geneva, 1998*. (Abstract No 42352).
165. Shor-Posner G. Increases cobalamin levels are associated with better cognitive function in HIV-1 disease. *International AIDS Congress, Geneva, 1998*. (Abstract No. 42359).
166. Falutz J. Clinical correlates of subnormal vitamin B12 levels in patients infected with the human immunodeficiency virus. *Am J Hematol* (abstract). 1995 Aug; 49(4):318-22.

167. Stern RA. Neurobehavioral impairments in early asymptomatic HIV infection: the effects of education, CD4, B12 level and depression. International Conference on AIDS, 1991. (Abstract No. TH B 88).
168. Remacha AF. Vitamin B12 abnormalities in HIV-infected patients. Eur J Hematol (abstract). 1991 Jul; 47(1): 60-4.
169. Beach RS. Plasma vitamin B12 level as a potential cofactor in studies of human immunodeficiency virus type 1-related cognitive changes. Arch Neurol (abstract). 1992 May; 49(5):501-6.
170. Robertson K. Vitamin B12 deficiency and nervous system disease in HIV infection. Arch Neurol (abstract). 1993 Aug; 50(8):807-11.
171. Rule SA. Serum vitamin B12 and transcobalamin levels in early HIV disease. Am. J Hematol (abstract). 1994 Nov; 47(3):167-71.
172. Kotler D. Antioxidant therapy and HIV infection. AJCN.1998;67:7-9.
173. Allard JP. Oxidative stress and plasma antioxidant micronutrients in humans with HIV infection. AJCN. 1998; 67:143-7.
174. Allard JP. Effects of vitamin E and C supplementation on oxidative stress and viral load in HIV-infected subjects. AIDS. 1998 Sept 10; 12:1653-9.
175. Harakeh S, Jariwalla RJ. NF-kappa B-independent suppression of HIV expression by ascorbic acid. AIDS Res Hum Retroviruses. 1997 Feb.10; 13:235-9.
176. Rock C. Update on the biological characteristics of the antioxidant micronutrients: Vitamin C, vitamin E and the carotenoids. JADA. 1996 July; 96(7):693.
177. Beck M. The influence of antioxidant nutrients on viral infection. Nutr Rev. Jan 1998; 2S:140-6.
178. Van der Hulst RRWJ. Glutamine and intestinal immune cells in humans. JPEN. 1997 Nov- Dec; 21(6):310-315.
179. Yihong C. Glutamine enhances gut glutathione production. JPEN. Jul-Aug 1998; 22(4):224-227.
180. Gianotti L. Oral glutamine decreases bacterial translocation and improves survival in experimental gut-origin sepsis. JPEN (abstract). Jan-Feb 1994;9(1).
181. Kinscherf R. Low plasma glutamine in combination with high glutamate levels indicate risk for loss of body cell mass in healthy individuals: the effect of N-acetyl cysteine. J Mol. Med (abstract). Jul 1996; 74(7).
182. Shabert J, Wilmore D. Glutamine deficiency as a cause of human immunodeficiency virus wasting. Med Hypothesis (abstract) Mar 1996; 46(3).
183. Ogle C. Effect of glutamine on phagocytosis and bacterial killing by normal and pediatric burn patients. JPEN. 1994 Mar-Apr; 18(2): 128-33.
184. Breitkreutz R. Improvement of immune functions in HIV infection by sulphur supplementation: two randomized trials. J. Mol. Med. 2000; 78(1):55-62.

185. Look M. Sodium selenite and N-acetylcysteine in antiretroviral-naïve HIV-1-infected patients: a randomized controlled pilot study. *Eur J. Clin Invest.* 1998 May; 28(5):389-97.
186. Ackerlund B. Effect of N-acetylcysteine (NAC) treatment on HIV-1 infection: a double-blind placebo controlled trial. *Eur J Clin Invest* 1996;50(6):457-61.
187. Packer L. Alpha-lipoic acid as a biological antioxidant. *Free Radic Biol Med.* 1995 Aug; 19(2): 227-50.
188. Han D. Alpha-lipoic acid increases intracellular glutathione in a human T-lymphocyte Jurkat cell line. *Biochem Biophys Res Commun.* 1995 Feb 6; 207(1):258-64.
189. Suzuki YJ. Alpha-lipoic acid is a potent inhibitor of NF-kappa B activation in human T cells. *Biochem Biophys Res Commun* 1992 Dec 30; 189(3): 709-15.

