

- [HIV/AIDS](#)

Recommendations Summary

H/A: Screening and Referral for Medical Nutrition Therapy 2010

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

HIV/AIDS: Screening for People with HIV Infection

The registered dietitian (RD) should collaborate with other health care professionals, administrators and public policy decision-makers to ensure that all people with HIV infection are screened for nutrition-related problems, based on referral criteria regardless of setting, at every visit. People with HIV infection are at nutritional risk at any time-point during the course of their illness.

Rating: Consensus
Imperative

HIV/AIDS: Referral for Medical Nutrition Therapy

The RD should collaborate with other health care professionals, administrators and public policy decision-makers to ensure that all people with HIV infection are referred for Medical Nutrition Therapy (MNT) based on nutritional risk. The timeline for referral of patients categorized by nutritional risk is as follows: High risk, to be seen by an RD within one week; moderate risk, to be seen by an RD within one month; low risk, to be seen by an RD at least annually.

Rating: Consensus
Conditional

- [Risks/Harms of Implementing This Recommendation](#)

None.

- [Conditions of Application](#)

The priority timeline for referral for patients categorized by nutritional risk is as follows:

- High risk, to be seen by an RD within one week
- Moderate risk, to be seen by an RD within one month
- Low risk, to be seen by an RD at least annually.

Detailed descriptions of the categories appear below:

I. High risk (see RD within one week)

- Poorly-controlled diabetes mellitus
- Pregnancy (mother's nutrition; infant, artificial infant formula)
- Poor growth, lack of weight gain or failure to thrive in pediatric patients
- Over 10% unintentional weight loss over four to six months
- Over 5% unintentional weight loss within four weeks or in conjunction with:
 - Chronic oral or esophageal thrush
 - Dental problems
 - Dysphagia
 - Chronic nausea or vomiting
 - Chronic diarrhea
 - CNS disease.
- Intercurrent illness or active opportunistic infection
- Severe dysphagia
- Enteral or parenteral feedings
- Two or more medical comorbidities or dialysis
- Complicated food-drug-nutrient interactions
- Severely dysfunctional psychosocial situation (especially in children).

II. Moderate risk (see RD within one month)

- Obesity
- Evidence for body fat redistribution
- Lipid abnormality
- Osteopenia or osteoporosis
- Glucose dysregulation
- Hypertension
- Evidence for hypervitaminoses or excessive dietary supplement intake
- Inappropriate use of diet pills, laxatives or other over-the-counter medications
- Substance abuse in the recovery phase
- Possible food-drug-nutrient interactions
- Food allergies or food intolerances
- Single medical comorbidity (such as, hepatic disease, renal disease, anemia, cancer, tuberculosis, etc.)
- Oral thrush
- Dental problems
- Gastrointestinal problems, such as (chronic nausea or vomiting, chronic diarrhea, heart burn, gas, etc.)
- CNS disease resulting in a decrease in functional capacity
- Chronic pain other than oral or gastrointestinal tract source
- Disordered eating
- Suspected poor composition or adequacy of diet
- Follows diet regimen for religious, vegetarian or other reasons
- Evidence for sedentary lifestyle or excessive exercise regimen
- Unstable psychosocial situation (especially in children).

III. Low risk (see RD at least annually)

- Stable weight
- Appropriate weight gain, growth and weight-for-height in pediatric patients
- Adequate and balanced diet

- Normal blood levels of cholesterol, triglycerides, albumin and glucose
 - Stable HIV disease (with no active intercurrent infections)
 - Regular exercise regimen
 - Normal hepatic and renal function
 - Psychosocial issues stable (especially in children).
- [Potential Costs Associated with Application](#)

None.
- [Recommendation Narrative](#)
 - People with HIV infection are at nutritional risk at any time-point during any time of their illness
 - Although weight loss and wasting remain common in HIV infection, nutrition-related problems such as obesity, diabetes, hyperlipidemia and hypertension also increasingly affect people living with HIV
 - A shift in causes of death from acute opportunistic infections to other causes, such as diabetes and heart disease, indicates the need for a more comprehensive approach to healthy living for people with HIV.
- [Recommendation Strength Rationale](#)

The ADA HIV/AIDS Work Group concurs with the references cited.
- [Minority Opinions](#)

Consensus reached.
- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

 - [References](#)
 - [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)
 - Hendricks KM, Dong KR, Gerrior JL, eds. *Nutrition Management of HIV and AIDS*. Chicago, Illinois: American Dietetic Association; 2009.
 - Los Angeles County Commission on HIV. *Standards of Care*. Medical Nutrition Therapy. Available at: http://hivcommission-la.info/cms1_034030.pdf
 - Nerad J, Romeyn M, Silverman E, Allen-Reid J, Dieterich D, Merchant J, A Pelletier V, Tinnerello D, Fenton M. General nutrition management in patients infected with human immunodeficiency virus. *Clin Infect Dis*. 2003 Apr 1; 36 (Suppl 2): S52-S62.
- [HIV/AIDS](#)

Quick Links

Recommendations Summary

H/A: Medical Nutrition Therapy 2010

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

HIV/AIDS: Medical Nutrition Therapy (MNT)

Medical nutrition therapy (MNT) provided by a registered dietitian (RD) is recommended for individuals with HIV infection. Four studies regarding MNT (with or without oral nutritional supplementation) report improved outcomes related to energy intake, symptoms and cardiovascular risk indices. Two studies regarding nutritional counseling (non-MNT) also report improved outcomes related to weight gain, CD4 count and quality of life.

Rating: Strong

Imperative

HIV/AIDS: Frequency of Medical Nutrition Therapy (MNT)

The Registered Dietitian (RD) should provide at least one to two Medical Nutrition Therapy (MNT) encounters per year for people with HIV infection (asymptomatic) and at least two to six (or more) MNT encounters per year for people with HIV infection (symptomatic but stable, acute or palliative), based on the following:

- Appropriate disease classifications
- Nutritional status
- Comorbidities
- Opportunistic infections
- Physical changes
- Weight or growth concerns
- Oral or gastrointestinal symptoms
- Metabolic complications
- Barriers to nutrition
- Living environment
- Functional status
- Behavioral concerns or unusual eating behaviors.

Studies regarding MNT (with or without oral nutritional supplementation) report improved outcomes related to energy intake, symptoms, and cardiovascular risk indices, especially with increased frequency of visits.

Rating: Consensus

Imperative

- [Risks/Harms of Implementing This Recommendation](#)
 - Access to registered dietitian who is linguistically and culturally sensitive to population and sensitive to HIV-infected population and has at least general HIV education, is most desirable and are potential barriers
 - Information about the patient's medical condition is necessary to initiate MNT.
- [Conditions of Application](#)
 - HIV-infected patients may be at nutritional risk at any point in their illness (Nerad et al, CID 2003)
 - The CDC classification by CD4 count and clinical signs and symptoms may not be appropriate for nutrition complications or referrals. Rather, defining

levels of risk for nutritional compromise as the trigger for nutrition referral and intervention may be more practical, given current resources. Ideally, all patients infected with HIV should have access to a registered dietitian (RD) (Nerad et al, CID 2003).

- There are four underlying assumptions in the design of this scope:
 - The assumption that level of experience, skills and proficiency with respect to identified activities varies among individuals
 - The assumption that dietetics practitioners may not be competent to practice in all aspects of the field
 - The assumption that individual practitioners are expected to practice only in areas in which they are competent
 - The assumption that practitioners should pursue additional education and experience to expand the scope of their personal dietetics practice. (American Dietetic Association: Scope of Dietetics Practice Framework).

<http://www.eatright.org/Members/content.aspx?id=8171>)

- [Potential Costs Associated with Application](#)

Costs of medical nutrition therapy (MNT) sessions and reimbursement vary, however, MNT sessions are essential for improved outcomes.

- [Recommendation Narrative](#)

- Seven studies were evaluated regarding Medical Nutrition Therapy (MNT) or nutrition counseling in people with HIV infection
- One study, completed prior to highly active antiretroviral therapy, stressed that early intervention may prevent progressive weight loss (Chlebowski et al, 1995)
- Four studies regarding MNT (with or without oral nutritional supplementation) report improved outcomes related to energy intake, symptoms and cardiovascular risk indices, especially with increased frequency of visits (Topping et al, 1995; Rabeneck et al, 1998; Schwenk et al, 1999; Fitch et al, 2006)
- Two studies regarding nutritional counseling (non-MNT) also report improved outcomes related to weight gain, CD4 count and quality of life (Kaiser et al, 1996; Tabi and Vogel, 2006).

- [Recommendation Strength Rationale](#)

Conclusion Statement received Grade I

- [Minority Opinions](#)

Consensus reached.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[What is the evidence regarding medical nutrition therapy for people with HIV infection?](#)

- [References](#)

[Chlebowski RT, Grosvenor M, Lillington L, Sayre J, Beall G. Dietary intake and counseling, weight maintenance, and the course of HIV infection. *J Am Diet Assoc* 1995; 95\(4\): 428-435.](#)

[Fitch KV, Anderson EJ, Hubbard JL, Carpenter SJ, Waddell WR, Caliendo AM, Grinspoon SK. Effects of a lifestyle modification program in HIV-infected individuals with the metabolic syndrome. *AIDS*. 2006; 20: 1843-1850.](#)

[Kaiser JD, Donegan E. Complementary therapies in HIV disease. *Alternative Therapies in Health and Medicine*. 1996; 2\(4\): 42-46.](#)

[Rabeneck L, Palmer A, Knowles JB, Seidehamel RJ, Harris CL, Merkel KL, Risser JMH, Akrabawi SS. A randomized controlled trial evaluating nutrition counseling with or without oral supplementation in malnourished HIV-infected patients. *J Am Diet Assoc*. 1998; 98: 434-438.](#)

[Schwenk A, Steuck H, Kremer G. Oral supplements as adjunctive treatment to nutritional counseling in malnourished HIV-infected patients: randomized controlled trial. *Clinical Nutrition*. 1999; 18\(6\): 371-374.](#)

[Tabi M, Vogel RL. Nutritional counselling: An intervention for HIV-positive patients. *Journal of Advanced Nursing*. 2006; 54\(6\): 676-682.](#)

[Topping CM, Humm DC, Fischer RB, Brayer KM. A community-based, interagency approach by dietitians to provide meals, medical nutrition therapy, and education to clients with HIV/AIDS. *J Am Diet Assoc*. 1995; 95: 683-686.](#)

- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

Hendricks KM, Dong KR, Gorrion JL, eds. *Nutrition Management of HIV and AIDS*. Chicago, Illinois: American Dietetic Association; 2009.

Los Angeles County Commission on HIV. *Standards of Care*. Medical Nutrition Therapy. Available at:

http://hivcommission-la.info/cms1_034030.pdf

Nerad J, Romeyn M, Silverman E, Allen-Reid J, Dieterich D, Merchant J, A Pelletier V, Tinnerello D, Fenton M. General nutrition management in patients infected with human immunodeficiency virus. *Clin Infect Dis*. 2003 Apr 1; 36 (Suppl 2): S52-S62.

Nutrition in Section 2: Health Maintenance and Disease Prevention; *Clinical Management of the HIV-Infected Adult*. Available at: http://www.aids-ed.org/aidsetc?page=cm-202_nutrition Manual: <http://www.aids-etc.org/aidsetc?page=cm-200-00>

PUBLIC LAW 109-415-DEC. 19, 2006 120 STAT. 2767 "Ryan White HIV/AIDS Treatment Modernization Act of 2006." <ftp://ftp.hrsa.gov/hab/reauth06.pdf>

- [HIV/AIDS](#)

Recommendations Summary

H/A: Nutrition Assessment 2010

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

HIV/AIDS: Nutrition Assessment

The registered dietitian (RD) should assess the following for people with HIV infection:

- Food/nutrition-related history, such as knowledge, beliefs and attitudes and factors affecting access to food and food/nutrition-related supplies (see also the Assess Food/Nutrition-Related History recommendation, [click here](#))
- Anthropometrics (see also the Anthropometric Assessment recommendation, [click here](#))
- Biochemical data, medical tests and procedures such as lipid profile, fasting blood glucose, electrolytes, complete blood count and bone density measurements

- o Nutrition-focused physical findings
- o Client history
 - Patient, client and family medical/health history
 - Social history
- o Comparative standards.

Assessment of nutritional and medical status is crucial to quality nutrition care for every person living with HIV infection.

Rating: Consensus

Imperative

- o [Risks/Harms of Implementing This Recommendation](#)

None.

- o [Conditions of Application](#)

None.

- o [Potential Costs Associated with Application](#)

Costs of medical nutrition therapy (MNT) sessions and reimbursement vary; however, MNT sessions are essential for improved outcomes.

- o [Recommendation Narrative](#)

- A complete baseline nutrition assessment should be done for each patient. Evaluation and interpretation of nutrition assessment data should be done by a registered dietitian (RD). Both baseline and ongoing assessment should include anthropometric assessment as well as clinical and biochemical parameters, dietary intake and psychosocial issues.
- Such assessment is necessary to prioritize appropriate nutrition interventions and to develop a multidisciplinary nutrition plan.

- o [Recommendation Strength Rationale](#)

The ADA [HIV/AIDS](#) Work Group concurs with the references cited.

- o [Minority Opinions](#)

Consensus reached.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

- o [References](#)
- o [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

Hendricks KM, Dong KR, Gerrior JL, eds. *Nutrition Management of HIV and AIDS*. Chicago, Illinois: American Dietetic Association; 2009.

Knox TA, Zafonte-Sanders M, Fields-Gardner C, Moen K, Johansen D, Paton N. Assessment of nutritional status, body composition, and human immunodeficiency virus-associated morphologic changes. *Clinical Infectious Diseases*. 2003; 36(Suppl 2): S63-S68.

- [HIV/AIDS](#)

Quick Links

Recommendations Summary

H/A: Assess Food/Nutrition-Related History 2010

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

HIV/AIDS: Assess Food/Nutrition-Related History

The registered dietitian (RD) should assess the food and nutrition-related history of people with HIV infection, including but not limited to:

- o Food and nutrient intake, focusing on energy, protein, fat, fiber, sodium, calcium and vitamin D
- o Medications/drugs, herbal/dietary supplements and their potential negative interactions
- o Knowledge, beliefs and attitudes
- o Behavior
- o Factors affecting access to food and food and nutrition-related supplies
- o Physical activity and function
- o Nutrition-related patient and client-centered measures

Several studies report variations in energy and nutrient intake in people with HIV infection, some were under- and over-estimated requirements. A clear understanding of food and nutrient intake will form the basis for the nutrition diagnosis, prescription and intervention.

Rating: Strong

Imperative

- o [Risks/Harms of Implementing This Recommendation](#)

None.

- o [Conditions of Application](#)

None.

- o [Potential Costs Associated with Application](#)

Costs of medical nutrition therapy (MNT) sessions and reimbursement vary; however, MNT sessions are essential for improved outcomes.

- o [Recommendation Narrative](#)

- 15 articles were reviewed to evaluate the monitoring of food intake in people with **HIV** infection
- Several studies report variations in energy and nutrient intake and weight changes (Chlebowski et al, 1995; Luder et al, 1995; Woods et al, 2002; Hendricks et al, 2006)
- Special considerations are needed for children (Henderson et al, 1997; Melvin et al, 1997; Heller et al, 2000), as well as individuals with fat deposition (Hendricks et al, 2003; Dong et al, 2006), those taking protease inhibitors (Woods et al, 2003; Shah et al, 2005), those with a history of drug abuse (Forrester et al, 2000; Forrester et al, 2004) and those with metabolic abnormalities (Joy et al, 2007)
- One study reported that three-day food records may be more valid than food frequency questionnaires when reporting food intake in the **HIV**-infected population (Hendricks et al, 2005)
- Further research is needed regarding frequency of food intake monitoring.

- [Recommendation Strength Rationale](#)

Conclusion statement received Grade II.

- [Minority Opinions](#)

Consensus reached.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[What is the evidence to regarding the monitoring of food intake in people with HIV infection?](#)

- [References](#)

[Chlebowski RT, Grosvenor M, Lillington L, Sayre J, Beall G. Dietary intake and counseling, weight maintenance, and the course of HIV infection. *J Am Diet Assoc* 1995; 95\(4\): 428-435.](#)

[Dong KR, Wanke CA, Tang AM, Ding B, Hendricks KM. Dietary glycemic index of human immunodeficiency virus-positive men with and without fat deposition. *J Am Diet Assoc*. 2006; 106: 728-732.](#)

[Forrester JE, Tucker KL, Gorbach SL. Dietary intake and body mass index in HIV-positive and HIV-negative drug abusers of Hispanic ethnicity. *Public Health Nutrition*. 2004; 7\(7\): 863-870.](#)

[Forrester JE, Woods MN, Knox TA, Spiegelman D, Skinner SC, Gorbach SL. Body composition and dietary intake in relation to drug abuse in a cohort of HIV-positive persons. *J Acquir Immune Defic Syndr*. 2000; 25 Suppl 1: S43-S48.](#)

[Heller L, Fox S, Hell KJ, Church JA. Development of an instrument to assess nutritional risk factors for children infected with human immunodeficiency virus. *J Am Diet Assoc*. 2000;100\(3\): 323-329.](#)

[Henderson RA, Talusan K, Hutton N, Yolken RH, Caballero B. Serum and plasma markers of nutritional status in children infected with the human immunodeficiency virus. *J Am Diet Assoc*. 1997; 97: 1,377-1,381.](#)

[Hendricks K, Tang A, Spiegelman D, Skinner S, Woods M. Dietary intake in human immunodeficiency virus-infected adults: a comparison of dietary assessment methods. *J Am Diet Assoc*. 2005; 105: 532-540.](#)

[Hendricks KM, Willis K, Houser R, Jones CY. Obesity in HIV-infection: dietary correlates. *J Am Coll Nutr*. 2006; 25 \(4\): 321-331.](#)

[Hendricks KM, Dong KR, Tang AM, Ding B, Spiegelman D, Woods MN, Wanke CA. High-fiber diet in HIV-positive men is associated with lower risk of developing fat deposition. *Am J Clin Nutr*. 2003; 78: 790-795.](#)

[Joy T, Keogh HM, Hadigan C, Lee H, Dolan SE, Fitch K, Liebau J, Lo J, Johnsen S, Hubbard J, Anderson EJ, Grinspoon S. Dietary fat intake and relationship to serum lipid levels in HIV-infected patients with metabolic abnormalities in the HAART era. *AIDS*. 2007; 21: 1591-1600.](#)

[Luder E, Godfrey E, Godbold J, Simpson DM. Assessment of nutritional, clinical, and immunologic status of HIV-infected, inner-city patients with multiple risk factors. *J Am Diet Assoc*. 1995; 95: 655-660.](#)

[Melvin D, Wright C, Goddard S. Incidence and nature of feeding problems in young children referred to a paediatric HIV service in London: FEAD screening. *Child Care Health Dev* 1997; 23 \(4\): 297-313.](#)

[Shah M, Tierney K, Adams-Huet B, Boonyavarakul A, Jacob K, Quitner C, Dinges WL, Peterson D, Garg A. The role of diet, exercise and smoking in dyslipidemia in HIV-infected patients with lipodystrophy. *HIV Medicine*. 2005; 6: 291-298.](#)

[Woods MN, Spiegelman D, Knox TA, Forrester JE, Connors JL, Skinner SC, Siva M, Kim JH, Gorbach SL. Nutrient intake and body weight in a large HIV cohort that included women and minorities. *J Am Diet Assoc*. 2002; 102: 203-211.](#)

[Woods MN, Tang AM, Forrester J, Jones C, Hendricks K, Ding B, Knox TA. Effect of dietary intake and protease inhibitors on serum vitamin B₁₂ levels in a cohort of human immunodeficiency virus-positive patients. *Clin Infect Dis*. 2003; 37\(Suppl 2\): S124-S131.](#)

- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

Hendricks KM, Dong KR, Gerrior JL, eds. *Nutrition Management of HIV and AIDS*. Chicago, Illinois: American Dietetic Association; 2009.

- [HIV/AIDS](#)

Quick Links

Recommendations Summary

H/A: Anthropometric Assessment 2010

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

HIV/AIDS: Anthropometric Assessment

The registered dietitian (RD) should include the following anthropometric measurements in the initial assessment: Weight, height and body mass index; for children, growth pattern indices.

In addition, measurements of body compartment estimates should also be included, such as circumference measurements (mid-arm muscle, waist, hip and waist-to-hip ratio) or measurements of body cell mass and body fat [measured with skinfold thickness measurements, dual energy X-ray absorptiometry (DXA), bioelectrical impedance analysis (BIA), or bioimpedance spectroscopy].

Baseline anthropometric measurements provide information for the nutrition assessment and the majority of research in men, women, children and adolescents reports that fat-free mass and fat mass are altered in people with [HIV](#) infection.

Rating: Strong

Imperative

o [Risks/Harms of Implementing This Recommendation](#)

None.

o [Conditions of Application](#)

- Privacy or chaperones may be required for certain anthropometric measurements, such as waist circumference and body composition
- RDs or other clinic staff should be appropriately trained to measure and interpret body compartment estimates
- Studies report that dual-energy X-ray absorptiometry, bioelectrical impedance analysis, bioimpedance spectroscopy and skinfold thickness measurements provide acceptable estimations of body composition if properly calibrated
- Special bioelectrical impedance analysis equations for use in children with HIV infection are needed
- Results from various methodologies may not be comparable.

o [Potential Costs Associated with Application](#)

- Costs of medical nutrition therapy (MNT) sessions and reimbursement vary, however MNT sessions are essential for improved outcomes
- Assessment of body composition may be costly depending on the time required and methodology.

o [Recommendation Narrative](#)

- 27 studies were reviewed to evaluate the assessment of body composition of people with HIV infection
- The majority of research in men, women, children and adolescents reports that fat-free mass and fat mass are altered in people with HIV infection (Ott et al, 1995; Grady et al, 1996; Schwenk et al, 1996; Sharpstone et al, 1996; Mulligan et al, 1997; Paton et al, 1997; Arpadi et al, 1998; Henderson et al, 1998; Engelson et al, 1999; Fontana et al, 1999; Kotler et al, 1999; Arpadi et al, 2000; Batterham et al, 2000; Forrester et al, 2000; Saint-Marc et al, 2000; McDermott et al, 2001; Meisinger et al, 2002; Wilson et al, 2002; Ramirez-Marrero et al, 2004; Karmon et al, 2005; Smit et al, 2005; Visnegarwala et al, 2005; Brown et al, 2006; Moscicki et al, 2006; Papatthakis et al, 2006; Study of Fat Redistribution and Metabolic Change, 2006; Visnegarwala et al, 2007)
- 18 studies were reviewed to evaluate certain methodologies in the measurement of body composition of people with HIV infection
- Six studies in men, two studies in women and six studies in men and women report that dual energy X-ray absorptiometry, bioelectrical impedance analysis, bioimpedance spectroscopy and skinfold thickness measurements provide acceptable estimations of body composition and for measuring change in body composition (Risser et al, 1995; Kotler et al, 1996; Paton et al, 1997; Paton et al, 1998; Batterham et al, 1999; Kotler et al, 1999; Niyongabo et al, 1999; Corcoran et al, 2000; Genior et al, 2001; Andrade et al, 2002; Cavalcanti et al, 2005; Ludy et al, 2005; Papatthakis et al, 2005; Aghdassi et al, 2007)
- Results of bioelectrical impedance analysis vary with the prediction equation used and the equipment manufacturer (Smith et al, 2003; Yang et al, 2004). Studies in children report the need for bioelectrical impedance analysis equations developed for use in children with HIV infection (Arpadi et al, 1996; Fontana et al, 1999).
- Results in skinfold thickness measurements vary with the number of sites measured and the prediction equation used
- Further research is needed regarding methodology for body composition measurement in women and children, as well as in conditions of lipodystrophy, areas of the body and different ethnic groups.

o [Recommendation Strength Rationale](#)

Conclusion statements received Grades I and II.

o [Minority Opinions](#)

Consensus reached.

• [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[What is the evidence regarding assessment of body composition for people with HIV infection?](#)

[What methodologies are appropriate in the measurement of body composition of people with HIV infection?](#)

o [References](#)

[Arpadi SM, Horlick MN, Wang J, Cuff P, Bamji M, Kotler DP. Body composition in prepubertal children with human immunodeficiency virus type 1 infection. Arch Pediatr Adolesc Med. 1998 Jul; 152\(7\): 688-693.](#)

[Arpadi SM, Cuff PA, Kotler DP, Wang J, Bamji M, Lange M, Pierson RN, Matthews DE. Growth velocity, fat-free mass and energy intake are inversely related to viral load in HIV-infected children. J Nutr. 2000; 130: 2,498-2,502.](#)

[Batterham MJ, Garsia R, Greenop PA. Dietary intake, serum lipids, insulin resistance and body composition in the era of highly active antiretroviral therapy "Diet FRS Study". AIDS. 2000; 14: 1839-1843.](#)

[Brown T, Wang Z, Chu H, Palella FJ, Kingsley L, Witt MD, Dobs AS. Longitudinal anthropometric changes in HIV-infected and HIV-uninfected men. J Acquir Immune Defic Syndr. 2006; 43\(3\): 356-362.](#)

[Engelson ES, Kotler DP, Tan Y, Agin D, Wang J, Pierson RN Jr, Heymsfield SB. Fat distribution in HIV-infected patients reporting truncal enlargement quantified by whole-body magnetic resonance imaging. Am J Clin Nutr. 1999; 69\(6\): 1162-1169.](#)

[Fontana M, Zuin G, Plebani A, Bastoni K, Visconti G, Principi N. Body composition in HIV-infected children: Relations with disease progression and survival. Am J Clin Nutr. 1999; 69: 1282-1286.](#)

[Forrester JE, Woods MN, Knox TA, Spiegelman D, Skinner SC, Gorbach SL. Body composition and dietary intake in relation to drug abuse in a cohort of HIV-positive persons. J Acquir Immune Defic Syndr. 2000; 25 Suppl 1: S43-S48.](#)

[Grady C, Ropka M, Anderson R, Lane HC. Body composition in clinically stable men with HIV infection. J Assoc Nurses AIDS Care. 1996; 7\(6\): 29-38.](#)

[Henderson RA, Talusan K, Hutton N, Yolken RH, Caballero B. Resting energy expenditure and body composition in children with HIV infection. J Acquir Immune Defic Syndr Hum Retroviro. 1998; 19\(2\): 150-157.](#)

[Karmon SL, Moore RD, Dobs AS, Kenuly J, Barnett S, Cofrancesco J Jr. Body shape and composition in HIV-infected women: An urban cohort. HIV Medicine 2005; 6: 245-252.](#)

[Kotler DP, Rosenbaum K, Wang J, Pierson RN. Studies of body composition and fat distribution in HIV-infected and control subjects. J Acquir Immune Defic Syndr Hum Retroviro. 1999; 20 \(3\): 228-237.](#)

[McDermott AY, Shevitz A, Knox T, Roubenoff R, Kehayias J, Gorbach S. Effect of highly active antiretroviral therapy on fat, lean, and bone mass in HIV-seropositive men and women. Am J Clin Nutr. 2001; 74: 679-686.](#)

[Meininger G, Hadigan C, Rietschel P, Grinspoon S. Body-composition measurements as predictors of glucose and insulin abnormalities in HIV-positive men. *Am J Clin Nutr*. 2002; 76: 460-465.](#)

[Moscicki AB, Ellenberg JH, Murphy DA, Jiahong X. Associations among body composition, androgen levels, and human immunodeficiency virus status in adolescents. *J Adolesc Health*. 2006; 39\(2\): 164-173.](#)

[Mulligan K, Tai VW, Schambelan M. Cross-sectional and longitudinal evaluation of body composition in men with HIV infection. *J Acquir Immune Defic Syndr Hum Retrovirol*. 1997; 15\(1\): 43-48.](#)

[Ott M, Fischer H, Polat H, Helm EB, Frenz M, Caspary WF, Lembcke B. Bioelectrical impedance analysis as a predictor of survival in patients with human immunodeficiency virus infection. *Journal of Acquired Immune Deficiency Syndromes and Human Retrovirology*. 1995; 9\(1\): 20-25.](#)

[Papathakis PC, Van Loan MD, Rollins NC, Chantray CJ, Bennish ML, Brown KH. Body composition changes during lactation in HIV-infected and HIV-uninfected South African women. *J Acquir Immune Defic Syndr*. 2006; 43: 467-474.](#)

[Paton NIJ, Macallan DC, Jebb SA, Noble C, Baldwin C, Pazianas M, Griffin GE. Longitudinal changes in body composition measured with a variety of methods in patients with AIDS. *J Acquir Immune Defic Syndr Hum Retrovirol*. 1997; 14\(2\): 119-127.](#)

[Ramirez-Marrero FA, Smith BA, Melendez-Brau N, Santana-Bagur JL. Physical and leisure activity, body composition, and life satisfaction in HIV-positive Hispanics in Puerto Rico. *J Assoc Nurses AIDS Care*. 2004; 15\(4\): 68-77.](#)

[Saint-Marc T, Partisani M, Poizat-Martin I, Rouviere O, Bruno F, Avellaneda R, Lang JM, Gastaut JA, Touraine JL. Fat distribution evaluated by computed tomography and metabolic abnormalities in patients undergoing antiretroviral therapy: preliminary results of the LIPOCO study. *AIDS*. 2000; 14: 37-49.](#)

[Schwenk A, Hoffer-Belitz E, Jung B, Kremer G, Burger B, Salzberger B, Diehl V, Schrappe M. Resting energy expenditure, weight loss, and altered body composition in HIV infection. *Nutrition*. 1996; 12: 595-601.](#)

[Sharpstone DR, Murray CP, Ross HM, Hancock MR, Phelan MS, Crane RC, Menzies IS, Reaveley DA, Lepri AC, Nelson MR, Gazzard BG. Energy balance in asymptomatic HIV infection. *AIDS*. 1996; 10: 1,377-1,384.](#)

[Smit E, Semba RD, Pilbosian E, Vlahov D, Tun W, Purvis L, Tang AM. Body habitus in a cohort of HIV-seropositive and HIV-seronegative injection drug users. *AIDS Patient Care STDS*. 2005; 19\(1\): 19-30.](#)

[Study of Fat Redistribution and Metabolic Change in HIV Infection \(FRAM\). Fat distribution in women with HIV infection. *J Acquir Immune Defic Syndr*. 2006; 42\(5\): 562-571.](#)

[Visnegarwala F, Raghavan SS, Mullin CM, Bartsch G, Wang J, Kotler D, Gibert CL, Shlay J, Grunfeld C, Carr A, El-Sadr W, for the Terry Bein Community Program for Clinical Research on AIDS. Sex differences in the associations of HIV disease characteristics and body composition in antiretroviral-naïve persons. *Am J Clin Nutr*. 2005; 82\(4\): 850-856.](#)

[Visnegarwala F, Shlay JC, Barry V, Gibert CL, Xiang Y, Wang J, Kotler D, Raghavan S, El-Sadr WM, for Terry Bein Community Programs for Clinical Research on AIDS \(CPCRA\). Effects of HIV infection on body composition changes among men of different racial/ethnic origins. *HIV Clin Trials*. 2007; 8\(3\): 145-154.](#)

[Wilson IB, Jacobson DL, Roubenoff R, Spiegelman S, Knox TA, Gorbach SL. Changes in lean body mass and total body weight are weakly associated with physical functioning in patients with HIV infection. *HIV Medicine*. 2002; 3: 263-270.](#)

[Aghdassi E, Arendt B, Salt IE, Allard JP. Estimation of body fat mass using dual-energy x-ray absorptiometry, bioelectric impedance analysis, and anthropometry in HIV-positive male subjects receiving highly active antiretroviral therapy. *JPEN J Paren Enteral Nutr*. 2007; 31: 135-141.](#)

[Andrade S, Lan SJJ, Engelson ES, Agin D, Wang J, Heymsfield SB, Kotler DP. Use of a Durnin-Womersley formula to estimate change in subcutaneous fat content in HIV-infected subjects. *Am J Clin Nutr*. 2002; 75: 587-592.](#)

[Apardi SM, Wang J, Cuff PA, Thornton J, Horlick M, Kotler DP, Pierson RN. Application of bioimpedance analysis for estimating body composition in prepubertal children infected with human immunodeficiency virus type 1. *J Pediatr*. 1996; 129\(5\): 755-757.](#)

[Batterham MJ, Garsia R, Greenop P. Measurement of body composition in people with HIV/AIDS: A comparison of bioelectrical impedance and skinfold anthropometry with dual-energy x-ray absorptiometry. *J Am Diet Assoc* 1999; 99 \(9\): 1109-1111.](#)

[Cavalcanti RB, Cheung AM, Raboud J, Walmsley S. Reproducibility of DXA estimations of body fat in HIV lipodystrophy. *Journal of Clinical Densitometry* 2005; 8\(3\): 293-297.](#)

[Corcoran C, Anderson EJ, Burrows B, Stanley T, Walsh M, Poulos AM, Grinspoon S. Comparison of total body potassium with other techniques for measuring lean body mass in men and women with AIDS wasting. *Am J Clin Nutr*. 2000; 72: 1053-1058.](#)

[Fontana M, Zuin G, Plebani A, Bastoni K, Visconti G, Principi N. Body composition in HIV-infected children: Relations with disease progression and survival. *Am J Clin Nutr*. 1999; 69: 1282-1286.](#)

[Gerrior J, Kantaros J, Coakley E, Albrecht M, Wanke C. The fat redistribution syndrome in patients infected with HIV: Measurements of body shape abnormalities. *J Am Diet Assoc*. 2001; 101: 1175-1180.](#)

[Kotler DP, Burastero S, Wang J, Pierson RN. Prediction of body cell mass, fat-free mass, and total body water with bioelectrical impedance analysis: Effects of race, sex and disease. *Am J Clin Nutr*. 1996; 64\(suppl\): 489S-497S.](#)

[Kotler DP, Rosenbaum K, Allison DB, Wang J, Pierson RN. Validation of bioimpedance analysis as a measure of change in body cell mass as estimated by whole-body counting of potassium in adults. *JPEN*. 1999; 23\(6\): 345-349.](#)

[Ludy MJ, Hendricks K, Houser R, Chetchotisakd P, Mootsikapun P, Anunnatsiri S, Price E, Wanke CA. Body composition in adults infected with human immunodeficiency virus in Khon Kaen, Thailand. *Am J Trop Med Hyg*. 2005; 73\(4\): 815-819.](#)

[Niyongabo T, Melchior JC, Henzel D, Bouchard O, LaRouze B. Comparison of methods for assessing nutritional status in HIV-infected adults. *Nutrition*. 1999; 15\(10\): 740-743.](#)

[Papathakis PC, Rollins NC, Brown KH, Bennish ML, Van Loan MD. Comparison of isotope dilution with bioimpedance spectroscopy and anthropometry for assessment of body composition in asymptomatic HIV-infected and HIV-uninfected breastfeeding mothers. *Am J Clin Nutr*. 2005; 82: 538-546.](#)

[Paton NIJ, Macallan DC, Jebb SA, Noble C, Baldwin C, Pazianas M, Griffin GE. Longitudinal changes in body composition measured with a variety of methods in patients with AIDS. *J Acquir Immune Defic Syndr Hum Retrovirol*. 1997; 14\(2\): 119-127.](#)

[Paton NI, Elia M, Jennings G, Ward LC, Griffin GE. Bioelectrical impedance analysis in human immunodeficiency virus-infected patients: Comparison of single frequency with multifrequency, spectroscopy, and other novel approaches. *Nutrition*. 1998; 14: 658-666.](#)

[Risser JMH, Rabeneck L, Foote LW, Klish WJ. A comparison of fat-free mass estimates in men infected with the human immunodeficiency virus. *JPEN*. 1995; 19: 28-32.](#)

[Smith DE, Hudson J, Martin A, Freund J, Griffiths MR, Kalnins S, Law M, Carr A, Cooper DA, for the PIILR DEXA Group and Investigators. Centralized assessment of dual-energy X-ray absorptiometry \(DEXA\) in multicenter studies of HIV-associated lipodystrophy. *HIV Clin Trials*. 2003; 4\(1\): 45-49.](#)

[Yang Y, Zhu WDJ, Paton NI. Comparison of dual-energy X-ray absorptiometry machines for measuring fat distribution changes of HIV-associated lipodystrophy. *Antivir Ther*. 2004; 9\(5\): 771-778.](#)

- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

Hendricks KM, Dong KR, Gerritor JL, eds. *Nutrition Management of HIV and AIDS*. Chicago, Illinois: American Dietetic Association; 2009.

- [HIV/AIDS](#)

Quick Links

Recommendations Summary

H/A: Energy Needs 2010

[Click here](#) to see the explanation of recommendation ratings (*Strong, Fair, Weak, Consensus, Insufficient Evidence*) and labels (*Imperative or Conditional*). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

HIV/AIDS: Determining Energy Needs

The registered dietitian (RD) should use clinical judgment and consider several factors when determining the energy needs of adults and children with HIV infection to maintain a healthy body weight. Factors related to energy needs in people with HIV infection include age, gender, stage of disease, nutritional status, opportunistic infections and comorbidities, inflammation and effects of medications. Although research reports increased *resting* energy expenditure (as much as 5% to 17%) in people with [HIV](#) infection, *total* energy expenditure may be similar to that of healthy control subjects.

Rating: Fair

Imperative

- [Risks/Harms of Implementing This Recommendation](#)

None.

- [Conditions of Application](#)

- In the critically ill, for more information regarding determination of resting energy expenditure, refer to the [Critical Illness Algorithm](#)
- In the normal-weight adult population, for more information regarding determination of resting energy expenditure, refer to the [Determining Resting Metabolic Rate](#) project
- In the overweight or obese adult population, for more information regarding determination of resting energy expenditure, refer to the [Adult Weight Management Algorithm](#)
- In the overweight or obese pediatric population, refer to the [Pediatric Weight Management Algorithm](#).

- [Potential Costs Associated with Application](#)

Costs of medical nutrition therapy ([MNT](#)) sessions and reimbursement vary, however MNT sessions are essential for improved outcomes.

- [Recommendation Narrative](#)

- 24 studies were evaluated regarding energy intake in people with HIV infection
- Eight out of nine studies report increased resting energy expenditure (as much as 5% to 17%) in people with HIV infection, compared to healthy controls (Schwenk et al, 1996; Sharpstone et al, 1996; Sharpstone et al, 1997; Grinspoon et al, 1998; Lane and Provost-Craig, 2000; Batterham et al, 2003; Batterham, 2005)
- However, total energy expenditure may be similar to that of control subjects (Macallan et al, 1995; Paton et al, 1996; Sheehan and Macallan, 2000)
- Energy balance deficits result in growth failure in children with HIV infection (Arpadi et al, 2000; Johann-Liang et al, 2000)
- Factors related to energy needs in people with HIV infection include stage of disease, opportunistic infections and comorbidities, inflammation and effects of medications (Beaugerie et al, 1998; Jimenez-Exposito et al, 1998; Silva et al, 1998; Renard et al, 1999; Sharpstone et al, 1999; Shevitz et al, 1999; Garcia-Lorda et al, 2000; Suttman et al, 2000; Batterham et al, 2002; Roubenoff et al, 2002; Jacobson et al, 2003; Mwamburi et al, 2005)
- Further research is needed regarding energy requirements in people with HIV infection.

- [Recommendation Strength Rationale](#)

Conclusion statement received Grade II.

- [Minority Opinions](#)

Consensus reached.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[What is the evidence regarding a particular dietary intake of energy for people with HIV infection?](#)

- [References](#)

[Arpadi SM, Cuff PA, Kotler DP, Wang J, Bamji M, Lange M, Pierson RN, Matthews DE. Growth velocity, fat-free mass and energy intake are inversely related to viral load in HIV-infected children. *J Nutr*. 2000; 130: 2,498-2,502.](#)

[Batterham MJ. Investigating heterogeneity in studies of resting energy expenditure in persons with HIV/AIDS: a meta-analysis. *Am J Clin Nutr*. 2005; 81: 702-713.](#)

[Batterham MJ, Garcia R, Greenop P. Prevalence and predictors of HIV-associated weight loss in the era of highly active antiretroviral therapy. *Int J STD AIDS*. 2002; 13: 744-747.](#)

[Batterham MJ, Morgan-Jones J, Greenop P, Garcia R, Gold J, Caterson I. Calculating energy requirements for men with HIV/AIDS in the era of highly active antiretroviral therapy. *Eur J Clin Nutr*. 2003; 57: 209-217.](#)

[Beaugerie L, Carbonnel F, Carrat F, Rached AA, Maslo C, Gendre J-P, Rozenbaum W, Cosnes J. Factors of weight loss in patients with HIV and chronic diarrhea. *J Acq Immune Def Syn Human Retrovirology*. 1998; 19: 34-39.](#)

[Garcia-Lorda P, Serrano P, Jimenez-Exposito MJ, Fraile J, Bullo M, Alonso C, Bonada A, Viciana P, Luna PPG, Salas-Salvado J. Cytokine-driven inflammatory response is associated with the hypermetabolism of AIDS patients with opportunistic infections. *J Parenteral Enteral Nutr*. 2000; 24: 317-322.](#)

[Grinspoon S, Corcoran C, Miller K, Wang E, Hubbard J, Schoenfeld D, Anderson E, Basgoz N, Klibanski A. Determinants of increased energy expenditure in HIV-infected women. *Am J Clin Nutr*. 1998; 68: 720-725.](#)

[Jacobson DL, Bica I, Knox TA, Wanke C, Tchetgen E, Spiegelman D, Silva M, Gorbach S, Wilson IB. Difficulty swallowing and lack of receipt of highly active antiretroviral therapy predict acute weight loss in human immunodeficiency virus disease. *Clin Infect Dis*. 2003; 37 \(10\): 1,349-1,356.](#)

[Jimenez-Exposito MJ, Garcia-Lorda P, Alonso-Villaverde C, de Virgala CM, Sola R, Masana L, Arija V, Izquierdo V, Salas-Salvado J. Effect of malabsorption on nutritional status and resting energy expenditure in HIV-infected patients. *AIDS*. 1998; 12: 1,965-1,972.](#)

[Johann-Liang R, O'Neill L, Cervia J, Haller I, Giunta Y, Licholai T, Noel GJ. Energy balance, viral burden, insulin-like growth factor-1, interleukin-6 and growth impairment in children infected with human immunodeficiency virus. *AIDS*. 2000; 14: 683-690.](#)

[Lane BJ, Provost-Craig MA. Resting energy expenditure in asymptomatic HIV-infected females. *J Women's Health Gen'd Based Med*. 2000; 9 \(3\): 321-327.](#)

[Macallan DC, Noble C, Baldwin G, Jebb SA, Prentice AM, Coward A, Sawyer MB, McManus TJ, Griffin GE. Energy expenditure and wasting in human immunodeficiency virus infection. *N Engl J Med*. 1995; 333: 83-88.](#)

[Mwamburi DM, Wilson IB, Jacobson DL, Spiegelman D, Gorbach SL, Knox TA, Wanke CA. Understanding the role of HIV load in determining weight change in the era of highly active antiretroviral therapy. *Clin Infect Dis*. 2005; 40 \(1\): 167-173.](#)

[Paton NJJ, Elia M, Jebb SA, Jennings G, Macallan DC, Griffin GE. Total energy expenditure and physical activity measured with the bicarbonate-urea method in patients with human immunodeficiency virus infection. *Clin Sci \(Lond\)*. 1996; 91 \(2\): 241-245.](#)

[Renard E, Fabre J, Paris F, Reynes J, Bringer J. Syndrome of body fat redistribution in HIV-1-infected patients: relationships to cortisol and catecholamines. *Clin Endocrinol \(Oxf\)*. 1999; 51 \(2\): 223-230.](#)

[Roubenoff R, Grinspoon S, Skolnik PR, Tchetchen E, Abad L, Spiegelman D, Knox T, Gorbach S. Role of cytokines and testosterone in regulating lean body mass and resting energy expenditure in HIV-infected men. *Am J Physiol Endocrinol Metab*. 2002; 283: E138-145.](#)

[Schwenk A, Hoffer-Beltz E, Jung B, Kremer G, Burger B, Salzberger B, Diehl V, Schrappe M. Resting energy expenditure, weight loss, and altered body composition in HIV infection. *Nutrition*. 1996; 12: 595-601.](#)

[Sharpstone DR, Murray CP, Ross HM, Hancock MR, Phelan MS, Crane RC, Menzies IS, Reaveley DA, Lepri AC, Nelson MR, Gazzard BG. Energy balance in asymptomatic HIV infection. *AIDS*. 1996; 10: 1,377-1,384.](#)

[Sharpstone D, Murray C, Ross H, Phelan M, Crane R, Lepri AC, Nelson M, Gazzard B. The influence of nutritional and metabolic status on progression from asymptomatic HIV infection to AIDS-defining diagnosis. *AIDS*. 1999; 13: 1,221-1,226.](#)

[Sharpstone D, Ross H, Hancock M, Phelan M, Crane R, Gazzard B. Indirect calorimetry, body composition and small bowel function in asymptomatic HIV-seropositive women. *Int J STD AIDS*. 1997; 8 \(11\): 700-703.](#)

[Sheehan LA, Macallan DC. Determinants of energy intake and energy expenditure in HIV and AIDS. *Nutrition*. 2000; 16: 101-106.](#)

[Shevitz AH, Knox TA, Spiegelman D, Roubenoff R, Gorbach SL, Skolnik PR. Elevated resting energy expenditure among HIV-seropositive persons receiving highly active antiretroviral therapy. *AIDS* 1999; 13: 1,351-1,357.](#)

[Silva M, Skolnik PR, Gorbach SL, Spiegelman D, Wilson IB, Fernandez-DiFranco MG, Knox TA. The effect of protease inhibitors on weight and body composition in HIV-infected patients. *AIDS*. 1998; 12: 1,645-1,651.](#)

[Suttman U, Holtmannspotter M, Ockenga J, Gallati H, Deicher H, Selberg O. Tumor necrosis factor, interleukin-6, and epinephrine are associated with hypermetabolism in AIDS patients with acute opportunistic infections. *Ann Nutr Metab*. 2000; 44: 43-53.](#)

- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

Hendricks KM, Dong KR, Gerrior JL, eds. *Nutrition Management of HIV and AIDS*. Chicago, Illinois: American Dietetic Association; 2009.

- [HIV/AIDS](#)

Quick Links

Recommendations Summary

H/A: Macronutrient Composition 2010

[Click here](#) to see the explanation of recommendation ratings (*Strong, Fair, Weak, Consensus, Insufficient Evidence*) and labels (*Imperative or Conditional*). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

HIV/AIDS: Macronutrient Composition

- The registered dietitian (RD) should prescribe an individualized diet with a macronutrient composition based on the Dietary Reference Intakes (DRI), 20% to 35% of calories from fat, 45% to 65% of calories from carbohydrate, 14g fiber per 1,000kcal and 10% to 35% of calories from protein)
- In people with HIV infection, protein needs are highly individualized. Low-fiber/high-fat diets are associated with fat deposition, insulin resistance and obesity. Studies indicate that diets low in saturated and total fat resulted in reduced triglyceride levels, increased HDL-cholesterol levels and a lower risk of lipohypertrophy.

Rating: Fair

Imperative

HIV/AIDS: Macronutrient Composition for Hyperlipidemia

- For people with HIV infection who have hyperlipidemia, the RD should encourage consumption of a cardioprotective dietary pattern tailored to the individual's needs to provide a fat intake of 25% to 35% of calories, less than 7% of calories from saturated fat, less than 1% of calories from trans-fatty acids and under 200mg of cholesterol per day
- Research on several lifestyle modification interventions for the treatment of hyperlipidemia in people with HIV infection reports improvements in serum lipid profile. Studies indicate that diets low in saturated and total fat and including omega-3 fatty acids resulted in reduced triglyceride levels, increased HDL-cholesterol levels and a lower risk of lipohypertrophy.

Rating: Strong

Conditional

- [Risks/Harms of Implementing This Recommendation](#)

None.

- [Conditions of Application](#)

- The acceptable DRI ranges for children are similar to those for adults, except that infants and younger children need a somewhat higher proportion of fat in their diets
- For the recommendation *HIV/AIDS: Macronutrient Composition for Hyperlipidemia*, this recommendation applies to people with HIV infection who have hyperlipidemia
- For more information regarding the treatment of hyperlipidemia, refer to the [Disorders of Lipid Metabolism](#) algorithm.

- [Potential Costs Associated with Application](#)

Costs of medical nutrition therapy (MNT) sessions and reimbursement vary, however MNT sessions are essential for improved outcomes.

- [Recommendation Narrative](#)

- In people with HIV infection, protein needs are highly individualized
- While diets that are higher in protein (at intake levels higher than the RDA) may result in increased body weight and body cell mass, protein requirements were not addressed in these studies (Henderson et al, 1997; Hendricks et al, 2003; Williams et al, 2003; Hendricks et al, 2008; Isaac et al, 2008; Samaras et al 2009)
- Further research regarding protein needs and implications in people with HIV infection is warranted
- Studies report that people with HIV infection generally consume diets that are low in fiber and high in fat. Evidence supports a positive relationship between low-fiber/high-fat diets and fat deposition, insulin resistance and obesity (Hendricks et al, 2003; Dong et al, 2006; Arendt et al, 2008; Capili and Anastasi, 2008; Hendricks et al, 2008; Isaac et al, 2008; Sharma et al, 2008; Samaras et al, 2009)
- Further research regarding carbohydrate needs and implications in people with HIV infection is warranted
- Studies report that people with HIV infection generally consume diets that are high in fat, saturated fat and cholesterol. Evidence supports a relationship between diets that are high in saturated fat and hyperlipidemia, particularly hypertriglyceridemia (Joy et al, 2007; Arendt et al, 2008; Capili and Anastasi et al, 2008; Hendricks et al, 2008; Samaras et al, 2009)
- Studies indicate that diets low in saturated and total fat and including omega-3 fatty acids resulted in reduced triglyceride levels, increased HDL-cholesterol levels and a lower risk of lipohypertrophy (Hellerstein et al, 1996; Agostoni et al, 1998; Pichard et al, 1998; de Luis Roman et al, 2001; Oosthuizen et al, 2006; De Truchis et al, 2007; Isaac et al, 2008; Tsiodras et al, 2009; Turcinov et al, 2009; Woods et al, 2009)
- Further research regarding dosage and duration of specific fatty acid supplementation in people with HIV infection is warranted
- 12 studies were reviewed to evaluate lifestyle interventions for the treatment of hyperlipidemia in people with HIV infection
- Two studies demonstrate that protease-inhibitor therapy is associated with hyperlipidemia (Segarra-Newnham et al, 2002; Wanke et al, 2005)
- Three studies report that other lifestyle factors are associated with hyperlipidemia, such as exercise and the consumption of fat, fiber and alcohol (Hadigan et al, 2001; Gavrilu et al, 2003; Shah et al, 2005)
- Research on several lifestyle modification interventions for the treatment of hyperlipidemia in people with HIV infection reports improvements in serum lipid profile (Melroe et al, 1999; Moyle et al, 2001; Yarasheski et al, 2001; Barrios et al, 2002; Thoni et al, 2002; Gerber et al, 2004; Wohl et al, 2005).

- [Recommendation Strength Rationale](#)

- For the recommendation *HIV/AIDS: Micronutrient Composition*, conclusion statements received Grades II and III
- For the recommendation *HIV/AIDS: Macronutrient Composition for Hyperlipidemia*, conclusion statements received Grades I and II.

- [Minority Opinions](#)

Consensus reached.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[What amount of dietary intake of protein is appropriate for people with HIV infection?](#)

[What amount of dietary intake of carbohydrate is appropriate for people with HIV infection?](#)

[What is the evidence regarding the consumption of dietary fatty acids for people with HIV infection?](#)

[What is the evidence regarding lifestyle interventions for the treatment of hyperlipidemia in people with HIV infection?](#)

- [References](#)

[Henderson RA, Talusan K, Hutton N, Yolken RH, Caballero B. Serum and plasma markers of nutritional status in children infected with the human immunodeficiency virus. *J Am Diet Assoc.* 1997; 97: 1.377-1.381.](#)

[Hendricks KM, Dong KR, Tang AM, Ding B, Spiegelman D, Woods MN, Wanke CA. High-fiber diet in HIV-positive men is associated with lower risk of developing fat deposition. *Am J Clin Nutr.* 2003; 78: 790-795.](#)

[Hendricks KM, Mwamburi DM, Newby PK, Wanke CA. Dietary patterns and health and nutrition outcomes in men living with HIV infection. *Am J Clin Nutr.* 2008; 88 \(6\): 1584-1592.](#)

[Isaac R, Jacobson D, Wanke C, Hendricks K, Knox TA, Wilson IB. Declines in dietary macronutrient intake in persons with HIV infection who develop depression. *Public Health Nutrition.* 2008; 11 \(2\): 124-131.](#)

[Samaras K, Wand H, Law M, Emery S, Cooper DA, Carr A. Dietary intake in HIV-infected men with lipodystrophy: relationships with body composition, visceral fat, lipid, glucose and adipokine metabolism. *Current HIV Research.* 2009; 7 \(4\): 454-461.](#)

[Williams SB, Bartsch G, Muurhainen N, Collins G, Raghavan SS, Wheeler D. Protein intake is positively associated with body cell mass in weight-stable HIV-infected men. *J Nutr.* 2003; 133: 1.143-1.146.](#)

[Arendt BA, Aghdassi E, Mohammed SS, Fung LY, Jalali P, Salit IE, Allard JP. Dietary intake and physical activity in a Canadian population sample of male patients with HIV infection and metabolic abnormalities. *Current HIV Research.* 2008; 6 \(1\): 82-90.](#)

[Capili B, Anastasi JK. Body mass index and nutritional intake in patients with HIV and chronic diarrhea: A secondary analysis. *J Am Acad Nurse Pract.* 2008; 20\(9\): 463-470.](#)

[Dong KR, Wanke CA, Tang AM, Ding B, Hendricks KM. Dietary glycemic index of human immunodeficiency virus-positive men with and without fat deposition. *J Am Diet Assoc.* 2006; 106: 728-732.](#)

[Hendricks KM, Dong KR, Tang AM, Ding B, Spiegelman D, Woods MN, Wanke CA. High-fiber diet in HIV-positive men is associated with lower risk of developing fat deposition. *Am J Clin Nutr.* 2003; 78: 790-795.](#)

[Hendricks KM, Mwamburi DM, Newby PK, Wanke CA. Dietary patterns and health and nutrition outcomes in men living with HIV infection. *Am J Clin Nutr.* 2008; 88 \(6\): 1584-1592.](#)

[Isaac R, Jacobson D, Wanke C, Hendricks K, Knox TA, Wilson IB. Declines in dietary macronutrient intake in persons with HIV infection who develop depression. *Public Health Nutrition.* 2008; 11 \(2\): 124-131.](#)

[Samaras K, Wand H, Law M, Emery S, Cooper DA, Carr A. Dietary intake in HIV-infected men with lipodystrophy: relationships with body composition, visceral fat, lipid, glucose and adipokine metabolism. *Current HIV Research.* 2009; 7 \(4\): 454-461.](#)

[Sharma TS, Kinnamon DD, Duggan C, Weinberg GA, Furuta L, Bechard L, Nichitta J, Gorbach SL, Miller TL. Changes in macronutrient intake among HIV-infected children between 1995 and 2004. *Am J Clin Nutr.* 2008; 88: 384-391.](#)

[Agostoni C, Zuccotti GV, Riva E, Decarlis S, Bernardo L, Bruzzese MG, Giovannini M. Low levels of linoleic acid in plasma total lipids of HIV-1 seropositive children. *J Am Coll Nutr.* 1998; 17 \(1\): 25-29.](#)

[Arendt BA, Aghdassi E, Mohammed SS, Fung LY, Jalali P, Salit IE, Allard JP. Dietary intake and physical activity in a Canadian population sample of male patients with HIV infection and metabolic abnormalities. *Current HIV Research.* 2008; 6 \(1\): 82-90.](#)

[Capili B, Anastasi JK. Body mass index and nutritional intake in patients with HIV and chronic diarrhea: A secondary analysis. *J Am Acad Nurse Pract.* 2008; 20\(9\): 463-470.](#)

[de Luis Roman DA, Bachiller P, Izaola O, Romero E, Martin J, Arranz M, Eiros Bouza JM, Aller R. Nutritional treatment for acquired immunodeficiency virus infection using an](#)

[enterotropic peptide-based formula enriched with n-3 fatty acids: a randomized prospective trial. *Eur J Clin Nutr.* 2001; 55: 1,048-1,052.](#)

[De Truchis P, Kirstetter M, Perier A, Meunier C, Zucman D, Force G, Doll J, Katlama C, Rozenbaum W, Masson H, Gardette J, Melchior JC, and the Maxepa-HIV Group. Reduction in triglyceride level with N-3 polyunsaturated fatty acids in HIV-infected patients taking potent antiretroviral therapy: A randomized prospective study. *J Acquir Immune Defic Syndr.* 2007; 44\(3\): 278-285.](#)

[Hellerstein MK, Wu K, McGrath M, Faix D, George D, Shackleton CHL, Horn W, Hoh R, Neese RA. Effects of dietary n-3 fatty acid supplementation in men with weight loss associated with the acquired immune deficiency syndrome: relation to indices of cytokine production. *J Acquir Immune Defic Syndr Hum Retrovirol.* 1996; 11 \(3\): 258-270.](#)

[Hendricks KM, Mwamburi DM, Newby PK, Wanke CA. Dietary patterns and health and nutrition outcomes in men living with HIV infection. *Am J Clin Nutr.* 2008; 88 \(6\): 1584-1592.](#)

[Isaac R, Jacobson D, Wanke C, Hendricks K, Knox TA, Wilson IB. Declines in dietary macronutrient intake in persons with HIV infection who develop depression. *Public Health Nutrition.* 2008; 11 \(2\): 124-131.](#)

[Joy T, Keogh HM, Hadigan C, Lee H, Dolan SE, Fitch K, Liebau J, Lo J, Johnsen S, Hubbard J, Anderson EJ, Grinspoon S. Dietary fat intake and relationship to serum lipid levels in HIV-infected patients with metabolic abnormalities in the HAART era. *AIDS* 2007; 21: 1,591-1,600.](#)

[Oosthuizen W, van Graan A, Kruger A, Vorster HH. Polyunsaturated fatty acid intake is adversely related to liver function in HIV-infected subjects: the THUSA study. *Am J Clin Nutr.* 2006; 83: 1,193-1,198.](#)

[Pichard C, Sudre P, Karsegard V, Yerly S, Slosman DO, Delley V, Perrin L, Hirschel B and the Swiss HIV Cohort Study. A randomized double-blind controlled study of six months of oral nutritional supplementation with arginine and omega-3 fatty acids in HIV-infected patients. *AIDS.* 1998; 12: 53-63.](#)

[Samaras K, Wand H, Law M, Emery S, Cooper DA, Carr A. Dietary intake in HIV-infected men with lipodystrophy: relationships with body composition, visceral fat, lipid, glucose and adipokine metabolism. *Current HIV Research.* 2009; 7 \(4\): 454-461.](#)

[Tsioufas S, Poulia KA, Yannakoulia M, Chimienti SN, Wadhwa S, Karchmer AW, Mantzoros CS. Adherence to Mediterranean diet is favorably associated with metabolic parameters in HIV-positive patients with the highly active anti-retroviral therapy-induced metabolic syndrome and lipodystrophy. *Metabolism* 2009; 58\(6\): 854-859.](#)

[Turcinov D, Stanley C, Rutherford G, Novotny T, Begovac J. Adherence to the Mediterranean diet is associated with a lower risk of body-shape changes in Croatian patients treated with combination antiretroviral therapy. *Eur J Epidemiol* 2009;24\(5\):267-74.](#)

[Woods MN, Wanke CA, Ling PR, Hendricks KM, Tang AM, Knox TA, Andersson CE, Dong KR, Skinner SC, Bistran BR. Effect of a dietary intervention and n-3 fatty acid supplementation on measures of serum lipid and insulin sensitivity in persons with HIV. *Am J Clin Nutr.* 2009; 90\(6\): 1,566-1,578.](#)

[Barrios A, Blanco F, Garcia-Benayas T, Gomez-Viera JM, de la Cruz JJ, Soriano V, Gonzalez-Lahoz J. Effect of dietary intervention on highly active antiretroviral therapy-related dyslipemia. *AIDS.* 2002; 16\(15\): 2,079-2,081.](#)

[Gavrila A, Tsioufas S, Doweiko J, Nagy GS, Brodovicz K, Hsu W, Karchmer AW, Mantzoros CS. Exercise and vitamin E intake are independently associated with metabolic abnormalities in human immunodeficiency virus-positive subjects: A cross-sectional study. *Clin Infect Dis.* 2003; 36\(12\): 1,593-1,601.](#)

[Gerber MT, Mondy KE, Yarasheski KE, Drechsler H, Claxton S, Stoneman J, DeMarco D, Powderly WG, Tebas P. Niacin in HIV-Infected individuals with hyperlipidemia receiving potent antiretroviral therapy. *Clin Infect Dis.* 2004; 39\(3\): 419-425.](#)

[Hadigan C, Jeste S, Anderson EJ, Tsay R, Cyr H, Grinspoon S. Modifiable dietary habits and their relation to metabolic abnormalities in men and women with human immunodeficiency virus infection and fat redistribution. *Clin Infect Dis.* 2001; 33\(5\): 710-717.](#)

[Melroe NH, Kopaczewski J, Henry K, Huebsch, J. Intervention for hyperlipidemia associated with protease inhibitors. *J Assoc Nurses AIDS Care.* 1999; 10: 55-69.](#)

[Moyle GJ, Lloyd M, Reynolds B, Baldwin C, Mandalia S, Gazzard BG. Dietary advice with or without pravastatin for the management of hypercholesterolemia associated with protease inhibitor therapy. *AIDS.* 2001; 15: 1,503-1,508.](#)

[Segarra-Newnham M. Hyperlipidemia in HIV-positive patients receiving antiretrovirals. *Ann Pharmacother.* 2002; 36: 592-595.](#)

[Shah M, Tiemey K, Adams-Huet B, Boonyavarakul A, Jacob K, Quittner C, Dinges WL, Peterson D, Garg A. The role of diet, exercise and smoking in dyslipidemia in HIV-infected patients with lipodystrophy. *HIV Medicine.* 2005; 6: 291-298.](#)

[Thoni GJ, Fedou C, Brun JF, Fabre J, Renard E, Reynes J, Varray A, Mercier J. Reduction of fat accumulation and lipid disorders by individualized light aerobic training in human immunodeficiency virus infected patients with lipodystrophy and/or dyslipidemia. *Diabetes Metab.* 2002; 28: 397-404.](#)

[Wanke C, Gerrior J, Hendricks K, McNamara J, Schaefer E. Alterations in lipid profiles in HIV-infected patients treated with protease inhibitor therapy are not influenced by diet. *Nutr Clin Pract.* 2005; 20\(6\): 668-673.](#)

[Wohl DA, Tien HC, Busby M, Cunningham C, MacIntosh B, Napravnik S, Danan E, Donovan K, Hossenipour M, Simpson RJ. Randomized study of the safety and efficacy of fish oil \(omega-3 fatty acid\) supplementation with dietary and exercise counseling for the treatment of antiretroviral therapy-associated hypertriglyceridemia. *Clinical Infectious Diseases.* 2005; 41: 1498-1504.](#)

[Yarasheski KE, Tebas P, Stanerson B, Claxton S, Marin D, Bae K, Kennedy M, Tantisiriwat W, Powderly WG. Resistance exercise training reduces hypertriglyceridemia in HIV-infected men treated with antiviral therapy. *J Appl Physiol.* 2001; 90: 133-138.](#)

- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

- Hendricks KM, Dong KR, Gerrior JL, eds. *Nutrition Management of HIV and AIDS.* Chicago, Illinois: American Dietetic Association; 2009.
- Institute of Medicine. Tables for DRI Values: Summary Listing Table. <http://www.iom.edu/Activities/Nutrition/SummaryDRIs/~//media/Files/Activity%20Files/Nutrition/DRIs/DRISummaryListing3.ashx>

- [HIV/AIDS](#)

Quick Links

Recommendations Summary

H/A: Vitamin and Mineral Supplementation 2010

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

HIV/AIDS: Vitamin and Mineral Supplementation

If people with HIV infection can not meet their Recommended Dietary Allowance (RDA) levels for micronutrients through diet, the registered dietitian (RD) should recommend vitamin and

mineral supplements, especially for calcium and vitamin D. Micronutrient deficiencies are common in HIV-infected individuals and studies report increased morbidity and mortality in those not taking vitamin supplementation.

Rating: Strong

Conditional

- [Risks/Harms of Implementing This Recommendation](#)
- [Conditions of Application](#)
- [Potential Costs Associated with Application](#)
- [Recommendation Narrative](#)
- [Recommendation Strength Rationale](#)

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[Is there evidence that micronutrient supplementation benefits people with HIV infection?](#)

[What is the evidence regarding dietary treatment of diarrhea/malabsorption in people with HIV infection?](#)

- [References](#)

[Austin J, Singhal N, Voigt R, Smail F, Gill MJ, Walmsley S, Salit I, Gilmour J, Schlech WF, Choudhri S, Rachlis A, Cohen J, Trottier S, Toma E, Phillips P, Ford PM, Woods R, Singer J, Zarowny DP, Cameron DW, for the CTN 091/CRIR Carotenoids Study Group. A community randomized controlled clinical trial of mixed carotenoids and micronutrient supplementation of patients with Acquired Immunodeficiency Syndrome. *European Journal of Clinical Nutrition*, 2006; 60: 1,266-1,276.](#)

[Baylin A, Villamor E, Rifai N, Msamanga G, Fawzi WW. Effect of micronutrient supplementation to HIV-infected pregnant women on the micronutrient status of their infants. *Eur J Clin Nutr*. 2005; 59: 960-968.](#)

[Fawzi WW, Msamanga GI, Kupka R, Spiegelman D, Villamor E, Mugusi F, Wei R, Hunter D. Multivitamin supplementation improves hematologic status in HIV-infected women and their children in Tanzania. *Am J Clin Nutr*. 2007; 85: 1,335-1,343.](#)

[Hendricks KM, Sansevero M, Houser RF, Tang AM, Wanke CA. Dietary supplement use and nutrient intake in HIV-infected persons. *AIDS Reader*. 2007; 17: 211-216, 223-227.](#)

[Irlam JH, Visser ME, Rollins N, Siegfried N. Micronutrient supplementation in children and adults with HIV infection. *Cochrane Database of Systematic Reviews*. 2005; \(4\): Art. No:CD003650. DOI:10.1002/14651858.CD003650.pub2.](#)

[Jones CY, Tang AM, Forrester JE, Huang J, Hendricks KM, Knox TA, Spiegelman D, Semba RD, Woods MN. Micronutrient levels and HIV disease status in HIV-infected patients on highly active antiretroviral therapy in the Nutrition for Healthy Living Cohort. *J Acquir Immune Defic Syndr*. 2006; 43\(4\): 475-482.](#)

[Kaiser JD, Campa AM, Ondercin JP, Leoung GS, Pless RF, Baum MK. Micronutrient supplementation increases CD4 count in HIV-infected individuals on highly active antiretroviral therapy: A prospective, double-blinded, placebo-controlled trial. *J Acquir Immune Defic Syndr*. 2006; 42: 523-528.](#)

[Kruzich LA, Marquis GS, Carriguiry AL, Wilson CM, Stephensen CB. US youths in the early stages of HIV disease have low intakes of some micronutrients important for optimal immune function. *J Am Diet Assoc*. 2004; 104: 1,095-1,101.](#)

[McGrath N, Bellinger D, Robins J, Msamanga GI, Tronick E, Fawzi WW. Effect of maternal multivitamin supplementation on the mental and psychomotor development of children who are born to HIV-1-infected mothers in Tanzania. *Pediatrics*. 2006; 117: e216-e225.](#)

[Merchant AT, Msamanga G, Villamor E, Saathoff E, O'Brien M, Hertzmark E, Hunter DJ, Fawzi WW. Multivitamin supplementation of HIV-positive women during pregnancy reduces hypertension. *J Nutr*. 2005; 135: 1,776-1,781.](#)

[Papatthakis PC, Rollins NC, Chantry CJ, Bennish ML, Brown KH. Micronutrient status during lactation in HIV-infected and HIV-uninfected South African women during the first six months after delivery. *Am J Clin Nutr*. 2007; 85: 182-192.](#)

[Villamor E, Saathoff E, Bosch RJ, Hertzmark E, Baylin A, Manji K, Msamanga G, Hunter DJ, Fawzi WW. Vitamin supplementation of HIV-infected women improves postnatal child growth. *American Journal of Clinical Nutrition*. 2005; 81: 880-888.](#)

[Villamor E, Saathoff E, Manji K, Msamanga G, Hunter DJ, Fawzi WW. Vitamin supplements, socioeconomic status and morbidity events as predictors of wasting in HIV-infected women from Tanzania. *Am J Clin Nutr*. 2005; 82\(4\): 857-865.](#)

[Allen SJ, Okoko B, Martinez E, Gregorio G, Dans LF. Probiotics for treating infectious diarrhoea. *Cochrane Database Syst Rev*. 2004; \(2\): CD003048.](#)

[Amadi B, Mwiya M, Chomba E, Thomson M, Chintu C, Kelly P, Walker-Smith J. Improved nutritional recovery on an elemental diet in Zambian children with persistent diarrhea and malnutrition. *J Trop Pediatr*. 2005; 51\(1\): 5-10.](#)

[Carroccio A, Guarino A, Zuin G, Verghi F, Bemì Canani R, Fontana M, Bruzzese E, Montalto G, Notarbartolo A. Efficacy of oral pancreatic enzyme therapy for the treatment of fat malabsorption in HIV-infected patients. *Aliment Pharmacol Ther*. 2001; 15: 1619-1625.](#)

[Craig CB, Damell BE, Weinsier RL, Saag MS, Epps L, Mullins L, Lapidus WI, Ennis DM, Akrabawi SS, Cornwell PE, Sauberlich HE. Decreased fat and nitrogen losses in patients with AIDS receiving medium-chain-triglyceride-enriched formula vs those receiving long-chain-triglyceride-containing formula. *J Am Diet Assoc*. 1997; 97: 605-611.](#)

[Fawzi WW, Mbise R, Spiegelman D, Fataki M, Hertzmark E, Ndossi G. Vitamin A supplements and diarrheal and respiratory tract infections among children in Dar es Salaam, Tanzania. *J Pediatr*. 2000; 137\(5\): 660-667.](#)

[Filleau SM, Rollins NC, Coutsoudis A, Sullivan KR, Willumsen JF, Tomkins AM. The effect of antenatal vitamin A and beta-carotene supplementation on gut integrity of infants of HIV-infected South African women. *J Pediatr Gastroenterol Nutr*. 2001; 32\(4\): 464-470.](#)

[Turner MJ, Angel JB, Woodend AK, Giguere P. The efficacy of calcium carbonate in the treatment of protease inhibitor-induced persistent diarrhea in HIV-infected patients. *HIV Clin Trials*. 2004; 5\(1\): 19-24.](#)

[Wanke CA, Pleskow D, Degirolami PC, Lambi BB, Merkel K, Akrabawi S. A medium chain triglyceride-based diet in patients with HIV and chronic diarrhea reduces diarrhea and malabsorption: A prospective, controlled trial. *Nutrition*. 1996; 12\(11-12\): 766-771.](#)

- [HIV/AIDS](#)

Quick Links

Recommendations Summary

H/A: Treatment of Diarrhea/Malabsorption 2010

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from

which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

HIV/AIDS: Treatment of Diarrhea/Malabsorption

For people with HIV infection who have diarrhea/malabsorption, the registered dietitian (RD) should encourage the consumption of soluble fiber, electrolyte-repleting beverages and medium-chain triglycerides (MCT) and decrease the consumption of foods that may exacerbate diarrhea. Studies of fat malabsorption reported that consumption of MCT resulted in fewer stools, decreased stool fat and weight and increased fat absorption.

Rating: Fair

Conditional

- [Risks/Harms of Implementing This Recommendation](#)

Chronic diarrhea that is unexplained or causes unintended weight loss, abdominal pain or bloating should be investigated further, through stool examination for ova and parasites, cultures for enteric pathogens and qualitative or quantitative measurement of fecal fat.

- [Conditions of Application](#)

This recommendation applies to people with HIV infection and diarrhea/malabsorption.

- [Potential Costs Associated with Application](#)

- Costs of medical nutrition therapy (MNT) sessions and reimbursement vary, however MNT sessions are essential for improved outcomes
- Medium-chain triglycerides may be costly.

- [Recommendation Narrative](#)

- Seven studies were reviewed to evaluate dietary treatment of diarrhea/malabsorption in people with HIV infection. Many of these studies did not provide information about medications.
- Two studies regarding fat malabsorption reported that consumption of MCT resulted in fewer stools, decreased stool fat and weight and increased fat absorption (Wanke et al, 1996; Craig et al, 1997)
- Two studies regarding vitamin A and beta carotene supplementation reported decreased gut permeability and risk of severe watery diarrhea (Fawzi et al, 2000; Filteau et al, 2001)
- Further research regarding amino acid-based elemental diets (Amadi et al, 2005), probiotics (Allen et al, 2004), pancreatic enzyme therapy (Carroccio et al, 2001), calcium carbonate (Turner et al, 2004), glutamine and the BRAT diet in people with HIV/AIDS is warranted, as well as research on the effect of medications.

- [Recommendation Strength Rationale](#)

Conclusion statement received Grade II.

- [Minority Opinions](#)

Consensus reached.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[What is the evidence regarding dietary treatment of diarrhea/malabsorption in people with HIV infection?](#)

- [References](#)

[Allen SJ, Okoko B, Martinez E, Gregorio G, Dans LF. Probiotics for treating infectious diarrhoea. *Cochrane Database Syst Rev*. 2004; \(2\): CD003048.](#)

[Amadi B, Mwiya M, Chomba E, Thomson M, Chintu C, Kelly P, Walker-Smith J. Improved nutritional recovery on an elemental diet in Zambian children with persistent diarrhea and malnutrition. *J Trop Pediatr*. 2005; 51\(1\): 5-10.](#)

[Carroccio A, Guarino A, Zuin G, Verghi F, Bemì Canani R, Fontana M, Bruzzese E, Montalto G, Notarbartolo A. Efficacy of oral pancreatic enzyme therapy for the treatment of fat malabsorption in HIV-infected patients. *Aliment Pharmacol Ther*. 2001; 15: 1619-1625.](#)

[Craig CB, Damell BE, Weinsier RL, Saag MS, Epps L, Mullins L, Lapidus WL, Ennis DM, Akrabawi SS, Cornwell PE, Sauberlich HE. Decreased fat and nitrogen losses in patients with AIDS receiving medium-chain-triglyceride-enriched formula vs those receiving long-chain-triglyceride-containing formula. *J Am Diet Assoc*. 1997; 97: 605-611.](#)

[Fawzi WW, Mbise R, Spiegelman D, Fataki M, Hertzmark E, Ndossi G. Vitamin A supplements and diarrheal and respiratory tract infections among children in Dar es Salaam, Tanzania. *J Pediatr*. 2000; 137\(5\): 660-667.](#)

[Filteau SM, Rollins NC, Coutsooudis A, Sullivan KR, Willumsen JF, Tomkins AM. The effect of antenatal vitamin A and beta-carotene supplementation on gut integrity of infants of HIV-infected South African women. *J Pediatr Gastroenterol Nutr*. 2001; 32\(4\): 464-470.](#)

[Turner MJ, Angel JB, Woodend AK, Giguere P. The efficacy of calcium carbonate in the treatment of protease inhibitor-induced persistent diarrhea in HIV-infected patients. *HIV Clin Trials*. 2004; 5\(1\): 19-24.](#)

[Wanke CA, Pleskow D, Degirolami PC, Lambi BB, Merkel K, Akrabawi S. A medium chain triglyceride-based diet in patients with HIV and chronic diarrhea reduces diarrhea and malabsorption: A prospective, controlled trial. *Nutrition*. 1996; 12\(11-12\): 766-771.](#)

- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

Hendricks KM, Dong KR, Gerrior JL, eds. *Nutrition Management of HIV and AIDS*. Chicago, IL: American Dietetic Association; 2009.

- [HIV/AIDS](#)

Quick Links

Recommendations Summary

H/A: Encourage Physical Activity 2010

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

HIV/AIDS: Encourage Physical Activity

If not contraindicated, the registered dietitian (RD) should encourage physical activity for people with HIV infection. Studies report that performing constant or interval aerobic exercise, progressive resistance exercise or a combination of both, for at least 20 minutes per session at a frequency of three times per week is generally safe in adults with HIV infection and may lead to significant improvements in strength, endurance, cardiopulmonary fitness and reductions in depressive symptoms.

Rating: Strong
Conditional

- [Risks/Harms of Implementing This Recommendation](#)
 - Intense physical activity in some overweight and obese individuals may contribute to disability or death, thus consultation with a physician prior to beginning an exercise program should be recommended
 - Before beginning a program of physical activity more vigorous than brisk walking, people with HIV infection should be assessed for conditions that might be associated with an increased risk of cardiovascular disease
 - In previously sedentary individuals whose 10-year risk of a coronary event is likely to be equal to or greater than 10%, a graded exercise test with electrocardiogram (ECG) monitoring is recommended.
- [Conditions of Application](#)
 - This recommendation applies to people with HIV for whom physical activity is not contraindicated, based on physician consultation
 - This recommendation may not apply to people with HIV infection who have reduced aerobic capacity, metabolic changes, pain, fatigue and other physical impairments.
- [Potential Costs Associated with Application](#)
 - Costs of medical nutrition therapy (MNT) sessions and reimbursement vary, however MNT sessions are essential for improved outcomes
 - In previously sedentary individuals, a graded exercise test with electrocardiogram (ECG) monitoring is recommended before undertaking aerobic physical activity with intensity exceeding the demands of every day living (more intense than brisk walking) and this is a potential cost.
- [Recommendation Narrative](#)
 - 18 publications were reviewed to evaluate physical activity for people with HIV infection
 - Two recent systematic Cochrane reviews conclude that performing constant or interval aerobic exercise, progressive resistance exercise or a combination of both, for at least 20 minutes per session at a frequency of three times per week is generally safe in adults with HIV infection and may lead to significant improvements in strength, endurance, cardiopulmonary fitness and reductions in depressive symptoms (O'Brien et al, 2004; Nixon et al, 2005)
 - Studies published since that time support those findings (Clingerman, 2004; Ramirez-Marrero et al, 2004; Shah et al, 2005; Dolan et al, 2006; Fillipas et al, 2006), however research on the relationship between physical activity and immunity in people with HIV is inconclusive (Cade, Fantry, Nabar and Keyser, 2003; Clingerman, 2003; Bopp et al, 2004)
 - Special considerations may be needed for people with HIV infection who have reduced aerobic capacity (Cade, Fantry, Nabar and Keyser, 2003; Cade, Fantry, Nabar, Shaw and Keyser, 2003; Oursler et al, 2006), metabolic changes (Cade et al, 2007), increased pain, fatigue and impairments while exercising (Rusch et al, 2004; Simmonds et al, 2005; Scott et al, 2007) and those with a history of drug and alcohol abuse (Smit et al, 2006; Fama et al, 2007)
 - Further research is needed on the effect of physical activity on serum lipid profile in people with HIV infection.
- [Recommendation Strength Rationale](#)

Conclusion statement received Grade I.
- [Minority Opinions](#)

Consensus reached.
- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[Is there evidence that physical activity benefits people with HIV infection?](#)

- [References](#)
 - [Bopp CM, Phillips KD, Fulk LJ, Dudgeon WD, Sowell R, Hand GA. Physical activity and immunity in HIV-infected individuals. *AIDS Care*. 2004; 16 \(3\): 387-393.](#)
 - [Cade WT, Fantry LE, Nabar SR, Keyser RE. Decreased peak arteriovenous oxygen difference during treadmill exercise testing in individuals infected with the human immunodeficiency virus. *Arch Phys Med Rehabil*. 2003; 84: 1.595-1.603.](#)
 - [Cade WT, Fantry LE, Nabar SR, Shaw DK, Keyser RE. Impaired oxygen on-kinetics in persons with human immunodeficiency virus are not due to highly active anti-retroviral therapy. *Arch Phys Med Rehabil*. 2003; 84 \(12\): 1.831-1.838.](#)
 - [Cade WT, Reeds DN, Mittendorfer B, Patterson BW, Powderly WG, Klein S, Yarasheski KE. Blunted lipolysis and fatty acid oxidation during moderate exercise in HIV-infected subjects taking HAART. *Am J Physiol Endocrinol Metab*. 2007; 292: E812-E819.](#)
 - [Clingerman EM. Participation in physical activity by persons living with HIV disease. *J Assoc Nurses AIDS Care*. 2003; 14 \(5\): 59-70.](#)
 - [Clingerman E. Physical activity, social support and health-related quality of life among persons with HIV disease. *J Comm Health Nurs*. 2004; 21: 179-197.](#)
 - [Dolan SE, Frontera W, Librizzi J, Ljungquist K, Juan S, Dorman R, Cole ME, Kanter JR, Grinspoon S. Effects of a supervised home-based aerobic and progressive resistance training regimen in women infected with human immunodeficiency virus. *Arch Intern Med*. 2006; 166: 1.225-1.231.](#)
 - [Fama R, Eisen JC, Rosenbloom MJ, Sassoon SA, Kemper CA, Deresinski S, Pfefferbaum A, Sullivan EV. Upper and lower limb motor impairments in alcoholism, HIV infection and their comorbidity. *Alcohol Clin Exp Res*. 2007; 31 \(6\): 1.038-1.044.](#)
 - [Fillipas S, Oldmeadow LB, Bailey MJ, Cherry CL. A six-month, supervised, aerobic and resistance exercise program improves self-efficacy in people with human immunodeficiency virus: A randomised controlled trial. *Aust J Physiotherapy*. 2006; 52: 185-190.](#)
 - [Nixon S, O'Brien K, Glazier RH, Tynan AM. Aerobic exercise interventions for adults living with HIV/AIDS. *Cochrane Database Syst Rev*. 2005; \(2\): CD001796.](#)
 - [O'Brien K, Nixon S, Glazier RH, Tynan AM. Progressive resistance exercise interventions for adults living with HIV/AIDS. *Cochrane Database Syst Rev*. 2004; \(4\): CD004248.](#)
 - [Oursler KK, Sorkin JD, Smith BA, Katzel LI. Reduced aerobic capacity and physical functioning in older HIV-infected men. *AIDS Res Hum Retroviruses*. 2006; 22\(11\): 1.113-1.121.](#)
 - [Ramirez-Marrero FA, Smith BA, Melendez-Brau N, Santana-Bagur JL. Physical and leisure activity, body composition, and life satisfaction in HIV-positive Hispanics in Puerto Rico. *J Assoc Nurses AIDS Care*. 2004; 15\(4\): 68-77.](#)
 - [Rusch M, Nixon S, Schilder A, Braitstein P, Chan K, Hogg RS. Impairments, activity limitations and participation restrictions: Prevalence and associations among persons living with HIV/AIDS in British Columbia. *Health Qual Life Outcomes*. 2004; 2: 46.](#)
 - [Scott WB, Oursler KK, Katzel LI, Ryan AS, Russ DW. Central activation, muscle performance, and physical function in men infected with human immunodeficiency](#)

[virus. *Muscle Nerve*. 2007; 36\(3\): 374-383.](#)

[Shah M, Tierney K, Adams-Huet B, Boonyavarakul A, Jacob K, Quittner C, Dinges WL, Peterson D, Garg A. The role of diet, exercise and smoking in dyslipidemia in HIV-infected patients with lipodystrophy. *HIV Medicine*. 2005; 6: 291-298.](#)

[Simmonds MJ, Novy D, Sandoval R. The differential influence of pain and fatigue on physical performance and health status in ambulatory patients with human immunodeficiency virus. *Clin J Pain*. 2005; 21: 200-206.](#)

[Smit E, Crespo CJ, Semba RD, Jaworowicz D, Vlahov D, Ricketts EP, Ramirez-Marrero FA, Tang AM. Physical activity in a cohort of HIV-positive and HIV-negative injection drug users. *AIDS Care*. 2006; 18\(8\): 1,040-1,045.](#)

- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

Hendricks KM, Dong KR, Gerrior JL, eds. *Nutrition Management of HIV and AIDS*. Chicago, Illinois: American Dietetic Association; 2009.

- [HIV/AIDS](#)

Quick Links

Recommendations Summary

H/A: Educate on Food and Water Safety 2010

[Click here](#), to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

HIV/AIDS: Educate on Food and Water Safety

The registered dietitian (RD) should educate people with HIV infection, especially those who are severely immunocompromised (having CD4 levels less than 200 cells per mm³) and others involved in their care, about food and water safety. Studies report that people with HIV infection are more susceptible to foodborne illness and also lack knowledge regarding food safety.

Rating: Strong

Imperative

- [Risks/Harms of Implementing This Recommendation](#)

None.

- [Conditions of Application](#)

None.

- [Potential Costs Associated with Application](#)

- Costs of medical nutrition therapy (MNT) sessions and reimbursement vary, however MNT sessions are essential for improved outcomes
- Staff and volunteers, such as food providers, may also need to be trained on food and water safety.

- [Recommendation Narrative](#)

- Six studies were evaluated regarding education about foodborne illness in people with HIV infection
- One narrative review concluded that people with HIV infection are more susceptible to foodborne illness (Hayes et al, 2003)
- Two studies reported confusion and lack of knowledge regarding food safety (Heathcock et al, 1998; Hoffman et al, 2005)
- Two studies evaluating home-delivered meals programs for people with HIV infection report strong adherence to food safety guidelines in the preparation and delivery of meals (Kraak et al, 1995; Balsam et al, 1996)
- One study evaluating a program that included a component of foodborne illness education demonstrated a decrease in the number of symptoms and eating difficulties in people with HIV infection (Topping et al, 1995).

- [Recommendation Strength Rationale](#)

Conclusion statement received Grade I.

- [Minority Opinions](#)

Consensus reached.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[What is the evidence regarding education on foodborne illness for people with HIV infection and their caregivers?](#)

- [References](#)

[Balsam A, Grant N, Rogers BL. Program characteristics of home-delivered meals programs for persons with HIV and AIDS. *J Community Health*. 1996; 21\(1\): 37-49.](#)

[Hayes C, Elliot E, Krales E, Downer G. Food and water safety for persons infected with human immunodeficiency virus. *Clin Infect Dis*. 2003; 36\(Suppl 2\): S106-S109.](#)

[Heathcock R, McLauchlin J, Newton LH, Soltanpoor N, Coker R, Bignardi G, McEvoy M Survey of food safety awareness among HIV-positive individuals. *AIDS Care* 1998; 10\(2\): 237-241.](#)

[Hoffman EW, Bergmann V, Shultz JA, Kendall P, Medeiros LC, Hillers VN. Application of a five-step message development model for food safety education materials targeting people with HIV/AIDS. *J Am Diet Assoc* 2005;105:1597-1604.](#)

[Kraak VI. Home-delivered meal programs for homebound people with HIV/AIDS. *J Am Diet Assoc*. 1995; 95\(4\): 476-481.](#)

[Topping CM, Humm DC, Fischer RB, Brayer KM. A community-based, interagency approach by dietitians to provide meals, medical nutrition therapy, and education to clients with HIV/AIDS. *J Am Diet Assoc*. 1995; 95: 683-686.](#)

- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

Hendricks KM, Dong KR, Gerrior JL, eds. *Nutrition Management of HIV and AIDS*. Chicago, Illinois: American Dietetic Association; 2009.

CDC Food and Water Safety Brochure, <http://www.cdc.gov/hiv/resources/brochures/food.htm>.

- [HIV/AIDS](#)

Recommendations Summary

H/A: Coordination of Care 2010

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

HIV/AIDS: Coordination of Care

For people with HIV infection, the registered dietitian (RD) should implement medical nutrition therapy (MNT) and coordinate care with an interdisciplinary team and community resources. The interdisciplinary team is composed of health professionals including, but not limited to: RDs, physicians, physician assistants, nurse practitioners, nurses, pharmacists, case managers, substance use disorders treatment providers, respiratory care practitioners, occupational therapists, physical therapists, speech therapists, exercise physiologists, dentists, mental health professionals and treatment adherence counselors. Community resources may include, but are not limited to, food assistance programs, support systems and recreational facilities. This approach is necessary to effectively integrate MNT into overall management for people with HIV infection.

Rating: Consensus
Imperative

- [Risks/Harms of Implementing This Recommendation](#)

None.

- [Conditions of Application](#)

RDs are encouraged to work in consultation with other experienced RDs whenever possible.

- [Potential Costs Associated with Application](#)

Costs of MNT sessions and reimbursement vary, however MNT sessions are essential for improved outcomes.

- [Recommendation Narrative](#)

- MNT services should be determined by the needs of each specific client, taking into consideration sex, ethnicity and race, co-occurring disorders and any other psychosocial or economic situations that could impact nutritional status
- Coordinate with primary health care providers and case managers to assess a client's need and eligibility for MNT and to ensure that the client's needs are being addressed
- Clients receiving MNT services may require referral to other medical professionals.

- [Recommendation Strength Rationale](#)

The ADA HIV/AIDS Work Group concurs with the references cited.

- [Minority Opinions](#)

Consensus reached.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

- [References](#)
- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

- Hendricks KM, Dong KR, Gerrior JL, eds. *Nutrition Management of HIV and AIDS*. Chicago, IL: American Dietetic Association; 2009.
- Los Angeles County Commission on HIV. *Standards of Care*. Medical Nutrition Therapy. http://hivcommission-la.info/cms1_034030.pdf.

- [HIV/AIDS](#)

Recommendations Summary

H/A: Educate on Presence of HIV in Breast Milk 2010

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

HIV/AIDS: Educate on Presence of HIV in Breast Milk

The registered dietitian (RD) should educate women with HIV infection who are pregnant or lactating about the presence of HIV in breast milk.

- In the United States and other parts of the world where replacement feeding is affordable, feasible, acceptable, sustainable and safe, breastfeeding by HIV-infected women (including those receiving antiretroviral drugs) is **NOT** recommended.
- In certain international settings, where replacement feeding is not affordable, feasible, acceptable, sustainable and safe, the registered dietitian (RD) should refer to the World Health Organization (WHO) guidelines, as well as country-specific Ministry of Health or other locally adapted guidelines, when educating women with HIV infection who are pregnant or lactating.

Note: Since the evidence was not analyzed using ADA's evidence analysis methodology this recommendation was based on the references cited below and it is rated consensus meaning the Work Group concurs.

Rating: Consensus
Conditional

- [Risks/Harms of Implementing This Recommendation](#)

None.

- [Conditions of Application](#)

- This recommendation applies to women with HIV infection who are pregnant or lactating
- Safe, affordable and feasible alternatives may not be available or culturally acceptable.

- [Potential Costs Associated with Application](#)

Costs of medical nutrition therapy (MNT) sessions and reimbursement vary, however MNT sessions are essential for improved outcomes.

- [Recommendation Narrative](#)

From the Recommendations for Use of Antiretroviral Drugs in Pregnant HIV-1-Infected Women for Maternal Health and Interventions to Reduce Perinatal HIV Transmission in the United States. May 24, 2010. Accessible at <http://aidsinfo.nih.gov/contentfiles/PerinatalGL.pdf>.

- In the United States and other parts of the world where replacement feeding is affordable, feasible, acceptable, sustainable, and safe, breastfeeding by HIV-infected women (including those receiving antiretroviral drugs) is not recommended.
- A number of studies have evaluated the use of maternal or infant antiretroviral prophylaxis during breastfeeding to reduce postnatal transmission. Observational data and randomized clinical trials have demonstrated that infant prophylaxis (primarily using daily infant nevirapine) during breastfeeding significantly decreases the risk of postnatal transmission in breast milk and that maternal triple drug prophylaxis during breastfeeding may likewise decrease postnatal infection. However, neither infant nor maternal postpartum antiretroviral prophylaxis completely eliminates the risk of HIV transmission through breast milk, and the combination of maternal and infant postpartum antiretroviral drug regimens, where safe, affordable and feasible alternatives are available and culturally acceptable. Both infant nevirapine prophylaxis and maternal triple drug prophylaxis during breastfeeding may be associated with the development of antiretroviral drug resistance in infants who become infected despite prophylaxis. Three studies have found multi-class drug resistance in breastfeeding infants who became infected despite maternal triple drug prophylaxis.

- [Recommendation Strength Rationale](#)

- The ADA HIV/AIDS Work Group concurs with the references cited
- Evidence in support of the recommendation was level "A-II evidence", however the evidence analysis was not reviewed by the ADA HIV/AIDS Work Group using the ADA evidence analysis methodology, resulting in a strength of Consensus.

- [Minority Opinions](#)

Consensus reached.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

- [References](#)
- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

Horvath T, Madi BC, Iuppa IM, Kennedy GE, Rutherford GW, Read JS.. Interventions for preventing late postnatal mother-to-child transmission of HIV. Cochrane Database of Systematic Reviews 2009, Issue 1. Art. No.: CD006734. DOI: 10.1002/14651858.CD006734.pub2

Recommendations for Use of Antiretroviral Drugs in Pregnant HIV-1-Infected Women for Maternal Health and Interventions to Reduce Perinatal HIV Transmission in the United States. May 24, 2010. Accessible at <http://aidsinfo.nih.gov/contentfiles/PerinatalGL.pdf>.

Guidelines on HIV and Infant Feeding 2010. Principles and Recommendations for Infant Feeding in the Context of HIV and a Summary of Evidence. World Health Organization (WHO). Accessible at http://www.who.int/child_adolescent_health/documents/9789241599535/en/index.html.

- [HIV/AIDS](#)

Recommendations Summary

H/A: Educate on Medications 2010

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

HIV/AIDS: Educate on Medications

For people with HIV infection who are prescribed medications, the registered dietitian (RD) should provide education regarding food and drug interactions, nutrition-related adverse effects and risk of teratogenicity. Adverse effects of medications, including metabolic complications, gastrointestinal disturbances, and compromised nutrition intake, may lead to non-adherence and/or resistance to the prescribed medication regimen and poor nutrition status.

Rating: Consensus

Conditional

- [Risks/Harms of Implementing This Recommendation](#)

None.

- [Conditions of Application](#)

This recommendation applies to people with HIV infection who have been prescribed medications.

- [Potential Costs Associated with Application](#)

Costs of medical nutrition therapy (MNT) sessions and reimbursement vary, however MNT sessions are essential for improved outcomes.

- [Recommendation Narrative](#)

- Adverse effects of medications, including metabolic complications and other toxicities, become increasingly important because they may lead to non-adherence to the prescribed medication regimen
- Use of antiretroviral drugs during pregnancy for prevention of perinatal transmission should be discussed with and provided to all infected pregnant women regardless of HIV RNA level (AI evidence)
- If already on therapy, regimens should be reviewed in terms of potential pregnancy (e.g., teratogenic potential of the drugs in the regimen, All evidence)
- The known benefits and potential risks of antiretroviral use during pregnancy should be discussed with all women (AIII evidence)

- [Recommendation Strength Rationale](#)

- The ADA HIV/AIDS Work Group concurs with the references cited.
- Evidence in support of the recommendation was level A-I, A-II and A-III evidence.

- [Minority Opinions](#)

Consensus reached.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

- [References](#)
- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

Guidelines for the Use of Antiretroviral Agents in HIV-1-Infected Adults and Adolescents. December 1, 2009. Accessible at <http://www.aidsinfo.nih.gov/Guidelines/GuidelineDetail.aspx?MenuItem=Guidelines&Search=Off&GuidelineID=7&ClassID=1>

Guidelines for the Use of Antiretroviral Agents in Pediatric HIV Infection. August 16, 2010. Accessible at <http://www.aidsinfo.nih.gov/Guidelines/GuidelineDetail.aspx?MenuItem=Guidelines&Search=Off&GuidelineID=8&ClassID=1>

Hendricks KM, Dong KR, Gerrior JL, eds. *Nutrition Management of HIV and AIDS*. Chicago, Illinois: American Dietetic Association; 2009.

Los Angeles County Commission on HIV. *Standards of Care*. Medical Nutrition Therapy. Available at: http://hivcommission-la.info/cms1_034030.pdf.

Nerad J, Romeyn M, Silverman E, Allen-Reid J, Dieterich D, Merchant J, A Pelletier V, Tinnerello D, Fenton M. General nutrition management in patients infected with human immunodeficiency virus. *Clin Infect Dis*. 2003 Apr 1; 36 (Suppl 2): S52-S62.

Recommendations for Use of Antiretroviral Drugs in Pregnant HIV-1-Infected Women for Maternal Health and Interventions to Reduce Perinatal HIV Transmission in the United States. May 24, 2010. Accessible at <http://aidsinfo.nih.gov/contentfiles/PerinatalGL.pdf>.

- [HIV/AIDS](#)

Recommendations Summary

H/A: Monitor and Evaluate Food- and Nutrition-Related History 2010

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

HIV/AIDS: Monitor and Evaluate Food- and Nutrition-Related History

The registered dietitian (RD) should monitor and evaluate the food and nutrition-related history of people with HIV infection, including but not limited to:

- Food and nutrient intake, focusing on energy, protein, fat, fiber, sodium, calcium and vitamin D
- Medications/drugs, herbal/dietary supplements and their potential negative interactions
- Knowledge, beliefs and attitudes
- Behavior
- Factors affecting access to food and food- and nutrition-related supplies
- Physical activity and function
- Nutrition-related patient and client-centered measures.

Several studies report variations in energy and nutrient intake in people with HIV infection. Some were under- and over-estimated requirements. A clear understanding of food and nutrient intake will form the basis for the nutrition diagnosis, prescription and intervention.

Rating: Strong

Imperative

- [Risks/Harms of Implementing This Recommendation](#)

None.

- [Conditions of Application](#)

None.

- [Potential Costs Associated with Application](#)

Costs of medical nutrition therapy (MNT) sessions and reimbursement vary, however MNT sessions are essential for improved outcomes.

- [Recommendation Narrative](#)

- 15 articles were reviewed to evaluate the monitoring of food intake in people with HIV infection
- Several studies report variations in energy and nutrient intake and weight changes (Chlebowski et al, 1995; Luder et al, 1995; Woods et al, 2002; Hendricks et al, 2006)
- Special considerations are needed for children (Henderson et al, 1997; Melvin et al, 1997; Heller et al, 2000) as well as individuals with fat deposition (Hendricks et al, 2003; Dong et al, 2006), those taking protease inhibitors (Woods et al, 2003; Shah et al, 2005), those with a history of drug abuse (Forrester et al, 2000; Forrester et al, 2004) and those with metabolic abnormalities (Joy et al, 2007)
- One study reported that three-day food records may be more valid than food frequency questionnaires when reporting food intake in the HIV-infected population (Hendricks et al, 2005)
- Further research is needed regarding frequency of food intake monitoring.

- [Recommendation Strength Rationale](#)

Conclusion statement received Grade II.

- [Minority Opinions](#)

Consensus reached.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

- [References](#)

[Chlebowski RT, Grosvenor M, Lillington L, Sayre J, Beall G. Dietary intake and counseling, weight maintenance, and the course of HIV infection. *J Am Diet Assoc* 1995; 95\(4\): 428-435.](#)

[Dong KR, Wanke CA, Tang AM, Ding B, Hendricks KM. Dietary glycemic index of human immunodeficiency virus-positive men with and without fat deposition. *J Am Diet Assoc*. 2006; 106: 728-732.](#)

[Forrester JE, Tucker KL, Gorbach SL. Dietary intake and body mass index in HIV-positive and HIV-negative drug abusers of Hispanic ethnicity. *Public Health Nutrition*. 2004; 7\(7\): 863-870.](#)

[Forrester JE, Woods MN, Knox TA, Spiegelman D, Skinner SC, Gorbach SL. Body composition and dietary intake in relation to drug abuse in a cohort of HIV-positive persons. *J*](#)

[Acquir Immune Defic Syndr. 2000; 25 Suppl 1: S43-S48.](#)

[Heller L, Fox S, Hell KJ, Church JA. Development of an instrument to assess nutritional risk factors for children infected with human immunodeficiency virus. *J Am Diet Assoc.* 2000;100\(3\): 323-329.](#)

[Henderson RA, Talusan K, Hutton N, Yolken RH, Caballero B. Serum and plasma markers of nutritional status in children infected with the human immunodeficiency virus. *J Am Diet Assoc.* 1997; 97: 1,377-1,381.](#)

[Hendricks K, Tang A, Spiegelman D, Skinner S, Woods M. Dietary intake in human immunodeficiency virus-infected adults: a comparison of dietary assessment methods. *J Am Diet Assoc.* 2005; 105: 532-540.](#)

[Hendricks KM, Willis K, Houser R, Jones CY. Obesity in HIV-infection: dietary correlates. *J Am Coll Nutr.* 2006; 25 \(4\): 321-331.](#)

[Hendricks KM, Dong KR, Tang AM, Ding B, Spiegelman D, Woods MN, Wanke CA. High-fiber diet in HIV-positive men is associated with lower risk of developing fat deposition. *Am J Clin Nutr.* 2003; 78: 790-795.](#)

[Joy T, Keogh HM, Hadigan C, Lee H, Dolan SE, Fitch K, Liebau J, Lo J, Johnsen S, Hubbard J, Anderson EJ, Grinspoon S. Dietary fat intake and relationship to serum lipid levels in HIV-infected patients with metabolic abnormalities in the HAART era. *AIDS.* 2007; 21: 1591-1600.](#)

[Luder E, Godfrey E, Godbold J, Simpson DM. Assessment of nutritional, clinical, and immunologic status of HIV-infected, inner-city patients with multiple risk factors. *J Am Diet Assoc.* 1995; 95: 655-660.](#)

[Melvin D, Wright C, Goddard S. Incidence and nature of feeding problems in young children referred to a paediatric HIV service in London: FEAD screening. *Child Care Health Dev.* 1997; 23 \(4\): 297-313.](#)

[Shah M, Tierney K, Adams-Huet B, Boonyavarakul A, Jacob K, Quittner C, Dinges WL, Peterson D, Garg A. The role of diet, exercise and smoking in dyslipidemia in HIV-infected patients with lipodystrophy. *HIV Medicine.* 2005; 6: 291-298.](#)

[Woods MN, Spiegelman D, Knox TA, Forrester JE, Connors JL, Skinner SC, Siva M, Kim JH, Gorbach SL. Nutrient intake and body weight in a large HIV cohort that included women and minorities. *J Am Diet Assoc.* 2002; 102: 203-211.](#)

[Woods MN, Tang AM, Forrester J, Jones C, Hendricks K, Ding B, Knox TA. Effect of dietary intake and protease inhibitors on serum vitamin B₁₂ levels in a cohort of human immunodeficiency virus-positive patients. *Clin Infect Dis.* 2003; 37\(Suppl 2\): S124-S131.](#)

- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

Hendricks KM, Dong KR, Gerrior JL, eds. *Nutrition Management of HIV and AIDS*. Chicago, Illinois: American Dietetic Association; 2009.

- [HIV/AIDS](#)

Quick Links

Recommendations Summary

H/A: Monitor and Evaluate Anthropometric Measurements 2010

[Click here](#) to see the explanation of recommendation ratings (Strong, Fair, Weak, Consensus, Insufficient Evidence) and labels (Imperative or Conditional). To see more detail on the evidence from which the following recommendations were drawn, use the hyperlinks in the [Supporting Evidence Section](#) below.

- [Recommendation\(s\)](#)

H/A: Monitor and Evaluate Anthropometric Measurements 2010

Using the same methodology as in the assessment of anthropometric measurements, the registered dietitian (RD) should monitor and evaluate body weight and height, body mass index, body compartment estimates and for children, growth pattern indices. The majority of research in men, women, children and adolescents reports that fat-free mass and fat mass are altered in people with HIV infection.

Rating: Strong
Imperative

- [Risks/Harms of Implementing This Recommendation](#)

None.

- [Conditions of Application](#)

- Privacy or chaperones may be required for certain anthropometric measurements such as waist circumference and body composition
- RDs or other clinic staff should be appropriately trained to measure body compartment estimates
- Studies report that dual energy X-ray absorptiometry, bioelectrical impedance analysis, bioimpedance spectroscopy and skinfold thickness measurements provide acceptable estimations of body composition if properly calibrated
- Special bioelectrical impedance analysis equations for use in children with HIV infection are needed
- Results from various methodologies may not be comparable.

- [Potential Costs Associated with Application](#)

- Costs of medical nutrition therapy (MNT) sessions and reimbursement vary, however MNT sessions are essential for improved outcomes
- Monitoring and evaluation of body composition may be costly depending on the time required and methodology.

- [Recommendation Narrative](#)

- 27 studies were reviewed to evaluate the assessment of body composition of people with HIV infection
- The majority of research in men, women, children and adolescents reports that fat-free mass and fat mass are generally lower in people with HIV infection (Ott et al, 1995; Grady et al, 1996; Schwenk et al, 1996; Sharpstone et al, 1996; Mulligan et al, 1997; Paton et al, 1997; Arpad et al, 1998; Henderson et al, 1998; Engelson et al, 1999; Fontana et al, 1999; Kotler et al, 1999; Arpad et al, 2000; Batterham et al, 2000; Forrester et al, 2000; Saint-Marc et al, 2000; McDermott et al, 2001; Meiningner et al, 2002; Wilson et al, 2002; Ramirez-Marrero et al, 2004; Karmon et al, 2005; Smit et al, 2005; Visnegarwala et al, 2005; Brown et al, 2006; Moscicki et al, 2006; Papatkakis et al, 2006; Study of Fat Redistribution and Metabolic Change, 2006; Visnegarwala et al, 2007)
- 18 studies were reviewed to evaluate certain methodologies in the measurement of body composition of people with HIV infection
- Six studies in men, two studies in women and six studies in men and women report that dual energy X-ray absorptiometry, bioelectrical impedance analysis, bioimpedance spectroscopy and skinfold thickness measurements provide acceptable estimations of body composition and for measuring change in body composition (Risser et al, 1995; Kotler et al, 1996; Paton et al, 1997; Paton et al, 1998; Batterham et al, 1999; Kotler et al, 1999; Corcoran et al, 2000; Gerrior et al, 2001; Andrade et al, 2002; Cavalcanti et al, 2005; Ludy et al, 2005; Papatkakis et al, 2005; Aghdassi et al, 2007)
- Results of bioelectrical impedance analysis vary with the prediction equation used and the equipment manufacturer (Smith et al, 2003; Yang et al, 2004). Studies in children report the need for bioelectrical impedance analysis equations developed for use in children with HIV infection (Arpad et al, 1996; Fontana et al, 1999).

- Results in skinfold thickness measurements vary with the number of sites measured and the prediction equation used
- Further research is needed regarding methodology for body composition measurement in women and children, as well as in conditions of lipodystrophy, areas of the body and different ethnic groups.

- [Recommendation Strength Rationale](#)

Conclusion statements received Grades I and II.

- [Minority Opinions](#)

Consensus reached.

- [Supporting Evidence](#)

The recommendations were created from the evidence analysis on the following questions. To see detail of the evidence analysis, click the blue hyperlinks below (recommendations rated consensus will not have supporting evidence linked).

[What is the evidence regarding assessment of body composition for people with HIV infection?](#)

[What methodologies are appropriate in the measurement of body composition of people with HIV infection?](#)

- [References](#)

[Arpadi SM, Horlick MN, Wang J, Cuff P, Bamji M, Kotler DP. Body composition in prepubertal children with human immunodeficiency virus type 1 infection. *Arch Pediatr Adolesc Med.* 1998 Jul; 152\(7\): 688-693.](#)

[Arpadi SM, Cuff PA, Kotler DP, Wang J, Bamji M, Lange M, Pierson RN, Matthews DE. Growth velocity, fat-free mass and energy intake are inversely related to viral load in HIV-infected children. *J Nutr.* 2000; 130: 2,498-2,502.](#)

[Batterham MJ, Garsia R, Greenop PA. Dietary intake, serum lipids, insulin resistance and body composition in the era of highly active antiretroviral therapy "Diet FRS Study". *AIDS.* 2000; 14: 1839-1843.](#)

[Brown T, Wang Z, Chu H, Palella FJ, Kingsley L, Witt MD, Dobs AS. Longitudinal anthropometric changes in HIV-infected and HIV-uninfected men. *J Acquir Immune Defic Syndr.* 2006; 43\(3\): 356-362.](#)

[Engelson ES, Kotler DP, Tan Y, Agin D, Wang J, Pierson RN Jr, Heymsfield SB. Fat distribution in HIV-infected patients reporting truncal enlargement quantified by whole-body magnetic resonance imaging. *Am J Clin Nutr.* 1999; 69\(6\): 1162-1169.](#)

[Fontana M, Zuin G, Plebani A, Bastoni K, Visconti G, Principi N. Body composition in HIV-infected children: Relations with disease progression and survival. *Am J Clin Nutr.* 1999; 69: 1282-1286.](#)

[Forrester JE, Woods MN, Knox TA, Spiegelman D, Skinner SC, Gorbach SL. Body composition and dietary intake in relation to drug abuse in a cohort of HIV-positive persons. *J Acquir Immune Defic Syndr.* 2000; 25 Suppl 1: S43-S48.](#)

[Grady C, Ropka M, Anderson R, Lane HC. Body composition in clinically stable men with HIV infection. *J Assoc Nurses AIDS Care.* 1996; 7\(6\): 29-38.](#)

[Henderson RA, Talusan K, Hutton N, Yolken RH, Caballero B. Resting energy expenditure and body composition in children with HIV infection. *J Acquir Immune Defic Syndr Hum Retrovirol.* 1998; 19\(2\): 150-157.](#)

[Karmon SL, Moore RD, Dobs AS, Kenuly J, Barnett S, Cofrancesco J Jr. Body shape and composition in HIV-infected women: An urban cohort. *HIV Medicine* 2005; 6: 245-252.](#)

[Kotler DP, Rosenbaum K, Wang J, Pierson RN. Studies of body composition and fat distribution in HIV-infected and control subjects. *J Acquir Immune Defic Syndr Hum Retrovirol.* 1999; 20 \(3\): 228-237.](#)

[McDermott AY, Shevitz A, Knox T, Roubenoff R, Kehavias J, Gorbach S. Effect of highly active antiretroviral therapy on fat, lean, and bone mass in HIV-seropositive men and women. *Am J Clin Nutr.* 2001; 74: 679-686.](#)

[Meininger G, Hadigan C, Rietschel P, Grinspoon S. Body-composition measurements as predictors of glucose and insulin abnormalities in HIV-positive men. *Am J Clin Nutr.* 2002; 76: 460-465.](#)

[Moscicki AB, Ellenberg JH, Murphy DA, Jiahong X. Associations among body composition, androgen levels, and human immunodeficiency virus status in adolescents. *J Adolesc Health.* 2006; 39\(2\): 164-173.](#)

[Mulligan K, Tai VW, Schambelan M. Cross-sectional and longitudinal evaluation of body composition in men with HIV infection. *J Acquir Immune Defic Syndr Hum Retrovirol.* 1997; 15\(1\): 43-48.](#)

[Ott M, Fischer H, Polat H, Helm EB, Frenz M, Caspary WF, Lembcke B. Bioelectrical impedance analysis as a predictor of survival in patients with human immunodeficiency virus infection. *Journal of Acquired Immune Deficiency Syndromes and Human Retrovirology.* 1995; 9\(1\): 20-25.](#)

[Papathakis PC, Van Loan MD, Rollins NC, Chantry CJ, Bennis ML, Brown KH. Body composition changes during lactation in HIV-infected and HIV-uninfected South African women. *J Acquir Immune Defic Syndr.* 2006. 43: 467-474.](#)

[Paton NJ, Macallan DC, Jebb SA, Noble C, Baldwin C, Pazianas M, Griffin GE. Longitudinal changes in body composition measured with a variety of methods in patients with AIDS. *J Acquir Immune Defic Syndr Hum Retrovirol.* 1997; 14\(2\): 119-127.](#)

[Ramirez-Marrero FA, Smith BA, Melendez-Brau N, Santana-Bagur JL. Physical and leisure activity, body composition, and life satisfaction in HIV-positive Hispanics in Puerto Rico. *J Assoc Nurses AIDS Care.* 2004; 15\(4\): 68-77.](#)

[Saint-Marc T, Partisani M, Poizat-Martin I, Rouviere O, Bruno F, Avellaneda R, Lang JM, Gastaut JA, Touraine JL. Fat distribution evaluated by computed tomography and metabolic abnormalities in patients undergoing antiretroviral therapy: preliminary results of the LIPOCO study. *AIDS.* 2000; 14: 37-49.](#)

[Schwenk A, Hoffer-Belitz E, Jung B, Kremer G, Burger B, Salzberger B, Diehl V, Schrappe M. Resting energy expenditure, weight loss, and altered body composition in HIV infection. *Nutrition.* 1996; 12: 595-601.](#)

[Sharpstone DR, Murray CP, Ross HM, Hancock MR, Phelan MS, Crane RC, Menzies IS, Reaveley DA, Lepri AC, Nelson MR, Gazzard BG. Energy balance in asymptomatic HIV infection. *AIDS.* 1996; 10: 1,377-1,384.](#)

[Smit E, Semba RD, Pilibosian E, Vlahov D, Tun W, Purvis L, Tang AM. Body habitus in a cohort of HIV-seropositive and HIV-seronegative injection drug users. *AIDS Patient Care STDS.* 2005; 19\(1\): 19-30.](#)

[Study of Fat Redistribution and Metabolic Change in HIV Infection \(FRAM\). Fat distribution in women with HIV infection. *J Acquir Immune Defic Syndr.* 2006; 42\(5\): 562-571.](#)

[Visnegarwala F, Raghavan SS, Mullin CM, Bartsch G, Wang J, Kotler D, Gibert CL, Shlay J, Grunfeld C, Carr A, El-Sadr W, for the Terry Bein Community Program for Clinical Research on AIDS. Sex differences in the associations of HIV disease characteristics and body composition in antiretroviral-naïve persons. *Am J Clin Nutr.* 2005; 82\(4\): 850-856.](#)

[Visnegarwala F, Shlay JC, Barry V, Gibert CL, Xiang Y, Wang J, Kotler D, Raghavan S, El-Sadr WM, for Terry Bein Community Programs for Clinical Research on AIDS](#)

[\(CPCRA\). Effects of HIV infection on body composition changes among men of different racial/ethnic origins. *HIV Clin Trials*. 2007; 8\(3\): 145-154.](#)

[Wilson IB, Jacobson DL, Roubenoff R, Spiegelman S, Knox TA, Gorbach SL. Changes in lean body mass and total body weight are weakly associated with physical functioning in patients with HIV infection. *HIV Medicine*. 2002; 3: 263-270.](#)

[Aghdassi E, Arendt B, Salit IE, Allard JP. Estimation of body fat mass using dual-energy x-ray absorptiometry, bioelectric impedance analysis, and anthropometry in HIV-positive male subjects receiving highly active antiretroviral therapy. *JPEN J Paren Enteral Nutr*. 2007; 31: 135-141.](#)

[Andrade S, Lan SJJ, Engelson ES, Agin D, Wang J, Heymsfield SB, Kotler DP. Use of a Durnin-Womersley formula to estimate change in subcutaneous fat content in HIV-infected subjects. *Am J Clin Nutr*. 2002; 75: 587-592.](#)

[Arapadi SM, Wang J, Cuff PA, Thornton J, Horlick M, Kotler DP, Pierson RN. Application of bioimpedance analysis for estimating body composition in prepubertal children infected with human immunodeficiency virus type 1. *J Pediatr*. 1996; 129\(5\): 755-757.](#)

[Batterham MJ, Garsia R, Greenop P. Measurement of body composition in people with HIV/AIDS: A comparison of bioelectrical impedance and skinfold anthropometry with dual-energy x-ray absorptiometry. *J Am Diet Assoc* 1999; 99 \(9\): 1109-1111.](#)

[Cavalcanti RB, Cheung AM, Raboud J, Walmsley S. Reproducibility of DXA estimations of body fat in HIV lipodystrophy. *Journal of Clinical Densitometry* 2005; 8\(3\): 293-297.](#)

[Corcoran C, Anderson EJ, Burrows B, Stanley T, Walsh M, Poulos AM, Grinspoon S. Comparison of total body potassium with other techniques for measuring lean body mass in men and women with AIDS wasting. *Am J Clin Nutr*. 2000; 72: 1053-1058.](#)

[Fontana M, Zuin G, Plebani A, Bastoni K, Visconti G, Principi N. Body composition in HIV-infected children: Relations with disease progression and survival. *Am J Clin Nutr*. 1999; 69: 1282-1286.](#)

[Gerrier J, Kantaros J, Coakley E, Albrecht M, Wanke C. The fat redistribution syndrome in patients infected with HIV: Measurements of body shape abnormalities. *J Am Diet Assoc*. 2001; 101: 1175-1180.](#)

[Kotler DP, Burastero S, Wang J, Pierson RN. Prediction of body cell mass, fat-free mass, and total body water with bioelectrical impedance analysis: Effects of race, sex and disease. *Am J Clin Nutr*. 1996; 64\(suppl\): 489S-497S.](#)

[Kotler DP, Rosenbaum K, Allison DB, Wang J, Pierson RN. Validation of bioimpedance analysis as a measure of change in body cell mass as estimated by whole-body counting of potassium in adults. *JPEN*. 1999; 23\(6\): 345-349.](#)

[Ludy MJ, Hendricks K, Houser R, Chetchotisakd P, Mootsikapun P, Anunnatsiri S, Price E, Wanke CA. Body composition in adults infected with human immunodeficiency virus in Khon Kaen, Thailand. *Am J Trop Med Hyg*. 2005; 73\(4\): 815-819.](#)

[Niyongabo T, Melchior JC, Henzel D, Bouchard O, LaRouze B. Comparison of methods for assessing nutritional status in HIV-infected adults. *Nutrition*. 1999; 15\(10\): 740-743.](#)

[Papathakis PC, Rollins NC, Brown KH, Bennish ML, Van Loan MD. Comparison of isotope dilution with bioimpedance spectroscopy and anthropometry for assessment of body composition in asymptomatic HIV-infected and HIV-uninfected breastfeeding mothers. *Am J Clin Nutr*. 2005; 82: 538-546.](#)

[Paton NIJ, Macallan DC, Jebb SA, Noble C, Baldwin C, Pazianas M, Griffin GE. Longitudinal changes in body composition measured with a variety of methods in patients with AIDS. *J Acquir Immune Defic Syndr Hum Retroviro*. 1997; 14\(2\): 119-127.](#)

[Paton NI, Elia M, Jennings G, Ward LC, Griffin GE. Bioelectrical impedance analysis in human immunodeficiency virus-infected patients: Comparison of single frequency with multifrequency, spectroscopy, and other novel approaches. *Nutrition*. 1998; 14: 658-666.](#)

[Risser JMH, Rabeneck L, Foote LW, Klish WJ. A comparison of fat-free mass estimates in men infected with the human immunodeficiency virus. *JPEN*. 1995; 19: 28-32.](#)

[Smith DE, Hudson J, Martin A, Freund J, Griffiths MR, Kahnins S, Law M, Carr A, Cooper DA, for the PIILR DEXA Group and Investigators. Centralized assessment of dual-energy X-ray absorptiometry \(DEXA\) in multicenter studies of HIV-associated lipodystrophy. *HIV Clin Trials*. 2003; 4\(1\): 45-49.](#)

[Yang Y, Zhu WDJ, Paton NI. Comparison of dual-energy X-ray absorptiometry machines for measuring fat distribution changes of HIV-associated lipodystrophy. *Antivir Ther*. 2004; 9\(5\): 771-778.](#)

- [References not graded in Academy of Nutrition and Dietetics Evidence Analysis Process](#)

Hendricks KM, Dong KR, Gerrier JL, eds. *Nutrition Management of HIV and AIDS*. Chicago, Illinois: American Dietetic Association; 2009.