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Diet, Sex, and PA: An Evolutionary Perspective on Adipose Tissue Distribution

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Propose: A healthy lifestyle is essential for optimal body composition in non-adults. Physical activity (PA) and nutrition are two fundamental pillars of this lifestyle. However, certain dietary patterns may either mimic or counteract the benefits of PA, regardless of its intensity. This study aimed to determine whether adipose tissue accumulation is solely influenced by diet in physically active children/adolescents following a Westernised diet.

Methods: Thirty-three participants (boys/girls; 8–17-year-old) from Virginia (US) were assessed anthropometrically and evaluated for PA levels. Regional fat mass (LEGFM%, ARMFM%, and TRUNKFM%) was measured using Dual-Energy X-ray Absorptiometry. PA was recorded over 7-days with a triaxial accelerometer (*ActiGraph*), measuring moderate-to-vigorous PA (MVPA min/day), considering only ≥4 valid days (≥10 hours/day). Dietary intake was monitored for three days (2 weekdays, 1 weekend day) within the seven days. Protein (PRO% and PROg), fat (FAT% and FATg), carbohydrates (CHO% and CHOg), and total energy intake (EI; kcal/day) were calculated using NDSR software. Resting metabolic rate was measured, and total energy expenditure (TEE; kcal/day) was estimated by adding activity energy expenditure from ActiGraph. Energy balance (EB) was calculated by subtracting EI from TEE.

Stepwise multiple regression analyses were performed to assess the influence of age, body mass (BM), height (H), sex, and MVPA on each fat mass distribution, and the residuals from each analysis were correlated with PRO%, PROg, FAT%, FATg, CHO%, CHOg, EI, and EB.

Results: Our sample exhibited high PA levels (145 MVPA min/day). Macronutrient intake averaged 36.18 FAT%, 48.64 CHO%, and 14.83 PRO%. BM, H, and MVPA min/day ($p < 0.01$) accounted for 66.58% and 60.29% of the variability only in LEGFM% and ARMFM%. Residual LEGFM% was significantly correlated with CHOg (Adj. $R^2 = 58.52$; $p = 0.0014$). This relationship was observed only in girls, where lower CHOg intake was linked to higher FATg, with no significant findings in boys.

Conclusion: Regardless of other factors – including high PA – lower CHO intake relative to FAT in girls is linked to increased LEGFM%. Absent in boys, this pattern suggests a female-specific predisposition. From an evolutionary and reproductive ecology perspective, this could represent an adaptive mechanism to store energy in a riskless area, preparing for future reproductive demands.