

Supplementary data

Table S1: Medical history when assessing an athlete with DE ^{4 9 50 79 80}

General	<ul style="list-style-type: none"> ▪ Medical ▪ Surgical ▪ Musculoskeletal ▪ Family history (ED, osteoporosis (OP), menstrual) ▪ Medications and supplements ▪ Allergies
Bone health	<ul style="list-style-type: none"> ▪ Bone stress injury ▪ BMD ▪ Calcium intake ▪ Vitamin D (sunlight & dietary intake) ▪ Mechanical loading ▪ Family history OP
Female	<ul style="list-style-type: none"> ▪ Age of menarche ▪ Length and frequency of periods (number of cycles per year), regularity, last normal menstrual period, flow ▪ Amenorrhoea (frequency and duration) ▪ Oral contraceptive use
Male	<ul style="list-style-type: none"> ▪ Loss of morning erections ▪ Decreased libido.

Table S2: Examinations to perform when assessing athletes with DE. ^{7 9 10 49 80}

Basic observations	<ul style="list-style-type: none"> ▪ Heart rate (HR), blood pressure (BP), (including postural measures of HR and BP) temperature
Pre-participation system examination	<ul style="list-style-type: none"> ▪ Cardiorespiratory, abdominal, thyroid, ear/nose/throat, lymph nodes
Specific systems of concern	<ul style="list-style-type: none"> ▪ Bones stress injury examination
Advanced ED	<ul style="list-style-type: none"> ▪ Lanugo, particularly, sub-conjunctival haemorrhages, swelling of parotid glands, erosion of tooth enamel, bradycardia, s oedema
Primary amenorrhoea	<ul style="list-style-type: none"> ▪ Gynaecological examination recommended ⁸⁰
Adolescent	<ul style="list-style-type: none"> ▪ Stage of sexual maturation (Tanner) ⁸¹

Table S3: Investigations to perform on athletes with suspected DE. ^{7 9 10 13 20 26 34 80}

First line	Tests
General screen	FBC, EUC, LFT, CRP, iron studies Lipid screen (fasting): total cholesterol, LDL, HDL, TG Blood glucose CMP, 25-OH vitamin D, +/- PTH Beta-hcg*, urine analysis Electrocardiogram (ECG)** +/- DXA BMD***
Hormonal screen	
General endocrine	TSH, T3
Female menstrual dysfunction ^{7 9 50}	LH, FSH, oestradiol, 17-OH-progesterone (morning), prolactin, cortisol (morning), freeT4 If evidence of hyperandrogenism (hirsutism, acne, androgenic alopecia): testosterone (free & total), DHEA-S, androstenedione, SHBG +/- progesterone challenge test +/- Abdominal/pelvic USS
Male hormonal screen ^{34 80}	Testosterone (free & total) (morning), oestradiol, SHBG, prolactin Cortisol, DHEA-S, androstenedione
Second Line	
Biomarkers	
Appetite hormones ^{26 34}	Leptin, ghrelin (females)
Bone Formation ⁸¹	BS-ALKP, osteocalcin
Bone Resorption ⁸¹	N- and C-terminal telopeptides, deoxypyridinoline Urinary pyridinoline
Other ³⁴	IGF-1, PYY, insulin, adiponectin, oxytocin

Key/Notes:
*Beta-hcg urine or blood test as appropriate in female athletes
**Electro conductive disturbances from electrolyte abnormalities ⁸⁰
***DXA is the gold standard BMD measure ²⁶
Full Blood Count (FBC), Electrolytes Urea Creatinine (EUC), Liver Function Test (LFT), C-Reactive Protein (CRP), Calcium Magnesium Phosphate (CMP), Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL), Triglycerides (TG), Calcium Magnesium Phosphate (CMP), Parathyroid hormone (PTH), Beta-Human Chorionic Gonadotrophin (Beta-hcg) Dual Energy X-ray Absorptiometry (DXA), Bone Mineral Density (BMD), Thyroid Stimulating Hormone (TSH), Tri-iodothyronine (T3), Luteinising Hormone (LH), Follicular Stimulating Hormone (FSH), Dehydroepiandrosterone Sulphate (DHEAS), Sex Hormone Binding Globulin (SHBG), Ultrasound Scan (USS), Bone Specific Alkaline-Phosphatase (BS-ALKP) Insulin-like Growth Factor-1 (IGF-1).

Table S4: A summary of the potential hormonal and physiological changes in athletes with LEA synthesised from the articles; parallels with the female athlete triad in male athletes by Tenforde et al. (2016), low energy availability in athletes: a review of prevalence, dietary patterns, physiological health, and sports performance by Logue et al. (2017), endocrine effects of RED-S by Elliott-Sale et al. (2018.) ^{26 34 35}

Hormone/physiology component	Female	Male	Hormone/physiology component	Female	Male
Body Mass Index	↓	↓	Insulin	↓	↓
Fat mass	↓	↓	IGF-1	↓	↓
RMR	↓	↓	T3	↓	↓
BMD	↓	↓	Cortisol	↑	↑
Leptin	↓	↓	Oestradiol	↓	-
Adiponectin	↑	-	Progesterone	↓	-

Ghrelin	↑	↔	Testosterone	-	↓
Peptide YY (PYY) (fasting)	↑	↑	Sex Hormone Binding Globulin (SHBG)	-	↑
Oxytocin	↓	↓	LH	↓	
			FSH	↓	