

### Biomarkers of Choline Metabolism in Women of Reproductive Age in Southern India

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**Objectives:** Inadequate maternal choline intake during pregnancy has been associated with adverse pregnancy and child health outcomes – and has been identified as a potential risk factor for neural tube defects. However, there is limited data on biomarkers of choline metabolism in women of reproductive age (WRA), and few representative population-level data from India. The objective of this analysis was to examine biomarkers of choline metabolism and their correlates in WRA, as part of a population-based biomarker survey in Southern India.

**Methods:** Participants were WRA (15–40y; n = 980) who were not pregnant or lactating. Free choline, betaine, dimethylglycine, methionine, and trimethylamine N-oxide concentrations were evaluated via liquid chromatography tandem mass spectrometry. Linear regression models were used to examine sociodemographic (e.g., age, parity), dietary (e.g., frequency of animal source food intake), and anthropo-

metric (e.g., body mass index [BMI], waist circumference, waist-hip ratio) correlates of biomarkers of choline metabolism, including betaine concentrations and betaine to choline ratio (B:C).

**Results:** Betaine concentrations (GM: 44.2  $\mu\text{mol/L}$  [95% CI: 43.4, 45.0]) were 4-fold higher compared to free choline (11.1  $\mu\text{mol/L}$  [10.9, 11.2]) levels, with an average B:C of 4.0 [3.9, 4.1]. Increased age ( $\beta$ :  $-0.01$  [SE: 0.002],  $P < 0.0001$ ), multiparity (multiparous/primiparous vs. nulliparous,  $P < 0.0001$ ), and increased frequency of animal source food intake (poultry,  $p = 0.004$ ; red meat,  $p = 0.01$ ), were associated with lower B:C. Higher BMI (betaine:  $\beta$ :  $-0.004$  [SE: 0.002],  $p = 0.02$ ; B:C:  $\beta$ :  $-0.02$  [SE: 0.002],  $P < 0.0001$ ), waist circumference (betaine:  $-0.002$  [0.001],  $p = 0.02$ ; B:C:  $-0.01$  [0.001],  $P < 0.0001$ ), and waist-hip ratio (betaine:  $-0.31$  [0.15],  $p = 0.04$ ; B:C:  $-1.02$  [0.16],  $P < 0.0001$ ), were also associated with lower betaine concentrations and B:C.

**Conclusions:** In this population, higher BMI and central adiposity were associated with lower betaine concentrations and B:C. Findings from this biomarker survey will inform prospective research on the role of choline biomarkers in the health and nutritional requirements of WRA.

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