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## Margarines with linseed oil: nutritional interests, specificities and development

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**Abstract** – The last national study on individual food consumption confirmed that French consumers have a very low intake of omega 3 alpha-linolenic acid (ALA), as well as an inadequate balance between omega 6 and omega 3 fatty acids, that should be compensated with a more important intake in omega 3. Certain types of margarines and spreads offer the possibility to increase the intake in this nutriment, in particular margarines containing linseed oil. Their high content of ALA allows, on the basis of a daily consumption of 20 g, to counterbalance, partially or totally, the low intake in omega 3. However, these spreads require a quite particular attention in their development and their production, mostly because of the relative instability of the linseed oil in the oxidation process and the need to avoid developing of off tastes until the end of shelf life.

**Keywords:** Margarines / linseed oil / omega 3 / nutrition

**Résumé – Margarines enrichies en huile de lin : intérêts, spécificités et développement.** Les dernières enquêtes nationales de consommation ont confirmé les apports très insuffisants en oméga 3 de type acide alpha-linolénique (ALA) de l'alimentation des Français ainsi que le déséquilibre dans les apports entre les oméga 6 et oméga 3 qui devrait être compensé par un apport plus important en oméga 3. Les margarines de table sont des aliments très intéressants pour retrouver des apports suffisants en acides gras insaturés et poly-insaturés, notamment les margarines contenant de l'huile de lin très riche en ALA. En remplacement d'autres matières grasses saturées, ce type de margarine permet, sur la base d'une consommation quotidienne de 20 g, de combler une partie, voire la totalité de l'insuffisance des apports en oméga 3. Cependant ces margarines demandent une attention toute particulière dans leur développement et leur fabrication, en particulier du fait de l'instabilité relative de l'huile de lin à l'oxydation et de la nécessité d'éviter toute évolution significative du goût jusqu'à la fin de durée de vie des produits.

**Mots clés :** Margarines / huile de lin / oméga-3 / nutrition

### 1 Introduction

Recommendations for French population on daily food intakes of fats, and especially of essential fatty acids like linolenic acid (omega 3 ALA), have been first published in 2001 and have been revised in 2011 by ANSES (French Agency for Food, Environmental and Occupational Health & Safety). Recommended daily consumption of ALA for an adult was increased from 0.8% of total Energy intake to 1% (equivalent to 2.2 g per day for an adult with a 2000 kcal diet), due to positive observation regarding prevention of cardiovascular diseases, obesity and inflammatory disease.

In addition, we recall in this paper that several studies show intake of alpha-linolenic acid by French population remain insufficient. Developing foods with higher content of omega 3 is

a way to solve or reduce this deficiency and help consumers to improve their diet.

Spreads and margarines are significant contributors to unsaturated fatty acids intake and improvement of these products: adding oils rich in omega 3 like linseed oil is in the nutritional interest for French population.

### 2 Deficiency in omega 3 is clearly demonstrated in France

In 2001, a publication by Combe and Boué (Combe and Boué, 2001) based on a population from the west of France, shows that, if the average consumption of omega 6 (linoleic acid) is sufficient with regards to recommendations, quantities of omega 3 are very low and have to be multiplied at least by two (Combe and Boué, 2001).

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**Table 1.** Extract of ONIDOL press release, Février 2015.

	Fatty acids	Average intake	ANC
Lipids	Total lipids	38.0%	35–40%
	ALA <sup>1</sup>	0.4%	1%
Oméga 3	DHA <sup>2</sup>	137 mg	250 mg
	EPA <sup>3</sup>	102 mg	250 mg
Oméga 6	LA <sup>4</sup>	3.9%	4%
Saturated fatty acids		14.4%	≤12%

ANC: recommended nutritional intake for an adult on basis of 2000 kcal/day – report from ANSES, May 2011. Value, except for DHA and EPA, are expressed in % of total energetic intake without alcohol. Value of EPA and DHA are expressed in mg/day.

More recently, a study based on the INCA 2 individual food consumption French survey confirms that French population has insufficient intakes in omega 3 (Pasteau *et al.*, 2015).

The daily average intake in poly-unsaturated fatty acids omega 3 for French population is twice lower than the recommended contributions (Tab. 1) and in average, the lack in omega 3 (ALA) is about 1.2 g per day and adult.

This survey shows also that French people eat 10 times more omega 6 than omega 3 when the target considered by nutritionists and PNNS\* is less than 5 times more.

### 3 Spreads and margarines with linseed oil are rich in omega 3

#### 3.1 Margarines composition

Composition of margarines significantly evolved during this last 20 years, with a parallel decrease of total fat and saturated fatty acids content and an increase of poly-unsaturated fatty acids. If margarines, from a regulatory point of view, do contain from 80 to 82% of fat, the current French market mostly offers light margarines or spreads, containing mostly 60% of fat or less (source FNCG<sup>1</sup>). The consumer usually names all these products as margarines.

Refined linseed oil has been authorized since 2008 only in mixture in edible oils or spreads in France and even it is one of the ‘best’ oil to increase significantly omega 3 content – it contains in average 54 g ALA/100 g – only few margarins on French market contain linseed oil in their recipe.

#### 3.2 Margarines with linseed oil present a real nutritional interest

Margarines containing linseed oil present noticeable amounts of omega 3, from 3 g to 7 g/100 g, depending on fat content of spread (Tab. 2). In all these products, linseed oil is mixed with other liquid oils and not used as the only source of polyunsaturated fatty acids.

Nearly all these margarins are rich in omega 3: more than 0.6 g/100 g and /100 kcal. Their consumption helps to improve daily intake in omega 3-ALA: with a portion of 20 g/day, the intake of omega 3-ALA is from 0.6 g to 1.4 g while the average deficiency is 1.2 g.

<sup>1</sup> National French association of oils and fats processors, [www.fnccg.fr](http://www.fnccg.fr).

Significant intake of omega 3 is beneficial for the preservation of a good health, especially on cardiovascular health and EFSA authorized a specific claim related to this nutrient. ALA contributes to the maintenance of normal blood cholesterol levels (Reg UE 432/2012, EFSA opinion 2009;7(9):1252, 2011;9(6):2203).

In addition, in relation with part of linseed oil in recipe and also composition of other oils, these products help to rebalance the ratio between omega 6 and omega 3 fatty acids (Tabs. 2 and 3).

Consumption of margarine with a low omega 6/omega 3 ratio automatically limits quantities of omega 6 for the same intake of omega 3 and allows coming closer to a ratio of 5 which is considered as better for health. The imbalance in this ratio leads to a physiological state propitious to the inflammatory state and to associated pathologies, like the cardiovascular diseases.

### 4 Nutritional interest of margarins with linseed oil are maintained when cooked

If consumption of margarins directly spread on bread is important, these products are also used for cooking food or making pastries. Therefore it’s important to check the availability of omega 3 when used by consumers. As St Hubert, we have worked with ITERG and analysis have been conducted after different types of culinary preparations with a margarine rich in omega 3 containing linseed oil.

Results show that, with the considered recipe, more than 95% of omega 3 are preserved during cooking (Tab. 4).

### 5 Development of margarins with linseed oil

Addition of linseed oils in margarins requires attention on some parameters.

#### 5.1 Quality of linseed oil

Production of margarines, due to presence of water and emulsion process, requires high quality oils in term of taste and stability, obtained, in particular, by an adapted refining process.

Refining of linseed oil must avoid the neoformation of unwanted components like trans fatty acids; they may appear due to a high content of poly unsaturated fatty acids, if temperature and time are too important. Tests have been conducted with different suppliers and processes in order to avoid significant quantities of these contaminants (*cf.*, Tab. 6).

Fine tuning the refining processes is key to maintain nutritional interest of recipes with linseed oil and avoid a trans fatty acids content superior to 0.5 g/100 g in products.

#### 5.2 Stability of linseed oils during storage

Stability in the oxidation process over time of the linseed oil is low, compared to rapeseed or sunflower oils (Fig. 1), mainly due to high quantity of unsaturated fatty acids.

**Table 2.** Margarines containing linseed oils (Mintel 2015 + internal data).

Product	g fat/ 100 g product	g ALA		Rich in omega 3	omega 6/ oméga 3
		/10 g fat	100 g product		
	50%	1.1	5.5	YES	1.4
	60%	1.15	7	YES	3.3
	35%	0.86	3	YES	5
Margarine Données report ONIDOL- février 2015	58%	0.25	1.5	NO	8
	70%	0.44	3	NO	
	65%	0.77	5	YES	4
	78.6 %	0.36	2.8	NO	NC
	78.6 %	0.97	7.7	YES	

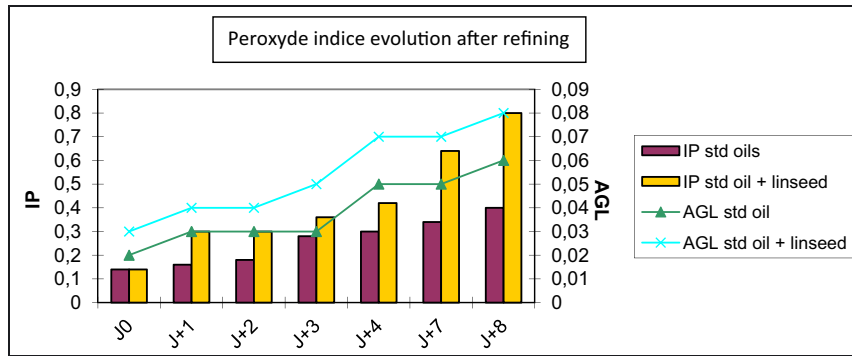


Fig. 1. Evaluation of peroxide value during storage of different oils (A. Fleuret, St Hubert, 2011).

Table 3. Average composition of different spreads in unsaturated fatty acids omega 3 and omega 6 (internal data).

	Omega 3 ALA (g/100 g)	Omega 6 LA (g/100 g)	O6/03
Linseed oil	54	16	0.3
Rapeseed oil	9.5	19	2
Soja	7.8	52	6.7
Sunflower	0.1	60	> 500

Table 4. Quantity of ALA before and after cooking margarine with linseed oil (ITERG, 2012).

Use of margarine with linseed oil	Oméga 3 g /100 g fat		
	before cooking	after cooking	% of loss
cooking of vegetables in the frying pan	10.5	10.3	1.9
cooking in cocotte of turkey filet	10.5	10.2	3.2
cooking in oven (quatre quarts)*	8.8	8.8	0

\* Fat of eggs mix with fat of margarine.

Table 5. Extract of typical specification for oil used in margarine production.

	Target
Peroxyde index	<1 meq/kg
Free fatty acids	<0.2 g /100 g
Taste	Neutral
Iron	<1 ppm

Specific conditions to avoid early oxidation have to be taken during storage to obtain products with good organoleptic properties.

## 6 Conclusion

Developing the use of linseed oil in margarins is interesting from a nutritional point of view, mainly due to the high

Table 6. Effect of composition and refining of linseed oil on trans fatty acids content of fat (A. Fleuret ST Hubert, 2011).

Oil/ supplier	% Linseed oil g/100 g product	oméga 3 of product g/100 g of product	Trans fatty acid on fat g/100 g
Standard recipe (rapeseed oil + hardstock)	0	3.1	0.6
standard recipe + linseed oil-refining A	4.3	5	1
standard recipe + linseed oil-refining B	4.3	5	<del>2</del>

content of omega 3 ALA of linseed oil and the improved balance between omega 6 and omega 3 derived from the use of linseed oil. But its very high content in poly unsaturated fatty acid in linseed oil increases the risk concerning of oxidation and apparition of off-tastes, which has to be managed by precise requirements concerning all production process, from the refining to the storage of spreads tubs.

Spreadable fats with linseed oil are already present on the French market, they represent a good opportunity for consumers to rebalance their lipidic diet.

## References

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