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Beyond Body Weight: Phase Angle and Metabolic Heterogeneity in Adults with Overweight and Obesity

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Introduction:

Clinical assessment of obesity commonly relies on body mass index and body fat measures. However, individuals with similar levels of adiposity often differ substantially in metabolic and functional health. Identifying markers that better reflect muscle quality and cellular status may improve obesity risk stratification. Whole-body phase angle (PhA), derived from bioelectrical impedance analysis, reflects cellular integrity and body fluid balance. This study examined the relationship between PhA and obesity-related body composition indices in adults participating in a workplace lifestyle programme.

Methods:

This cross-sectional analysis used baseline data from adults enrolled in *Commit 2 Fit: 12 Months to a Healthier, Happier You* at the Faculty of Medicine, Universiti Malaya. After removal of duplicate and incomplete records, 99 adult participants, predominantly classified as overweight or obese, were included. Body composition was assessed using multi-frequency bioelectrical impedance analysis (InBody 970). Variables analysed included whole-body PhA (50 kHz), skeletal muscle index (SMI), body cell mass (BCM), visceral fat area (VFA), and extracellular water to total body water ratio (ECW/TBW). Pearson correlation analyses were performed.

Results:

Whole-body PhA showed wide inter-individual variability and was not consistently aligned with body weight or body fat percentage. PhA was positively correlated with SMI ($r = 0.49, p < 0.001$) and BCM ($r = 0.51, p < 0.001$), and inversely correlated with VFA ($r = -0.22, p = 0.032$) and ECW/TBW ($r = -0.83, p < 0.001$). Notably, approximately 38% of participants classified as overweight or obese fell within the upper tertile of PhA, indicating preserved muscle and cellular health despite elevated adiposity.

Conclusions:

Whole-body PhA highlights clinically meaningful heterogeneity within obesity that is not captured by weight-based measures alone. Incorporating PhA into obesity assessment may support more personalised, risk-informed lifestyle and exercise interventions.