

DAIRY PRODUCTS NUTRITION & HEALTH - MAJOR STUDIES

# BEST *of*

2016





## Milk, cheese, yogurt, milk fat... What's new, doc?

Whether it's consumed as-is or in the form of cheese, yogurt or other dairy products, milk is an essential part of our diet.

Since 2012, Best Of has helped you better understand the health benefits of dairy products, including through many special editions: the "milk special", the "cheese special", the "yogurt special" and the "milk fat special".

### What's happened since then?

Over 2,000 scientific studies have been published on the relationship between dairy products and health. Many of these studies have demonstrated the benefits of dairy products for all (including the young, the not so young, seniors, athletes...) and their role in the prevention of many illnesses (including diabetes, hypertension and overweight).

This **new Best of 2016** presents an overview of the scientific advances related to the health benefits of milk, cheese, yogurt and milk fat.

### Enjoy without moderation!

#### Dr Yvette Soustre

Nutrition Director, French National Dairy Council (CNIEL)

Each year, scientific studies that are good for the industry are published in the nutrition and health field. In order to keep track of them and make them easy for dairy professionals at the different levels (regulations, lobbying, communication, R&D etc.) to use, Cniel's scientific and technical department created "Best Of". This publication compiles summaries (written for you) of (positive) articles on a given topic. They are written in language that is as simple as possible in order to be as accessible as possible and convey the essential information.

# BEST of

A theme-based publication  
of the Scientific and Technical Affairs Division of CNIEL  
aimed at professionals in the dairy industry

#### For this issue

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# "Milk aversion? Treat it with... milk"

- A 21-day "rehabilitation treatment" for 27 milk-averse patients.
- Progressively adding milk to meals: reduces aversion and symptoms of intolerance; teaches milk dislikers to enjoy milk; improves diet quality, particularly calcium consumption.

**Milk**  
What's new  
since... 2013

## Improving Milk Intake in Milk-Averse Lactose Digesters and Maldigesters.

O'Connor LE, Eaton TK, Savaiano DA.  
Department of Nutrition Science, Purdue University, West Lafayette, IN/USA.  
J Nutr Educ Behav. 2015; 47(4): 325-30.

*"The results suggest a reversal of milk avoidance and the possibility that milk avoiders can increase likeness and incorporate milk into their diet after exposure."*

**A**versions to one or multiple foodstuffs are not uncommon. This disgust and refusal reaction can have many different causes. For example, it can be difficult to eat foods that have previously made one sick (such as mussels). Even if the food in question was not the direct cause of the ailment (for example, dining on mussels just before the onset of a viral stomach flu), the effect is the same: the food and the illness are subconsciously associated (and the person cannot eat mussels again) ...

Milk aversion is no exception. While some people avoid milk due to lactose intolerance, suspected lactose intolerance, or because they simply "cannot digest" milk, others claim to dislike milk for no clear reason.

Studies have shown that many food aversions are reversible, and others, that it is possible to give increasing amounts of lactose to individuals who are lactose-intolerant or have difficulty digesting it (malabsorbers). American researchers wanted to test if milk aversion was reversible and if it was possible to get people to drink milk who would previously avoid it for whatever reason. Members of a large American university who claimed to be milk-averse were selected for the study. They were to follow a 21-day "milk rehabilitation treatment". After answering a diet questionnaire and taking a breath hydrogen test (to measure their degree of lactose malabsorption), they were instructed to drink increasing quantities of milk with lunch and dinner (days 1-7: 1/2 cup, or

approximately 120 ml; days 8-14: 2/3 cup; days 15-21: 1 cup, or 240 ml). The participants were then contacted 3 and 6 months later to reanalyse their behaviour with regards to milk and estimate their calcium consumption. 27 milk-averse subjects (20 women and 7 men) with an average age of 28 were selected at the beginning of the study. 15 of them could properly digest lactose (according to the test) and 12 qualified as "malabsorbers".

**The main results** for both the malabsorbers and the others:

- symptoms of intolerance were quite limited, due to the fact that the milk was consumed with food;
- the symptoms of intolerance diminished

throughout the study;

- adding milk to meals reduced the participants' milk aversion;
- the number of subjects claiming to like milk increased;
- diet quality, including calcium consumption, improved.

According to the authors, the decreased aversion could be due to the subjects gradually getting used to the taste of milk, as well as due to changes in the composition of their microbiota.

This suggests that milk aversion is a reversible phenomenon. Milk-averse individuals may be able to learn to like it simply by gradually adding it to their daily meals.

## Malabsorption and lactose intolerance

- In France, 30 - 50% of adults may be "malabsorbers", meaning that they display low levels of intestinal lactase activity and, therefore, incomplete lactose digestion.
- Not all malabsorbers are lactose intolerant: they do not all display clinical signs following lactose consumption.
- Approximately 20% of malabsorbers are believed to display clinical signs of intolerance after consuming 12g of lactose at once (the equivalent of approximately a quarter litre of milk).
- It can therefore be estimated that around 6 to 10% of French adults may experience clinical signs of intolerance after consuming 1/4 litre of milk.
- It is also estimated that 3 to 5% of French adults are intolerant to 7g of lactose. However, double-blind studies have generally not shown more clinical signs with this amount of lactose than with a lactose-free placebo.
- Irritable bowel syndrome causes many inaccurate diagnoses of lactose intolerance.
- It is possible for most intolerant individuals to continue to consume dairy products with a few simple dietary recommendations (smaller, more frequent servings, mixing milk with other foods, etc.).

Entre intolérance au lactose et maldigestion. Marteau A, et al. Cah Nutr Diet 2005; 40(HS1): 20-3.

# “MILK: the new sports drink”

Rehydration, performance, prevention of muscular damage, and even weight control: milk is here!

## Milk: good for rehydration

For the athlete, or for any active individual, hydration has an important effect on physical and mental performance. Dehydration can not only affect athletic performance, but it can also lead to serious health problems. The consumption of water and/or sports drinks, both during and after exercise, is essential to maintain fluid balance and prevent dehydration. Multiple studies performed on adult athletes have suggested that cow's milk may be a good alternative to these drinks. Milk's nutritional composition ensures proper post-exercise rehydration due to its water and electrolyte (e.g. sodium and potassium) content. In addition to the many studies demonstrating milk's effectiveness for rehydration, recent studies have shown that milk performs just as well as sports drinks <sup>(1)</sup>.

**And for kids?** Fewer studies have been done with children. Recently, a team tested the effect of a drink supplemented with milk protein on rehydration in 15 youths between 10 and 12 years old. The results were very positive. Other studies will, however, be necessary to more precisely determine the amount of milk protein that should be added <sup>(2)</sup>.

(1) Milk: An Alternative Beverage for Hydration? *Pegoretti C, Antunes AEC, Manchado-Gobatto FDB, et al. Food Nutr Sci 2015; 6(6): 547-54.*

(2) The Effect of Post-Exercise Milk Protein Intake on Rehydration of Children. *Volterman KA, Moore DR, Obeid J, et al. Pediatr Exerc Sci 2016; 28(2): 286-95.*

## Milk fat globule membranes improve athletic performance

Studies in mice have previously demonstrated that supplementing their food with milk fat globule membranes (MFGMs) improves their endurance and muscular function by stimulating neuromuscular development. This double-blind, placebo-controlled study evaluated the effectiveness of the same supplementation on 44 middle-aged Japanese subjects (22 women and 22 men). Over 10 weeks, 11 men and 11 women were given MFGMs (1g/day), and the rest were given a placebo (1g/day of powdered milk). The participants worked out twice a week. Multiple tests (measuring agility, trophicity and muscle strength) were performed at the beginning of the study, 5 weeks in and at the end of the study: the side step test, muscular cross-section area measurements, and muscle fibre conduction velocity (MFCV).

No changes were observed in the control group. In the MFGM-supplemented group, however, the researchers observed major improvements by the 10<sup>th</sup> week. The side step score and CSA significantly improved and the MFCV was greater than that of the control group.

Daily MFGM consumption combined with regular exercise may therefore improve physical performance in middle-aged adults.

Daily consumption of milk fat globule membrane plus habitual exercise improves physical performance in healthy middle-aged adults. *Ota N, Soga S, Hase T, Shimotoyodome A. Springerplus 2015; 4: 120.*

## MILK to attenuate muscular damage

In male athletes, it has been demonstrated that the consumption of 1/2 litre of milk after exertion may decrease the consequences of strenuous muscular exercise (decreased muscular capacity, increased markers of muscle damage and pain). A new study has now been performed on both men and women. Thirty-two athletes (16 men and 16 women) were divided into 4 groups of 8. A group of men and a group of women were made to drink 500 ml of milk right after exercise, and the others consumed a carbohydrate drink. Tests were performed after 24, 48 and 72 hours. While the results were more significant in the male group, they also demonstrated milk's effectiveness in decreasing muscle damage in female athletes.

The effect of milk on the attenuation of exercise-induced muscle damage in males and females. *Rankin P, Stevenson E, Cockburn E. Eur J Appl Physiol 2015; 115(6): 1245-61.*

## Milk for those who play sports to lose weight, or at least to not get fatter...

Playing sports can make one very hungry. An experiment was performed on 9 young women (age around 20 y) to determine whether drinking milk after exercise would reduce food intake at the next meal. The women drank 600ml of skim milk or orange juice diluted with water (475 ml + 125 ml water) 30 minutes after moderately intense cycling. One hour later, they were served a meal of as much pasta as they could eat.

**Result:** the women who drank milk ate less, thereby consuming less calories.

Milk consumption following exercise reduces subsequent energy intake in female recreational exercisers. *Rumbold P, Shaw E, James L, Stevenson E. Nutrients 2015; 7(1): 293-305.*

## Judokas can count on chocolate milk

Judokas must stay within the weight class in which they compete. In order to achieve this, they keep a close eye on their weight and diet before a competition, while also taking care not to harm their athletic performance.

In a study simulating preparation for a competition, 12 young judokas (19 years old +/- 4 years) tested the effectiveness of chocolate milk as a post-training recovery drink.

**Result:** Their performance improved significantly more than that of judokas drinking only water, without affecting their weight. Their muscle fatigue markers were also better.

Effects of acute postexercise chocolate milk consumption during intensive judo training on the recovery of salivary hormones, salivary SIgA, mood state, muscle soreness, and judo-related performance. *Papacosta E, Nassis G P, Gleeson M. Appl Physiol Nutr Metab. 2015; 40(11): 1116-22.*

# “Milk: Not just for kids!”



## Milk for obesity-predisposed children

Obesity prevention is a public health priority. Special attention is paid to at-risk children (as determined according to their family history, birth weight, socioeconomic class, etc.). Multiple studies have demonstrated that excessive consumption of sugary drinks (soda, fruit juice, etc.) can adversely affect children's weight. In many countries, these drinks represent over 20% of children's calorie consumption, and their role in glycaemic load and insulin response (diabetes risk factors) has been much discussed. This study on 366 obesity-predisposed Danish children between 2 and 6 years old confirms that the sugary drink consumption has a detrimental effect on children's weight gain and increases their body mass index. It demonstrates that milk has a positive effect on these obesity risk markers. According to the authors, milk is a good alternative to sugary drinks and should be recommended for obesity-predisposed children.

Replacing sugary drinks with milk is inversely associated with weight gain among young obesity-predisposed children. *Zheng M, Rangan A, Allman-Farinelli M, et al. Br J Nutr. 2015; 114(9): 1448-5.*

## Milk consumption and age at menarche: no connection

It is strongly recommended for children to drink milk – especially before puberty – to increase bone stock and thereby mitigate the consequences of age-related bone loss (osteoporosis). However, some claim that drinking milk quickens the onset of puberty.

Over 5 years, a team of American researchers followed 5,583 prepubescent girls between 9 and 14 years of age.

**Result:** No connection was found between their milk consumption and age of puberty onset. Whether they drank more than 3 glasses of milk per day or 1-4 glasses per week, the average age at menarche was 13.

Milk Consumption after Age 9 Years Does Not Predict Age at Menarche. *Carwile JL, Willett WC, Wang M, et al. J Nutr. 2015; 145(8): 1900-8.*

## AND FOR SENIORS?

### Milk is good for the head and the legs!

- Over 1,000 Japanese seniors over 60 years of age were followed for 17 years.
  - Those consuming the most milk had a reduced risk of Alzheimer's.
- J Am Geriatr Soc 2014; 62(7): 1224-30.*
- 4,797 Icelandic men and women between 66 and 96 years old.
  - Regular milk consumption – particularly in midlife – improves bone health, most significantly in men.
- Osteoporos Int 2014; 25(2): 663-72.*
- 764 American men and women with an average age of 77, followed over approximately 11 years.
  - A 40% lower risk of hip fracture in milk drinkers at the threshold of significance.
- J Bone Miner Res 2014; 29(8): 1756-62.*
- 1,479 Japanese men aged over 65 years, living at home.
  - Increased milk consumption improves bone health markers.
- Osteoporos Int 2015; 26(5): 1585-94.*
- 2,148 Americans suffering from knee arthritis followed over 4 years.
  - Daily milk consumption may slow knee arthritis progression in women.
- Arthritis care Res 2014; 66(6): 802-9.*





# Milk also offers:



## A reduced risk of Crohn's disease

- An epidemiological study of over 401,300 Europeans.
- Milk drinkers had a significantly lower risk (-70%) of Crohn's disease\*.

\* Crohn's disease is a chronic inflammatory disease of the digestive system which progresses in flare-ups followed by periods of remission. It is primarily characterized by episodes of abdominal pain and diarrhoea, which can last multiple weeks or months.

Dairy Products, Dietary Calcium, and Risk of Inflammatory Bowel Disease: Results From a European Prospective Cohort Investigation. *Opstelten JL, Leenders M, Dik VK, et al. Inflamm Bowel Dis 2016; 22(6): 1403-11.*

## A positive effect on colorectal cancer in men

- A meta-analysis of 13 studies including over 882,700 subjects. 5,000 cases of colorectal, colon or rectal cancer detected.
- A lower risk of colorectal cancer (-30%) in milk-drinking men.

Colorectal cancer and nonfermented milk, solid cheese, and fermented milk consumption: a systematic review and meta-analysis of prospective studies. *Ralston RA, Truby H, Palermo CE, et al. Crit Rev Food Sci Nutr 2014; 54(9): 1167-79.*

## A smaller waist circumference in obese adults

- 2,181 obese Spanish adults between 25 and 74 years old.
- Replacing 100 kcal of sugary drinks with whole milk significantly decreases waist circumference (by between 1.1 and 1.3 cm).

Soft drink consumption is positively associated with increased waist circumference and 10- year incidence of abdominal obesity in Spanish adults. *Funtikova A, Subirana I, et al. J Nutr 2015; 145(2): 328-34.*

## A good way to prevent postpartum depression

- Postpartum depression typically occurs a few days after birth. This temporary depression is closely linked to hormonal fluctuations following birth, and to milk production. An epidemiological study of 1,319 Japanese women demonstrated that depressive symptoms were significantly reduced in the women who consumed the largest amounts of milk during pregnancy. This backs up previous studies that had suggested that women who consumed sufficient quantities of calcium during pregnancy were the least likely to suffer from anxiety disorders.

Milk intake during pregnancy is inversely associated with the risk of postpartum depressive symptoms in Japan: The Kyushu Okinawa Maternal and Child Health Study. *Miyake Y, Tanaka K, et al. Nutr Res 2016.*

## An elixir for children suffering from chronic fatigue?

- Chronic fatigue affects many children, but no effective treatment is available. One possible explanation for this ailment is that it is caused by vitamin or mineral microdeficiencies. 98 children (between 2 and 16 years old) presenting symptoms of chronic fatigue were divided into 2 groups. The diet of one of the groups was modified for a 3-month period, while the other served as a control. The first group consumed green vegetables, meat, whole milk and butter. At the end of the experiment, the "dieting" children slept better at night and were less likely to need naps during the day. Daily whole milk consumption was especially effective. These simple nutritional guidelines may be helpful for any child suffering from chronic fatigue.

Could a Change in Diet Revitalize Children Who Suffer from Unresolved Fatigue? *Steenbruggen T, Hoekstra S, et al. Nutrients 2015; 7(3): 1965-77.*

## No contraindication for women with abdominal obesity

- 27 women with abdominal obesity consumed 3 American servings (3 x 250 ml) of 2% milk as part of a balanced diet over 6 weeks.
- Milk consumption had a broadly neutral impact on the risk factors involved in metabolic syndrome (blood lipids, blood sugar regulation, inflammation, arterial pressure etc.).

Impact of milk consumption on cardiometabolic risk in postmenopausal women with abdominal obesity. *Drouin-Chartier JP, Gagnon J, Labonté MÈ, et al. Nutr J 2015; 14: 12.*

# "Yogurt: good for the waistline"



## With a positive impact on weight:

### ● In a prospective study on Spanish adults

- 8,516 Spanish men and women (with an average age of 37.1 years +/- 10.8) followed for 2 years (Sun cohort study).
- Consumption of more than 7 yogurts per week was associated with a decreased incidence of overweight and obesity. The association is even stronger in those consuming large amounts of fruit.

Yogurt consumption, weight change and risk of overweight/obesity: The SUN cohort study M. Martinez-Gonzalez MA, Sayon-Orea C, et al. Nutr Metab Cardiovasc Dis 2014; 24(11): 1189-96.

### ● In an RCT\* study on obese women

During a weight loss program with 89 obese women (27-40 BMI, between 18 and 50 years old), the authors compared the influence of low-fat yogurt or probiotic fermented milk on weight and various cardiovascular risk factors. After 12 weeks, weight loss and cardiovascular risk levels had significantly improved in both groups.

\* RCT: randomized controlled trial. This type of study is considered the gold standard of clinical trials.

Comparison of the effect of daily consumption of probiotic compared with low-fat conventional yogurt on weight loss in healthy obese women following an energy-restricted diet: a randomized controlled trial. Madjd A, Taylor MA, et al. Am J Clin Nutr 2016; 103(2): 323-9.

### ● In a systematic review of 22 studies (13,631 data points)

Yogurt consumption is associated with a lower BMI, weight, weight gain, waist circumference and body fat content than non-consumption.

Is consuming yoghurt associated with weight management outcomes? Results from a systematic review. Eales J, Lenoir-Wijnkoop I, et al. Int J Obes (Lond) 2016; 40(5): 731-46.

## And on other factors related to weight:

### ● Positive effects on waist circumference in seniors at high cardiovascular risk

- An epidemiological study on 4,545 people.
- The consumption of full-fat yogurt (versus low-fat) is associated with a lower waist circumference and an increased chance of reversing abdominal obesity.

Yogurt consumption and abdominal obesity reversion in the PREDIMED study Santiago S, Sayon-Orea C, et al. Nutr Metabol Cardiovasc Dis 2016; 26(6): 468-75.

### ● Lower body fat content in American children

American children between the ages of 8 and 18 were followed between 2005 and 2008 (NHANES). Their yogurt and dairy product consumption was measured, as were various anthropometric parameters such as BMI. Yogurt eaters consumed more calcium, vitamin D and protein and less fat, and had lower body fat content.

Associations between Yogurt, Dairy, Calcium, and Vitamin D Intake and Obesity among U.S. Children Aged 8–18 Years: NHANES, 2005–2008. Keast D, Gallant K, et al. Nutrients 2015; 7(3): 1577-93.

## Yogurt and weight also means:

### ● A reduced risk of abdominal fat in Spanish adults

After at least 6 years of tracking, a subgroup of the SUN cohort (8,063 adults between 20 and 90 years old) demonstrated that yogurt consumption is inversely correlated with abdominal fat levels. In addition, consuming both yogurt and fruit was associated with a significantly lower risk of metabolic syndrome.

Yogurt consumption and the risk of Metabolic Syndrome over 6 years in the SUN study. Sayon-Orea C, Bes-Rastrollo M, et al. BMC Public Health 2015; 15(1): 1518.

## Other heavyweight articles!

- Evidence for the Effects of Yogurt on Gut Health and Obesity. Pei R, Martin DA, et al. Crit Rev Food Sci Nutr 2016.
- Impact of yogurt on appetite control, energy balance, and body composition. Tremblay A, Doyon C, et al. Nutr Rev 2015; 73(suppl 1): 23-7.
- Longitudinal association between dairy consumption and changes of body weight and waist circumference: the Framingham Heart Study. Wang H, Troy LM et al. Int J Obes (Lond) 2014; 38(2): 299-305.
- Effects of Probiotic Yogurt on Fat Distribution and Gene Expression of Proinflammatory Factors in Peripheral Blood Mononuclear Cells in Overweight and Obese People with or without Weight-Loss Diet. Zarrati M, Salehi E, et al. J Am Coll Nutr 2014; 33(6): 417-25.
- Effects of probiotic yogurt consumption on metabolic factors in individuals with nonalcoholic fatty liver disease. Nabavi S, Raftaf M, et al. J Dairy Sci 2014; 97(12): n7386-93.



# “Consuming one yogurt per day may reduce type 2 diabetes risk by 18%”

- A meta-analysis of 3 American cohort studies including 41,479 men between 40 and 75 years old and 153,022 women between 25 and 55 years old.
- An analysis of 3 cohort studies and the update of a meta-analysis of 14 studies including 459,790 participants.
- A connection between yogurt consumption and a reduced risk of type 2 diabetes.

## Dairy consumption and risk of type 2 diabetes: 3 cohorts of US adults and an updated meta-analysis.

Chen M, Sun Q, Giovannucci E, et al.  
Department of Nutrition, Harvard School of Public Health, Boston, MA, USA.  
BMC Med 2014; 12: 215.

*“Pooled data from 3 large prospective cohort studies (3 984 203 persons years) have shown that eating one serving of yoghurt a day was associated with lower risk of type2 diabete. A following meta-analysis on 17 studies confirmed a 18% lower risk.”*

**T**ype 2 diabetes (T2D) affects 366 million people worldwide, and this figure is expected to grow to 552 million by 2030.

Primary prevention of this disease is a public health priority.

Researchers from the Harvard School of Public Health compiled the as yet unused data from three large American prospective studies including 41,436 men (Health Professionals Follow-Up), 67,138 women (Nurses' Health Study) and 85,884 women (Nurses' Health Study II). These studies were carried out over 24, 30 and 16 years, respectively.

The participants filled out a food frequency questionnaire every 4 years. Subjects suffering from diabetes, cardiovascular illnesses or cancer at the beginning of the study were excluded from the analysis.

### Results:

15,156 cases of T2D occurred while tracking the 3,984,203 person-years\*. After adjusting for age, BMI, lifestyle and food habits, no link was found between dairy product consumption and T2D occurrence.

With regard to the different kinds of dairy products, neither full-fat nor low-fat products were correlated with T2D risk.

However, yogurt consumption was significantly inversely correlated with T2D risk, with an 18% lower risk with the consumption of one serving of yogurt\*\* per day.

The researchers then pooled these new results with those of previous studies to perform a new meta-analysis. This new analysis covered 14 studies in total (including 9 on yogurt), 459,790 participants and 35,863 cases of T2D.

The conclusions of this new analysis are the same: **daily consumption of one yogurt reduces the risk of T2D by 18%.**

There are a few different mechanisms that could explain these results. It has been demonstrated that probiotic bacteria can improve the lipid profile and antioxidant status of diabetic patients. In addition, there are multiple components of dairy products (calcium, magnesium, vitamin D, serum proteins) that may have a positive impact on the metabolic factors related to T2D (such

as weight, hypertension, MCV and glucose homeostasis).

The strengths of this meta-analysis are its sample size, the subjects' compliance and the repeated measurements of food habits and lifestyle. However, it also has its limitations. The study was performed on health professionals of European origin. The population's homogeneity does not allow its results to be generalized to other populations. In addition, the use of food frequency questionnaires makes errors unavoidable. Although the observational nature of the study does not permit the establishment of a cause and effect relationship between yogurt consumption and a reduced risk of T2D, its results are encouraging. Randomized clinical trials will surely be performed in the near future to further explore this relationship.

\* The notion of person-years refers to the total time spent tracking the at-risk individuals in the population being studied: for example, if 100 at-risk subjects were studied for 2 years, the total time they were tracked would be 200 person-years.

\*\*American serving (approximately 200g).



# ... more positive effects on type 2 diabetes:



## In Europe

- Pooling of the results of two prospective studies, EPIC-Interact (8 European countries) and EPIC-Norfolk (UK), with 4,127 male and female participants followed for 11 years.
- A strong link between yogurt consumption and a reduced risk of developing diabetes. The mechanisms of action are as yet poorly understood; probiotics and certain fatty acids may be involved.

Association between consumption of dairy products and incident type 2 diabetes-insights from the European Prospective Investigation into Cancer study. *Forouhi NG. Nutr Rev* 2015; 73(suppl 1): 15-22.



## In Brazil

- ELSA-Brazil, a study of 10,000 non-diabetic subjects between 35 and 74 years old living in 6 major Brazilian cities.
- Many biological measurements taken: fasting and 2-hour postprandial glucose and insulin, glycated haemoglobin, insulin resistance.
- The consumption of dairy products, and especially of fermented dairy products, has a favourable effect on these parameters.
- Myristic acid may explain this correlation. Moderate doses promote the conversion of alpha linolenic acid into DHA, a fatty acid which may have a protective effect against insulin resistance. Studies have suggested that other saturated fatty acids in milk might protect against diabetes.

Associations of dairy intake with glycemia and insulinemia, independent of obesity, in Brazilian adults: the Brazilian Longitudinal Study of Adult Health (ELSA-Brazil). *Drehmer M, Pereira MA, et al. Am J Clin Nutr* 2015; 101(4): 775-82.



## In Iran

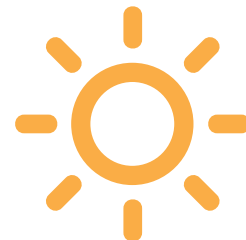
- An RCT\* study of 60 diabetics between 35 and 65 years old over 8 weeks.
- One group consumed 600ml/day of probiotic fermented milk (kefir), and the other, 600ml/day of traditional fermented milk.
- Biological measurements taken: fasting glucose, glycated haemoglobin and lipid profile.
- Only the glycated haemoglobin level was significantly lower in the kefir group.

Effect of probiotic fermented milk (kefir) on glycemic control and lipid profile in type 2 diabetic patients: a randomized double-blind placebo-controlled clinical trial. *Ostadrahimi A, Taghizadeh A, et al. Iran J Public Health* 2015; 44(2): 228-37.

\* See p7.

# “Bone health: yogurt for vitamin D enrichment”

- Two servings per day of yogurt enriched with calcium and vitamin D3 for 3 months improves markers related to bone health in English women over 60.
- Controlled study on 48 women (average age 73.4 years), enriched vs standard yogurt.



## Fortification of Yogurts with Vitamin D and Calcium Enhances the Inhibition of Serum Parathyroid Hormone and Bone Resorption Markers: A Double Blind Randomized Controlled Trial in Women over 60 Living in a Community Dwelling Home.

Bonjour JP, Benoit V, Atkin S, Walrand S.  
Division of Bone Diseases, University Hospitals and Faculty of Medicine, Geneva, Switzerland.  
J Nutr Health Aging. 2015; 19(5): 563-9.

“Fortification of yogurts with vitamin D3 and calcium should provide a greater prevention of secondary hyperparathyroidism and accelerated bone resorption as compared to non-fortified equivalent food”

In 2013, a study by a French-Swiss team indicated the potential benefit of Vitamin D3- and calcium-enriched yogurt on bone health in French women of an average age of 86 living in institutions (*Best Of Yogurt, 2013; p14*).

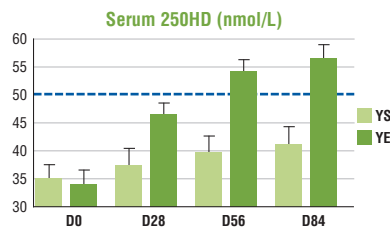
These results are confirmed by this new study on 48 English women around 10 years younger (73.4 years old) living independently in their own homes.

The effects on bone health of the consumption of 125g of yogurt twice daily were measured monthly for three months. Two types of yogurt were tested: one “standard” (SY) and one “enriched” (EY). The total amount of additional calcium consumed in the SY was of 280 mg/day. The two daily servings of EY contained a combined total of 800mg of calcium and 10µg of vitamin D3.

The two groups were statistically identical at the beginning of the study with regards to the demographic parameters and the risk of osteoporotic fracture. The participants filled out a food questionnaire every 3 days.

This was a randomized, controlled double-blind study. Multiple parameters were measured: circulating vitamin D levels, parathyroid hormone (PTH), and two markers of bone resorption (CTX and TRAP5b).

The results demonstrate a gradual increase in circulating vitamin D3 levels in the EY group, with a level considered to be sufficient being reached after 56 days (p=0.00001).



PTH levels decrease over the same period (p=0.0011), and by the end of 3 months the TRAP5b marker also significantly decreases (p=0.0228). The CTX marker also decreased, but not to a significant degree. The simulta-

neous reduction of these factors in combination with an increase in serum vitamin D levels indicates the slowing of bone resorption, and therefore also a decrease in bone fragility.

In these two independent studies, the authors demonstrated the effectiveness of vitamin D supplementation in the diets of older women at high risk for fracture. These results confirm the effectiveness of the nutritional approach in the prevention of bone fractures.

### Vitamin D-supplemented yogurt: effective and cheap

The purpose of this study – conducted over three years – was to evaluate the cost effectiveness for menopausal women of consuming 1-3 servings of vitamin D-enriched yogurt compared to traditional medicinal supplementation.

Scenario 1 : **one serving of yogurt per day** 400mg of Ca + 200 IU of vitamin D

Scenario 2 : **two servings of yogurt per day** 800 mg of Ca + 400 IU of vitamin D

Scenario 3 : **three servings of yogurt per day** 1200 mg of Ca + 600 IU of vitamin D

#### Results:

- One serving of yogurt per day provides the best cost-effectiveness ratio for women over 70, as well as for those with low bone mineral density or vertebral fractures.
- Two servings of yogurt per day provides the best cost-effectiveness ratio for women over 80 and for those over 70 with a high risk of fracture.
- Three servings of yogurt per day is effective over 80 years of age and for women with a low bone mineral density or a high risk of vertebral fracture.

Cost-effectiveness of personalized supplementation with vitamin D-rich dairy products in the prevention of osteoporotic fractures. *Ethgen O, Hilligsmann M, Burler N, et al. Osteoporos Int 2016; 27(1): 301-8.*

# "SWEETENED YOGURT IS TOO SUGARY?"

## Not really..."

- A 2-month quantitative behavioural study of 199 French men and women with an average age of 49.
- The amount of sugar added to plain yogurt is at least equal, if not greater than that found in pre-sweetened yogurts!

### How much sugar do consumers add to plain yogurts?

#### Insights from a study examining French consumer behavior and self-reported habits.

Saint-Eve A, Leclercq H, Berthelo S, et al.

UMR Génie et Microbiologie des Procédés Alimentaires, AgroParisTech, Inra, Université Paris-Saclay, 78850 Thiverval - Grignon, France.

KOS Research Marketing and Sensory Consumer studies, Paris, France.

Appetite 2016; 99: 277-84.

*"For the first time in France, researchers measured, how much sugar (sucrose, honey or jam) consumers added to plain yogurt. On average participants added 13,6 g of sugar which is higher than the 10,2 g sugar contained in pre-sweetened commercial yogurt."*

In France, 40 to 50% of the yogurt bought is plain, and it is normally eaten (84% of the time) as a dessert after lunch or dinner.

A previous study demonstrated that half of consumers added a sweetener (sucrose, honey or jam) to their yogurt. In light of this observation, it was worthwhile to precisely measure the amount of sweetener added in consumption conditions as close as possible to "real life".

199 French adults (half Parisian and half from Avignon), regular consumers of plain yogurt (set or stirred yogurt or fermented milk) with an added sweetener, were included in the study. This sample was made up of 50% men and 50% women with an average age of 49, representative of regular consumers of plain yogurt (with regard to their age and sex).

The participants consumed a standardized meal (lunch or dinner) at the study centre, after which they ate a plain yogurt (125g) with the option to sweeten it as they normally do. The amount of sweetener added was measured without their knowledge (by weighing the container of sweetener before and after their meal). These quantities were then converted into "sugar/saccharose equivalent" (100g for white sugar, 97g for brown sugar, 76g for honey and 50g for jam).

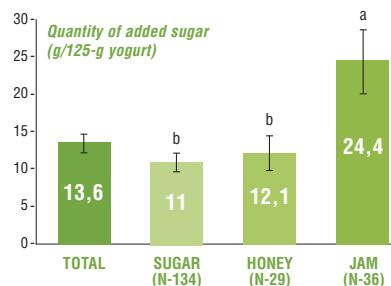
In addition, the participants were asked to answer a series of questions on hunger, thirst, and their plain yogurt preferences, and to estimate the amount of sweetener added (self-evaluation). Data on their consumption

habits, sociodemographic factors and BMI were also collected.

#### Results:

► On average, 13.6g of sugar was added to each pot of plain yogurt (125g), a larger amount than is found in the sweetened yogurts on the market (10.2g/pot for standard sweetened yogurts and 13.3g/pot for gourmet sweetened yogurt).

► The amount of sugar added was significantly greater for jam (24.4g/pot, compared to 11g for powdered sugar and 12.1g for honey).



In order to evaluate whether sugar adding habits were linked to BMI or sociodemographic factors such as age, sex, or socioprofessional category (SPC), the participants were divided into three groups:

- L / Low-level sugar users (N=67): amount of sugar under 8.4g (median 6.1g/serving).
- M / Mid-level sugar users (N=66): amount of sugar between 8.4 and 14g (median 11.4g/serving).
- H / High-level sugar users (N=66): amount of sugar greater than 14g (median 19.9g/serving).

► The members of group L were characterized by low food enjoyment and a low BMI. They found fruit-flavoured yogurt to be too sweet and tried to limit their sugar intake. They also believed that sweetening food and drinks is "bad for health".

► The members of group H had a high average BMI. They enjoyed eating yogurt. They used jam more frequently than the others and kept adding more.

► In group M, yogurt was believed to be "healthy". Sugar was added "out of habit" to reduce sourness. The members of group M enjoyed eating and had a medium BMI.

Generally speaking, the amount of sugar added is closely linked to age, SPC, and BMI. Low and average SPCs tend to sweeten their yogurt more than higher SPCs, as do older subjects and those with higher BMIs (over 65s sweeten more than 50-65s). The amount of sugar added also varies according to the time of consumption: it is significantly greater at lunch.

At the end of the meal, the participants were asked to evaluate the quantity of sweetener they had added. According to them, they added small or moderate quantities. In reality, they added twice as much as they estimated. For the first time, a study has provided robust data on the amount of sugar that is actually added to plain yogurt under real consumption conditions. This amount is at least equal to the amount of sugar added to pre-sweetened yogurts on the market.



# “Cheese: a neutral, or even positive effect on the occurrence of cardiovascular disease”

Cardiovascular disease (CVD) includes coronary diseases (such as heart attacks) and strokes (see *inset*). Diet is one aspect of risk prevention, and its role in certain risk factors – such as high cholesterol or high blood pressure – is often emphasized.

The neutral, or possibly even beneficial, impact of cheese on various cardiovascular risk factors, and more generally on the occurrence of CVD, has been demonstrated by epidemiological studies as well as by human intervention trials.

## What's new since 2012?

**In 2013:** the results of a study on 33,636 Swedish women between 48 and 83, followed for nearly 12 years, demonstrate that women who eat more cheese have a 26% lower coronary risk <sup>(1)</sup>.

**In 2014:** a meta-analysis of 15 studies including 764,635 participants shows a significant connection between cheese consumption and a reduced risk of CVD regardless of sex <sup>(2)</sup>.

**In 2015:** a review of the literature on cheese's effect on cardiovascular risk. 4 prospective studies show no correlation; 1 shows increased risk; 2 show decreased risk; and another shows no correlation in men but decreased risk in women <sup>(3)</sup>.

**In 2016:** a meta-analysis of 18 studies which tracked participants for between 8 and 2 years. A total of 762,414 subjects and 29,943 diagnoses of CVD. The authors observed a negative correlation (small but significant) between cheese consumption and CVD risk. The best prognosis was for subjects consuming approximately one serving of cheese per day (25g) <sup>(4)</sup>.

One explanation for the neutral or possibly beneficial role of cheese may be its effect on certain cardiovascular risk factors such as high blood pressure or high cholesterol.

**Cheese and high blood pressure:** certain nutrients found in milk may play a role in arterial pressure prevention and/or control mechanisms: calcium, potassium, phosphorus, magnesium, vitamins (D, B6), and peptides. Dairy peptides have demonstrated anti-hypertensive effects; some, such as casein derivatives (casokinins),  $\alpha$ -lactalbumin or  $\beta$ -lactoglobulin (lactokinins), may work by inhibiting an enzyme (ACE) that is known to raise blood pressure. Others may work in other ways (opioid activity, calcium absorption, etc.). ACE-inhibiting peptides are found in rather high concentrations in certain cheeses.

► In a recent study on 168 Norwegians with an average age of 51 (56% women), the authors demonstrated that cheese eaters had lower systolic blood pressure <sup>(5)</sup>.

**Cheese and high cholesterol:** high cholesterol is a CVD risk factor, but the relationship between cholesterol level and CVD risk is quite complex. It is overly simplistic to refer to total cholesterol or LDL cholesterol as a stand-alone marker for risk. Other markers – such as HDL cholesterol, which is considered to have a protective effect – must also be taken into consideration.

► **In 2014,** a study conducted in Iran on 1,752 participants (782 men and 970 women) demonstrated that cheese eaters had higher levels of C-reactive protein (CRP, apolipoprotein A and HDL cholesterol (beneficial) <sup>(5)</sup>. However, their fasting blood sugar, total cholesterol, LDL cholesterol, Apo B and triglyceride levels were not higher <sup>(6)</sup>.

► An intervention trial conducted in France on 115 subjects with moderately high cholesterol levels compared the effect of daily cheese consumption (2 servings of 30g of camembert) to that of yogurt (2 125g servings). After 5 weeks, the authors did not observe the cheese having any effect on cholesterol levels or blood pressure <sup>(7)</sup>.

► **In 2015,** a metabolomics study analyzed the metabolic profiles of the urine and feces of 15 volunteers fed isocaloric diets (1.5% MF milk, cow's milk cheese containing the same amount of calcium and a control diet). Milk or cheese consumption caused a reduction in urine choline and trimethylamine N-oxide (TMAO), a potential biomarker of cardiovascular disease, and increased fecal excretion of acetate, propionate and lipids. Compared with the milk diet, cheese consumption caused a reduction in citrate, creatine and creatinine levels and an increase in microflora metabolites (butyrate, hippurate and malonate). Cheese may therefore have a direct effect on lipid metabolism and/or on the microbiota <sup>(8)</sup>.



► **In 2015**, 153 people (with an average age of 43, 52.3% women) were randomly sorted into 3 groups. The first group consumed 50g of cheese low in fat and salt; the second, 80g/day of Gouda cheese (27% MF), and the control group had limited cheese intake. After 8 weeks of intervention, no metabolic changes were observed in the cheese groups. Neither total cholesterol nor LDL cholesterol levels increased. The authors even observed a decrease in total cholesterol and triglyceride levels in the Gouda group <sup>(9)</sup>.

- (1) Association between Dairy Food Consumption and Risk of Myocardial Infarction in Women Differs by Type of Dairy Food. *Patterson E, Larsson SC, Wolk A*, et al. *J Nutr* 2013; 143(1):74-9.
- (2) Dairy foods and risk of stroke: a meta-analysis of prospective cohort studies. *Hu D, Huang J, Wang Y*, et al. *Nutr Metab Cardiovasc Dis* 2014; 24(5): 460-9.
- (3) Cheese and Cardiovascular Disease Risk: A Review of the Evidence and Discussion of Possible Mechanisms. *Hjerpsted J, Tholstrup T*. *Crit Rev Food Sci Nutr* 2016; 56(8): 1389-403.
- (4) Dairy Consumption and Risk of Stroke: A Systematic Review and Updated Dose-Response Meta-Analysis of Prospective Cohort Studies. *de Goede J, Soedamah-Muthu SS, Pan A*, et al. *J Am Heart Assoc* 2016; 5: e002787.
- (5) Short communication: Is consumption of a cheese rich in angiotensin-converting enzyme-inhibiting peptides, such as the Norwegian cheese Gamalost, associated with reduced blood pressure? *Nilsen R, Pripp AH, Hostmark AT*, et al. *J Dairy Sci* 2014; 97(5): 2662-8.
- (6) Cheese consumption in relation to cardiovascular risk factors among Iranian adults- IHHP Study. *Sadeghi M, Khosravi-Boroujeni H, Sarrafzadegan N*, et al. *Nutr Res Pract* 2014; 8(3): 336-41.
- (7) Effect on blood lipids of two daily servings of Camembert cheese. An intervention trial in mildly hypercholesterolemic subjects. *Schlienger JL, Paillard F, Lecerf JM*, et al. *Int J Food Sci Nutr*. 2014; 65(8): 1013-8.
- (8) Metabolomics investigation to shed light on cheese as a possible brick in the French paradox puzzle. *Zheng H, Yde CC, Clausen MR*, et al. *J Agric Food Chem* 2015; 63(10): 2830-9.
- (9) Effect of a high intake of cheese on cholesterol and metabolic syndrome: results of a randomized trial. *Nilsen R, Hostmark AT, Haug A*, et al. *Food Nutr Res* 2015; 59: 27651.

## Cardiovascular disease (CVD)

Includes heart disease and strokes.

**Heart disease** is primarily caused by the development of atherosclerosis in the coronary arteries. Atherosclerosis, characterized by the buildup of atheromatous plaque on the inner walls of the arteries, causing them to gradually shrink (stenosis) and possibly even become completely blocked. Angina pectoris and heart attack are the major consequences.

**Strokes**, or cerebrovascular accidents (CVA), are caused by reduced blood flow to a region of the brain, causing the “death” of the brain tissue (necrosis). They cause potentially debilitating brain injury, which may or may not be reversible, with potentially serious aftereffects.

*There are many risk factors for cardiovascular disease (genetics, tobacco use, age, sex, obesity, high blood pressure, high cholesterol, etc.), but diet plays a role in its prevention.*



# Other benefits of cheese:



## A matrix effect that limits salt's effects?

► Although the overall effect of cheese consumption on cardiovascular disease is neutral or possibly even beneficial, some may wonder about the potential effects of its salt content. Indeed, excessive salt intake disrupts endothelial\* function, namely by reducing vasodilation (via the NO system). An intervention trial compared the effect of the same amount of sodium consumed in the form of cheese or pretzels on the microcirculation of the forearm.

**Result:** greater vasodilation with cheese. This suggests that some of the ingredients in cheese might limit the effect of the salt it contains; like a sort of matrix effect.

*\* Needed for proper blood vessel function, namely vasodilation and inhibition of platelet aggregation.*

Macronutrients and Proteins in Cheese Reduce Acute Dietary Sodium-induced Endothelial Dysfunction in the Cutaneous Microcirculation. *Stanhewicz A, Alba B, Kenney W, et al. FASEB J 2015; 29(1 Suppl): 994.5.*

## A weighty asset for the Basque

► A study conducted in the Basque Country, in northern Spain, on 1,081 adults (530 men and 551 women over 17). It demonstrates lower levels of overweight and obesity in Basque men and women who eat more cheese, whether soft or aged.

► Potential explanations include: calcium (which increases faecal lipid excretion and may have a positive effect on appetite control and adipocyte metabolism); protein (which has a satiating effect and is rich in leucine, which helps maintain lean body mass); certain bioactive peptides (which reduce adipocyte lipogenesis); rumenic acid (which has a positive effect on adiponectin and body fat); effects on the microbiota; etc.

Cheese consumption and prevalence of overweight and obesity in a Basque adult population: a cross-sectional study. *Alegria-Lertxundi I, Rocandio Pablo A, Arroyo-Izaga M. Int J Food Sci Nutr 2014; 65(1): 21-7.*

## A source of whey with multiple applications

► Cheese-making involves the production of whey. Considered to be "safe" (GRAS), it has been used in food and animal feed for decades. It is also processed to obtain concentrates, isolates, and specific proteins. Whey protein is also transformed into bioactive peptides through fermentation or enzymatic processes. It has numerous functional, nutritional and therapeutic applications.

Cheese whey: A potential resource to transform into bioprotein, functional/nutritional proteins and bioactive peptides. *Yadav JS, Yan S, Pilli S, et al. Biotechnol Adv 2015; 33(6Pt1): 756-74.*

## Processed cheeses with varied nutritional characteristics

► Processed cheeses are secondary processing dairy products: mixes of one or multiple cheeses of different ages and with different levels of dairy components, melted together with heat. Due to the multiple ingredients they contain, their nutritional characteristics are varied (protein, fats, sodium, phosphorus, etc.). They are nevertheless a source of calcium and help various population groups (such as children and seniors) consume the recommended amounts of dairy products.

Caractéristiques nutritionnelles des fromages fondus. *Richonnet C. Cah Nutr Diet 2016; 51(1): 48-56.*





# "Milk fat: a tool against diabetes"



It has been scientifically proven that fat intake can disrupt carbohydrate metabolism, causing insulin imbalances that contribute to the development of type 2 diabetes. However, many studies suggest that milk fat and full-fat dairy products may have a protective effect against the development of this disease. **In brief:**

## Full-fat dairy products reduce diabetes risk by 23%

This study, conducted on the Malmö Diet and Cancer Cohort database, which includes 26,930 participants who were tracked for 14 years, indicates a link between dietary fat sources and the risk of type 2 diabetes.

- The consumption of milk, full-fat yogurt and cheese is correlated with a 23% decrease in the risk of developing type 2 diabetes.
- In women, risk reduction is observed for all full-fat dairy products, including butter and cream.
- No correlation was found with low-fat dairy products.
- The consumption of short-chain saturated fatty acids (found in dairy products) is associated with a lowered risk of diabetes, which suggests that milk fat may at least partly explain this protective effect.

Food sources of fat may clarify the inconsistent role of dietary fat intake for incidence of type 2 diabetes. *Ericson U, Hellstrand S, et al. Am J Clin Nutr 2015; 101(5): 1065-80.*

## An inverse correlation between full-fat milk products and the development of type 2 diabetes

- A meta-analysis examining the correlations between the amounts of full-fat dairy products consumed and the development of type 2 diabetes.
- 22 epidemiological studies including nearly 580,000 people, including 43,000 type 2 diabetics.
- An inverse correlation between full-fat dairy products and the occurrence of type 2 diabetes.

**Note:** The significant heterogeneity of the results does not permit recommendations to be made regarding the proper amounts of full-fat dairy products to consume in order to reduce the risk of type 2 diabetes.

Consumption of dairy foods and diabetes incidence: a dose-response meta-analysis of observational studies. *Gijsbers L, Ding EL, et al. Am J Clin Nutr 2016; 103(4): 1111-24.*

## Two saturated fatty acids, found only in milk fat, lead to reduced diabetes risk

Pentadecanoic acid (C15:0) is a saturated fatty acid only found in dairy fat, and a good indicator of its consumption. This American study was conducted on 659 adults of Hispanic, American or African origin between 40 and 60 years old who did not have diabetes at the time of inclusion. The results demonstrate a correlation between C15:0 and a 27% lower risk of developing diabetes. The participants with the highest blood C15:0 levels also had the lowest risk of developing diabetes 5 years later.

Trans-palmitoleic acid (trans-C16:1 n-7), another fatty acid found in milk fat, has also demonstrated protective properties against type 2 diabetes in a study published by Mozaffarian's team in 2010\*.

Serum pentadecanoic acid (15:0), a short term marker of dairy food intake, is inversely associated with incident type 2 diabetes and its underlying disorders. *Santerén I, Watkins S, et al. Am J Clin Nutr 2014; 100(6): 1532-40.*

\* Trans-Palmitoleic acid, other dairy fat biomarkers, and incident diabetes: the Multi-Ethnic Study of Atherosclerosis (MESA). *Mozaffarian D, de Oliveira Otto MC, Lemaitre RN, Fretts AM, Hotamisliligil G, Tsai MY, et al. Am J Clin Nutr 2013; 97(4): 854-61.*



# “Milk fat and cardiovascular disease: a new on the health benefits”

For far too long, milk fat has been believed to be a risk factor for cardiovascular disease, due to certain saturated fatty acids it contains. Today, new data and the differentiation between different saturated fatty acids offers promising developments for milk fat.

## SATURATED FATTY ACIDS don't all have the same effects

- **The short-chain saturated fatty acids found in full-fat dairy products reduce the risk of heart disease.**
- **A Dutch study on 35,597 men and women aged between 20 and 65.**

**The association between dietary saturated fatty acids and ischemic heart disease depends on the type and source of fatty acid in European Prospective Investigation into Cancer et Nutrition-Netherlands cohort.**

*Praagman J, Beulens J, et al.  
Julius Center for Health Sciences and Primary Care, University Medical Center Utrecht, NL.  
Am. J. Clin. Nutr. 2016; 103(2): 356-65.*

*“Our results suggest that the inverse association between total SFAs and ischemic heart disease was mainly driven by SFAs from dairy sources”*

**T**his study takes a new look at the data obtained from the Dutch EPIC (European Prospective Investigation into Cancer) and MORGEN (Monitoring Project on Risk Factors for Chronic Diseases) cohorts.

The connection between saturated fatty acids and heart disease risk was studied with regard to:

- the type of nutrient replacing saturated fatty acids,
- the lengths of the carbon chains of saturated fatty acids,
- the dietary source of saturated fatty acids.

The data was collected through food questionnaires and the participants (35,597 men and women between 20 and 65) were regularly tracked for 12 years.

Over 97% of participants exceeded the recommended saturated fatty acid intake levels (over 10% of total caloric intake). The primary sources of saturated fatty acids are: meat (17.5%), cheese (17.4%), full-fat milk and dairy products (16.6%), margarine (8.6%) and butter (7.3%).

**Note:** meat contains the most long-chain saturated fatty acids (C16:0 and C18:0), while dairy products are the primary source of short-chain saturated fatty acids (C4:0 to C14:0). The results show a 17% decrease in the risk of developing heart disease in correlation with total saturated fatty acid

intake, regardless of carbon chain length. When saturated fatty acids are replaced with polyunsaturated fatty acids or high glycaemic index sugars, the risk is higher. No correlation is found when saturated fatty acids are replaced with plant protein. More specifically, short-chain saturated fatty acids, as well as medium-chain (such as C14:0) are correlated with a significantly lower risk. No correlation is found for fatty acids whose carbon chains have more than 16 carbons.

These correlations between short- and medium-chain saturated fatty acids and heart disease risk are supported by the NHS (National Health Service).

In addition, the authors observe that saturated fatty acids from dairy products (particularly cheese and butter) are also correlated with a lower risk of heart disease.

This study's strength lies in its robustness, with a large sample size and a long timeframe. The benefits of dairy products on the heart disease risk of the Dutch population are clearly demonstrated by this study.

The mechanisms associated with the observed results remain to be determined. Proposed explanations include the interactions between saturated fatty acids from dairy, the dairy matrix and its mineral components (calcium, potassium, etc.).



## Replacing saturated fat with n-6 does not reduce heart disease risk

Replacing saturated fatty acids with polyunsaturated is frequently recommended to reduce the risk of stroke. The aim of this work was to explore this hypothesis by analysing the data of a double-blind study with 9,423 participants. The participants were given a “saturated” or “unsaturated” diet rich in PUFA n-6. A meta-analysis of five studies related to strokes was also included in the work.

- The intervention study showed that the “unsaturated” group presented 14% lower serum cholesterol levels. However, the coronary death risk increased by 22% when serum cholesterol levels decreased by 30mg/dl.
- The meta-analysis did not indicate any benefits to increasing PUFA n-6 on the risk of death caused by stroke.

Re-evaluation of the traditional diet-heart hypothesis: analysis of recovered data from Minnesota Coronary Experiment (1968-73). Ramsden CE, Zamora D, et al. BMJ 2016; 353: i1246.

## Full-fat milk products associated with decreased metabolic syndrome risk markers

Data was taken from the Brazilian longitudinal study ELSA-Brazil, conducted on 9,835 non-diabetic adults between the ages of 35 and 74 who do not suffer from cardiovascular disease.

Dairy product consumption was tracked using a questionnaire and multiple biological measurements were taken of blood lipid parameters (HDL cholesterol, fasting triglycerides, glucose).

Full-fat dairy product consumption was inversely correlated with these measurements. This inverse correlation with the markers of metabolic syndrome appears to be mediated by the saturated fatty acids specific to milk fat.

This correlation was not found with low-fat dairy products.

The authors remain cautious and specify that further research is necessary, particularly to verify the role of saturated fatty acids found in milk.

Total and full-fat, but not low fat, dairy products intakes are inversely associated with metabolic syndrome in Adults. Dreher M, Perreira M, et al. J Nutr 2016.

## The expert's take:

### Replace saturated fats with... saturated fats!

According to Prof. Lawrence (a professor of chemistry and biochemistry at Long Island University in the USA), replacing saturated fatty acids with polyunsaturated fatty acids is not always beneficial:

- PUFAs stimulate cholesterol production (via SREBP transcription factor)
- Polyunsaturated fatty acids oxidation (particularly PUFA n-6) may increase low-grade inflammation and speed up the development of atherosclerosis in high-risk individuals.

Replacing saturated FA with glucose isn't a solution either. This may cause major imbalances in carbohydrate metabolism, and therefore potentially lead to type 2 diabetes.

The author recommends replacing long-chain saturated FA (such as palmitic acid) with short- or medium-chain saturated FA (C4 to C14). These saturated fatty acids, found in dairy products, are rapidly metabolized, and many studies have shown their beneficial effects, particularly on body fat.

Dietary Fats and Health: Dietary Recommendations in the Context of Scientific Evidence. Lawrence GD. Adv Nutr 2013; 4(3): 294-302.

## The expert's take:

### We need to change our view of saturated fatty acids, and view them as friends rather than as enemies

*In their nutritional guidelines, most health agencies worldwide recommend reducing saturated fat intake due to its link with heart disease. However, many meta-analyses have failed to find a link between saturated fatty acids from milk and increased cardiovascular risk.*

More and more scientists, such as Arne Astrup, are now stressing the lack of scientific evidence and the complexity of the relationships between heart disease risk factors.

A changing view on saturated fatty acids and dairy: from enemy to friend. Arne Astrup (chef du département de nutrition, Université de Copenhague, Danemark) dans l'éditorial de l'*American Journal of Clinical Nutrition*. Am J Clin Nutr 2014; 100(6): 1407-8.



# “Focus on the *trans* fatty acids in milk fat: minor components with major

Excessive *trans* fatty acid consumption is known worldwide for its detrimental health effects, including increased LDL cholesterol levels, decreased HDL levels and increased cardiovascular risk. The association between *trans* fats of technological (industrial) origin and those naturally found in dairy products pushes the latter's health benefits away from the spotlight. Let's shine a light on these minor components with promising effects.

## **Trans fatty acids of natural origin vs trans fatty acids of technological origin**

- This systematic review with meta-analysis looks at 12 prospective studies. It compares the effects of *trans* fatty acids of technological and natural origin on the risk of stroke.
- No correlation was observed between *trans* fatty acids of natural origin and the occurrence of strokes. However, the harmful effects of *trans* fatty acids of technological origin – when consumed in excess – which are well-documented in the literature were confirmed.

Intake of saturated and *trans* unsaturated fatty acids and risk of all cause mortality, cardiovascular disease, and type 2 diabetes: systematic review and meta-analysis of observational studies. *De Sousa R, Mente A, et al. BMJ 2015; 351: h3978.*

## **Trans fatty acids of natural origin and cardiovascular risk markers**

- This systematic review with meta-analysis looks at all of the scientific literature published between January 1975 and December 2013. Thirteen studies were selected, with a total of 666 participants (mostly Americans and Europeans).
  - Intake of *trans* fatty acids of natural origin greater than 4.19% of total daily energy intake has no effect on blood LDL or HDL cholesterol levels.
- The results obtained with a quantity of natural *trans* fatty acids resembling the daily amount (0.12 to 4.9% of total energy intake) does not demonstrate any harmful effects on cardiovascular risk markers.

Is there a linear relationship between the dose of ruminant *trans*-fatty acids and cardiovascular risk markers in healthy subjects: results from systematic review and meta-regression of randomized clinical trials. *Gayet-Boyer C, Tenenhaus-Aziza F, et al. Br J Nutr 2014; 112(12): 1914-22.*

## **A hypotensive and antidiabetic effect from milk trans fats in obese patients?**

200 participants between 18 and 55 years of age, randomly selected from the subjects of the study “Health Canada's *Trans* Fat Task Force”. Half of the participants were obese, with a body mass index (BMI) over 30. The correlation between plasma milk *trans* fatty acid levels, blood lipid parameters (cholesterol, triglycerides, adiponectin) and blood pressure was examined.

- *Trans* vaccenic acid is correlated with high adiponectin levels in healthy individuals, increasing insulin sensitivity.
- *Trans* palmitoleic acid is correlated with a reduction in insulin levels and BMI\*.

These results suggest that these two fatty acids reduce the chances of occurrence of type 2 diabetes and insulin resistance by reducing blood insulin levels and increasing insulin's efficiency.

- No correlation was observed between *trans* fatty acids from milk and blood lipid markers in the obese population.
- The subjects with the highest blood levels of milk *trans* fatty acids had lower blood pressure than the participants in the non-obese group.

The authors conclude that there are beneficial effects to *trans* fatty acids of natural origin, primarily from milk.

*\* Results consistent with other recent publications mentioned in the inset*

Natural Rumen-Derived *trans* fatty acids are associated with metabolic markers of cardiac health. *Da Silva M, Julien P, et al. Lipids 2015; 50(9): 873-82.*

## Milk *trans* fats, markers of dairy product consumption?

180 male and female New Zealanders over 18, randomly divided into three groups:

- 3 more servings\*/day of full-fat milk products added to their normal diet,
- 3 less servings/day of full-fat milk products and reduced red meat consumption,
- no change in eating habits.

Increasing dairy product intake is marked by an increase in the level of C14, C15 and C17 saturated fatty acids in the participants' plasma. Plasma levels of all *trans* fatty acids found in milk also slightly but significantly increased. *Trans* fatty acids found in milk fat may therefore be useful as a marker of dairy product consumption.

\* In this study, an American serving corresponds to 250 ml of 3% MF milk or 500ml of 1.5% MF milk or 250 of yogurt or 35g of cheddar.

The effects of changing dairy intake on *trans* and saturated fatty acid levels-results from randomized controlled study. Benatar JR, Stewart RA. Nutr J 2014; 13:32.

## A beneficial effect of *trans*-palmitoleic acid from milk fat on metabolic syndrome?

Specific to milk fat, *trans* palmitoleic acid is considered to be a marker of dairy product consumption. Multiple teams of researchers have been studying this *trans* C16:1 n-1 for many years.

Two studies by the team of Dr Mozaffarian (a professor of epidemiology at Harvard) demonstrate that human blood plasma levels of *trans* palmitoleic acid are specifically correlated with a low fasting insulin concentration, low triglyceride levels and a low total cholesterol/HDL cholesterol ratio.

Its blood plasma concentration is also correlated with a lower incidence of type 2 diabetes, and more generally with a reduced risk of metabolic syndrome.

This data may partly explain the protective effect of “whole” dairy products on metabolic syndrome and type 2 diabetes risk in humans.

*Trans*-palmitoleic acid, metabolic risk factors, and new-onset diabetes in U.S. adults: a cohort study. Mozaffarian D, Cao H, King IB, et al. Ann Intern Med. 2010; 153(12): 790-9.

*Trans*-Palmitoleic acid, other dairy fat biomarkers, and incident diabetes: the Multi-Ethnic Study of Atherosclerosis (MESA), Mozaffarian D, de Oliveira Otto MC, Lemaitre RN, et al. Am J Clin Nutr 2013; 97(4): 854-61.

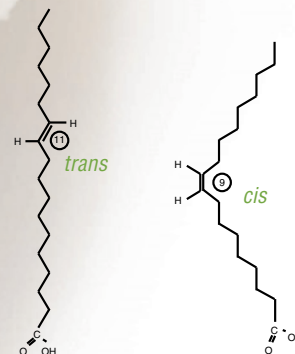


## What is a *trans* fat?

*Trans* fatty acids are unsaturated fatty acids with at least one double bond in a *trans* position. *Trans* fatty acids can have one of two origins:

- **Natural:** produced by the bacteria found in the stomachs of cows, and found in meat and dairy products.
- **Technological:** synthesized during industrial processes such as the partial hydrogenation of vegetable oils.

In 2005, ANSES set the maximum *trans* fatty acid intake to 2% of total energy intake. According to the INCA 2 study, the French population consumes far less (less than 1.3% of total energy intake).



# “Nutritional guidelines: Beyond saturated fats!”

## The expert's take

### Dietary and policy priorities for cardiovascular disease, diabetes, and obesity, a comprehensive review.

Mozaffarian D. *Circulation* 2016; 133(2): 187-22.

*“Most dietary guidelines simply group different types together (eg, grouping milk, cheese, and yogurt as “dairy”, categorize these by fat content, and then recommend selection of low fat products. Such recommendations largely derive from theoretical considerations about selected single nutrients (calcium, vitamin D, calories, saturated fat), rather than empirical evidence on health effects of the actual foods.”*

**Dariusz Mozaffarian** – Professor of epidemiology at Harvard (Boston, USA) – recently conducted an overview of dietary habits and nutritional guidelines throughout the world.

In his opinion, certain dietary policy decisions concerning milk fat are especially questionable.

The most striking example is the United States, where whole milk was banished from school breakfasts and replaced with sweetened skim milk. Many scientific studies have demonstrated that children fed skim milk gain more weight than those fed whole milk. In fact, the consumption of low-fat products (particularly dairy products) carries a risk of unintentional compensation for the loss of fats by increased carbohydrate intake.

This prompted Dr Mozaffarian to wonder why anyone would risk causing the imbalance of carbohydrate metabolism and a heightened risk of type 2 diabetes when whole milk's effects are at least neutral, if not beneficial. The explanation is in fact simple: such policies are based on the poor reputation of saturated fatty acids.

Dairy products, while high in saturated fat, are generally associated with a lower incidence of diabetes (particularly cheese and yogurt). Butter is another example. Studies have not demonstrated any link between its

consumption and the occurrence of various diseases (diabetes, heart disease, stroke), nor any increased risk of death. And yet...

In addition, in this article, the author states his opinion on the saturated fatty acids that make up milk fat. While the idea that these fats should not be lumped together is gaining ground, their origin should also be considered (cheese, butter, cream, whole milk...). Indeed, technology's effects on food matrixes are not neutral.

For D. Mozaffarian, studies of the long-term health impacts of a foodstuff must be multifactorial. The best example is

cheese. Although rich in saturated fatty acid, it nevertheless has a positive impact on cardiovascular risk markers, which may be explained by a “matrix effect”.

**Note:** Conversely, monounsaturated and polyunsaturated omega-6 fatty acids are losing their aura. More and more studies are highlighting the methodological weaknesses of the scientific evidence put forward in their favour. As for trans fatty acids of technological origin, the author believes that they should be banned and should become a public health priority.

### Guidelines based on weak scientific foundations

The nutritional guidelines in the United States and England were created in the 1980s. They recommend reducing saturated fatty acid consumption to less than 10% of total energy consumption. A systematic review of the literature combined with a meta-analysis attempted to analyse the data used to justify such measures. Six clinical studies conducted in Europe, the United States and Australia were combined and analysed. In the 2,467 male participants, no difference was observed in the occurrence of strokes or deaths due to cardiovascular disease according to whether or not the participants followed the guidelines. The authors called into question the scientific foundations underlying the guidelines concerning saturated fatty acid intake, which affect nearly 290 million Americans and Brits.

Evidence from randomized controlled trials did not support the introduction of dietary fat guidelines in 1977 and 1983: a systematic review and meta-analysis. *Harcornbe Z, Barker JS, et al. Open Heart* 2015; 2: e000196



# Other benefits of milk fat:



## A decreased risk of hypertension

- A study of 5,616 Iranian adults.
- Those with the highest milk fat consumption levels had the lowest risk of developing hypertension.

High fat dairy is inversely associated with the risk of hypertension in adults: Tehran lipid and glucose study. *Mirmiran P, Golzarand M, et al. Int Dairy J 2015; 43: 22-6.*

## A role in cholesterol metabolism gene expression

In dairy products, fat can be found in two forms: contained in fat globules, or free. This study, conducted on 57 overweight men and women, demonstrates that the greater the number of “fat globules” in the product consumed, the lower the lipid levels in the participants’ blood plasma. This inverse correlation is not seen with products containing free fat. The authors hypothesize that a modulation of the expression of certain lipid metabolism genes is connected to the nature of the fat globule membranes. The mechanism is yet to be determined.

Potential role of milk fat globule membrane in modulating plasma lipoproteins, gene expression, and cholesterol metabolism in humans: a randomized study. *Rosqvist F, Smedman A, et al. Am J Clin Nutr 2015; 102(1): 20-30.*

## Butter increases good cholesterol

- A study of 47 participants under 70 with a BMI under 32.
- Daily consumption of 16g of butter significantly increases blood HDL cholesterol (good cholesterol) levels.

Butter increased total and LDL cholesterol compared with olive oil but resulted in higher HDL cholesterol compared with a habitual diet. *Engel S, Tholstrup T. Am J Clin Nutr 2015; 102(2): 309-15.*

## The neutral effect of butter + cheese consumption on pigs’ cholesterol levels

Three diets – butter, cheese and butter & cheese – were given to pigs between 3 and 4 months old for 14 days. No significant effect was observed on blood lipid parameters (including LDL) for any of the diets. The authors conclude that these results are due to strong matrixes, and more specifically interactions between saturated fatty acids and calcium (which form “calcium soap” which cannot be assimilated by the organism).

Pigs are very similar to humans in terms of both their diets (omnivorous) and their development of heart disease. It would be worthwhile to repeat this study on humans “for those who enjoy their cheese with butter”.

Importance of the fat content within the cheese-matrix for blood lipid profile, faecal fat excretion, and gut microbiome in growing pig. *Thorning T, Raben A, et al. Int Dairy J 2016; 61: 67-75.*

## Fatty acids, markers of dairy product consumption

- 124 participants in good health consumed 3 servings of dairy products per day.
- After 4 weeks, daily dairy product consumption increased blood plasma C15:0 and C17:0 levels. These two fatty acids may be good markers of dairy product consumption.

Recommended dairy product intake modulates circulating fatty acid profile in healthy adults: a multi-centre cross-over study. *Abdullah MM, Cyr A, et al. Br J Nutr 2015; 113(3): 435-44.*

## Good for the figure?

- A study on 1,352 Luxembourgish subjects.
- Those who consumed dairy products had lower scale weights and less abdominal fat.

Whole-fat dairy food intake is inversely associated with obesity prevalence: findings from the Observation of Cardiovascular Risk Factors in Luxembourg study. *Crichton GE, Alkerwi A. Nutr Res. 2014; 34(11): 936-43.*

## Butter’s triumphant return

- A meta-analysis of 9 publications including 636,151 participants in 15 countries.
- Overall neutral results regarding the link between butter consumption and mortality, heart disease, stroke and diabetes risk.

Is Butter Back? A Systematic Review and Meta-Analysis of Butter Consumption and Risk of Cardiovascular Disease, Diabetes, and Total Mortality. *Pimpin, L., J. H. Y. Wu, et al. PLoS One 2016; 11(6): e0158118.*

# “Dairy products: other interesting articles”

## Dairy products' proven benefits for bone health

- A review of the nutritional benefits of dairy products and a discussion of the results of 27 clinical trials.
- A significant inverse correlation between DP consumption and bone resorption markers. A positive correlation with bone mineral density. Vitamin D-enriched DPs had an even more positive effect on these metabolic parameters. The correlation between DP consumption and the risk of fracture is less clear, although yogurt consumption demonstrates preventative tendencies against hip fracture.
- The nutritional intake recommended for good bone health can be reached with 3 servings of DP per day.

Dairy products, yogurts, and bone health. *Rizzoli R*. Am J Clin Nutr 2014; 99 (5 Suppl): 1256S-62S.

## Camembert against Alzheimer's... in mice

- Alzheimer's mouse model.
- By transforming oleic acid into oleamide, penicillium candidum, a mould found in cheeses like Camembert:
  - reduces the accumulation of illness progression markers:  $\beta$ -amyloid peptide and inflammatory factors in the hippocampus (an area of the brain).
  - boosts the synthesis of protective neurotrophic factors.

Preventive effects of a fermented dairy product against Alzheimer's disease and identification of a novel oleamide with enhanced microglial phagocytosis and anti-inflammatory activity. *Ano Y, Ozawa M*, et al. Plos one 2015; 10(3): e0118512.

## Dairy products, good for adolescents' waistlines

- 511 adolescents between 12 and 17 in eight European countries, tracked over 2 years.
- Milk and yogurt consumption reduces the waist circumference and body fat content in adolescents of both sexes.
- Overall dairy product consumption is correlated with reduced cardiovascular risk in girls.

Is dairy consumption associated with low cardiovascular disease risk in European adolescents? Results from the HELENA Study. *Bel-Serrat S, Mouratidou T*, et al. Pediatr Obes 2014; 9(5): 401-10.

## Canadian yogurt eaters are faring very well

- 664 Quebecers between 18 and 55
- Yogurt consumption is generally associated with “healthy” eating
- Yogurt eaters have lower weights, waist circumferences and BMIs.
- Among the obese, yogurt eaters have a better metabolic profile.

Association between yogurt consumption, dietary patterns, and cardio metabolic risk factors. *Cormier H, Thifault E*, et al. Eur J Nutr 2016; 55(2): 577-87. Nutr 2015; 113(3): 435-44.

## Dairy products for men with less high blood pressure

- 89 men and women with moderate hypertension (systolic BP  $\geq 135$  mm Hg and  $\leq 160$  mm Hg; diastolic BP  $\leq 119$  mm Hg)
- 3 Canadian servings of dairy products per day for 4 weeks.
- Dairy product consumption had a beneficial effect on systolic BP in men ( $-2$  mm Hg).
- Endothelial function (required for proper blood vessel functioning, including vasodilation and inhibition of platelet aggregation) improved by the consumption of dairy products in all participants.

Impact of dairy consumption on essential hypertension: a clinical study. *Drouin-Chartier JP, Giguere I*, et al. Nutr J 2014; 13: 83.

## Eating cheese every day? Sure, even with a mildly elevated cholesterol!

- 159 French adults with moderately high cholesterol.
- 2 servings of full-fat yogurt for three weeks, then either 2 servings of yogurt or 2 servings of Camembert (2 x 30g) for another 5 weeks.
- Cheese consumption had no effect on blood lipid levels or on blood pressure.

Effect on blood lipids of two daily servings of Camembert cheese. An intervention trial in mildly hypercholesterolemic subjects. *Schlienger JL, Paillard F*, et al. Int J Food Sci Nutr 2014; 65(8): 1013-8.

## Milk to help the Japanese live (even) longer

- 94,980 Japanese adults between 40 and 79.
- 21,775 deaths reported over the 19 years of tracking.
- Lower mortality (total, cardiovascular and due to cancer) in milk drinkers. For men, 1 to 2 times per month appears to be sufficient. Women, on the other hand, should drink milk 3 to 4 times a week.

Milk drinking and mortality: findings from the Japan collaborative cohort study. Wang C, Yatsuya H, et al. J Epidemiol 2015; 25(1): 66-73.

## Full-fat dairy product consumption not correlated with high cholesterol

- The MONICA study (MONItoring of trends and determinants in CARDiovascular disease) conducted between 1995 and 1997 demonstrates that full-fat dairy product consumption is not correlated with high total cholesterol. Daily full-fat dairy product intake combined with fruits and vegetables is correlated with a lower overall mortality risk in men.

Food groups associated with a reduced risk of 15-year all-cause death. Bongard V, Arveiler D et al. Eur J Clin Nutr 2016; 70(6): 715-22.

## The beneficial effects of dairy products against the risk of stroke

- 18 studies including 762,414 participants tracked for between 8 and 26 years.
- An increase in milk consumption by 200ml/day is correlated with a 7% decrease in the risk of stroke.
- More specifically, the authors observe that the maximum risk reduction is achieved with the consumption of 125ml of milk and/or 25g of cheese per day.

Dairy consumption and risk of stroke : a systematic review and updated dose-response meta analysis of prospective cohort studies. de Goede J, Soedamah-Muthu SS, et al. J Am Heart Assoc 2016; 5(5): e002787.

- Consuming dairy products more than 7 times a week may have beneficial effects on the risk of stroke.

Optimal dairy intake is predicated on total, cardiovascular, and stroke mortalities in a Taiwanese cohort. Huang LY, Wahlqvist ML, et al. J Am Coll Nutr 2014; 33(6): 426-36.

## Dairy products are an important dietary component

- Products not associated with an increase in mortality due to cardiovascular disease.
- Eliminating milk and dairy products does not appear to be the best strategy to reduce the risk of cardiovascular disease.

Plenary Lecture 2: Milk and dairy produce and CVD: new perspectives on dairy and cardiovascular health. Lovegrove JA, Hobbs DA. Proc Nutr Soc 2016.

## Dairy product consumption is beneficial against cardiovascular disease

This meta-analysis covers 22 studies and examines the association between dairy product consumption and the development of cardiovascular disease. It demonstrates that dairy product consumption is associated with a 12% reduction in the risk of developing cardiovascular disease.

Even very high levels of dairy product consumption, including cheese, is not correlated with cardiovascular mortality.

Dairy consumption and risk of cardiovascular disease: an updated meta-analysis of prospective cohort studies. Qin L, Xu J, et al. Asia Pac J Clin Nutr 2015; 24(1): 90-100.

## Dairy products during pregnancy for less-allergic children?

- 1,354 Japanese mother-child pairs
- A study of food habits during pregnancy and reports of the children's allergic reactions at 2 years of age (23-29 months).
- A reduced risk of eczema in children whose mothers had consumed the most dairy products during pregnancy. Less asthma in the children of those who ate cheese, and less eczema in the children of yogurt eaters.
- However, higher childhood eczema when mothers had high vitamin D intake during pregnancy.

Maternal consumption of dairy products, calcium, and vitamin D during pregnancy and infantile allergic disorders. Miyake, Y., K. Tanaka, et al. Ann Allergy Asthma Immunol 2014; 113(1): 82-87.

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- 58. Chronic diseases (2016)
- Special edition no.1c. "Rumours" about milk (2014)

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