PLACENTA N-6/N-3 PUFA RATIO IS ASSOCIATED WITH VISCERAL ADIPOSITY AND CARDIOVASCULAR RISK IN THE OFFSPRING AT 6 YEARS OF AGE

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BACKGROUND

Long chain polyunsaturated fatty acids **(LC-PUFA)** are **essential nutrients** for the development of the fetus and are supplied by the mother through the placenta. Omega-6 (n-6) arachidonic acid (**AA**) and both omega-3 (n-3) eicosapentaenoic acid (**EPA**) and docosahexaenoic acid (**DHA**) stand out for their **functional roles**. Recent studies show that the concentrations of these fatty acids in maternal blood and umbilical cord are associated with adiposity in the offspring. Indeed, prenatal exposure to AA n-6 promotes adipocyte maturation while DHA n-3 is known to inhibit it.

OBJECTIVES

- To study **the placental levels** of n-6 and n-3 **functional LC-PUFA.**
- To determine its **association** with **anthropometric and cardio-metabolic parameters** in the offspring at **6 years** of age.

METHODS

The **n-6 and n-3 PUFA profile** was analyzed in 117 **placentas** from a population cohort of pregnant women-newborn pairs by gas chromatography.

Total n-6 and n-3 PUFA content as well as the ratios of LC-PUFA (AA/EPA and AA/DHA) were calculated from the percentages of relative abundance of each PUFA.

These PUFA were subsequently correlated with anthropometric (weight, height and body mass index) and cardio-metabolic parameters [visceral fat and carotid intima-media thickness (cIMT)] in the offspring followed-up at 6 years of age (N=85).

RESULTS

Table 1: Relative abundance (%) of the analyzed placental fatty acids. Mean±SD

Lipid Profile	Relative Abundance (%)
TOTAL SFA	54.22±6.07
TOTAL MUFA	15.64±2.71
18:2n6 (linoleic) LA	9.69±1.39
20:2n6 (eicosadienoic)	0.1±0.07
20:3n6 (dihomo-γ-linolenic)	0.61±0.1
20:4n6 (arachidonic) AA	**12.47±3.84**
22:4n6 (adrenic)	0.5±0.17
22:5n6 (osbond)	0.1±0.06
TOTAL PUFA n6	**23.47±5.63**
18:3n3 (α-linolenic) ALA	0.22±0.07
18:4n3 (stearidonic)	0.65±0.58
20:3n3 (eicosatrienoic)	3.5±1.17
20:5n3 (eicosapentaenoic) EPA	0.88±0.25
22:5n3 (docosapentaenoic) DPA	0.25±0.08
22:6n3 (docosahexaenoic) DHA	**1.17±0.53**
TOTAL PUFAn3	**6.67±2.68**
AA/EPA	**14.49±4.14**
AA/DHA	**11.81±4.08**
AA/EPA+DHA	6.27±1.58
Total PUFAn6/Total PUFAn3	3.55±0.57

Table 2: Descriptive characteristics of the offspring at the age of 6 years.

Follow-up (6 year)	Cohort N= 85
Anthropometry	
Girls (%)	31.6
Age (years)	5.89±0.94
Weight (kg)	22.58±4.99
Weight-SDS	0.16±1.21
Height (cm)	116.08±7.83
Height-SDS	0.14±1.20
Hip (cm)	60.08±7.98
Waist (cm)	56.64±7.13
BMI (kg/m^2)	16.61±2.21
BMI-SDS	0.13±1.05
Cardio-metabolic	
Fat mass (%)	23.50±8.04
% Fat mass-SDS	0.19±1.36
Visceral fat (mm^3)	5.23±1.13
cIMT (cm)	0.04±0.004
Glucose (mg/dl)	82.92±7.30
Insulin (mIU/L)	5.47±2.21
HOMA-IR	1.14±0.52
Triglycerides (mg/dl)	50.35±15.337
Total cholesterol (mg/dl)	163.31±26.37
HDL cholesterol (mg/dl)	55.39±10.83

Placental concentrations of **AA (n-6) and total PUFA n-6** were **positively correlated with visceral fat** (r = 0.229, p = 0.036 and r = 0.211, p = 0.045, respectively). **DHA (n-3) and total PUFA n-3** were **negatively correlated with cIMT** (r = –0.228, p = 0.036 and r = –0.254, p = 0.019, respectively). The **AA/EPA** ratio was **positively correlated with visceral fat** (r = 0.337, p = 0.002) while the **AA/DHA ratio was positively correlated with cIMT** (r = 0.243, p = 0.025). All these associations remained significant in multivariate analysis after adjusting for possible confounding variables (maternal age, gestational weight gain, gestational age, sex, and birth-weight).

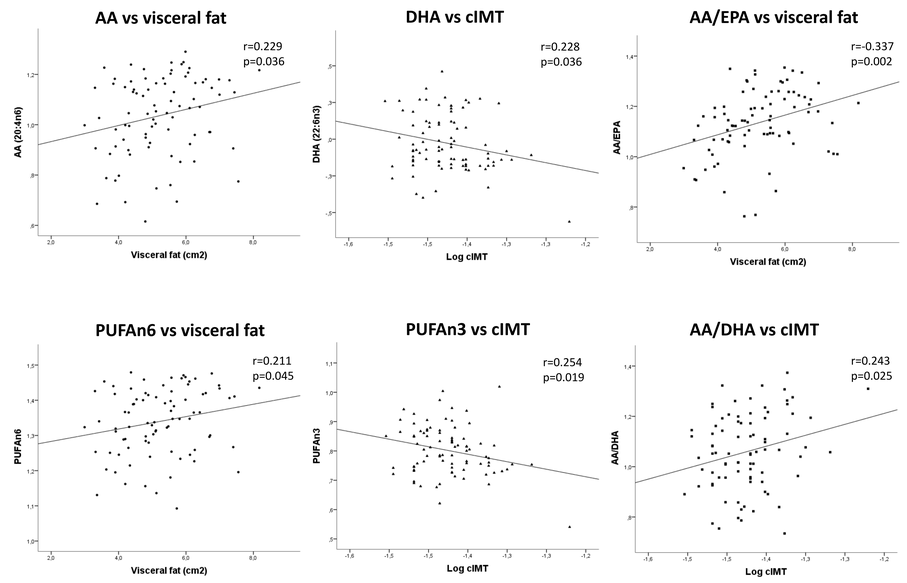

Figure 1: Graphical representation of the correlations between the main placental PUFA and the anthropometric and cardio-metabolic parameters of the offspring at the age of 6 years.

CONCLUSIONS

A higher ratio of LC-PUFA n-6/n-3 **(AA/EPA and AA/DHA) in placenta is associated with higher visceral fat and thicker cIMT at 6 years of age.** The n-6 and n-3 fatty acids provided by the mother during pregnancy may influence visceral adiposity and cardiovascular risk in the offspring at 6 years of age.