Supplementary Materials

Table 1: An overview of studies focused on low EA and its manifestations in endurance-trained men

Source	Participants	Methodology	Findings	LEA
Høeg et al., 2022	Ultramarathon runners (n=83)	Questionnaires, DXA, vit.D, TST, Ferritin, Identification of risk factors of the “Males Athletic Triad”, explaining the link between sex hormones and bone density.	44.5% of men with ↑ ED risk, 30.1% of men with Z-score <-1.0. When assessing Triad Cumulative Risk Assessment Score 29.2% of men achieved a medium risk and 5.6% of men a high risk.	-
Lane et al., 2021	Endurance runners (n = 27), cyclists (n = 21), triathletes (n = 7) and others (n = 5)	Detection of EA, RMR, BC and BMD using DXA, hormonal markers from the blood, EEE using training diaries and EI through a 4-day food diary	Mean EA at 28.7 ± 13.4 kcal / kg / FFM / day. ↓ EA present in 62% of participants. Bone and hormone markers were normal despite LEA. RMR ratio OK.	62%
Matt et al., 2022	High school cross-country runners (n = 12)	EA and energy intake detection. Body composition using DXA.	The mean EA was 35.8 ± 14.4 kcal / kg / FFM / day with 30% of men with low EA. Daily energy intake (2614.2 ± 861.8 kcal / day) - below the recommended daily doses for "active boys" (> 3100 kcal / day)	30%
Jurov et al., 2021	Trained cyclists and triathletes (n = 12)	EI through dietary records and photo documentation, EEE using HR chest straps. Blood markers, RMR, BC psychological parameters via questionnaires.	Mean EA 29.5 kcal / kg / FFM / day with LEA in 67% of men. Without significant differences in performance, blood parameters between the group with LEA and normal EA.	67%
Jesus et al., 2021	Elite cross-country runners (n = 124)	Estimated prevalence of LEA using LEAF-Q questionnaires adapted to the male sex (LEAM-Q not available at that time)	High prevalence of athletes at risk of LEA - 54%. No connection between the risk of LEA and weight or BMI of athletes	54%
Langan-Evans et al., 2021	International taekwondo fighter (n=1)	Case study with 3 stages: 1) EA 20 kcal / kg / FFM / day) 2) EA 10 kcal / kg / FFM / day) 3) Ad Libitum. Monitoring EEE, DXA, RMR, hormonal panel .	BMD reduced in 8 weeks by 13.5%, TST reduced to 4 nmol / L, RMR ratio drops to 0.87, values took back to normal during stage 3.	-

Taguchi et al., 2020	University long distance runners (n = 6)	To establish a link between energy deficit, bone health and metabolism. EI: 3 day dietary record, EEE: HR monitoring and VO2max, DXA, RMR, Blood samples	Mean EA 18.9 ± 6.8 kcal / kg / FFM / day. 5 runners with LEA, at the same time reduced RMR + reduced BMD.	83%
Stratton et al., 2020	Recreationally trained men (n=26)	Comparing BC (DXA), TST, RMR while 25% caloric deficit in Time-restricted feeding (TRF) group and normal diet group (ND).	Significant decrease in body mass, fat mass, testosterone and RMR in both groups.	-
Lee et al., 2020	University soccer players (n = 12)	EA using food records and photo documentation, EEE using HR monitoring and BC using DXA. Blood hormone panel, RMR screening	Mean EA 31.9 ± 9.8 kcal / kg / FFM / day. 5 players with LEA, at the same time reduced RMR.	42%
Ishibashi et al., 2020	Long distance runners (n=6)	LEA state for 3 days - impact on muscle glycogen and iron metabolism.	20 kcal / kg / FFM means reduction of glycogen stores and increasing of blood hepcidin levels.	-
Torstveit et al., 2019	Endurance trained men (n = 53)	Questionnaires for EDS, EDE-Q, DXA, RMR, EI (food diaries 3-4 days), EEE - training diary and HR monitoring, glucose and blood hormones	↑ ED score correlates positivelly with ED manifestations, ↑ negative EB and ↑ cortisol. ↑ ED score associated with ↓ glucose, cortisol: TST ratio and ↑ cortisol: insulin ratio	-
Narla et al., 2019	Juniors Swimmer (n=1)	Case study examining low levels of TST (30ng / dL), intentional weight reduction from 91 to 86 kg - given by coaches and sports doctors.	Starts with negative EA = -1.3 kcal / kg / FFM. Contract for "no training" for 1 month. After 13 days ↑ weight of 3.3 kg and 42 kcal / kg / FFM / day. Also TST increased to 136 ng / dL. After 3 months with TST at 269, 302, 244 ng / dL)	100%

McCormack et al., 2019	Cross-country male runners (n=27)	BMD and BC (DXA), EA (FFQ and EDE-Q)	Runners showed greater BMD than controls. Runners scored higher in dietary restraint of eating behaviors	42%
Heikura et al., 2019	UCI World Tour Professional Cyclists (n = 6)	Blood hormones, 24h food diaries, EEE via HR monitor and wattmeter, EA, BC with caliper. 9 days of duration.	Mean EA during race day vs. day off = 14 vs. 57 kcal / kg / FFM. ↓ TST and IGF-1 at LEA (10 kcal / kg / day) on race days.	50%
Lane et al., 2019	Endurance trained athletes from cycling / running / triathlon (n = 108)	Monitoring of LEA prevalence, EA using online food and training diaries.	47% of athletes with LEA. The lowest values were recorded by cyclists.	47%
Keay et al., 2018	Road cyclists (n = 50)	Sport-Specific-Questionnaire and Clinical Interview). BC and BMD using DXA. Hormonal markers from the blood.	LEA in 28% of cyclists. Decreased BMD in 44% of cyclists. LEA correlates positively with amount of subcutaneous fat. 10 cyclists with LEA also with ↓ TST compared to normal EA.	28%
Hackney et al., 2018	Habitual competive runners (n=196)	Runners (>80km / week or >7h / week) vs. controls. Measuring total TST, with cutpoint of 300 ng/dl for androgen deficiency (AD)	Prevalence of AD 15.3% in runners and 5.6% in controls.	
Heikura et al., 2018	Medium and long distance walkers and runners (n = 24)	Monitoring prevalence of EA using food and training diaries. BC using DXA, blood for metabolic and hormonal markers, injury questionnaires.	25% of athletes with LEA, 42% overall with ↓ TST levels. T3 values significantly lower in the group with ↓ TST compared to the norm. Fractures occurred 4.5 times more often in these athletes.	25%
Geesmann et al., 2017	Well-trained male cyclists (n=14)	Total TST and IGF-1 before and after 1230 km ultra endurance cycling event	Total TST decreased (-67%), IGF-1 decreased (-45%) and also positively correlated with energy deficit	-
Torstveit et al., 2018	Endurance trained men (n=31)	Comparing within day energy balance (WDEB) in males with suppressesed and normal RMR. Measuring BC (DXA) and cortisol, testosterone, glucose	No difference in 24 hour energy balance or energy availability between groups but larger single hour energy deficit with suppressed RMR	-

Cangemi et al., 2010	Men (n=72)	Comparing BC, TST, SHBG between “Caloric restricted” group (CR), endurance runners (EX) and sedentary controls with “Western diet” (WD)	Lower body fat in both CR and EX (8.7 vs. 10.5 vs. 23.2%). Total TST lower and SHBG higher in CR than in the EX and WD independently of adiposity	-

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