OCL 2020, 27, 25
© C. Leray, Hosted by EDP Sciences, 2020
https://doi.org/10.1051/ocl/2020018

OCL Oilseeds & fats Crops and Lipids

Available online at:
www.ocl-journal.org

INTRODUCTION OPEN ACCESS

Lipids and Health[☆, ☆☆]

Claude Leray (Directeur de recherche)[*]

CNRS, Toulon, France

Received 9 March 2020 – Accepted 20 March 2020

To fully comprehend the recent revolution in ideas that consists in identifying increasingly closer links between food lipids and health, it is necessary to recall the previous revolutions in thought brought about by a small number of researchers.

Shortly after lipids emerged as a concept and, thanks in 1823 to Michel-Eugène Chevreul, the structure of the most important of them became known, the English chemist and doctor William Prout taught physiologists that lipids are as an important component of food as sugar and protein. We owe the first experimental bases of our nutritional knowledge on lipids to the American physiologist Francis Bénédict who in 1907 proved that the lipids contained in food are used to produce muscular energy. Throughout the 20th century, researchers and clinicians drew attention to nutrition as one of the major factors involved in the occurrence of various pathologies; this is the basis of modern dietetics. It should also be recalled that prior to the Second World War no country had issued recommendations on the quantity and quality of lipids to be consumed by its population. That situation changed in the 1960s in the United States, when cardiologists recommended reductions in the overall fat intake and in the proportion of saturated fatty acids in particular. Though it was not until 1982 that R.T. Holman described the first case of linolenic acid (18:3 n-3) deficiency in humans, the essential nature of certain fatty acids (most notably omega-3) had been established by G.O. Burr as far back as 1929.

The contributions that dietary lipids make to a range of pathologies have been widely explored over recent years. This issue of OCL takes stock of a number of important areas, which are still very controversial, such as the role played by omega-3 in energetic balance, especially if we consider the complementarity of white and brown adipose tissue (Pisani and Ailhaud, 2019). The authors point out that excessive consumption of omega-6 is likely to counteract the positive effects of omega-3, the former promoting weight gain while the latter limit it, largely by reducing inflammation accompanied by activation of brown adipose tissue. It therefore seems definitively proven, as in other areas, that the omega-6/omega-3 ratio is more important than the amount of omega-3 alone.

The role that the two types of essential fatty acids (omega-6 and omega-3) plays in the onset of obesity and especially the physiological mechanisms involved are analyzed well in the article by Simopoulos (2020). She specifies the key role of endocannabinoids, derivatives of omega-6, in the increase of fat deposits, by insisting on the reverse action of omega-3 and the need for a reduction of the omega-6/omega-3 ratio in the diet. As she points out, since the genetic component of the risk of obesity is well established, it is urgent that we envisage preventive measures at the nutritional level for the people concerned, notably the use of omega-3 supplements. Simopoulos emphasizes the need to personalize lipid intake, *i.e.*, to take into account the increasingly well-known relationships between nutrients, genes and pathologies.

The possible origin of the inflammation associated with a nutritional imbalance in essential fatty acids is the subject of a detailed review by Buaud (2020). He reviews the last forty years' scientific literature on the mechanisms linking the content and balance in our food of omega-6 and omega-3 and the functioning of the immune system. It is clear that these mechanisms involve eicosanoids derived from omega-6. In addition, it would appear that an effect in the immune cells themselves of the omega-6/omega-3 balance must also be taken into account, one that acts directly on the synthesis of cytokines.

If the lipid mediators resulting from omega-3 seem to be the most positive response to inflammatory flares, it must be recognized that the interaction between the two types of essential fatty acids is complex and remains incompletely understood.

The contribution of natural *trans* fatty acids, from dairy products (milk and dairy products) and ruminant meats, in the fight against the 21st century plagues of inflammation, obesity and type-2 diabetes is the subject of a detailed and well-documented review (Guillocheau *et al.*, 2019). The authors rightly insist on the fact that natural *trans* fatty acids in food, not those resulting from artificial interventions, have particular physiological beneficial effects on the aforementioned pathologies. Epidemiological studies reinforce the certainties derived from over thirty years of working on animals.

☆ Contribution to the Topical Issue "Lipids and health / Lipides et santé"

☆☆ The French version is available in "Supplementary Material".

*Correspondence: leraycl@gmail.com

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (https://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

It has long been known that low birth weights are most frequently found in the lower socio-economic strata. This was swiftly attributed to an imbalance in the lipid intake, in quantity as well as in quality. van der Beek and Oosting (2020) take stock of the important question of the impact on the health of children of the quality of lipids ingested during their first 1000 days. They are right to insist that during the period of being breastfed (a source of nutrition recognized as highly beneficial to the child's survival) through to the age of two, growth in body and brain is faster than during any other period in life. Recent research supports the idea that specific improvements in the quality of dietary fat, its richness in omega-3, in both mothers and young children, can reduce the risk of obesity and other pathologies that appear later in life.

The effect of diet on the nervous system was explored only after the complex lipid composition of the brain had become sufficiently understood. So, it is only during the last fifty years that the dependence of brain function on fatty acids, especially omega-3, has been brought to light. This is probably the most promising area of all neuroscience. The importance of breastfeeding in brain development is reviewed and discussed in detail by Schipper *et al.* (2020). The authors emphasize the need to re-examine the composition of industrially produced infant formula so that they provide sufficient quantities of omega-3, while restricting omega-6, without forgetting the essential complex lipids (gangliosides, sphingomyelin), thereby reproducing the composition of the membranes of breast milk fat globules.

The explanation for the undisputedly higher frequency of many chronic diseases among the French population over recent years has often been linked to a progressive deterioration in the quality of diet. Duru (2019) traces the evolution in France of omega-6 and omega-3 food intake over the past 55 years. He shows that after a deterioration in the lipid intake for almost forty years, as in all Western countries, hope has emerged since the 2000s. In fact, we have observed over recent years a decrease in the consumption of omega-6, saturated fatty acids, and an increase especially in that of omega-3. We should welcome the efforts of farmers to promote oleic sunflower oil (low in omega-6) and rapeseed oil (rich in omega-3), efforts which lead indirectly to improvements in the composition of essential fatty acids in breast milk. Despite these encouraging results, efforts must be made to reach the officially recommended levels, in particular those concerning the balance between omega-6 and omega-3. Tangible results will only be obtained once coordination has been achieved between agricultural policies, the agro-food industry and above all national health policy.

Regulators at the highest level, the Commission of the European Union, have long taken an interest in the lipid content of the foods sold across the continent. In order to coordinate the composition of a wide variety of current and future foods, the laws enacted must obviously evolve in step with the discoveries of researchers and their transposition by the industrial sector. The very clear review by Bucchini (2019) takes stock of this fundamental aspect of consumer protection. An important part is devoted to omega-3 and trans fatty acids, their origin, their use and the acceptance of scientifically indisputable claims. In addition to the nutritional aspects, the problems linked to the increasing use of lipids in the cosmetics industry are also discussed.

From a more general point of view, the search for synergy between public initiatives and private efforts in the food sector, all directed towards improving the quality of available foods, is the subject of the review by Sebillotte (2019). She examines the modalities of the National Nutrition and Health Program (PNNS) and analyzes in detail the usefulness and the limits of such recommendations as formalized by the French government. She articulates a number of reservations regarding the effectiveness of the government's mode of action through agreements with professional bodies. She insists, correctly in my view, on the praiseworthy contribution of this plan to combatting the pathologies linked to poor diet, while stressing that it is nevertheless insufficient in view of the urgency of the situation. This review highlights the difficulties encountered by the authorities in sending clear signals to economic actors and gaining their support.

Two articles refer to technical processes. One (by Gravé *et al.*, 2019) concerns the optimal yield of linolenic acid from new crops on French soil. The importance that the production of plants rich in omega-3 has taken in the enrichment of the human diet and possibly that of animals too, led the authors to investigate a plant native to Central America and Mexico, but likely also to grow successfully in northern climates, a new cultivar of Chia Oruro. The authors highlight the importance for the production of lipids of the seeds' degree of maturity, the maximum yield being obtained for advanced maturities, with a very high content of oils in linolenic acid (60%) and in γ-tocopherol (48 mg/100 g). These numbers are such as to allow us to imagine a fruitful future for this new source of nutrients essential for human health.

The article by Naeem *et al.* (2019) describes methods of extracting lipids from seeds cultivated with a view to optimizing the recovery of fatty acids, vitamin E vitamers and phenolic compounds. These seeds are those of a Hibiscus of which other parts of the plant are industrially exploited in Egypt. Among the methods considered as "green", the authors show the advantages of extraction *via* supercritical CO_2 which leads to better yields of fatty acids, tocopherols and antioxidant activity. These results will be invaluable to the agri-food industry in developing by-products to supply the food or cosmetic industries with quality products that respect the environment.

Supplementary Material

French version. Lipides et santé.
The Supplementary Material is available at https://www.ocl-journal.org/10.1051/ocl/2020018/olm.

References

Buaud B. 2020. How fats we eat modulate our immunity? *OCL* 27: 22.
Bucchini L. 2019. Nutrition and health claims in Europe: Oils & fats related claims, regulatory and labeling challenges. *OCL* 26: 48.
Duru M. 2019. Trends in agri-food choices for health since the 1960s: The case of fatty acids. *OCL* 26: 44.
Gravé G, Mouloungui Z, Poujaud F, *et al.* 2019. Accumulation during fruit development of components of interest in seed of Chia (*Salvia hispanica* L.) cultivar Oruro© released in France. *OCL* 26: 50.

Guillocheau E, Legrand P, Rioux V. 2019. Benefits of natural dietary trans fatty acids towards inflammation, obesity and type 2 diabetes: defining the n-7 trans fatty acid family. *OCL* 26: 46.

Naeem MA, Zahran HA, Hassanein MMM. 2019. Evaluation of green extraction methods on the chemical and nutritional aspects of roselle seed (*Hibiscus sabdariffa L.*) oil. *OCL* 26: 33.

Pisani DF, Ailhaud G. 2019. Involvement of polyunsaturated fatty acids in the control of energy storage and expenditure. *OCL* 26: 37.

Schipper L, van Dijk G, van der Beek EM. 2020. Milk lipid composition and structure; the relevance for infant brain development. *OCL* 27: 5.

Sebillotte C. 2019. Efficiency of public-private co-regulation in the food sector: the French voluntary agreements for nutritional improvements. *OCL* 26: 34.

Simopoulos AP. 2020. Omega-6 and omega-3 fatty acids: Endocannabinoids, genetics and obesity. *OCL* 27: 7.

Van der Beek EM, Oosting A. 2020. Nutritional programming in early life: the role of dietary lipid quality for future health. *OCL* 27: 15.

Cite this article as: Leray C. 2020. Lipids and Health. *OCL* 27: 25.