Er relativ energimangel innen idrett (RED-S) bare et jenteproblem? Hva med gutta?

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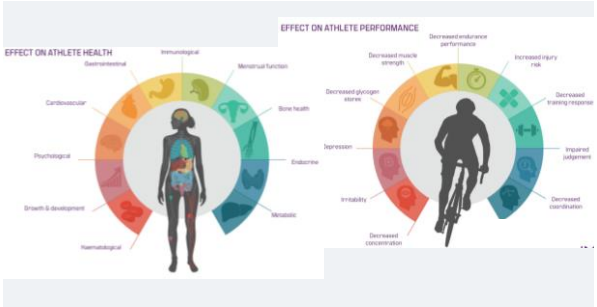
Konsulent
Test og laboratorietesting
Olympiatoppen Sør

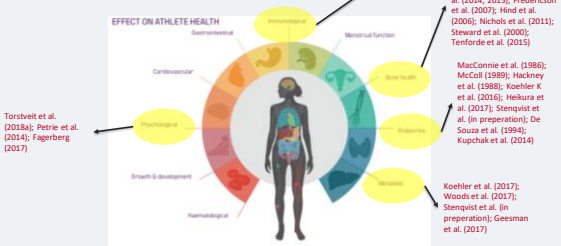
1



Keay & Rankin (2018)

2

RED-S overblikk blant menn



Hanstock et al. (2019)

Barrack et al. (2017); Papageorgiou et al. (2018); Viner et al. (2015); Wilson et al. (2014; 2015); Fredericson et al. (2007); Hind et al. (2006); Nichols et al. (2011); Steward et al. (2000); Tenforde et al. (2015)

MacConnie et al. (1986); McColl (1989); Hackney et al. (1988); Koehler K et al. (2016); Heikura et al. (2017); Stenqvist et al. (in preperation); De Souza et al. (1994); Kupchak et al. (2014)

Torstveit et al. (2018a); Petrie et al. (2014); Fagerberg (2017)

Koehler et al. (2017); Woods et al. (2017); Stenqvist et al. (in preperation); Geesman et al. (2017)

Keay & Rankin (2018)

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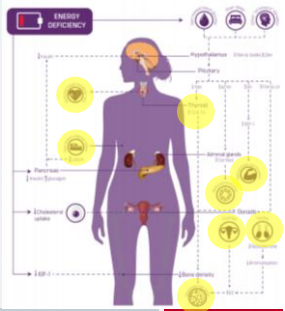
LEA assosiasjoner

- Reduksjon i hvilemetabolismen
- Reduksjon i kjønnshormoner
- Endring i kroppssammensetning
- Redusert immunforsvar
- Redusert skjelettstyrke

- Spesifikke endringer er ennå ikke forstått fullstendig blant mannlige utøvere



Keay & Rankin (2018); Mountjoy et al., (2014); Tenforde et al., (2016)

4

Hva vet vi om LEA blant mannlige utøvere

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LEA blant mannlige utøvere?

- Høyere forekomst blant kvinner
- Usikre estimater!
- Menn er utsatt
- Ulike idretter
- Understudert

Elliott-Sale et al., (2018); Tenforde et al., (2016)

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Indikasjoner på LEA blant mannlige utøvere

- Unge syklister og løpere (Barrack et al., 2012; Julian-Almarcegui et al., 2013)
- Profesjonelle skihoppere (Muller et al., 2006)
- Profesjonelle jockeys (Dolan et al., 2012)
- Profesjonelle roere (Woods et al., 2017)
- Wrestling og judo (Fogelholm et al., 1993; Horswill et al., 1990)
- Konkurranseaktive syklister (Riebl et al., 2007; Stenqvist et al., in preperasion)

Barrack et al., 2012; Dolan et al., 2011; Fogelholm et al., 1993; Horswill et al., 1990; Julian-Almarcegui et al., 2013; Muller et al., 2006; Riebl et al., 2007

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LEA målt blant mannlige utøvere

- Profesjonelle syklister; svært lav energitilgjengelighet på 8 kcal/kg/FFM/dag (Vogt et al. 2005)
- Konkurranseaktive syklister; 70% hadde lav energitilgjengelighet gjennom sesongen (Viner et al., 2015)
- Godt trente syklister og løpere; 65% hadde redusert energitilgjengelighet (Torstveit et al., 2018b)

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Faktorer som bidrar til LEA

- Høyt energiforbruk
- Lavt energiinntak

Table 2 Daily and average training distances, energy expenditure during training, and total energy intake (in MJ). Difference between total energy intake and expenditure (MJ) in a 6-day training camp of professional cyclists (n = 11)

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Average
Type of training	150 km, flat	150 km, 3 climbs	180 km, hilly	33 km, flat	140 km, hilly	180 km, 3 climbs	160 km
Energy expenditure during training	13.3 ± 0.6	13.5 ± 0.6	14.0 ± 0.6	2.1 ± 0.3	11.3 ± 0.4	14.9 ± 0.7	11.5 ± 4.4
Total energy expenditure	20.8 ± 0.4	21.4 ± 0.5	21.2 ± 0.5	11.3 ± 0.3	18.8 ± 0.7	22.0 ± 1.0	19.1 ± 4.1
Total energy intake	12.9 ± 1.9	13.3 ± 2.2	13.6 ± 2.6	13.2 ± 2.5	12.6 ± 1.6	15.6 ± 2.2	13.5 ± 1.5
Difference	−7.9 ± 1.1	−7.8 ± 0.8	−7.8 ± 1.3	1.9 ± 0.5	−6.2 ± 1.2	−6.4 ± 1.3	−5.6 ± 2.8

Mean values ± SD

Vogt et al., (2005)

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Forstyrret spiseadferd og spiseforstyrrelser som årsak til LEA

- Australske mannlige elite utøvere; (Byrne & McLean, 2002)
  4% (versus 0% blant mannlige kontroller)
- Franske mannlige elite utøvere; (Schaal et al., 2011)
  4%
- Norske mannlige elite utøvere; (Sundgot-Borgen & Torstveit, 2004)
  8% (versus 0.5 % blant mannlige kontroller)

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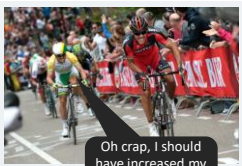
Faktorer som bidrar til LEA

- Power to weight ratio
- Lav beinmineraltetthet



Oh crap, I should have increased my power to weight ratio!!!!!

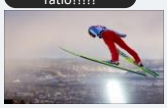


Table 3 Dual-energy X-ray absorptiometry measurements expressed as bone mineral density (g/cm²) for runners and cyclists. Values are presented as means and SD (n=40)

Measure	Runners (n=21)	Cyclists (n=19)
L-spine L2–L4 (g/cm²)	1.287 (0.094)*†	1.166 (0.144)*†
Femoral neck (g/cm²)	1.157 (0.124)*†	1.052 (0.123)*†
Total BMD (g/cm²)	1.263 (0.090)**	1.195 (0.102)**
Number of athletes with Z-score ≤−1	0	10
Number of athletes with Z-score ≤−2	0	1

*P≤0.05; P≤0.01.
†Missing data form one subject.
BMD, bone mineral density; L-spine, lumbar spine.

Andersen et al., (2018)

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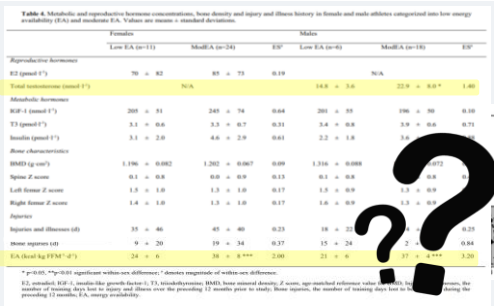

Table 4. Metabolic and reproductive hormone concentrations, bone density and injury and illness history in female and male athletes categorized into low energy availability (EA) and moderate EA. Values are means ± standard deviations.

	Females			Males		
	Low EA (n=11)	ModEA (n=24)	ES'	Low EA (n=6)	ModEA (n=18)	ES'
Reproductive hormones						
E2 (pmol·l⁻¹)	70 ± 82	85 ± 73	0.19		N/A	
Total testosterone (nmol·l⁻¹)	N/A			14.8 ± 3.6	22.9 ± 8.0 *	1.40
Metabolic hormones						
IGF-1 (nmol·l⁻¹)	205 ± 51	245 ± 74	0.64	201 ± 55	196 ± 50	0.10
T3 (pmol·l⁻¹)	3.1 ± 0.6	3.3 ± 0.7	0.31	3.4 ± 0.8	3.9 ± 0.6	0.71
Insulin (pmol·l⁻¹)	3.1 ± 2.0	4.6 ± 2.9	0.61	2.2 ± 1.8	3.6	
Bone characteristics						
BMD (g·cm²)	1.196 ± 0.082	1.202 ± 0.067	0.09	1.316 ± 0.088		0.72
Spine Z score	0.1 ± 0.8	0.0 ± 0.9	0.13	0.1 ± 0.8	0.8	
Left femur Z score	1.5 ± 1.0	1.3 ± 1.0	0.17	1.5 ± 0.9	0.9	
Right femur Z score	1.4 ± 1.0	1.3 ± 1.0	0.17	1.6 ± 0.9	1.3 ± 0.9	
Injuries						
Injuries and illnesses (d)	35 ± 46	45 ± 40	0.23	18 ± 22		0.25
Bone injuries (d)	9 ± 20	19 ± 34	0.37	15 ± 24		0.84
EA (kcal·kg FFM⁻¹·d⁻¹)	24 ± 6	38 ± 8***	2.00	21 ± 6	37 ± 8***	3.20

* p<0.05, **p<0.01 significant within-sex difference; ' denotes magnitude of within-sex difference.

E2, estradiol; IGF-1, insulin-like growth factor-1; T3, triiodothyronine; BMD, bone mineral density; Z score, age-matched reference value for BMD; Injuries, the number of training days lost to injury and illness over the preceding 12 months prior to study; Bone injuries, the number of training days lost to bone injury during the preceding 12 months; EA, energy availability.

Friedl et al., (2000); Hackney et al., (2005); Heikura et al., (2017); Hooper et al., (2017); Loucks (2007); Tenforde et al., (2016)

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LEA terskelverdier og varighet

- Terskelverdien for- og varigheten er ukjent
- Studie av høy kvalitet (randomisert kontrollert studie)
- Hvor lave verdier?
- Ikke konsise funn blant ulike parametere

Conclusion

In exercising men, a short-term reduction of energy availability to 15 kcal · kg^{-1} FFM · day^{-1} is associated with a suppression of leptin and insulin. However, low energy availability did not impact other metabolic hormones, such as IGF-1, free T3 and testosterone, which is contrary to previous controlled experiments in sedentary women. Consequently, exercising men appear to be metabolically more robust against short-term reductions in energy availability when compared to sedentary women. Because these metabolic alterations are linked to long-term health consequences, further research is needed to explore the underlying mechanisms that modulate the differential endocrine and metabolic response to energy deficiency.

Table 1. Energy intake, exercise expenditure, energy availability and nutrient intake in exercising men ($n = 6$) during each of the four study conditions.

Condition	Actual Energy Intake (kcal · kg^{-1} FFM · day^{-1})	Prescribed Energy Intake (kcal · kg^{-1} FFM · day^{-1})	Actual to Prescribed Energy Intake (%)	Exercise Energy Expenditure (kcal · kg^{-1} FFM · day^{-1})	Energy Availability (kcal · kg^{-1} FFM · day^{-1})	Carbohydrate Intake (g · kg^{-1} · day^{-1})	Protein Intake (g/kg/day)	Fat Intake (g/kg/day)
LEA	15.9 ± 0.2	15.0 ± 0	106 ± 1	0	15.9 ± 0.2	1.6 ± 0.2	0.8 ± 0.1	0.5 ± 0.1
LEA + EX	30.0 ± 0.8	29.0 ± 0.9	104 ± 2	15	16.0 ± 0.5	3.1 ± 0.3	1.4 ± 0.2	0.9 ± 0.1
C	40.2 ± 0.4	40.0 ± 0	101 ± 1	0	40.2 ± 0.4	4.0 ± 0.2	1.5 ± 0.1	1.4 ± 0.1
C + EX	52.2 ± 2.3	53.9 ± 0.7	97 ± 4	15	38.3 ± 2.0	5.6 ± 0.5	1.8 ± 0.1	1.7 ± 0.1

LEA: low energy availability without exercise, LEA + EX: low energy availability with exercise, C: control without exercise, C + EX: control with exercise.

Koehler et al., (2016)

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Robuste menn?

- Er menn mer robuste sammenlignet med kvinner?
- Noe forskning peker i den retning
- For tidlig å konkludere med sikkerhet

Conclusion

In exercising men, a short-term reduction of energy availability to 15 kcal · kg^{-1} FFM · day^{-1} is associated with a suppression of leptin and insulin. However, low energy availability did not impact other metabolic hormones, such as IGF-1, free T3 and testosterone, which is contrary to previous controlled experiments in sedentary women. Consequently, exercising men appear to be metabolically more robust against short-term reductions in energy availability when compared to sedentary women. Because these metabolic alterations are linked to long-term health consequences, further research is needed to explore the underlying mechanisms that modulate the differential endocrine and metabolic response to energy deficiency.

Koehler et al., (2016); De Souza et al., (2019)

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En oppsummering om LEA og RED-S

- Ulikt fra idrett til idrett
- Endring i kroppsmasse og sammensetning
- Utilstrekkelig energiinntak over tid
  - Høyt energiforbruk i trening eller konkurranse
- Utilstrekkelig tilgang til mat, usikkerhet, uvitenhet eller økonomisk ustabilitet
- Forstyrret spiseadferd og spiseforstyrrelser
- Faktorer eksisterer også blant eliteutøvere

Burke et al., (2018)

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RED-S forskning i Norge

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Forskning på UIA

- RED-S blant unge utøvere, et longitudinelt design
- RED-S risiko blant eliteutøvere i Norge?
  - Over 100 utøvere
  - Samarbeide med Ina Garthe, Gøran Paulsen, Gary Slater med mer

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Forskning på UIA

- Validering av LEAM-Q for enklere screening av mannlige utøvere
  - Samarbeide med AUS, IRE, SE og NO
- Hjelpeverktøy

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If you are a male athlete, or work with male athletes, and think that Relative Energy Deficiency in sport (RED-S) is just a problem for females, think again.

Sitat; Dr. N. Keay