Body Composition

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History

- 440BC Hippocrates
- Ancient Chinese scholars
- 980AD
- Late 1900’s

http://www.bodysystems.co.nz/bodystat.shtml
Body Composition

![Body Composition Diagram]

* Density of water, protein, & bone minerals can change with age, activity, illness, & ethnicity.

[www.exercisebiology.com/index.php/site/articles/which_is_the_most_accurate_body_fat_measurement_method_calculator/]

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Lean Build vs. Non-Lean Build

**Aesthetic and weight dependent Sports**
- Cross-country
- Track
- Swimming
- Body builders
- Wrestling/Boxing
- Dance/Ballet

**Non-weight dependent Sports**
- Tennis
- Volleyball
- Basketball
- Soccer
- Hockey
- Lacrosse
- Field events from Track and Field

[www.livestrong.com]

Analyzing Body Composition and Assessing Weight

- Physical measurements: Important for assessment of progress to achieve peak performance.
  - Height
  - Weight
  - Somatotype
  - Girth
  - Body Composition

Height & Weight

- Height (stature) & weight (body mass)
  - Optimal weight is relative to height

- For accurate measurements:
  - Measurement boards
  - Calibrated scales
Somatotype (Body Build)

- **Endomorph**
  - stocky, gain fat easily

- **Mesomorph**
  - muscular, do not gain large amounts of fat

- **Ectomorph**
  - minor, small amounts of fat and muscle

Girth

- Circumference of different body parts
  - waist, hips, calves, thighs, arms, chest.

- Helps track changes in body size
Tools To Assess Body Composition

- Near-infrared interactance (NIR)
- Bioelectrical impedance (BIA)
- Skinfold thickness
- Body plethysmography (Bod Pod)
- Hydrostatic (underwater) weighing
- Dual-energy X-ray absorptiometry (DEXA or DXA)

Images taken from: http://s1.hubimg.com/u/1136328_f260.jpg
https://teach.lanecc.edu/naylore/225lectures/09a/thumbnails/09omronhandheldimpedence.jpg
http://i2.cdn.turner.com/cnn/2009/HEALTH/01/02/healthmag.measuring.body.fat/art.calipers.arm.jpg
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http://www.livebetterwiki.com/Portals/0/underwater%20weighing.jpg
http://www.tappmedical.com/page_images/dexa.jpg
## Weight Maintenance

- Athletes can face unwanted weight gain/weight loss
- Focus on a time in the past when weight was maintained
- Periodization
- Change of training and competition season
  - May increase or decrease nutrient needs
- Injuries and Off Season

## Weight Reduction

- Identify an Appropriate Weight Range
- Evaluate Current Dietary and Exercise Practices
- Establish Energy and Macronutrient Requirements
- Devise a Dietary Plan for Achieving Goals on Established Needs
- Educate the Athlete; Review the Dietary Plan, Monitor Status
Weight Gain

- Gaining body weight requires consistent excess energy intake
- Gain lean weight or muscle mass
- Increase Carbohydrates, Proteins, and Fats
- Similar five steps from Weight Reduction

Four steps to achieving optimal performance weight

1. Assessment
2. Goal Setting
3. Action Plan
4. Evaluation and Reassessment

http://www.behaviortherapyassociates.com/histepsummersocialskillprogrannewjersey.html
Gain Muscle, Lose Excess Fat

- In order to do this recommendations are:
  - Aerobic activity
  - Resistance Training
    - keeps fat off and increases muscle mass
- Aerobic workouts and weight training along with proper nutrition enables an athlete to get their desired body composition

More Protein?

- Do athletes need excess protein to build muscle?
  - Do not need excessive amounts of protein
  - No benefits from excess protein
    - Lower carbohydrate intake
    - Excessive caloric intake
    - Greater fluid losses
    - Higher food costs
HET

11/22/10

Articles
Body composition assessment in athletes with spinal cord injury: comparison of field methods with dual-energy X-ray absorptiometry


Purpose

- Purpose of the study was to compare estimates of body fat % from SKF and BIA with the DXA estimates in athletes who have spinal cord injury.
Methods (Participants)

- 16 Caucasian athletes with SCI
  - 8 women & 8 men
  - 12 wheelchair basketball & 4 wheelchair racing programs.
  - 11 complete SCI & 5 incomplete SCI

Methods (Procedures)

- No alcohol
- No exercise 16hr before testing
- Empty bladder
- Women: during days 7-14 from start of last menstrual period
- Anthropometric & BIA measured during morning after 12 hr fasting
Methods (Procedures cont.)

- Anthropometry
- SKF
- BIA
- Compared to DXA
- Statistical analyses

Results/Conclusions

- Men taller & weighed more than Women
- Women had greater %Fat than men
- %Body Fat for the BIA equations were closer to DXA %Body Fat than SKF estimates for both men and women
- Believe neither measurements accurately estimate %Body Fat
Purpose

- To examine relationships between laboratory tests and on-ice skating performance in division I men’s hockey athletes.
Methods

- 21 men (age 20.7 ± 1.6 years)
- Assessed body comp., isokinetic force production in quadriceps and hamstring muscles, and anaerobic muscle power (AMP)
- Air displacement plethysmography (% body fat)
- Wingate 30-second cycle ergometer test (AMP)
- On-ice skating performance measured during 6 timed 89-m sprints
  - Subjects wore full hockey equipment

Results:

- %Fat 11.9 ± 4.6
- Avg. skating times were moderately correlated to %Fat
- Greater %Fat => slower skating speeds
- Faster speeds correlated with Wingate Fatigue index

Conclusions:

- Laboratory testing of select variables can predict skating performance in ice hockey athletes.
- Info used to develop targeted and effective strength and conditioning programs to improve skating speed
Dietary Intake and Body Composition of Prepubescent Female Aesthetic Athletes


Purpose

- To assess energy and nutrient intakes in prepubescent athletes practicing different aesthetic sport disciplines as well as to assess possible differences that there might be between these groups of athletes.
Methods

- 39 female athletes (9 artistic gymnasts, 14 rhythmic gymnasts, 16 ballet dancers).
- Actively training for at least 5 years
- Age 9-13 (median 11)
- National level competition

- Control – 15 premenarcheal females
- Age 10-12 (median 11)
- No history of participation in competitive sports
- Recruited from a public school in Zagreb

- No dieting was reported

Methods Cont.

- Anthropometry
  - Height, weight and 2 skinfold thickness sites measured (triceps and calves).
  - Taken by skilled tech. before morning training.

- Food Intake
  - Quantitative Food Frequency Questionnaire
  - 7 day diet record
  - qFFQ readministered after 30 days
  - Diet analysis includes: food, beverage, supplement
Results/Conclusions

- Rhythmic gymnasts: sig. taller, no difference in weight or BMI than artistic gymnasts.
- Significant diff. in body fat % between artistic gymnasts and ballet dancers. (12.4% ± 1.8% to 17.4% ± 4.7%)
- No difference between artistic & rhythmic gymnasts

Results/Conclusions

- Energy & Macronutrients
  - No significant difference in energy intake
  - Difference in macronutrient contribution to total energy intake. Higher CHO, lower fat.
    - Artistic gymnasts: 57% ± 6%, 29% ± 5%
    - Rhythmic gymnasts: 48% ± 6%, 36% ± 5%
    - Ballet dancers: 51% ± 4%, 34% ± 3%
    - Controls: 51% ± 5%, 34% ± 4%
- No difference in intake of minerals/vitamins
  - Sodium above upper limit, potassium & calcium below adequate intake, all other minerals/vitamins higher than current daily recs.
- Hydration inadequate in all except controls.
Sport and training influence bone and body composition in women collegiate athletes


Purpose

- This is a novel descriptive study to characterize off-season, preseason, and postseason bone and body composition measures in women collegiate athletes.
Methods

- Athletes from five sports (softball, basketball, volleyball, swimming, track jumpers)
- Analyzed their total body mass, lean mass, fat mass, percent body fat, bone mineral density, arm, leg, pelvis, and spine BMD during three different parts of the season.
- They were analyzed during the off-season, preseason, and post season.

Results

- Significant off-season to preseason or postseason changes in %BF, LM, and BMD within each sport were as follows, respectively:
  - Softball, -7, +4, +1%
  - Basketball, -11, +4, +1%
  - Volleyball, unchanged, unchanged, +2%
  - Swimming, unchanged, +2.5%, unchanged
  - Track jumpers and sprinters, -7, +3.5, +1%
Results Cont.

- Comparisons among athletes in each sport showed bone measurements of swimmers averaged 4-19% lower than that of athletes in any other sport.
- Track jumpers and sprinters, %BF and FM averaged 36 and 43% lower compared with other sports at all seasonal periods.
- Athletes playing basketball and volleyball were most similar.
- Softball athletes' values fell between all other athletes.
- These data serve as sport-specific reference values for comparisons at in-season and off-season training periods among women collegiate athletes in various sports.

Body Mass Index as a Predictor of Percent Fat in College Athletes and Nonathletes

Purpose

- The purpose of this study was to evaluate the relationship of Body Mass Index (BMI) and percent body fat focusing on the college athlete and the college nonathlete

  □ Why?
  - there have been some misclassifications in the college athlete populations when athletes are given BMI that state they are overweight when they actually have healthy body fat percentage
Methods/Materials

- Total of 440 participants
  - 213 college aged nonathletes (78 male/135 male)
    - Undergraduate kinesiology majors in an exercise physiology class
  - 226 varsity college athletes (149 male/77 female)
    - Males: football, basketball, hockey and wrestling
    - Females: basketball, crew, and softball
- 3 male groups and 2 female groups
  - Male athletes, male nonathletes, and linemen
  - Female athletes and female nonathletes
- Calculated BMI and calculated their percent fat with the BOD POD
  - BMI: reading greater or equal to 25 kg per meter was defined as overweight.
  - PERCENT FAT: A score of 20% fat for males and 33% fat for females was deemed overfat

Results

- Male Athletes
  - 67% of the participant’s BMI scores said they were overweight but they were in the normal fat percentage range
  - Small proportion of participants were given normal BMI scores when they were actually deemed overfat
- Male Nonathletes
  - 25% of the participant’s BMI scores said they were overweight but they were in the normal fat percentage range
- Linemen
  - No linemen had a BMI lower than 25– all deemed overweight based on this number
  - Only one was less than 20% body fat
- Female Athletes
  - 31% of the participant’s BMI results said they were overweight but they were in the normal fat percentage range
- Female Nonathlete
  - Only 7% of the participant’s BMI scores said they were overweight but they were in the normal fat percentage range
  - 44% of the participants were given normal BMI scores when they were actually deemed overfat
Conclusion

- “BMI should be used cautiously when classifying fatness in college athletes and nonathletes. Our results support the need for different BMI classifications of overweight in these populations” (Ode, Pivarnik, Reeves, & Knous, 2007, p. 403).

- Athletes have a greater muscle mass than the general population and therefore the BMI system often misclassifies them as overweight.

- Coaches, athletes, trainers, and registered dietitians
  - BMI has been found unreliable for athletes
Reference


References