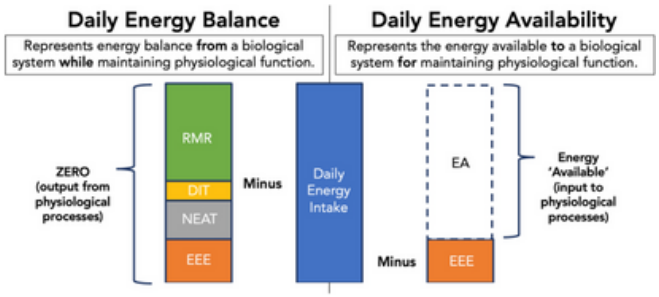
Physiology of Low Energy Availability (LEA)

For Health Care and Strength and Conditioning Professionals

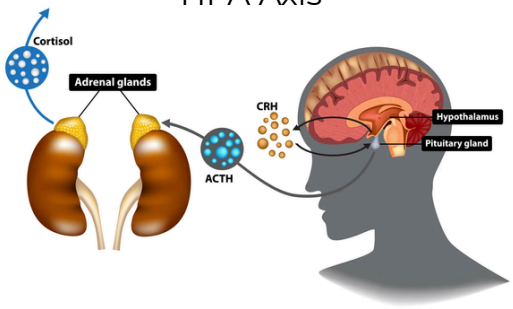
Dietary Intake and Energy Balance:
Energy mismatch puts body in survival mode, which causes the following changes In males and females. Metabolism is affected, with T3 and insulin lowered, with cortisol increased.



Hormonal Stress Response: interplay of nervous, endocrine, immune mechanisms

- Activation of Sympathetic + HPA and HPG axes
- Functions to prepare the body to handle stress
- Chronic stress/LEA → maladaptive response → depression, anxiety, cognitive impairment, CVD
- Stress and LEA can activate SNS and BOTH axes!

HPA Axis

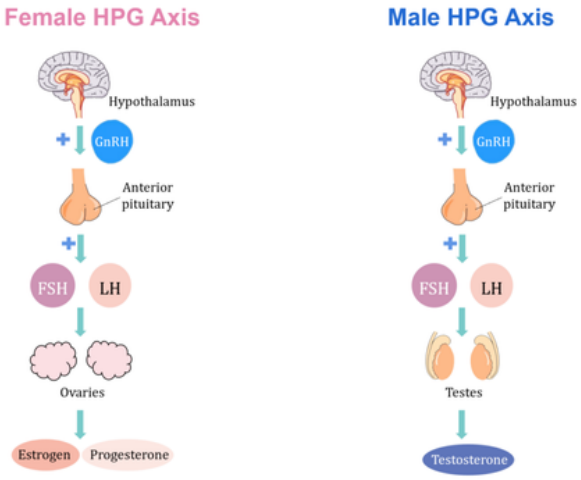


SYSTEMS AFFECTED:

Nervous and Endocrine Systems

- ***HPA Axis:*** neuroendocrine component of the stress response that mediates effects of stressors
  - Regulates metabolism, immune response, ANS
  - CRH → ACTH→ Cortisol
- ***HPG Axis:*** Governs reproduction
  - Disrupted energy availability reduces GnRH (hypothalamus)→ menstrual dysfunction
  - Degree to which the HPG axis is affected, directly dictates the severity of menstrual dysfunction

HPG Axis



Reproductive System: Decreased LH pulsatility in both

- Females:
  - ***Functional hypothalamic amenorrhea*** occurs from decreased energy availability and fat stores
  - Causes chronic anovulation and the absence of menstruation
- Males:
  - ***Exercise hypogonadal male condition*** mostly seen in endurance athletes, but can occur from LEA through diet or EEE. Seen in overtraining.
  - Low Testosterone, Normal LH, HPG Axis disruption

Skeletal System: Shift in body's priorities with LEA

- Reduced energy for bone health/function
- Reduced LH→ decreased Testosterone (males) and Estrogen (females), cruicial for bone growth/density
- Leptin, T3, IGF-1 reduced, suppressed bone formation

Abbreviations:
EEE: Exercise Energy Expenditure
NEAT: Non-Exercise Activity Thermogenesis
DIT: Diet-Induced Thermogenesis
RMR: Resting Metabolic Rate
HPA: Hypothalamic Pituitary Adrenal Axis
HPG: Hypothalamic Pituitary Gonadal Axis
LEA: Low Energy Availability
T3: Triiodothyronine
GnRH: Gonadotropin Releasing Hormone
LH: Lutenizing Hormone
IGF-1: Insulin-like Growth Factor 1

Takeaway for Clinicians and Strength Professionals:
Early recognition and intervention in LEA is critical as the systems above can be disrupted after only 4-5 days of LEA. Even small daily deficits can disrupt endocrine, reproductive, and skeletal systems, increasing both short- and long-term health risks.