DAIRY PRODUCTS NUTRITION & HEALTH - MAJOR STUDIES

BEST of 2013

Special Issue: Milk

Editorial

MILK

Global production of cow's milk is approaching 637 billion liters per year. In France, it is around 24 billion liters per year, i.e. 4% of global production.

Whether consumed in its natural state or in the form of yogurts, cheeses or other dairy products, milk is an essential component of our diet. Because of its exceptional nutritional richness, it contributes to the intake of numerous nutrients and is part of a "balanced diet", regardless of gender, age or physical activity levels…

Because of its omnipresence in our diet, milk is the subject of numerous research projects. And more and more studies are highlighting its potentially beneficial role in relation to various pathologies (hypertension, diabetes, metabolic syndrome, colon cancer…).

This *Best of* "Special Issue: Milk" sums up the main scientific studies published in 2013 on the beneficial relationship between "milk and health".

Yvette Soustre & Corinne Marmonier
Ph.D. in Nutrition

Each year, **positive scientific studies** are 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

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Chief editor: Yvette Soustre - Design: Thierry Beaufils

"Milk: a nutritionally rich and functional composition"

- Review of the nutritional composition of milk and its effects on our health.
- Through its nutritional richness and functional diversity, milk has a place of honor in dietary recommendations.

Milk nutritional composition and its role in human health.

Paula C. Pereira.
Laboratorio de Bioquimica – CiiEm - Portugal.
Nutrition 2014 doi : 10.1016/j.nut.2013.10.011

"Nutritional richness is unquestionable."

The composition of milk is influenced by various factors: the genetic and nutritional status of the animal, environmental conditions, stage of lactation… On average, milk is composed of 87% water, 4 to 5% lactose, 3% proteins, 3 to 4% lipids, 0.8% minerals and 0.1% vitamins.

Proteins

Milk is an important source of proteins; 20% of its proteins are soluble (whey proteins) and 80% are insoluble (caseins). Their composition in amino-acids, digestibility and bioavailability gives proteins their high nutritional quality. Milk proteins and bioactive peptides derived through hydrolysis have multiple beneficial effects on health (antibacterial, antiviral, antifungal, antimicrobial and antioxidant actions, antihypertensive effect, immunomodulator, improvement in the absorption of other nutrients…)*.

** Certain whey proteins (lactoferrin, lactoperoxidase and lysozyme) are antimicrobial agents, others (lactoferrin, β-lactoglobulin and α-lactalbumin) play a role against the development of certain tumors, in the transport of retinol (β-lactoglobulin) and even in the absorption of iron (lactoferrin). The main capacities of caseins – α, β and κ – are the binding and transport of minerals (calcium, phosphorus…). They are also the basis of bioactive peptides that play a possible role in weight control through the regulation of food intake.*

Lipids

The lipid fraction of milk is composed mainly of triglycerides but also around 2% diacylglycerol, less than 0.5% cholesterol, 1% phospholipids and 0.1% free fatty acids. Milk lipids are a result of the cow's diet or the microbial activity of the rumen. On average, milk contains 70% saturated fatty acids (palmitic, myristic, stearic and butyric acids…) and 30% unsaturated fatty acids (essentially monounsaturated (oleic) with a low polyunsaturated content). Milk also contains conjugated linoleic acid (CLA), which has health benefits (cardiovascular system and immune function in particular). Dairy products provide around 70% of the conjugated linoleic acid consumed each day.
The dairy industry has been able to adapt to the needs of consumers by offering milk with various fat contents: whole milk contains 3.5g per 100ml, semi-skimmed milk 1.5g, and skimmed milk traces (less than 0.2g).

Vitamins and minerals

Calcium is present in high quantity in milk (1,200mg/l). It also contains phosphorus (950mg/l), magnesium (120mg/l), zinc (3 – 4mg/l) and selenium (30µg/l).

Its vitamin profile is composed of liposoluble vitamins (A, D, E) and water-soluble vitamins from the B group (thiamine, riboflavin…) in particular.
The concentration of liposoluble vitamins depends on the milk's fat content. In certain countries, low-fat milk is enriched with vitamins A and D. Vitamin A is particularly important for growth, development, immunity and vision. Vitamin D is crucial for the absorption of calcium, therefore for bones, and also has multiple effects (anti-carcinogenic, cardio-protective, immunomodulatory). Vitamins from the B group help in the production of energy and in the synthesis of hormones and neurotransmitters.

Milk and dairy products form part of a healthy and balanced diet. Numerous studies confirm the nutritional importance of milk and reinforce its potential effect in the prevention of several chronic diseases (cardiovascular disease, certain forms of cancers, obesity and diabetes…).

Spotlight on Oligosaccharides

Oligosaccharides – strong presence in breast milk and colostrum – have particularly interesting functional and health properties: immunomodulatory actions, protection of the intestinal mucus membrane and microbiota…
Around 40 different oligosaccharides have been identified in cow's milk. Their concentration may be relatively low, but their functional properties deserve attention.

Advances in Nutrition 2014 ; 5 : 131-43

"Drinking milk (plain or flavored) helps children meet their calcium requirement without impacting on their weight"

- 4,487 Australian children aged 2 to 16 years.
- Milk drinkers (plain or flavored) have a significantly higher nutrients intake and better meet their calcium requirement.
- Milk consumers do not have a different body mass index to nonconsumers.

Australian children who drink milk (plain or flavored) have higher milk and micronutrient intakes but similar body mass index to those who do not drink milk.

Flavia Fayet, Leisa A. Ridges, Jutta K. Wright, Peter Petocz.
Nutrition Research Australia ; Nestlé Australia ; Macquarie University Australia.
Nutrition Research 2013 ; 33(2) : 95-102.

"Milk drinking (exclusively plain or flavored) is an intake pattern associated with higher nutrient intakes and likelihood of meeting calcium requirements."

Calcium is essential for bones, in particular in adolescence when bones are growing, developing and strengthening. In Australia, only 40% of 9 – 16 years old meet their average requirement for calcium. Dairy products have long been recognized as being an important source of calcium. Milk is the most consumed dairy product among Australian children. It is particularly interesting nutritionally speaking since it contains numerous nutrients such as proteins, vitamins (A, B12 and riboflavin) as well as minerals (calcium, phosphorus, magnesium, potassium and zinc). For children who do not like the taste of milk, sugar can be added to improve consumption. Studies have shown that, among young people, the number of servings of dairy products consumed per day as well as the intake of calcium and phosphorus were positively associated with the consumption of sweetened dairy products (for example, flavored milk). However, certain health professionals advise against flavored milk due to its supposed effect on children's weight. There is little data on the relationships between the various ways of consuming milk, calcium intake and weight. The objective of this study was therefore to compare the intake of nutrients, the probability of meeting the average nutritional calcium requirement and the anthropometric measurements of Australian children depending on how they consume milk.

The study was carried out on 4,487 children aged 2 to 16 years, representative of Australian children. The food survey was carried out using the 24-hour recall method, on two occasions. The children were then categorized into 4 groups according to their milk consumption: Nonconsumers; Exclusively plain milk drinkers; Flavored milk drinkers (these may also drink plain milk); Nondrinkers of milk (these do not drink either plain or flavored milk but consume it in conjunction with other foods, such as for example with cereal, in mashed potato…). The waist circumference as well as the Body Mass Index calculation (BMI = Weight/Height²) and level of physical activity were taken.

The results show significantly higher milk consumption and intakes of calcium, phosphorus, magnesium, potassium, iodine and lipids among children who drink plain or flavored milk than among children who do not drink or consume it. The highest milk consumption is observed among flavored milk drinkers (see table). The energy intake is significantly higher among flavored milk drinkers but also among nondrinkers of milk. However, no difference in the BMI, waist circumference or level of physical activity is observed between the various groups. The fact that nondrinkers of milk have the same energy intake as flavored milk drinkers may be explained through the foods they consume with milk (cereal, milkshakes…).

The proportion of children meeting their average nutritional calcium requirement is lowest among nonconsumers of milk (37.4%). Among milk consumers, children who drink flavored milk are most likely to meet their calcium requirement (74.9%), followed by plain milk drinkers (70.8%) and nondrinkers but consumers (50.7%).

This study suggests that consuming milk as a drink and not purely in conjunction with other foods leads to better nutrient intake and a higher probability of meeting the average requirement for calcium. The fact of the milk being a bit sweeter (flavored milk) helps improve consumption among children and adolescents, without impacting negatively on their weight.

Type of consumers (% of total participants)	Average milk consumption (g/day)	Average calcium intake (mg/day)
Nonconsumers of milk (11%)	0	633 ± 11
Exclusively plain milk drinkers (28%)	376 ± 5,4	929 ± 7
Flavored milk drinkers (30%)	418 ± 5,2	949 ± 7
Nondrinkers of milk (31%)	173 ± 5,2	734 ± 7

"Weight gain among American children: recommending low-fat milk is not a cure-all"

- Longitudinal study of 10,700 children monitored at age 2 years then at age 4 years.
- The fat content of milk consumed has no influence on children's weight at pre-school age.

Longitudinal evaluation of milk type consumed and weight status in preschoolers.

Rebecca J Scharf, Ryan T Demmer, Mark D DeBoer.
Department of Pediatrics, University of Virginia School of Medicine, Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, USA.
Arch Dis Child 2013 ; 98(5) : 335-40.

"Consumption of low-fat milk did not restrain weight gain in preschoolers over time."

The development of obesity from a very young age contributes to the onset of health problems later in life. So, in a prevention context, nutritional recommendations for children in the United States favor the consumption of reduced-fat milk and dairy products. However, no study has shown that the consumption of reduced-fat milk and dairy products is beneficial for weight control.

This longitudinal study therefore aimed to evaluate the relationships between the type of milk consumed and weight status in a large cohort of young American children.

10,700 children were monitored at age 2 years then at age 4 years. The drink commonly consumed by the children (whole milk, 2% fat milk, 1% fat milk, skimmed milk, soya-based drink or other) and the frequency of consumption during the previous week were reported by the parents, as well as fruit juice and sugary drink consumption.

The calculation of the Body Mass Index (BMI) corresponding to their age and sex (BMI Z-Score) made it possible to categorize the children into 3 groups: normal weight (< 85th percentile), overweight (> 85th – 95th percentile) and obese (> 95th percentile).

The study shows that:

► The majority of the children drink whole or 2% fat milk (86% at age 2 years and 81% at age 4 years).

► Around 30% of the children are overweight or obese at age 2 years and 32% at age 4 years. The consumption of very low-fat milk is more common among these children than among those of a normal weight (14% vs. 9% at age 2 years and 16% vs. 13% at age 4 years).

► At 2 and 4 years, the average BMI Z-Score is significantly lower among whole or 2% fat milk drinkers, even after adjusting the different variables (sex, ethnicity, socio-economic status, fruit juice and sugary drink consumption and maternal BMI).

► Among children of a normal weight at age 2 years, the probability of being overweight or obese at age 4 years is nearly 60% higher for skimmed or 1% milk drinkers than for the others.

Regardless of the fat content of the milk consumed, the evolution of the BMI Z-Score during the 2 years is not significantly different. In other words, the consumption of low-fat milk does not seem to lead to favorable changes to the corpulence of the children over time.

The authors conclude that the nutritional recommendations favoring the consumption of low-fat milk by children should without doubt be reconsidered.

Children: low-fat or not low-fat?

The recommendation to consume reduced-fat milk is based on the opinion that this can contribute to a reduction in energy and also lipid intake, in particular in saturated fatty acids. But a study by Prof Willett of Harvard showed that if lipid intake was reduced in children consuming skimmed milk, this was not necessarily the case for the energy intake. In fact, the reduction in lipids consumed could be offset by higher consumption of calorific foods, in particular those high in sugars. The recommendation to replace whole milk with low-fat milk in a context of weight management could therefore be unfavorable.

In addition, milk cannot be described as a fatty food. Consuming one serving (150ml) of skimmed milk instead of whole milk reduces the lipid intake by just 4.95g! And remember also that lipids are necessary for the young children's development, they play an energy, structural and functional role and it is not advisable to remove them from their diet.

Three Daily Servings of Reduced-Fat Milk, An Evidence-Based Recommendation ?
David S. Ludwig, Walter CWillett.
Jama Pediatrics, 2013 ; 167(9) : 788-9.

“Milk guarantees the waist circumference of teens”

- Cross-sectional study on 1,209 Portuguese teenagers from 15 to 18 years.
- Abdominal obesity risk is lower among teens who consume more milk, regardless of their physical activity level.

Relationship of milk intake and physical activity to abdominal obesity among adolescents.

S. Abreu, R. Santos, C. Moreira, et al.
Research Centre in Physical Activity, Health and Leisure, Faculty of Sport, University of Porto, Porto, Portugal.
Pediatric Obesity 2014 ; 9(1) : 71-80.

“High milk intake seems to have a protective effect on abdominal obesity, regardless of physical activity levels in adolescents.”

Abdominal obesity in particular has increased significantly among adolescents over the last few years. An alarming acknowledgement since abdominal obesity is a significant risk factor for insulin resistance, hyperinsulinemia, dyslipidemia and hypertension among young people. Several studies have suggested that the dairy product consumption, in particular milk, was associated with a lower excess weight risk. And others have shown that practicing a physical activity was inversely associated with abdominal obesity. These studies may suggest that milk consumption and physical activity each play a role in abdominal obesity, but few have studied their combined effect. However, drinking milk and practicing sport are not incompatible and often coexist among young people.

The aim of this work was to study the impact of milk consumption, associated or not with physical activity among Portuguese adolescents. 1,209 girls and boys from 15 to 18 years took part. Their food consumption was measured using a semi-quantitative frequency questionnaire over the previous year. Whole, semi-skimmed and skimmed milk were grouped into a single variable “milk”. The type of milk consumed by the majority was semi-skimmed (84%), followed by skimmed (9%). The adolescents were categorized according to their milk consumption: “high” milk consumers (consumption higher than or equal to 2 servings per day, one serving of milk corresponding to 250ml) or “low” consumers (less than 2 servings per day). They were also categorized according to their physical activity level (duration and frequency): active or low-active. The adolescents were split into 4 groups: low milk consumers/low-active, low milk consumers/active, high milk consumers/low-active and high milk consumers/active.

The anthropometric measurements (weight, height, body fat percentage, waist circumference) were taken. Adolescents with a waist circumference greater than or equal to 90th percentile were considered as having abdominal obesity.

Results:

Nutritional intakes: no difference in carbohydrate or fat intake was observed between the 4 groups. However, the energy, protein and calcium intake was higher among the “high” milk consumers than among the “low” consumers, regardless of their physical activity level.

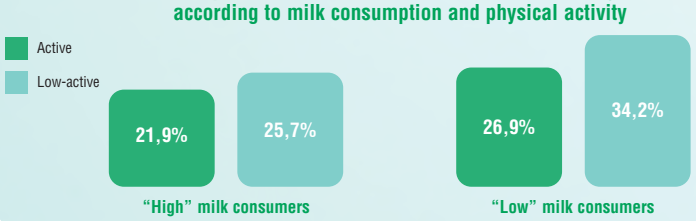
BMI, body fat and abdominal obesity: no significant difference was observed between the 4 groups in terms of Body Mass Index (BMI = weight/height²). However, the active adolescents had a lower body fat percentage than those who were low-active, regardless of their milk consumption.

Around 27% of the adolescents present abdominal obesity. The proportion of adolescents with abdominal obesity is lower among the “high” milk consumers than among the “low” consumers (23.1% vs. 29.7%). The same was noted between those who are active and those who are low-active (24.6% vs. 30.9%).

In comparison to the low-active adolescents with low milk consumption, abdominal obesity risk is very significantly reduced among active or low-active adolescents with high milk consumption.

This study shows that, among adolescents, the consumption of ½ liter of milk per day reduces abdominal obesity risk regardless of the physical activity level. Milk consumption has a more marked protective effect against abdominal obesity with associated physical activity. Milk consumption and physical activity are therefore lifestyle habits to be promoted among adolescents.

Proportion of adolescents with abdominal obesity according to milk consumption and physical activity



"Cardiometabolic risk among teens: milk's protective effect"

- Cross-sectional study on 494 Portuguese adolescents, aged 15 to 18 years.
- The risk of presenting metabolic syndrome (or cardiometabolic risk) is much lower among adolescents with a higher milk consumption (> 260ml/day).

Intake of milk, but not total dairy, yogurt, or cheese, is negatively associated with the clustering of cardiometabolic risk factors in adolescents.

Sandra Abreu, Pedro Moreira, Carla Moreira, et al.
University of Porto, Portugal.
Nutrition Research 2014 ; 34(1) : 48-57.

"Adolescents with appropriate milk intake were less likely to have high cardiometabolic risk score than those with low milk intake."

Numerous epidemiologic studies have shown that milk and dairy product consumption among adults is associated with a lower metabolic syndrome risk, a predisposing factor for cardiovascular diseases. There have been few studies on children and adolescents and these generally relate to components of the metabolic syndrome taken separately.

The aim of this study was to analyze the association between the consumption of various dairy products and metabolic syndrome risk as well as its components among adolescents.

494 girls and boys, aged 15 to 18 years, took part in this study. Their food consumption was evaluated using a semi-quantitative frequency questionnaire over the previous year. For each participant, the consumption of dairy products (combined), milk, yogurts and fermented milks and cheeses was estimated. They were then categorized into 2 groups: "low consumption" (equal to or lower than the median observed in the sample) and high consumption (more). The median consumption in the sample was 484g/day for dairy products; 260ml/day for milk; 54g/day for yogurts and fermented milks and 13g/day for cheese. A health check (clinical, biological, lifestyle…) was carried out.

The metabolic syndrome risk score, also called cardiometabolic risk score (CMRS), was defined taking into account the following variables: Total cholesterol/HDL cholesterol ratio, triglyceride level, insulin resistance, body fat percentage and cardiorespiratory fitness. An adjustment score based on age and sex was allocated to each of these variables beforehand.

Results: No significant association was observed between metabolic syndrome risk and the consumption of dairy products, yogurts and fermented milks or cheeses. However, the proportion of adolescents presenting metabolic syndrome was significantly lower among those consuming the most milk (10.6% vs. 18.1% among those consuming less). Similarly, the risk of having metabolic syndrome was reduced by 47% among adolescents consuming the most milk (> 260ml/day) after adjusting on different variables.

In other words, among adolescents, milk consumption seems to have a protective effect against the risk of developing metabolic syndrome, a risk factor for cardiovascular diseases and type-2 diabetes in adults.

The potentially protective effect of milk nutrients

Milk provides a unique association of nutrients and the beneficial effect observed could be attributed to certain minerals (calcium, magnesium, and potassium), its bioactive peptides or the combination of these components. Calcium could influence cardiometabolic risk factors by adjusting the energy metabolism (reduction in lipogenesis and increase in lipolysis in the adipocytes) and by increasing fecal excretion as well as fat oxidation. It has also been suggested that calcium, magnesium and potassium may control blood pressure, in particular regulating the intracellular concentration of calcium, decreasing sodium retention and reducing platelet aggregation.

"MILK AND HEALTH: facts and fiction"

- **Four articles examine the relationships between milk, dairy products and health: lactose intolerance, allergies, cardiovascular diseases, weight, blood pressure, metabolic syndrome…**

Milk, Dairy Products, and Their Functional Effects in Humans: A Narrative Review of Recent Evidence.

Francesco Visioli, Andrea Strata.
Laboratory of Functional Foods, Madrid Institute for Advanced Studies, Spain and Department of Clinica Nutrition, University of Parma, Italy.
Adv. Nutr 2014 ; 5: 131–43.

"In conclusion, whereas future studies will help to elucidate the role of milk and dairy products in human health, their use within a balanced diet should be considered in the absence of clear contraindications."

Milk nutritional composition and its role in human health.

Paula C. Pereira.
Laboratorio de Bioquimica – CiiEm – Portugal.
Nutrition 2014 doi : 10.1016/j.nut.2013.10.011.

"In spite of some controversial recent hypotheses about the possible pejorative effects from milk consumption, adding up to lactose malabsorption and intolerance symptoms which would be natural in adulthood, no clear mechanisms and strong evidence had been found thus there is no clear argument to completely exclude a moderate consumption of milk."

Milk: white elixir or white poison?

DI Givens, KM Livingstone, JE Pickering et al.
University of Reading, UK ; Cardiff School of Medicine, UK; Lund University, Sweden.
Animal Frontiers 2014 ; 4 (2): 8- 15.

"Public health nutrition policy related to milk consumption should be based on the evidence presented and not solely on the believed negative effects of dietary fat."

Mistaken beliefs and the facts about milk and dairy foods.

Paige Zaitlin, Johanna Dwyer, Gary R. Gleason.
Tufts University, USA.
Nutrition Today 2013 ; 48(3) : 135-43.

"Milk and other dairy products are an important part of the human diet, but some people believe that they are harmful… Heath professionals can play an important role in dispelling these nutrition myths through nutrition education ans counselling."

Lactose intolerance

It is not necessary to stop milk and dairy product consumption in case of lactose intolerance. It is possible – even recommended – to consume dairy products in the majority of cases. Even with reduced lactase activity, it is possible to consume up to 12g of lactose (250ml of milk) in one go without any particular difficulty. It is also always possible to split your milk consumption or mix it with other foods. In case of severe problems, milk can be replaced with yogurt or matured cheese (which contain little or even no lactose)..

Mucus

Some people think that drinking milk increases the production of mucus. In fact, this sensation could be linked to the "milk-saliva" mixture, as the production of saliva increases after drinking milk (or water). Milk does not lead to the production of mucus and does not make it worse. There is therefore no reason not to consume it in case of cold or respiratory illness.

Allergy

Cow's milk allergy can be developed from birth, it decreases during childhood and is uncommon in adults. It is the result of an immunological reaction that affects predisposed people. It is most often due to the whey proteins (β-lactoglobulin and α-lactalbumin). Reactions can be more or less severe (rash, edema, respiratory and gastrointestinal problems, anaphylaxis…). With this type of allergy, it is necessary to completely stop milk and milk-based product consumption

Weight control

Drinking milk as part of a calorie-controlled diet may prove beneficial for weight. The satiety power of milk leading to lower calorie intake is one of the possible explanations.

Cognitive functions

Studies have shown that milk consumption has a beneficial effect on learning capacities among young people but also on cognitive performance much later in life.

Type-2 Diabetes

Studies of cohorts and meta-analyses have shown that high milk consumption is associated with a lower type-2 diabetes risk. This protective effect could be due to calcium and magnesium, two important minerals for insulin sensitivity and glucose tolerance. Whey proteins may also have a positive effect on glycemic control, insulin response and satiety. These help reduce excessive food intake and therefore make it possible to prevent weight gain, thus limiting diabetes risk.

Prevention of osteoporosis

Low bone density is one of the main osteoporosis risk factors. Milk consumption has been associated with an increase in bone density. An effect attributed to calcium and proteins. Other components – certain peptides and other minerals (phosphorus) – could also have a favorable effect..

Prevention of hypertension and vascular health

There is extensive literature showing the potentially beneficial effect of milk consumption on arterial hypertension. Milk's calcium, magnesium and potassium content is one of the possible explanations, as is the production of bioactive peptides capable of inhibiting certain enzymes (ACE) involved in the mechanisms of hypertension. Milk consumption has also a beneficial effect on blood vessel walls and their elasticity.

Cancer

The relationship between diet and cancer is complex. It seems that milk and dairy products have a protective effect against colon and bladder cancer. However, certain studies suggest that too high calcium intake (much higher than the usual or recommended intake) could have a negative effect on prostate cancer.

Cardiovascular diseases

The studies available to date do not allow any conclusion to be drawn on whether milk consumption has any effect on the onset of cardiovascular diseases (CVD). However, it has been attributed a beneficial effect on the various CVD risk factors (insulin levels, dyslipidemia, oxidative stress and inflammatory markers for example) through a whole range of arguments…

Metabolic syndrome

Metabolic syndrome is the collective name for various anomalies (hypertension, carbohydrate and/or fat metabolism, abdominal obesity), which increase diabetes and/or cardiovascular diseases (heart disease and stroke) risk. Several international epidemiologic studies have shown that milk consumption can have a beneficial effect on the prevention of metabolic syndrome through direct action on its components (obesity, dyslipidemia, diabetes, arterial hypertension…). However, little is yet know about the mechanisms at work, the components involved or even the significance of their interactions within the "milk" matrix.

"Milk: THE new hydrating drink for athletes?"

- Randomized cross-over intervention study on 8 young men.
- Recovery drinks with milk proteins are more effective for rehydration than pure carbohydrate drinks.

Effect of varying the concentrations of carbohydrate and milk protein in rehydration solutions ingested after exercise in the heat.

Lewis J. James, Gethin H. Evans, Joshua Madin, et al.
School of Sport, Loughborough University; School of Science and Technology, Nottingham Trent University ; School of Healthcare Science, Manchester Metropolitan University, UK.
British Journal of Nutrition 2013 ; 110(7) : 1285-91.

The present study further demonstrates that after exercise-induced dehydration, a carbohydrate–milk protein solution is better retained than a carbohydrate solution.

Sports drinks make it possible to reduce the imbalance in water, minerals and energy caused by physical activity. They generally contain carbohydrates (sugars) and electrolytes (in particular sodium), and some contain proteins. The significance of the combined intake of proteins and carbohydrates for protein and glycogen resynthesis after exertion is well-known. However, the significance of this association for rehydration is less well-known.

Various studies have shown that skimmed milk was just as effective as commercial recovery drinks for rehydration. Researchers wanted to gain a better understanding of the role of milk proteins on water retention. They therefore compared various drinks with various protein and carbohydrate contents.

On 3 occasions, 8 young men (≈ age 22) pedaled intensively in a hot and humid environment (35°C and 52% humidity) until they had lost around 1.8% of their body weight through perspiration. Following this exertion, they drank the equivalent of 150% of their lost weight (around 2 liters) over 4 sittings staggered over 1 hour, on each test consuming one of the 3 isoenergetic drinks being compared. One was a classic carbohydrate drink (C) with 60g/l of carbohydrates; one a drink with 20g/l of milk proteins and 40g/l of carbohydrates (CP20); and one a drink with 40g/l of milk proteins and 20g/l of carbohydrates (CP40). The concentrations of sodium (20mmol/l) and potassium (5mmol/l) were the same for each drink. Urine volume was measured before and just after the physical exercise, after rehydration, then every hour for 4 hours.

Results: During the 4 hours following the ingestion of the drinks, the quantity of urine was significantly lower when the volunteers had drunk the protein drinks. The participants therefore had a better capacity to store the drink ingested and to compensate for the fluid losses with the protein drinks (58% and 64% of the volume ingested retained with CP20 and CP40 opposed to 46% with the carbohydrate drink C). At the end of the experiment, the fluid balance was better with the protein drinks, with no notable difference between the 2 drinks.

This study shows the significance of consuming a drink containing milk proteins for rehydration after physical exercise. It provides new arguments in favor of milk consumption after exertion. Because of its composition, milk is a particularly interesting drink for the recovery of athletes. Like commercial sports drinks, it contains water, proteins, carbohydrates, sodium and potassium…

Milk, an ideal drink for athletes

More and more often, sport nutritionists and doctors are integrating milk into athletes' diets and recommending it during the recovery phase. A recent work published in Australia shows that milk has benefits for the various essential stages of recovery. A better choice and more economical than commercial sports drinks.

http://www.sportsdietitians.com.au

"Post-match celebrations: what if "les Bleus" get milk?"

- Intervention study on 14 semi-professional football players.
- Drinking ½ liter of semi-skimmed milk immediately after intense physical exertion makes it possible to optimize the recovery phase.

Effect of Milk on Team Sport Performance following Exercise-Induced Muscle Damage.

Emma Cockburn, Phillip G. Bell and Emma Stevenson.
Department of Sport Development, Northumbria University ; Department of Sports Sciences, Northumbria University, United Kingdom.
Medicine & Science in Sports & Exercise 2013 ; 45(8) : 1585-92.

"Athletes suffering from muscle damage may be able to limit performance decrements during subsequent training or competition through the acute intake of milk."

After each training session or competition, the recovery phase, which starts as soon as the physical activity stops, is a crucial aspect in sports performance. This recovery or regeneration phase makes it possible to promote the repair of muscle damaged by physical activity. It is about rebuilding protein, water and carbohydrate reserves as quickly as possible after exertion by supplying them simultaneously. In fact, carbohydrates are energy substrates required for protein synthesis.
Numerous studies have been carried out on the impact of combined intake of carbohydrates and proteins during the recovery phase. Due to milk's carbohydrate (lactose) and protein composition, several studies have focused on the significance of its use as a recovery drink after endurance exercise practice such as running or cycling. These showed that milk presented advantages for several aspects of recovery. Alternating between static and muscle acceleration phases, team sports such as football, rugby or handball mobilize the muscles and body differently to endurance sports. Recovery phases are also very important for these athletes who often take part in a series of training sessions or competitions.

The objective of this study was therefore to measure the impact of milk consumption after intense physical exertion on recovery among semi-professional footballers.

14 semi-professional football players (average age 24 ± 4 years) participated in this study. They were divided into 2 groups of 7 and consumed either 500ml of semi-skimmed milk or 500ml of water (control), immediately after having carried out intense exercise. Various physiological parameters (creatine kinase and myoglobin, muscle damage blood markers) were measured before exercise then 24, 48 and 72h afterwards. The players were also subjected to several performance tests (vertical jump height, sprint speed over 10 and 15m, repeated sprint speed over 15m, agility…).
Results: 48 and 72h after exercise, the players who drank milk had better results in certain performance parameters than those who drank the water. In fact, sprint speed tests over 10m and repeated sprint speed tests over 15m, carried out 48h after the exercise, as well as sprint speed tests over 15m and agility, carried out 72h after exercise, were much better, suggesting a better recovery in this group. However, no difference was observed between the 2 groups in the physiological parameters. The authors conclude that drinking half a liter of semi-skimmed milk immediately after training or competition makes it possible to optimize the recovery phase in field-based team sports. Drinking milk during the recovery phase could thus be integrated into coaches' strategies.

In context

In addition to being composed of around 87% water, milk provides a combination of carbohydrates and proteins, which maximize recovery and rehydration after exercise. In fact, it contains as much carbohydrate as numerous commercial sports drinks and milk proteins have a high biological value, they are therefore balanced in essential amino acids and can easily be used by the body. In addition, milk contains nutrients, such as sodium and potassium, which rebalance the electrolytes lost through sweat during exercise, as well as calcium and vitamin D, which promote good general health of muscles, bones and cardiovascular system.

"Colon cancer among men: the protective effect of milk?"

- Meta-analysis with a total of more than 900,000 participants.
- Milk consumption is associated with a 26% reduction in the colon cancer risk among men.

Colorectal cancer and non-fermented milk, solid cheese, and fermented milk consumption: A systematic review and meta-analysis of prospective studies.

Robin A Ralston, Helen Truby, Claire E Palermo, Karen Z Walker.
Department of Nutrition and Dietetics, Southern Clinical School of Medicine, Monash University, Victoria, Australia.
Crit Rev Food Sci Nutr 2014 ; 54(9) : 1167-79.

"This meta-analysis supports the inverse association between non-fermented milk consumption and risk of colon cancer in men, and provides an evidence base to assist in the formulation of dietary guidelines involving dairy foods."

Colorectal cancer is one of the most common cancers in the world. It is slightly more common among men than among women. The incidence of colorectal cancer is higher in developed countries, which indicates the significance of environmental factors in its etiology. Diet is one of the major factors. Numerous epidemiologic studies show the protective effect of milk or dairy products on colorectal cancer. However, the majority have not carried out separate analyses according to the type of dairy product.

The aim of this work was therefore to examine the associations between the various types of dairy products consumed (milk, cheese and fermented milk) and the development of colorectal cancer in adults.

Researchers carried out a meta-analysis involving 919,680 participants (34% men, 62% women and 5% where sex was not determined) monitored for 5 to 24 years and recording more than 5,200 cases of cancer (colorectal, colon or rectal).

The relative risk (RR) comparing the lowest dairy product consumption with the highest was calculated.

Results: Individuals with a high milk consumption (average: 439ml/day) presented a 15% reduction in the risk of colorectal cancer. However, when sex and cancer location were analyzed separately, the protective effect of milk was limited to men and colon cancer. So men consuming on average 525ml/day of milk (corresponding to around 2 servings of milk in the United States) run a 26% lower risk of colon cancer than those consuming less.

No association was observed with the consumption of cheeses or fermented milks. For the authors, this absence of association could be explained, among other things, through a lower consumption of these products and therefore a lower intake of calcium, a nutrient often mentioned as a protective element.

As for the difference between men and women, this could be linked to the higher incidence of colon cancer among men.

How can milk and dairy products have a protective effect on colon cancer?

A review of the effects of milk and dairy product consumption on various types of cancers looked into the question. Several components of milk are involved:

- Calcium could protect the colon by binding to bile acids and fatty acids, reducing their effects on the proliferation of epithelial cells. It could also influence the process leading to cell differentiation and to the apoptosis of tumor cells.
- Vitamin D could modulate on effects of calcium.
- Caseins could protect against colon cancer by inhibiting the enzymes produced by the intestinal bacteria responsible for the appearance of carcinogenic molecules.
- Conjugated linoleic acids, butyric acid and lactic bacteria could also have a protective effect.

Effects of Milk and Milk Products Consumption on Cancer : A Review.
H. Davoodi, S. Esmaeili, and A.M. Mortazavian.
Comprehensive Reviews in Food Science and Food Safety 2013 ; 12(3) : 249-64.

"Young people are consuming less and less milk!"

- Evaluation of milk and dairy product consumption among children and adolescents in various countries.
- Milk and dairy product consumption is decreasing.

Dairy product intake in children and adolescents in developed countries: trends, nutritional contribution, and a review of association with health outcomes.

Daphna K Dror and Lindsay H Allen.
USDA, Human Nutrition Research Center, Davis, USA.
Nutrition Reviews 2014 ; 72(2) : 68-81.

"Despite its contribution to nutrient intake and status, consumption of milk and dairy products by children and adolescents in many countries has waned in recent decades."

The aim of this work was to evaluate milk and dairy product consumption among children and adolescents in developed countries as well as the link between their nutritional contribution and health. The authors analyzed 78 studies carried out among young people from 2 to 19 years.

For under 9s, the recommendation is between 2 and 3 servings of dairy products (DP) per day (i.e. around 500ml of milk depending on the country). This is between 3 and 5 servings per day (i.e. more than 600ml of milk) for adolescents.

Between 1977 and 2001, the proportion of American children drinking milk went from 94% to 84% and the number of servings of DP consumed went from 3.5 to 2.8 servings per day.

In France, between 1999 and 2007, dairy product consumption decreased by 10% among 3 – 10 year olds; by 12% among 11 – 14 year olds and by 9% among 15 – 17 year olds. A trends essentially linked to a marked decrease in milk consumption among 3 – 14 year olds (-15%) and among girls of all ages (-20%).

The factors affecting milk and dairy product consumption in childhood are: age, sex, parents' habits, sugary drink consumption and eating habits.

So several studies have shown higher milk consumption and calcium intake among children and adolescents that eat breakfast. And according to American studies, for each 30ml decrease in milk consumption per day, there will be a 126ml increase in sugary drink consumption, with an increase in energy intake of 31kcal and a loss of 34mg of calcium.

Yet, milk and dairy products are important sources of macro and micronutrients in the diets of children and adolescents. They help them meet the recommended intake of calcium, phosphorus, magnesium, iodine, zinc, potassium, vitamins A, D and B12, riboflavin…

Among young Americans, milk contributes 50% or more of the total calcium intake. Cheese and milk used as ingredients provide an additional 20%.

In France, dairy products provide 53% of the total calcium intake among 3 – 17 year olds, around half of which is provided by milk.

Milk and dairy products have a significant effect on growth and development in children. As for weight, studies have shown no or inverse associations between dairy product consumption and body mass index, fat mass, adiposity and energy balance. There is also an inverse association between dairy product consumption during childhood and blood pressure later in life.

Despite the importance of milk and dairy products for the nutritional contributions and health of young people, their consumption is continuing to decrease over time and with age.

Milk is also:

Reduction in the risk of obesity in India

In India, milk and dairy production consumption is much lower than in western countries but it is increasing. Since obesity is also increasing, researchers wanted to check whether there was a link to the body mass index (BMI) and waist circumference of 3,698 men and 2,659 women. The risk of having a BMI ≥ 25kg/m² was significantly lower (by 33% among men and by 43% among women) in Indians consuming one serving per day (120ml) or more of milk. The risk of having a high waist circumference was also significantly lower among men (-29%). Fermented milk and lassi consumption had no significant effect. These results therefore suggest a link between milk consumption and a reduction in the risk of obesity in India.

Association between Milk and Milk Product Consumption and Anthropometric Measures in Adult Men and Women in India: A Cross-Sectional Study.
Ambika Satija, Sutapa Agrawal, Liza Bowen, *et al.*
PLoS ONE 2013 ; 8(4) : e60739.

Improvement in the lipid profile among diabetic Koreans

Due to disturbances in the carbohydrate metabolism, diabetics are more at risk of having high LDL-cholesterol levels (bad cholesterol) and low HDL-cholesterol levels (good cholesterol), factors associated with cardiovascular diseases risk. Researchers studied the relationship between milk and dairy product consumption among 509 female Koreans (35 – 80 years) with type-2 diabetes. They evaluated their dairy product consumption (milk, yogurt, ice-cream and cheese) and their calcium intake. HDL and Apo A-1 levels were significantly higher and the atherogenic risk significantly lower among women consuming more than 200g of dairy products per day. Patients with a calcium intake above the Estimated Average Requirement (EAR) consumed more dairy products and had high HDL-cholesterol levels and a lower atherogenic risk than women below the EAR. This study shows beneficial effect of milk, dairy products and calcium on the lipid profile of this Asian population.

Relationship between milk and calcium intake and lipid metabolism in female patients with type 2 diabetes.
JaeHee Kim, Ji-Yun Hwang, Ki Nam Kim, *et al.*
Yonsei Med J 2013 ; 54(3) : 626-636.

Cardiovascular health of teens in Europe

Cardiovascular disease (CVD) risk factors cause an even higher risk in adults if they are present in childhood or adolescence. The aim of this study was in particular to examine the relationship between dairy product consumption and various CVD risk factors among 511 European adolescents (Greek, German, Belgian, French, Italian, Swedish, Austrian and Spanish), aged 12 to 17 years. Milk consumption was inversely associated with body fat among boys and triglyceride levels and CVD risk score among girls. Total dairy product consumption was inversely associated with waist circumference and body fat and positively associated with cardiorespiratory fitness in both sexes. Among girls, it was also inversely associated with BMI, triglyceride levels, total/HDL-cholesterol ratio and the CVD risk score. The authors conclude that dairy product consumption is beneficial for cardiorespiratory fitness and corpulence in teens as well as cardiovascular diseases risk among girls.

Is dairy consumption associated with low cardiovascular disease risk in European adolescents ? Results from the HELENA Study.
S. Bel-Serrat, T. Mouratidou, D. Jiménez-Pavón, *et al* on behalf of the HELENA study group.
Pediatr Obes 2013 DOI: 10.1111/j.2047-6310.2013.00187.x

Protection of vascular function in obese adults

The aim of this study was to determine the vasoprotective activities of low fat milk by examining the postprandial effects of its consumption on vascular function and oxidative stress markers among 19 obese adults aged 18 to 50 years, with metabolic syndrome. Two isocaloric test drinks were consumed in a random order: 475ml of 1% fat milk or 435ml of rice juice. Results: The postprandial responses of the vascular function marker and oxidative stress markers were not affected by the ingestion of milk. The concentration of glucose increased after the ingestion of both test drinks, but more significantly with rice juice. This study suggests that low fat milk limits postprandial hyperglycemia, which alters vascular function by increasing fat oxidation and decreasing the bioavailability of nitric oxide. It thus maintains vascular endothelial function among adults with metabolic syndrome.

Low-Fat Milk Ingestion Prevents Postprandial Hyperglycemia-Mediated Impairments in Vascular Endothelial Function in Obese Individuals with Metabolic Syndrome.
Kevin D. Ballard, Eunice Mah, Yi Guo *et al.*
J Nutr 2013 ; 143(10) : 1602-10.

Other articles of interest…

Influence of Dairy Product Consumption on Children's Blood Pressure : Results from the QUALITY Cohort.

Yuan WL., Kakinami L., Gray-Donald K., *et al. INSERM, Centre for Research in Epidemiology and Population Health, Villejuif, France.* J Acad Nutr Diet. 2013 ; 113(7) : 936-41.

► Dairy product consumption higher than or equal to 2 servings per day during pre-adolescence has an antihypertensive effect.

Basophil reactivity, wheal size, and immunoglobulin levels distinguish degrees of cow's milk tolerance.

Ford LS., Bloom KA., Nowak-Wegrzyn AH., *et al. Jaffe Food Allergy Institute, Mount Sinai School of Medicine, New York, USA.* J Allergy Clin Immunol 2013 ; 131(1) : 180-6.

► The majority of patients allergic to milk proteins can tolerate some forms of heated milks in their diet.

Protective Association of Milk Intake on the Risk of Hip Fracture: Results from the Framingham Original Cohort.

Sahni, S., K. M. Mangano, *et al. Institute for Aging Research, Harvard Medical School, USA.* J Bone Miner Res 2014 DOI: 10.1002/jbmr.2219.

► High milk or milk + yogurt consumption could reduce the risk of hip fracture via mechanisms linked to an increase in bone mineral density but not only.

Milk consumption and progression of medial tibiofemoral knee osteoarthritis: Data from the Osteoarthritis Initiative.

Lu, B., J. B. Driban, *et al. Women's Hospital and Harvard Medical School, USA.* Arthritis Care Res 2014 DOI: 10.1002/acr.22297.

► Milk could reduce the progression of osteoarthritis among women.

Milk consumption throughout life and bone mineral content and density in elderly men and women.

T. Eysteinsdottir, T. I. Halldorsson, I. Thorsdottir *et al. University of Iceland and Landspitali, Iceland.* Osteoporos Int 2014 ; 25(2) : 663-72.

► Link between regular milk consumption and better bone density towards the end of life.

An Update on the Cardiovascular Pleiotropic Effects of Milk and Milk Products.

Chrysant, S. G. and G. S. Chrysant. *University of Oklahoma, USA.* J Clin Hypertens 2013 ; 15(7) : 503-10.

► Milk consumption could have preventative effects on the development of atherosclerosis, coronary risk, hypertension, stroke and type-2 diabetes.

Milk, chocolate and Nobel prizes.

Linthwaite S., Fuller GN. *Department of Neurology, Gloucester Royal Hospital, UK.* Pract Neurol 2013 ; 13(1) : 63.

► Correlation between national chocolate consumption and the number of Nobel prizes of a country. But, chocolate is generally accompanied by milk…

and to find out more

Available upon request.

BEST of 2012 & 2013

« Dairy products and decreased cardiovascular risk »
« Dairy products, diabetes prevention and weight management »*
« Special Issue: Cheese »*
« Special Issue: Yogurt »*

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* *Available in English.*

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QS HS 1b. Rumeurs autour du lait
QS HS 2b. Histoire, sociologie et image du lait

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