

DAIRY PRODUCTS NUTRITION & HEALTH - MAJOR STUDIES

BEST

2013

of

“Yogurt”
special



“Eat yogurt!”

French people like to eat yogurt. But they don't eat enough of it – on average just 1 yogurt every two days... However, yogurt is one of the three dairy products per day recommended by health authorities.

Although the scientific literature is very interested in the health benefits of certain constituents of yogurt (particularly the probiotic role of lactic bacteria), increasingly more research today is focusing on the benefits of yogurt itself as a food.

When we look at yogurt as food holistically, we see health benefits that have been little explored: its beneficial effect on lowering blood pressure, improving dental and bone health, regulating energy uptake, and reducing stress... Lots of examples!

This new Best of compiles the most recent studies, to help you better understand the potential benefits of yogurt for health.

Dr Yvette Soustre

Nutrition Director, French National Dairy Council (CNIEL)

Every year sees **positive scientific studies** published on the nutrition and health benefits of dairy products. In order to track them and make them easily usable by **dairy professionals** at various levels (regulatory, lobbying, communication, R&D, etc.), the scientific and technical division of CNIEL has created the "Best of". This publication compiles summaries (written for you) of (positive) articles on a given topic. The language has been **simplified** as much as possible in order to be accessible to as many people as possible and to highlight the essentials of the subject.

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

Editors: Yvette Soustre (PhD Science) and Brigitte Le Révérend (PhD Microbiology)

Editorial Office: Anne Girard

Researcher: Vanessa Bodot

Proofreading of the English version: Laurence Rycken (FIL/IDF)

Multiple copies available on request from: nutritionssante@maisondulait.fr

Cniel - 42 rue de Châteaudun - F 75314 PARIS CEDEX 09 - Tel: +33(1) 49 70 72 24



Foreword: Health benefits, between yogurt and fermented milk

In France the term **fermented milk** or "LF" (*laits fermentés*) is reserved for dairy products prepared with milk (full-fat or skim, concentrated, powdered...) that has undergone heat treatment at least equivalent to pasteurization and cultured with microorganisms characteristic of each product. Three main types of bacteria are used in making French LF: lactobacilli (*Lactobacillus bulgaricus*, *L. acidophilus* and *L. casei*), lactococci (*Lactococcus lactis*, *Streptococcus thermophilus*) and bifidobacteria (*Bifidobacterium bifidum* and *B. longum*). The bacteria and strains used give the products their particular properties.



Yogurt is a particular kind of fermented milk (*Codex 2003*). In France, in order to be allowed to call it yogurt, the milk must be cultured with two specific lactic bacteria: *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. Also, the bacteria must be alive and abundant in the finished product (at least 10 million bacteria/g).

Even though yogurt "made in France" is a living product, product definitions vary from country to country. What type of yogurt is consumed is often colored by local traditions or corresponds to certain life styles. Thus, in Eastern Europe and Asia, people consume lots of milk that has undergone alcoholic fermentation by combining bacteria and yeasts (*Kefir*, *Koumis*, etc.). In Germany and Spain, once the yogurt has been made it is usually heat-treated to kill the bacteria. In yet other countries, various **probiotics** and/or **prebiotics*** are added to the mix.

These varying definitions often make it difficult to interpret the scientific data and to extrapolate the results of studies from one product to another.

This *Best of* reports a good number of studies carried out in France. The term "yogurt" should therefore be understood in parentheses as it very often differs from France's national definition.

Having said that, increasingly more researchers are becoming interested in the health benefits of "yogurt". And 2013 has proven to be especially prolific in terms of publications, as witnessed by this issue of *Best of*.

* Probiotic et prebiotic

- ▶ A prebiotic (fructo-oligosaccharide (FOS), oligofructose, inulin for example) is an indigestible food component capable of stimulating the growth and/or activity of good bacteria in the digestive tract and of probiotics.
- ▶ Probiotics are living microorganisms that, when ingested in sufficient quantities, have beneficial effects on human health.

“The benefits of fermented milk on high blood pressure”

- Meta-analysis of 14 intervention studies with a total of 702 participants.
- Significant drop in systolic and diastolic blood pressure in people who consume fermented milk. Bigger drop in people with high blood pressure.

Effect of probiotic fermented milk on blood pressure: a meta-analysis of randomised controlled trials.

Dong JY, Szeto IM, Makinen K, Gao Q, Wang J, Qin LQ, Zhao Y.

Department of Nutrition and Food Hygiene, School of Public Health, Soochow University, China Nestle Research Center Beijing, China et Lausanne, Switzerland. British Journal of Nutrition 2013 ; 110(7) : 1188-94.

“In summary, the present meta-analysis suggests that probiotic fermented milk has BP-lowering effects in pre-hypertensive and hypertensive subjects.”

High blood pressure is an important risk factor for cardiovascular disease. Twenty-nine percent of the world’s population is expected to have high blood pressure by 2025. For many years, researchers have been focusing on the potential beneficial role of fermented milk on high blood pressure but have not been able to come to an conclusion, as the results of the studies have been somewhat contradictory.

To get a clearer picture, researchers based in China carried out a meta-analysis of the available intervention studies. Of the 235 studies, they selected the most reliable, i.e., randomized studies against a placebo. This was a total of 14 studies (6 Japanese, 2 Danish, 4 Finnish and 2 Dutch) including a total of 702 participants.

Results: people who consume fermented milk have significantly lower blood pressure (BP) – on average 3 millimeters of mercury (mmHg) lower systolic BP and 1 mmHg lower diastolic BP. The effect on systolic BP is even more marked in hypertensive patients/ participants (nearly 4 mmHg drop versus 2 mmHg in normal-BP people). Also, although this needs to be confirmed, the Japanese seem to be more

sensitive than Europeans of the virtues of fermented milk.

Although these reductions (of 3 and 1 mmHg) may seem slight, even a modest BP drop among the population at large can have major public health consequences. Thus, a 2 mmHg drop in systolic BP has been associated with a 10% decline in mortality from strokes and a 7% decline in mortality from heart attacks.

According to the authors’ calculations, the biggest consumers of fermented

milk may have a 9% lower risk of high blood pressure than those who consume little/low amounts. Various mechanisms may explain these beneficial effects of fermented milk including the presence of certain antihypertensive peptides (valine-proline-proline or isoleucine-proline-proline) or the content of various nutrients in the milk itself (potassium, calcium, phosphorus). The contribution of probiotic microorganisms in this hypotensive effect, is still hypothetical and must be investigated in human beings.

Put in perspective

In 2012, a meta-analysis of 45,000 subjects showed a 13% drop in the risk of high blood pressure in people who eat a lot of dairy products. Milk and yogurt alone reduced the risk by 8%.* Also in 2012, the renowned Farmingham study in the US gave its verdict after 15 years of following more than 2,000 volunteers.** When “yogurt” accounted for 2% of total daily calories ingested, the risk of high blood pressure dropped by 31%. In practice, this corresponds to just under four yogurts a week. The study’s researchers also noted that systolic BP rose less among yogurt eaters.

* J. Human Hypertension 2012 ; 26(1) : 3-13.

** Abstract 188 - American Heart Association - septembre 2012.

“Yogurt against dental caries”

- Like other fermented milk, yogurt does not cause dental caries. It may also help prevent caries.
- A study in India of 68 students.

Effect of consuming different dairy products on calcium, phosphorus and pH levels of human dental plaque: a comparative study.

Ravishankar TL*, Yadav V*, Tangade PS*, Tirth A*, Chaitra TR**.

*Department of Public Health Dentistry, **Department of Pedodontics & Preventive Dentistry, Kothiwal Dental College. Eur Arch Paediatr Dent. 2012; 13(3): 144-8.



“Dairy products can be recommended as desserts after meals especially to school children, which would help to reduce the incidence of dental caries.”

Dental caries (tooth decay) is an infectious disease caused by bacteria in the mouth: *Streptococcus mutans*. With excessive consumption of carbohydrates, these bacteria multiply and stick to the surface of the teeth (dental plaque). They use the sugars in food to feed a fermentation process that causes the formation of acid (lactic acid). This acid sharply reduces the pH of the dental plaque and demineralizes the enamel (the hard outside layer of the tooth). Cavities form when demineralization is faster than remineralization. Various factors affect the caries process, such as: **the nature of the host** (*genetic, mouth-dental hygiene...*); **saliva** (*it contains protective agents and has a buffering effect that limits the virulence of acid attacks*); **time factor** (*frequency of carbohydrate consumption, its duration and retention in the mouth*) and of course **food...**

As regards the impact of food, the various studies carried out to date have shown that yogurt and other fermented milk (non sugared) do not cause dental caries. These results were confirmed in 2012 by a meta-analysis¹ of 9 studies and more than 5,600 yogurt consumers.

As regards prevention, although the role of cheese in preventing dental caries is well established (see *Best of “Cheese” 2012*), the data relating to fermented milk is more fragmentary.

A new study – carried out in India – has compared the effect of various dairy products (milk, cheeses, yogurts) on calcium and phosphorus levels and on the pH of dental plaque in 68 students aged 17 to 20 with and without dental caries. This study confirms that fermented milk (non sugared) and cheese are not cariogenic, and that these dairy products have a preventive effect on the dental caries process. Fermented milk increases (although somewhat less than cheese) the amount of calcium and phosphorus in dental plaque as well as its pH.

Among the hypotheses advanced by the authors of the study as reasons for this effect are the calcium and phosphorus content in yogurt and the concentration of CPP (a casein phosphopeptide produced by the proteolytic activity of the bacteria in yogurt). A direct effect of the probiotic bacteria in yogurt is also advanced.² In fact, the ferments in yogurt and in other fermented milk (*Lactobacillus rhamnosus GG*) may reduce the concentration of certain cariogenic bacteria in the mouth (mainly streptococci and lactobacilli) ensuring greater diversity in the dental biofilm. The authors therefore advise young people in India to replace their dessert with dairy products. And as regards to public health – the particular context of a developing country like India – they recommend yogurt.

YOGURT for the teeth of Chinese schoolchildren too

A study of 280 young Chinese aged 7 to 12 shows that children who consume a drinkable yogurt two to four times a week have less dental caries than others.³

1 Li H, Zou Y, Ding G Dietary Factors Associated with Dental Erosion: A Meta-Analysis PLoS One 2012, 7(8) : e42626.

2 Twetman S., Keller M.K. - Probiotics for Caries Prevention and Control - Acta Dent Res 2012; 24(2) : 98-102.

3 Wu L, Chang R, et al - Association between Obesity and Dental Caries in Chinese Children - Caries Res 2013; 47 : 171-176.



“Yogurt consumption is associated with better diet quality and metabolic profile in American men and women.”

- 6,526 men and women aged 19 to 89 monitored for 1 year.
- Yogurt consumption is inversely correlated to blood sugar levels, insulin resistance, and blood pressure.

Yogurt consumption is associated with better diet quality and metabolic profile in American men and women.

Wang H, Livingston KA, Fox CS, Meigs JB, Jacques PF. *Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts University, Boston ; National Heart, Lung and Blood Institute's Framingham Heart Study, Framingham, Dpt of Medicine, Massachusetts General Hospital, General Internal Medicine Unit, Boston.* Nutr Res. 2013 ; 33(1) : 18-26.

“Yogurt intake was associated with a better diet quality with greater intakes of several shortfall nutrients and healthier metabolic profiles in adult American population.”

Nutritional recommendations aimed at the American population advise consuming more low-lipid milk and dairy products. As the role of yogurt has not been studied much, scientists have researched the link between yogurt consumption, the nutritional quality of diets, and the metabolic profiles of adult Americans.

For a number of years, two large cohorts – the “Framingham Heart Study Offspring” and “Generation Three Cohort” – allows the monitoring of the incidence of cardiovascular disease in the American population.

6,526 men and women aged 19 to 89 from these cohorts participated in this study, during one year. They had to fill out a food frequency questionnaire containing 126 items. This was used to calculate their Dietary Guidelines Adherence Index (DGAI) to evaluate the overall quality of their diet. They also underwent a full clinical checkup including blood levels for blood sugar, total cholesterol, HDL cholesterol, triglycerides and insulin. For statistical analysis, the results of non-consumers (no yogurt consumed) were separated from consumers (at least one yogurt per week). Then the group of consumers was split into two: low and high consumers either side of the median consumption value (relative calorie contribution of about 2%). Generalized estimating equations were used to establish the link between yogurt consumption, nutritional diet quality and metabolic profile.

The results show that yogurt consumption is inversely correlated to blood sugar levels, insulin resistance, and blood pressure after adjusting for a certain number of criteria including Body Mass Index (BMI). The authors considered the health benefits of yogurt to be partially due to its impact on carbohydrate metabolism. Yogurt consumers (64% of women and 41% of men) have higher DGAI than non consumers. They also have a higher potassium intake (120 mg/d higher), which is known to have a beneficial role on blood pressure and the risk of stroke and heart attack. In high consumers of yogurt, some of these effects are more marked: potassium intake and fiber intake are higher, and some biological para-

meters are lower, such as triglycerides, fasting insulin levels and insulin resistance (homeostasis model assessment for insulin resistance or HOMA-IR).

The main strength of this study is its representative nature due to the large number of participants. It concludes that yogurt can be considered an excellent source of vitamins and minerals.

Vitamin and mineral deficiency can impact health by aggravating certain pathologies. The beneficial role of yogurt as a purveyor of nutrients has been shown with a dose-response effect for calcium, magnesium, potassium, zinc, and vitamins B2 and B12.

Put in perspective

- ▶ A 4-year study of American adults (National Health and Nutrition survey) has shown that consuming one extra yogurt a day limits weight gain and reduces the prevalence of metabolic syndrome with 60%.¹
- ▶ A meta-analysis of four clinical studies reveals the positive role of yogurt in type 2 diabetes.²
- ▶ Recent prospective studies have shown the positive effect of yogurt consumption on weight and waist size (see page 15).

¹ Beydoun MA et al, *Am J Clin Nutr* 2008 ; 87 : 1914-25.
² Tong X et al, *Eur J Clin Nutr* 2011 ; 65(9) : 1027-31.

“France: people who eat yogurt have especially healthy hearts!”

- People who eat a lot of milk and fresh dairy products - including yogurt - are less likely to have heart attacks.
- A study of 3,078 men and women aged 35 to 64 living in three regions of France (Lower Rhine, Haute Garonne and Greater Lille).

Low-fat and high-fat dairy products are differently related to blood lipids and cardiovascular risk score.

Huo Yung Kai S, Bongard V, Simon C, Ruidavets JB, Arveiler D, Dallongeville J, Wagner A, Amouyel, Ferrières J.
Department of Cardiology, Toulouse University Hospital, France.
European Journal of Preventive Cardiology online 3 September 2013 – DOI: 10.1177/2047487313503283

Participants with the highest low-fat dairy intakes (milk and milk in desserts, yogurts, cottage cheese) exhibited the lowest risk scores of cardiovascular mortality and presented with the best lipid profile, whereas no significant independent association was found for high-fat dairy intake (other cheese).

The MONA LISA study (**MO**nitoring **N**ational **du** **r**isque **A**rtériel) was a population survey conducted between 2005 and 2007 in three regions of France (Lower Rhine, Haute Gironne, and Greater Lille). Its objective was to study the relationship between eating habits and cardiovascular risk factors.

A specific study was conducted of dairy consumption among one sample of the population: 3,078 men and women aged 35 to 64. The data on eating habits was collected using a food diary covering three consecutive days and various clinical and biological parameters were measured.

For this study, dairy consumption was split into two groups: fresh dairy products (milk, yogurt, cottage cheese, milk desserts) and cheese. The 10-year risk of fatal heart attack and stroke was estimated using equations that take multiple risk factors into account (the Systematic Coronary Risk

Evaluation (SCORE) equation and the Framingham equation).

Result: After adjusting for certain variables (notably physical activity and diet quality), higher dairy consumption was found to be negatively associated with the risk of having high LDL cholesterol (bad cholesterol), of presenting with metabolic syndrome, and to be at average or high cardiovascular risk (defined by the scores).

The probability of being at cardiovascular risk was approximately 32% lower in people consuming

approximately 380 g of fresh dairy products per day (one yogurt and one bowl of milk for example).

Although this observation study suggests the beneficial effect of fresh dairy products on lipid profile and on cardiovascular risk, long-term intervention studies still need to be carried out to show actual causality. This is because the consumption of fresh dairy products is often synonymous with “better eating habits”, and even though a statistical analysis has taken this variable into account, confounding factors may persist.

The consumption of fresh dairy products, a marker of a healthier diet

A Crédoc study carried out in France using 2010 CCAF data, shows a positive association between quasi-daily consumption of ultra-fresh dairy products and a more balanced and varied diet in children. It also shows that adults and big consumers of fresh dairy products adopt overall better diets that lead to better nutritional intake.

Crédoc - JFN 2013



“Yogurt: The snack of choice to reduce hunger and food intake?”

- Two independent studies in the UK and US respectively, report convergent results: Yogurt snacks reduce hunger and food intake.

“Two independent clinical studies (one from England and the other from USA) reported similar results. Yogurt snacks led to reduce hunger and delayed subsequent eating.”

Differential effects of dairy snacks on appetite, but not overall energy intake.

Douglas A, Minihane A M, Givens D I, Reynolds C K, Yaqoob P. Hugh Sinclair Human Nutrition Group, Food and Nutritional Sciences, Faculty of Life sciences, & Faculty of Life sciences, School of Agriculture Policy and Development University of Reading, UK et Department of Nutrition, Norwich Medical School, University of East Anglia(UEA), Norwich, UK. British Journal of Nutrition 2012 ; 108(12) : 2274-85.

“In conclusion, all dairy snacks reduced appetite and lunch intake compared with water. Yogurt had the greatest effect on suppressing subjective appetite ratings, but did not affect subsequent food intake compared with milk or cheese.”

A British team recalls that milk proteins play an important and recognized role in controlling appetite and energy intake. Multiple studies have shown that caseins and serum proteins regulate the feeling of fullness and food intake. Intestinal hormone secretion has been suggested as one action mechanism. However, the quantities of proteins tested in these studies are often high and do not correspond to standard dairy products on the market. Other factors such as calcium content, or product texture could also be involved but the conclusions of the various studies remain ambiguous. The authors compared the impact of consuming three commercial dairy products, as morning snacks, on appetite and energy intake at the following lunch.

Forty men aged 18 to 50, in good health but overweight (BMI of 25 to 29.9), each took part in four tests separated by at least one week (randomized crossover trial). Each test consisted of consuming a dairy product (semi-skim-

med milk, natural yogurt or cheddar) or drinking water (the control product). The portions were isocaloric (200 kcal), yogurt and cheddar were consumed with water to match the volume of milk (410 ml).

Subjects had to follow strict instructions for 24 hours before the test, such as limiting alcohol and then eat the standard dinner provided. The morning of the test, a light breakfast was eaten at the study center. Two hours later the subject ate their dairy snack. For lunch they could eat what they liked three-and-a-half hours after breakfast. Questionnaires in the form of Visual Analog Scales were used to measure food intake, physical activity, mood and appetite a set times throughout the morning. Two blood samples were taken (one fasting and 80 minutes after eating the snack) to measure the change in the various markers linked to the feeling of fullness such as the concentration of amino acids, blood sugar, insulin, ghrelin, and peptide tyrosine-tyrosine.

Results: The feeling of hunger was significantly weaker ($p < 0.001$) after eating yogurt: by 8% compared to cheese, 10% compared to milk, and 24% compared to water.

Energy intake at the next meal (eating whatever they liked) measured in kJ was 11% less after consuming yogurt, 9% less after consuming cheese, and 12% less after consuming milk compared when water was consumed. However, when including the calorie value of the snacks the total energy intake was higher than after drinking water: 4,690 kJ (yogurt) vs 4,301 kJ (water). For biological constants, no post-prandial difference was noted for glucose, insulin, PYY or ghreline. On the other hand, concentrations of alanine and isoleucine were significantly higher after eating yogurt than after eating cheese or drinking milk.

In conclusion: Compared to water, consuming milk, cheese and yoghurt reduces appetite and energy intake at the next meal. Yogurt has the most marked effect on reducing the feeling of hunger.



Low, moderate, or high protein yogurt snacks on appetite control and subsequent eating in healthy women.

Douglas SM, Ortinau L C, Hoertel H A, Leidy H J.

University of Missouri, Dept of Nutrition and Exercise Physiology, School of Medicine, University of Missouri, Columbia, USA. *Appetite* 2013 ; 60(1) : 117-22.

"In conclusion, an afternoon snack of Greek yogurt, containing 24 g protein, led to reduced hunger, increased fullness, and delayed subsequent eating compared to lower protein snacks in healthy women."

A US team carried out a randomized crossover study on the influence of the protein content in various yogurts eaten as afternoon snacks, on appetite control and the timing of the next meal. Fifteen women aged 18 to 50, in good health, with a body mass index between 18 and 27 ate 160 kcal of yogurt for three days, with the control group having no snack at all. The yogurts had low, moderate or high protein levels (LP=5, MP=14, HP=24 g of protein respectively).

The fourth day, the volunteers had a balanced and standardized breakfast (300 kcal) and lunch (500 kcal) at the study center. Three hours after breakfast, they had their snacks and measurements were taken (of hunger for example) every 30 minutes. At dinnertime, subjects who wanted to eat could eat what they liked (ad libitum).

Results: Without taking protein content into account, eating a snack reduced the feeling of hunger, increased the feeling of fullness, and delayed the time of the next meal. The higher the yogurt's protein content, the more marked was the effect. Also, the calorie content of the next meal was lower with the snack than without.

In conclusion, a snack like Greek yogurt, containing 24 g of protein, eaten in the afternoon, reduces the

feeling of hunger and delays the time of the next meal more effectively than yogurt containing lower protein content (5 g). With a yogurt snack, the number of calories eaten at the next meal is slightly less than without any snack but depends of the quantity of protein in the product (60 kcal (LP), 90 kcal (MP) or 83 kcal (HP)). These results suggest therefore that eating a protein-rich afternoon snack potentially curbs overeating in the evening.

Put in perspective

The benefit of milk protein for weight management has been shown in numerous cases (Best of 2012). These two new studies reinforce earlier results but are interesting in having been conducted using commercial products. They underscore the nutritional benefit of yogurt and other dairy products eaten as snacks. Additional studies should be carried out to better understand the mechanism by which these proteins act on the body and how yogurt influences total food intake.

“Why eat yogurt if you suffer from poor lactose digestion or lactose intolerance?”

- Because it works! The benefits of “real” yogurt have been confirmed by the European Food Safety Authority (EFSA).
- In order not to cut your consumption of dairy products and thereby your nutritional intake of calcium and vitamin D in particular.

Maldigestion du lactose : formes cliniques et solutions thérapeutiques.

Burgain J, Gaiani C, Jeandel C, Cailliez-Grimal C, Revol AM, Scher J.
Laboratoire d'ingénierie des biomolécules, université de Lorraine, Vandœuvre-lès-Nancy, France.
Cahiers de Nutrition et de Diététique 2012 ; 47 : 201-9.

“Yogurt containing lactic acid cultures *Lactobacillus bulgaricus* and *Streptococcus thermophilus* improved lactose digestion and helps to prevent calcium and vitamin D deficiency.”

Seventy percent of the world's population have problems digesting lactose. In France, 10% to 50% of the population may be affected. Lactose is the main sugar in milk. It is also found in various industrial preparations (soups, sauces, biscuits, etc.) and some drugs.

When lactase activity (an enzyme that digests lactose in the gut) is low or absent, some of the lactose remains undigested. This residual lactose is then fermented by the intestinal microbiota in the colon, leading to the formation of lactate, volatile fatty acids, gas, causing acidification of the environment and accelerated transit through the gut.

Lactose intolerance results from the malabsorption of lactose. It is linked to the dose of lactose absorbed. Although the most sensitive subjects feel indigestion symptoms on eating just 3 g of lactose, most can drink up to 250 ml of milk (12 g of lactose) with any special problems.

The clinical symptoms of lactose intolerance are intestinal pain, cramps,

rumblings and diarrhea. Other symptoms may also be observed including nausea, vomiting, headache, etc. The usual treatment starts with greatly reducing the lactose in the diet but only over a short period of time. This is because a clinical study of 30 children with lactose intolerance showed that reducing dairy products for two years could lead to abnormally low bone mineral density.¹

In order to reduce the risk of nutritional deficiency (mainly calcium and vitamin D), it is therefore important to maintain an intake of dairy products during treat-

ment. One solution is to eat “real yogurt” containing the two strains *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. These two species of bacteria have a particularly strong membrane-shielding effect that protects their endogenous lactase against gastric acidity and bile salts. When eating yoghurt, the digestibility of the lactose in the product is greatly enhanced and can attain 90% efficiency.

Eating yogurt is an easy and nutritionally satisfying solution for people suffering from lactose intolerance.

The EFSA recognizes that yogurt improves the digestion of lactose

In 2010 the EFSA confirmed a health claim for yogurt for improving the digestion of lactose. It is based on 13 clinical studies which have clearly confirmed a reduction in the excretion of hydrogen* after ingesting real yogurt containing 10⁸ cfu/g of the two species *Lactobacillus bulgaricus* and *Streptococcus thermophilus*.

* Malabsorption can be diagnosed by measuring the excreted hydrogen. This test measures the hydrogen in exhaled breath before and after ingesting 20 g of lactose.

EFSA J 2010 ; 8(10) : 1763-81.

¹ Infante D, Tormo R. Risk of inadequate bone mineralization in diseases involving long-term suppression of dairy products. *J Pediatr Gastroenterol Nutr.* 2000 ; 30(3) : 310-3.

“Yogurt, an ally in preventing metabolic syndrome”

- Study of 4,862 Koreans over 19 years of age.
- Metabolic syndrome less frequent among yogurt eaters.

Dairy food consumption is inversely associated with the risk of metabolic syndrome in Korean adults.

Kim J.
Department of Medical Nutrition, School of East-West Medical Science, Kyung Hee University, south Korea.
J Hum Nutr Diet. 2013 ; 26 Suppl 1 : 171-9.



“In summary, the present study suggests that high intake of dairy foods including yogurts is associated with lower risk of metabolic syndrome.”

Metabolic syndrome covers various disorders (high blood pressure, carbohydrate and/or lipid metabolism disorders, abdominal obesity) that increase the risk of diabetes and/or cardiovascular disease (heart attack and stroke). Various studies have suggested a link between the consumption of dairy products (primarily fermented) and a reduction in the risk of metabolic syndrome.¹⁻⁵

In Korea, metabolic syndrome affects approximately 33% of men and 26% of women over 30 years of age. As dairy products are traditionally not consumed by Korean's, the results of the various publications studying their impact on metabolic syndrome have so far proven somewhat contradictory. The purpose of this study, based on the *Korean National Health and Nutrition Examination Survey (KNHANES)*, was to establish a link between the consumption of dairy products and the frequency of metabolic syndrome, taking into account confounding factors such as socioeconomic conditions, lifestyle health and general diet. data from 4,863 adults over 19 years of age (1,993 men and 2,869 women) was collected over two months between October and December 2010.

Results: A typology of "high" consumers of dairy products (at least one per day, which is a lot in Korea) was established. This group mainly consisted of women, of young age, with a relatively high level

of education, moderate users of tobacco and alcohol, with relatively high-calorie diets rich in lipids and calcium.

Their "high" consumption of dairy products (milk & yogurt) was associated with lower BMI, waist size, blood pressure, fasting blood sugar and triglycerides, and with higher HDL Cholesterol (good cholesterol).

Specifically for yogurt, the authors showed its significant beneficial role for three parameters: fasting glucose ($OR=0.89$, IC 95%: 0.64 -1.25, $p=0.0213$), HDL-C ($OR=0.72$, IC 95%: 0.52-1.00, $p=0.0197$) and the risk of metabolic syndrome ($OR= 0.71$, IC 95% 0.48-1.05 $p=0.0067$). The authors thus concluded that yogurt consumption is associated with lower risk of metabolic

syndrome and lower risk of lower HDL after adjusting for the other risk factors. The mechanisms in play are still not well understood. The protective effect of yogurt on lipid metabolism was shown in earlier studies.⁶⁻⁸ In the digestive tract, certain lactic bacteria resistant to bile may limit the absorption of cholesterol.⁷

Healthier overall eating habits and lifestyle (with more fiber and calcium, and less alcohol) among yogurt consumers may also be part of the explanation. Although yogurt alone cannot prevent metabolic syndrome or its complications, when combined with a balanced diet and healthy lifestyle it can help prevent it.

Put in perspective

This study confirms earlier studies which showed a link between eating dairy products and reduced risk of metabolic syndrome.¹⁻³ A recent prospective study in France showed, over a 9-year period, that the consumption of dairy products was associated with smaller waist size, lower triglyceride levels and lower frequency of metabolic syndrome.⁵ One European in five suffers from the metabolic syndrome, /with 50 million Americans concerned! The increase in the number of people who are obese or overweight may also sharply increase the frequency of metabolic syndrome in the years to come!

- 1 Crichton GE et al, *Obesity Reviews* 2011 ; 12(5) : e190-201.
- 2 Pereira MA et al, *JAMA* 2002 ; 287 : 2081-89.
- 3 Azadbakht L et al, *Am.J.Clin.Nutr* 2005 ; 82 : 523-530.
- 4 Liu S et al, *Diabetes Care* 2005 ; 28 ; 2926-32.
- 5 Fumeron F et al, *J.Am.Coll.Nutr.* 2011 ; 30 : 454S-63S.
- 6 Pfeuffer M et Schrezenmeier J *Obes Rev* 2007 ; 8 : 109-18.
- 7 Zemel MB et al, *FASEB J* 2000 ; 14 : 1132-8.
- 8 Saint Onge MP et al, *Am.J.Clin.Nutr* 2000 ; 71 : 674-81.



“The role of yogurt in preventing type 2 diabetes”

- Results for yogurt calculated from seven studies of 254,892 participants and 19,082 cases of diabetes.
- Consuming 200 g of yogurt a -day correlates with a 22% reduction in the risk of type 2 diabetes.

Dairy products and the risk of type 2 diabetes: a systematic review and dose-response meta-analysis of cohort studies.

Aune D, Norat T, Romundstad P, Vatten LJ.
 Dpt Public Health and General Practice, Faculty of Medicine, Norwegian University of Science and Technology, Trondheim, Norway,
 Dpt Epidemiology and Biostatistics, School of Public Health, Imperial College London, United Kingdom.
 Am J Clin Nutr. 2013 ; 98(4) : 1066-83.

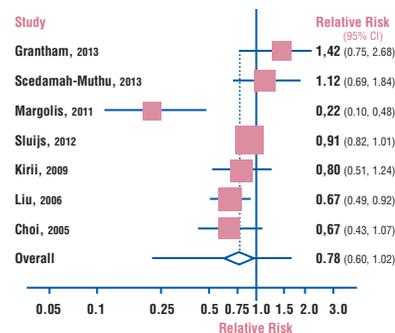
“The results from this meta-analysis support the hypothesis that intake of dairy products decreases the risk of type 2 diabetes and are consistent with 2 previous meta-analyses of cohort studies of dairy products and type 2 diabetes that also found inverse associations.”

Type 2 diabetes or late-onset diabetes represent the great majority of diabetes cases (about 90% of cases in France). It generally appears after the age of 45 and is associated with hereditary and environmental factors (obesity and sedentary lifestyle). It is characterized by insulin resistance in cells (mainly in muscles and liver). Treatment mainly involves losing weight and/or taking drugs. The number of diabetics (mainly type 2 diabetes sufferers) was estimated at 336 million in 2011 and this should increase to 522 million by 2030 with considerable human and economic consequences. The prevention of type 2 diabetes and its risk factors are thus becoming a particularly major public health challenge. Numerous recent epidemiological studies and meta-analyses have revealed an association between the consumption of dairy products and a reduced risk of type 2 diabetes.⁽¹⁻³⁾ Studies attempting to separate these effects by product category or to define “suggested consumption” quantities have proven less conclusive.

By including 17 studies, 426,000 participants and 27,000 cases of diabetes, this new meta-analysis confirms the overall protective effect of dairy product consumption on the risk of diabetes. It also shows – as do numerous other studies – a preventive effect specific to fermented milk products: cheese and yogurt. The yogurt-related results are based on 7 studies and 19,082 diabetes cases among 254,892 participants. Although a little less than 2 yogurts a day (200 g) correlates to approximately 22% risk reduction, there does not seem to be a “dose-response” effect, however. In other words, eating more yogurt than that would not provide any additional benefit. However, the great heteroge-

neity of the seven studies included in this analysis (populations studied, type of food survey, lifestyle, etc.) could explain that (*see illustration*). Further studies will undoubtedly be necessary to better evaluate the dose effect of yogurt in type 2 diabetes prevention.

Yogurt and type 2 diabetes, dose-response, per 200 g/d



How to explain the potential protective effect of dairy products on type 2 diabetes?

The hypotheses include: Beneficial role on weight management; link between diet and/or healthier lifestyle; role of certain constituents (proteins, minerals, vitamins, trans palmitoleic acid); beneficial influence of probiotic bacteria on the digestive system; etc.

(1) Elwood PC, Pickering JE, Givens DJ, Gallacher JE. The consumption of milk and dairy foods and the incidence of vascular disease and diabetes: an overview of the evidence. *Lipids* 2010 ; 45:925–39.
 (2) Pittas AG, Lau J, Hu FB, Dawson-Hughes B. The role of vitamin D and calcium in type 2 diabetes: a systematic review and meta-analysis. *J Clin Endocrinol Metab* 2007 ; 92:2017–29.
 (3) Tong X, Dong JY, Wu ZW, Li W, Qin LQ. Dairy consumption and risk of type 2 diabetes mellitus: a meta-analysis of cohort studies. *Eur J Clin Nutr* 2011 ; 65:1027–31.

“Eat yogurt to prevent bone loss”

- In both men and women in America, eating 4 portions of yogurt a week (which equates to one 125 g yogurt per day in France) is associated with higher bone mineral density.
- 3,212 participants from the famous Framingham study were monitored for 12 years. Average age 55.

Milk and yogurt consumption are linked with higher bone mineral density but not with hip fracture: the Framingham Offspring Study.

Sahni S, Tucker KL, Kiel DP, Quach L, Casey VA, Hannan MT.
Institute for Aging Research, Hebrew SeniorLife and Harvard Medical School, Boston, USA.
Arch Osteoporos. 2013 ; 8(1-2) : 119.



“Milk and yogurt intakes were associated with hip but not spine BMD (Body Mass Density). Suggestive fracture results for milk and yogurt intakes need further confirmation.”

These results are from the famous Framingham study and relate to 3,212 Americans aged 26 to 85 (average age 55). They show that Americans’ eating four portions of yogurt a week (equivalent to one French yogurt a day) have higher femur density (than those who do not eat yogurt). The effect on the trochanters (protuberances either side of the femur near the pelvic joint that allow the insertion of certain muscles) is significant but not at the neck of the femur. However, it becomes significant when milk consumption is added to yogurt consumption. This result is undoubtedly explained by Americans’ low consumption of yogurt (an average of one serving per week, a little less than two yogurts). From a fractures point a view, the protective effect of yogurt consumption is also noted by the authors, even if it does not reach the threshold of statistical signi-

ficance. Low yogurt consumption, the small number of fractures observed (43) and the young age of certain participants could be part of the explanation. Hence the need to conduct further studies...

Overall, this study also shows that large consumers of dairy products also have higher intake of protein, calcium, vitamin D, magnesium, phosphorus... Nutrients known for their beneficial effect on bone strength.

From bone density to fractures is just one step

Osteoporosis (porous bones) is a skeletal disease the frequency of which increases with age. It combines a reduction in bone density with disruption of the bone’s internal architecture. Bone becomes thinner, more porous, weaker, with heightened risk of breaking. In France, this disease is responsible every year for some 50,000 new cases of spine fractures, 35,000 wrist fractures and 50,000 hip (neck of femur) fractures. Studies show a gradient between the reduction in bone mineral density and the increase in fracture risk. A recent meta-analysis of intervention studies (11 randomized controlled trials involving 2,397 subjects) showed that milk intake significantly reduced bone loss.

Ma DF et al - Milk intake increases bone mineral content through inhibiting bone resorption: Meta-analysis of randomized controlled trials. e-SPEN journal 2013 ; 8 (1) : e1-e7.

YOGURT: excellent for fortification



Fortification consists of adding to a food a number of components (usually vitamins, minerals and trace elements but also pre- and probiotics) to enhance nutritional quality and/or health benefits. Yogurt is proving to be particularly interesting in this respect.

YOGURT + Vitamin D3 + Calcium & improvement in bone health in the elderly:

Researchers have studied the effects of adding 125 g of yogurt per day for two months, on the bone health of 59 elderly people (average age 85.5). Two types of yogurts were tested: a “classic yogurt” (containing 280 mg of calcium) and a yogurt fortified with calcium and vitamin D3 (800 mg of calcium and 10 µg of vitamin D). Various plasma markers of bone resorption were measured (vitamin D, PTH, TRAP5b, and others). The study was randomized and double-blind. Results: The fortified yogurts were well accepted by the elderly people. It increased their intake of calcium and vitamin D, and reduced further bone loss. The results were interesting for this elderly population who are particularly at risk for fractures and often difficult to keep nourished.

Consumption of yogurts fortified in vitamin D and calcium reduces serum parathyroid hormone and markers of bone resorption: a double-blind randomized controlled trial in institutionalized elderly women.

Bonjour JP, Benoit V, Payen F, Kraenzlin M.
J Clin Endocrinol Metab 2013 ; 98(7) : 2915-21.

YOGURT + Vitamin D3 with or without Calcium & reduced inflammation in diabetics

Chronic inflammation is suspected to play a role in the development and/or persistence of type 2 diabetes. The impact of consuming 250 ml/day of yogurt drink on inflammation markers was tested in 90 diabetics aged 30 to 60 for 12 weeks. Three types of yogurts were tested: classic, fortified with vitamin D, and fortified with vitamin D and calcium. The study was randomized and double-blind. Result: Fortifying with vitamin D improved the number of inflammation markers. Fortifying with calcium provides added benefit by acting on adiponectin (a hormone produced by adipose tissue which is involved in regulating the metabolism of lipids and glucose, among other things).

Improvement of Vitamin D Status via Daily Intake of Fortified Yogurt Drink Either with or without Extra Calcium Ameliorates Systemic Inflammatory Biomarkers, including Adipokines, in the Subjects with Type 2 Diabetes.

Neyestani TR, Nikooyeh B, Alavi-Majid H, Shariatzadeh N, Kalayi A, Tayebinejad N, HeraviFarid S, Salekzamani S, Zahedirad M.
J Clin Endocrinol Metab. 2012 ; 97(6) : 2005-11.

YOGURT + Omega 3 & reduced cardiovascular risk

For 10 weeks, 57 German adults with moderately high triglyceride levels (1.7 mmol/L) consumed various types of yogurts: classic yogurt; yogurt fortified with 0.8 g of long-chain Omega 3 (0.01 g ALA, 0.44 g EPA, 0.06 g DPA, 0.31 g DHA); yogurt fortified with 3 g long-chain Omega 3 (0.07 ALA, 1.59 g EPA, 0.23 DPA, 1.12g DHA). The study was randomized and double-blind. Eating yogurt with the highest Omega 3 led to increased plasma levels of Omega 3 and red blood cells. This was also followed by improved plasma inflammation markers (lower PGD2, 5-, 8-, 9-, 11-HETE and higher PGE3, 12-, 15-, 18-HEPE) and an improved lipid profile (higher HDL and lower TG) in some subjects. Fortification with Omega 3 can thus lead to a reduction in inflammation and in cardiovascular risk factors in people with hypertriglyceridemia

Randomized placebo-controlled intervention with n-3 LC-PUFA-supplemented yoghurt: Effects on circulating eicosanoids and cardiovascular risk factors

Dawczynski C, Massey KA, Ness C, Kiehnkopf M, Stepanow S, Platzer M, GrUn Ml, Nicolaou A, Jahreis G.
Clin Nutr 2013 ; 32(5) : 686-96.

Yogurt + micronutrients + probiotics & improved immune function in AIDS sufferers

Antiretroviral therapies aggravate diarrhea and other gastrointestinal disorders in AIDS patients. Some probiotics such as *Lactobacillus rhamnosus* GR-1 are known to alleviate diarrhea and slow the decline in CD4 T lymphocytes (the primary mechanism by which HIV positive status leads to AIDS). Furthermore, these patients are very often given micronutrient supplements to improve their quality of life and their immune function. Researchers therefore tested the benefits of three types of yogurts: fortified with probiotics and micronutrients*; fortified only with probiotics; and fortified only with micronutrients. Each yogurt was trialed for 30 days in a randomized double-blind study. All the yogurts were well tolerated and the patients felt more energetic and performed everyday tasks more easily. Fortifying with micronutrients and associating probiotics/micronutrients led to improved immune status in patients (increased CD4).

* Vitamins (A, E, B1 and B12, C...), iron, selenium, zinc, DHA and EPA.

Micronutrient supplemented probiotic yogurt for HIV-infected adults taking HAART in London, Canada.

Hemsworth JC, Hekmat S, Reid G.
Gut Microbes. 2012 ; 3(5) : 414-9.

Other articles of interest...

“Eating yogurt curbs weight gain and waist circumference”

Longitudinal association between dairy consumption and changes of body weight and waist circumference: the Framingham Heart Study.
Wang H, Troy LM, Rogers GT, et al *Nutritional Epidemiology Program, Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts University, Boston, USA.*
Int J Obes (Lond). 2013. doi: 10.1038/ijo.2013.78.

3,440 participants of the famous Framingham study monitored for 13 years (average age 55). Americans consuming at least 3 portions of yogurt a week (equal to slightly less than one French yogurt a day) gained less weight than people who ate no yogurt (0.07 ± 0.04 kg vs 0.16 ± 0.03). In other words, their annual weight gain was reduced by 50%. The waist circumference of those eating the most yogurt also shrank by 20%, or by 0.13 ± 0.05 cm a year. These results confirm a 2011 study showing 0.37 kg less weight gain by unit of yogurt consumed over a period of 4-year.*

* Mozaffarian D, Hao T, Rimm EB, Willett WC, Hu FB. *N Engl J Med.* 2011; 364(25):2392-404.

Fermented Milks and Milk Products as Functional Foods - A Review.

SHIBY V. K. & MISHRA H. N. - *Defence Food Research Laboratory, Siddharthanagar, Mysore, India & Indian institute of Technology, Kharagpur, India.*
Crit Rev Food Sci Nutr. 2013 ; 53(5) : 482-96.

Dairy products : how they fit in nutritionally adequate Diets.

Clerfeuille E, Maillot M, Verger EO, Lluich A, Darmon N, Rolf-Pedersen N. - *Danone Research-Centre Daniel Carasso, Palaiseau, France.*
J Acad Nutr Diet. 2013 ; 113(7) : 950-6.

Effects of probiotic yoghurt on symptoms and intestinal microbiota in patients with irritable bowel syndrome.

Lee J, Rheem S, Yun B, et al - *Division of Food Bioscience and Technology, College of Life Sciences and Biotechnology, Korea University, Seoul.*
Int J Dairy Technol 2013 ; 66(2) : 243-55.

Dairy product consumption, calcium intakes, and metabolic syndrome-related factors over 5 years in the STANISLAS study.

Samara A, Herbeth B, Ndiaye NC, Fumeron F, et al. *EA 4373 "Génétique Cardiovasculaire", Faculté de Pharmacie, Université de Lorraine, Nancy, France.*
Nutrition 2013 ; 29(3) : 519-24.

Effects of low-fat or full-fat fermented and non-fermented dairy foods on selected cardiovascular biomarkers in overweight adults.

Nestel PJ, Mellett N, Pally S, Wong G, Barlow CK, et al. *Baker Heart and Diabetes Institute, Melbourne, VIC, Australia.*
Br J Nutr 2013 ; doi: 10.1017/S0007114513001621.

Probiotics as an Alternative Strategy for Prevention and Treatment of Human Diseases: A Review.

Khani S, Hosseini HM, Taheri M, Nourani MR, Imani Fooladi AA. *Department of Biochemistry, Pasteur Institute of Iran, Tehran, Iran.*
Inflamm Allergy Drug Targets 2012 ;11(2) : 79-89.

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scientific studies showing the beneficial effects of dairy products summarized for you!



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nutritionssante@maisondulait.fr



