RELATIVE ENERGY DEFICIENT IN SPORT (RED-S):

IMPLICATIONS FOR TRIATHLON COACHES

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Paddy McClusky, MD
Ashley Armstrong, MS, RD

Presentation overview

1) Welcome: Speakers
2) Definition of RED-S and Evolution – S. Taylor & T. Stellingwerff
3) Bio-Psycho-Social Model of athlete care – S. Taylor
4) Periodization & Health and Performance Consequences of RED-S – T. Stellingwerff (Exercise Physiology)
5) Psychological Factors and Disordered Eating – S. Taylor
6) Medical Screening, Risk Assessment and Diagnosis Treatment options and Return-to-play – Paddy McClusky
7) Nutrition Considerations & Case Study: Ashley Armstrong
8) Questions & Group Discussion on Triathlon-specific Considerations

All types of athletes = many different needs = individualization

LONDON 2012

HARD BODIES

OLY… STYLE

BETWEEN JULY 27 and Sept. 9, London will play host to more than 14,000 athletes gunning for gold in 28 Olympic and 20 Paralympic sports. United by the exceptional drive and determination necessary to become so much Faster, Higher and Stronger than the rest of us, each of them will bring along a body perfectly tailored to the execution of their chosen sport. Here, with the help of 12 members of the Canadian delegation, a closer look at the forms that function so well.

1. CRISTY NURSE ROWING
2. KARSN COCKBURN TRAMPOLINE
3. ADAM VAN KOEVERDEN KAYAK
4. REID COOLSAET MARATHON
5. BRENT HAYDEN SWIMMING
6. JENNIFER ABEL DIVING
7. DYLAN ARMSTRONG SHOT PUT
8. DAVE WI… WHEELC…
9. TARA WHITTEN TRACK CYCLING
10. CHRISTINE GIRARD WEIGHTLIFTING
11. ROB GIBSON ROWING
12. BRIAN PRICE ROWING

Negative Energy Balance and Hormone Changes

Tissue/Organ	Hormone/Compound	Expected Change
Adipocytes & Hypothalamus	Leptin	Decreased
Adrenal	Cortisol	Increased
Gastrointestinal Tract	Ghrelin	Increased
Liver	Plasma Glucose IGF-1(1) IGFBP-1(2)	Decreased Decreased Increased
Pancreas	Insulin	Decreased (Fasting) Increased (Eating)
Thyroid	Total T3(3)	Decreased

(1) Insulin-like growth factor-1
(2) Insulin-like growth factor binding protein-1
(3) Triiodothyronine

Sources: Stafford DEJ. Treat Endocrinol 2005;4(3):147-154
Laughlin GA & Yen SSC. J Clin Endocrinol Metab 1996; 81(12): 4301-9
Laucks AB et al. J Appl Physiol 1998; 84(1):37-46
Laucks AB & Callister R. J Appl Physiol 1993; 264: R924-30
Laucks AB & Heath EM. Am J Physiol 1994; 266: R817-23

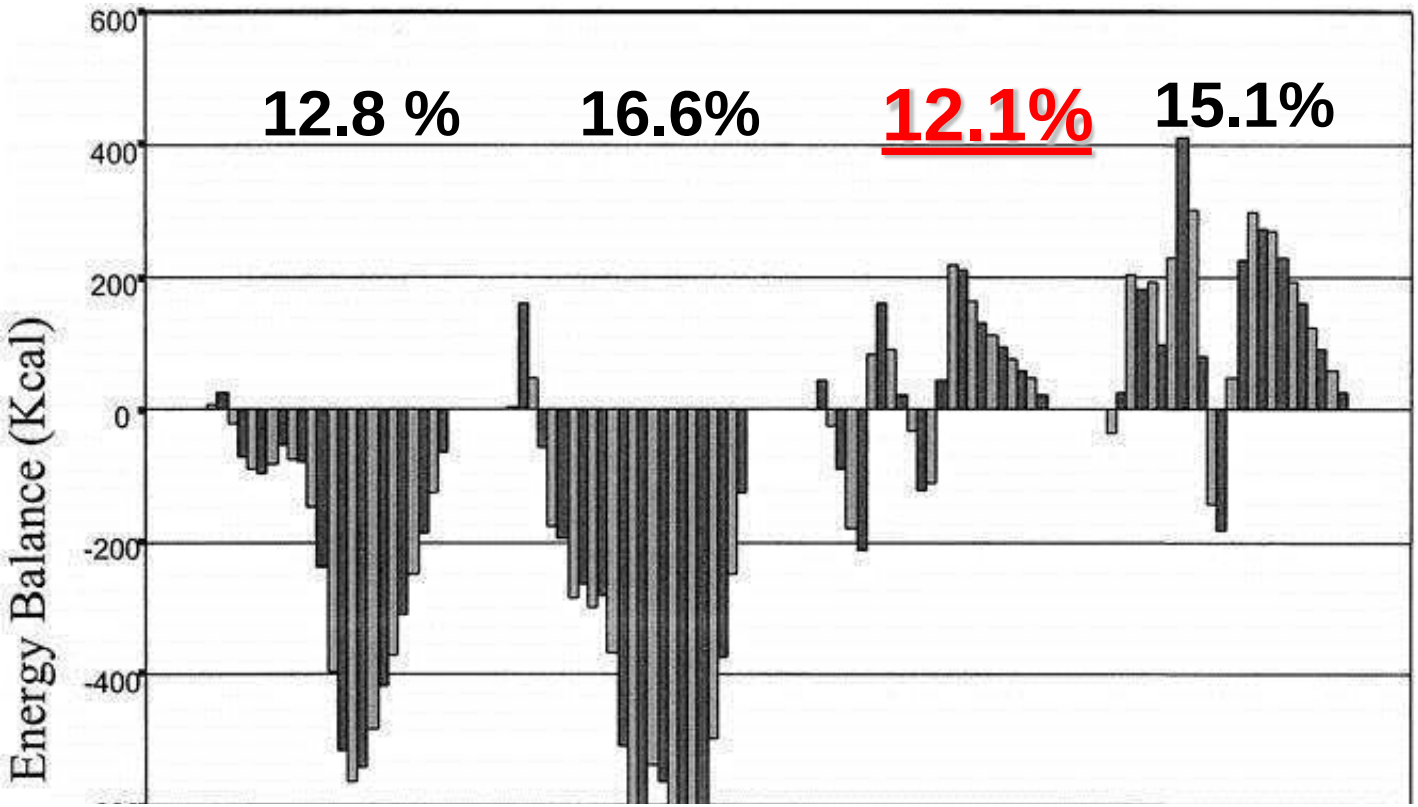
Endocrine / Metabolic Outcomes Resulting from Short-Term and Long-Term Energy Inadequacy

- Increased cortisol production
- Increased insulin production
- Lower Leptin production
- Higher Ghrelin Production
- Abnormal Gonadotropin-releasing hormone (GnRH) pulse
- Reduced Leutenizing hormone (LH) pulse frequency or amplitude
- Decreased estrogen production / hypoestrogenemia
- Low bone density

Eating Disorders a very real concern.

Athlete Literature and General Literature

Heavy training schedules may not be matched with sufficient energy, affecting height, inability to enlarge the muscle mass, and greater anorexia risk. (Georgopoulos et al. 2010; Theintz et al. 1993; Lindhold et al. 1994; Daly et al. 1998)



n= 62
elite **females**
-Body Comp via DEXA

- Energy balance was determined with a Computerized Time-Line Energy Analysis (CTLEA; like 24 hr recall) procedure on a typical training day

The number of hours with energy deficits greater than 300 kcal is positively associated with body fat percentage. (r=0.407; *P =0.001)*

"Thus, dietary restriction resulting in energy intake below estimated energy needs should be avoided, not only because inadequate energy impairs performance, but also because the increased stored body fat affects appearance."

Ovarian hormone suppression leads to decreased performance outcomes

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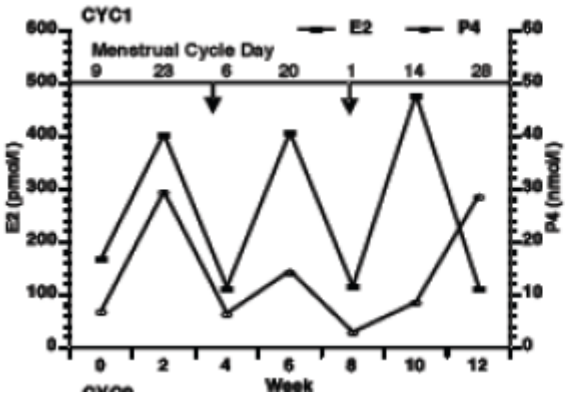
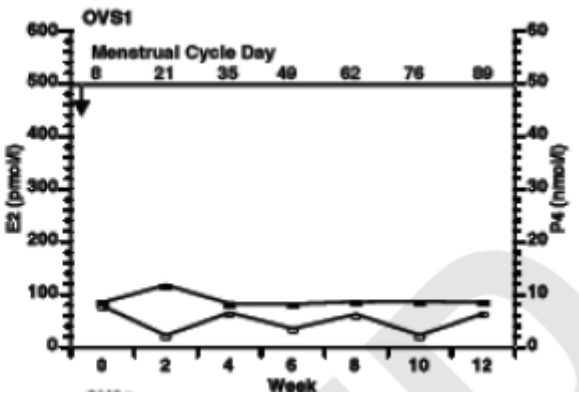
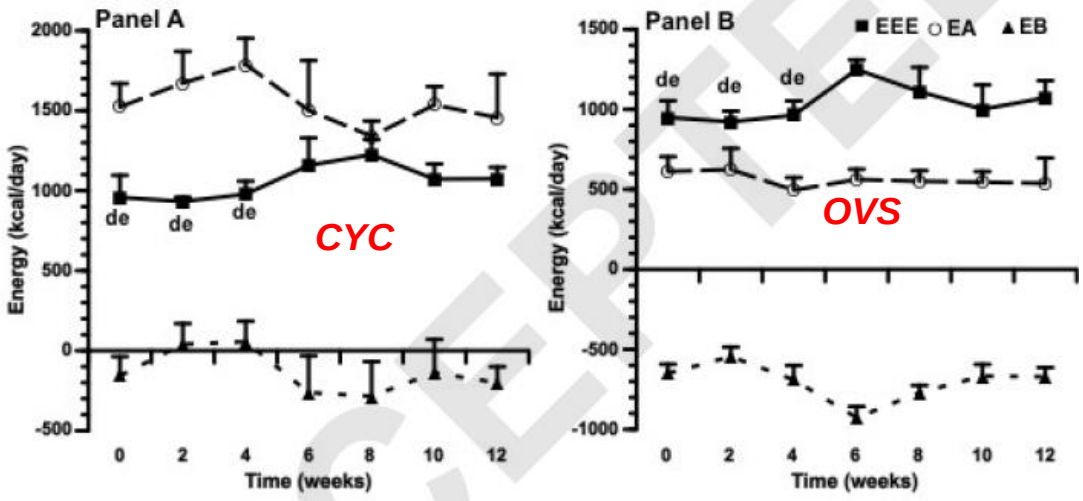
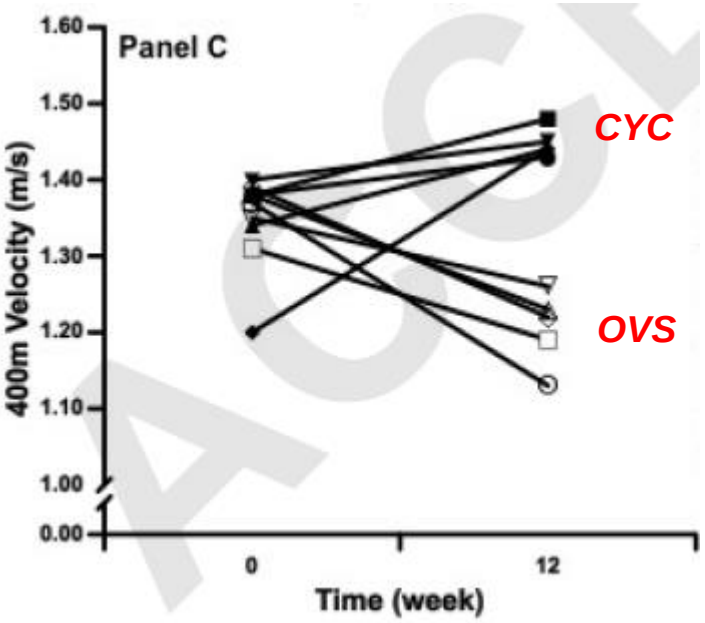
Vanheest, J. L., Rodgers, C. D., Mahoney, C. E., & De Souza, M. J. (2013). Ovarian Suppression Impairs Sport Performance in Junior Elite Female Swimmers. Medicine and science in sports and exercise.

Methods: Menstrual status was determined by circulating estradiol (E2) and progesterone (P4) in ten junior elite female swimmers (15-17 yrs). The athletes were categorized as cyclic (CYC) or ovarian suppressed (OVS). They were evaluated every two weeks for metabolic hormones, bioenergetic parameters and sport performance over the 12-week season.

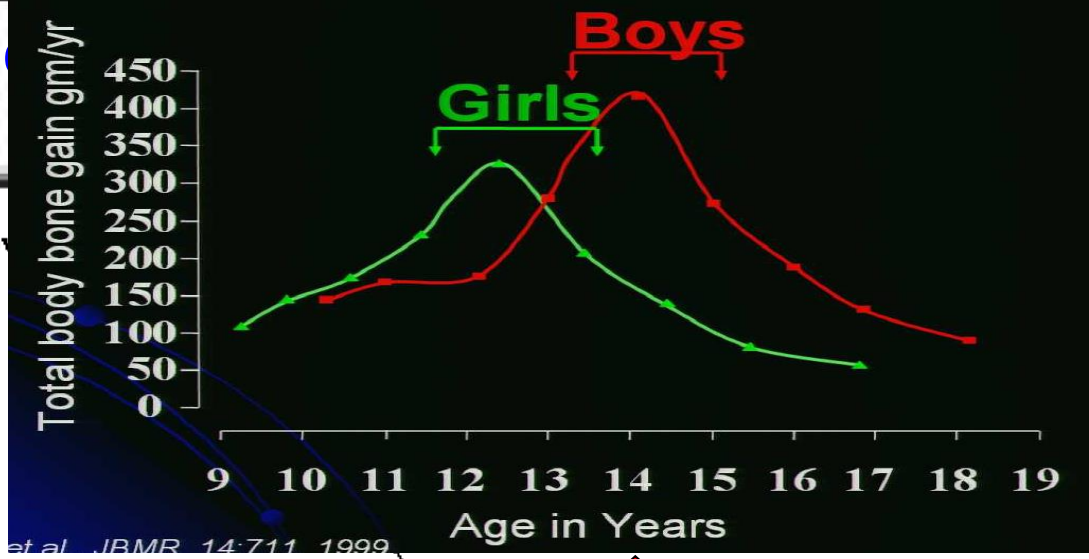


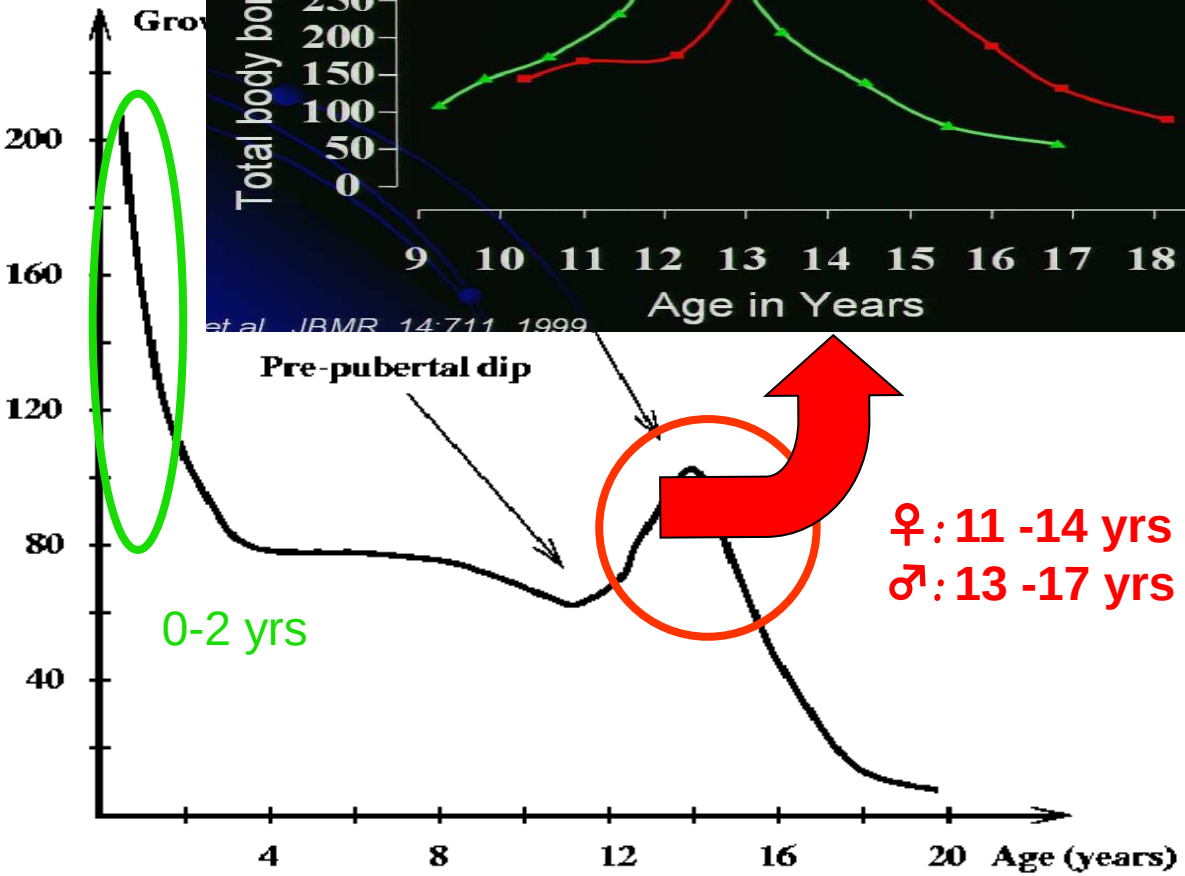






Is there a key age at which b development takes place?





The skeleton appears to respond quite well to changes in the intake of calcium or in the degree of physical activity during the years **preceding the period of sexual maturation**.

Optimal nutrition & training during adolescence critical for peak bone mass

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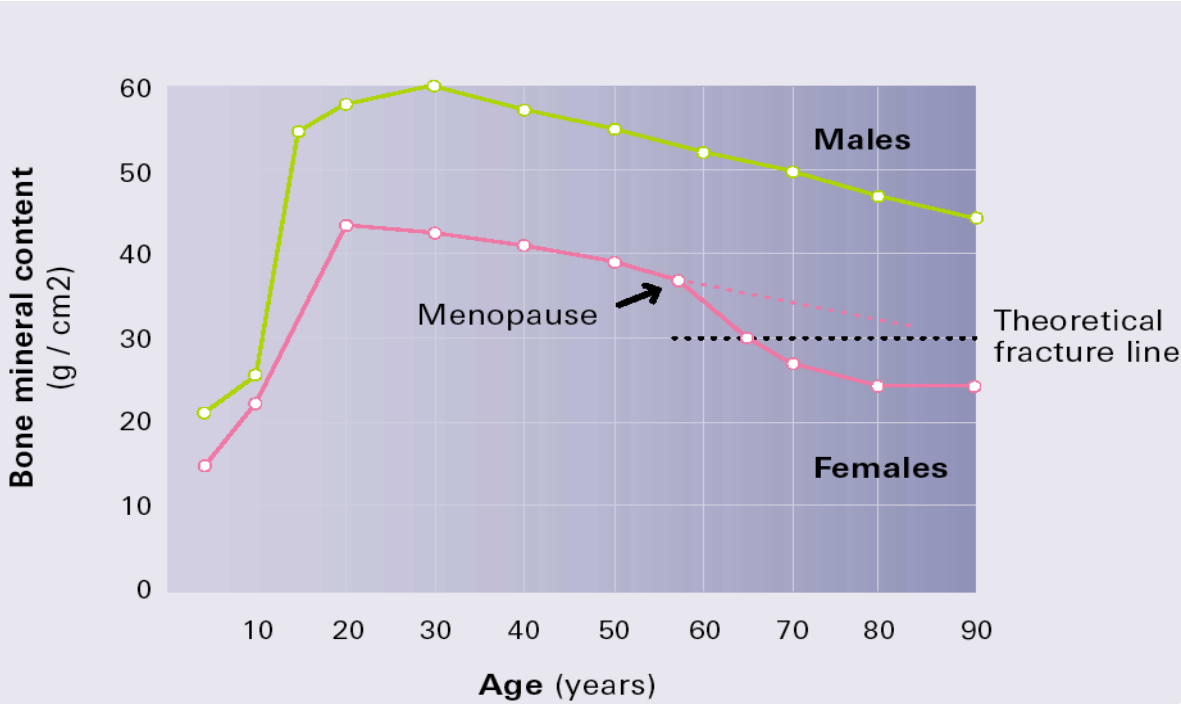
Modulating Peak Bone Mass

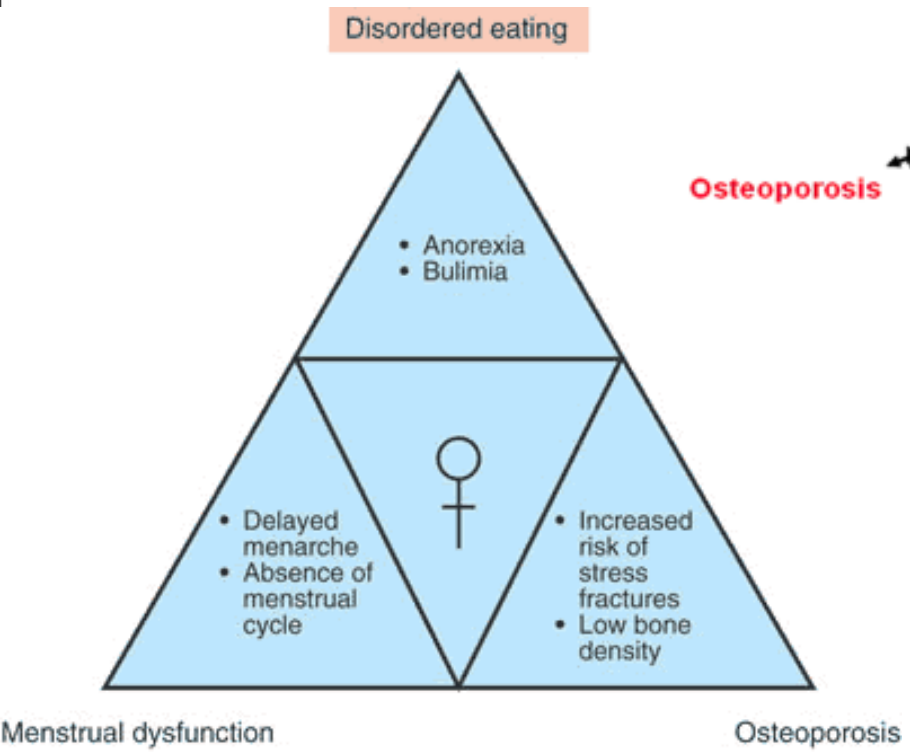
60-80% genetic, 20-40% lifestyle

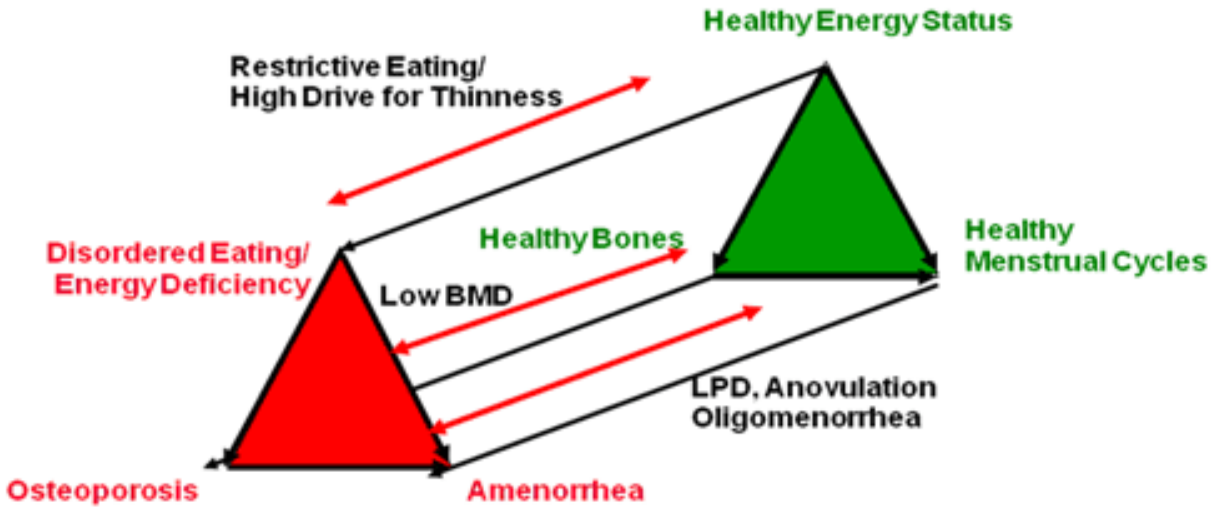
- Calcium
- Physical activity
- Vitamin D
- Phosphorous
- Protein
- Overall good nutrition: energy, minerals & vitamins

Nutrition & physical activity is critical



Female Athlete Triad





"REDS"

Relative **E**nergy **D**eficiency in **S**port

2013 IOC Consensus meeting defin'
Captures both male and female
All negative aspects of both health & performance

Female Athlete Triad

Risk Factors

- Playing sports that require weight checks
- Social isolation due to sporting activities
- Pressure to “win at all costs”
- Consequences for weight gain
- Controlling parents and/or coaches
- Being a performer where undue emphasis is placed on having a low body weight and a lean physique
- Familial predisposition to perfectionism*

http://www.femaleathletetriad.org/for-athletes-coaches/risk-factors/

Signs Of The Triad

- Irregular or absent menstrual cycles
- Always feeling tired and fatigued Problems sleeping
- Stress fractures and frequent or recurrent injuries
- Often restricting food intake
- Constantly striving to be thin
- Eating less than needed in an effort to improve performance or physical appearance
- Cold hands and feet

http://www.femaleathletetriad.org/for-athletes-coaches/signs-of-the-triad/

“Ideal Characteristics” in Elite Sport

An ideal “Elite Athlete”

•is willing to train and exercise harder and longer than teammates
•performs through pain and injury
•is selflessly committed to “team”
•complies completely with coaching instructions
•accepts nothing less than perfection
•is willing to lose weight / alter body comp to improve performance

This is also true of an athlete with an eating disorder (ED)

Some Protective Factors in Sport

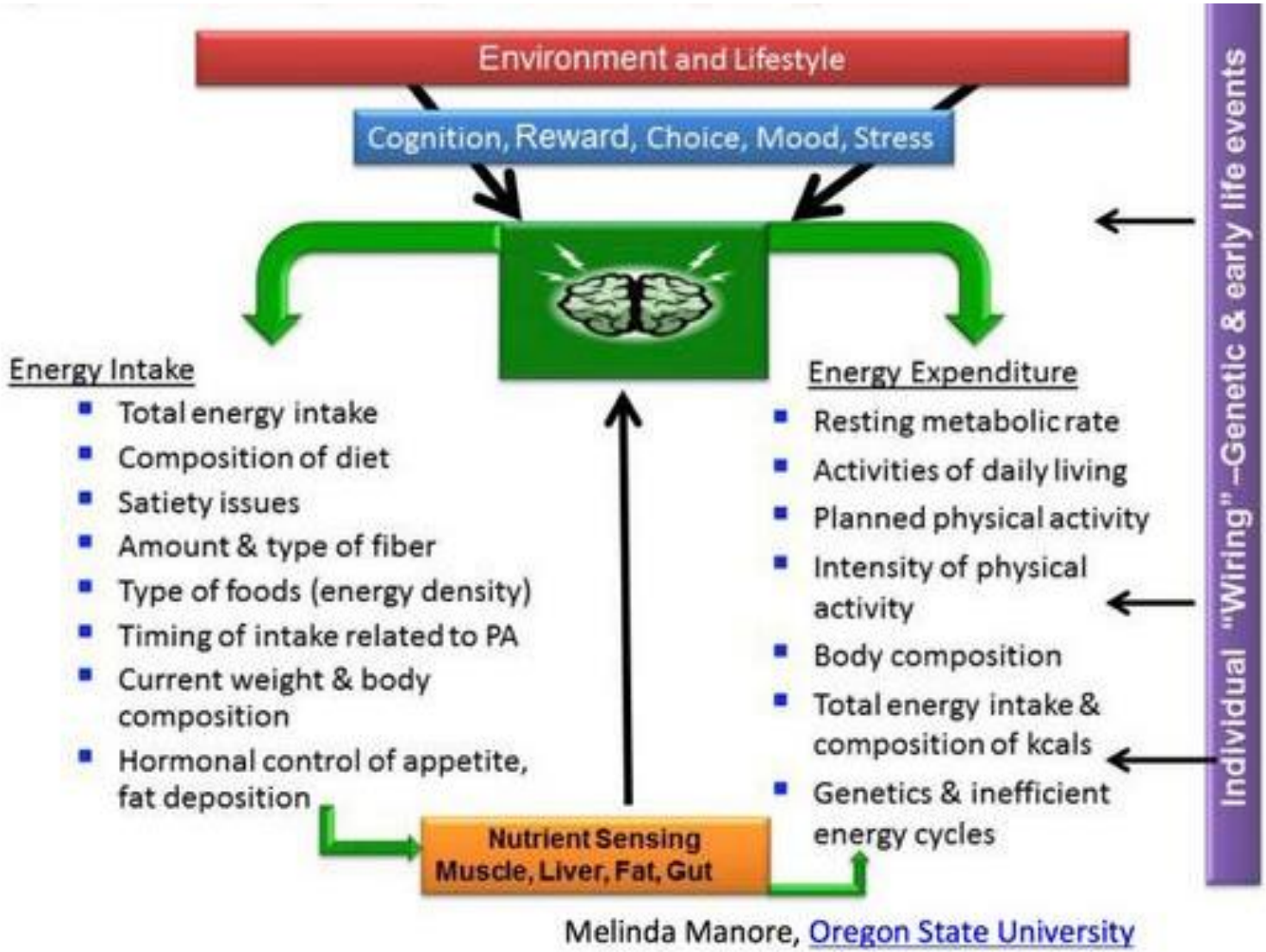
•Intuitive & educated coach on risks (open culture with built in recovery monitoring)
•Strong stress management skills & relationship with coach
•Early intervention (Thompson & Sherman , 2010)

2014 Female Athlete Triad Coalition Consensus Statement

Risk Factors	Magnitude of Risk		
	Low Risk = 0 points each	**Moderate Risk = 1 point each**	**High Risk = 2 points each**
Low EA with or without DE/ED	☐ No dietary restriction	☐ Some dietary restriction‡; current/past history of DE;	☐ Meets DSM-V criteria for ED*
Low BMI	☐ BMI ≥ 18.5 **or** ≥ 90% EW** or weight stable	☐ BMI 17.5 < 18.5 **or** < 90% EW **or** 5 to < 10% weight loss/month	☐ BMI ≤17.5 **or** < 85% EW **or** ≥ 10% weight loss/month
Delayed Menarche	☐ Menarche < 15 years	☐ Menarche 15 to < 16 years	☐ Menarche ≥16 years
Oligomenorrhea and/or Amenorrhea	☐ > 9 menses in 12 months*	☐ 6-9 menses in 12 months*	☐ < 6 menses in 12 months*
Low BMD	☐ Z-score ≥ -1.0	☐ Z-score -1.0*** < - 2.0	☐ Z-score ≤ -2.0
Stress Reaction/Fracture	☐ None	☐ 1	☐ ≥ 2; ≥ 1 high risk or of trabecular bone sites†
Cumulative Risk (total each column, then add for total score)	**_____ points +**	**_____ points +**	**_____ points = _____Total Score**

FIGURE 4. Female Athlete Triad: Cumulative Risk Assessment. The cumulative risk assessment provides an objective method of determining an athlete's risk using risk stratification and evidence-based risk factors for the Triad.[16,17,46] This assessment is then used to determine an athlete's clearance for sport participation (Figure 5). ‡Some dietary restriction as evidenced by self-report or low/inadequate energy intake on diet logs; *Current or past history[41,57]; **≥90% EW[66,91,100,107]; absolute BMI cut offs should not be used for adolescents; ***Weight-bearing sport[2]; †High risk skeletal sites associated with low BMD, and delay in return to play in athletes with 1 or more components of the Triad include stress reaction/fracture of trabecular sites (femoral neck, sacrum, pelvis).[18,83] EA, energy availability; DE, disordered eating; ED, eating disorder; BMI, body mass index; BMD, bone mineral density; EW, expected weight.

Complexities of Energy Balance



Complexities of Energy Balance

Many psycho-social factors make RED-S difficult to diagnose & treat (cultural factors also make it difficult to **prevent without education & intervention**)

Few studies in disability sport

TRIAD or “FAT” is gender-specific, and does not account for males who present with energy balance challenges, who participate in the same sport cultures

Higher probability of going undetected in males

Osteopenia & disordered eating <-> disorders on the rise in men

RED-S: Relative Energy Deficient Syndrome

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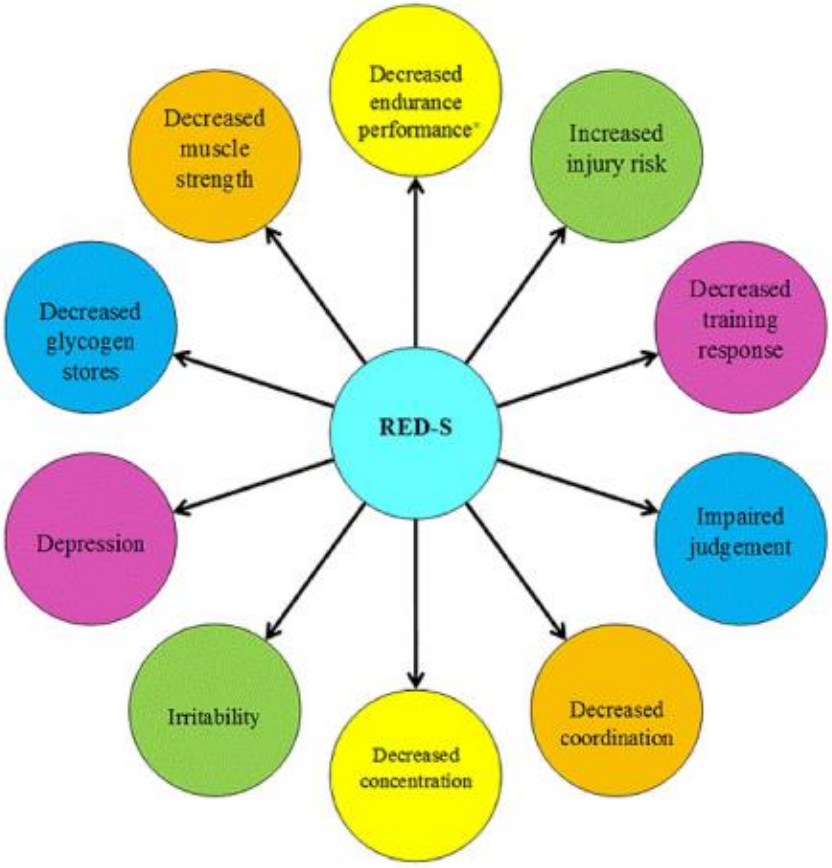
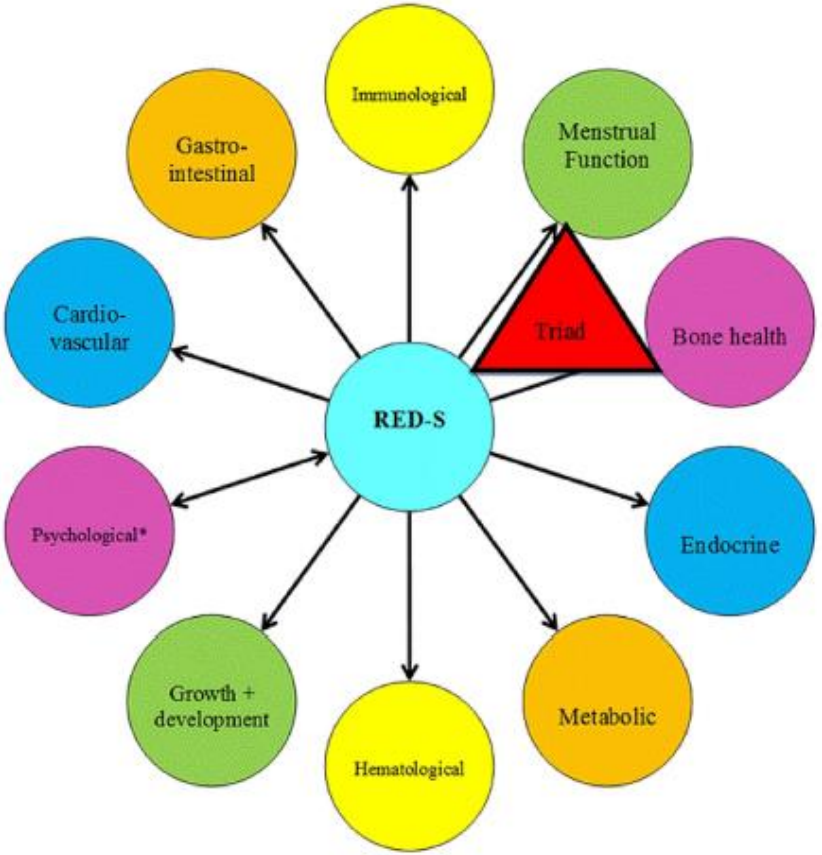
Mountjoy M, Sundgot-Borgen J, Burke L, et al. The IOC consensus statement: beyond the Female Athlete Triad--Relative Energy Deficiency in Sport (RED-S). Br J Sports Med. Apr 2014;48(7):491-497.

Negative Performance Outcomes



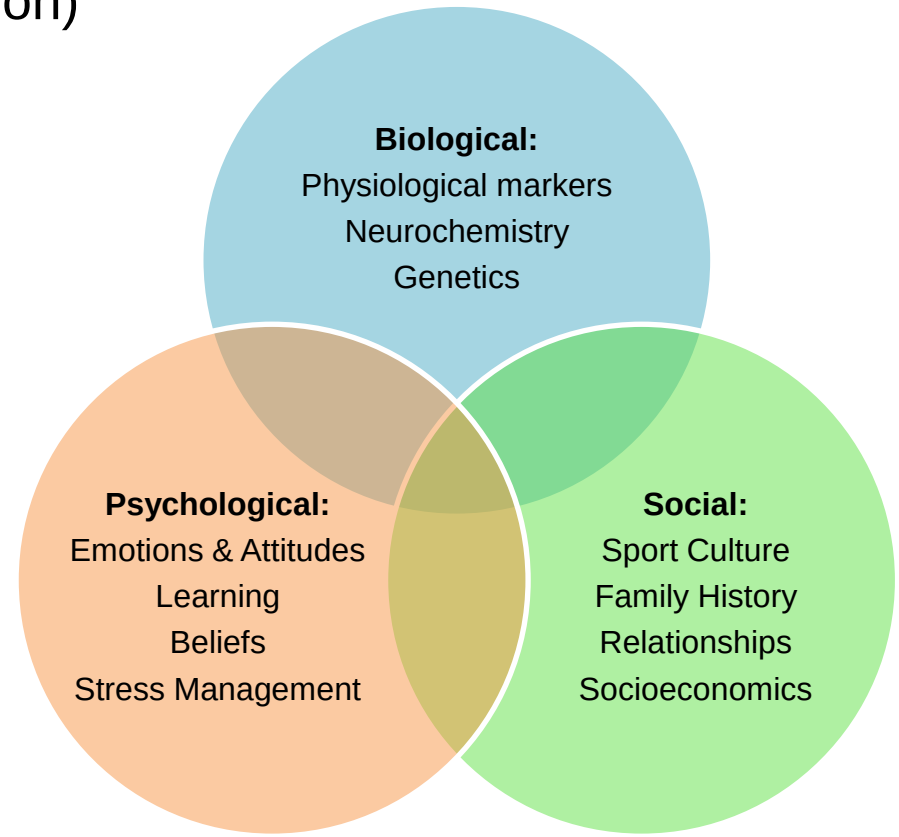
Negative Health Outcomes



Psychology & Holistic Athlete Care

Biopsychosocial (BPS) model of athlete care

(Group Discussion)



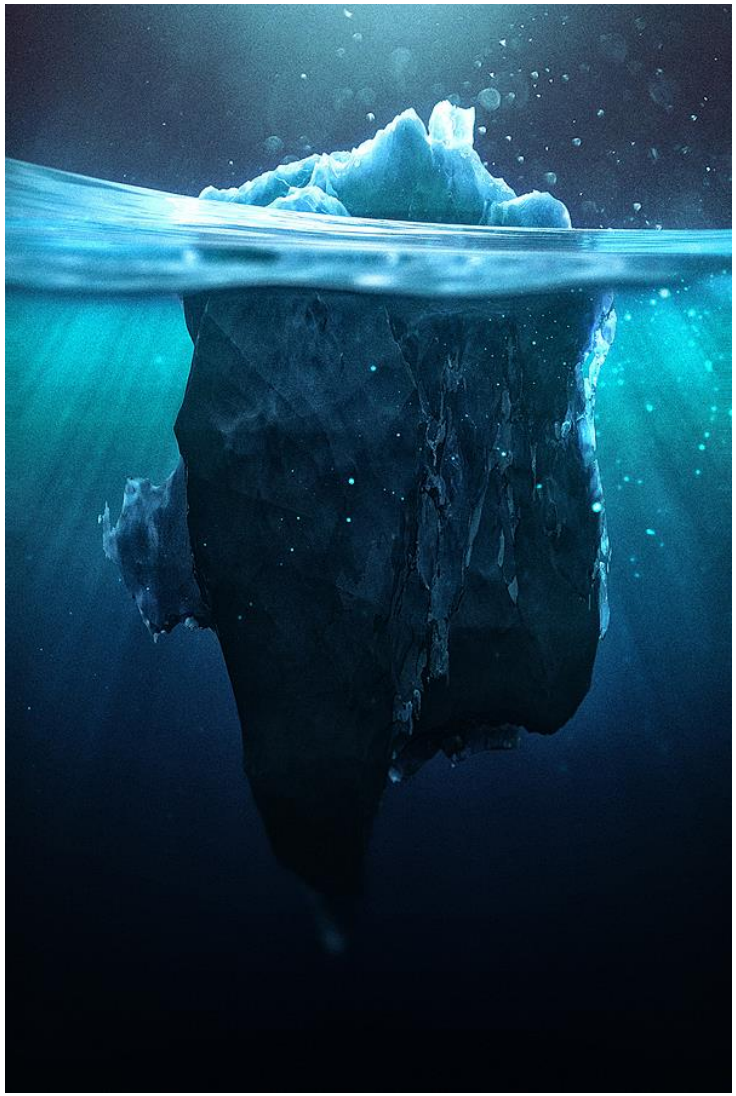
Holistic 3-Pronged Approach

- **Biological** (Sport medicine, nutritional, physiological support & assessment)

- **Psychological**
- Athlete beliefs, behaviors, self-care interventions

- **Social**
- Coach / team / family assessment: education and intervention where required

Icebergs



There’s a lot going on under the surface

HEALTH AND PERFORMANCE CONSEQUENCES OF RED-S

(LONGITUDINAL BODY COMP PERIODIZATION IN ELITE ATHLETES)

Trent Stellingwerff, PhD

Canadian Sport Institute – Pacific

Athlete Background…

Hilary Stellingwerff

DOB: Aug. 7, 1981
800m: 2:01:20
1500m: 4:05.08
2012 Olympic Semi-Finalist
6 x World Championship Team Member
2 x Commonwealth Games 1500m Finalist
3 x Canadian Champion
8 x Canadian Medalist

Increased Protein Intake Reduces Lean Body Mass Loss during Weight Loss in Athletes

Mettler S, Mitchell N, and Tipton KD. Increased protein intake reduces lean body mass loss during weight loss in athletes. *Med Sci Sports Exerc 42: 326-337. 2010.*

~2-4% body weight loss and ~1-3% loss of % body fat in 2 wks

1-RM, jump height, Wingate performance was not compromised by the 2 wk negative energy balance

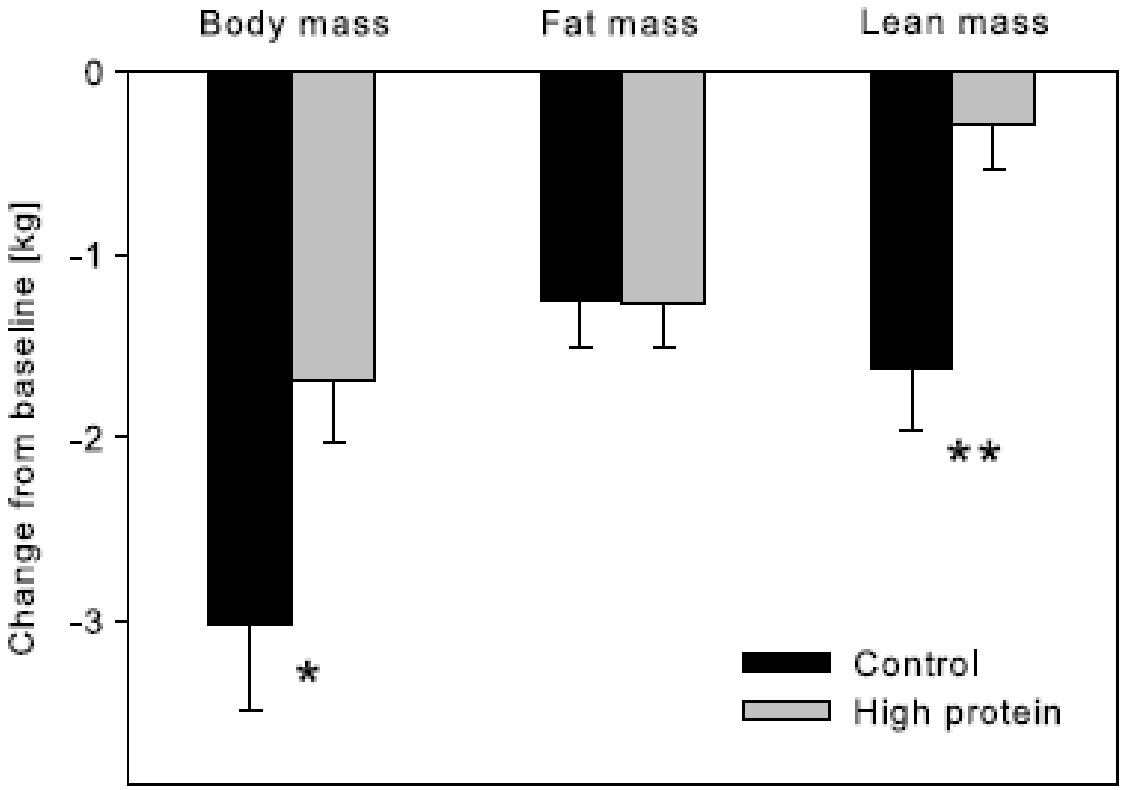


FIGURE 2—Change of body mass, fat, and lean mass from baseline (average of the two measurements before the weight loss) to the end of the 2-wk weight loss for the control ($n = 10$) and the high-protein ($n = 10$) groups. Values are mean ± SE. *Significant difference between the two groups ($P = 0.036$). **Significant difference between the two groups ($P = 0.006$).

Effect of Two Different Weight-Loss Rates in Elite Athletes: Body Comp and Performance?

Garthe I et al. Effect of Two Different Weight-Loss Rates on Body Composition and Strength and Power-Related Performance in Elite Athletes. *IJSNEM. ePUB. 2010.*

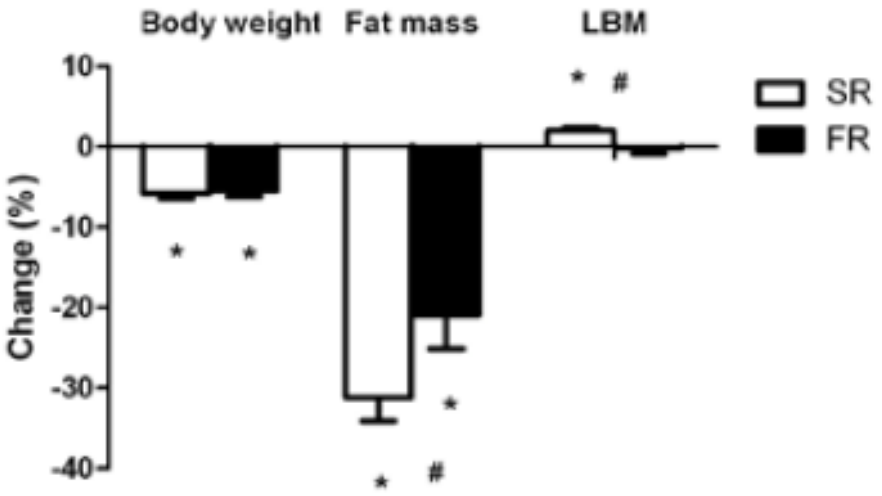


Figure 1 — Changes in body weight, fat mass, and lean body mass (LBM) in the slow-rate weight-loss group (SR) and the fast-rate weight-loss group (FR), $M \pm SE$. $*p < .05$ significantly different from pre. $\#p < .05$ significant difference between groups.

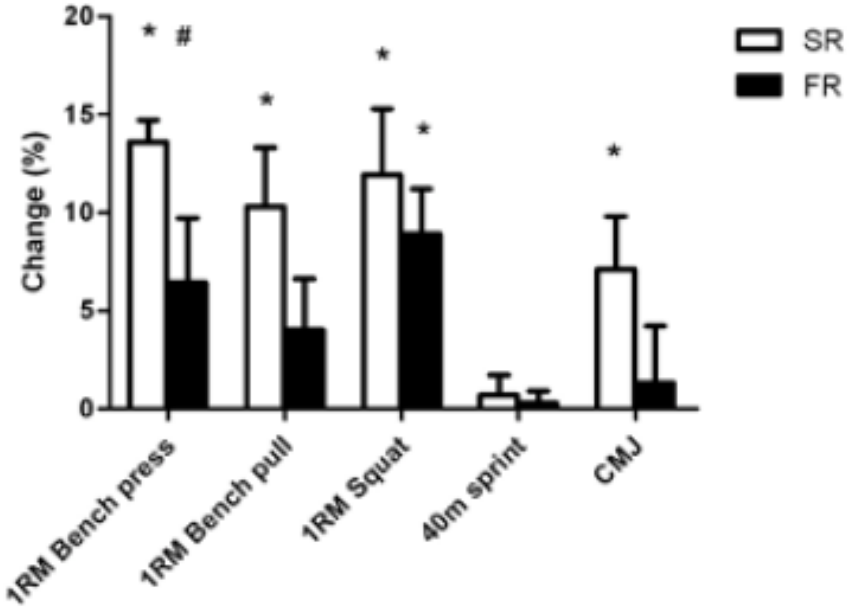


Figure 2 — Changes in one-repetition-maximum (1RM) bench press, bench pull, and squat; 40-m-sprint performance; and countermovement jump (CMJ) in the slow-rate weight-loss group (SR) and the fast-rate weight-loss group (FR), $M \pm SE$. $*p < .05$ significantly different from pre. $\#p < .05$ significant difference between groups.

"This leads to a general suggestion that athletes who want to gain LBM and increase strength- and power-related performance during a weight-loss period combined with strength training should aim for a weekly weight loss of 0.7% of BW…"

Does the 3500 kcal / one pound weight loss rule work?

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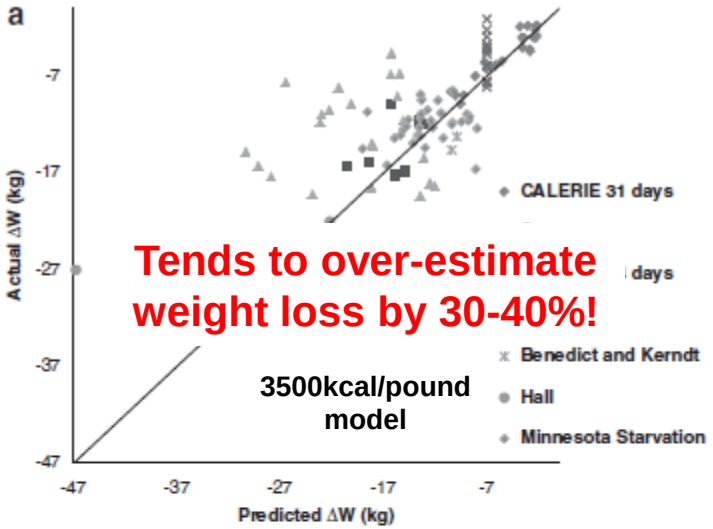
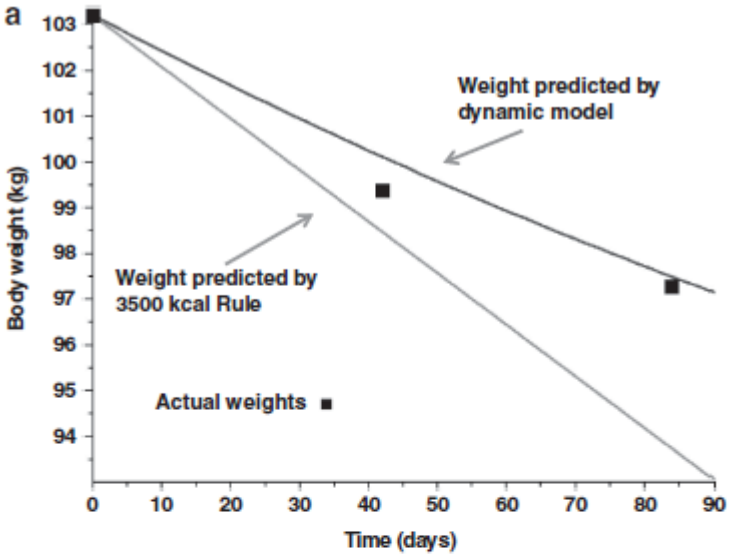
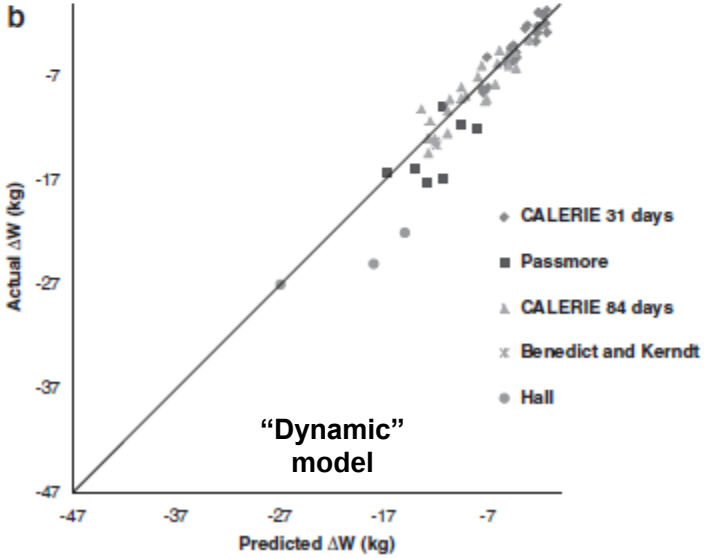
Thomas DM et al.. Can a weight loss of one pound a week be achieved with a 3500-kcal deficit? Commentary on a commonly accepted rule. Int J Obes (Lond), 37, 1611-1613., 2013



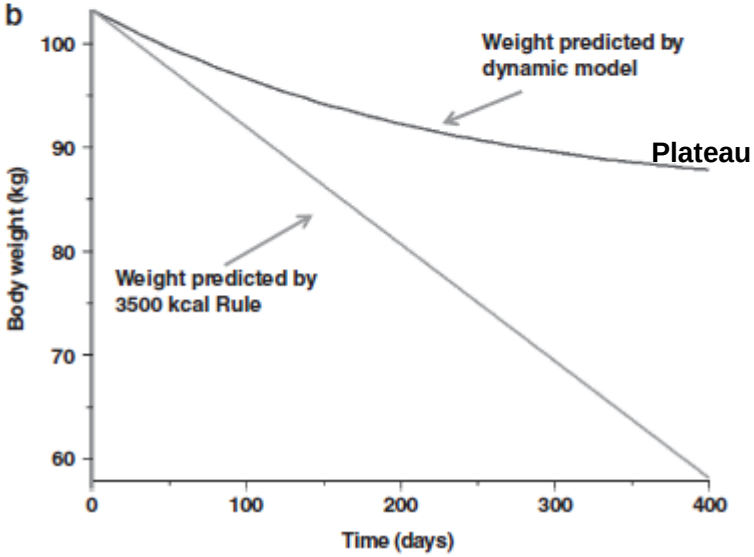
Tends to over-estimate weight loss by 30-40%!

3500kcal/pound model





"Dynamic" model

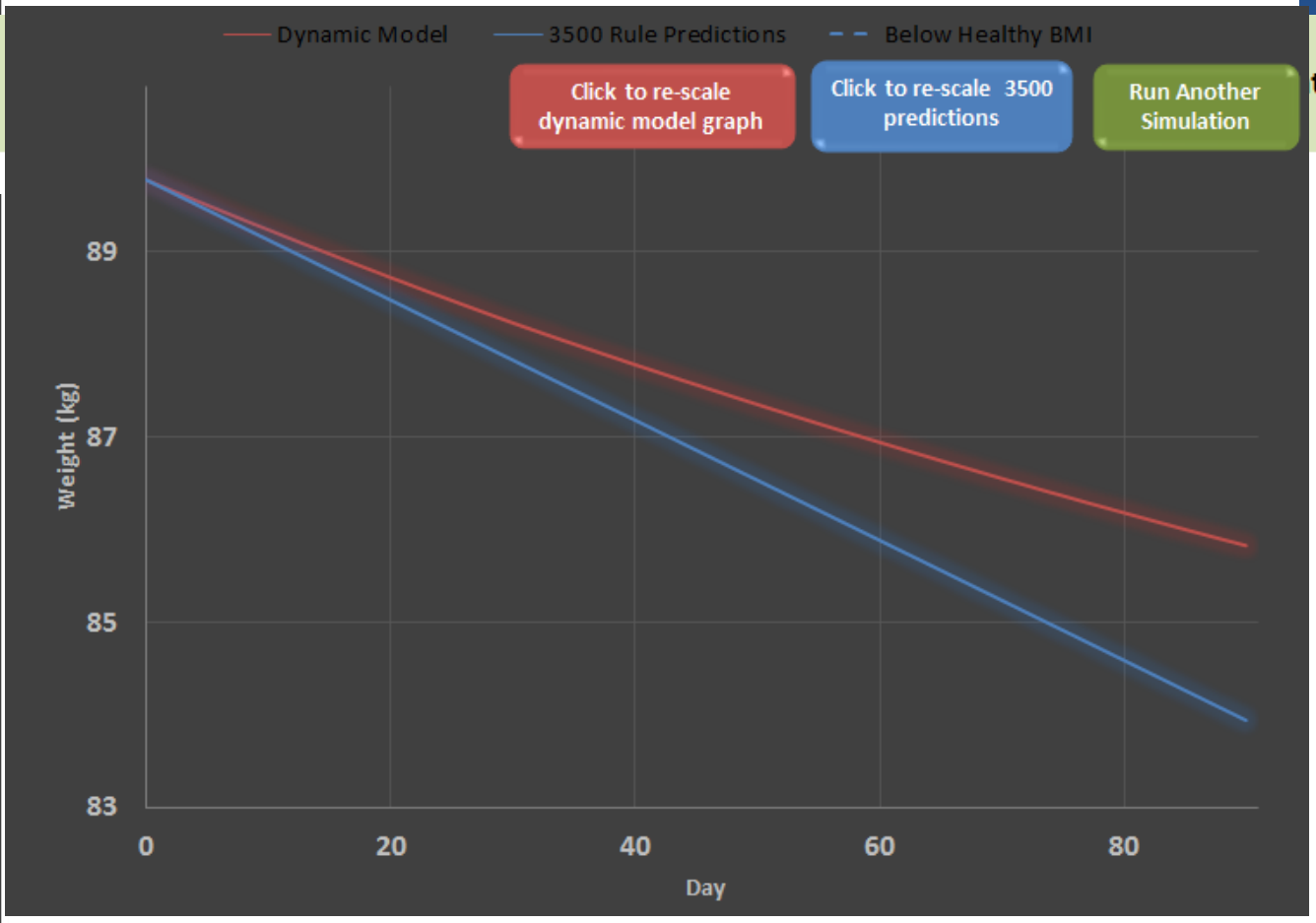


Plateau at ~1.4yrs

Weight Loss Predictor – Calculator

Thomas DM et al.. Can a weight loss of one pound a week be achieved with a 3500-kcal deficit? Commentary on a commonly accepted rule. Int J Obes (Lond), 37, 1611-1613., 2013

http://www.pbrc.edu/research-and-faculty/calculators/sswcp/



take Reduction (kcal/d)	3500 kcal/d Weight Graph?
500 kcal/d	Yes

GOOD Approaches to weight and body comp management

#1 GOAL: Aim for 'optimal' body composition
with 'optimal' body physiology
before championship season

BEFORE Championship Season

- long term plan with coach for optimal weight w/ lowest % body fat achievable: males ~4-8% females ~10 to 15% (approx, very variable)

- losing fat weight (not lean muscle mass) before championship season = periodize body weight during the year

DURING Championship Season

- well fueled and hydrated for optimal performance
- not in energy deficit

RED-S: Case-Study Male Distance Runner

PARAMETER	Hgb	Hct	RBC Count	MCV	MCH	Testosterone	Testosterone - Free	Testosterone	THYROTROPIN (SENSITIVE TSH)	Ferritin
UNITS	g/L	L/L	/L	fL	pg	nmol/L	pmol/L	ng/ml	mIU/L	ug/L
NORMAL RANGE	135-175	0.40 - 0.50	4.50 - 6.00	80-98	27.5 - 33.0	8.4 - 28.8	31.0-94.0	3.5-11.0	0.35-5.00	25-200
July 30, 2013	140	0.425		89.5	29.5					
Sept 5, 2013	130	0.402		90.1	29.2			2.4		88
Jan 15, 2014	139	0.41	4.91	84.1	28.3		30		1.1	50
Mar 19, 2014	133	0.392	4.6	85.2	28.9					93

+ continual symptoms of high fatigue over many, many months

Weight 66 kg

3 day dietary record

					Daily Totals per kg BW			
	Calories	CHO	PRO	FAT	Calories	CHO	PRO	FAT
Thursday	4236	576	210	127	64.2	8.7	3.2	1.9
Friday	4144	612	199	116	62.8	9.3	3.0	1.8
Saturday	3880	422	208	153	58.8	6.4	3.2	2.3
3-day Average	**4086.7**	**536.7**	**205.7**	**132.0**				
3-day Average/kg	**61.9**	**8.1**	**3.1**	**2.0**				

Harris Benedict Equation for prediction of BMR and caloric requirements (including 15% variability factor) puts BMR at ~1665 calories/day for a total of ~3200 calories/day to stay weight stable (+/- 15% factor puts a total caloric intake range of about 2700 to 3700 calories per day).

***** But no breakfast, so a 12-15 hour stretch every 24hrs without any calories**

Periodized body-comp approach case study

Female elite middle-distance runner

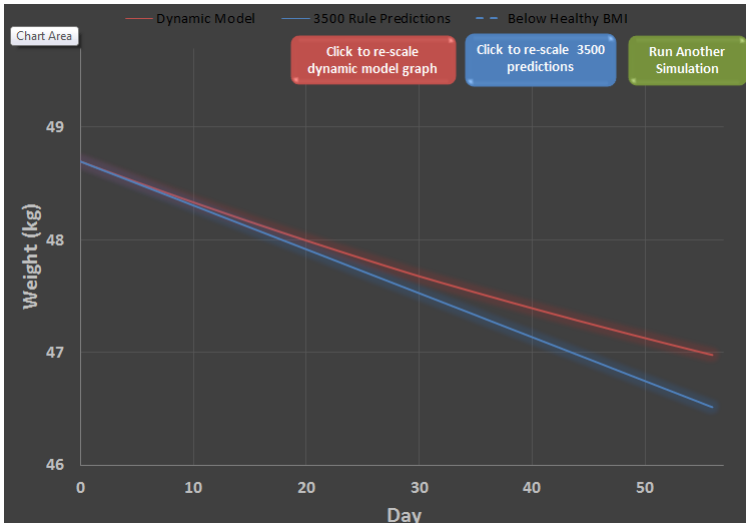
April 25th 2013 anthro assessment

49kg / 1.61m

%BF = 15.4% / Lean mass = 41.5kg / Fat mass = 7.5kg

The PLAN

~300 kcal deficient



Rationale Body Comp Target = 10% BF

10% of 49kg = ~4.9kg total fat mass to get to 10% BF.

Current fat mass = 7.5kg – 4.9 kg = 2.6kg of fat mass to loose

Current BM = 49 – 2.6kg =

Target BM = 46.4kg

Rationale Time-Frame

No more than 0.7% BM reduction per week

= 0.7% of 49kg = 0.34kg/week

2.6kg / 0.34kg/week **= ~8 weeks (56 days)**

Practical approaches to periodized body comp

Majority of training year- Energy Balance

- being 4 - 6% above race competition weight / % body fat is OK
- fully eating to handle training volume
- good wholesome nutrition the cornerstone, periodic treats are OK
- focus on recovery, less immune system problems

Realizing ideal championship body comp (only a few months / year)- Short-Term Energy Deficit

- fully focus on very healthy food (no extra fat in diet, skip treats)
- Intensity of training, with slightly smaller meal portion sizes will strip off weight and result in ideal body comp
- Focus on smaller snacks that include fruit and some protein (milk, or protein shake)

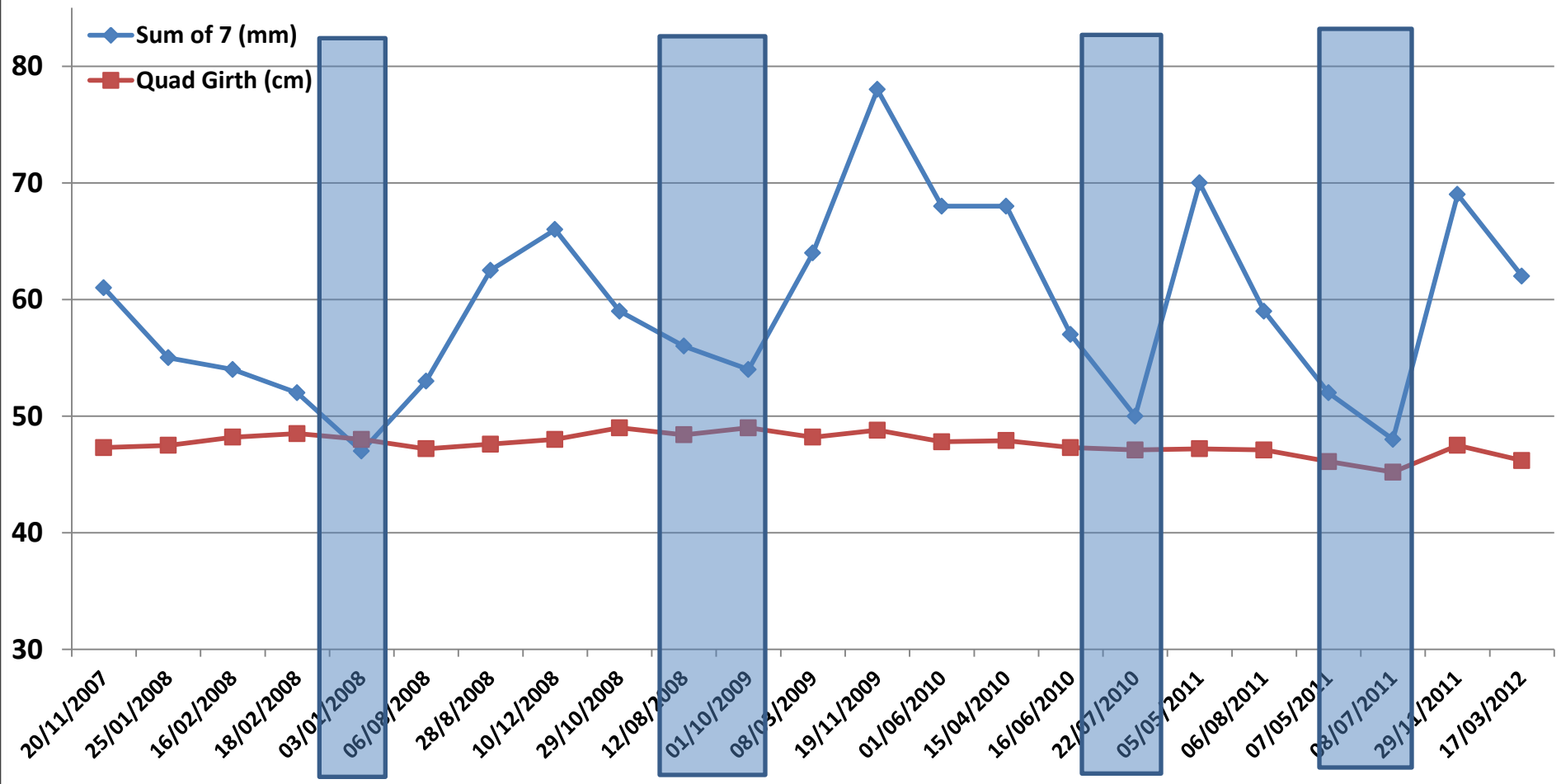
Practical approaches to periodized body comp

General Prep Phase Plate

Tapering / Body Optimization Phase

Plates courtesy of United States Olympic Committee Nutrition Department

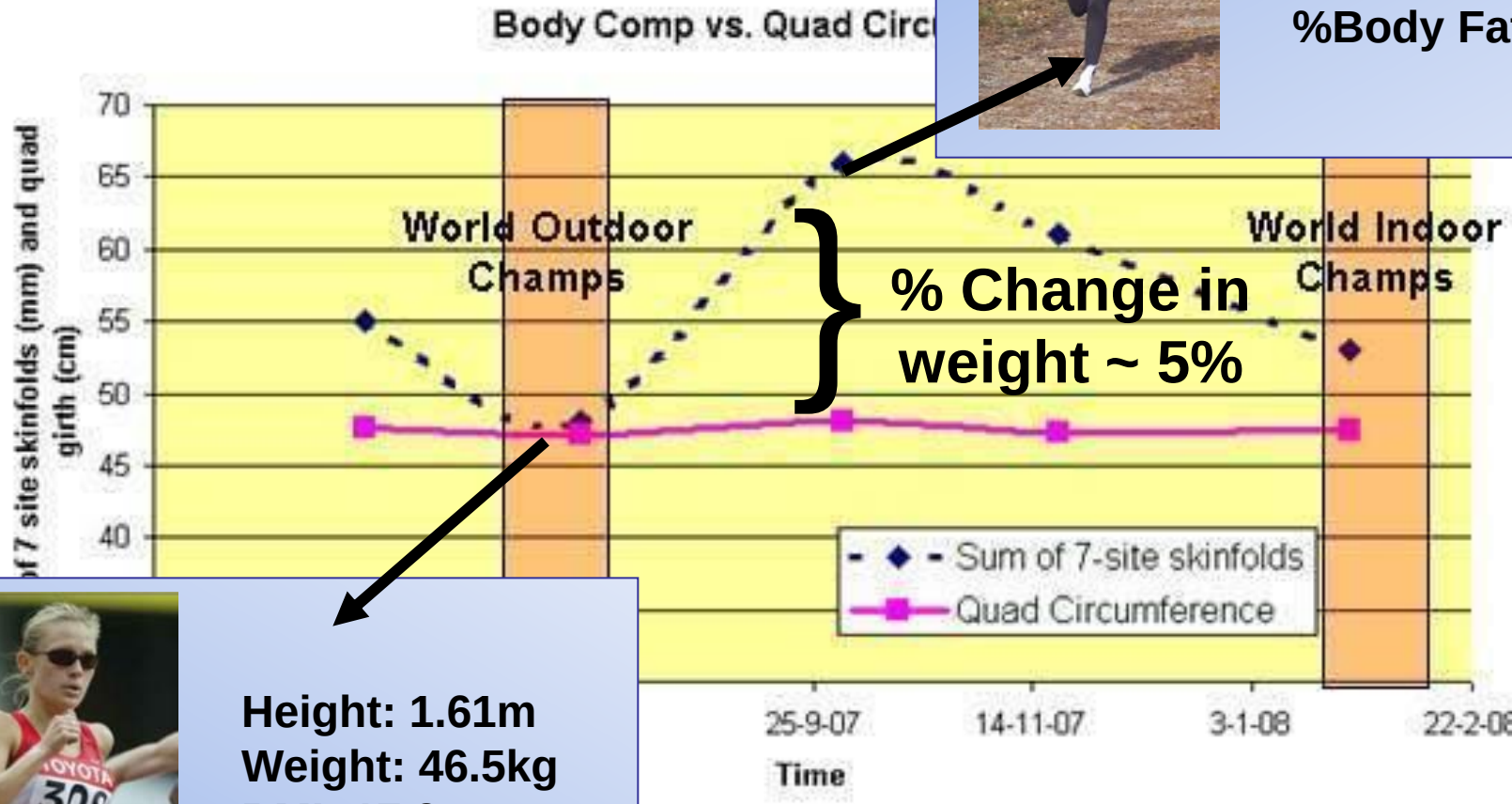
Periodized body composition throughout the year (elite female 1500m runner)



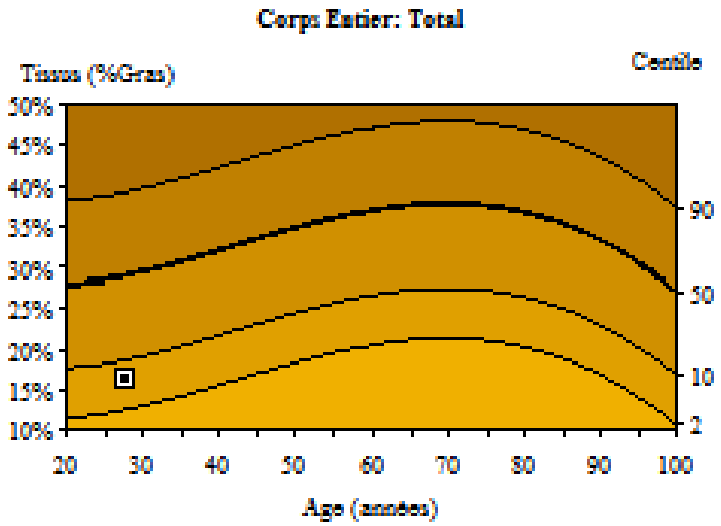
Competition Phase

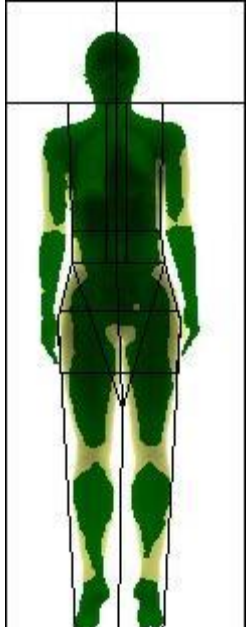
Periodized body composition throughout the year

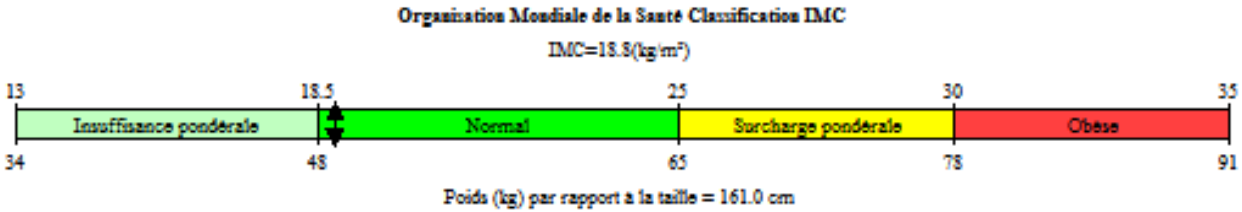
Height: 1.61m
Weight: 49.0kg
BMI: 18.9
%Body Fat: 14.5%



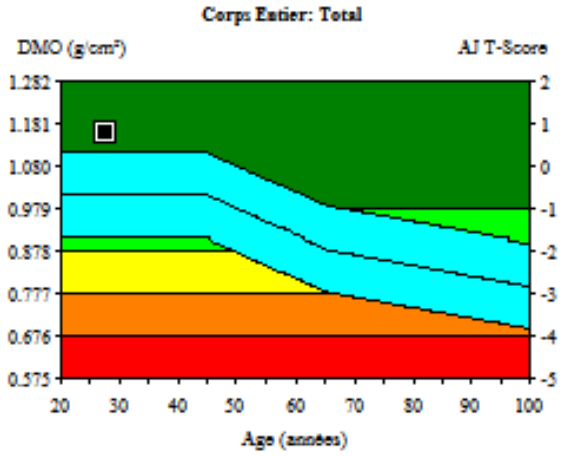
Height: 1.61m
Weight: 46.5kg
BMI: 17.9
%Body Fat: 10.1%







Region	Up. limbs	Low. Limbs	Trunk	Androïd	Gynoïd	Total
Tissue (%Fat)	18.40%	18.70%	13.50%	14.30%	24.10%	16.40%
Region (%Fat)	17.60%	17.90%	13.10%	14.00%	23.50%	15.70%
Tissue	5'138 g	17'463 g	20'978 g	2'922 g	7'944 g	46'732 g
Fat	945 g	3'264 g	2'822 g	417 g	1'914 g	7'685 g
Lean	4'193 g	14'198 g	18'156 g	2'505 g	6'030 g	39'047 g
BMC	234 g	822 g	566 g	43 g	215 g	2'089 g
Total	5.4 kg	18.3 kg	21.5 kg	3.0 kg	8.2 kg	48.8 kg



RMR (Resting Metabolic Rate) 1,290 kcal/day

Periodized body composition throughout the year

Off-Season

VS

In-Season

Meserat Defar

5 Distance WR's
10+ Olympic and World Champs Medals

8:23.72	**3000m WR (Indoors)**
14:12.88	**5000m**

PSYCHOLOGICAL FACTORS AND DISORDERED EATING

RISKS, PREVENTION , INTERVENTION

Shaunna Taylor, PhD

Triathlon Canada and Canadian Sport Institute – Pacific

Psychological factors

Testing + Body Regulation + High Stress Environment

What we know:

- **Regulation** (testing/measurement) of athlete bodies is commonplace in elite sport (Cosh et al., 2012)
- Athletes are at **significantly higher risk** of eating disorders (Milligan & Pritchard, 2006; Torstveit et al., 2008; 2010)
- Pressure to reduce body fat **remains commonplace**, despite lack of evidence that body comp benefits & expected performance outcomes outweigh psychological and/or overall health factors in many cases (Bouchard, 2007; Cosh et al., 2012; Thompson & Sherman, 2010)

**CASEM Statement (2001 + 2003)

Psychological factors

We also know:

- Pressure to perform and an emphasis on reducing body fat can lead to development of eating disorders and **sub-clinical disordered eating**
- Development of an **exclusive identity** (“identity foreclosure”) in an athlete also serves as a risk factor for eating disorders (Jones et al., 2005; Papathomas & Lavallee, 2006; Haase, 2009)

Getting at real numbers is a huge challenge

- **Powerful incidence stats**: Large scale study (Norway) (total pop. female elites) ED prevalence 47.8% (Torstveit et al., 2008; 2010); 70% weight class athletes Martinson et al., British Journal of Sports Medicine – 2010

What causes an eating disorder?

- A complex interaction between vulnerability factors and triggering events.
- A vulnerable athlete who has been exposed to risk factors may experience an adverse event that triggers behaviors/feelings.
- Once in the cycle of disordered eating = “maintaining factors” or initial rewards

  - compliments on appearance,

  - improved performance,

  - a sense of control via weight loss can cause continuation of dieting behaviors into an eating disorder” (BJSM)

The Hunger Games

Athletics chief thinks Jessica Ennis is fat, claims coach

'I'm not fat': Jessica Ennis hits back at bizarre jibe as her teammate reveals she was also told she's overweight

- Toni Minichiello said high-ranking staff at the Games 'should know better'

Olympics-bound athletes Jessica Ennis, Louise Hazel told to lose weight: report

Track stars worry similar comments could have severe effects on athletes and other women

Psychological factors

Psychological factors

BodySense

Basic #2
The Facts

The higher the level of competition, and the longer a coach has been using weight/body comp testing routinely, sometimes it can displace or distort true performance indicators.

Discuss real performance indicators for strength, endurance, technical/tactical execution measures, cognitive functioning under pressure,

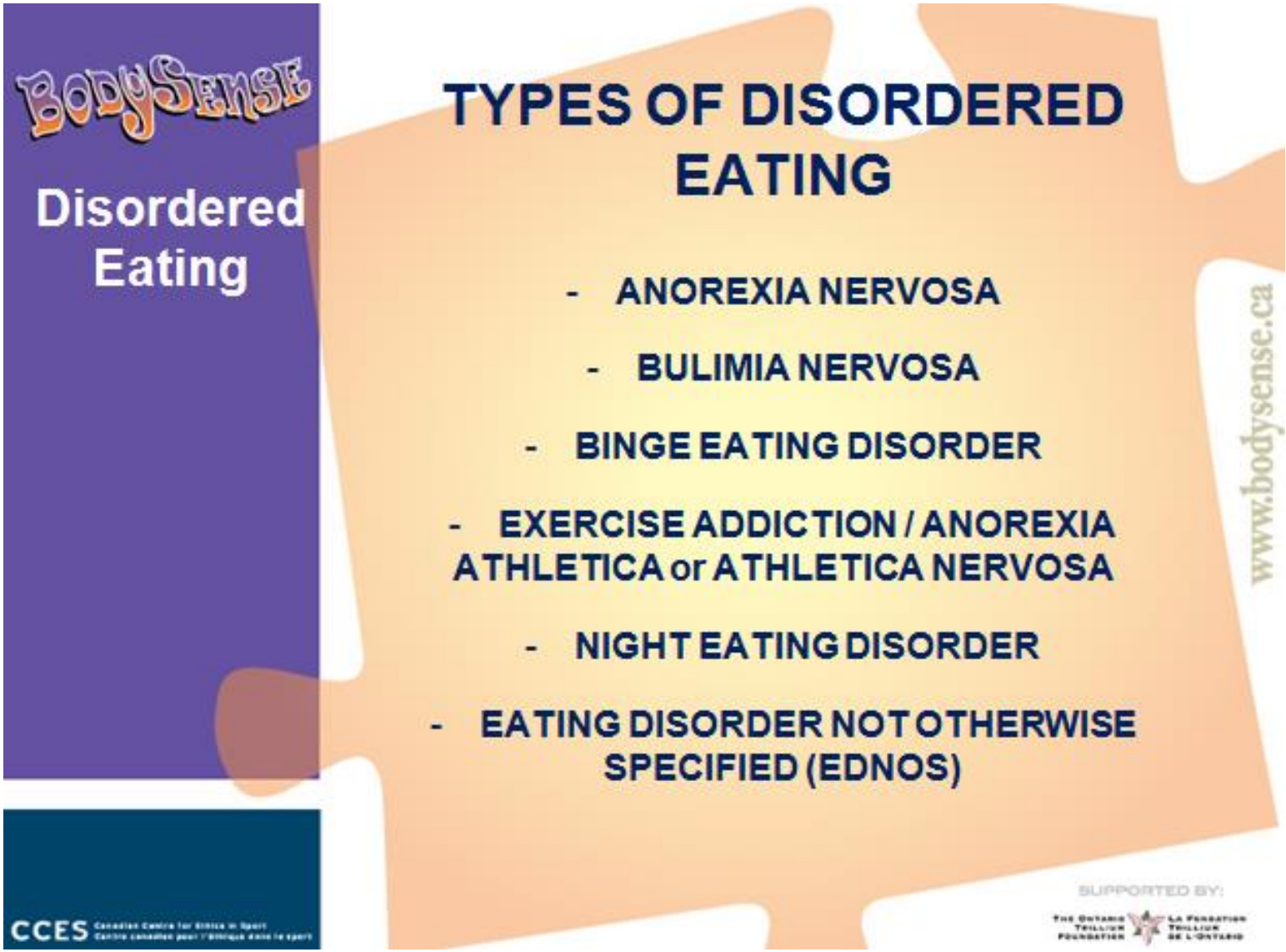
speed, power etc.

www.bodysense.ca

CCES Canadian Centre for Ethics in Sport / Centre canadien pour l'éthique dans le sport

SUPPORTED BY:

Psychological factors



Psychological factors

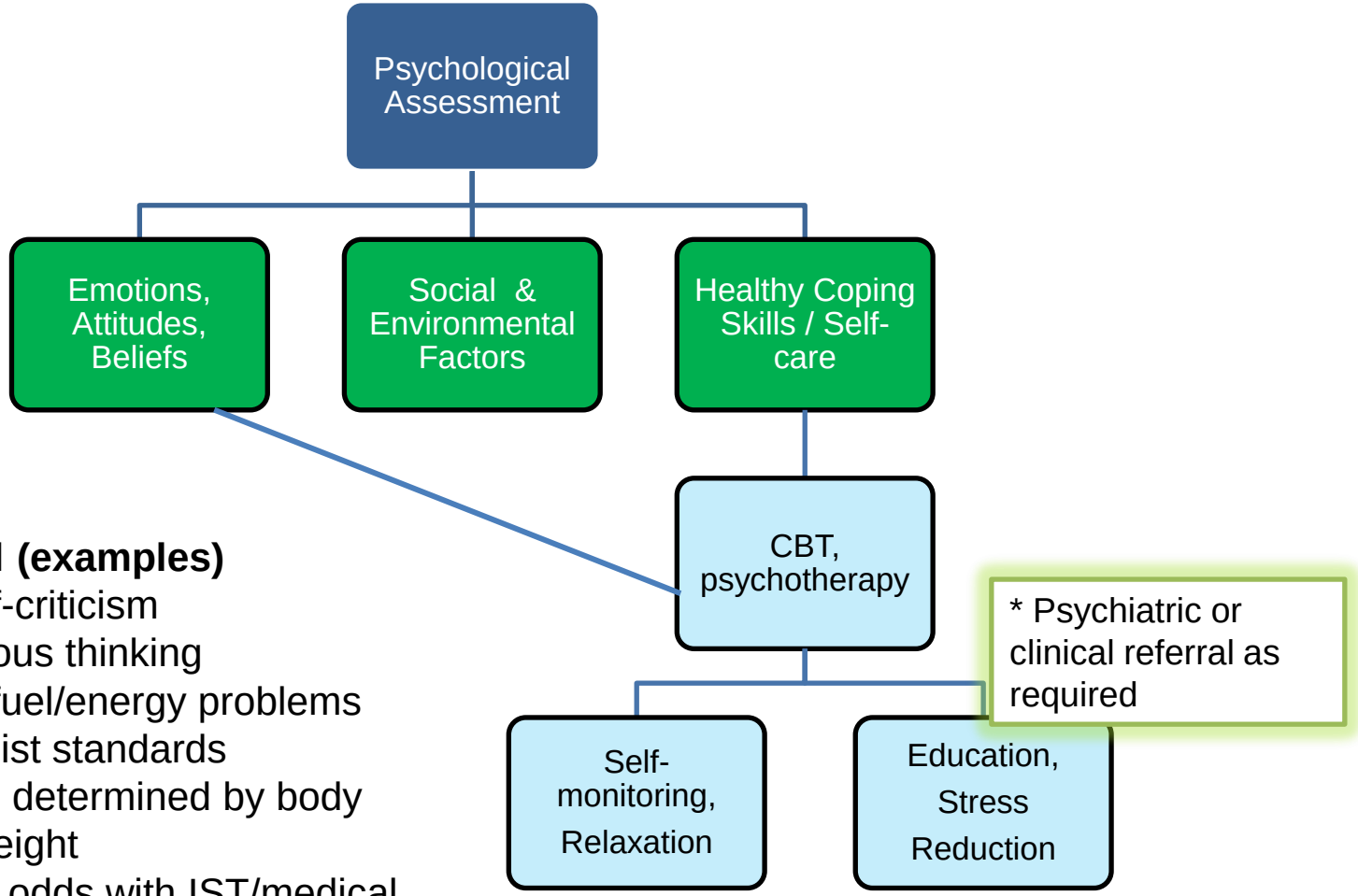
'Hidden' Messages

- ✓ "You look good, did you lose weight?"
- ✓ "That athlete is too fat, doesn't have the right body type for this sport"
- ✓ "I'm cutting back on carbohydrates. Have you tried it?"
- ✓ "That athlete still has her baby fat"

* Athletes reported seeking out endurance sport or sports where their sub-clinical / clinical conditions will be embraced: "Ultra running was a place I could hide. And still be rewarded. And it was killing me"

**Also significant concern in age-group & adult triathlon

Psychology



Attitudinal (examples)
-Harsh self-criticism
-Dichotomous thinking
-Denial of fuel/energy problems
-Perfectionist standards
-Self-worth determined by body comp or weight
-May be at odds with IST/medical staff
-Pleaser personalities will want to please everyone (coaches + IST)

Sample Screening Tools

*Triad Consensus Panel screening questions:

Have you ever had a menstrual period?
How old were you when you had your first menstrual period?
When was your most recent menstrual period?
How many periods have you had in the last 12 months?
Are you presently taking any female hormones (estrogen, progesterone, and birth control pills)?
Do you worry about your weight?
Are you trying to or has anyone recommended that you gain or lose weight?
Are you on a special diet or avoid certain foods or food groups?
Have you ever had an ED?
Have you ever had a stress fracture?
Have you ever been told you have low bone density (osteopenia or osteoporosis)?

Intervention techniques

Listen – Support – Challenge model

Cognitive Behavioural Therapy (CBT) methods:

If I add a rest period / night off, as per my physician's recommendation, I'll be deselected"

"If I can't significantly modify my body comp in pre-season, I'll be perceived as fat and non-competitive, and I'll be deselected"

"If I listen to dietician, increase protein/iron-rich/calcium foods, etc. I will get fat, which will inhibit performance, and it will get me deselected"

Cognitive behavioral therapy (CBT) aims to give athletes a framework with which to understand their symptoms and identify the many different triggers and associated thoughts and feeling associated with disordered eating spectrum behaviours / eating disorder behaviour

Intervention techniques

A word about male athletes

Special attention should be paid to male athletes who exhibit signs and symptoms of disordered eating (men have no diagnostic hallmark such as amenorrhea for detecting eating disorders).

Athletes diagnosed with disordered eating, but no other underlying medical disorder, who are unable or unwilling to follow the eating recommendations made by the dietician, trainer and/or physician shall be referred to an eating disorder treatment specialist

* Interesting autoethnography: Stone, “Running Man” – 2009)

Intervention techniques

IST & Coach Interventions = Team Approach

- Consistent messaging by entire performance team
- Focus on holistic health + true performance indicators
- Rest / recovery is a form of “training” (how do you measure? e.g. using apps, Hooper-Mac, REST-Q etc.?)
- Reinforce adequate energy budgeting & guidelines by physiologist, doctor, dietician, etc.
- Resist temptation to compare with teammates (“compare + despair”) & instill stress management skills/tools
- Model healthy straight up “performance” messaging

  (no “fat talk” in your coaching practice)
- Insist that as a group, your staff, assistants, IST, maintain the same biopsychosocial model principles

MEDICAL SCREENING, RISK ASSESSMENT AND DIAGNOSIS

*(*TREATMENT AND RETURN-TO-PLAY)*

Dr. Paddy McClusky, MD

Canadian Sport Institute – Pacific

Medical

- What are the potential medical consequences
  - Sport related:
    - Poor performance
    - Recurrent soft tissue and bone stress injuries
    - anemia
  - General Health
    - Recurrent infections
    - Mental health issues
    - Osteoporosis
    - Cardiovascular disease
    - Menstrual irregularity is a risk for unintended pregnancy

Medical

- Prevention is key

"I'll have an ounce of prevention."

Medical: Screening

- Should occur annually
  - History most important
- Screening may include
  - Formal nutritional assessment
    - Quantify energy availability vs energy expenditure
    - REDS likely when less than ~30kcal/kg lean body mass available after exercise requirements
  - Resting metabolic rate
    - Below 90% of predicted may suggest chronic energy deficit
  - Determination of menstrual cycle
    - How many missed menstrual cycles over last year
    - When did they occur in the season

Medical: Diagnosis

- The Triad of
  - Amenorrhea
  - Bone stress injury
  - Reduce energy availability
- Can be other symptoms from other affected systems
  - Chronic GI symptoms
  - Low energy, early fatigue
  - Stress/anxiety/depressed mood
- Other clues to diagnosis
  - BMI <17.5 or <85% predicted in adolescents
  - Menstrual irregularity, missed cycles
  - BMR: If <90% predicted, indicates chronic energy deficit
  - Formal nutritional assessment: energy in vs energy out
    - Altered hypothalamic function occurs with energy intake <30kcal/kg FFM/d (Loucks 2003)

Medical: Diagnosis

- Amenorrhea
  - No menstrual cycle for more than 3 months
  - Irregular cycles is on this spectrum
    - Important to note that early in menstrual history, not uncommon for females to have irregular cycles
      - That should resolve within 1-2 years of first menstruation
- Low bone mineral density
  - Often diagnosed at time of injury
  - Usually quantify with bone mineral density
    - Important for stratifying risk in athletes for further injury
- Low energy availability
  - Often can get from history
  - Sometimes requires formal nutritional assessment
    - Or RMR

Medical: Treatment

Treatment

- Multidisciplinary
  - MD, RD, Psychologist, Coach, Physiotherapist

- Most important treatment is eliminating energy deficit
  - Only this will correct metabolic derangements caused by being in energy deficit
  - The only clear sign athlete is in energy balance is regular menstruation
    - May take months before menstruation resumes but importance of this sign cannot be over-emphasized

Medical: Treatment

Treatment

- Formerly used hormone contraception to restore menses
  - But this did not address energy deficit and is now thought to place athlete at greater risk of negative consequences of prolonged REDS

Medical: Treatment

Treatment

- Vitamin D 2000IU daily +
- Calcium 1500mg daily (500mg three times a day)
  - maximizing bone health
- Mental Health support

Medical: Multidiciplinary Tx

The IOC consensus statement: beyond the Female Athlete Triad—Relative Energy Deficiency in Sport (RED-S)

Margo Mountjoy,[1] Jorunn Sundgot-Borgen,[2] Louise Burke,[3] Susan Carter,[4] Naama Constantini,[5] Constance Lebrun,[6] Nanna Meyer,[7] Roberta Sherman,[8] Kathrin Steffen,[2,9] Richard Budgett,[9] Arne Ljungqvist[9]

- Educational programmes on RED-S, healthy eating, nutrition, EA, the risks of dieting and how these affect health and performance.
- Reduction of emphasis on weight, emphasising nutrition and health as a means to enhance performance.
- Development of realistic and health-promoting goals related to weight and body composition.
- Avoidance of critical comments about an athlete's body shape/weight.
- Use of reputable sources of information.
- Promotion of awareness that good performance does not always mean the athlete is healthy.
- Encouragement and support of appropriate, timely and effective treatment.

Medical: Return to Play

Table 1 Relative Energy Deficiency in Sport risk assessment model for sport participation (modified from Skårderud *et al*)[140]

High risk: no start red light	Moderate risk: caution yellow light	Low risk: green light
▶ Anorexia nervosa and other serious eating disorders ▶ Other serious medical (psychological and physiological) conditions related to low energy availability ▶ Extreme weight loss techniques leading to dehydration induced haemodynamic instability and other life-threatening conditions	▶ Prolonged abnormally low % body fat measured by DXA or anthropometry using The International Society for the Advancement of Kinanthropometry ISAK[141] or non-ISAK approaches[142] ▶ Substantial weight loss (5–10% body mass in 1 month) ▶ Attenuation of expected growth and development in adolescent athlete	▶ Healthy eating habits with appropriate energy availability
	▶ Abnormal menstrual cycle: FHA amenorrhoea >6 months ▶ Menarche >16 years ▶ Abnormal hormonal profile in men	▶ Normal hormonal and metabolic function
	▶ Reduced BMD (either from last measurement or Z-score < −1 SD). ▶ History of 1 or more stress fractures associated with hormonal/menstrual dysfunction and/or low EA	▶ Healthy BMD as expected for sport, age and ethnicity ▶ Healthy musculoskeletal system
	▶ Athletes with physical/psychological complications related to low EA/ disordered eating - ECG abnormalities- Laboratory abnormalities ▶ Prolonged relative energy deficiency ▶ Disordered eating behaviour negatively affecting other team members ▶ Lack of progress in treatment and/or non-compliance	

BMD, bone mineral density; DXA, dual-energy X-ray absorptiometry; EA, energy availability; FHA, functional hypothalamic amenorrhoea; ISAK, International Society for the Advancement of Kinanthropometry

Table 3 The Relative Energy Deficiency in Sport Return-to-Play Model (modified from Skårderud *et al*, 2012)[140]

High risk red light	Moderate risk yellow light	Low risk: green light
▶ No competition ▶ Supervised training allowed when medically cleared for adapted training ▶ Use of written contract (see supplementary appendix 1)	▶ May compete once medically cleared under supervision ▶ May train as long as is following the treatment plan	▶ Full sport participation

Return To Play – RED-S

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Table 2 The Relative Energy Deficiency in Sport Decision-based Return-to-Play Model (modified from Creighton *et al*[143])

Steps	Risk modifiers	Criteria	Red-S-specific criteria
Step 1 Evaluation of health status	Medical factors	Patient demographics Symptoms Medical history Signs Laboratory tests Psychological health Potential seriousness	Age, sex (see Yellow light column of table 1) Recurrent dieting, menstrual health, bone health Weight loss/fluctuations, weakness Hormones, electrolytes, ECG and DXA Depression, anxiety, disordered eating/eating disorder Abnormal hormonal and metabolic function Stress fracture
Step 2 Evaluation of participation risk	Sport risk modifiers	Type of sport Position played Competitive level	Weight sensitive, leanness sport Individual vs team sport Elite vs Re-creational
Step 3 Decision modification	Decision modifiers	Timing and season Pressure from sthlete External pressure Conflict of interest Fear of litigation	In/out of season, travel, environmental factors Desire to compete Coach, team owner, athlete family and sponsors If restricted from competition

DXA, dual-energy X-ray absorptiometry.

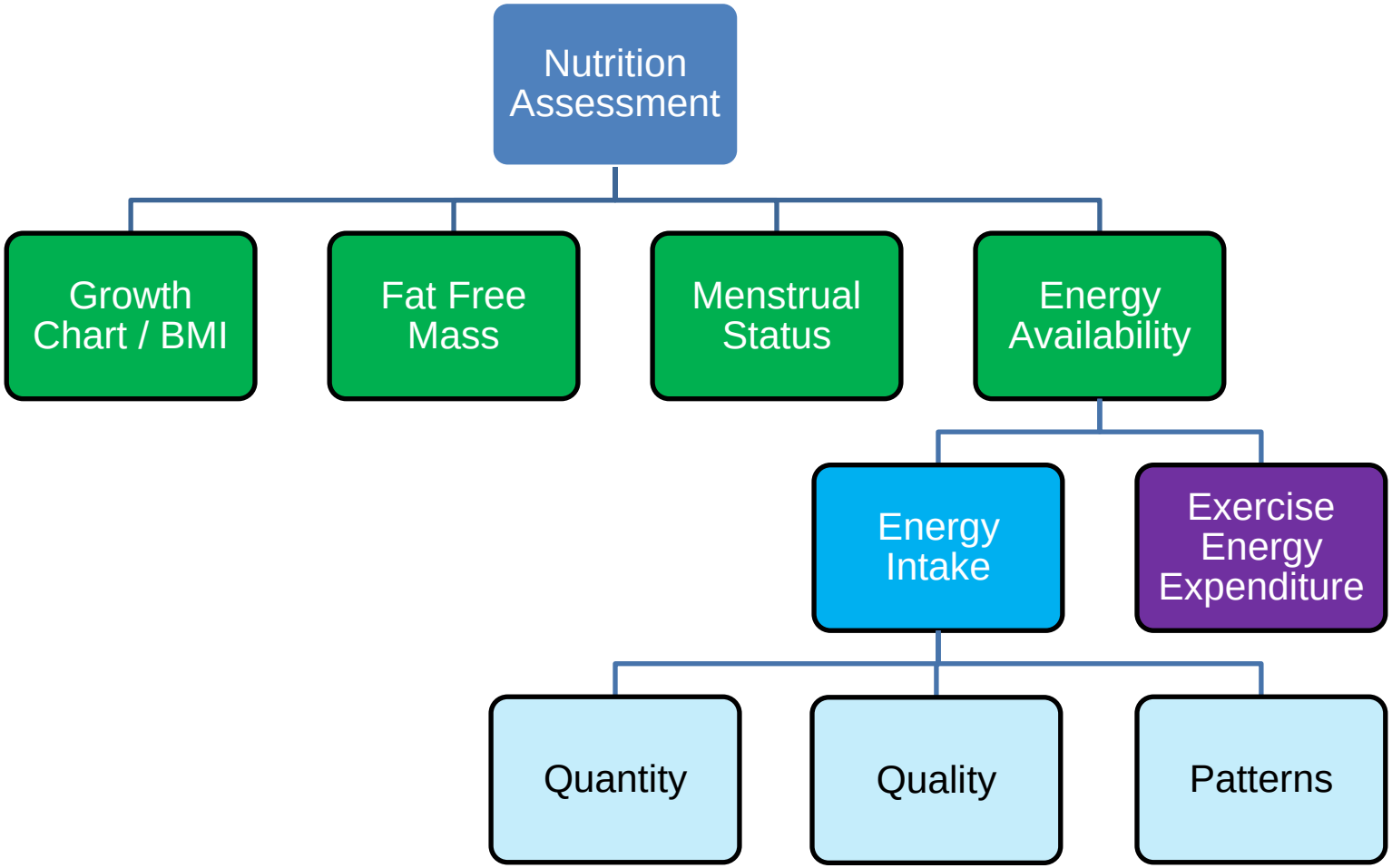
NUTRITION CONSIDERATIONS

(*BEST PRACTICES AND CASE STUDY)

Ashley Armstrong, MS., RD

Canadian Sport Institute – Pacific

Nutrition


Nutrition Assessment
Growth Chart / BMI
Fat Free Mass
Menstrual Status
Energy Availability
Energy Intake
Exercise Energy Expenditure
Quantity
Quality
Patterns

Energy Deficiency in Athletes

Nattiv, et al (2007)

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1

- Obsessive eating disorders
  - Clinical Mental Illness

2

- **Intentional and rational but mismanaged efforts to reduce body size and fatness for athletic competition**
  - Includes: fasting, diet pills, laxatives, diuretics, enemas, and vomiting

3

- **Inadvertent failure to increase energy intake to compensate for the energy expended in exercise**

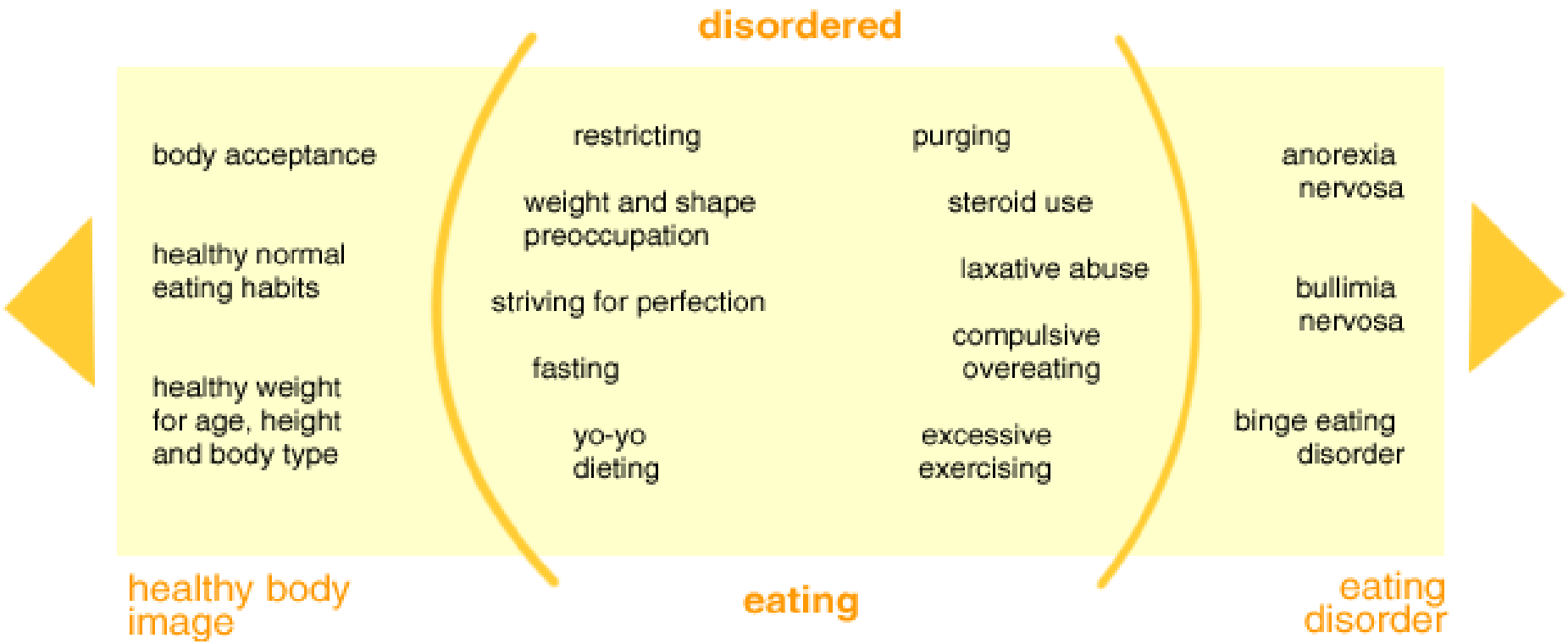
CASE STUDY 1

- 14 year old Female Waterpolo player
- RE: weight loss; fatigue during training; feeling cold
- CBW: 52.3kg; Ht: 171.1cm; BMI: 18.03 (15-50th%ile)
- Wt loss of 21% since June/14 due to dietary changes
- Based on growth chart IBW = 59kg (BMI at 50%)
- Age of menarch = 12
- Currently Ammenorrheic
- Weekly Training Schedule:
  - Waterpolo 5 days a week x 2 hours
  - Pilates 30min, twice a week
  - Recreational Dance 1hr/week

Alarm Bell

- Dietary Changes
  - Cut out all “unhealthy food”
  - Choosing only fat free products
  - Egg whites only
  - Little added fat
  - Low CHO
  - No red meat
  - Admitted to wanting to go on a vegan diet (ethical?)
- Some texture issues and severe dislikes to foods
- Veggies only for snacks
- No recovery
- Fear of gaining weight/getting “fat”
- Disclosure to parents

Disordered Eating Continuum



Strategy

- 1) Full nutrition assessment
- 2) Physician assessment
- 3) Be Honest!
- 4) Gradual increase of energy until needs are met for health, metabolic function & performance
  - Attain IBW by increase in 0.5-1kg per week for a total of 9kg by January 26, 2014
  - Increasing Calories by increasing macronutrient intake, esp CHO and FAT
  - Increasing Calcium and Iron consumption
  - Continued discussion around Vegan decision – goal is for no avoidance of foods
- 4) Set SMART goals
- 5) Decision around training/competition plan
  - Athlete decided to discontinue training/competition until weight goals reached and health status improved
  - Focus first on the person rather than the athlete

Dietary Assessment

- Energy Intake based on 3 day food record:
  - ~1100kcal/day
  - ~2.8g CHO/kg/day
  - ~1.2g PRO/kg/day
  - ~0.6g FAT/kg/day
  - Calcium: ~520mg/day
  - Iron: ~9mg/day

Key Nutrient Needs:

EEE: 2203-3100kcal/day

CHO	PRO	FAT	CALCIUM	IRON
5-7g/kg/day	~1.2-1.6g/kg/day	1-2g/kg/day 20-35%	1300mg	18mg

Performance Food Guide

The Performance Food Guide

Total Servings	Super Foods (Vegetables)	Super Foods (Fruits)	Energizers	Support & Recovery Foods	Building & Repair Foods	Essentials	Other Foods	Fluids
17-20	4+	3 - 4	6 - 7	3-4	2-3	2	1-2 a day	8
21-24	4+	4	8-9	3-4	3-4	2-3		10
25-27	4+	4	10-12	4	4	3		12

Daily Tracking of Servings

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TRACKING SHEET

FOOD GROUP	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
Super Foods Vegetables 4+							
Super Foods Fruit 4-5							
Energizers 6-7							
Support and Recovery Foods 3-4							
Building and Repair Foods 3							
Essentials 2-3							
Other 1-2							

MEAL PLAN

BREAKFAST

- Have __2_ servings of Energizers
- Have __1__ serving of fruit (canned, frozen or fresh)
- Have _1_ servings of Support and Recover Foods

MORNING SNACK

- Have __1__ serving of Fruit (canned, frozen, dried or fresh)
- Have __1__ serving of Essentials

LUNCH

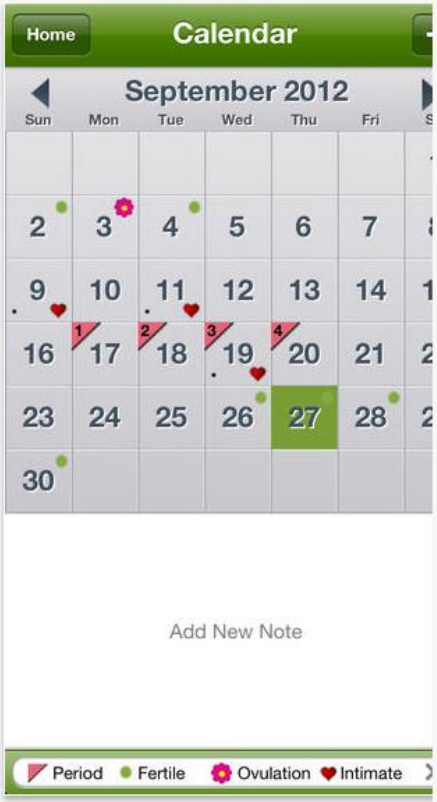
- Have __2__ servings of Energizers
- Have __1___ serving of fruit (canned, frozen or fresh)
- Have__1___ servings of support and recovery:
- Have __2__ servings of vegetables (canned, frozen or fresh)
- Have ___1__ servings of building and repair

Warning Signs & Symptoms

- Loss of or irregular periods (failure to start menstruating by 16 years of age)
- Fatigue or overall low energy
- Poor performance and slow recovery times
- Repetitive injury, stress fractures
- Poor immunity
- Cold hands and feet
- Sleep difficulties
- Nutrient deficiency; weak or brittle hair, nails; poor skin integrity
- Drastic changes in weight in a short period of time
- Excess body fat despite high volume of training or activity (especially abdominal wt)
- Mood changes, depression, lack of ability to concentrate
- Drive to be thin at all costs!

Period Tracking Apps

iPhone Screenshot



Period Tracker Lite

iPeriod Period Tracker

iPhone Screenshot

What the athlete may say….

- Headaches
- Constipation
- Diarrhea
- Sleeping difficulties
- Breathing difficulties
- Dizziness
- Sadness
- Fatigue

What to do as Coaches

- Explore your own believes & attitudes around weight, dieting and body image
- Regular collection of food records throughout the training year
  - Look for: gaps in intake through the day; low CHO; low Fat; Food avoidance including avoiding whole food groups; Poor recovery, etc.
  - Look at nutrition habits around training session: pre/during/recovery
- Athletes considered ‘at risk’ should meet with a sport nutritionist/dietitian
  - Know your local resources
- If weight loss is desired, refer to a profession
- Those unable to improve their eating habits/behaviour should be referred to a clinician for further assessment of EDs
- Referral to a sport psyc may also be needed to determine underlying cause of DE/ED

What does under-eating look like and how to bump up EI

SAMPLE DIET (1170 KCAL)	WITH ADDITIONS (1917 KCAL)
	Breakfast:
1/3 cup oats (uncooked) – 120 calories	Increase oats to ½ cup: add 60 calories
½ cup skim fat milk – 43 calories	Increase the milk to ¾ cup: add 21 calories
½ cup blueberries – 42 calories	Add 8 walnut halves - 105 calories
8 oz. green tea – 0 calories	Add 1 Tbsp. ground flaxseed - 37 calories
	Snack:
½ cup low-fat cottage cheese – 81 calories	Add ½ cup pineapple - 41 calories
	Lunch:
3 oz. skinless chicken breast - 93 calories	Include a small whole grain wrap -105 calories
1.5 cups mixed green salad – 12 calories	Add ½ cup mixed veggies in wrap - 10 calories
	½ medium tomato – 11 calories
Squeeze of lemon – 0 calories	Add 2 tsp. of olive oil - 80 calories
	1 medium pear – 103 calories
	Snack:
	Medium apple – 95 calories
10 almonds – 70 calories	Add 5 more almonds: add 35 calories
	Dinner:
5 oz. grilled salmon – 215 calories	Add ¾ cup cooked quinoa: add 167 calories
	1.5 cups mixed grilled vegetables - 45 calories
	2 teaspoons olive oil – 80 calories
	Dessert:
2 oatmeal cookies – 160 calories	Add 1 cup skim milk: add 86 calories

Adapted from Sygo, J, *Eat More to Stay Fit.* In Oxygen Magazine, Sept. 2010

Energy Needs

Timing	Energizers	Superfoods Fruits	Superfoods Vegetables	Support & Recovery	Building & Repair	Essentials
Off season	8-9	3-4	4+	3-4	3-4	2-3
Preparatory	10-14	4	5+	3-4	3-4	3-4
Taper	9-11	4-5	6+	4-5	4-5	2-3
Competition	12-14	4-5	6+	5	5	3-4

ENERGIZERS
•1 slice (35 g) bread or ½ bagel (45 g) = hockey puck
•½ c. / 125 mL cooked rice, pasta, or couscous = ½ baseball
•30 g cold cereal or ¾ c. / 175 mL hot cereal ½ bag= small fist

SUPERFOODS - FRUITS
•1 piece of fruit = tennis ball
•½ c. / 125 mL (½ cup) fruit
•¼ c. / 125 mL dried fruit = golf ball

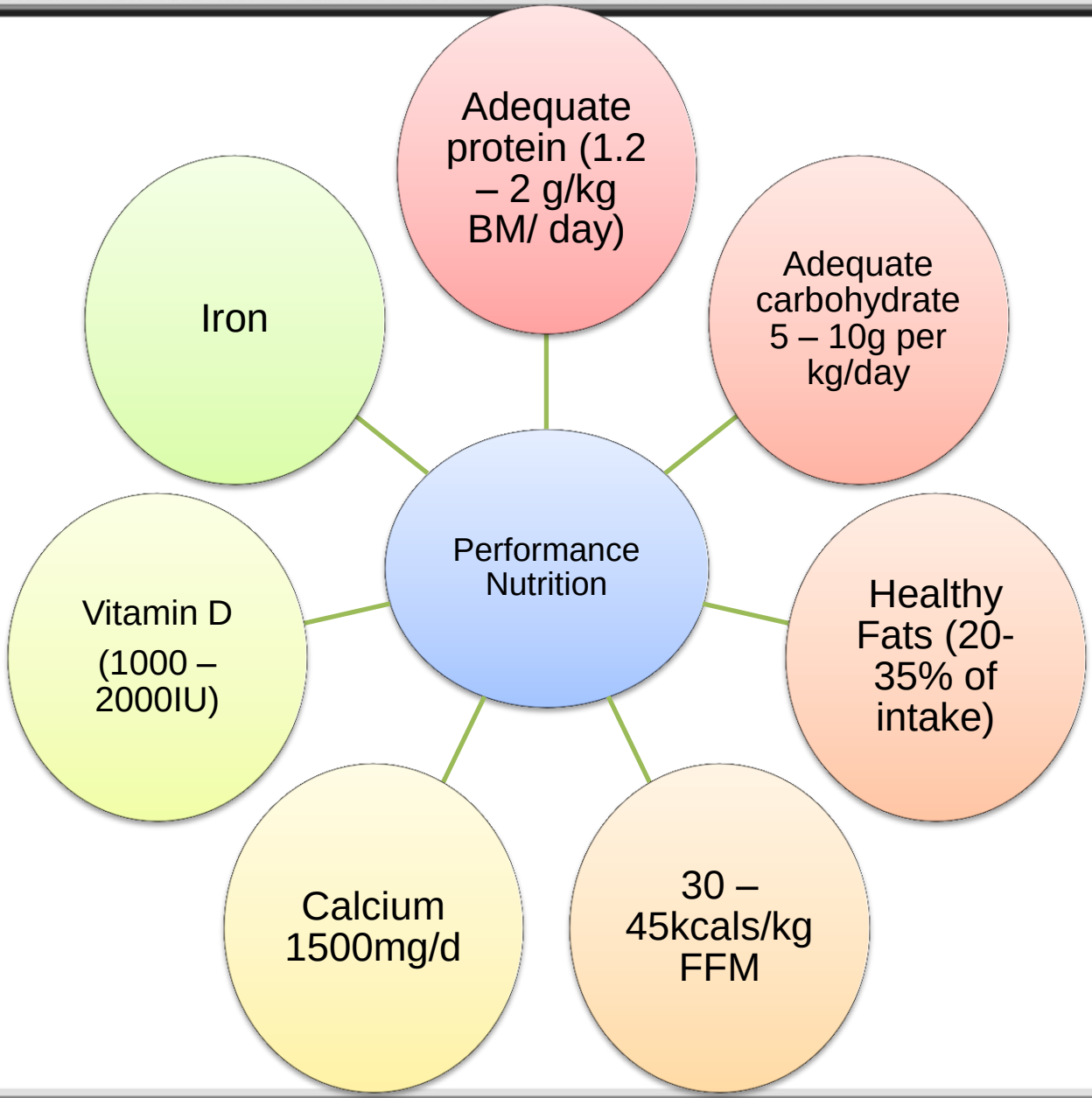
SUPERFOODS - VEGETABLES
•½ c. / 125 mL fresh, frozen or canned vegetable
•1 c. / 250 mL leafy raw vegetables or salad = 1 cupped hand

SUPPORT & RECOVERY
•1 c. / 250 mL milk or fortified soy beverage
•¾ c. / 175 g yogurt
•1½ oz / 50 g cheese = 2 thumbs

BUILDING & REPAIR
•90 g (3 oz.)/ 125 mL (½ cup) cooked fish, shellfish, poultry or lean meat = deck of cards
•¾ c. / 175 mL cooked beans = small light bulb
•2 eggs

ESSENTIALS
- 1 tbsp vegetable oil (incl. butter, margarine)
- 2 tbsp salad dressing
- 2 tbsp seeds/nuts (any kind) or 1 tbsp nut butter

Overall Nutrition Considerations…



Questions?

Questions & Small Group Discussion

*What are your biggest challenges?

*Biggest take-aways and implications for your practice?

Thank you!