

Fetal Developmental Deviations reflected in a Functional Autonomic Brain Age Score

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Introduction

The Fetal Autonomic Brain Age Score (fABAS) is based on a system biology approach that applies universal principles of evolution and self-organization to the ontogenetic functional development of the fetus. It can be understood as a proxy for the neural integration of the developing organism. fABAS is calculated from the fetal cardiac autonomic outflow using fetal heart rate variability (fHRV) indices.

fABAS was originally fitted to the normal development between 20 and 36 weeks of gestation (GA). Maternal docosahexaenoic acid (DHA) supplementation was previously shown to increase traditional fHRV and Neonatal Behavioral Assessment Scale values. DHA is a long-chain polyunsaturated fatty acid critical for fetal brain and nervous system development. In the present work we investigate changes of fABAS in response to maternal DHA supplementation.

Methods

Women were randomized to either placebo (corn/soy oil) or 600 mg of DHA during the last two trimesters of pregnancy (NCT01007110). fABAS estimates functional brain age by means of a multivariate linear regression model based on evolution-related fHRV indices calculated from fetal RR interval series obtained from magnetocardiographic recordings.

Results

At 32 and 36 weeks GA, fABAS values in the DHA group were significantly higher compared to the placebo group. The relationships between fABAS and traditional fHRV indices and influences of fetal behavioral states will be presented in more detail.

Conclusions

Maternal DHA intake during the last two trimesters of pregnancy positively influences fetal complex autonomic control, suggesting a nutritional programming effect. In order to make recommendations with regard to fetal development and health, we must understand intervention effects on physiology and neural integration. In that regard, fABAS/HRV is an important measure that advances our knowledge and understanding of the complex neural interactions taking place during fetal development.