ENERGY AVAILABILITY, BODY COMPOSITION, AND NEUROMUSCULAR FUNCTION IN FEMALE DISTANCE RUNNERS

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BACKGROUND

- Distance running is characterized by high energy demands and an emphasis on maintaining a lean physique, subjecting athletes to risks stemming from exposure to low energy availability (LEA).

PURPOSE

- Determine energy availability (EA) status.
- Compare body composition, macronutrient intake, and bone mineral density (BMD) between groups.
- Explore associations between body composition and neuromuscular function.

METHODS

- 22 female distance runners (age: 23.2 ± 4.2 y)
- ≥ 35 miles/week

Day 1

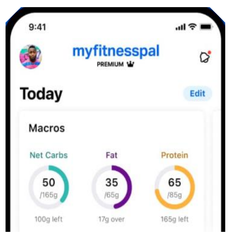
- Dual energy x-ray absorptiometry (DXA)
- Isometric mid-thigh pull (IMTP) test
- Countermovement jump (CMJ) test

Day 2

- Energy intake (EI) tracking
- Exercise energy expenditure (EEE) tracking

Day 6

Status	Kcal/kg FFM/day
LEA	< 30
Subclinical LEA	30-45
Optimal EA	> 45



RESULTS

Table 1. Body composition and BMD by group (mean ± SD; $p < 0.05$). Body mass and FFM were greater in LEA group compared to Non-LEA (NLEA)

	LEA (n=9)	NLEA (n=13)	p, Hedges' g [95% CI]
Body mass (kg)	66.9 ± 7.6	59.4 ± 3.6	**0.02, 1.3 [0.4, 2.2]**
Fat-free mass (FFM; kg)	48.7 ± 5.4	44.1 ± 3.8	**0.04, 0.9 [0.1, 1.9]**
Body fat (%)	27.9 ± 4.3	26.5 ± 4.9	0.46, 0.30 [-0.6, 1.2]
Whole body BMD (z)	0.97 ± 0.9	0.78 ± 0.9	0.64, 0.19 [-0.7, 1.1]
Hip BMD (z)	0.89 ± 1.2	0.67 ± 0.6	0.62, 0.24 [-0.6, 1.1]
Femoral neck BMD (z)	0.63 ± 1.1	0.45 ± 0.9	0.67, 0.19 [-0.7, 1.1]
Spine BMD (z)	0.2 ± 0.9	-0.5 ± 0.9	0.11, 0.73 [-0.2, 1.6]

Table 2. EEE, EA status, and EI by group (mean ± SD; $p < 0.05$). EA was lower in LEA compared to NLEA.

	LEA (n=9)	NLEA (n=13)	p, Hedges' g [95% CI]
EEE (kcal)	735 ± 326	481 ± 143	0.05, 1.0 [0.12, 1.9]
EA (kcal/kg FFM/day)	**23.7 ± 4.7**	**40.8 ± 7.9**	**< 0.001, 2.4 [1.3, 3.5]**
CHO intake (g/day)	224 ± 54	270 ± 75	0.11, 0.6 [-0.2, 1.5]
PRO intake (g/day)	85 ± 43	112 ± 39	0.15, 0.7 [-0.2, 1.5]
FAT intake (g/day)	73 ± 22	89 ± 34	0.21, 0.5 [-0.4, 1.4]

Figure 1. Relative energy (Kcal), carbohydrate (CHO), protein (PRO), and fat intake between groups. Green shaded regions represent recommended ranges for endurance athletes; * $p < 0.05$.

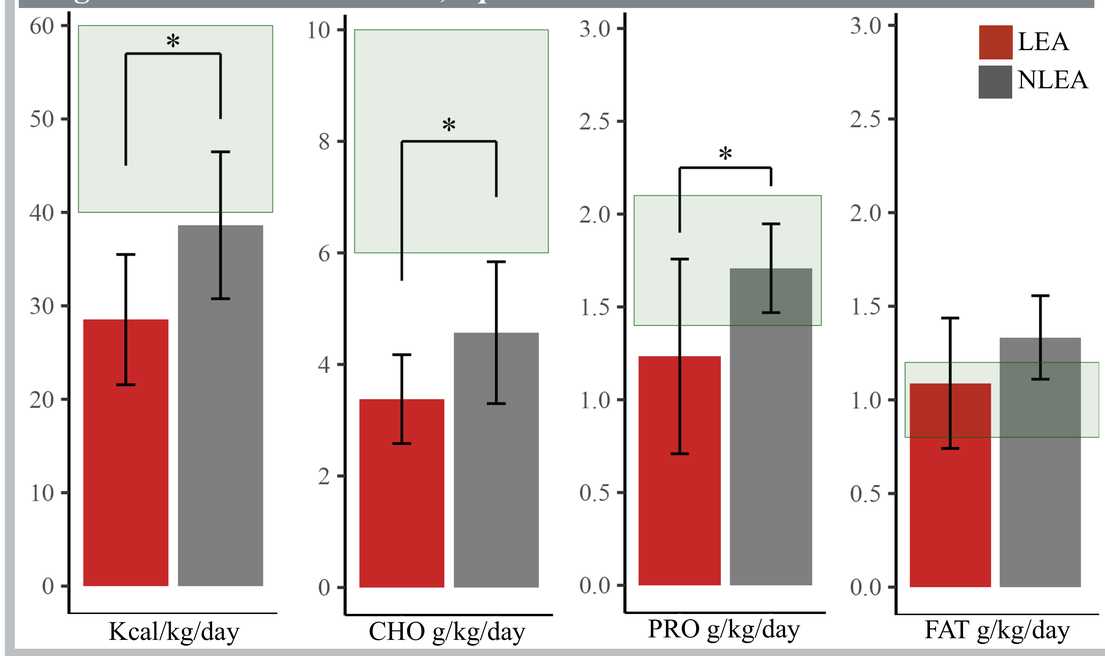
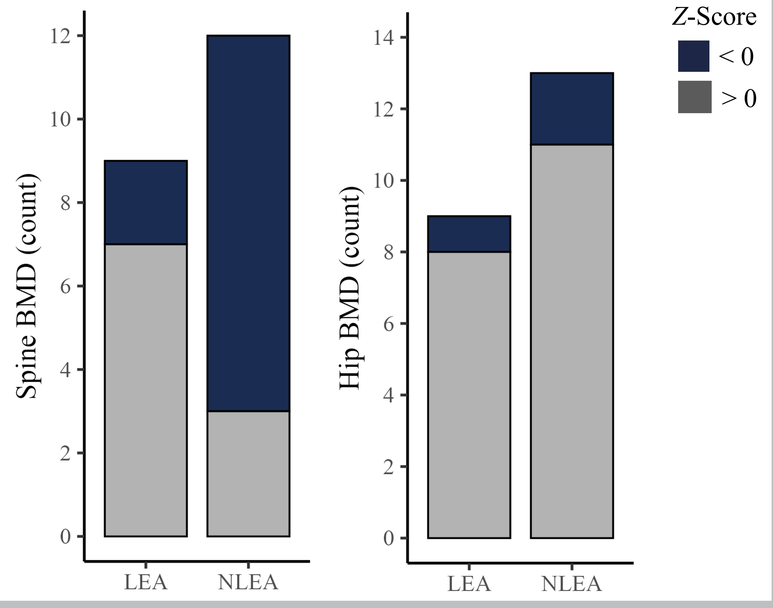


Figure 2. Spine and hip BMD z-score classification by group. Based on descriptive counts, a greater proportion of NLEA athletes had z-scores <0, though interpretation should be cautious due to the small sample size.



CONCLUSIONS & PRACTICAL APPLICATION

- Results indicate a high prevalence of LEA (41%); however, classification should be interpreted cautiously given unexpected BMD z-score patterns.
- Athletes consumed insufficient energy and carbohydrates relative to recommendations.
- Strong positive relationships were observed between body composition (FFM) and neuromuscular performance (IMTP, CMJ) metrics.