

The correlation of fetal sonographic parameters with cord blood lipid concentrations in growth restricted fetuses

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OBJECTIVE

- Fetal lipid metabolism is important for adequate fetal growth and development
- Identifying fetuses with impaired lipid metabolism via ultrasound may help in the management of fetal growth restriction (FGR)
- Our objective is to assess the relationships between cord blood levels of various lipid concentrations and ultrasound (US) markers of altered fetal growth and neurological maldevelopment in GR fetuses.

STUDY DESIGN

- Retrospective cohort study
- Singleton non-anomalous pregnancy with growth restricted fetuses diagnosed after 20 weeks
- Ultrasound data from last US prior to delivery
- US parameter used: umbilical artery (UA) pulsatility index (PI), middle cerebral artery (MCA) PI, cerebroplacental ratio (CPR), umbilical vein flow (UVF, figure 1) insula-head circumference ratio (IC, Figure 2), thigh volume (TV), and thigh fat to lean mass ratio (FLR, figure 3)
- Targeted lipid class analyses using liquid chromatography mass spectrometry were done on umbilical cord blood:
 - triglyceride (TG), phosphatidylcholine (PC), lysophosphatidylcholine (LPC), eicosanoid (Eic), and non-esterified fatty acids (NEFA)
- Species containing arachidonic acid (AA) and docosahexaenoic acid (DHA) were highlighted given their biochemical importance in development.
- Pearson correlation was used to assess the relationship between variables, $p < 0.05$ was considered significant

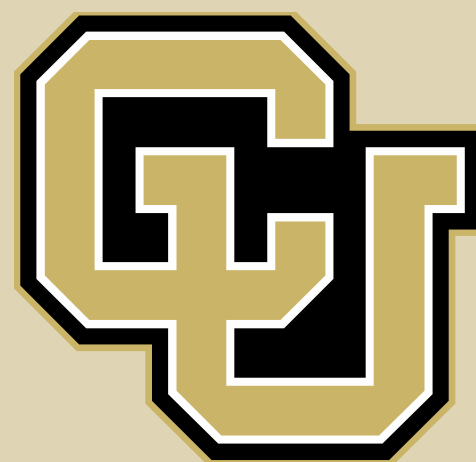
RESULTS

- This cohort includes 20 subjects
- Descriptive data is presented in Table 1
- US parameters that significantly correlate with the most species in each lipid class were as follow:
 - CPR centile was inversely correlated with 15/24 of plasma TG species
 - FLR was inversely correlated 17/51 of plasma PC
 - UA PI centile was inversely correlated with 9/9 plasma LP
 - UA PI centile was correlated with 3/15 plasma Eic
 - IC was inversely correlated with 8/10 plasma NEFA
- FLR was inversely correlated with AA and DHA containing PC species. IC was correlated with AA- and DHA-LPC.

Table 1. Descriptive distribution of demographic and sonographic measurements

	Median (Interquartile range) (N = 20)
Maternal age (years)	28.5 (23.75 – 32.25)
Body mass index (kg/m ²)	27.22 (24.33 – 32.04)
Race – N (%)	
White	19 (95%)
Black	1 (5%)
Ethnicity – N (%)	
Hispanic or Latino	2 (10%)
Not Hispanic or Latino	18 (90%)
Estimated fetal weight percentile	3.25 (2.07 – 11.78)
Abdominal circumference percentile	3.15 (1.0 – 22.75)
UA-PI percentile	0.716 (0.51 – 0.88)
MCA-PI percentile	0.46 (0.12 – 0.81)
CPR percentile	0.34 (0.06 – 0.68)
Thigh volume MoM	1.045 (0.86 – 1.078)
Thigh fat/Lean mass ratio	1.93 (1.64 – 2.12)
Insula circumference/HC ratio	0.22 (0.2 – 0.23)

Values are displayed in n (%) or median (interquartile range). FGR: fetal growth restriction; SGA: small-for-gestational age; UA: umbilical artery; PI: pulsatility index; MCA: middle cerebral artery; CPR: cerebroplacental ratio; MoM: multiples of median - HC: head circumference.



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RESULTS

Table 2. Percent of significantly correlated species by each lipid class and ultrasound parameter

	Cord blood				
	TG	PC	LPC	Eic	NEFA
EFW centile	0.0%	7.8%	44.4%	0.0%	10.0%
AC centile	0.0%	3.9%	0.0%	0.0%	0.0%
UA PI centile	0.0%	11.8%	100.0%	20.0%	50.0%
MCA PI centile	20.8%	0.0%	88.9%	13.3%	0.0%
CPR centile	62.5%	2.0%	100.0%	0.0%	0.0%
UVF centile	0.0%	0.0%	0.0%	0.0%	0.0%
IC/HC ratio	8.3%	11.8%	33.3%	6.7%	80.0%
TV MoM	33.3%	5.9%	0.0%	13.3%	40.0%
FLR	0.0%	33.3%	0.0%	0.0%	0.0%
Total species	9	51	9	15	10

CONCLUSIONS

- Fetal US parameters of altered fetal growth and neurological maldevelopment in GR fetuses are correlated with cord blood lipid concentrations
- The correlation of FLR and IC with AA, DHA, and NEFA requires further investigation as it may help in predicting fetuses at risk of neurodevelopmental issues.

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FIGURES

Figure 1. Acquisition of umbilical vein flow

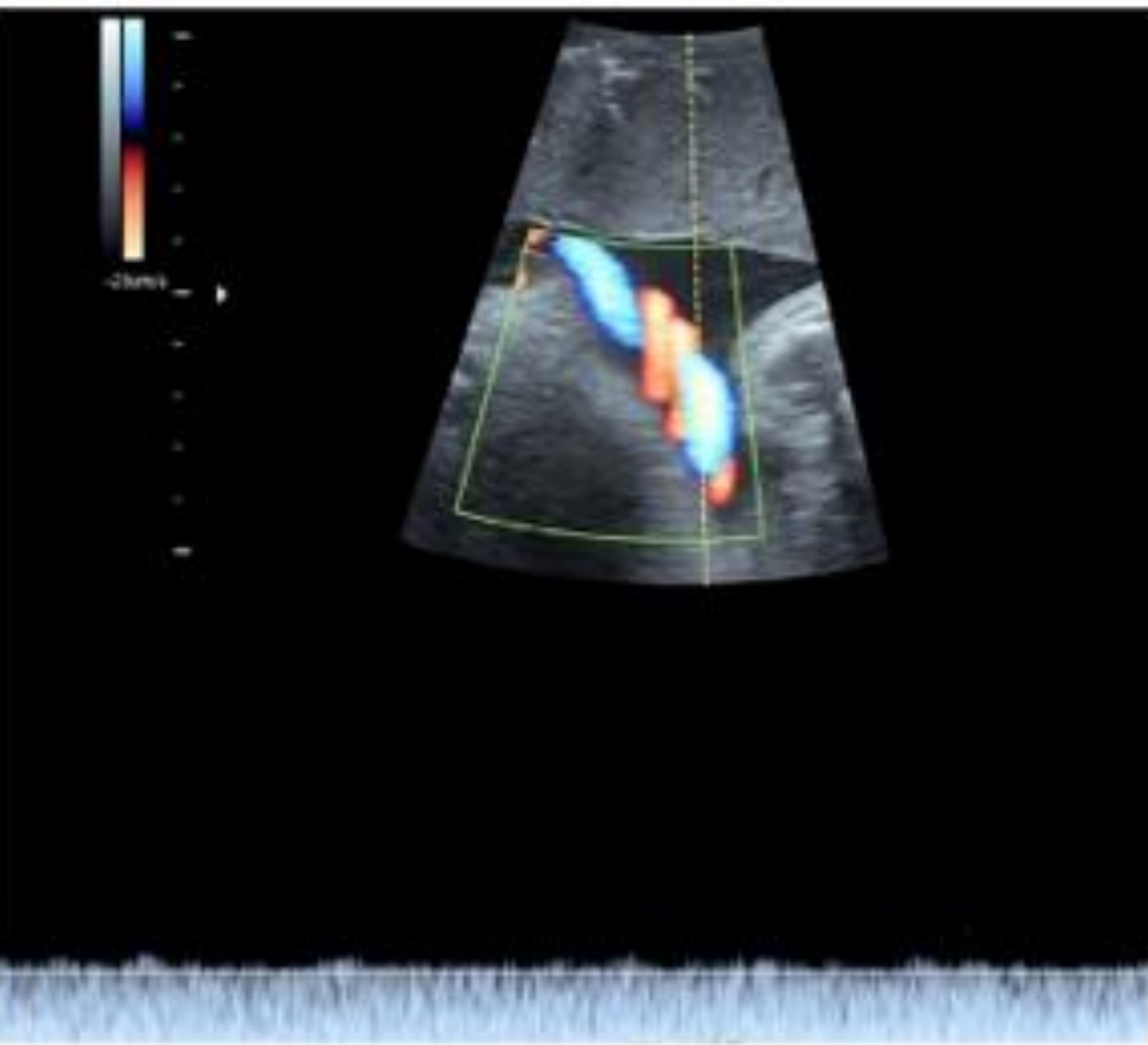


Figure 2. Acquisition of insular circumference

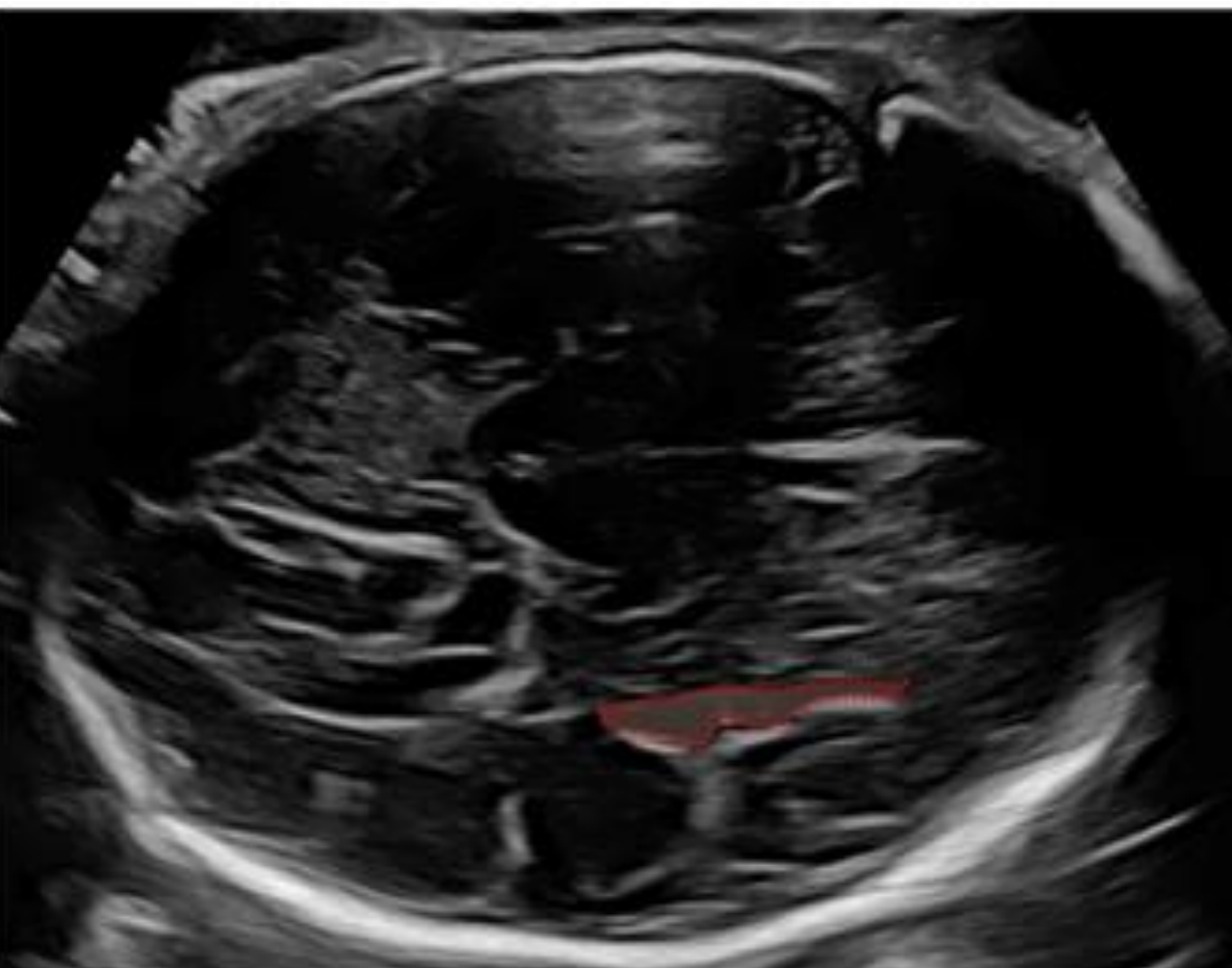


Figure 3. Acquisition of thigh volumes

