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Omega-3 and Omega-6 Polyunsaturated Fatty Acid Levels in Placental Tissue and Association With Maternal Dietary Intake

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OMEGA-3 AND OMEGA-6 POLYUNSATURATED FATTY ACID LEVELS IN PLACENTAL TISSUE AND ASSOCIATION WITH MATERNAL DIETARY INTAKE

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Background: Omega-3 (n-3) and omega-6 (n-6) polyunsaturated fatty acids (PUFAs) are precursors to lipid mediators that modulate inflammation throughout the body. Derivatives of n-3 PUFAs have anti-inflammatory properties and promote growth and neurodevelopment in the fetus. Conversely, n-6 PUFA metabolites exert pro-inflammatory effects and may contribute to adverse pregnancy and birth outcomes. Studies have shown that maternal dietary intakes of n-3 and n-6 PUFAs are associated with their levels in maternal serum, but less is known about the association between PUFA intake and placental levels of these nutrients. A fetus must obtain essential PUFAs from their mother through the placenta, therefore it is important to ascertain how maternal diet may impact placental PUFAs. Understanding this relationship may help inform dietary recommendations in pregnancy.

Objective: The purpose of this study is to assess the relationship between dietary intake of n-3 and n-6 PUFAs and their levels in placental tissue.

Methods: An IRB-approved study enrolled 29 mother-infant pairs who were delivering at a Midwest Academic Medical Center. Placental tissue samples were obtained at delivery and levels of n-3 and n-6 PUFAs (including Eicosapentaenoic acid (EPA), Docosahexaenoic acid (DHA), Docosapentaenoic acid (DPA), a-Linolenic acid (ALA), Linoleic acid (LA), and Arachidonic acid (AA)) were quantified in each sample. The Harvard Food Frequency Questionnaire (FFQ) was used to assess maternal dietary intake of n-3 and n-6 PUFAs. Descriptive statistics were run for all variables. Spearman correlations were used to assess the relationships between dietary intake and placental PUFA levels. A $p<0.05$ was considered statistically significant.

Results: Median gestational age at delivery was 39.7 weeks in this cohort. Significant positive correlations were observed between maternal EPA intake and levels of placental DHA ($R=0.52$, $p<0.01$), total placental n-3 PUFAs ($R=0.50$, $p<0.01$), and placental AA ($R=0.38$, $p=0.046$). Conversely, maternal EPA intake was negatively correlated with the ratio of placental n-6:n-3 PUFAs ($R=-0.45$, $p=0.02$). Maternal DHA intake demonstrated significant positive correlations with placental DHA ($R=0.46$, $p=0.01$) and total placental n-3 PUFAs ($R=0.43$, $p=0.02$). No significant associations were observed between n-6 PUFA intake and placental levels of n-3 or n-6 PUFAs.

Conclusion: Our findings suggest that maternal dietary intakes of EPA and DHA are correlated with n-3 and n-6 PUFA levels in the placenta. This information may help guide optimal dietary guidelines for n-3 PUFAs during pregnancy. A limitation to our study is the small sample size; thus, future studies should focus on replicating these results in a larger sample.