Abstract  Fatty acid composition of erythrocyte phosphatidylcholines was determined by high-resolution capillary gas chromatography in Spanish (n = 120), German (n = 78) and Hungarian (n = 43) expectant women at the 20th week of gestation. The sum of trans isomeric fatty acids was significantly (p < 0.05) lower in Hungarian (0.68 [0.43]% wt/wt, median [IQR]) than in Spanish (0.82 [0.53]) expectant women. There were no significant correlations between the sum of trans isomers and linoleic acid or alpha-linolenic acid in either of the three groups. In contrast, there were significant inverse correlations between the sum of trans fatty acids and arachidonic acid and docosahexaenoic acid in all the three groups. These data raise the possibility that maternal trans isomeric fatty acid status may be inversely associated to the essential fatty acid status of the foetus.

Keywords  Arachidonic acid • docosahexaenoic acid • foetal nutrition • trans fatty acids

Abbreviations  AA: arachidonic acid; ALA: alpha-linolenic acid; DHA: docosahexaenoic acid; LA: linoleic acid; LCPUFA: long-chain polyunsaturated fatty acid; C18:1t: trans hexadecenoic acid

1 Introduction

Unsaturated fatty acids are usually found in nature in their cis configuration form, while trans isomers are produced in the rumen of ruminant animals and during the hydrogenation of oils. Cis double bonds break the spatial linearity of the
carbon chain, while trans fatty acids, similarly to saturated fatty acids, are linear in space; the different biological properties of the cis and the trans isomers of the same unsaturated fatty acids arise mainly from the different spatial configuration (Koletzko and Decsi 1997). Because cis and trans isomeric fatty acids use the same enzymes during their metabolism, trans fatty acids may disturb the desaturation and chain elongation of essential fatty acids, the n-6 linoleic acid (LA; C18:2n-6) and the n-3 alpha-linolenic acid (ALA; C18:3n-3) to their respective LCPUFA metabolites, arachidonic acid (AA; C20:4n-6) and docosahexanoic acid (DHA; C22:6n-3). The most important n-3 LCPUFA, DHA plays an important role in the early development of central nervous system; hence, optimal perinatal DHA supply is of great concern. Previously we found significant inverse correlations between trans isomers and LCPUFAs in cord blood lipids of preterm (Koletzko 1992) and full-term infants (Decsi et al. 2001) as well as in mature human milk samples (Szabó et al. 2007). Here we report data on the association of the availability of trans fatty acids to those of LCPUFA in maternal blood lipids at mid gestation.

2 Methods

At the 20th week of gestation we collected blood samples of German (n = 78), Hungarian (n = 43) and Spanish (n = 120) expectant women participating in the NUHEAL study. Detailed description of the supplementation study has been provided elsewhere (Decsi et al. 2005; Krauss-Etschman et al. 2007). Briefly, apparently healthy pregnant women were recruited before the 20th week of gestation in the Departments of Obstetrics at Ludwig Maximilians University, Munich, Germany; the University of Granada, Granada, Spain; and the University of Pécs, Pécs, Hungary. Inclusion criteria were singleton pregnancy, gestational age lower than 20 weeks at enrolment, and intention to deliver in one of the obstetrical centres. Women with serious chronic illness or those using fish oil supplements since the beginning of pregnancy or folate or vitamin B12 supplements after the 16th week of gestation were excluded from the study.

Fatty acid composition of erythrocyte membrane lipids was determined by high-resolution gas–liquid chromatography. Statistical analysis was performed with the use of SPSS 11.5 for Windows. Differences between the three nations were calculated with the analysis of variance followed by Mann-Whitney test, whereas correlations between fatty acids were calculated with Spearman’s rho correlation analysis. In this paper, we focus on phosphatidylcholines.

3 Results

Values of trans hexadecenoic acid (C16:1t) were significantly higher in German (0.20 [0.16], % wt/wt, median [IQR]) than in Spanish (0.16 [0.16], p < 0.05) and Hungarian mothers (0.14 [0.12], p < 0.05). There were no significant differences in