Female Athlete Triad: Update and Management

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Disclosure

- I have no actual or potential conflict of interest in relation to this program/presentation

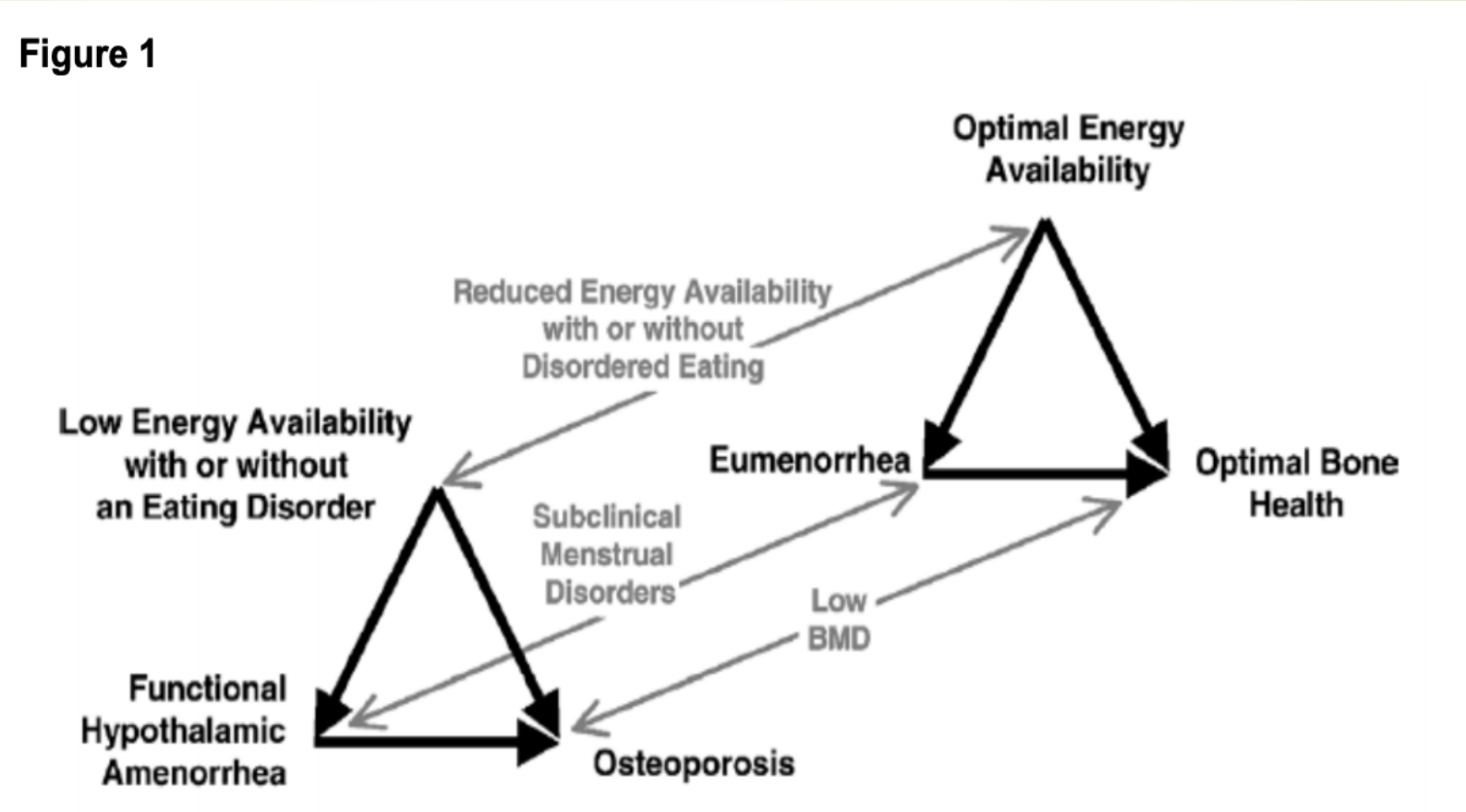
Objectives:

- **Review and Definitions**
- Prevention
- Screening
- Non-pharmacological Management
- Pharmacological Interventions

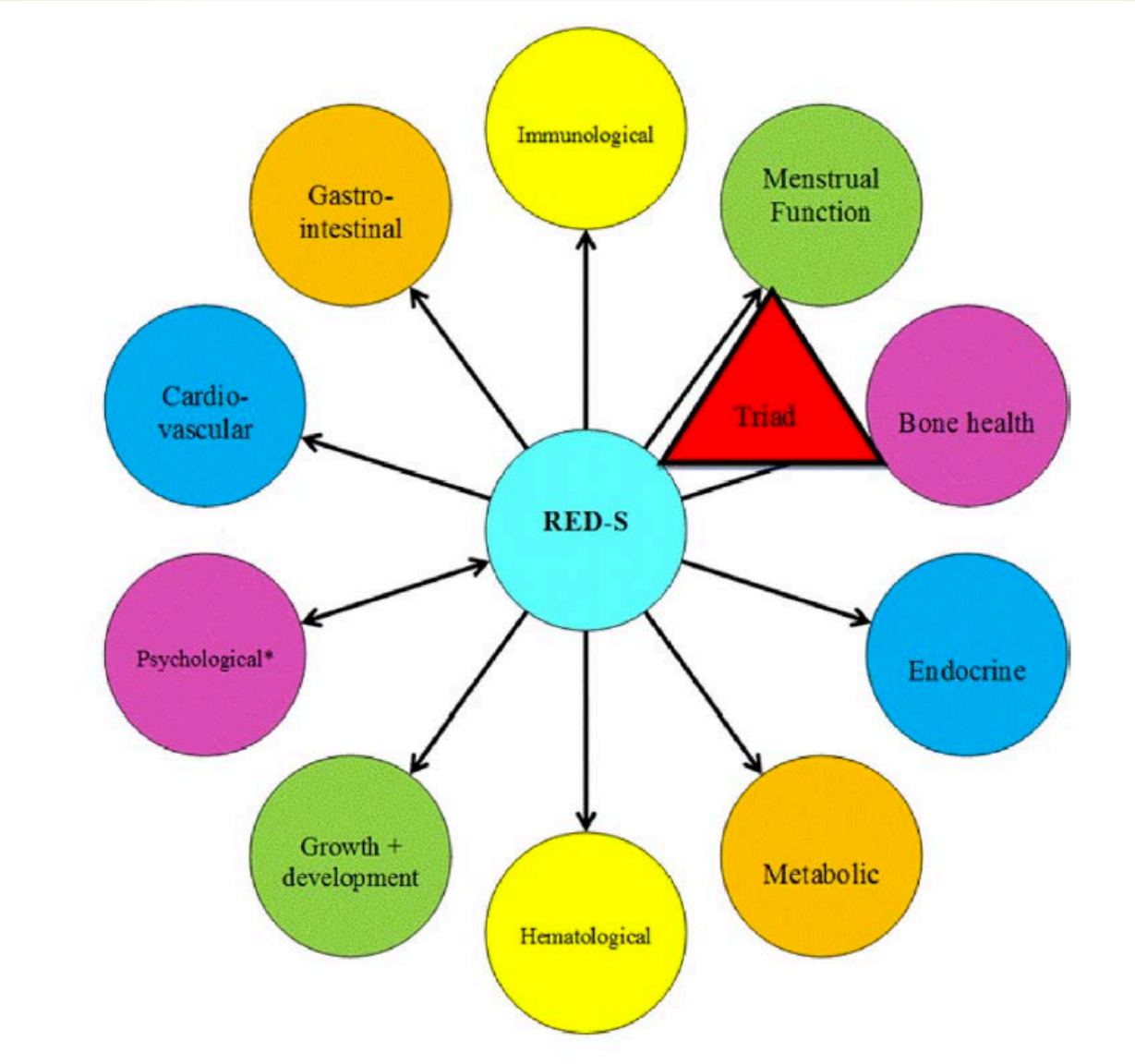
Female Athlete Triad

- One or more of the following criteria:
  - Low energy availability with or without disordered eating
  - Menstrual cycle disturbances
  - Low bone mineral density (BMD)
- Sports that emphasize leanness, demand high energy expenditure and/or an aesthetic component (cross country running, gymnastics, figure skating, etc.)
- Prevalence of one component of the Triad ranged from 16 to 60% in female athletes.

Female Athlete Triad

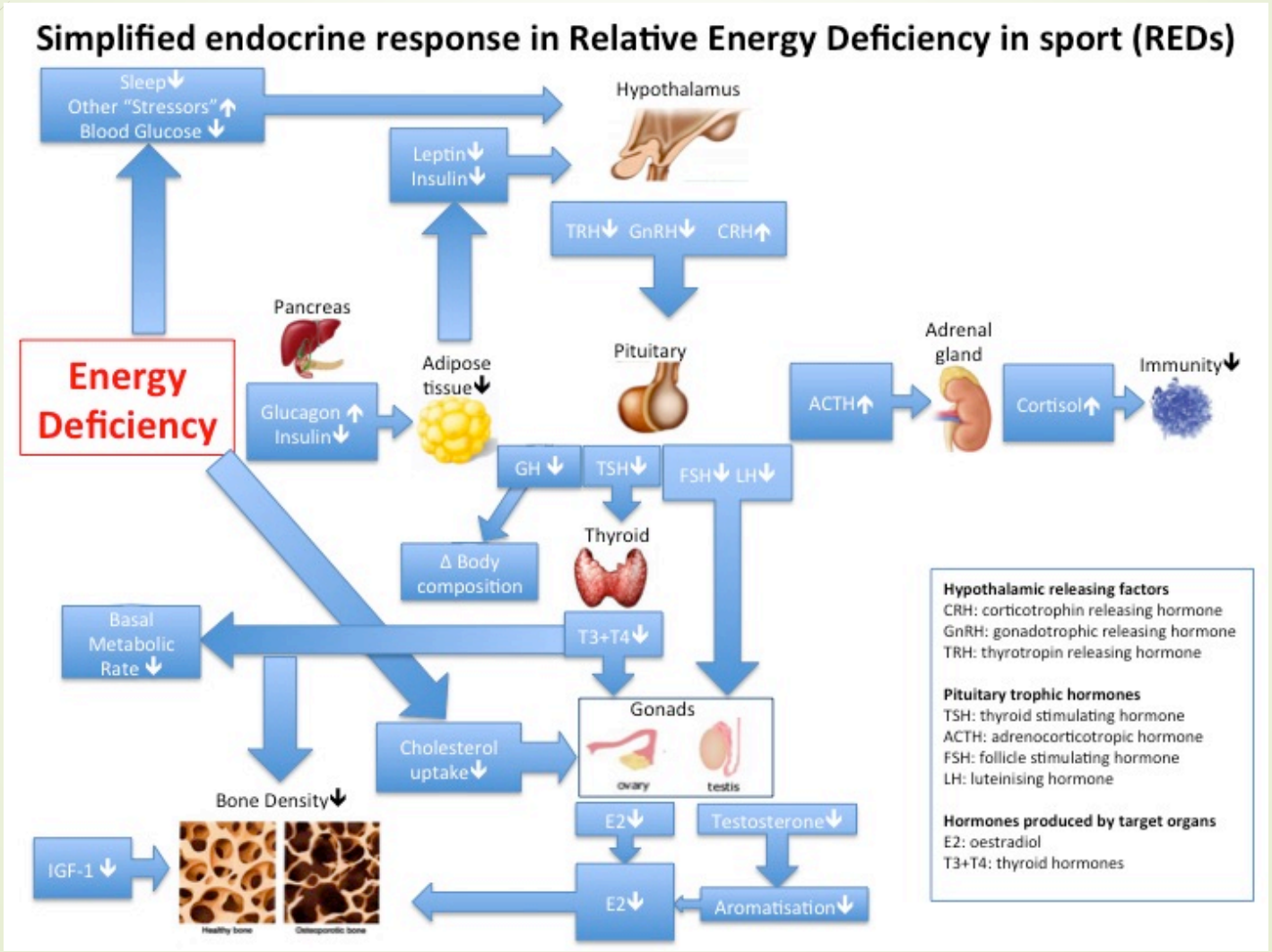


Relative Energy Deficiency in Sports



Relative Energy Deficiency in Sports

Menstrual Function and Bone Health



Energy Availability (EA)

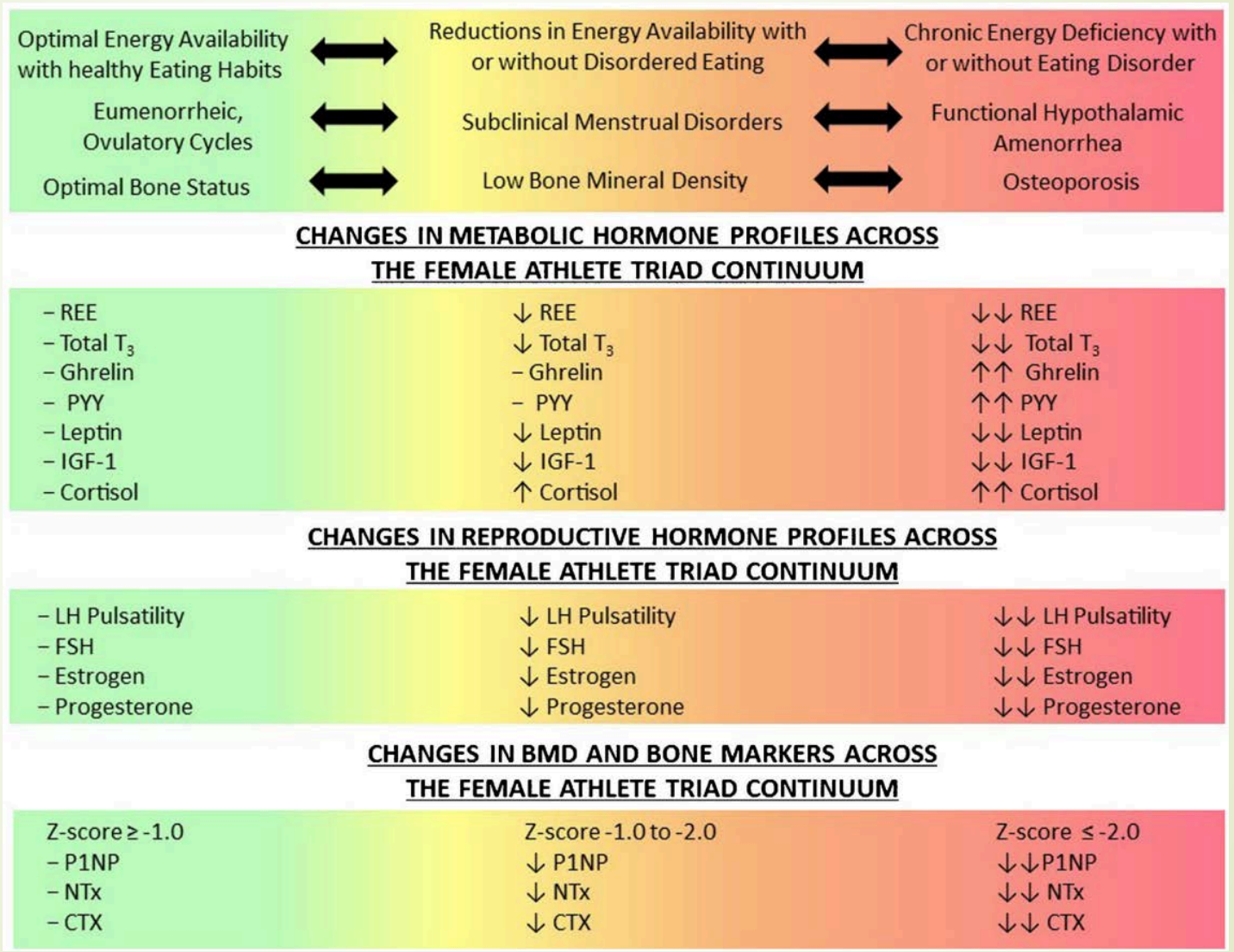
$$\frac{(daily\ dietary\ intake\ (kcals) - daily\ exercise\ energy\ expenditure\ (kcals))}{ffm\ (kg)}$$

- Optimal EA for healthy physiological function is achieved at 45 kcal/kg ffm
- EA < 30 kcal/kg ffm has been shown to affect the hypothalamic-pituitary axis
  - Slowing of LH pulse frequency → menstrual disturbances
  - Reduced serum glucose, Ttiiodothyronine, insulin, IGF-1
  - Decreased GH and cortisol

Measurement of EA

- How practical and reliable is it?
  - No standardized or reference protocol for undertaking an EA assessment.
- Difficult and expensive to calculate
- Will require a lot of equipment and precision to be a stand-alone diagnostic tool
- Best surrogate measure is a biomarker.

Measurement of EA



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Prevention of Female Athlete Triad requires increased awareness

- Feldman, J, et al. “Female Adolescent Athletes’ Awareness of the Connection between Menstrual Status and Bone Health” (2011)
  - 33.3% of 103 adolescent female track athletes reported menstrual irregularity.
  - High mileage athletes and runners with greater tenure corresponded with more awareness
  - Higher awareness levels associated with menstrual regularity

Prevention of Female Athlete Triad requires increased awareness

- Pantano, K, “Current Knowledge, Perceptions and Interventions Used By Collegiate Coaches” (2006)
  - 64% of 91 NCAA D1 coaches have “heard about the triad”.
  - 43% were able to identify the three components of the triad.
  - College coaches with a high degree of knowledge had a statistically significant difference in their attitudes and skills.
  - Knowledge about the triad has no correlation with gender of the coach or years of experience.

Prevention of Female Athlete Triad requires increased awareness

- Kroschus, E, et. al. "Assessing the Awareness and Behavior of U.S. High School Nurses With Respect to the Female Athlete Triad" (2015)
  - 28.4% of the 370 nurses had heard of the triad
  - 13.8% were able to identify the 3 components
  - 44.5% thought amenorrhea is not normal and requires a medical referral
  - 40.8%thought amenorrhea was normal but should be reassessed every 3-6 months
  - 10.8% of responders' schools had policies in place to deal with disordered eating, 0.9% with menstrual irregularity and 4.3% with repeated stress fractures

Prevention of Female Athlete Triad requires increased awareness

- Curry, E. et al, “Female Athlete Triad Awareness Among Multispecialty Physicians” (2015)
  - 37% of the responding primary care physicians have heard of the Triad
  - 51% reported feeling comfortable treating or referring a patient with the Triad
  - 32% of attendings, 46% of fellows and 44% of resident physicians have heard of the Triad.
  - Residents and fellows were significantly better at identifying the components of the Triad.
  - Awareness rated were highest among orthopedists, ob/gyn and PM&R physicians

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Screening for Female Athlete Triad

- Female Athlete Coalition Consensus Statement (2014)
  - Disordered eating
  - Clinical eating disorder
  - Intenional weight loss without disordered eating
  - Inadvertent undereating

Screening for Female Athlete Triad

- Several disordered eating/eating disorder screening tools for the general population
  - Eating Disorder Inventory-3
  - SCOFF
    - ≥2 positive answers
    - Sensitivity 84.6%-100%
    - Specificity 87.5% - 89.6%

S	Do you make yourself *SICK* (vomit) because you feel uncomfortably full?
C	Do you worry that you have lost *CONTROL* over how much you eat?
O	Have you recently lost more than *ONE* stone (15 pounds) in a 3-month period?
F	Do you believe yourself to be *FAT* when others say you are thin?
F	Would you say that *FOOD* dominates your life?

Screening for Female Athlete Triad

- Validated screening tools for the detection of disordered eating behavior in athletes
  - Athletic Milieu Direct Questionnaire (AMDQ)
  - Female Athlete Screening Tool (FAST)
  - American Physiological Screening Test for eating disorderes among Female College Athletes.

Screening for Female Athlete Triad

- Low Energy Availability in Females Questionnaire (LEAF-Q)
  - Screening tool based on self-reported physiological symptoms
  - Self-reported physiological symptoms linked to persistent energy deficiency, with or without DE/ED

Screening for Female Athlete Triad

- Plateau, C. et al., “Female Athlete Experiences of Seeking and Receiving Treatment for an Eating Disorder”
  - 13 in-person interviews – preliminary study
  - Challenges to treatment include lack of eating disorder literacy among athletes and coaches
  - Feeling out of place
  - Coping with exercise transitions

Screening for Female Athlete Triad

- In-depth personal interview must be performed to make the diagnosis.
- Prevalence of energy deficiency is high without the presence of disordered eating.
- Coaches have difficulty identifying disordered eating and convincing athletes to seek treatment.

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Non-Pharmacological Management

- If low energy availability is due to unintentional under eating, nutritional education may suffice (eg, sports dietician).
- Increased food intake.
- Changes in food choices.
- Individualized changes based on athlete's energy expenditure and exercise goals.
- May need reduction or cessation of exercise.
- Achieve level of 25-hydroxy vitamin D > 30 ng/mL
- Adequate consumption of Calcium
- Cognitive behavioral therapy
- Non-compliance with therapy may lead to removal of athlete from competition/training

Non-Pharmacological Management

Relative Energy Deficiency in Sport (RED-S) Treatment Contract

RED-S Treatment Contract for _____

Multidisciplinary Team:

- (Physician) _____
- (Psychotherapist/Psychiatrist) _____
- (Exercise physiologist) _____
- (Dietitian) _____
- (Other) _____

Requirements

Meet with:

- The psychotherapist at intervals recommended by the health professional treatment team
- The dietitian at intervals recommended by the health professional treatment team
- The physician at intervals recommended by the health professional treatment team
- Follow daily meal plan developed by the health professional treatment team
- Follow the adapted training plan developed by the health professional treatment team
- If underweight, weight gain expected to be _____ kg per week/weight stable within week _____
- If underweight, must achieve minimal acceptable body weight/fat of _____ kg/percent by _____
- Regular weigh-in at the following time intervals of _____ week (s)
- After this date, _____ (dd/mm/yyyy), must maintain weight and % fat at or above minimal acceptable body weight/fat mass of _____ (kg/%)
- Other _____

If **ALL** requirements are met and the eating behavior (and other severe conditions) are normalized the Team Physician will decide if cleared for competition.

I, _____ have read this contract and all of my questions were answered.

Athlete Name	Athlete Signature	Date
Team Physician Name	Team Physician Signature	Date

Non-Pharmacological Management

- Mallison, R., “A Case Report of Recovery of Menstrual Function Following a Nutritional Intervention in Two Exercising Women With Amenorrhea of Varying Duration (2013).
  - 19 yo female with 11 months of amenorrhea.
  - Menses resumed after 2.5 months of increased daily dietary intake by 500 kcal.
  - Menses continued to be irregular for several cycles.
  - Estrogen levels increased 64.3% compared to baseline.
  - No increase in BMD in 12 months but there was an increase by 49.6% in P1NP, a marker of bone formation

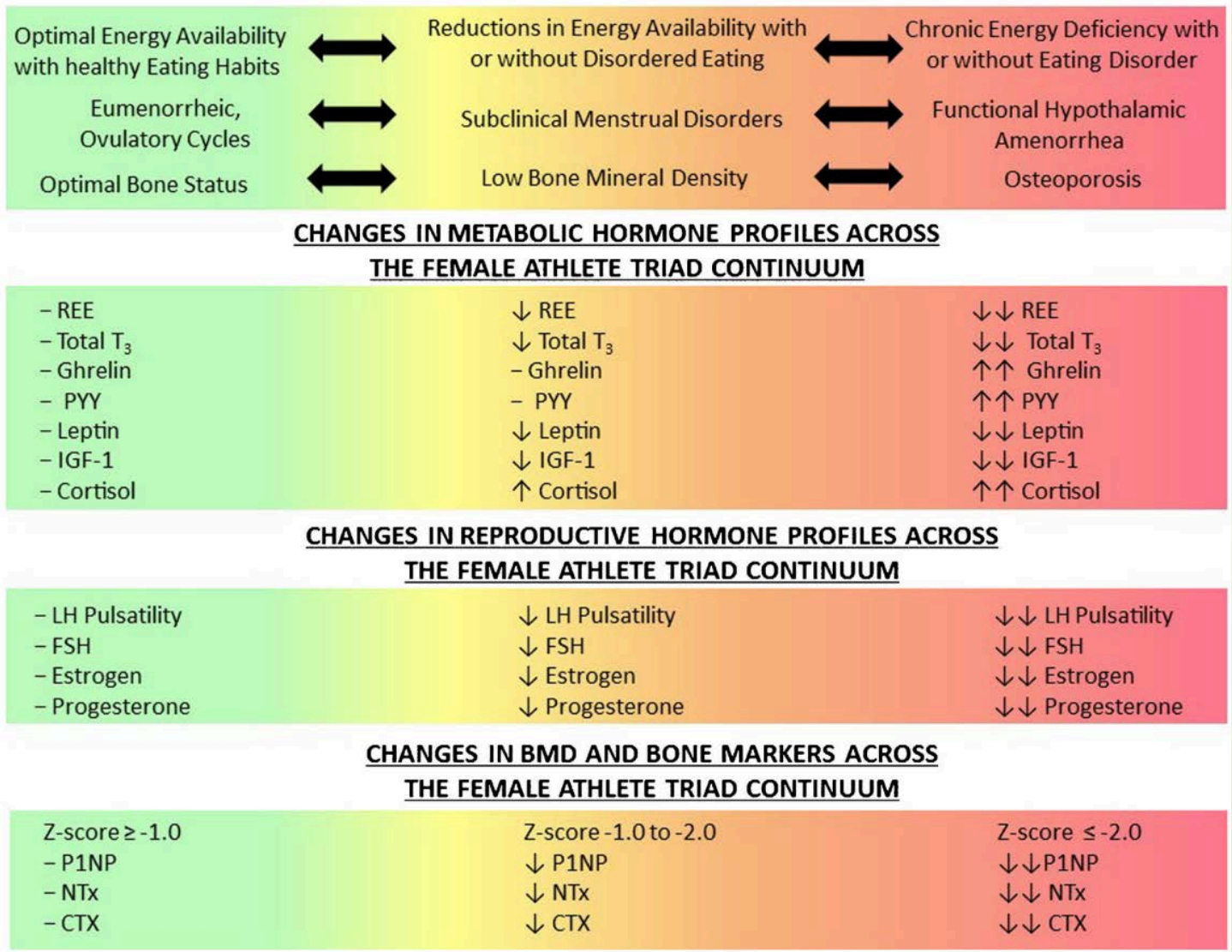
Non-Pharmacological Management

- Ruohola, J., “Association Between Serum 25(OH)D Concentrations and Bone Stress Fractures in Finnish Young Men (2006).
  - 756 army recruits
  - Median serum 25(OH)D of recruits with stress fractures was significantly lower than in the group without stress fracture.
  - Recruits with serum concentration of 25(OH)D < 30 ng/mL had a significantly higher number of stress fractures.

Non-Pharmacological Management

- Michopoulos, V., “Neuroendocrine recovery initiated by cognitive behavioral therapy in women with functional hypothalamic amenorrhea: a randomized controlled trial” (2013).
  - Sample of 8 women in CBT.
  - 87.5% exhibited a decrease in cortisol levels vs 33% in control arm (9 women).
  - 75% of women in CBT resumed ovulation vs. 33% in the control arm.
  - BMI was not affected by CBT
  - Leptin levels were increased in women who underwent CBT, whereas leptin remained constant in women in the control arm
  - TSH levels in women who underwent CBT increased, but did not change in women in the control arm

Future of Non-Pharmacological Management



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Pharmacological Interventions

- Daily calcium (1,200-1,500 mg) and vitamin D (400- 800 IU) will assist the bone with building materials.
- Combined oral contraceptives are NOT recommended for regaining menses or improving bone mineral density.
- Transdermal oestradiol (E2) therapy with cyclic oral progestin
  - Short-term use
  - If not responding to non-pharmacological management
- Recombinant parathyroid hormone 1–34 (rPTH)
  - Short-term use in setting of delayed fracture healing or very low bone mineral density
  - Contraindicated in adolescents with open growth plates

Pharmacological Interventions

- Lopez LM, Steroidal contraceptives and bone fractures in women: evidence from observational studies (Cochrane Review, 2015).
  - Included 6 observational studies examining OCPs effect on risk of fracture in women.
  - Overall, no relationship between OCPs and risk of fracture.
  - One cohort study reported OC had increased risk for all fractures.
  - Another case-control study reported increased risk only for those who had 10 or more prescriptions
  - Two other studies found little evidence of association between OC use and fracture risk

Pharmacological Interventions

- Ackerman, K., “Oestrogen replacement improves bone mineral density in oligo-amenorrhoeic athletes: a randomised clinical trial” (2019)
  - 121 young oligo-amenorrhoeic female athletes.
  - Compared transdermal birth control vs. OCP vs. no intervention over 12 months.
  - Transdermal estradiol plus cyclic oral progesterone showed improvement in bone mineral density over the OCPs and arm with no intervention
  - IGF-1 and P1NP decreased during the study in OCP compared with transdermal arm.
  - Great adjunct in treatment

Pharmacological Interventions

- Fazeli, P., et. al., “Teriparatide Increases Bone Formation and Bone Mineral Density in Adult Women With Anorexia Nervosa” (2014).
  - 21 adult women with anorexia nervosa received PTH for 6 months
  - Spine bone mineral density increased significantly with PTH (6-10% increase)
  - No changes in BMD of the hip and femoral neck
  - Serum P1NP increased after 3 months of PTH and remained the same at 6 months
  - IGF-1 levels were unchanged
  - PTH is a great adjunct in treatment

Treatment Strategies

- Multidisciplinary team approach
  - Physicians
  - Athletic trainers
  - Coaches
  - Sports dieticians
  - Mental health support
- Inpatient treatment for patients with
  - Bradycardia
  - Hypotension
  - Orthostasis
  - Electrolyte imbalance

Treatment Strategies

- Resistance to treatment increases with severity of problem
- Patients see disorders as purposeful and necessary
- Use sport participation as leverage
- Concurrent depression, anxiety and substance abuse has to be addressed
- Athletes with severe eating disorders, participation in competition is not recommended

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