



Introductory remarks on some minor components of the fat fraction of milk and their role in nutrition - Note 1

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Given that it is now widely accepted that the key events responsible for reducing human lifespan are linked to the high risk of cardiovascular events, many sources have suggested that the risk of these events can be directly associated with the action of saturated fatty acids (FAs), *trans*-FAs and cholesterol (CHOL) in pathologies related to obesity and type-2 diabetes. It goes without saying that the origins of obesity and type-2 diabetes have unfortunately been proven time and again to be rooted in dietary excesses and bad habits, as well as in genetics. For the sake of clarity, it is therefore necessary to consider that the results of dietary excesses and bad habits are precisely what have led to hastily identify FAs and *trans*-FAs (saturated fatty acids) as the culprits responsible for compromising the cholesterol balance and the sugar metabolism balance. The oversimplifications that are often made when describing the dynamics of metabolic phenomena are detrimental because they distort certain realities: by simplifying, one comes to identify FAs and *trans*-FAs as the compounds responsible for a series of dysfunctions and the frantic and urgent search for the culprits leads to stigmatizing a series of 'saturated' compounds that do nothing more than live in a 'natural' balance with 'unsaturated' compounds, as happens precisely in the structural reality of the fat fraction of milk. This is the first note on the topic of 'minor but essential compounds': the reader will have access to periodic publications on the subject.

Fatty acids are not present in milk lipids as free compounds except in quantities of the order of 0.1 - 0.4% (values expressed on fatty matter) but predominantly as esterified triacylglycerols (triglycerides) in the amount of 96 - 98%, and to a lesser extent as diacylglycerols (diglycerides) and monoacylglycerols: fatty acids are also present to a limited extent as 'phospholipids and sphingolipids'. In particular, the content in percent of the latter, calculated in relation to total milk lipids, is within the narrow limits of 0.2 - 1.0 %, but analytical experience in the biological field shows that the compounds with the greatest biologically 'targeted' effect are precisely those least quantitatively represented in the world of animal and plant matter and in food in general.

The intimate structure of 'phospholipids' is worth mentioning: these are the essential biomembrane components of cellular structures and contain phosphoric groups in their intimate molecular structure. The



most important phospholipids are: phosphatidylcholine, phosphatidylserine, phosphatidylethanolamine, and sphingomyelin. These are compounds that have a positive effect on neurological syndromes such as Alzheimer's disease and Parkinson's disease, on reducing cardiovascular risk, and on rheumatoid arthritis.

'Sphingolipids', on the other hand, are a particular class of phospholipids that contain an amino acid called 'sphingosine' in their intimate structure: these lipids are essential components of nervous tissues.

Therefore, through the intake of milk fat, higher organisms of all kinds acquire the essential and irreplaceable elements for growth. Later, in adulthood, milk also provides the substances that replenish biological systems in natural decline.

However, it is also worth pointing out some of the particularly targeted functions that saturated fats perform. These can be found in some of the essential citations, and those interested should refer to textbooks on the physiology of nutrition for more comprehensive information.

Among the essential notes to be mentioned to debunk the myths about the damage claimed by a fringe of the press about the consumption of saturated triglycerides is that concerning the fatty acid C18:0 (saturated), which is now finally considered to play a role in lowering plasma cholesterol. Furthermore, the saturated fatty acids C4:0 and C6:0 and the medium-chain saturated fatty acids C8:0 and C10:0 are also considered to have antibacterial and antiviral properties, as stated by H. Hilmarsson et al. in Arch. Vir 151, 1217-1224 (2006) in *Virucidal effect of lipids on visna virus, a lentivirus related to HIV*, and also by H. Thormar and H. Hilmarsson in Chem. Phys. Lipids 150, 1-11 (2007) in *The role of microbicidal lipids in host defence against pathogens and the potential as therapeutic agents*, and also by J.B. German in Nutr. Bull 24, 203-209 in *Butyric acid: a role in cancer prevention* (1999).

In addition, in connection with these citations concerning the function of short- and medium-chain saturated fatty acids, it should be noted that these lipid components are absorbed by the intestine and transported into the circulatory system without undergoing new synthesis and are incorporated into the tissues to a greater extent than is possible for other fatty acids with a higher number of carbon atoms and this has unquestionable benefits in situations characterized by gastrointestinal disorders. P.W. Parodi reports on this in *Advanced Dairy Chemistry, 3rd Ed. Springer U.S. (2006)*.

TFAs (or Trans-saturated Fatty Acids), such as octadecenoic acid, deserve particular attention. They have traditionally been considered as being involved in the development of cardiovascular disorders but are now being reassessed in terms of their biological activity.

It should be borne in mind that the studies that have led TFAs to being considered "deplorable" for their activity were carried out on TFAs obtained by biohydrogenation of vegetable oils containing C18:1 *trans* 10



and C18:1 *trans* 9, i.e., from two *trans* oleic acid structures (Y. Wang, 2012). By doing so, it was ignored that the TFAs contained in the fatty matter of milk consist mainly of *trans*-vaccenic acid, a C18:1 *trans*-11 acid, which has been shown to have a positive activity in atherosclerotic syndromes (I.A. Brower et al., *Trans fatty acids and cardiovascular health: research completed*, in Eur. J. Clinical Nutr, 67, 541-547 (2013)).

Trans-vaccenic acid is also the physiological precursor of rumenic acid (RA), which R.P. Jutzler van Wijlen and P.C. Colombani consider as a potent regulator of lipid metabolism, as demonstrated in *Grass-based ruminant production methods and human bioconversion of vaccenic acid with estimations dietary intake of conjugated linoleic acids* and published in Int. Dairy Journal 20, 433-448 (2010).

The limited information provided in this note only serves to confirm that biochemical research is constantly evolving, and that the significant contribution of analytical chemistry is essential to get to the heart of organic structures to precisely consider the minor components of milk, to which nature has assigned tasks hidden in a huge body of structural information that can never be obtained from conventional analyses. The resulting biochemical considerations are such that health and nutritional reviews are required on a daily basis. The BSC's focus on advanced analytical investigations, a unique and essential source for enhancing the dairy world, is therefore no coincidence: in fact, it is now necessary to go beyond the common determinations made as a result of the need to draw up label data for the characterization of dairy products, and to give consumers more detailed information that provide a more conscious and truthful picture of reality. It is certainly no trivial task, but it will be the only way to firmly and concretely combat attempts at producing dairy-like products, which can only be called 'substitutes', and whose most efficient marketing tool is their total reliance on deliberately superficial consumer misinformation.