SESSION 3. LINKS BETWEEN NUTRITION AND HIV

Purpose (slide 2)

- The purpose of this session is to provide students with information about the relationship between nutrition and HIV.

Learning objectives (slide 3)

By the end of the session, students will be able to:

- Explain the relationship between nutrition and infection.
- Describe how nutrition affects HIV.
- Describe how HIV affects nutrition.

Prerequisite knowledge

- Basics of nutrition (Session 1)
- Basics of HIV and AIDS (Session 2)

Estimated time: 60 minutes

Session guide (slide 4)

Content	Methodology	Activities	Estimated time (minutes)
Nutrition and infection	Participatory presentation	Explain the relationship between nutrition and infection.	5
Relationship between nutrition and HIV	Large group activity	Present and discuss the cycle of poor nutrition and infection.	10
Effects of poor nutrition on HIV and AIDS	Participatory presentation	Pass out cards with the effects of nutrition on HIV and the effects of HIV on nutrition. Ask students to place their cards under the appropriate heading. Discuss in plenary.	20
Effects of HIV and AIDS on nutrition	Participatory presentation	Introduce the relationship between nutrition and HIV.	10
Conclusions			5
Review			5
Total time			60

Required materials

- Flipchart stand and paper
- Writing pens
- Blackboard and chalk or whiteboard and markers
- LCD or overhead projector
- PowerPoint 3
- 2 poster-size pieces of paper or card
- 11 index cards

Materials provided

- PowerPoint 3

Preparation

1. Review Lecture Notes and PowerPoint 3 to identify questions to help students master the concepts.
2. Be familiar with the relationships between nutrition and infection and nutrition and HIV.
3. Prepare the cards for Exercise 1 as follows. Mark one poster-sized piece of paper or card "Effects of Poor Nutrition on HIV" and the other, "Effects of HIV on Nutrition." On each of the index cards, write one of the following:

    - Lowered immune system functioning
    - Slower healing
    - Faster disease progression
    - Increased nutrient needs
    - Nutrient malabsorption
    - Adverse drug effects
    - Anorexia
    - Nausea
    - Recurrent infections
    - Abnormal metabolic response
    - Frequent diarrhea

Suggested reading

Food and Nutrition Technical Assistance (FANTA) Project. 2004. HIV/AIDS: A Guide for Nutritional Care and Support, 2nd edition. Washington, DC: FHI 360.

Piwoz, E. G. 2004. Nutrition and HIV/AIDS: Evidence, Gaps, and Priority Actions. Washington, DC: SARA Project, FHI 360.

Piwoz, E. G., and E. A. Preble. 2000. HIV/AIDS and Nutrition: A Review of the Literature and Recommendations for Nutritional Care and Support in Sub-Saharan Africa. Washington, DC: SARA Project, FHI 360.

World Health Organization (WHO). 2003. Nutrient Requirements for People Living with HIV/AIDS: Report of a Technical Consultation. Geneva.

Related terms

Antioxidant vitamin – A type of vitamin found in fruits and vegetables that may help fight infection

Immunocompetent – Having normal capacity to develop an immune response to infection-causing antigens

Immunosuppressed – Having a suppressed immune response to infection-causing antigens, including deliberate suppression of the response in order to control autoimmune diseases

Opportunistic infection – An infection that takes advantage of a weak immune system. Opportunistic infections common in people with HIV vary from tuberculosis and persistent diarrhea to pneumonia and Kaposi's sarcoma.

Oxidative stress – A disturbance in the equilibrium of pro-oxidant/antioxidant systems of intact cells. Oxidative stress in HIV may be caused by both overproduction of reactive oxygen intermediates (ROI) and a simultaneous deficiency of antioxidant defenses.

Wasting – In children, weight for height more than two standard deviations below the median reference level; in adults, involuntary weight loss of at least 10 percent of body weight

Introduction

The relationship between nutrition and HIV is a vicious cycle, similar to the relationship between nutrition and other infections. HIV compromises nutritional status, and poor nutrition further weakens the immune system, increasing susceptibility to opportunistic infections (OIs) (CRHCS and SARA Project 2001).

Nutrition and infection (slide 5)

Before looking at the relationship between nutrition and HIV, it is important to understand the relationship between nutrition and infection in general. Poor nutrition increases the body's vulnerability to infections, and infections aggravate poor nutrition. Inadequate dietary intake leads to poor nutrition and lowers immune system functioning. Poor nutrition reduces the body's ability to fight infections and therefore helps increase the incidence, severity, and length of infections. Symptoms that accompany infections such as loss of appetite, diarrhea, and fever lead to reduced food intake, poor nutrient absorption, nutrient loss, and altered metabolism. All of these contribute to weight loss and growth faltering, which further weaken the immune system.

An adequate nutrient-dense diet, proper hygiene, food safety, and nutrition management of symptoms are critical interventions to break the cycle of infection and poor nutrition.

HIV and nutrition (slide 6)

HIV infection progressively destroys the immune system, leading to recurrent OIs, debilitation, and death. OIs are infections that take advantage of a weak immune system. Poor nutritional status is one of the major complications of HIV and a significant factor in full-blown AIDS. In resource-limited settings, many people who become infected with HIV may already be undernourished. Their weakened immune systems further increase their vulnerability to infection.

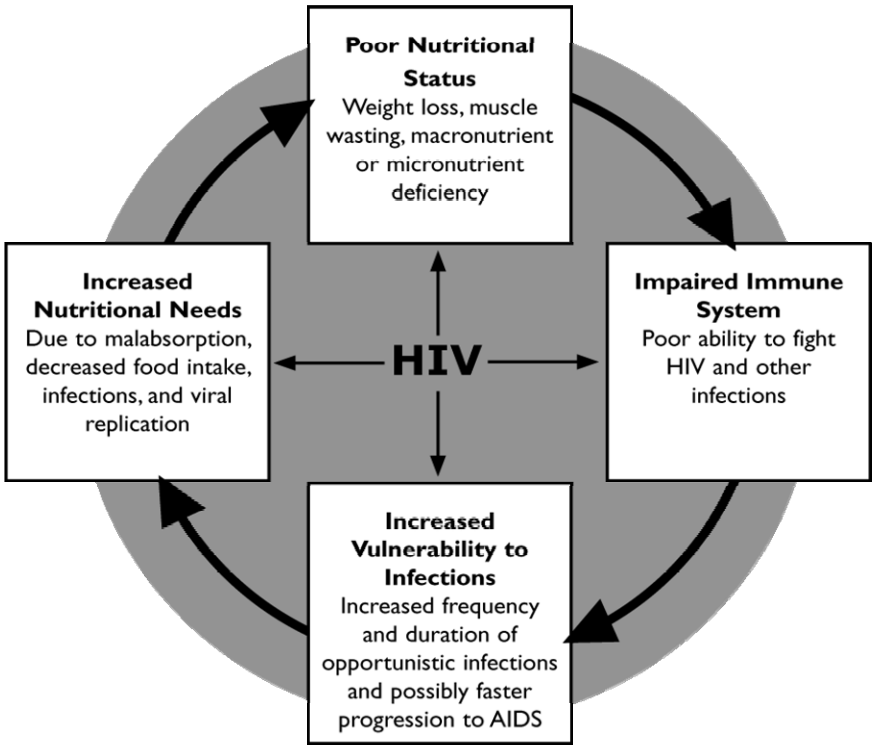
Poor nutrition and HIV: A vicious cycle (slide 7)

The relationship between HIV and nutrition is multifaceted and multidirectional. HIV can cause or worsen undernutrition by causing reduced food intake, increased energy requirements, and poor nutrient absorption. Undernutrition in turns further weakens the immune system, increasing vulnerability to infection and worsening the disease's impact. This cycle can result in the following:

- Weight loss, the most common and often most disturbing symptom of HIV, reported in most people with AIDS (RCQHC and FANTA Project 2003b)
- Loss of muscle tissue and fat
- Vitamin and mineral deficiencies
- Increased nutritional needs because of infections, metabolic changes, viral replication, and poor nutrient absorption
- Weakness and reduced productivity
- Reduced immune function
- Increased susceptibility to OIs

Figure 1 illustrates this relationship (slide 8)

Figure 1. Malnutrition and HIV: A vicious cycle

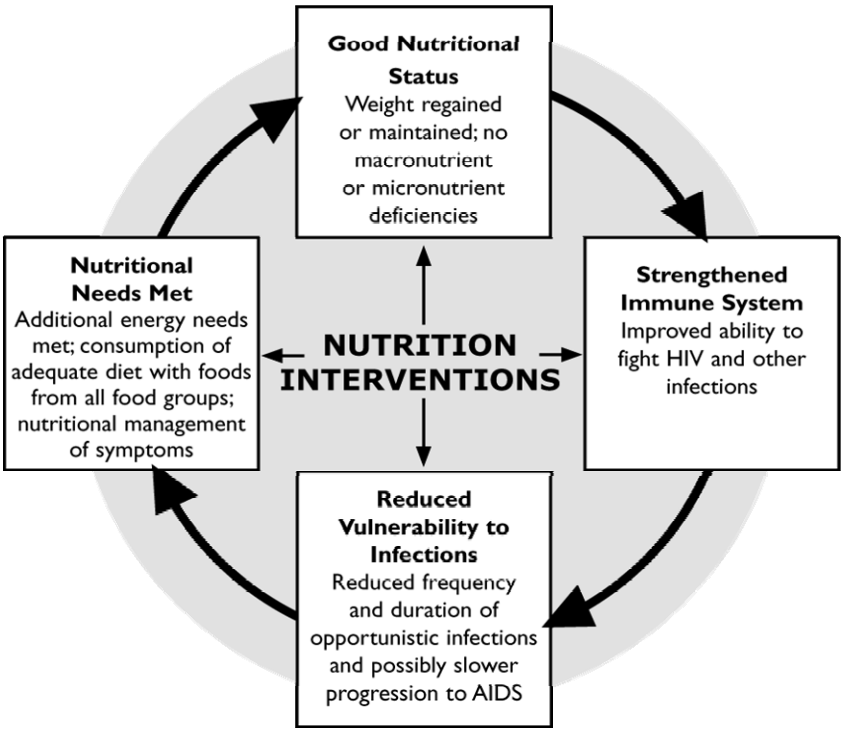


Source: Adapted from RCQHC and FANTA 2003a.

Nutrition care and support helps break this cycle by helping people living with HIV (PLHIV) maintain and improve their nutritional status, boost their immune response, manage the frequency and severity of symptoms, and improve their response to antiretroviral therapy (ART) and other medical treatment.

Figure 2 illustrates how effective nutrition interventions can help transform the vicious cycle of HIV and undernutrition into a positive relationship between improved nutritional status and stronger immune response (slide 9).

Figure 2. Nutrition and HIV: The cycle of benefits from nutrition interventions



Source: Adapted from: RCQHC and FANTA 2003a.

Effects of poor nutrition on HIV (slide 10)

Poor nutritional status can affect HIV in the following ways:

- Weakened immune system
- Increased susceptibility to OIs
- Slower healing process
- Possibly faster progression of disease
- Poorer response to treatment
- Despair and worsening depression

Improving and maintaining good nutrition may prolong health and delay the progression of HIV to AIDS. The impact of proper nutrition begins early in the course of HIV infection, even before other symptoms are observed.

Effects of HIV on nutrition (slide 11)

HIV affects nutritional status in three distinct ways, listed below. These effects can occur simultaneously in the same person.

1. **Reduced food consumption** (slide 12).

Symptoms of OIs can result in reduced food intake because of the following:

- Inability to eat or swallow because of nausea or painful sores in the mouth or throat
- Loss of appetite because of fatigue, depression, and other changes in mental state
- Side effects of medications including nausea, appetite loss, taste changes, diarrhea, vomiting, and abdominal cramps
- Reduced quantity or quality of household food because of inability to work or absenteeism resulting from HIV-related illness or the need to divert money to pay for treatment or other HIV-related expenses

2. **Increased energy needs** (slide 13).

The body's response to HIV infection and viral replication uses additional energy. As the disease progresses and OIs occur, infections and symptoms such as fever further increase energy expenditure. When infection is prolonged, muscle wasting occurs and muscle tissue is broken down. These processes increase PLHIV's energy requirements during the asymptomatic phase by 10 percent over those recommended for healthy, non-HIV-infected people of the same age, sex, and physical activity level. During the symptomatic phase, energy requirements increase by 20–30 percent over those recommended for healthy, non-HIV-infected people of the same age, sex, and physical activity level. The range in the requirement reflects the fact that people with more frequent and severe symptoms need up to 20 percent more energy. Energy requirements for symptomatic children who experience weight loss increase by 50–100 percent (WHO 2003, 2005).

Data are insufficient to recommend an increase in protein intake for PLHIV. WHO recommends that they eat the same amount of protein as people without HIV, that is, enough to make up 12–15 percent of their total energy intake (WHO 2003, 2005). There is no evidence that PLHIV need have increased fat requirements, and WHO (2003) recommends that they eat the same amount of fat as non-infected people.

PLHIV frequently have micronutrient deficiencies, and there is some evidence that low intake of certain micronutrients may contribute to disease progression. There is not enough evidence, however, to support increased micronutrient requirements of PLHIV. WHO (2003, 2005) recommends that PLHIV get 1 recommended daily allowance (RDA) of all micronutrients, if possible from food. If the diet does not provide enough micronutrients, supplementation at 1 RDA may be necessary. PLHIV with micronutrient deficiencies may need higher intake.

Box 1 summarizes the nutrient requirements of PLHIV.

Box 1. Nutrient requirements of PLHIV

Energy. Asymptomatic PLHIV need 10 percent more energy, and symptomatic PLHIV 20–30 percent more energy, than healthy, non-HIV-infected people of the same age, sex, and physical activity level. Symptomatic children with HIV need 50–100 percent more energy than healthy, non-HIV-infected children of the same age, sex, and physical activity level.

Protein. Protein requirements for PLHIV are the same as for non-HIV-infected people; that is, 12–15 percent of energy intake should come from protein.

Fat. Fat requirements for PLHIV are the same as for non-HIV-infected people.

Micronutrients. PLHIV should consume 1 RDA of micronutrients, or more if deficiencies exist.

Source: Adapted from RCQHC and FANTA 2003a

3. **Reduced absorption of nutrients** (slide 14).

HIV interferes with the body's ability to absorb nutrients, an effect that occurs with many infections. Poor absorption is also caused by OI symptoms such as diarrhea and vomiting. Poor absorption can occur in any phase of HIV infection in both adults and children and leads to excess nutrient loss. Poor fat absorption reduces the absorption and use of fat-soluble vitamins such as A and E, which can further compromise nutritional and immune status.

Exercise 1. Post the poster-sized paper or card marked with "Effects of Poor Nutrition on HIV" and "Effects of HIV on Nutrition" on a wall where all students can see them. Give one of the index cards marked with an effect of poor nutrition on HIV or an effect of HIV on nutrition to each of 11 students. Ask the students to walk to the wall and tape their index cards under the appropriate heading. The result should like the illustration below.

Effects of Poor Nutrition on HIV	Effects of HIV on Nutrition
Lower immune system functioning	Increased nutrient needs
Slower healing	Nutrient malabsorption
Faster disease progression	Adverse drug effects
	Frequent diarrhea
	Anorexia
	Nausea
	Recurrent infections
	Abnormal metabolic response

Allow time for discussion. Then ask students to explain their choices, for example, why "Anorexia" was placed under "Effects of HIV on Nutrition" rather than under "Effects of Poor Nutrition on HIV."

AIDS-associated wasting syndrome (slide 15)

AIDS-associated wasting is the involuntary loss of at least 10 percent of body weight. Wasting is a complication of HIV that is well known to be associated with increased morbidity and mortality. AIDS-associated wasting syndrome may be caused by reduced energy intake, reduced nutrient absorption resulting from infections and gastrointestinal disorders including diarrhea, and metabolic changes.

Changes in body composition (slide 16)

When a healthy person has an acute illness that reduces food intake, the body does not ingest and absorb adequate nutrients to meet increased energy needs. As a result, the person may lose fat mass first, though this is usually regained immediately after normal eating habits return. The body stores and uses fats to fuel its energy needs, leaving amino acids needed to build or preserve lean body mass.

However, the opposite seems to happen with HIV in some cases. Amino acids are used to fuel energy needs, while fat continues to accrue. The person with HIV may eat adequate nutrients but utilize and store them inadequately. Such a person has excess fat-storing tissue in proportion to lean tissue as the body converts the digested nutrients into fat instead of lean tissue. The underlying causes of the inability to preserve or regain lean tissue are unknown. This process can lead to excess fat deposits and loss of lean body tissue, especially if the person is taking certain antiretroviral drugs.

Nutrition in the different phases of HIV (slides 17 and 18)

The effects of HIV on nutrition vary according to the phase of the disease, as described below.

1. **Acute phase**

Initial infection. As soon as HIV enters the body, it replicates quickly. This rapid replication requires energy and nutrients, which the virus takes from the body. HIV relies completely on the host for survival and will deplete the host of whatever it needs to multiply and survive. The HIV infection may have a rapid onset, leading to hypermetabolism (an abnormal increase in metabolic rate) with catabolism (the metabolic breakdown of complex molecules into simpler ones, often resulting in a release of energy). Some PLHIV may not have symptoms at this stage, but they need more energy and nutrients, and their food intake should increase accordingly. A PLHIV who does not increase food intake will not have enough nutrients to meet the body's needs. This period lasts from 1 to 6 weeks, depending on the person.

Seroconversion. During this phase the body produces antibodies to fight the virus. The body needs more energy and nutrients to mount this immune response. If the diet does not provide these, the person loses weight and may gradually become undernourished, which weakens the immune system and makes the host more vulnerable to OIs.

2. **Asymptomatic phase**

The length of the asymptomatic phase varies and may last several years, depending on the person's health and nutritional status before HIV infection and during the initial years

of infection. The asymptomatic phase is marked by hypermetabolism. As mentioned above, energy requirements increase by 10 percent during this phase.

3. **Symptomatic phase**

The initial symptomatic phase is marked by the onset of OIs. Common symptoms include fever, night sweats, fungal infection of the mouth, chronic diarrhea, and weight loss. The onset of OIs is a sign of a weakened immune system. Apart from the "true" OIs that generally affect only immunosuppressed people, a number of other infections such as TB that may affect immunocompetent people occur more often in PLHIV. Symptoms that accompany infections, such as appetite loss, diarrhea, and fever, lead to reduced food intake, malabsorption, nutrient losses, and changed metabolism, which in turn lead to weight loss, growth faltering, and further weakening of the immune system. Negative nitrogen balance occurs early in acute infections because of the decrease in food intake and increased urinary protein losses. OIs further increase the nutritional needs of PLHIV and continue to weaken their immune systems and hasten disease progression.

Persistent symptoms and OIs lead to increased energy needs, reduced food intake, nutrient malabsorption, weight loss, and wasting. Wasting is often accompanied by changes in lead body mass and body cell mass (Babameto and Kotler 1997). Persistent reduced food intake, nutrient malabsorption, weight loss, and wasting contribute to progression to full-blown AIDS.

As mentioned above, energy requirements increase by 20–30 percent during the symptomatic phase and by 50–100 percent for symptomatic HIV-affected children who are losing weight.

4. **Full-blown AIDS**

The late phase is marked by metabolic change, weight loss, and wasting. Other characteristics are high viral load, lower CD4 count, and infections such as pneumonia, Kaposi's sarcoma, systemic fungal infection, bacterial infection, and certain types of cancer. Energy requirements at this stage of 20–30 percent higher than those of non-infected people, generally at the higher end of the range. Weakness and symptoms can make it difficult for PLHIV to eat enough food during this phase to meet these requirements.

Evidence base (slide 19)

Early observational studies showed that nutritional status and HIV were inter-related. These studies reported that weight loss, body cell mass depletion, and low body mass index (BMI) were significantly associated with reduced survival rates, accelerated disease progression, and reduced capacity to prevent OIs (Kotler 1989; Guenter et al 1993; Suttmann et al 1995; Wheeler et al 1998; can der Sande et al 2004). A recent study (Paton et al 2006) showed that malnutrition at the time of starting ART is significantly associated with decreased survival among patients starting ART. While evidence of the impact of nutrition interventions on HIV is more limited, studies are ongoing on this topic.

Some studies (e.g., Kaiser et al 2006; Fawzi et al 2004) have found benefits in providing micronutrient supplementation for PLHIV, but evidence is still emerging, and the impacts

of specific micronutrients are still not known. For example, studies on vitamin A supplementation for PLHIV have yielded mixed results. There is also no evidence of the optimal dosage and combination of micronutrients. Meanwhile, as mentioned earlier, WHO currently recommends that PLHIV obtain 1 RDS of all micronutrients, if possible from the diet. People with micronutrient deficiencies may need higher levels.

Additional studies are ongoing, including studies of the impact of food supplementation. More evidence is needed on the impact of specific nutrition interventions on nutritional status, immune response, HIV progression, quality of life, adherence to drug regimens, and survival.

Conclusions (slide 20)

HIV affects nutrition by:

- Reducing food consumption
- Impairing nutrient absorption
- Increasing energy needs
- Causing HIV-associated wasting
- Changing metabolism
- Changing body composition

Poor nutrition affects HIV by:

- Decreasing immunity
- Slowing the healing process
- Possibly hastening disease progression

Other interactions between nutrition and HIV (slide 21)

Specific interactions between nutrition and HIV are discussed in the following sessions:

- Session 4: Nutrition actions to manage symptoms of OIs
- Session 5: Interaction between drugs to treat HIV or OIs and food, affecting drug efficacy, adherence to drug regimens, and nutritional status
- Session 6: Infant feeding choices for HIV-infected women that affect mother-to-child transmission of HIV and infant nutrition
- Session 7: Effect of reduced production or wages lost because of illness on household food security of PLHIV

Exercise 2 (optional). Ask students to list on a flipchart or board factors that are likely to influence the nutritional status of PLHIV in their country. When the factors are listed, ask the students to categorize them according to the following:

- Social factors
- Biological factors
- Programmatic factors.

Allow students time for discussion. Then ask them to explain how each factor influences nutrition outcomes for PLHIV. Make sure the explanations are relevant to the local context.

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Session Three:
Links between Nutrition and HIV

Purpose

Provide information about the relationship between nutrition and HIV.

2

Learning Objectives

- Describe the relationship between nutrition and infection.
- Explain how HIV affects nutrition.
- Explain how nutrition affects HIV.

3

Session Outline

- Nutrition and infection
- Relationship between nutrition and HIV
- Effects of poor nutrition on HIV and IADS
- Effective of HIV and AIDS on nutrition

4

Nutrition and Infection

- Poor nutrition increases vulnerability to infection.
- Infections cause and aggravate poor nutrition.
- Poor nutrition weakens the immune system.
- Poor nutrition helps increase the incidence, severity, and duration of infections.
- Symptoms of infections lead to weight loss and growth faltering, further weakening immunity.

5

HIV and Nutrition: Effects on the Immune System

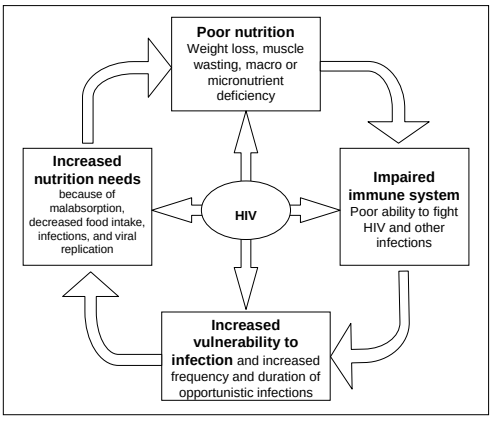
- HIV progressively destroys the immune system, leading to opportunistic infections (OI) and debilitation.
- Pre-existing undernutrition makes it difficult for PLHIV to stay healthy and productive.
- Both HIV and undernutrition limit the ability to fight infection and stay healthy.

6

Nutrition and HIV: A Vicious Cycle

- Weight loss
- Loss of muscle tissue and body fat
- Vitamin and mineral deficiencies
- Increased nutritional needs
- Reduced immune function
- Increased susceptibility to infection
- Weakness and reduced productivity

7



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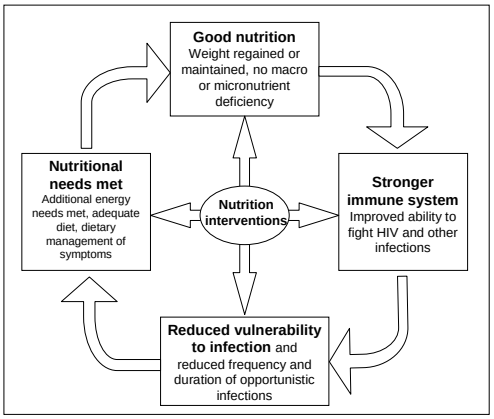

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Nutrition's Effect on HIV

- Weakened immune system
- Increased susceptibility to OI
- Slower healing
- Possibly faster disease progression
- Poorer response to treatment
- Sense of despair, depression

10

HIV's Effect on Nutrition

1. Reduced food intake
2. Increased energy needs
3. Altered nutrient metabolism and absorption

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1. Reduced Food Intake

- Symptoms of OI (e.g., mouth sores, taste changes, nausea, appetite loss)
- Side effects of medications
- Reduced quantity or quality of food

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2. Increased Energy Needs

- Because of viral replication and OI
  - Asymptomatic: 10% more than healthy people
  - Symptomatic: 20−30% more than healthy people
  - Symptomatic children with weight loss: 50−100% more than healthy people
- No change in protein, fat, and micronutrient requirements for PLHIV
  - Protein: 12−15% of energy intake
  - Micronutrients: 1 RDA, possibly more if deficiencies

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3. Poor Absorption

- Can be caused by HIV infection and OI symptoms (diarrhea, vomiting)
- Can occur at any stage
- Results in excess nutrient loss

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AIDS-Associated Wasting Syndrome

- Increases morbidity and mortality
- Associated with
  - Reduced energy intake
  - Infections and gastrointestinal disorders including diarrhea and malabsorption
  - Metabolic changes

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Changes in Body Composition

- Body responds differently after illness
  - Amino acids used for energy
  - Fat continues to accrue
- Nutrient intake may be adequate, but inadequate nutrient storage and use
- Increased resting energy expenditure

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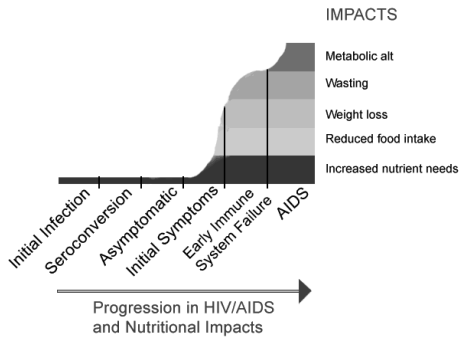
Nutrition in the Different Phases of HIV



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Nutrition in the Different Phases of HIV, Cont.

- Asymptomatic phase: Energy and nutrient needs increase because of virus replication
- Symptomatic phase: Energy and nutrient needs increase even more because of virus replication and the effects of HIV-related symptoms

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Evidence Base

- Evidence of association between nutritional status and OI, disease progression, and survival
- Limited evidence of impact of food and micronutrient (MN) supplementation; studies ongoing
- Some positive outcomes from MN supplements, but impacts of specific MN unknown (mixed evidence on some MN, such as vitamin A)
- WHO recommendation: 1 RDA MN for PLHIV, if possible through diet, possibly more if specific deficiencies

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Conclusions

- HIV affects nutrition by:
  - Reducing food consumption
  - Impairing nutrient absorption
  - Increasing energy needs
  - Causing HIV-associated wasting
  - Changing metabolism
  - Changing body composition
- Poor nutrition affects HIV by:
  - Decreasing immunity
  - Slowing the healing process
  - Possibly hastening disease progression

20

Nutrition and HIV: Beyond Nutritional Status and Infection

- Management of symptoms (Session 4)
- Drug-food interactions in HIV and AIDS therapy (Session 5)
- Infant feeding (mother-to-child transmission of HIV) (Session 6)
- Food security (Session 7)

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