Impact of n-3 docosapentaenoic acid (DPA) supplementation on n-3 fatty acid composition of tissues in rats

Gaëtan Drouin, Daniel Catheline, Charlotte Baudry, Pascale Le Ruyet, Philippe Legrand

To cite this version:

HAL Id: hal-01888814
https://hal.archives-ouvertes.fr/hal-01888814
Submitted on 5 Oct 2018

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Distributed under a Creative Commons Attribution 4.0 International License
Impact of n-3 docosapentaenoic acid (DPA) supplementation on n-3 fatty acid composition of tissues in rats.

Drin G¹, Cathline D¹, Baudy C², Le Ruyet P², Legrand P¹.
¹Laboratory of Biochemistry and Human Nutrition - Agrocampus Ouest, Rennes, France
²Lactalis R&D, Retiers, France

Poster number: N-P-005

Introduction
The role of n-3 Polyunsaturated Fatty Acids (n-3 PUFA) on lipid metabolism is well known. However, most research focuses on docosahexaenoic acid (DHA, C22:6 n-3) and eicosapentaenoic acid (EPA, C20:5 n-3). Few studies concern n-3 docosapentaenoic acid (n-3 DPA, C22:5 n-3), which is not commercially available in sufficient amount for in vivo studies. This fatty acid (FA) is an intermediate between EPA and DHA in the n-3 PUFA conversion pathway from α-linolenic acid (ALA, C18:3 n-3). It could be of interest both for DPA ability to be converted to EPA or DHA, and for its potential specific physiological effects. To our knowledge, no study has been able to describe the specific enrichment of this FA in the tissues when it was supplemented in vivo. The objective of this study was therefore to examine the effect of DPA supplementation at a physiological dose on the PUFA composition of the main tissues in rats in order to guide future studies towards the search for physiological effects.

Methods
Sprague Dawley rats (n=8) were fed after weaning with a control diet (Ctrl) or a n-3 DPA-supplemented diet (0.5% n-3 DPA) containing a mix of plant oils during 3 weeks.

Lipids were extracted from 18 different frozen tissues (Desai, 1944). FA were then derived into FA methyl esters whose composition was assessed by gas chromatography coupled with mass spectrometry (GCMS).

Results were expressed as mean ± SEM. Significance between groups was evaluated by Student t-test. * p<0.05; ** p<0.01; *** p<0.001; M 0.1±p<0.05

An Orthogonal Partial Least Square Discriminant Analysis (OPLS-DA) was performed on reduced centered Log-Ratio of FA to all tissues to determine the most discriminant variables between diets. Cross Validation ANOVA was used to validate the model. Colored variables have a Variable Importance in the Prediction (VIP) > 1.

Results
Univariate analysis

n-3 DPA % of total fatty acid

DHA

EPA

n-6 PUFA / LA ratio

Multivariate analysis

All the rats of each diet are well separated on the score scatter plot. The loadings scatter plot shows the most discriminant FA levels between the 2 diets.

Heart, liver, lung, kidney, spleen then bone marrow and pancreas were the most impacted by the n-3 DPA supplementation.

The changes in FA proportions concerned PUFA metabolism only; suggesting a specific action of n-3 DPA supplementation on these pathways.

Beyond an increase in all n-3 PUFA, the n-3 DPA supplementation induced principally a decrease in n-6 docosapentaenoic acid (C22:5 n-6) and arachidonic acid (20:4 n-6).

Conclusion and perspectives
After only 3 weeks of physiological n-3 DPA supplementation, the omega-3 status was improved in most tissues. The impact of n-3 DPA diet was tissue-dependent. It specifically affected heart, lung, spleen, kidney and bone marrow and was specific of PUFA metabolism. These results suggest potential physiological effects specific of DPA metabolism in these organs compared to the EPA and DHA, whose assimilation was less specific from our findings.

Furthermore, some studies have shown an increase in n-3 DPA in red blood cells and in some tissues when the diet is partially enriched with dairy lipids compared to diet composed of vegetable oils (Dinel et al., 2016, PLEFA) (Du et al., 2013, PLEFA). It would be interesting to investigate whether the potential physiological effects associated with n-3 DPA supplementation would be found with a diet partially enriched with dairy lipids.