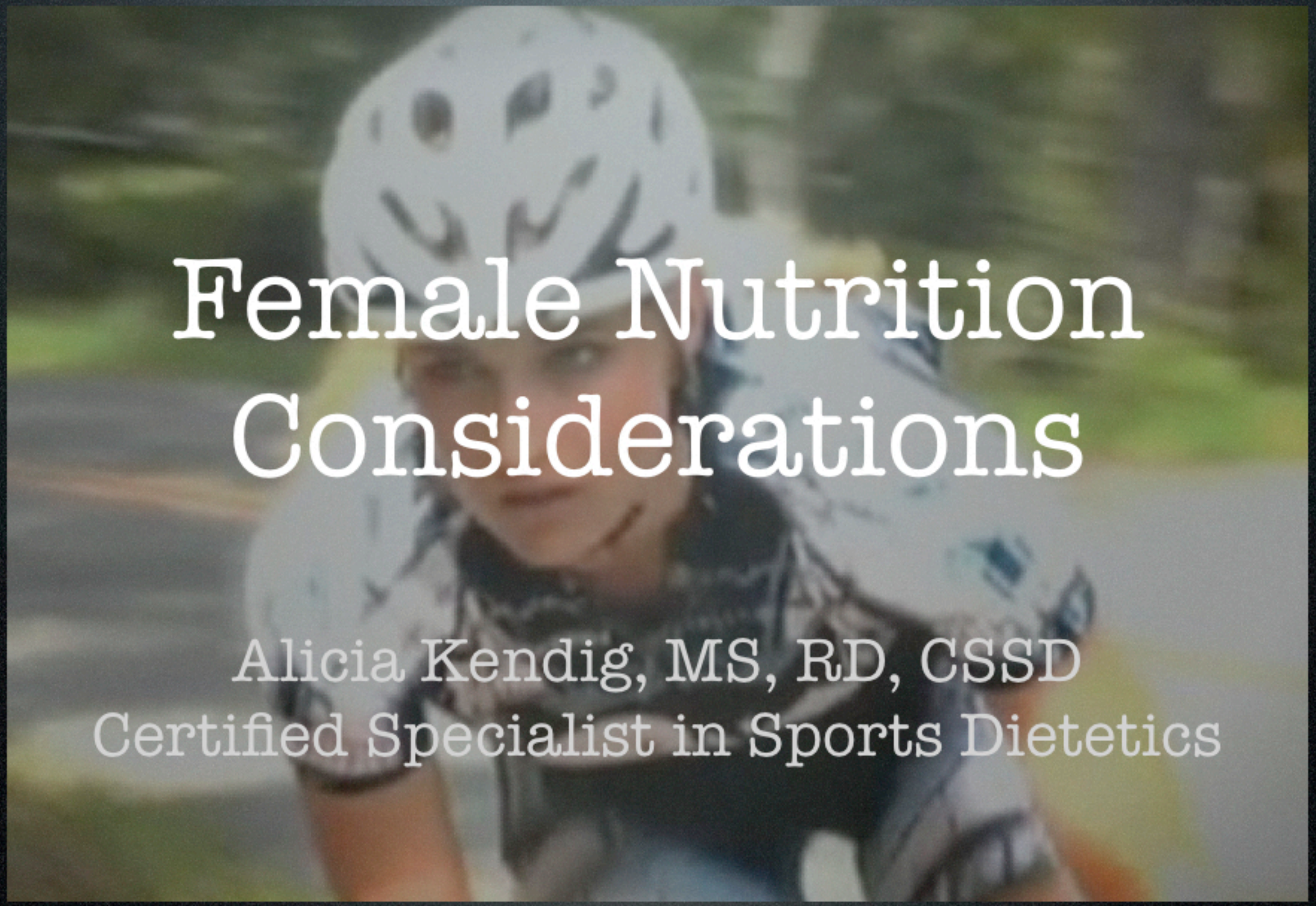


Female Nutrition Considerations

Alicia Kendig, MS, RD, CSSD
Certified Specialist in Sports Dietetics

Objectives

- Outline the importance of food for the female athlete
- Identify known trends and common inadequacies of the female athletes diet
- Understand the consequences of The Female Athlete Triad and the importance of prevention
- Put the research into practice

Function of Energy from Food

- Cellular maintenance
- Thermoregulation
- Locomotion
- Growth
- Reproduction

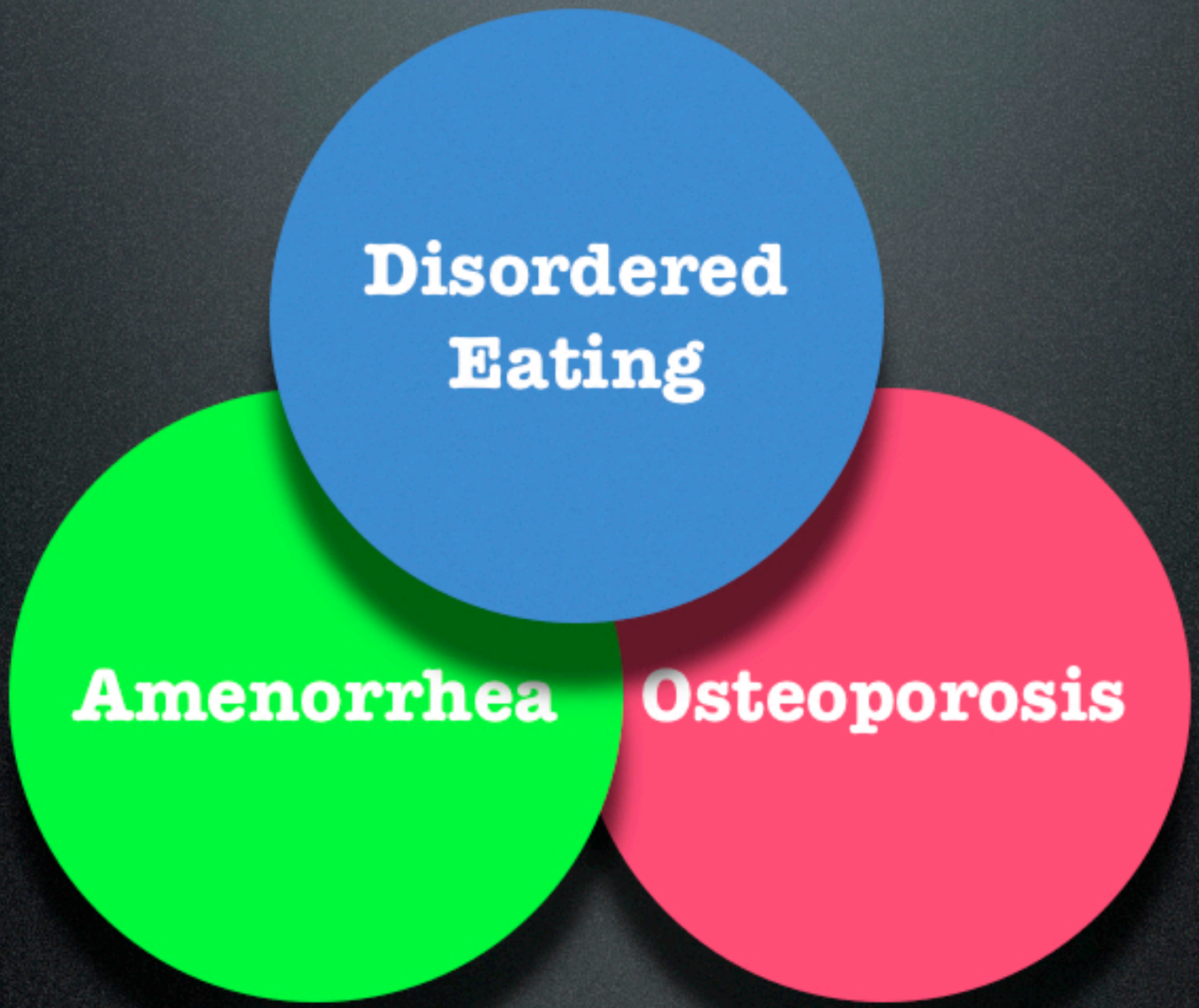
Optimal Performance?

- Energy Availability
- Energy Metabolism
- Bone Density
- Oxygen availability

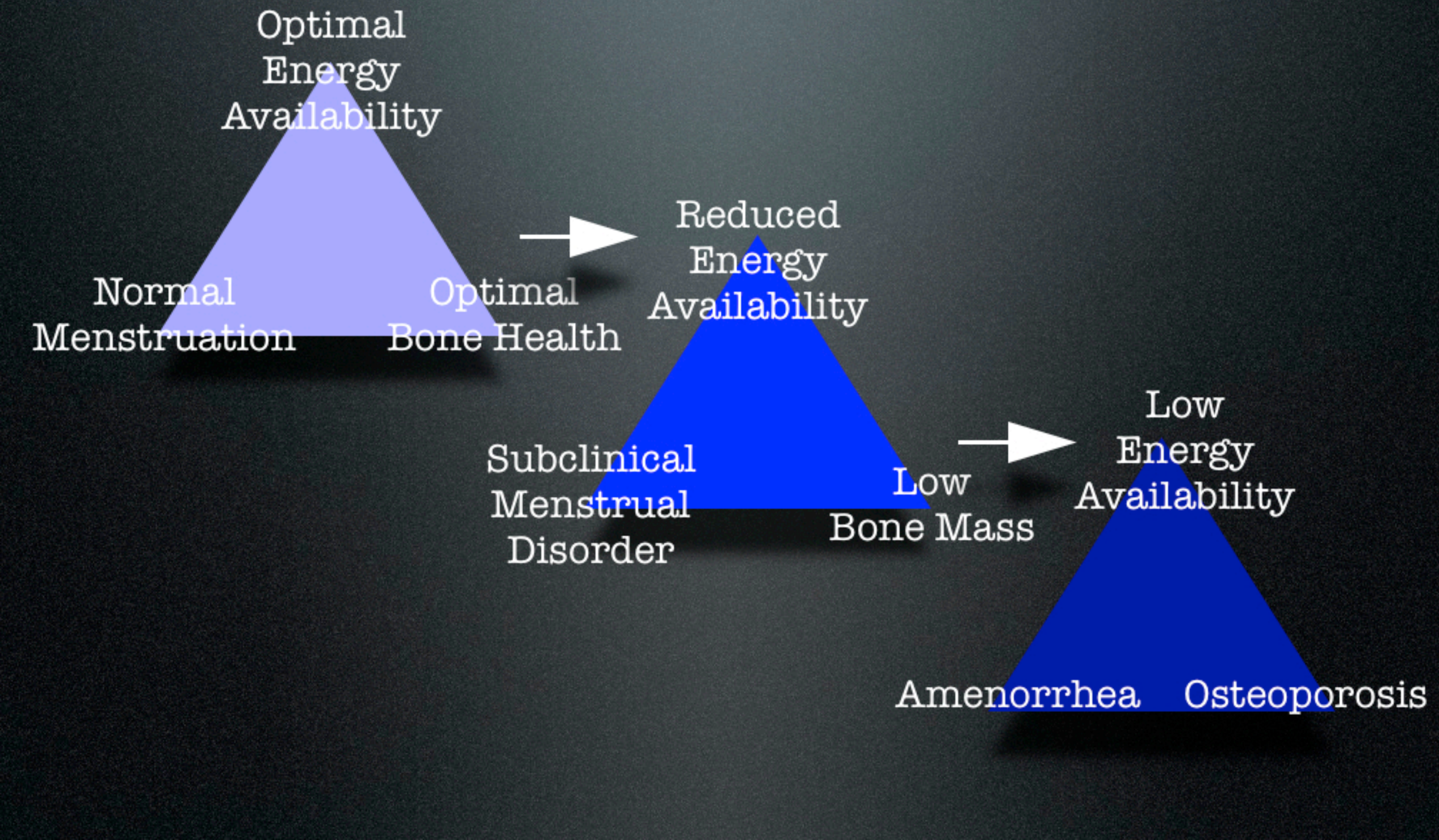
General Trends: The Female Endurance Athletes

- Low in energy
  - Low in carbohydrate
  - Potentially low in protein (essential AA) and fat (essential FA)
- Low in bone-building nutrients
  - Calcium, Vitamin D, magnesium
- Low in oxygen transport nutrients
  - Iron, folate, vitamin B12
- Sometimes low in energy nutrients (B vitamins)

Traditional Female Athlete Triad



The Female Athlete Triad
ACSM Position 2007

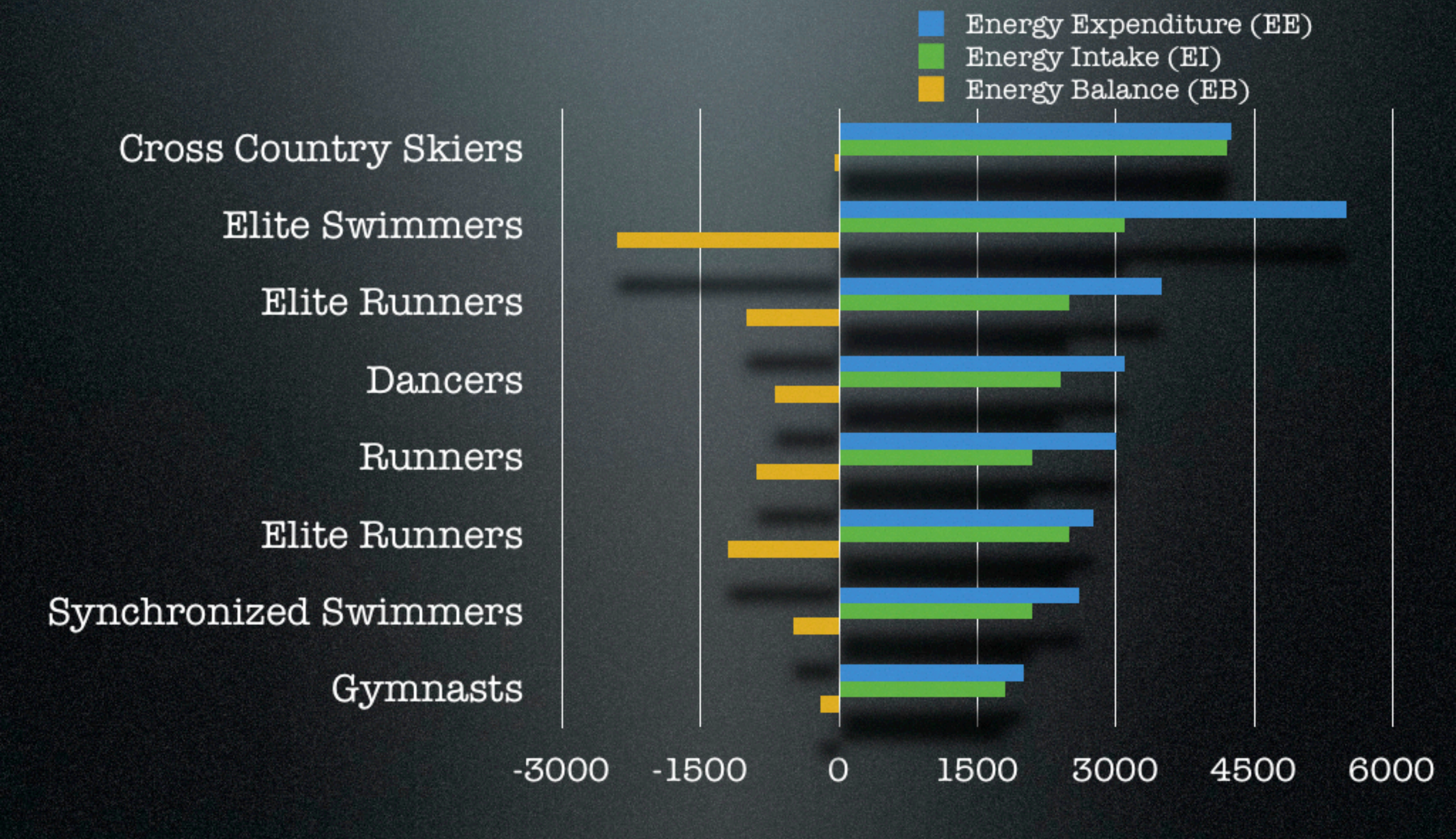


Energy Availability

- Energy availability occurs ~45 kcal/kg FFM
  - RMR is ~30 kcal/kg FFM/day
- Energy Balance below ~30kcal/kg/day, the female body will suppress reproductive function and skeletal health

Ihle & Loucks, 2004

Energy Expenditure, Intake and Balance in Female Athletes in Training



Insufficient intake or Eating Disorder

- Rapid increase in energy expenditure, inadequate increase in caloric intake
  - Can easily occur with high carbohydrate diets
- Or intentional altering of body size and/or composition
  - For competitive success or social pressures

Recommended Energy Availability Calculations

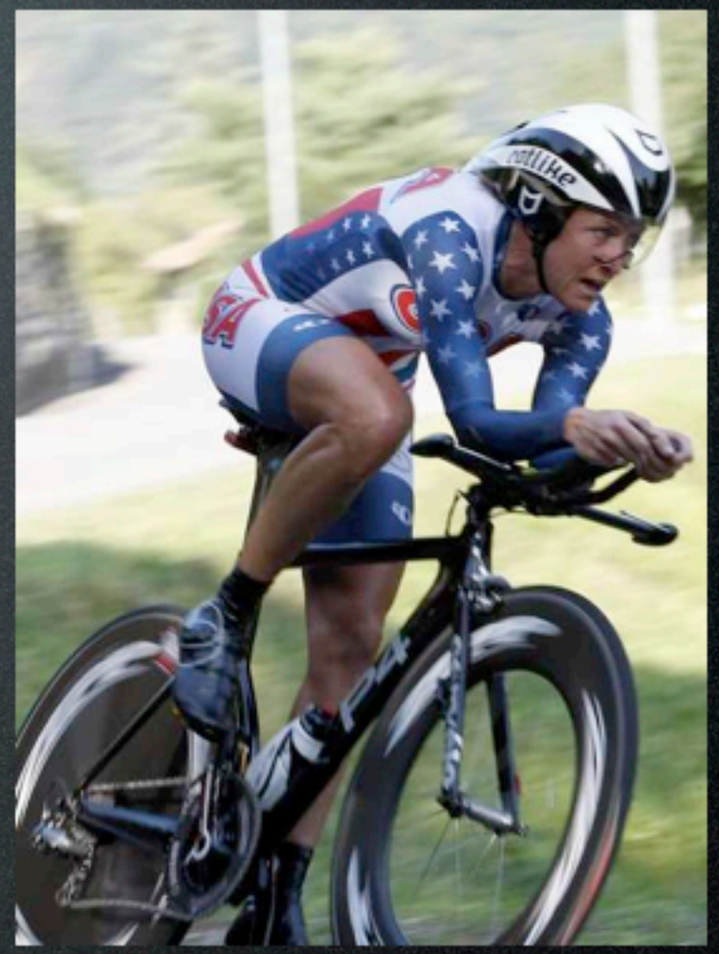
Example	Body Weightt (kg)	Body Fat (%)	FFM (kg)	EI/day	EEE (kcal/ day)	(EI-EEE)/ FFM
Low Energy Availability	61.5	13.5	53.2	1422	520	17
Weight Loss	61.5	13.5	53.2	2382	520	35
Weight Maintenance	61.5	13.5	53.2	2914	520	45
CHO Loading	61.5	13.5	53.2	3192	0	60

Manore, et al. The Female Athlete Triad: Components, nutrition issues, and health consequences. 2007

Inadequate Energy Availability

- Survival Mode
  - Body will sustain energy-consuming activities necessary for survival
  - Less critical energy-consuming processes such as reproductive function and growth may be compromised
  - Not to mention athletic performance!

Causes for Menstrual Dysfunction

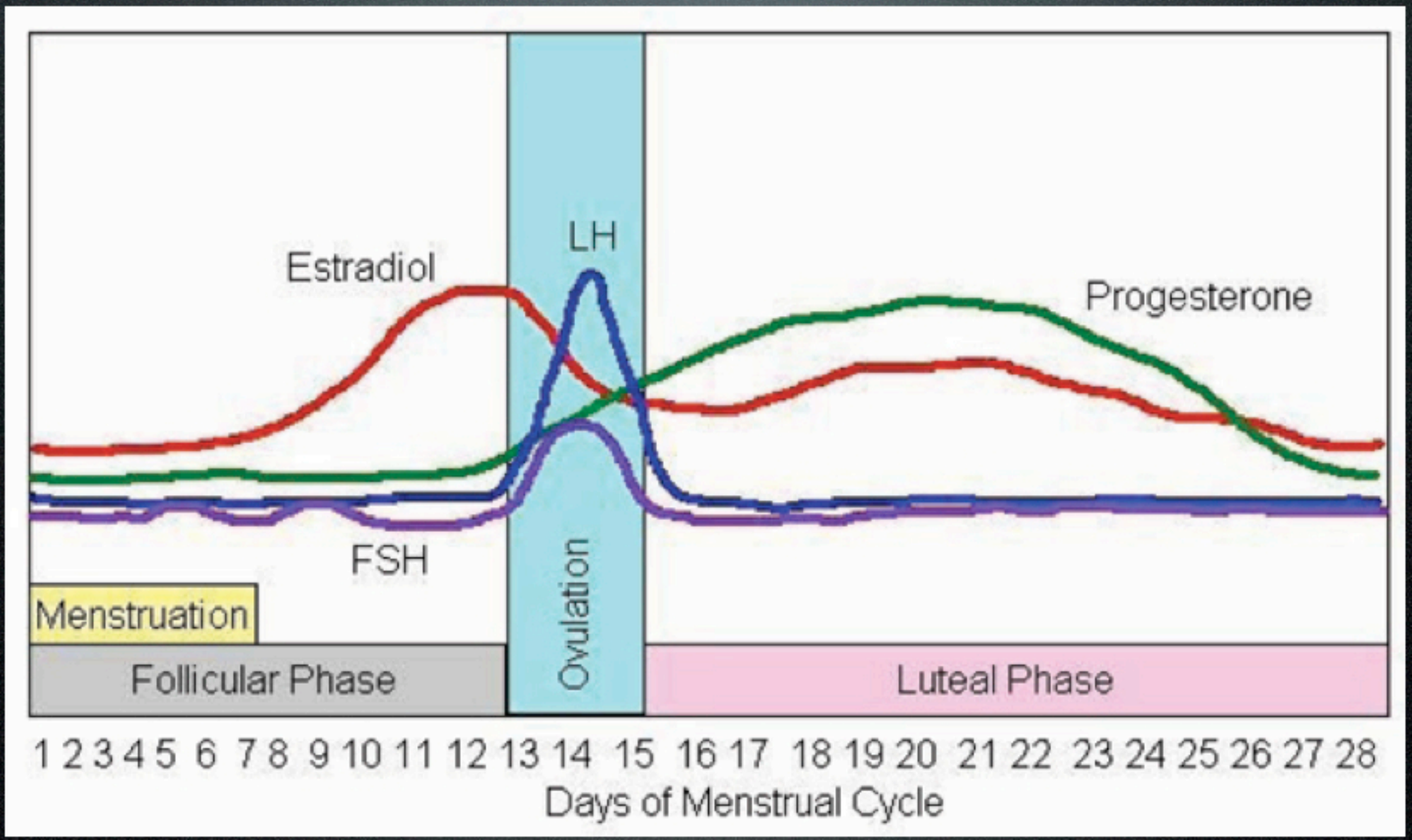


- Old-School Thoughts
  - Low Body Fat Level
  - Increased Exercise Stress
- Today's Research
  - Energy Availability
    - LH pulsatility in hypothalamus disrupted by low energy availability
    - Energy supplementation prevents LH disruption in exercising women

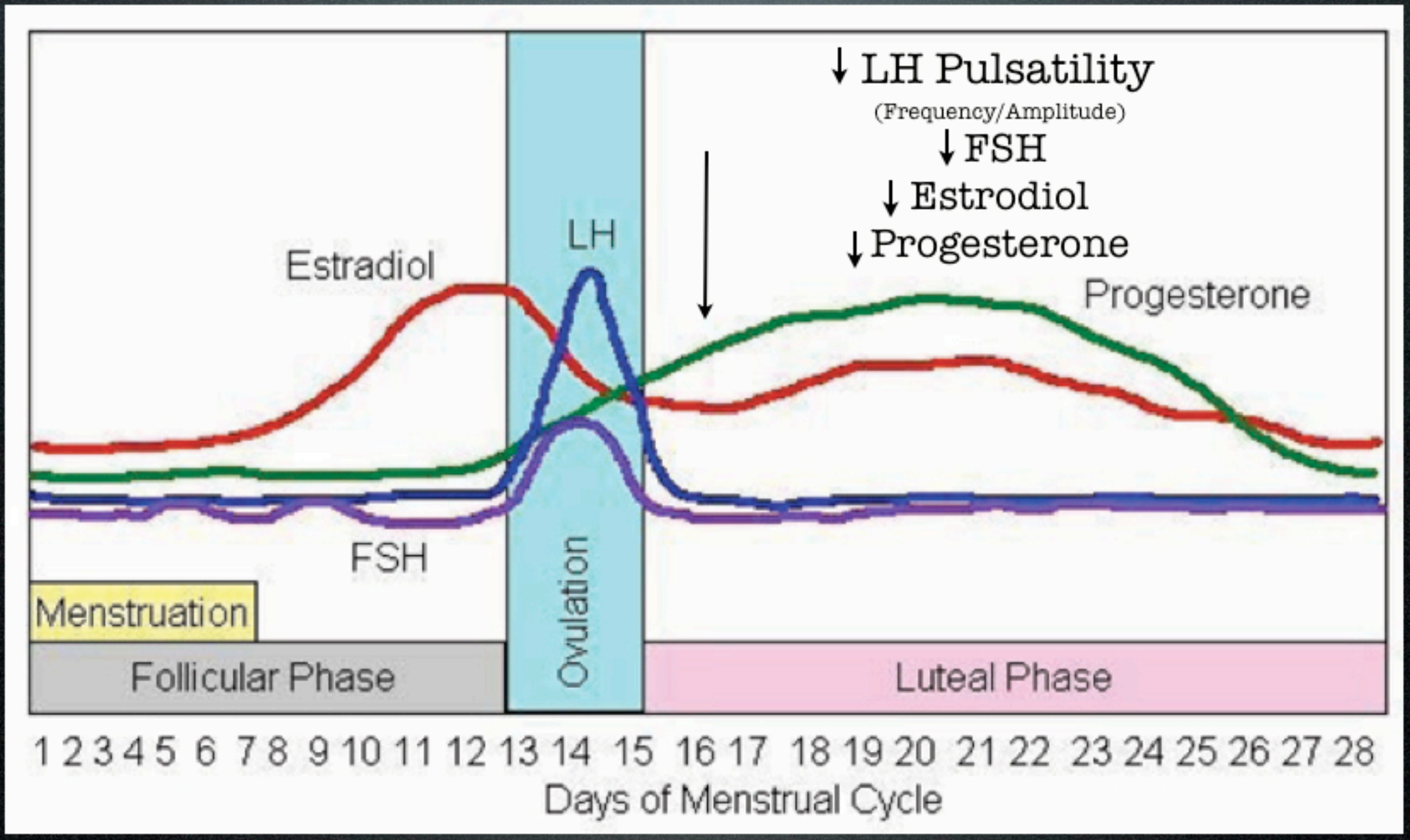
Menstrual Status - Clinical Definitions

- Clinical
  - Eumenorrhea - Normal 28 day/cycle
  - Oligomenorrhea - More than 35 day/cycle
  - Amenorrhea - More than 90 day/cycle
- Sub-Clinical
  - Luteal Deficiency - Inadequate progesterone production during the luteal phase
  - Anovulation - No ovulation

Normal Menstrual Cycle



Low Energy Availability



Louke et al, 1989

How long does it take?

- In experiments of exercising women, luteinizing hormone pulse frequency was suppressed within 5 days, when energy availability was reduced below ~30kcal/kg/day

Loucks & Thurma, 2003

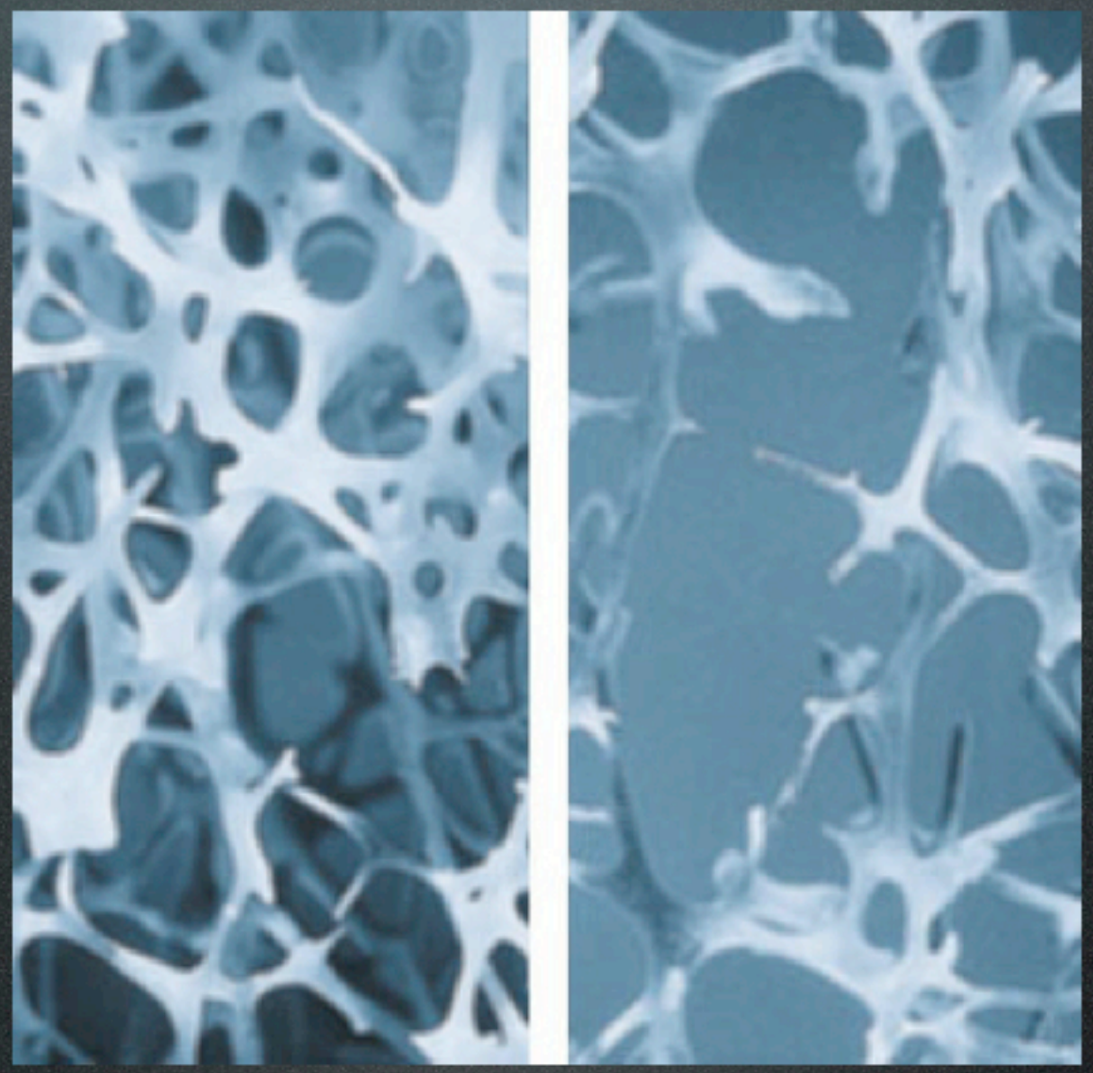
- In animal experiments, reducing dietary intake by more than 30% has caused infertility.

ACSM, 2007

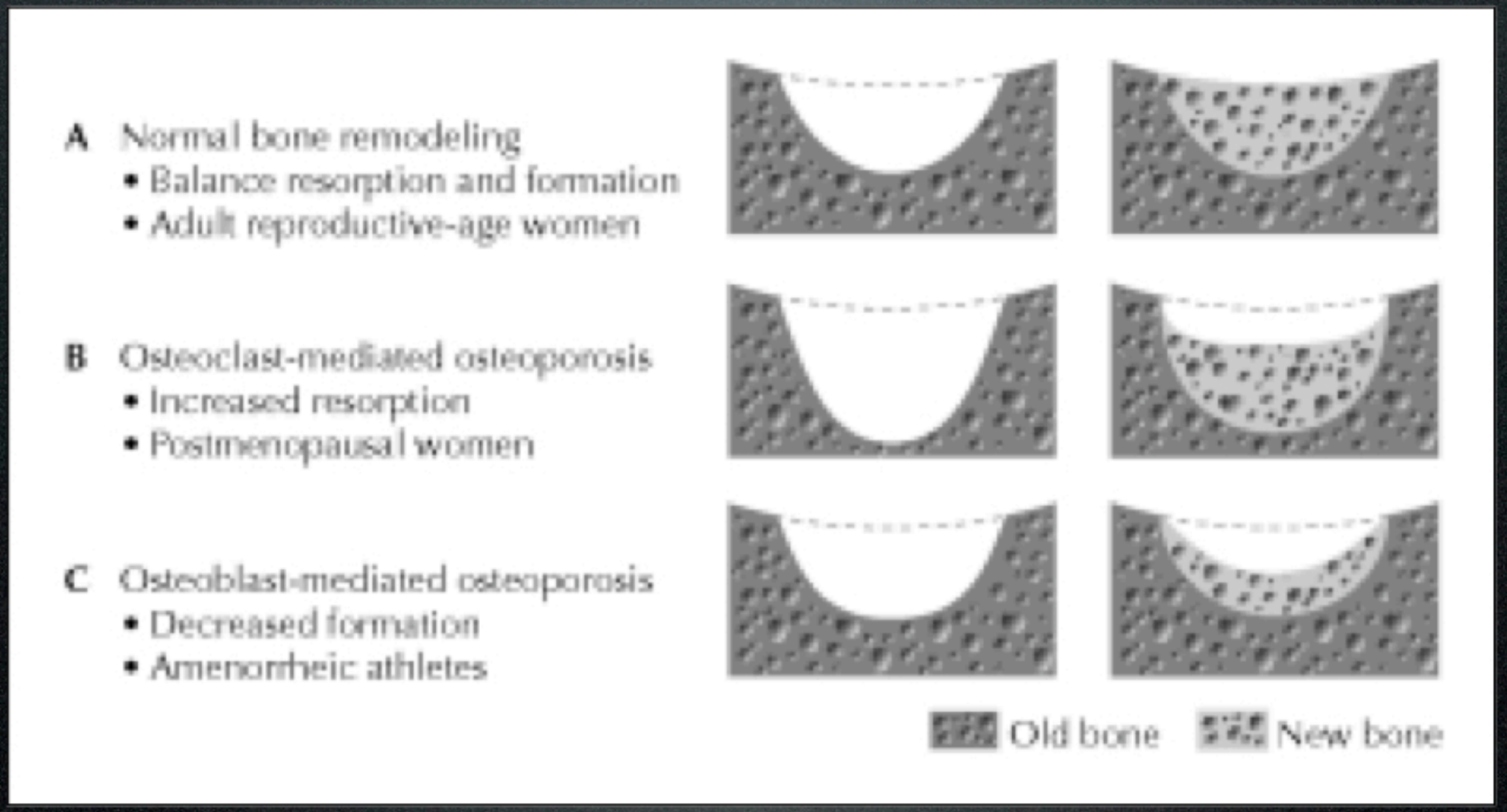
Effect of Low Hormone Levels on Bone Formation

- Hypoestrogenism
  - Compromised metabolic hormone/ substrate availability
  - Increased bone resorption
  - Suppressed bone formation

Healthy Bone vs Osteoporotic Bone



Bone Remodeling



Parfitt, 2001

Implications of low BMD

- Increased risk of stress fractures
- Load fractures of the hip and spine
- Inability to tolerate increases in training load
- Development of severe conditions post-menepause

BMD with Reappearance of Menses

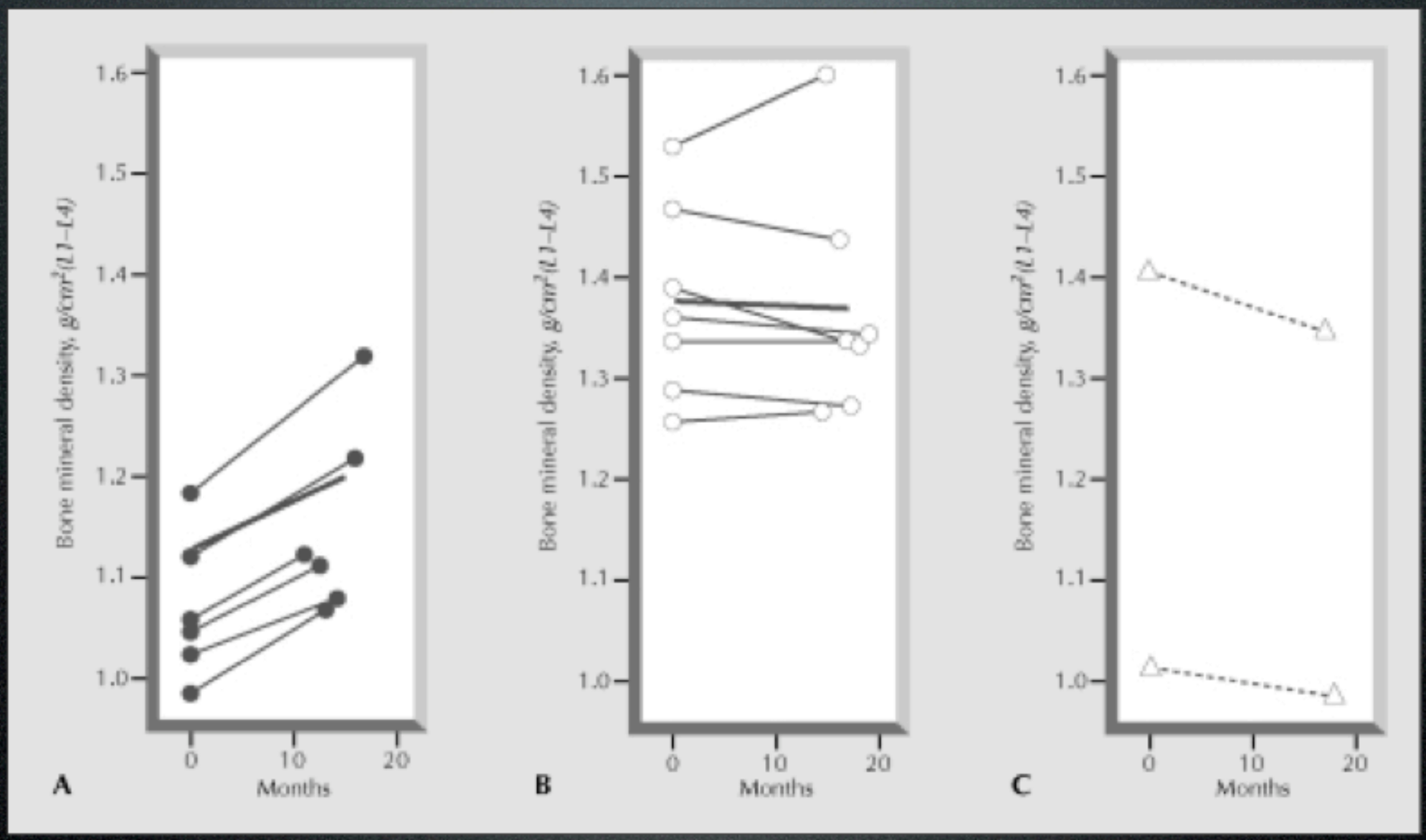


Figure 1. *Changes in bone mineral density of the lumbar spine (L1–L4) across time between testing time 1 and 2 in athletes who regained menses (Panel A), athletes who remained cyclic (Panel B), and athletes who remained amenorrheic (Panel C).*

Regained Menses Cyclic Amenorrheic

Drinkwater, et al 1986

Fighting Low BMD and Helping Bone Formation

- Childhood to adulthood (30 yoa) bones forming
- Building bone mass
- Calcium w/ Vitamin D
- Calories and Protein
- Exercise

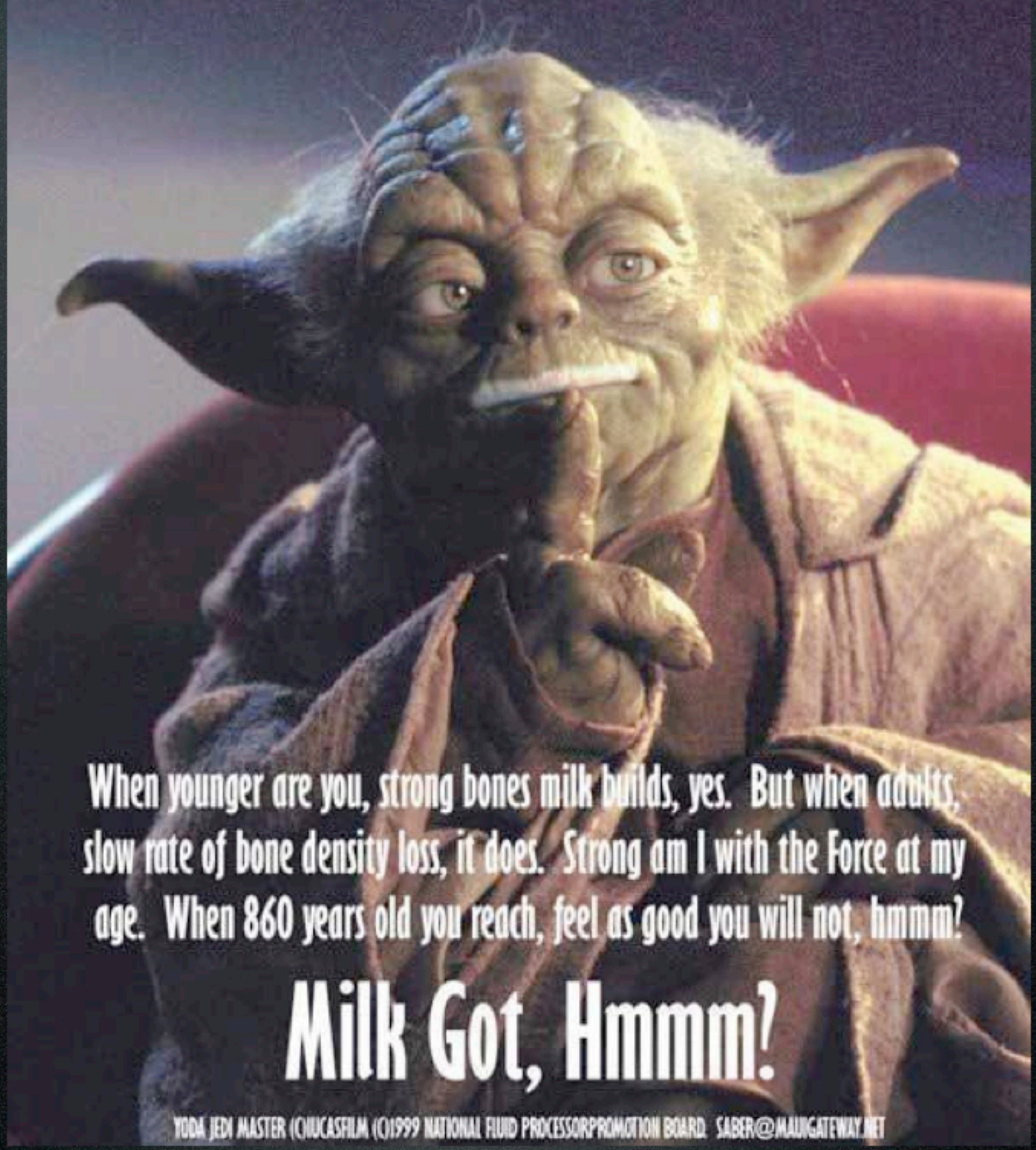
Fighting Low BMD and Helping Bone Formation

- Sodium
- Protein
- Caffeine
- Alcohol

Increased Urinary Calcium

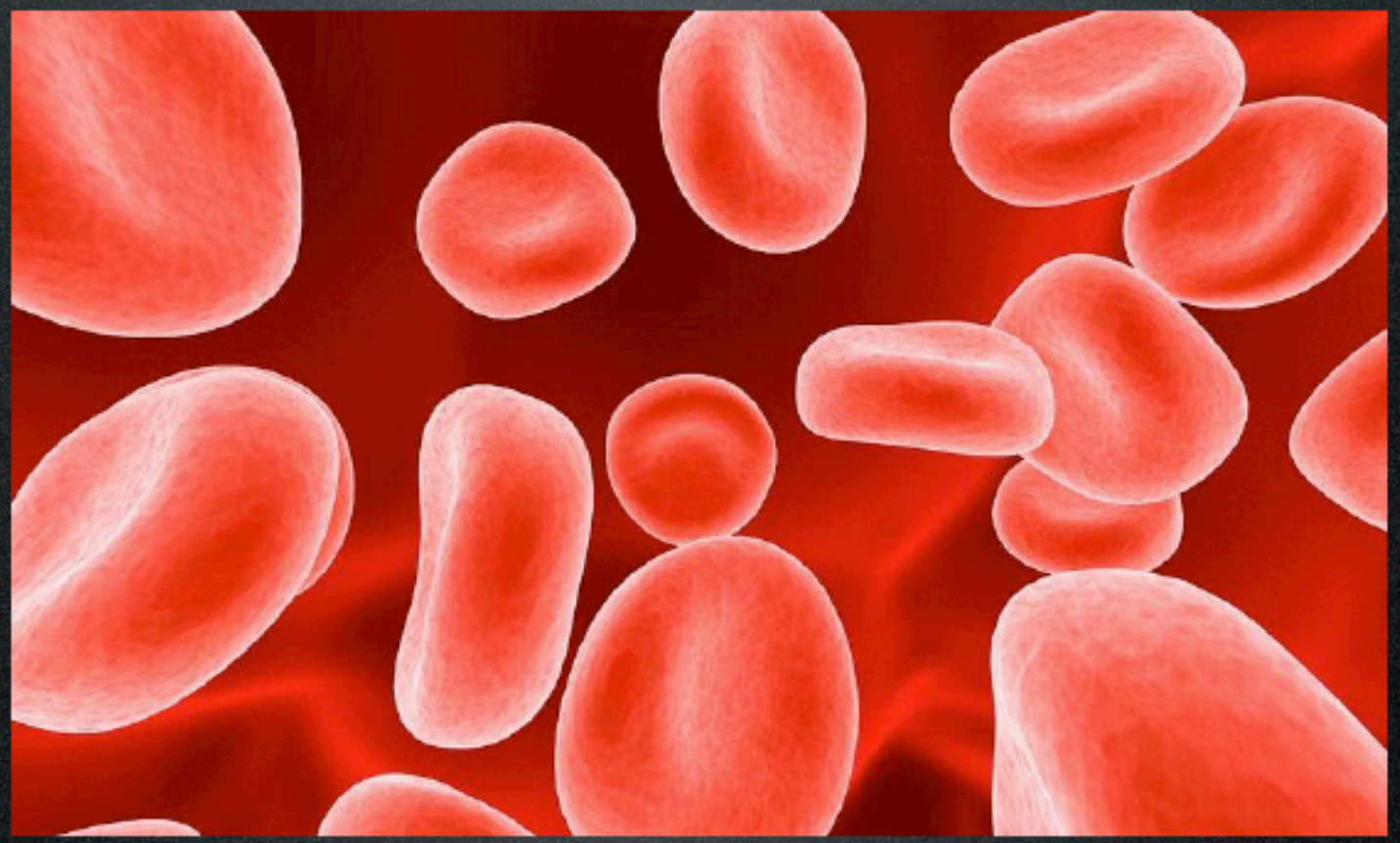
Dual X-Ray Absorpiometry

- DXA
- Most accurate BMD scan
- Can also measure body composition
- Not easily accessible...


When younger are you, strong bones milk builds, yes. But when adults, slow rate of bone density loss, it does. Strong am I with the Force at my age. When 860 years old you reach, feel as good you will not, hmmm?
Milk Got, Hmmm?
YODA JEDI MASTER (C)LUCASFILM (C)1999 NATIONAL FLUID PROCESSORPROMOTION BOARD SABER@MAUIGATEWAY.NET

Oxygen Transporting Nutrients

- Iron, Folate, Vitamin B12
- Involved in the formation and integrity of Red Blood Cells



Iron Deficiency

- Causes
  - Blood loss
  - Nutrient/Medication Interactions
  - Poor Eating Habits
    - (Increased altitude, training load)
- Symptoms
- Fatigue (during training)
- Weakness
- Short of Breath
- Increased Heart Rate

Iron Status

- Periodic CBC screening
  - Hemoglobin (Hgb)
  - Hematocrit (Hct)
  - RBC
  - Serum Ferritin

An example of how this all fits together

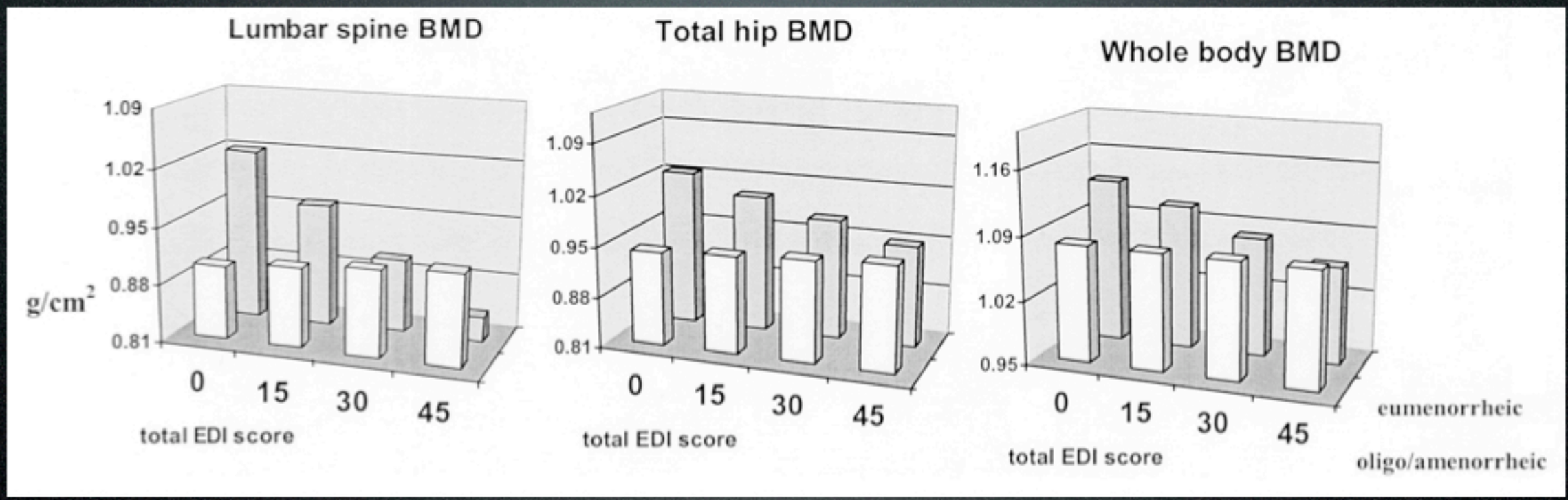
- Disordered Eating, Menstrual Irregularity, and Bone Mineral Density in Female Runners
- 91 competitive female distance runners, age 18-26
- Measures/Prevalences
  - Eating Disorders: Eating Disorder Inventories (EDI)
  - Bone Density: Dual x-ray absorpiometry (DXA)
  - Menstrual Irregularity: 0-9 menses in 12 months

Cobb, et al. 2003

Results

- An elevated EDI score was associated with olio/amenorrhea
- Olio/amenorrhea athletes had lower Spinal BMD than eumenorreic athletes
- Eumenorreic athletes with higher EID scores had lower BMD scores than eumenorreic athletes with normal EID scores

Cobb, et al. 2003

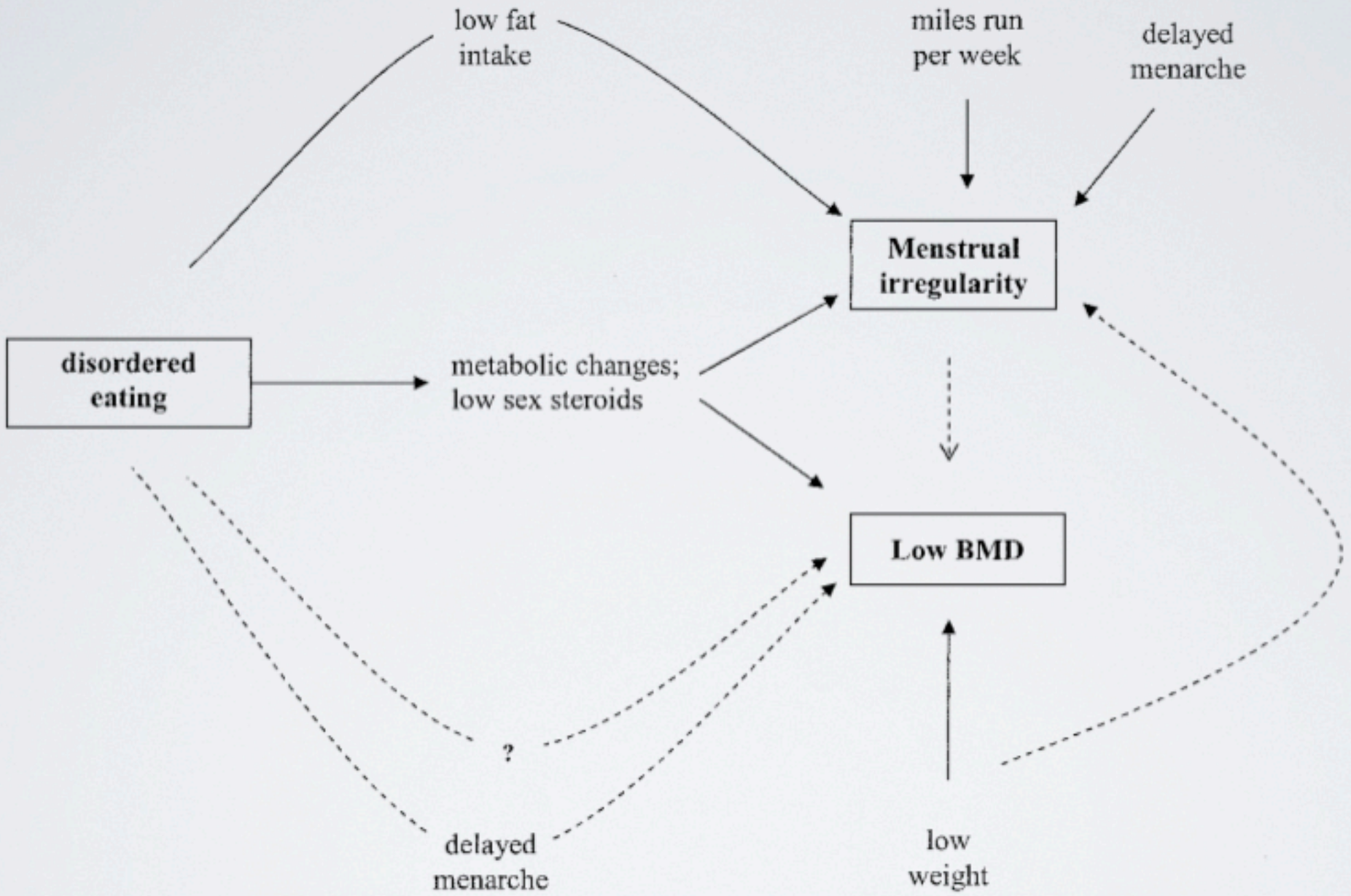


Cobb, et al. 2003

Results

- Disordered eating is strongly associated with menstrual irregularity
- Menstrual irregularity is associated with low BMD
- Disordered eating is associated with low BMD in the absence of menstrual irregularity

Cobb, et al. 2003



Cobb, et al. 2003

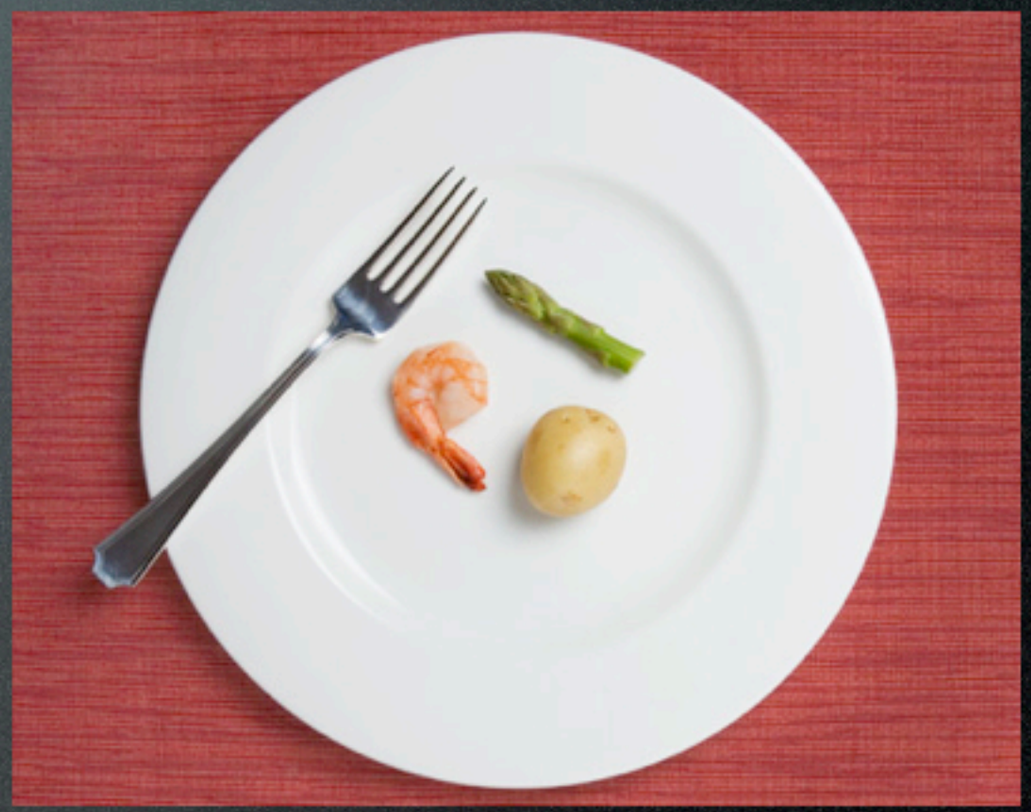
Thus, the key to success is....

ENERGY

AVAILABILITY

Low Energy Availability
(Macro- and Micro-nutrients)

- Decreased ability to…
  - Provide co-factors for
  - Build bone
  - Maintain muscle mass
  - Repair damaged tissue
  - Recover from injury
  - Replace red blood cells
  - Maintain immune system integrity



Carbohydrate Needs

- Most females need at least 5-6g CHO/kg/day to maintain glycogen stores
  - For moderate duration/low intensity training
- 7-12g CHO/kg/d for high duration/intensity training
- The difference can often be obtained through on sports nutrition pre/during/post training (i.e. sports drinks, bars, gels, CHO snacks)

Protein Needs

- Females need more protein than the RDA : 1.0-1.3 g/kg/d for low to moderate intensity training
- Elite Female Endurance : 1.6-1.7g/kg
- Recommendations assume athlete is healthy, weight stable, and energy sufficient

Dietary Fat Needs

- The Institute of Medicine (IOM) recommendation is 20-35% of energy intake (35% for lower caloric intakes, 20% for higher needs)
- Essential Fatty Acids are crucial for regulating numerous bodily processes, including vasoconstriction, inflammation, and blood-clotting

Micronutrient Needs

- Intentionally restricting calories can eliminate key ingredients in the diet
  - Energy - B-Complex
  - Blood - Vit B12, Folate, Iron
  - Bone Building - Calcium, Magnesium, Vitamin D
- Without these the energy consumed can’t be used efficiently to provide fuel to the body
- Exercise may increase the need of some of these nutrients as well

“There’s no crying in Baseball!...”

Those at Increased Risk for Sub-Optimal Nutrition

- Females
- Dieting Behavior
- Middle/Upper-class
- Dysfunctional families
- History of physical/mental abuse
- Sports that stress thinness
- Perfectionist Tendencies

First things first...

- Communication
- Nutrition education from the very beginning of the season
  - Positive effects that nutrition can have on performance
- This open dialogue up front can be a screening tool

Optimization via Prevention

- Screening
- Educate and adopt nutrition periodization along with training periodization
- Focus less on the scale and more on healthy eating
- Mark changes in performance, energy levels, prevention of injury and normal menstrual function

RESEARCH in Nutrition for Exercise and Sport

UCCS Health Sciences

Caucasian and African-American Female Athletes
(18-35 yrs) Wanted for Research Study
on Bone Health and Eating Habits

University of Colorado at Colorado Springs

Benefits:

- Bone mineral density and body composition testing using DXA
- Analysis of diet and exercise energy expenditure
- Nutrition consult

Inclusion Criteria:

- Train ≥ 10 hours per week
- Compete regionally, nationally or internationally
- Not pregnant
- Not currently taking glucocorticoids or thyroid medication

This research is conducted under the direction of Nanna L. Meyer, PhD, RD, CSSD, Assistant Professor Health Sciences, University of Colorado in Colorado Springs. For more information, please call Jade Garneau-Fournier at 719-255-7524 or email at jgarneau@uccs.edu

In summary…

- Female athletes should adjust eating patterns to high training and competition loads
    - Sports nutrition education
    - Quality, quantity and timing
- Screening and monitoring
    - Performance, fatigue, injury
    - Triad
    - Biochemical Testing
        - Iron
        - Vitamin D
        - Estrogen
- Refer to multidisciplinary team

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