PRENATAL DIETARY PROGRAMMING OF INFANT NEGATIVE AFFECT: EXPLORING THE ROLE OF THE GLYCEMIC INDEX AND VITAMIN C

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BACKGROUND

Negative affect reflects the propensity to experience negative emotions and is an early indicator of future mental health outcomes.

The prenatal environment is shaped by many factors, including maternal mood and nutrition, and exerts a programming effect on infant behavioral health.

Understanding the mechanisms by which the prenatal environment influences the neurodevelopmental processes underlying the emergence of negative affect in infants is key to identifying early risk factors and appropriate intervention targets.

PURPOSE

Here, we explore inflammation as a potential pathway, by examining the programming effects of pro- and anti-inflammatory prenatal diets on infant negative affect at six months.

- ***Pro-inflammatory***: The dietary glycemic index (GI) is a measure of the rate of of plasma glucose generation from food consumption, with higher GI foods leading to rapid increases in blood sugar and with fetal exposure to higher levels of glucose associated with neuroinflammation.
- ***Anti-inflammatory*****:** Vitamin C is an anti-inflammatory and immune-supportive nutrient with the propensity to influence cortisol regulation during chronic stress and may thus be a promising factor in supporting infant neurodevelopment.

METHODS

Participants

- *N* = 302 mother-infant dyads (73% White, non-Hispanic; M_{age} = 31.97).

Nutritional Measures

Dietary: Six, unannounced 24-h dietary recalls conducted by trained nutritionists during the 2nd and 3rd trimesters (3/trimester), from which we captured *Glycemic Index* and *Vitamin C* intake***.***

Supplemental: Questionnaires on the composition, frequency, and dosage of dietary supplements during the 2nd and 3rd trimesters. Vitamin C supplement totals were capped at 500 mg.

Mood Measures

Center for Epidemiological Studies-Depression Scale (CES-D): Maternal depression was evaluated during the 2nd and 3rd trimesters and 6-months following delivery.

Pregnancy-Related Anxiety Questionnaire (PRAQ): Standardized, 10-item self-report instrument capturing worries and concerns about the pregnancy during the 2nd and 3rd trimester.

- *Factor 1*: Anxiety related to own health.
- *Factor 2:* Anxiety related to health of the child.
- *Factor 3:* Anxiety related to childbirth.

Infant Negative Affect Measures

Still Face Paradigm (SFP): Validated objective measure of infant propensity to experience negative emotions.

Infant Behavior Questionnaire- Revised (IBQ-R): Standardized, 91-item parent-report questionnaire examining infant temperament completed 6-months post-delivery. Examined negative affect and subscales (fear, falling reactivity, sadness, and distress to limitations).

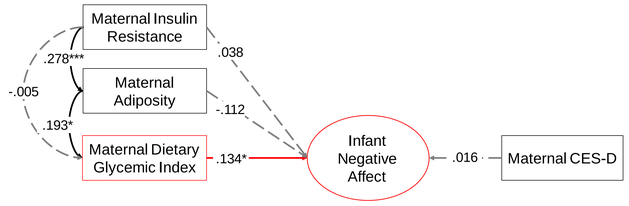
Analyses

- All analyses were conducted in *M*plus using a robust maximum likelihood estimator.

RESULTS

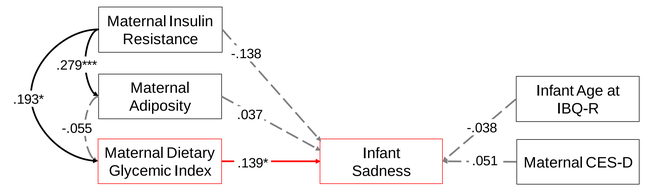
Simple prenatal dietary changes may reduce infant risk for negative affect.

Higher 3rd trimester glycemic index is associated with more objective infant negative affect at 6 months



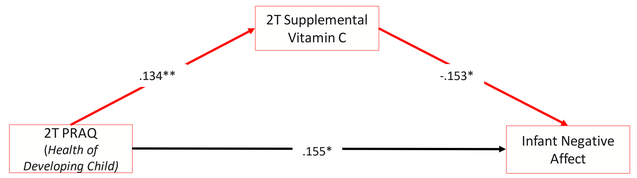
Note. *Model had good fit (CFI = .98, TLI = .966). All estimates adjusted for maternal age, race, parity, household income, and infant sex and age.*

Higher 3rd trimester glycemic index is associated with more caregiver-reported infant sadness at 6 months



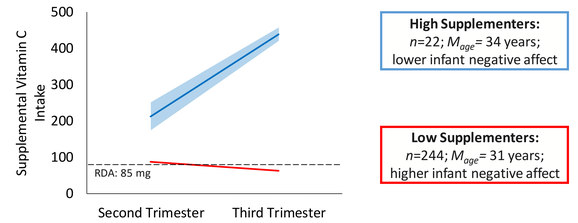
Note. *Model was just-identified. All estimates adjusted for maternal age, race, parity, household income, and infant sex and age.*

Prenatal supplemental vitamin C protects against pregnancy-related anxiety and its impact on infant negative affect at 6 months



Note. *Vitamin C supplementation mediated the effects of pregnancy-related anxiety on infant negative affect ($\beta_{indirect}$ = -.03, [95% CI= -.053, -.003]). All estimates adjusted for maternal age, race, parity, household income, and infant sex and age.*

Latent class analysis found two distinct patterns of prenatal vitamin C supplementation



Note. *High Supplementers exhibited significantly higher supplemental Vitamin C intake during the second (t(250)= -3.44, p = .001) and third trimesters (t(219)= -19.73, p < .001), when compared to Low Supplementers. High Supplementers were also older than Low Supplementers (t(264) = -2.15, p = .02).*

CONCLUSIONS

- **Simple dietary substitutions (e.g., from high GI foods to lower GI foods) or additions (e.g., increasing vitamin C supplementation) during pregnancy may reduce infant risk for negative affect and subsequent developmental psychopathology.**
- ***Higher prenatal dietary GI*** was associated with increased negative affect in 6-month-olds, suggesting that dietary GI has a programming effect on the child.
  - Effects were specific to the 3rd trimester, which may be related to synaptic refinement of burgeoning emotional regulatory capacities during this developmental window.
  - Caregiver-reports suggested that the effects were specific to infant sadness, which may indicate a relationship with emergent hippocampal functioning and increased risk for future internalizing disorders.
- ***Vitamin C supplementation*** mediated the effects of pregnancy-related anxiety on infant negative affect, suggesting that increased vitamin C supplementation ameliorated the effects of pregnancy-related anxiety on negative affect at 6-months.
  - Two latent classes of vitamin C supplementation emerged, with older mothers supplementing more and whose offspring exhibited lower negative affect.
  - Increasing vitamin C intake may help pregnant individuals to cope with pregnancy-related anxiety and promote offspring psychological resilience.
- Future research should consider pro- and anti-inflammatory dietary factors simultaneously, as well as assess maternal-placental-fetal inflammatory factors as potential pathways by which these effects occur.

This work is supported by R01 MH117177, R01 MH124824, and K12 AR084221

Learn more about the **P**renatal **E**nvironment **A**nd **C**hildhood **H**ealth study: