RELATIONSHIP BETWEEN DIETARY INTAKE, ENERGETIC STATUS, AND WHOLE-BODY BIOELECTRICAL IMPEDANCE VALUES

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BACKGROUND

- Raw bioimpedance analysis (BIA) reflects cellular health and body composition
  - Resistance (R), Reactance (Xc), Phase Angle (PhA)
- Currently used to help assess nutritional status in clinical populations at risk for malnutrition
  - May also help identify low energy availability or inadequate energy status (ES) in active individuals at risk for health and performance consequences
- Research on the application of raw bioimpedance to assess nutrition and ES in active individuals, and especially in women, is limited.

PURPOSE

To explore relationships between dietary intake (calories [CAL], protein [PRO], carbohydrates [CHO], fats [FAT]), energetic status (daily energy need to caloric intake), and whole-body BIA (R, Xc, PhA) in recreationally active women.

METHODS

Participants: Healthy, recreationally active women (EUM: n=10; IUD: n=6; OC: n=8) (Table 1).

Day-of visit estrogen level (E; ng/mL) via urinary hormone analysis

Prior-day food log analyzed for dietary intake (CAL [kcal], CHO [g], FAT [g], and PRO [g]).

Resting Metabolic Rate (RMR) via indirect calorimetry

BIA measured whole-body R, Xc, and PhA at 50 kHz

$$\text{Energetic Status (ES)} = \frac{\text{Daily Energy Need (RMR * 1.55)}}{\text{Dietary Intake (kcal)}}$$

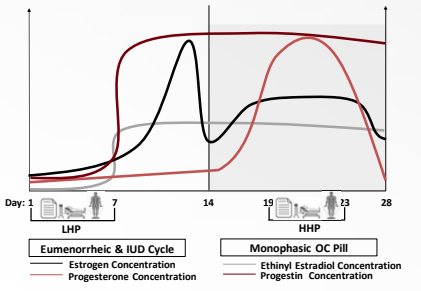

Figure 1. Participants completed a 24-hour food log, RMR test and BIA, randomized into LHP or HHP for their first visit.

STATISTICAL ANALYSES:

- Paired t-tests compared variables between the low (LHP) and high hormone phase (HHP)
- Pearson's correlations assessed relationships among dietary intake, ES, and BIA values
- Regression analyses evaluated phase-specific associations, adjusting for E levels.

RESULTS

Table 1: Participant Demographics and Outcomes (n=37).

Age (years)	22.9 ± 4.0	
Height (cm)	164.6 ± 6.9	
Weight (kg)	62.2 ± 8.1	
%BF (%)	25.8 ± 5.7	
	LHP	**HHP**
Day-of-Testing Estrogen	78.4 ± 60.1	160.7 ± 117.5 *
Bioimpedance Analysis		
Phase Angle (PhA)	6.0 ± 0.6	6.0 ± 0.6
Resistance (R)	670.6 ± 58.7	664.0 ± 56.6
Reactance (Xc)	69.3 ± 7.9	68.7 ± 7.5
Dietary Intake		
Total Calories (kcal)	1743.6 ± 651.8	1807.5 ± 643.8
Carbohydrates (g)	185.8 ± 73.2	197.7 ± 90.4
Fats (g)	68.7 ± 28.5	75.1 ± 32.4
Protein (g)	89.1 ± 48.8	90.7 ± 41.8
Resting Metabolic Rate (RMR)		
Measured RMR	2121.0 ± 231.7	2168.2 ± 237.6
Projected RMR	1743.6 ± 651.8	1807.5 ± 643.8
Energetic Status	1.5 ± 0.9	1.4 ± 0.7

Values presented as Mean ± SD

* Indicates significance (p<0.05) between low (LHP) and high hormone phase (HHP)

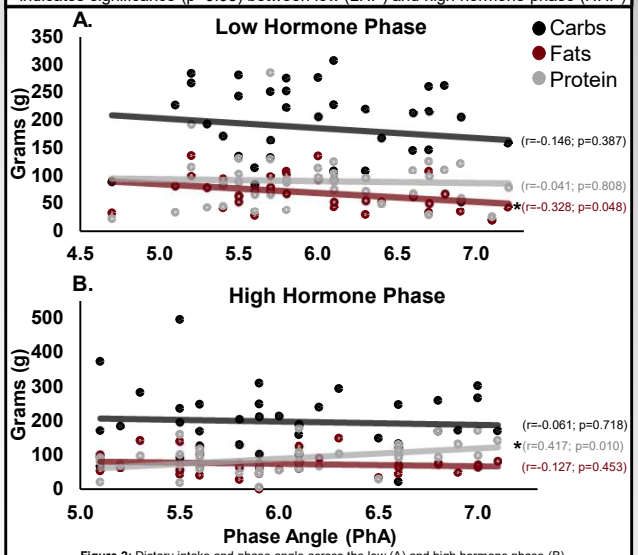

Figure 2: Dietary intake and phase angle across the low (A) and high hormone phase (B).

Paired sample t-tests:

- Estrogen was significantly higher in the HHP (p>0.001)

Pearson's correlations:

- PhA was negatively correlated with FAT in the LHP (r=-0.328, p=0.048)
- PhA was positively correlated with PRO in the HHP (r=0.417, p=0.010)

Linear regression:

- Controlling for E indicated that PRO in HHP significantly predicted PhA (β=0.005, p=0.033, R^2=0.240)

CONCLUSION

- Macronutrient intake did not differ between phases
- PhA relationships with FAT and PRO seem to be phase-dependent
  - May reflect hormonal effects on substrate metabolism and cellular function
  - Higher FAT intake in LHP may be associated with lower overall cellular health
  - Higher PRO intake in HHP may support overall cellular health when hormone levels are elevated
- While exploratory, findings suggest that the relationship between macronutrients and PhA may vary by hormonal phase

PRACTICAL APPLICATION

Raw BIA, especially PhA, may serve as a **non-invasive tool to monitor cellular health** in active women.

Phase-specific tracking of PhA could help guide dietary strategies—reducing FAT intake in LHP and emphasizing PRO in HHP—to support performance, recovery, and well-being.