Nutrition & HIV

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Nutrition and HIV/AIDS

Nutrition Problems Affect:

- HIV+ Men, Women and Children
- Quality of Life
- Survival
Topics

• Link between HIV/AIDS and nutrition

• Effects of HIV/AIDS on nutritional status

• Effects of nutrition (macronutrients, micronutrients and existing nutritional status) on HIV/AIDS
SLIM Disease
AIDS-Related Wasting Syndrome

• 10% weight loss in a 6 mo. Period with diarrhea or fever >30 days without a known cause (CDC)

• Even more complicated in the era of HAART

Pathogenesis of Malnutrition in HIV Infection

IMPACT OF HIV/AIDS ON NUTRITIONAL STATUS

• Depressed appetite
• Malabsorption
• Metabolic disturbances
• Muscle and tissue catabolism
• Fever, nausea, vomiting, and diarrhea
• Depression
Potential Mechanisms of AIDS Wasting

1) Increased energy expenditure
2) Decreased energy intake
3) Altered metabolism
4) Hormonal Alterations

Altered Metabolism

- Infection increases energy (10%-15%) and protein (50% or more) requirements
- Infection increases demand for and utilization of antioxidant vitamins (E, C, beta-carotene) and minerals (zinc, selenium, iron)
- Insufficient antioxidants from increased utilization causes oxidative stress
  - Increases HIV replication
  - Leads to higher viral loads
Poor Nutrient Absorption

- Poor absorption of fats and carbohydrates at all stages of HIV infection because of:
  - HIV infection of intestinal cells
  - Frequent diarrhea and vomiting
  - Opportunistic infections

- May affect use of fat-soluble vitamins
Nutrition in the HAART Era
Pharmacotherapy Challenges

1. Potential Interactions with Food
2. Body Metabolism
3. Side Effects
Medication Side Effects

- Anorexia
- Sore/dry/painful mouth
- Swallowing difficulties
- Constipation/Diarrhea
- Nausea/Vomiting/Altered Taste
- Depression/Tiredness/Lethargy

# HIV Drug Treatments & Nutrition

<table>
<thead>
<tr>
<th>GENERIC NAME</th>
<th>WITHOUT FOOD</th>
<th>WITH FOOD</th>
<th>WITH NON-FAT FOOD</th>
<th>WITH HIGH-FAT FOOD</th>
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<tr>
<td>Lopinavir/Ritonavir</td>
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<tr>
<td>Lamivudine</td>
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<td>Nelfinavir</td>
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<tr>
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<tr>
<td>Zidovudine</td>
<td>✓</td>
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</table>
Impact of Malnutrition on Disease Status

*Malnutrition CAN*

- Contribute to impaired immune response, increase frequency and severity of infections
- Result in more rapid disease progression & shortened survival
- Result in fatigue, loss of appetite, sense of taste and smell, and decreased quality of life
- Decrease tolerance to therapy and lessen medication efficacy

Vicious Cycle of Malnutrition and HIV

Poor Nutrition resulting in weight loss, muscle wasting, weakness, nutrient deficiencies

Increased Nutritional needs, Reduced food intake and increased loss of nutrients

Impaired immune system Poor ability to fight HIV and other infections, Increased oxidative stress

Increased vulnerability to infections e.g. Enteric infections, flu, TB hence Increased HIV replication, Hastened disease progression, Increased morbidity

Source: Adapted from RCQHC and FANTA 2003
Effects of Malnutrition and HIV on the Immune System

Malnutrition

- CD4 T-lymphocyte number
- CD8 T-lymphocyte number
- Delayed cutaneous hypersensitivity
- CD4/CD8 ratio
- Serologic response after immunizations
- Bacteria killing

HIV
Malnutrition and Infection
A Devastating Synergy

Fever, Vomiting, Diarrhea, Food Intake

Infection
Antibody synthesis
Phagocytes
Malnutrition

Nutritional Abnormalities in HIV/AIDS

1985 (Kotler, Brinson)

1987 (Burkes, Smith)

1988 (Dworkin, Falutz)
Role of Micronutrients

- Immune Processes
- Antioxidant Defense
- Brain Function
The Brain

- Zinc
- Calcium
- Ascorbic Acid
- Magnesium
- Cobalamin
- Iron
- Copper
- Pyridoxine
- Selenium
- Niacin
- α-Tocopherol
- Calcium
- Thiamin
- Ascorbic Acid
Specific Nutritional Deficiency and HIV-Related Mortality

<table>
<thead>
<tr>
<th>NUTRITIONAL DEFICIENCY</th>
<th>RISK RATIO (95% C.I.)</th>
<th>P-VALUE</th>
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<tbody>
<tr>
<td>Prealbumin</td>
<td>4.01 (1.46-11.0)</td>
<td>0.007</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>3.23 (1.10-9.48)</td>
<td>0.03</td>
</tr>
<tr>
<td>Vitamin B₆</td>
<td>2.35 (0.74-7.43)</td>
<td>0.14</td>
</tr>
<tr>
<td>Vitamin B₁₂</td>
<td>8.33 (1.69-41.1)</td>
<td>0.009</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>0.44 (0.15-1.30)</td>
<td>0.14</td>
</tr>
<tr>
<td>Zinc</td>
<td>2.91 (1.04-8.18)</td>
<td>0.04</td>
</tr>
<tr>
<td>Selenium</td>
<td>19.9 (5.52-71.9)</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

Baum et al. JAIDS 1997.
Nutritional Status and HIV/AIDS: Observational Studies

- Weight loss associated with HIV infection, disease progression, and mortality
- Some nutrient deficiencies (vitamins A, B<sub>12</sub>, and E, selenium and zinc) associated with HIV transmission, disease progression, and mortality

Observational studies do not tell us whether these conditions caused or resulted from more rapid progression.
Micronutrient Needs In HIV/AIDS
To Supplement or Not to Supplement???

- Requirements Unknown
- No official Guidelines
- Few Clinical Trials
- Data Contradictory

“Do No Harm”
Selenium Therapy Trial

- 259 HIV+ Drug Users
- 200 μg/day Se or placebo

NIDA
Selenium Therapy Trial Findings

Se-Treated vs. Placebo

Mycobacterial infections
Hospitalizations
Anxiety
Viral Load Suppression

Quality of life (health)

Multiple micronutrients and HIV infection

Intervention trial

- Randomised trial in Thailand
  - 481 HIV+ adults
  - Multimicronutrient or placebo for 48 wks
    - minerals: zinc 30 mg, iron 10 mg, selenium 0.4 mg, copper 3 mg, iodine 0.3 mg, chromium 0.15 mg, manganese 8 mg, magnesium 80 mg
    - vitamins A, B-complex, C, D, E, K
  - Mortality reduced
  - No effects on HIV load and CD4 cell counts

(Jiamton S, 2003)
Micronutrient Formulation in Tanzania Trial

Vit A
Beta carotene
Vit D
Vit E
Vit C
Folacin
Pantothenic Acid
Iron
Zinc
Selenium
Copper
Vit B12
Folic Acid
Vit B1
Iodine
Vit K
Cystine
Magnesium
Vit B2
Manganese
Chromium
Niacin
Vit B6

E.G. PIWOZ, 2006, ACCESS
Tanzanian mothers receiving daily high dose MV (B, C, E) were less likely to experience HIV-related disease progression or death during follow up

MV (n=271) vs. placebo (n=268)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Relative Risk</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIDS related death</td>
<td>0.73</td>
<td>0.51-0.04</td>
<td>0.09</td>
</tr>
<tr>
<td>Progression to stage 4</td>
<td>0.50</td>
<td>0.28-0.90</td>
<td>0.02</td>
</tr>
<tr>
<td>Progression to stage 3</td>
<td>0.72</td>
<td>0.58-0.90</td>
<td>0.003</td>
</tr>
<tr>
<td>&gt;= 2 stage increases</td>
<td>0.66</td>
<td>0.52-0.84</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Mean diff in viral load = -0.18 log – or est. 30% increase in survival time

Fawzi et al, NEJM, 2004
Micronutrients used in Kenya HIV shedding of the reproductive tract study - ADVERSE EFFECT

E.G. PIWOZ, 2006, ACCESS
Micronutrients (TZ vitamins + Se) increased vaginal tract shedding of HIV-1 in Kenya  (McClelland et al, JAIDS, 2004)

• 400 non-pregnant HIV+ women randomized to receive:
  – MN (20 mg $B_1$, 20 mg $B_2$, 25 mg $B_6$, 100 mg niacin, 50µg $B_{12}$, 500 mg Vitamin C, 30 mg Vit. E, 0.8 mg folic acid, 200 µg selenium
  – or placebo

• Follow up 6 wks later

Findings:

• MN women were 2.5 times more likely to have vaginal HIV-shedding ($p=0.001$), and higher vaginal RNA levels ($p=0.004$)

• MNS increased likelihood of HIV shedding in women who had no detectable HIV at baseline – “increase infectivity”

• Interaction w/ baseline Se status – if not deficient, then adverse impact, but no effect of MN supplements if Se deficient ($< 85$µg/L)

• No other interactions

E.G. PIWOZ, 2006, ACCESS
MN may still play a role in the era of HAART

(Tang et al, AIDS, 2005)

- Metabolic syndrome may be associated with oxidative stress
  - “lipodystrophy”, insulin resistance/glucose intolerance

- Some ARV drugs may induce oxidative stress, increasing demand for anti-oxidant nutrients

- These conditions increase the risk of CVD – possible role for MN (anti-oxidants) for patients on ART

E.G. PIWOZ, 2006, ACCESS
MN supplementation increased CD4 count in patients on HAART

*Kaiser et al, JAIDS, August, 2006*

*These nutrients + others were contained in the supplement*

E.G. PIWOZ, 2006, ACCESS
Daily selenium supplementation (200 mg/day) improved CD4 cell response in HIV+ Nigerian adults on HAART (d4T/3TC/NVP)  
(Odonukwe et al. IAS, MoAb0403, 2006)

- Randomized trial (n=170 per group) Patients were followed for 72 weeks.
- Median time for undetectable viral load was similar in the two groups (p = 0.2),
- Patients in HAART + selenium group had:
  - Improved CD4 recovery from B/l to 72 wks (+120 cells/mm3 versus +50 cells/mm3)
  - Reduced OI incidence & hospitalizations
  - Increased WT gain (p=0.004)
  - Increased Hb response (+30g/l versus +10g/l).

“Selenium might be a useful complement to HAART in the management of people with HIV with severe immune-suppression”

E.G. PIWOZ, 2006, ACCESS
WHO Technical Review
Micronutrients and HIV

• Studies have shown that some micronutrient supplements may prevent HIV disease progression and adverse pregnancy outcomes

• Micronutrients are not an alternative to comprehensive HIV treatment including ARV therapy
Food For Thought

**GOALS OF NUTRITION INTERVENTION:**

- Help delay progression to AIDS
- Help immune system function
- Reduce infections
- Achieve maximum benefit from drug therapies
- Improve quality of life
Nutritional Evaluation

- Biochemical Assessment – Proteins, Vitamins, Trace Elements
- Dietary Assessment – FFQ, Food Patterns and 24-Hour Recall
- Anthropometric Measurements
- Clinical Assessment – Signs and Symptoms
Promote a Healthy Diet

• Promote a diet adequate in energy, protein, fat, and other essential nutrients

• Even asymptomatic HIV-infected persons may have increased body metabolism, which increases their daily energy, protein and micronutrient requirements

• Therefore, a person with HIV requires 10% to 15% more energy and 50% to 100% more protein a day.
TO YOUR HEALTH

– a healthy diet should contain a balance of:

– carbohydrates and fats to produce energy and growth: (rice, maize/millet porridge, barley, oats, wheat, bread, cassava, plantain, bananas, yams, potatoes, etc.)

– proteins to build and repair tissue: (meat, chicken, liver, fish, eggs, milk, beans, soybeans, groundnuts, etc.)
TO YOUR HEALTH

vitamins and minerals
to protect against opportunistic infections by
ensuring that the lining of skin, lungs and gut
remain healthy and that the immune system
functions properly
Antioxidants: Eat your colors

**Blue**... very powerful!

**Red**... high in antioxidants!

**Green** and **Orange**... contain Lutein

**Gold**
curry power
Food as Medicine
Eat well...Be well!
Acknowledgements

Victoria Elf

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