

MUSCLE OS

P 1



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The first chapter of the first domain — Energy Balance & Energy Availability, including TDEE components, energy availability zones, and metabolic adaptation.

Domain 1: Nutritional Foundations

1. Energy Balance & Energy Availability

1.1 The First Law Applied to Body Composition

Energy balance is the application of the first law of thermodynamics to living systems: changes in body energy stores equal energy intake minus energy expenditure. This forms the non-negotiable foundation of any body composition intervention. No nutritional strategy can bypass this fundamental equation; it merely shifts the composition of what is gained or lost.

Key Distinction

Energy balance determines weight changes. The P-Ratio determines that weight change is made of (fat vs. lean mass). Both must be managed simultaneously.

1.2 Total Daily Energy Expenditure

TDEE is the sum of four components:

Table 1.1 Components of Total Daily Energy Expenditure

COMPONENT	DESCRIPTION	TYPICAL % OF TDEE
Basal Metabolic Rate (BMR)	Energy required for basic physiological functions at rest	60-75%
Thermic Effect of Food (TEF)	Energy cost of digestion, absorption, and nutrient storage	8-12%
Non-Exercise Activity Thermogenesis (NEAT)	Energy from all non-exercise movement (fidgeting, walking, posture)	15-30%
Exercise Activity Thermogenesis (EAT)	Energy from deliberate exercise	5-15%

1.3 Energy Availability vs. Energy Balance

Energy availability (EA) separates physiological health from thermodynamics. EA is defined as dietary energy remaining for physiological functions after subtracting the energy cost of

exercise:

$$EA = (\text{Energy Intake} - \text{Exercise Energy Expenditure}) / \text{kg Fat-Free Mass}$$

Table 1.2 Energy Availability Zones

ZONE	VALUE (KCAL/KG FFM/DAY)	PHYSIOLOGICAL IMPACT
Optimal	>45	Full physiological function, optimal hormonal health
Reduced	30–45	Possible menstrual disruption, metabolic adaptation begins
Low	<30	Physiological suppression, hormonal dysfunction, LEA syndrome

1.4 Metabolic Adaptation

Prolonged caloric restriction triggers metabolic compensation: reduced NEAT, reduced TEF, reduced activity in the sympathetic nervous system, and hormonal downregulation (leptin, T3, testosterone). This is not metabolic damage—it is adaptive thermogenesis. Expect a 10–15% reduction in TDEE beyond what is predicted by weight loss alone. Reversal requires a structured reverse-dieting approach (typically 50–100 kcal increases per week over 4–12 weeks).

CHAPTER SUMMARY

Energy balance determines whether weight changes; the P-Ratio determines what that change is made of. A coach must understand the four TDEE components (BMR, TEF, NEAT, EAT) and distinguish energy balance from energy availability. Metabolic adaptation is a compensatory response, not damage — expect a 10–15% TDEE reduction beyond weight-loss predictions. Before adjusting calories, audit tracking accuracy and confirm the deficit is truly being followed.

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