



# FATTY ACID PROFILE OF MATERNAL AND FETAL ERYTHROCYTES AND PLACENTAL EXPRESSION OF FATTY ACID TRANSPORT PROTEINS IN NORMAL AND INTRAUTERINE GROWTH RESTRICTION PREGNANCIES



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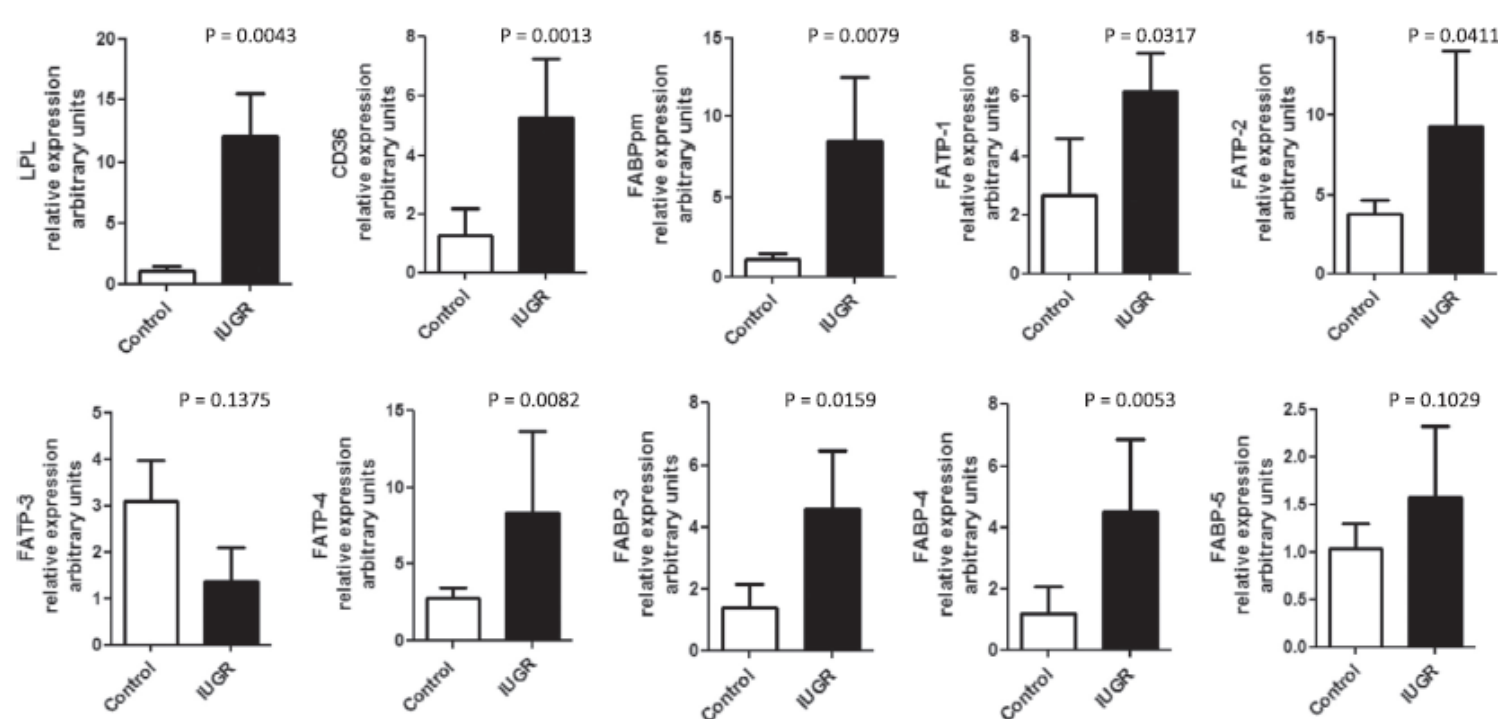
## Introduction

Long-chain polyunsaturated fatty acids (LC-PUFA), mainly docosahexaenoic (DHA) and arachidonic acids (AA), are critical for adequate fetal growth and development. We investigated mRNA expression of proteins involved in hydrolysis, uptake and/or transport of fatty acids in placenta of fifteen full term normal pregnancies and eleven pregnancies complicated by intrauterine growth restriction (IUGR) with normal umbilical blood flows..

## Methods

Fatty acid methyl esters in the placenta and maternal-fetal erythrocyte compartments were separated and detected on an Agilent Technologies 7890 A CG chromatograph. The expression of genes that encode proteins involved in the uptake and transport of fatty acids in human placenta was evaluated by qRT-PCR in both groups.

## Results



Fatty acid concentrations in placenta of normal and IUGR pregnancies.

Fatty acids (mg/100 mg)	AGA placenta (n = 15)	IUGR placenta (n = 11)
<b>Saturated (SFA)</b>		
Myristic acid (14:0)	0.3 ± 0.1	0.3 ± 0.2
Palmitic acid (16:0)	26.7 ± 4.0	25.8 ± 1.5
Stearic acid (18:0)	14.7 ± 1.4	16.7 ± 2.2
Arachidic acid (20:0)	0.44 ± 0.2	0.63 ± 0.3
<b>Monounsaturated (MUFA)</b>		
Oleic acid (9c-18:1, n-9)	11.8 ± 3.8	9.60 ± 1.3
<b>Essential (EFA)</b>		
LA (18:2n-6)	8.9 ± 1.5	8.74 ± 1.9
ALA (18:3n-3)	0.10 ± 0.08	0.20 ± 0.08
<b>Long-chain polyunsaturated (LC-PUFA)</b>		
AA (20:4n-6)	17.6 ± 3.3	16.8 ± 3.8
Adrenic Acid (22:4n-6)	1.1 ± 0.3	1.1 ± 0.2
EPA (20:5n-3)	0.39 ± 0.04	0.42 ± 0.1
DPA (22:5n-3)	0.56 ± 0.2	0.62 ± 0.08
DHA (22:6n-3)	2.6 ± 0.5	2.6 ± 0.96
Total SFA <sup>a</sup>	42.7 ± 5.0	43.4 ± 3.7
Total MUFA <sup>b</sup>	14.2 ± 3.5	11.9 ± 1.8
Total EFA <sup>c</sup>	9.1 ± 1.5	9.0 ± 1.9
Total n-6 <sup>d</sup>	29.7 ± 4.1	30.4 ± 4.8
Total n-3 <sup>e</sup>	3.4 ± 1.2	3.3 ± 0.9
Total LC-PUFA <sup>f</sup>	20.2 ± 3.6	19.8 ± 4.7
AA/LA n-6 ratio	1.9 ± 0.1	1.9 ± 0.1
DHA/ALA n-3 ratio	26.0 ± 2.4	13.3 ± 1.1 <sup>g</sup>

The mRNA expression of LPL, FATPs (-1, -2 and -4) and FABPs (-1 and -3) was increased in IUGR placentas, however, tissue profile of LC-PUFA was not different between groups. Relative mRNA expression results are expressed as means ± SD. GAPDH was used as housekeeping gene to normalize the data.

Fatty acid composition (mg/100 mg) of maternal and umbilical cord erythrocytes from AGA and IUGR pregnancies.

Fatty acids (mg/100 mg)	AGA group (n = 15)		IUGR group (n = 11)	
	Maternal erythrocytes	Umbilical cord erythrocytes	Maternal erythrocytes	Umbilical cord erythrocytes
<b>Saturated (SFA)</b>				
Myristic acid (14:0)	0.5 ± 0.09	0.5 ± 0.1	0.6 ± 0.08	0.8 ± 0.2
Palmitic acid (16:0)	23.5 ± 1.4	23.9 ± 0.9	23.3 ± 1.9	24.2 ± 2.1
Stearic acid (18:0)	17.4 ± 0.8	18.5 ± 0.5	19.0 ± 1.2	19.9 ± 1.2
Behenic acid (22:0)	0.8 ± 0.13	0.6 ± 0.09	1.0 ± 0.28	0.9 ± 0.26
<b>Monounsaturated (MUFA)</b>				
18:1n-9	12.5 ± 0.3	10.1 ± 1.2 <sup>*</sup>	13.5 ± 1.2	9.1 ± 0.5 <sup>*</sup>
18:1n-7	0.7 ± 0.3	0.4 ± 0.2	0.5 ± 0.3	0.3 ± 0.1
<b>Essential (EFA)</b>				
LA (18:2n-6)	11.0 ± 1.9	4.2 ± 0.6 <sup>*</sup>	10.4 ± 1.9	4.2 ± 0.6 <sup>*</sup>
ALA (18:3n-3)	0.3 ± 0.1	0.2 ± 0.1	0.5 ± 0.1	0.3 ± 0.08
<b>Long-chain polyunsaturated (LC-PUFA)</b>				
AA (20:4n-6)	15.8 ± 1.7	20.0 ± 1.6 <sup>*</sup>	12.6 ± 2.1 <sup>g</sup>	16.4 ± 3.5 <sup>g</sup>
Adrenic Acid (22:4n-6)	3.8 ± 0.7	4.3 ± 0.6	3.5 ± 0.8	4.0 ± 0.6
EPA (20:5n-3)	0.7 ± 0.3	0.8 ± 0.1	0.9 ± 0.4	0.9 ± 0.3
DPA (22:5n-3)	1.9 ± 0.5	0.5 ± 0.2 <sup>*</sup>	1.6 ± 0.4	0.6 ± 0.3 <sup>*</sup>
DHA (22:6n-3)	5.5 ± 1.3	6.1 ± 0.9	3.6 ± 0.7 <sup>g</sup>	4.6 ± 0.8 <sup>g</sup>
Total SFA <sup>a</sup>	41.8 ± 2.7	43.6 ± 1.7	46.0 ± 3.8	48.0 ± 1.9 <sup>g</sup>
Total MUFA <sup>b</sup>	13.8 ± 1.4	12.1 ± 1.3	15.6 ± 1.1	12.5 ± 0.9 <sup>*</sup>
Total EFA <sup>c</sup>	11.5 ± 1.8	4.4 ± 0.6 <sup>*</sup>	11.0 ± 1.9	4.5 ± 0.6 <sup>*</sup>
Total n-6 <sup>d</sup>	33.5 ± 2.4	32.1 ± 1.7	29.7 ± 3.5	29.2 ± 4.7
Total n-3 <sup>e</sup>	8.5 ± 1.2	7.7 ± 1.1	6.7 ± 0.9 <sup>g</sup>	6.5 ± 0.5
Total LC-PUFA <sup>f</sup>	21.9 ± 3.3	27.1 ± 1.5 <sup>*</sup>	19.6 ± 1.4 <sup>g</sup>	24.1 ± 3.3 <sup>g</sup>
AA/LA n-6 ratio	1.4 ± 0.7	4.8 ± 0.5 <sup>*</sup>	1.2 ± 0.9	3.9 ± 0.5 <sup>g</sup>
DHA/ALA n-3 ratio	18.3 ± 1.9	30.5 ± 2.7 <sup>*</sup>	7.2 ± 0.7 <sup>g</sup>	15.3 ± 1.7 <sup>g</sup>

Values are expressed as means ± standard deviation (SD). LA, linoleic acid; ALA, alpha-Linolenic acid; AA, arachidonic acid; EPA, eicosapentaenoic acid; DPA, docosapentaenoic acid; DHA, docosahexaenoic acid.

Erythrocytes from both mothers and fetuses of the IUGR group showed lower concentrations of AA and DHA and inferior DHA/ALA ratio compared to normal pregnancies (P<0.05).

## Conclusions

We hypothesize that reduced circulating levels of AA and DHA could up-regulate mRNA expression of placental fatty acids transporters, as a compensatory mechanism, however this failed to sustain normal LC-PUFA supply to the fetus in IUGR.

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