Dietary intake and counseling, weight maintenance, and the course of HIV infection

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ABSTRACT

Objective  To define relationships among dietary intake and counseling, weight maintenance, and the clinical course of patients infected with the human immunodeficiency virus (HIV).

Design  A prospective cohort study in an HIV clinic in a county hospital.

Subjects  HIV-infected patients (68 with and 40 without acquired immunodeficiency syndrome [AIDS]) who had a good performance status and no chronic diarrhea were assessed at entry to the study and after 6 months. The following assessments were made: energy and nutrient intake based on 7-day food records, anthropometric measurements, immunologic function as lymphocyte T-cell subpopulations (ratio of CD4 to CD8), and serum cholesterol level. Patients were monitored to determine clinical outcome.

Intervention  All patients received standardized dietary counseling designed to address identified intake deficiencies and maintain body weight.

Main outcome measures  Changes in energy and nutrient intake, body weight, and clinical outcome (ie, time to AIDS-defining illness and overall survival time).

Statistical analyses performed  Group differences (HIV group vs AIDS group) were sought using χ² analyses and Student's t test. A multivariate regression model was used to determine the best predictors of clinical outcome.

Results  At baseline, total energy intake (based on 30 kcal/kg usual body weight) was adequate in both HIV and AIDS patients (101±4% and 103±5% [mean±standard deviation] of need, respectively). Despite dietary counseling and continued maintenance of energy intake, body weight, serum cholesterol level, and CD4 level progressively decreased. Consequently, saturated fat intake was found to be inversely related (P<.01) to serum cholesterol level. Clinical outcome (after 3.5 years) was associated with baseline ratio of CD4 to CD8 (P<.0001), weight (P<.01), and serum cholesterol level (P<.001). Multivariate analysis related ratio of CD4 to CD8 (P<.001) and weight maintenance (P<.001) to favorable outcome in the final model.

Applications  Weight loss in patients with HIV infection is independently prognostic of clinical outcome, and development of hypcholesterolemia is not favorable for clinical outcome. Because weight loss progresses despite conventional dietary counseling to identify energy need, interventions earlier in the disease course should be considered along with increased target levels for energy intake. J Am Diet Assoc. 1995; 95:428-432, 435.

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Progressive weight loss occurs in most patients infected with the human immunodeficiency virus (HIV) (1-4). Pilot studies have suggested that malnutrition is an indicator of adverse clinical outcome (5,6). Thus, an increasing number of HIV patients are candidates for dietary counseling and nutrition intervention (7-10). Reduced nutrient intake, malabsorption, systemic effects of infections, and hypermetabolism have been reported to influence development of malnutrition in such patients (2,5,9,11-13). Despite potential clinical importance, to our knowledge dietary intervention guidelines based on success-
ful clinical experience are not currently available for HIV-infected patients. In fact, relatively few studies have explored this area. Therefore, we conducted a prospective cohort study to assess the influence of dietary intake and weight maintenance, reinforced by concurrent standardized dietary counseling, on clinical outcome of patients infected with HIV.

**METHODS**

Patients with HIV infection, with or without an acquired immunodeficiency syndrome (AIDS)-defining illness, and a favorable performance status (asymptomatic or with minimal symptoms) were eligible for our study. Exclusion factors included chronic diarrhea (ie, persisting for more than 30 days and/or requiring medication), severe gastrointestinal symptoms, and infection of the central nervous system. Approximately 60% of the ambulatory population at an HIV clinic in a county hospital in a large metropolitan area met these criteria. Informed written consent in accord with federal and institutional requirements was obtained.

**Study Design**

All patients had baseline assessment of nutritional status (including anthropometric measurements); energy and nutrient intake based on a 7-day food records; gastrointestinal symptoms (based on a standardized questionnaire developed previously to assess factors influencing weight loss as a result of cancer (14)); immunologic function, including measurements of lymphocyte T-cell subpopulations (ratio of CD4 to CD8); serum immunoglobulin levels; and serum cholesterol level. Assessments were repeated after 6 months. Patients were monitored to determine clinical outcome; clinical management was established by each patient’s primary physician.

**Dietary Assessment and Counseling**

Seven-day food records were used to estimate energy and macronutrient and micronutrient intake (15,16). Instructions in record keeping provided by registered dietitians incorporated food scales and models to enhance accuracy in regard to portion size. The food records were reviewed by a registered dietitian who used a standardized protocol to clarify portion size and food preparation questions. Records were analyzed using a computerized nutrient database developed by the Harbor-UCLA General Clinical Research Center and based on Handbook No. 8 of the US Department of Agriculture (17). The database was supplemented from published sources or manufacturer’s data as needed.

The goals of dietary counseling, which were based on nutritional intake and status at baseline, were to address identified energy and nutrient deficiencies and maintain body weight. An energy intake deficiency was considered to be less than 30 kcal daily per kilogram actual or pre-illness usual weight; deficiencies in micronutrients were considered as less than 60% of Recommended Dietary Allowances (RDAs) (18). Patients with deficiencies were counseled by registered dietitians in accord with standard nutrition clinical practice. In this context, dietary counseling was used in conjunction with enteral supplements, if needed, to address deficiencies. Enteral tube feedings or parenteral nutrition were not given to any patient in the study.

**Anthropometric Assessment**

Assessments included current weight, height, triceps skinfold thickness, and midarm circumference. Patients were weighed clothed, without shoes, on the same printing beam scale according to a standardized protocol.

**Laboratory Assessment**

Blood for determining cholesterol level was drawn from patients who had fasted at least 10 hours (no food or liquid except water).

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Characteristics of HIV patient population</th>
</tr>
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<tbody>
<tr>
<td>Characteristic</td>
<td>Patient population</td>
</tr>
<tr>
<td></td>
<td>HIV only</td>
</tr>
<tr>
<td>Patients (No.)</td>
<td>65</td>
</tr>
<tr>
<td>Age (years)</td>
<td>35 ± 3</td>
</tr>
<tr>
<td>Sex (% male)</td>
<td>96</td>
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<tr>
<td>Intravenous drug use history (% used)</td>
<td>5</td>
</tr>
<tr>
<td>CD4 cell count</td>
<td>376 ± 39</td>
</tr>
<tr>
<td>Azathioprine use (%)</td>
<td>40</td>
</tr>
<tr>
<td>Body weight (% usual)</td>
<td>101 ± 1</td>
</tr>
<tr>
<td>Serum albumin level (g/L)</td>
<td>42 ± 1</td>
</tr>
<tr>
<td>Serum cholesterol level (mmol/L)</td>
<td>4.29 ± 1.8</td>
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</tbody>
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*Mean ± standard error.

**Table 2**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Weight loss*</th>
</tr>
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<tbody>
<tr>
<td>Yes (n = 28)</td>
<td>No (n = 80)</td>
</tr>
<tr>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Sore mouth</td>
<td>24</td>
</tr>
<tr>
<td>Diarrhea (sporadic)</td>
<td>21</td>
</tr>
<tr>
<td>Nausea</td>
<td>23</td>
</tr>
<tr>
<td>Abdominal fullness</td>
<td>18</td>
</tr>
<tr>
<td>Vomiting</td>
<td>9</td>
</tr>
</tbody>
</table>

*Loss of >5% of usual body weight.

**Clinical End-point Assessment**

Criteria of the Centers for Disease Control and Prevention were used to define progression from HIV infection to AIDS (22). Overall survival time was calculated from the date of entry to the study to date of death. Event-free survival time was calculated from the date of entry to the study to date of either an AIDS-defining illness or death from any cause. The median follow-up period was 3.5 years.

**Statistical Analysis**

Baseline data from 108 patients were used for clinical outcome analyses. Differences between groups (HIV vs AIDS, HIV baseline vs 6-month follow-up, AIDS baseline vs 6-month follow-up) were determined by means of Y2 analysis and Student’s t test. Survival curves were constructed using life-table analysis, and differences were tested for event-free survival and overall survival (29,21). A multivariate Cox proportional hazards regression model was used to determine the best predictors of clinical outcome. All calculations were performed according to the survival analysis in BMDP (BMDP Statistical Software, vol 2, version 1990, University of California).
### RESULTS

The characteristics of the 108 HIV patient cohort are outlined in Table 1. At baseline, serum albumin level and percentage usual body weight were somewhat lower in the AIDS group compared with the HIV group, but not significantly so. Serum cholesterol level was significantly lower \((P<0.01)\) in the AIDS group. Although eligibility criteria excluded patients who had chronic diarrhea or severe gastrointestinal symptoms, other gastrointestinal symptoms that could have influenced intake and/or alimentation were not uncommon (Table 2). However, the frequency of these symptoms was similar in patients who experienced weight loss and those who did not, and the symptoms did not explain the weight loss in this population.

Daily energy and nutrient intakes at the time of entry to the study were determined from 442 food-record days in HIV patients and 301 food-record days in AIDS patients. Daily energy intake was similar in HIV and AIDS patients and was calculated to be adequate for weight maintenance based on 30 kcal/kg usual body weight \((101±4\% \text{ vs } 103±5\% \text{ [mean±standard error of the mean]}\) for HIV and AIDS patients, respectively) or 30 kcal/kg ideal body weight. Intakes of macronutrients also appeared sufficient to meet identified needs. Of vitamins and micronutrients, only vitamin B-6, zinc, and folic acid were less than the RDA \((74\%, 65\%, \text{ and } 57\% \text{ of need, respectively})\) in both HIV and AIDS groups; differences between groups were not significant.

Serial changes in study parameters for patients with baseline and follow-up determinations, based on a total of 1,124 food record days, are outlined in Table 3. As immunologic function decreased (as manifest by decreased CD4 levels), modest but progressive decreases in body weight occurred. The body weight change occurred despite relatively constant energy intakes \((P<0.01)\) for weight maintenance by conventional criteria and in the absence of severe diarrhea or clinical evidence of malabsorption. As a result, few patients met the criteria for aggressive dietary counseling or intervention. A downward fluctuation of serum albumin level within the normal range was also observed. A progressive, significant decrease in serum cholesterol level occurred despite stable or increasing daily dietary intake of energy, fat, and cholesterol. As a result, dietary saturated fat intake was inversely related to serum cholesterol level \((r=-0.56, P<0.01)\) in this HIV-infected population (Figure 1).

With respect to clinical outcome, life-table analyses (Figure 2) indicated strong clinical benefit associated with favorable ratio of CD4 to CD8 \((P<0.001)\); weight maintenance \((P<0.001)\); and high serum cholesterol level \((P<0.001)\). A multivariate analysis using 16 variables including immunologic status \((CD4, CD8, \text{ lymphocyte count, ratio of CD4 to CD8}, \text{ serum immunoglobulins (IgA, IgG), nutritional status (percentage usual body weight; serum albumin level; energy, fat, and protein intakes), and major infections or malignant complications was conducted to determine the best predictor for event-free survival. The ratio of CD4 to CD8 \((P<0.001)\) and percentage usual weight loss \((P<0.001)\) were identified as independent factors best predictive of event-free survival.

### DISCUSSION

In this study, baseline nutritional status \((P<0.01)\) association seen in life-table analyses, percentage usual body weight emerged as a significant \((P<0.001)\) predictor of clinical outcome in a multivariate analysis. These results expand...
In patients with HIV infection, weight loss is independently prognostic of clinical outcome and development of a low serum cholesterol level is not favorable.
The difficulty in reliably determining energy intake in a population with changing intakes (e.g., patients with a complicated HIV disease course) is well recognized (15,16). Seven-day food records were selected as the method best able to capture the dietary detail needed to estimate total energy intake. Because of the limitations of any method selected to accurately assess energy intake, implications regarding the mechanisms underlying the development of malnutrition in this population must be guarded. Practical inferences can be made, however, from the lack of success of the "standard" dietary counseling approach used for this prospective patient cohort. In our experience, even use of 7-day food records to identify energy intake deficiency for guiding timing and level of dietary counseling was inadequate to prevent progressive weight loss. These results are similar to those of Ysella et al (47) who reported that malnutrition commonly developed in an HIV-infected patient population despite the use of "nutritional support" (of a nature not clearly specified) in 68% of patients. Thus, dietary interventions based solely on identifying problems with nutrient intake are not likely to be successful. If the goal of dietary intervention is to prevent weight loss and mitigate its adverse clinical consequences, new strategies based on early intervention to increase energy intake should be considered.

Several groups have demonstrated the feasibility of increasing energy intake in ambulatory HIV patients by means of dietary counseling combined with supplement use (48-51). Preliminary evidence also supports the concept that early nutrition intervention in patients with HIV infection can favorably influence nutritional and clinical outcomes. In a randomized trial, Chlebowski and coworkers (52) reported that before identification of intake deficiency, use of supplements — in excess of calculated need and provided as an enterotrophic peptide-based formula in addition to regular dietary intake — was associated with body weight maintenance and fewer hospitalizations compared with supplementation with a standard enteral formula in a patient in the early stages of HIV infection. Such results support further research (53) to evaluate similar dietary interventions in the early stages of HIV infection.

**APPLICATIONS**

In patients with HIV infection, weight loss is independently prognostic of clinical outcome and development of a low serum cholesterol level is not favorable. As weight loss progresses despite apparently adequate energy intake, use of conventional criteria to identify energy requirements for counseling will be unlikely to prevent weight loss and to improve clinical outcome. Dietary interventions early in the disease course combined with increased target levels for energy intake should be considered.

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**References**