The Female Training Advantages 2012
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Recommended Reading: Fatigue Resistance: An Intriguing Difference in Gender (Len’s WEB page)

I. Benefits of resistance training for women
   A. Increase in bone mineral density, increase in fat-free mass, increase in muscular strength and muscular endurance, increase in glucose metabolism (insulin sensitivity)
   B. Increase in HDL-C (some studies), altered total cholesterol and LDL-C (some studies), RMR (7-9%), increase in psychological well-being
   C. Exercise and insulin sensitivity (aerobic and resistance exercise): the number and availability of insulin receptors increases (increases sensitivity to insulin)

II. Resistance training excels
   A. Growth: 1972 passage of Title IX, 1972—300,000 women in sport; 1998—2.2 million women in sports; 2010—58.7 million women exercise walking
   B. 31.5% women participants in resistance exercise in 2010
   C. 38.5% women participants in aerobic exercise in 2010

III. Factors affecting performance
   A. > 50 trillion cells in human body and reproductive cells are how sexes differ
   B. Males have 10-20x more testosterone
   C. Female body matures earlier due to estrogen
   D. Hormones of reproductive system account for major gender differences
   E. IMPORTANCE of core training
   F. What two joints in the female are wider than in male? (knee and hips)
   G. ‘True pelvis’ is larger to accommodate fetus
   H. Females have greater lumbar (anterior) spinal curvature due to ‘true pelvis’ which often leads to more chronic low back pain (Core training needs to be staple in training females!)
   I. Crucial advice about women’s knees: 1 in five sports injuries is knee, women more susceptible to ‘runners knee’, 2-8 times more likely to have an ACL injury
   J. Injury prevention suggestions:
      1. Multi-mode training to offer varied stimulus challenge while avoiding overuse
      2. Matrix lunges: forward, 45 degree forward, side, 45 degree back, back lunge
      3. Squat variations: narrow, shoulder width, wide, ‘summo’
      4. Platform stationary lunges
   K. Body Composition: Women have 8%-10% more body fat (much is body composition); 5% is sex-specific to females (reproduction)
   L. Elite endurance male and female athletes vary 2%-6% in body fat
M. Body composition swimming training advantage (Gertude Ederle example)
   1. Body fat aids in buoyancy, females have less ‘drag’ in water
   2. Expend 20% less energy (at same pace and distance as male counterpart)

N. What % does skeletal muscle comprise of total body weight in females? (31%)
O. What % does skeletal muscle comprise of total body weight in males? (38%)

P. Adult female abdominal obesity mechanism
   1. Challenged situation=norepinephrine ‘fight’ hormone; loss of control=epinephrine ‘flight/anxiety’ hormone; chronic stress=cortisol cascade
   2. Cortisol cascade: release fatty acids in blood (precursor to heart disease), relocate fat to deep abdomen (visceral obesity), enhances lipogenesis (fat creation)
   3. Best intervention: resistance exercise, aerobic exercise, mind-body programs, healthy working environment
   4. Nurses Health Study (16 years following 44,636 women); 751 CVD deaths, 1748 cancer deaths; even normal weight women face elevated CVD and cancer risk with abdominal obesity; women with largest waists are 63% more likely to develop cancer; overall, women with waistline ≥88 cm (35 in) saw a 79% greater risk of death from all causes

Q. Important training message: a woman can increase FFM (muscle) with resistance training and lower subcutaneous fat and have no change in body weight

R. How much does strength decline due to aging and inactivity? 8-10% per decade (4\textsuperscript{th} decade)

S. Are physically active women healthier than sedentary women (9,704 females, ≥65 yrs)

T. Results: sedentary women who increased their physical activity equivalent to 1 mile/day brisk walking at a 40% to 50% lower risk to CVD, cancer and all causes of mortality

IV. Fat metabolism and aerobic exercise program design
A. Fat mobilization is the releasing of fat from storage depots
B. Epinephrine stimulates mobilization and lipolysis (splitting of fat)
C. Estrogen enhances epinephrine production
D. Estrogen inhibits lipoprotein lipase (LPL)
E. Estrogen stimulates growth hormone (GH) production: GH enhances fatty acid metabolism and inhibits glucose metabolism

F. Why is there a difference in fat distribution in males and females
   1. Fat cells have norepinephrine receptors
   2. Alpha receptors inhibit lipolysis; beta receptors stimulate lipolysis
   3. Women have more alpha receptors in hips/thighs
   4. Women have more lipoprotein lipase (LPL) in the hips and thighs (LPL deposits fat)
G. Respiratory Exchange Ratio (RER) is the volume of carbon dioxide (CO₂) expired in relation to the volume of oxygen (O₂) inspired: it reflects what fuels utilized in exercise

H. Is there a gender difference in fat utilization: BIG DEBATE! Most recent research conclude that YES, a gender difference exits in the relative contribution from carbohydrate and lipids

I. Designing aerobic programs to enhance fat metabolism
   1. Incorporate low-to-moderate int., long-duration workouts (increase metabolic base)
   2. Incorporate FAST continuous training (increase total fat metabolism)
   3. Incorporate interval training (more work = increased total fat metabolism)

J. Lactate threshold design (for fat metabolism); Monitor with RPE and Talk Test: Case study of client who is doing 200 minutes of Cardio Training in a week
   1. 80% of total should be low-to-moderate int. exercise: 160 minutes, so perhaps four, 40 minute workouts {RPE 11-13}; Talk test=easily cite ‘Pledge of Allegiance’
   2. 10% of total should be Fast Continuous; perhaps one 20-minute workout {RPE 14-15}; Talk test=cite ‘Pledge of Allegiance’ with difficulty
   3. 10% of total should be Interval Training, perhaps one 20-minute workout {RPE 16-17}; Talk test= cannot cite ‘Pledge of Allegiance’
   4. Individualize the progression: incremental increased in volume and intensity: try to avoid injury, overuse and overtraining to the client

V. Fatigue resistance: Resistance training design
   A. Females have much greater ‘fatigue resistance’ than males
   B. Females have 23% greater fatigue resistance (then men) at task specific relative forces at any intensity
   C. Lower absolute muscle mass, lower muscle oxygen demand, increased oxygen extraction and waste clearance, estrogen increases blood flow to working muscle, increased neuromuscular activation after fatiguing exercise
   D. Fatigue resistance training implications: Fit females capable of more high volume (reps x sets) workouts, fit females require less recover time between sets (60 sec); fit females need fewer rest days between intense (≥ 80% 1RM) workouts
   E. What training systems are recommended (from the published research): Periodization
   F. Systematic changes of volume and intensity with variation manipulation
   G. Volume=reps x sets; intensity=%1RM

**Undulating Approach (Marx et al. study):** Young women average age 22 years; 6 month study; Results Indicated:
No change in body mass, body fat (26.5% to 19.8%), fat-free mass (42.3 kg to 45.6 kg), bench press improved 50%, wingate power improved 27%, speed improved 6%, testosterone and Insulin growth factor-1 increased (anabolic hormones), no change in human growth hormone, cortisol levels decreased

Program (3 day/wk): Total body workout each day; 2-4 sets, within week variation of exercises
Option 1: Monday (all sets done in 12-15 RM zone), Wednesday (all sets done in 8-10 RM zone), Friday (all sets done in 3-5 RM zone); note that every 2-3 weeks the program rotated as follows in Option 2
Option 2: Monday (all sets done in 3-5 RM zone), Wednesday (all sets done in 8-10 RM zone), Friday all sets done in 12-15 RM zone)
Three other weekly (MWF) sequence options by rep zones: (a=8-10 RM, 3-5 RM, 12-15 RM; b=3-5 RM, 12-15 RM, 8-10 RM; c=12-15 RM, 3-5 RM, 8-10 RM)

Two-Day Linear Periodization (Roepstorff et al. study): Total body workout each day with untrained middle-aged women (52 yrs) and mature women (64 yrs). Results indicated:
Significant increases in maximal and explosive strength characteristics of lower body, improved walking speed, improvement in static and dynamic balance capabilities in this 21 week study.
52yr grp: increase in isometric strength (28%), dynamic strength (20%) & dynamic balance (31%)
64yr grp: increase in isometric strength (27%), dynamic strength (20%) & dynamic balance (18%)
Program (2 day/wk): Total body workout each day
First 7 weeks: 2-4 sets of 10 total body exercises:
Day 1 of week 40-60% 1RM (10-15 reps); Day 2 of week 60-70% of 1RM (8-10 reps)
PLUS: 1 Set (8-12 Reps) at 50% 1RM of explosive leg press, leg extension, hamstring curl
Second 7 weeks: 2-4 sets of 10 total body exercises:
Day 1 of week 60-70% 1RM (10-12 reps); Day 2 of week 70-80% of 1RM (5-8 reps)
PLUS: 1 Set (8-12 Reps) at 50% 1RM of explosive leg press, leg extension, hamstring curl
Third 7 weeks: 3-5 sets of 10 total body exercises:
Day 1 of week 70-80% 1RM (8-10 reps); Day 2 of week 70-80% of 1RM (5-8 reps)
PLUS: 1 Set (8-12 Reps) at 50% 1RM of explosive leg press, leg extension, hamstring curl

References Found on Len’s WEB site: