Blood Cell Membranes as Biomarkers for Fatty Acid incorporation in Humans

K. Kuhnt[1], L. Angelov[2], G. Jahreis[1]

[1]Institute of Nutrition, University of Jena, Jena, Germany

[2]Institute of Cryobiology, Sofia, Bulgaria

Tissue samples are not easily available to examine the fatty acid (FA) supply in humans. The isolation of cells from the whole blood is a minimal invasive method to obtain human tissue samples. The membranes of red blood cells (RBC) and peripheral blood mononuclear cells (PBMC) could be useful biomarkers for dietary intake of FA via their incorporation into membrane lipids. The lipids of serum reflect only the short-term dietary situation. It should be examined whether both isolated cell types are adequate biomarkers for dietary intake and FA metabolism in human intervention-studies.

A.) Healthy subjects consumed a baseline-diet poor in *trans* (*t*)FA and conjugated linoleic acids (CLA) over 54 d. The diet of the test-group was supplemented with two *t*FA; 3 g/d of *t*11-18:1 (vaccenic acid; *t*11) and 3 g/d of *t*12-18:1 (*t*12). The diet of the control group was supplemented with a CLA- and *t*FA-free control oil.

The lipid analyses of membranes of RBC and PBMC resulted in an increased incorporation of the supplemented *t*11 and *t*12 in both cell types. In addition, due to the supplementation of the *trans* isomers the portion of *c*9,*t*11 CLA was significantly increased whereas the portion of *c*9,*t*12 18:2 was unchanged. Due to these analyses the Ä9-desaturation of only *t*11 and not of *t*12 could be confirmed. The mean *t*11 conversion rate was 20%.

During the *t*FA and CLA-free baseline diet the content of these fatty acids decreased in lipids of the analysed cell membranes. In membranes of RBC of control-subjects the *c*9,*t*11 CLA content significantly decreased by 50% (0.15 to 0.08; % of FAME). The *t*11 and *t*12 content decreased minimal by 10%. In general, these decreases could not be determined in serum lipids. These results indicate that in respect to the incorporation and metabolism of FA after a long-term FA intervention the membranes of blood cells (RBC and PBMC) are more qualified biomarkers for dietary intake than serum lipids.

B.) The dietary intake of *t*11- and CLA-rich sheep milk increases the CLA pool of the human body. The milk of free-living Bulgarian sheep from the Rhodope Mountains is rich in *t*11- and CLA. We used Bulgarian herdsmen with a high intake of their self-produced sheep milk products as test subjects to analyse the FA distribution of their RBC membranes. In comparison to control subjects with a balanced diet, the content of *t*11 and *c*9,*t*11 CLA of Bulgarian herdsmen's RBC membranes was about twofold higher (*t*11: 0.2 *vs* 0.5; *c*9,*t*11 CLA: 0.3 *vs* 0.6; % of FAME). In conclusion, RBC membranes are sensitive biomarkers for (long-term) dietary FA intake.