



HAL
open science

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

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

► To cite this version:

Gaëtan Drouin, Daniel D. Catheline, Charlotte Baudry, Pascale P. Le Ruyet, Philippe P. Legrand. Impact of n-3 docosapentaenoic acid (DPA) supplementation on n-3 fatty acid composition of tissues in rats. The European Society for Paediatric Gastroenterology Hepatology and Nutrition (ESPGHAN) Annual Meeting 2017, May 2017, Prague, Czech Republic. , 2017. hal-01888814

HAL Id: hal-01888814

<https://hal.science/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.

Drouin G¹, Catheline D¹, Baudry C², Le Ruyet P², Legrand P¹.

contact : gaetan.drouin@agrocampus-ouest.fr

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 (Delsal, 1944). FA were then derived into FA methyl esters whose composition was analysed by gas chromatography coupled with mass spectrometry (GCMS).

Results were expressed as mean \pm SEM. Significance between groups was evaluated by Student t-test. * $p < 0,05$; ** $p < 0,01$; *** $p < 0,001$; td $0,1 < p < 0,05$

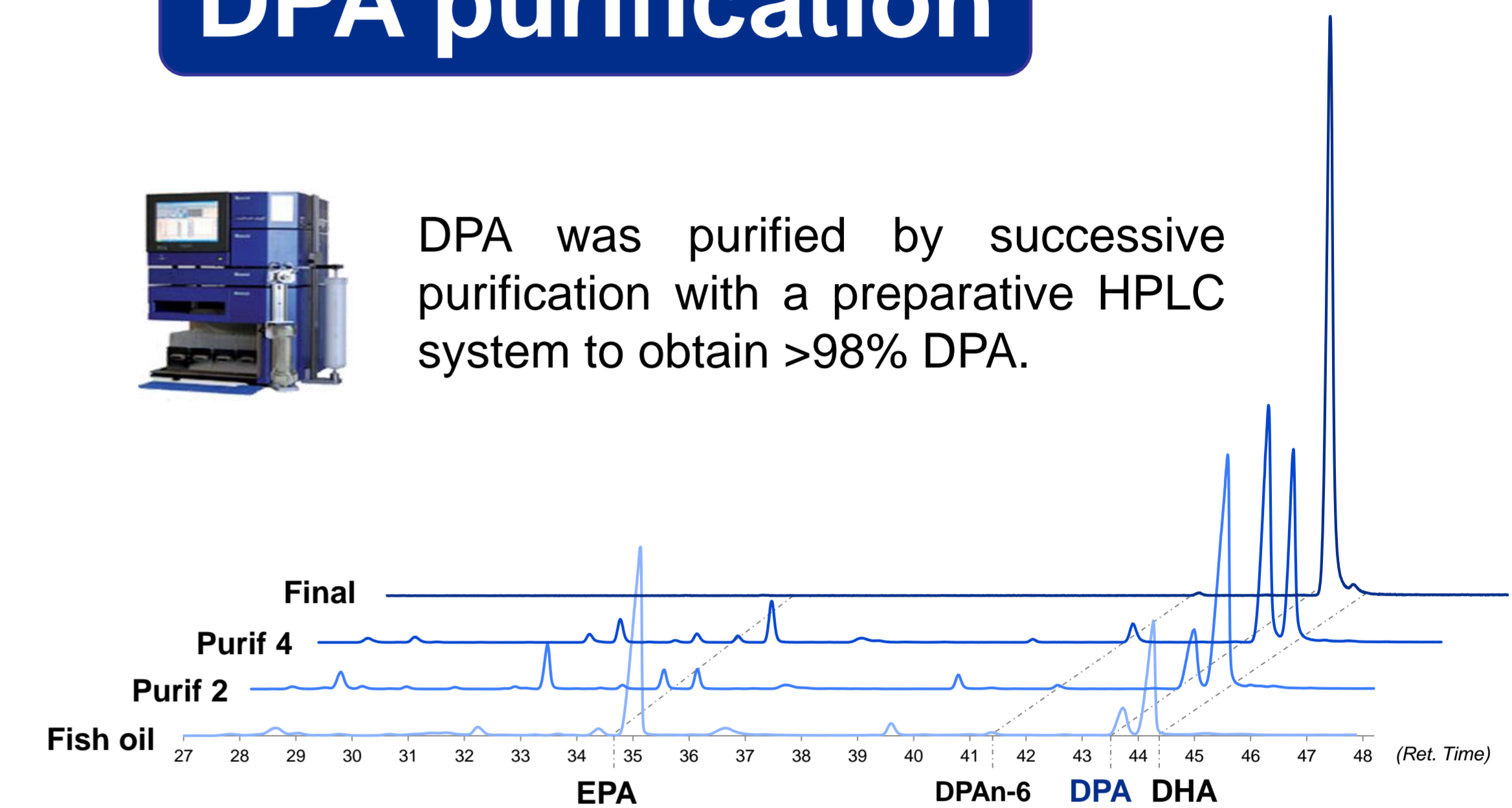
An Orthogonal Partial Least Square Discriminant Analysis (OPLS-DA) was performed on reduced centered Log-Ratio of FA for all tissues to determine the most discriminant variables between diets. Cross Validation ANOVA was used to validate the model. Colored variables have a Variable Importance in the Prediction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

Diets : % FA	Ctrl	N-3 DPA
Saturated (14:0 to 22:0)	21.0	20.9
16:0 (palmitic acid)	17.2	17.1
Mono-unsaturated	65.3	65.0
18:1 n-9 (oleic acid)	63.3	63.0
Poly-unsaturated	13.7	13.6
18:2 n-6 (LA)	11.3	11.3
18:3 n-3 (ALA)	2.3	2.3
LA/ALA ratio	4.9	4.9
22:5 n-3 (n-3 DPA)	0	0.5

DPA purification

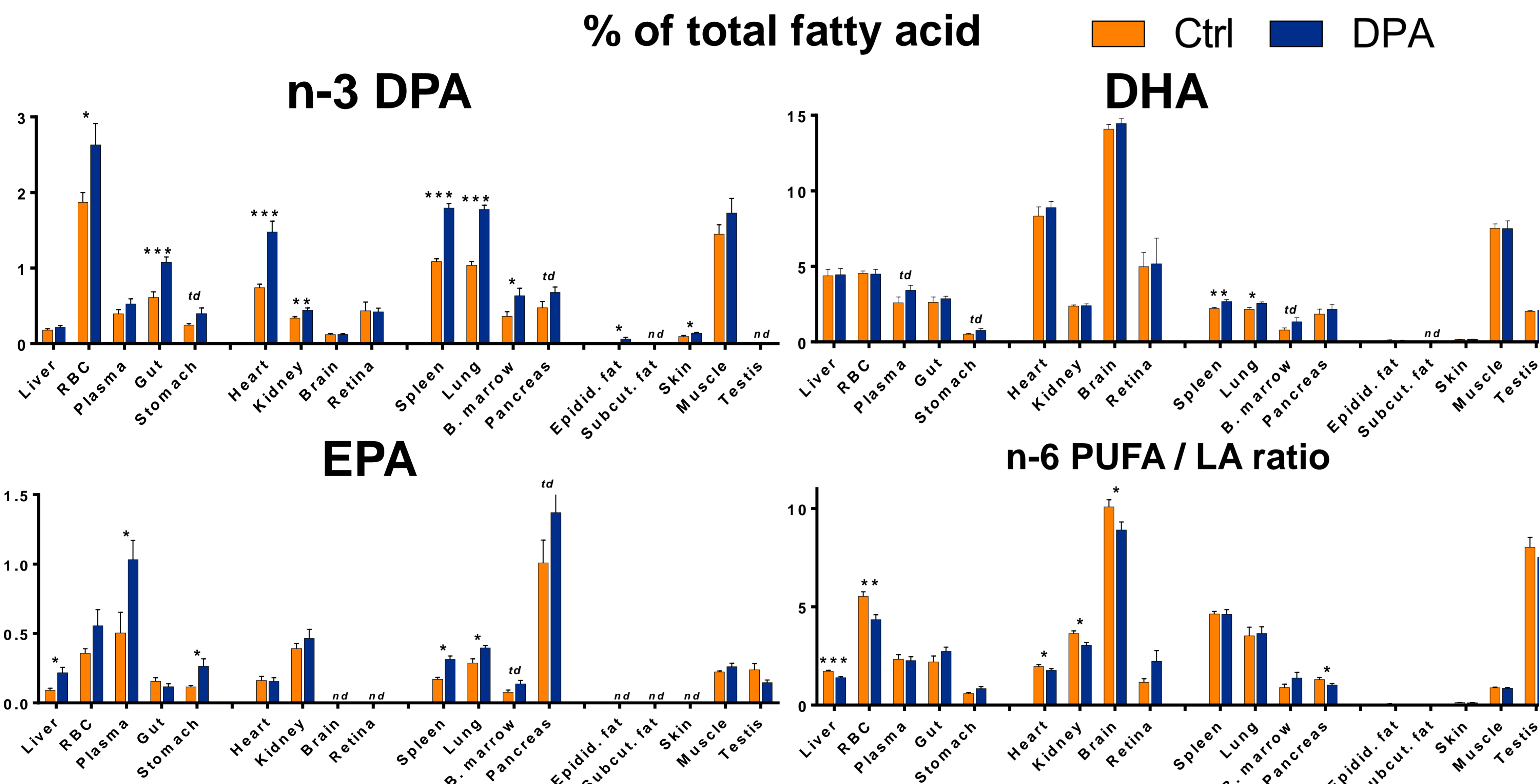


DPA was purified by successive purification with a preparative HPLC system to obtain >98% DPA.



Results

Univariate analysis



n-3 DPA was increased in most tissues when diets were supplemented with this FA, and particularly heart, spleen, lung and bone marrow but not in liver, plasma, brain, retina and muscle.

DHA profile was not impacted by the DPA diet except in spleen, lung and bone marrow where it was increased.

EPA proportion was increased in some tissues like in the liver. This FA might come from the peroxisomal retroconversion of DPA into EPA.

The **n-6 PUFA / LA ratio** was decreased in some tissues and especially in the liver, suggesting a decrease in the n-6 PUFA conversion. This result could be due to a substrate competition between n-3 PUFA and n-6 PUFA for the different enzymes of the conversion pathway, since these enzymes are common for both families.

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.

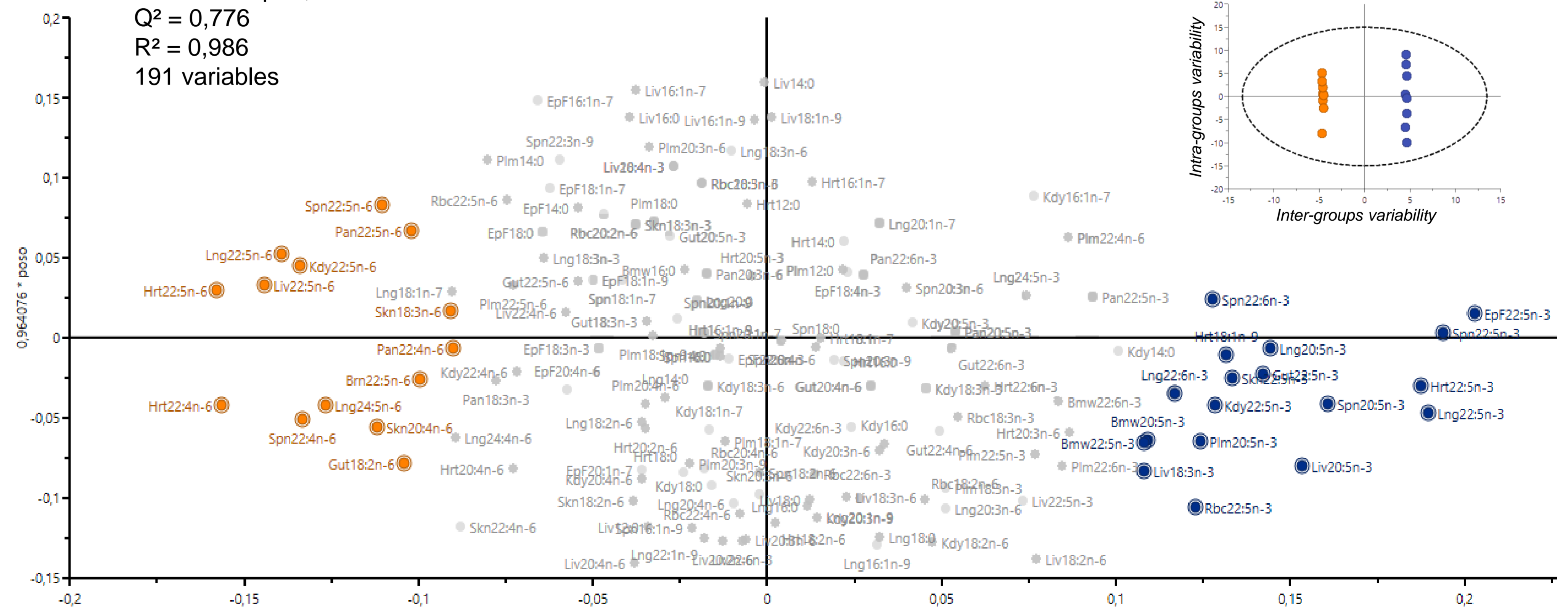
The changes in FA proportions concerned PUFA metabolism only; suggesting a specific action of n-3 DPA supplementation on these pathways.

Beyond an increase in all n-3 PUFA, the n-3 DPA supplementation induced principally a decrease in n-6 docosapentaenoic acid (22:5 n-6) and arachidonic acid (20:4 n-6).

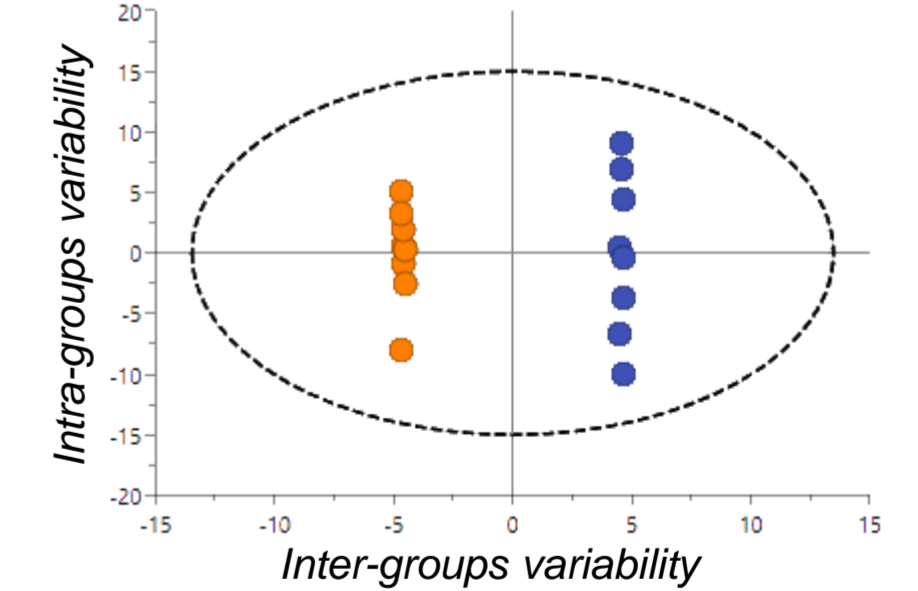
Model validation

CV ANOVA $p < 0,05$
 $Q^2 = 0,776$
 $R^2 = 0,986$
 191 variables

Loadings scatter



Score scatter



Bm : brain ; Hrt : heart ; Kdy : kidney ; Liv : liver ; Lng : lung ; Skn : skin ; Spn : spleen ; Pan : pancreas ;

Mus : muscle ; Ret : retina ; Stc : stomach ; ScF : subcutaneous fat ; Tes : testis.

Bmw : bone marrow ; EpF : epididid.fat ; Hrt : heart ; Kdy : kidney ; Liv : liver ; Lng : lung ; Plm : plasma ; Rbc : red blood cells ; Skn : skin ; Spn : spleen ;

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 & al., 2016, PLEFA) (Du & 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.

