Weight/Strength Training: The Impact on Wasting and Functioning in HIV/AIDS

John E. Lewis, Ph.D.

Assistant Professor
Director of Education-Fogarty Training Program
Director of Research-Center for Complementary and Integrative Medicine
Associate Director-Medical Wellness Center
University of Miami Miller School of Medicine
1120 NW 14th Street
Suite #1474 (D-21)
Phone: 305-243-6227
Fax: 305-243-3648
E-mail: jelewis@miami.edu
The Wasting Problem in HIV

What is wasting or more specifically the HIV wasting syndrome?

It consists of involuntary loss of 10% or more of baseline body weight plus:

- Chronic diarrhea lasting longer than 30 days OR
- Chronic weakness AND
- Prolonged fever lasting longer than 30 days

Wasting syndrome weight loss occurs in the absence of a concurrent illnesses or conditions.

Source: US CDC and WHO stage of disease defining criteria
The Wasting Problem in HIV

1. Wasting has been a profound characteristic of HIV since the first reported case of the disease.

2. Since the start of the epidemic, wasting has been linked to extremely high morbidity and mortality, and wasting has been an AIDS-defining criterion since 1993.


The Wasting Problem in HIV

Even though therapies have improved greatly (primarily antiretroviral treatments) for HIV and mortality and wasting have been dramatically improved, weight loss continues to be problematic for people living with the virus.

The Wasting Problem in HIV

1. **Wasting is still strongly related to the risk of disease progression and death, even with highly active antiretroviral therapy.**

2. **Wasting is clearly devastating in most places affected by the virus, where antiretroviral therapy is not particularly available.**


So What Can Be Done about Wasting?

Several strategies are used:

1. Anabolic steroids or anti-catabolic agents
2. Eradicating acute illness
3. Increase in nutrients and calories
4. **Strength training/weight lifting exercise**

We will focus on the benefits of weight lifting.
Strength Training Studies
A Comparison of the Clinical and Cost-Effectiveness of 3 Intervention Strategies for AIDS Wasting

Purpose of the Study:

To compare oxandrolone (OX) or strength training with nutrition alone (NA) for AIDS wasting.

Mid-thigh cross-sectional muscle area (CSMA), self-reported physical functioning (PF), and measures of strength were the major outcomes.
Methods:

Fifty patients with AIDS participated and 47 completed the study.

Subjects were randomized to: (1) NA with placebo pills, (2) nutrition with 10 mg of OX administered orally twice a day, or (3) nutrition with progressive resistance training (PRT) for 12 weeks.

Strength training was performed in a thrice-weekly program with leg press, chest press, knee extension, seated row, and modified abdominal curl-ups. The workload was progressively increased toward a goal intensity of 80% of the 1 repetition maximum (1RM) on each exercise. Muscle strength was assessed by 1RM testing.
Overall Results:

OX and PRT subjects had increases in CSMA (7.0% ± 2.5%, P = 0.01; 5.0% ± 2.0%, P = 0.04, respectively), although these increases did not differ significantly from the NA arm (NA: 1.0% ± 1.0%; OX vs. NA: P = 0.09; PRT vs. NA: P = 0.26).

Only PRT caused significant improvements in PF (mean ± SE: 10.4 ± 3.8 points on a 100-point scale) and 7 measures of strength (P values: 0.04 to 0.001).

There were no overall differences between groups in PF change.

In addition, PRT proved to be the most cost-effective intervention with OX being the most expensive.
Conclusions:

OX and PRT induce similar improvements in body composition, but PRT improves quality of life more than nutrition or OX, particularly among patients with impaired PF.

PRT was the most cost-effective intervention, and OX was the least cost-effective intervention.
Effects of Testosterone and Progressive Resistance Training in Eugonadal Men with AIDS Wasting

Purpose of the Study:

To investigate the independent effects of testosterone therapy and progressive resistance training in eugonadal men with AIDS wasting.
54 eugonadal men with AIDS wasting (weight < 90% ideal body weight or weight loss > 10%) were randomly assigned to receive testosterone enanthate (200 mg/wk) or placebo injections and progressive resistance training (three times weekly) or no training for 12 weeks. Cross-sectional muscle area and other indices of muscle mass were compared between the two groups.
Exercise Intervention:

Supervised progressive strength training and aerobic conditioning three times per week for 12 weeks.

During each session, subjects began by performing 20 minutes of aerobic exercise on a stationary bicycle at a target heart rate of 60% to 70% of their age-predicted maximum, in accordance with ACSM guidelines. A cool-down period of 15 minutes and normalization of heart rate preceded resistance training.

Training was performed isotonically for leg extension, leg curl, leg press, latissimus dorsi pull-down, arm curl, and triceps extension. A one-repetition maximum weight was established at baseline for each subject on each machine in the best of three efforts.
Exercise Intervention:

Subjects increased resistance as follows:

1. weeks 1-2, 2 sets, 8 repetitions/set, 60% one-repetition maximum
2. weeks 3-6, 2 sets, 8 repetitions/set, 70% one-repetition maximum
3. weeks 7-12, 3 sets, 8 repetitions/set, 80% one-repetition maximum

Outcomes

Upper- and lower-extremity muscle strength were measured by using the peak isometric force of shoulder flexion, shoulder extension, elbow flexion, elbow extension, knee flexion, knee extension, dorsiflexion, and grip on the best of two repetitions.
Overall Strength Results:

Response to placebo compared to testosterone (kg)

1. Shoulder extension 1.8 ± 3.5 vs. 5.3 ± 5.9 [P = 0.033]
2. Elbow flexion 0.8 ± 3.3 vs. 3.9 ± 4.1 [P = 0.014]
3. Knee flexion 0.2 ± 4.4 vs. 2.6 ± 4.7 [P = 0.121]
4. Knee extension 0.3 ± 8.1 vs. 3.6 ± 7.6 [P > 0.20]

Response to non-training compared to training (kg)

1. Shoulder extension 3.0 ± 5.5 vs. 4.0 ± 4.6 [P > 0.20]
2. Elbow flexion 1.7 ± 3.9 vs. 2.9 ± 4.0 [P > 0.20]
3. Knee flexion 0.74 ± 4.6 vs. 2.0 ± 4.8 [P > 0.20]
4. Knee extension 1.7 ± 8.4 vs. 2.2 ± 7.6 [P > 0.20]
Muscle Mass Results:

Response to training compared with non-training

1. Change in arm muscle mass:
   
   $499 \pm 349 \text{ mm}^2$ vs. $206 \pm 264 \text{ mm}^2$ [P = 0.004]

2. Change in leg muscle mass:
   
   $1106 \pm 854 \text{ mm}^2$ vs. $523 \pm 872 \text{ mm}^2$ [P = 0.045]

Response to testosterone compared to placebo

1. Change in arm muscle mass

   $512 \pm 371 \text{ mm}^2$ vs. $194 \pm 215 \text{ mm}^2$ [P < 0.001]

2. Change in leg muscle mass

   $1236 \pm 881 \text{ mm}^2$ vs. $399 \pm 729 \text{ mm}^2$ [P = 0.002]
Results for Lipids:

Change in High-Density Lipoprotein Cholesterol

1. Response to testosterone compared to placebo

- $-0.03 \pm 0.13$ mmol/L vs. $0.05 \pm 0.13$ mmol/L
- $-1 \pm 5$ mg/dL vs. $2 \pm 5$ mg/dL, $P = 0.011$

2. Response to training compared with non-training

- $0.05 \pm 0.13$ mmol/L vs. $0.00 \pm 0.16$ mmol/L
- $2 \pm 5$ mg/dL vs. $0 \pm 6$ mg/dL, $P = 0.052$
Conclusion:

In contrast to anabolic therapies that may have adverse effects on metabolic variables, supervised exercise effectively increases muscle mass and lean body mass and is associated with significant positive health benefits in eugonadal men with AIDS wasting.
Progressive Resistance Training in Elderly HIV-Positive Patients: Does It Work?

Paula de Souza, Wilson Jacob-Filho, José Maria Santarém, Alexandre Rodrigues da Silva, Ho Yeh Li, Marcelo Nascimento Burattini (Clinics, 2008;63(5):619-24).
Purpose of the Study:

To investigate the effects of progressive resistance training on body composition, muscular strength, physical fitness, and CD4+ and CD8+ cell counts in HIV-positive elderly subjects.
Methods:

Subjects were prospectively recruited to participate in a training program that consisted of three sets of 8-12 repetitions of leg press, seated row, lumbar extension, and chest press. These exercises were performed with free weight machines twice/week for one year.

Body composition was assessed by anthropometric measures and dual-energy x-ray absorptiometry before and after the training program.
Exercise Intervention:

This supervised progressive resistance training program consisted of four different exercises on free weight machines: leg press, seated row, lumbar extension, and chest press.

Exercises were performed in three sets of 8-12 repetitions at light, moderate and heavy resistance, respectively, with 1-2 minutes of rest between the series, twice a week for one year.

Sub-maximum weight lifted (in the heavy resistance cycle) was defined as the maximum weight lifted smoothly without Valsalva maneuver, apnea, or isometry. For the purposes of this work, it was a surrogate of muscular strength.
Results:

Fourteen subjects, aged 62-71 years old of both genders, without regular physical activity who had an average of nine years of HIV/AIDS history were enrolled.

Strengths of major muscle groups increased (74%-122%, p=0.003-0.021) with a corresponding improvement in sit- standing and walking 2.4 m tests (p=0.003).

Body composition measures did not change, but triceps and thigh skinfolds were significantly reduced (p=0.037).

In addition, CD4+ counts (151 cells; p=0.008) and the CD4+/CD8+ ratio (0.63 to 0.81, p=0.009) significantly increased.
Conclusions:

Resistance training increased strength, improved physical fitness, reduced upper and lower limb skinfolds, and were associated with an improvement in the CD4+ and CD4+/CD8+ counts in HIV positive elderly patients without significant side effects.
Summary of Benefits

Progressive resistance training is effective for improving strength and body composition, although the results are not equivocal.

One study even showed that weight training was effective for improving the level of HDL cholesterol, which is usually only found for aerobic training.

Weight training was shown to be safe for people with HIV as well.
Exercise Recommendations

Four Primary Components of Designing an Exercise Program:

1. Frequency: How many days per week?
2. Intensity: What percentage of maximal heart rate?
3. Duration: How long in a given bout?
4. Mode: What type of exercise?
What is Needed to Help Those with HIV-Associated Wasting

Unfortunately, effective exercise programs tailored for the needs of the wasted HIV-positive population are not provided as standard medical care and are typically not covered by medical insurance.
Hippocrates explained the principle behind weight training.

He wrote, “That which is used develops, and that which is not used wastes away.”
Thank you for your attention and now go lift some weights!