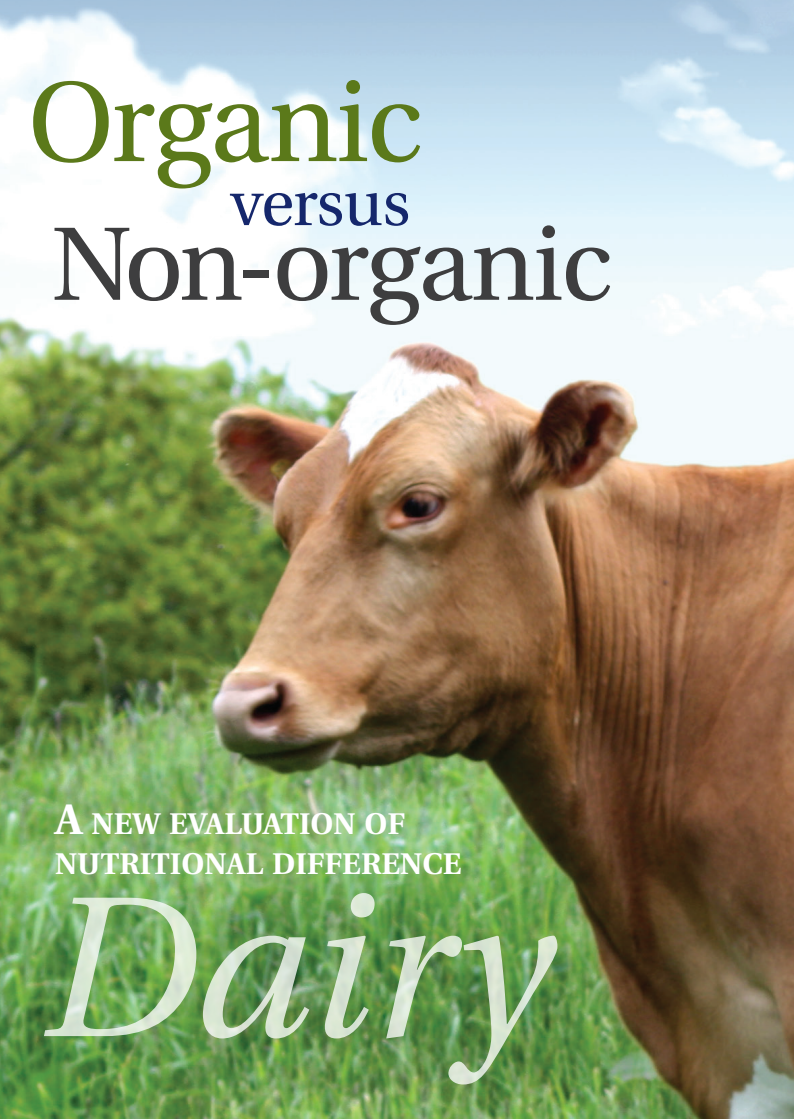



Organic versus Non-organic

A NEW EVALUATION OF
NUTRITIONAL DIFFERENCE

Dairy





“Switching to organic milk consumption will increase the intake of omega-3 fatty acids and was linked to a range of health benefits in mother and child human cohort studies”

Contents

New evidence	4
At a glance – organic vs non-organic	5
Why is this study different?	6
Key findings	8
Organic farming standards	13
How do organic standards affect milk quality?	14
Can the nutritional quality of organic milk be improved further?	16
Can non-organic, “grass-fed” systems deliver high milk quality?	17
What are saturated, unsaturated and omega-3 fatty acids?	19
Iodine	22
Why was organic milk lower in iodine?	23
What does this mean for consumers?	24
Into the future...	27
Finding out more	29
References	30

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New evidence

A landmark paper in the “British Journal of Nutrition” concludes that organic milk differs substantially from conventional milk.

Organic milk contains significantly higher concentrations of total omega-3 fatty acids, including over 50% more of the nutritionally desirable Very Long Chain omega-3 fatty acids (EPA, DPA and DHA).

The study also confirmed previous reports that conventional milk contains 74% more iodine, an essential mineral for which milk is a major dietary source. However in February 2016, the Organic Milk Suppliers Cooperative (OMSCo) reported that following a successful 2 year project of organic feed fortification, iodine levels in organic milk are now on a par with those in conventional milk.

The study also shows that composition differences are closely linked to the outdoor-grazing and conserved forage (hay and silage) based nutritional regimes prescribed by organic farming standards.

Nutritional impacts

The Newcastle University-led international study is the most comprehensive and up-to-date analysis of published research into the nutrient content of organic compared to conventionally produced foods, synthesising results from many more studies than previous analysis. The results of this meta-analysis showed that organic milk has a nutritionally more desirable fat profile.

The lower iodine concentration in organic milk is also nutritionally relevant and the study therefore highlights the need to optimise iodine supply based on strategies that minimise the risk from either iodine deficiency or excessive intakes.

At a glance – organic vs non-organic

- **Production method affects quality:** This new analysis is the most extensive and reliable to date, and supports the view that the quality of milk is influenced by the way it is produced. The outdoor-grazing and conserved forage based feeding regimes and the low use of concentrate feeds are identified as major drivers for the differences in milk composition.
- **More good fats:** organic milk has more desirable omega-3 fatty acids including the Very Long Chain (VLC) omega-3 fatty acids EPA, DPA and DHA. Omega-3 fatty acids are of scientific interest due to strong evidence for beneficial effects on human health including potential protection against cardiovascular diseases and dementia. Western diets are deficient in VLC omega-3 fatty acids and the European Food Safety Authority (EFSA) recommends that dietary intakes are doubled.
- **Less iodine:** The Newcastle University study highlights the difficulty of optimising iodine supply via milk fortification alone. It describes that in some regions of the world “too high iodine supplementation of livestock feeds has led to excessive dietary intakes and negative effects in human health” (Flachowski *et al.* 2014) but also that “a lower iodine content in organic milk could result in deficiency in population groups with a higher demand of iodine (pregnant, nursing or young women) or low dairy consumption and/or insufficient supply of iodine from other foods”.
- **Organic IS different:** the new study clearly shows there are meaningful nutritional differences between organic and non-organic foods.

Why is this study different?

The Newcastle University-led study “*Higher PUFA and omega-3 PUFA, CLA, α -tocopherol and iron but lower iodine and selenium concentrations in organic milk*” is the most comprehensive scientific comparison of organic and conventional milk and dairy products. Other studies in the same research programme focused on crops (Baranski *et al.* 2014) and meat (Srednicka-Tober *et al.* 2016).

Its conclusions contrast markedly with some widely cited studies of the past decade (Dangour *et al.* 2009; Smith-Spangler *et al.* 2012) in finding significant differences in the nutritional composition of organic versus non-organic food, and there are several likely reasons for this.

More recent data

It is the first analysis to extensively review results from 196 published studies on milk and dairy products. All previous analyses were based on a much smaller number of studies. The widely publicised UK Food Standard Agency (FSA) sponsored study by Dangour *et al.* (2009a) only used evidence from 12 comparative studies on milk (Figure 1).

More reliable methodology

The weighted meta-analysis method used in the Newcastle University-led study was similar to those used by two previous analyses on milk composition differences (Smith-Spangler *et al.* 2012; Palupi *et al.* 2012). These statistical methods were an advance over the previous research synthesis published by Dangour *et al.* 2009a, which did not balance out the contribution of larger studies versus smaller ones. Also the Dangour *et al.* study used less reliable inclusion criteria and combined data from meat and milk composition comparisons.

Interestingly, Dangour *et al.* reported trends towards significantly higher levels of polyunsaturated and omega-3 fatty acids in organic livestock products (meat and milk) in their report to the FSA (Dangour *et al.* 2009b), but this was not mentioned in the published paper or press release.

Figure 1. Numbers of published papers used in meta-analysis of composition differences in milk

KEY

- Dangour *et al.* (2009a)*
- Smith-Spangler *et al.* (2012)
- Palupi *et al.* (2012)
- Srednicka-Tober *et al.* (2016)

196
papers



* In the FSA sponsored study by Dangour *et al.* (2009a) data from 11 papers on meat were combined with data from 12 papers on milk and analysed together and reported as composition

Key findings

The Newcastle University-led study is based on a systematic review and analysis of data from 196 papers on milk and dairy products using state-of-the-art meta-analysis methods. This involves scientists combining and then carrying out a statistical analysis of all available published data, to provide much more comprehensive estimates for composition differences than a single study could.

The aim of this study was to identify and quantify compositional differences between organic and conventional milk that could be potentially relevant to human health.

The results present substantial evidence that switching to food produced using organic standards can lead to increased intake of nutritionally desirable omega-3 fatty acids, certain fat soluble vitamins and iron without increasing calories or intakes of nutritionally undesirable saturated fatty acids.

The study confirmed previous reports that organic milk contains lower concentrations of iodine an essential mineral for which milk is a major dietary source.

“The quality of milk is directly influenced by livestock husbandry and feeding regimes”

Fatty acid composition

Organic milk had a more desirable fatty acid profile with higher concentrations of nutritionally desirable poly-unsaturated fatty acids (PUFA) and omega-3 fatty acids including 57% higher concentrations of the nutritionally most desirable, very long chain omega-3 fatty acids eicosapentaenic acid (EPA), docosapentaenoic acid (DPA) and docosahexaenoic acid (DHA) (Figure 2).

Organic milk also had a more desirable ratio of omega-6/omega-3 fatty acids and contained 41% more of the potentially beneficial PUFA conjugated linoleic acid (CLA).

Milk and dairy products are major dietary sources for omega-3 fatty acids, especially for individuals, who eat little or no meat or fish. The average intakes of VLC omega-3 fatty acids from typical western diets are far too low and the European Food Safety Authority (EFSA) therefore recommends that consumers double their VLC omega-3 intake to at least 250 mg per day. EFSA also recommend that the VLC omega-3 intake (especially of DHA) is increased by 100-200 mg per day in pregnant and breast feeding women.

A switch to consuming organic milk could therefore contribute to increasing VLC omega-3 intake without adding to milk fat or calorie intake. The Newcastle University group estimate that consuming ½ litre of conventional full fat milk (or equivalent dairy products) would supply 11% of the recommended daily intake of VLC omega-3 fatty acids and this would rise to 16% with organic milk.

Milk and dairy consumption varies widely and Figure 3 shows the estimated VLC omega-3 fatty acids intakes (in relation to total recommendations) from organic and conventional milk for countries with different levels of dairy consumption.

Figure 2. Differences in fatty acid, vitamin and mineral composition between organic and conventional milk

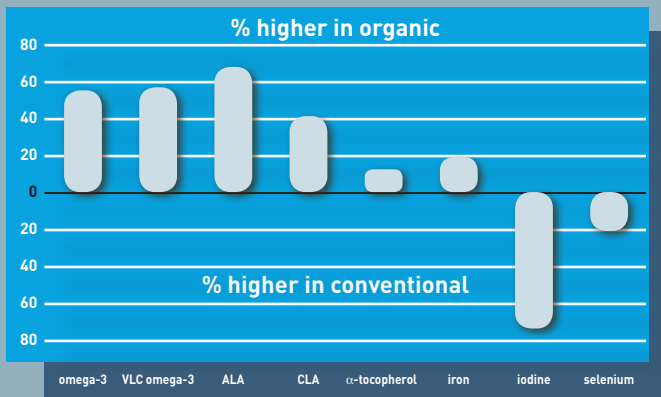
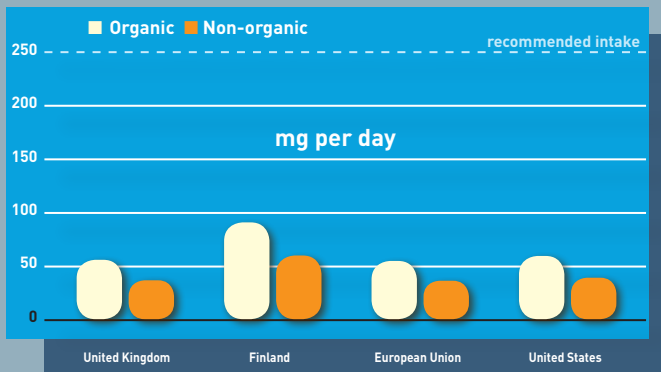


Figure 3. Estimated intakes of VLC omega-3 fatty acids (EPA+DPA+DHA) from milk/dairy product in countries with different levels of milk/dairy consumption



Minerals and vitamins

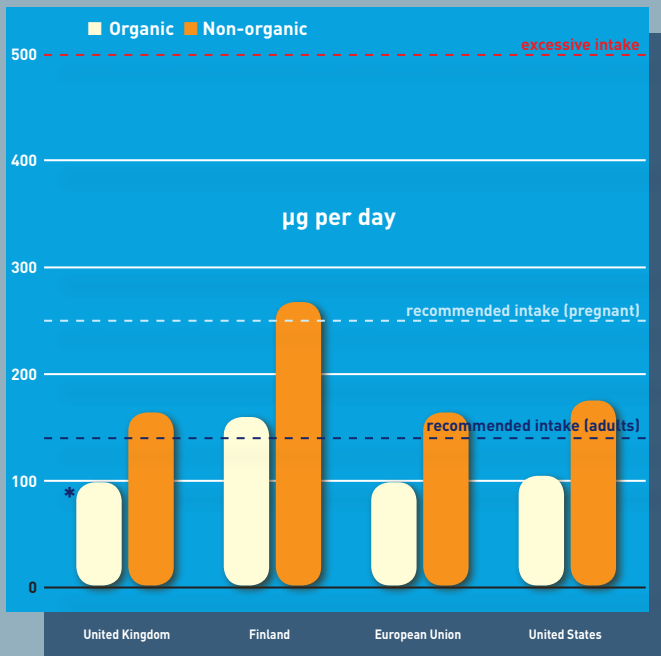
Organic milk contained significantly higher levels of α -tocopherol (Vitamin E) and iron (Fe), but lower concentrations of iodine (I) and selenium (Se) (Figure 2).

Analyses also identified trends towards higher vitamin A, β -carotene, lutein and zeaxanthin, potassium (K) and lower copper (Cu) levels in organic milk, but further studies are required to confirm these results.

Milk is not a major dietary source for iron, Vitamin E and selenium, and the differences found were small and so unlikely to have a major nutritional impact. However, milk and dairy products are important sources of iodine. For detailed information on iodine see Scientific Advisory Committee on Nutrition (2014), Chambers (2015) and WHO (2015).

Figure 4 (over page) shows the estimated average iodine intakes from organic and conventional milk for countries with different levels of milk consumption in relation to the total recommended intakes for adults and pregnant women. It is important to point out that, even in the UK (where iodized salt is not widely available), dairy products account for only between 35 and 50% of iodine intake, so total dietary iodine intake is likely to be at least double that supplied from dairy products in this chart.

Figure 4. Estimated intakes of iodine from milk/dairy products in countries with different levels of milk/dairy consumption. Horizontal lines show recommended and excessive amounts of daily iodine intakes



* Now similar to levels in conventional milk

Organic farming standards

Organic livestock standards are strictly regulated in the European Union, the USA and many other countries. Any food labelled 'organic', 'biological' or 'ecological' must legally meet these standards and is regularly inspected by organic certification bodies. Organic standards prescribe that:

- livestock are reared outdoors at least for part of the year, although the length of outdoor periods differs among regions and livestock species
- at least 60% of ruminants (cattle, sheep, goats) diets are fresh or conserved forages (hay, silage), and that fresh forages are from outdoor grazing “whenever conditions allow”
- mineral supplementation of cereal based compound feeds (including iodine) is permitted under organic farming standards and is widely used if necessary

In many regions of Europe livestock diets and rearing methods therefore differ substantially between conventional and organic farms. Most importantly in conventional systems there has been a trend towards **(a)** longer periods or all year round housing indoors, **(b)** reduced access to grazing and conserved forage use, but **(c)** increasing reliance on cereals and grain legumes and other more concentrated feeds.

How do organic standards affect milk quality?

Results from the large cross-European survey on milk quality led by Newcastle University showed that differences in fatty acid and vitamin profiles between organic and conventional milk are primarily due to the differences in feeding. Specifically the study concludes that:

“high fresh forage intakes by grazing animals (as prescribed by organic farming standards) increases concentrations of nutritionally desirable fatty acids (e.g. PUFA, MUFA, omega-3 fatty acids, CLA) and antioxidants/ vitamins in milk, while high intakes of concentrates have the opposite effect”

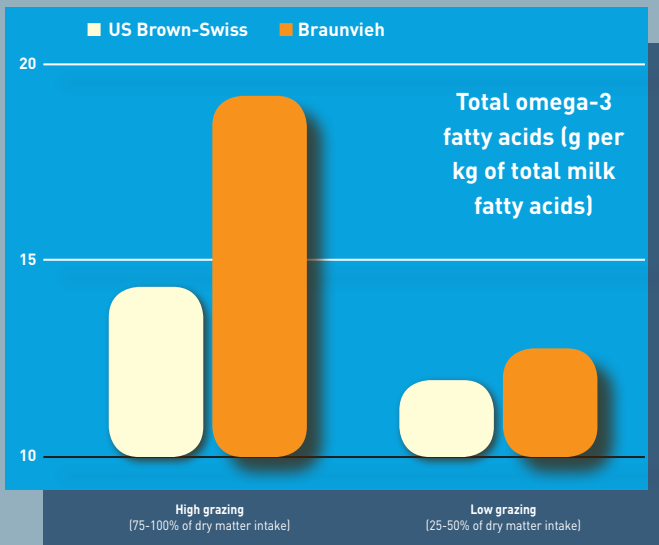
There is also evidence which suggest that:

- traditional breeds may have a positive effect on milk quality, especially concentrations of omega-3 fatty acids (Stergiades *et al.* 2015a) (Figure 5)
- high milking frequency and/or robotic milking has negative effects on milk quality and/or udder health (Stergiades *et al.* 2012)

Effect of traditional breed genetics on milk quality

It is important to note that research showed that the ability of traditional breeds (e.g. traditional Braunvieh) to generate milk with higher omega-3 levels than modern breeds (e.g. US Brown-Swiss) depends on cows receiving high grazing based diets (75-100 dry matter intake from grazing); on low grazing diets (25-49% dry matter intake from grazing) the difference in omega-3 fatty acids between traditional and modern breeds was not significant (Figure 5).

Figure 5. Effect of feeding regime (high grazing versus low grazing) and animal breed type (mainly traditional “Braunvieh” versus mainly “US Brown-Swiss” genetics) on total omega-3 fatty acid concentrations in organic milk



Can the nutritional quality of organic milk be improved further?

Research has identified diets based on **(a)** long periods grazing outdoors, **(b)** high forage and **(c)** low concentrate intakes as the main reasons for higher concentrations of omega-3, CLA and Vitamin E in organic milk. There is also evidence that traditional breeds can increase milk quality in grazing-based systems (Stergiades *et al.* 2015a).

However, a recent cross-European survey showed that **(a)** the amounts of concentrate used in organic dairy herds are close to the maximum permitted under EU organic standards and **(b)** highly productive Holstein Friesian genotypes are the predominant breed used on organic farms in many regions of Europe.

This indicates there is considerable potential to further increase the nutritional quality of organic milk and dairy products by:

- increasing access to pasture and total forage intakes
- further reducing concentrate use and
- switching to more robust, traditional breeds

This was confirmed by a range of studies comparing milk from:

- extensive organic systems using long periods of grazing, virtually no concentrate feeds, and usually traditional breeds or cross bred cows with

- semi-intensive organic systems using grass supplemented with concentrate and in primarily mainly Holstein Friesian cows

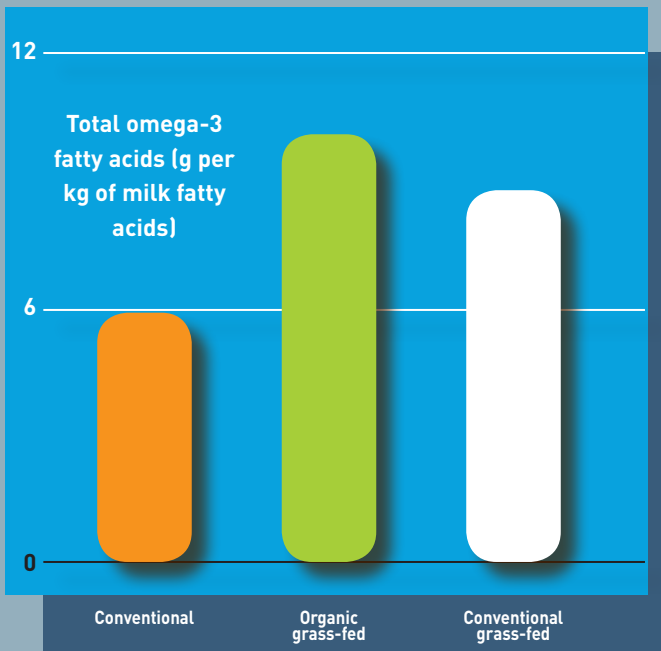
The extensive organic systems produced milk with substantially higher concentrations of omega-3 fatty acids, CLA, vitamin E and/or certain carotenoids and a lower omega-6/omega-3 ratio (Butler *et al.* 2008, 2009&2011; Stergiades *et al.* 2015b; Kusche *et al.* 2014).

Can non-organic, “grass-fed” systems deliver high milk quality?

Pasture-based and “grass-fed” dairy systems not certified to organic farming standards have been shown to produce milk with very similar fatty acid, antioxidant and mineral profiles/concentrations to organic systems.

However, even when milk from grazing-only organic and non-organic production systems was compared some small, but significant milk composition differences (e.g. higher omega-3 and lower CLA concentrations in organic milk) could still be detected (Figure 6 over page). These were mainly attributed to the higher clover and lower grass content in organic pastures (Stergiades *et al.* 2015b).

Figure 6. Effect of different dietary regimes (standard conventional with concentrate vs organic and conventional grazing only) on omega-3 fatty acid concentrations in milk



What are saturated, unsaturated and omega-3 fatty acids?

The fat in our foods and body is composed of a mixture of a wide range of fatty acids. Dietary fats are “broken down” into fatty acids, which are then taken up and used for energy generation, building blocks in our cell walls and/or fat storage.

Fatty acids are chains of carbon atoms defined by **(a)** the length (number of carbon atoms) of the carbon chain and **(b)** the number and position of double bonds in the carbon chains. A saturated fatty acid (SFA) has no double bonds, a monounsaturated fatty acid (MUFA) has one double bond and a polyunsaturated fatty acid (PUFA) two or more double bonds.

All fatty acids account for the same amount of energy (9kcal/g), and if we take up more fat than the body needs for “burning” as energy or as cell wall building blocks, excess will be stored as body fat. Too much of any fat can therefore contribute to weight gain, but there are major differences in the impacts of saturated, mono-unsaturated and poly-unsaturated fatty acids on the risk of a range of chronic diseases.

Saturated fatty acids

High consumption of saturated fatty acids (particularly stearic, myristic and palmitic acid) is associated with increased blood cholesterol and insulin resistance, which contribute to cardiovascular disease and type 2 diabetes risk (Hu *et al.*, 2001).

Dietary sources of saturated fats include dairy products, meat and certain vegetable oils (e.g. palm oil).

Unsaturated fatty acids

Both MUFA and PUFA contribute to reductions in blood cholesterol levels and a range of PUFA are associated with reduced risk of cardiovascular disease (Hu *et al.*, 2001).

Major dietary sources of unsaturated fats are vegetable oils which may contain high levels of MUFA (e.g. olive oil, avocado and peanut oil) or PUFA (e.g. sunflower, sesame and flax or linseed oil).

Omega-3 and omega-6 fatty acids

The human body can make all of the fatty acids it needs *except* for two specific polyunsaturated fatty acids both with 18 carbon atoms in their chains (EFSA, 2010):

- alpha (α)-linoleic acid (ALA), an omega-3 (*n*-3) fatty acid, and
- linoleic acid (LA), an omega-6 (*n*-6) fatty acid

Since the body cannot generate ALA and LA these two fatty acids are considered essential and have to be taken up with the diet. ALA and LA are found in both animal fat and vegetable oils, but concentrations and ALA:LA ratios differ considerably.

The human body can convert ALA into longer chain omega-3 fatty acids (with 20 or more carbon atoms). These very long chain (VLC) omega-3 fatty acids are particularly important for human health. They include **(a)** eicosapentaenoic acid (EPA), **(b)** docosapentaenoic acid (DPA), and **(c)** docosahexaenoic acid (DHA). Since the conversion of ALA to VLC-omega-3 fatty acids in the human body is relatively inefficient, we rely on taking sufficient amounts of EPA, DPA and DHA in our diet.

Important dietary sources for EPA, DPA and DHA are fish (especially oily fish), meat and dairy fat and seaweed, while vegetable oils contain virtually no VLC omega-3 fatty acids.

Conjugated linoleic acid (CLA)

CLA is a polyunsaturated fatty acid (PUFA) produced as a result of microbes in the rumen. It is therefore only found in milk and meat fat from ruminant livestock (cattle, sheep and goats) and milk and dairy products account for 60% of total dietary CLA intake.

Increased intakes of CLA have been linked to a range of health benefits including reduced risk for obesity, cancer, diabetes and cancer development, but most evidence is from cell culture and animal studies (Lawson *et al.* 2001). As a result, there is still debate about the health benefits of increasing CLA intake in humans, but a recent analysis of 18 human studies concluded that CLA supplements produce a modest weight loss in humans (Whigham *et al.* 2007). However, CLA supplements, marketed as having a range of health benefits, are mainly made synthetically from vegetable oils and have a different chemical composition from that found naturally in milk and meat.

For further information on fat and fatty acids see WHO (2008) and EFSA (2010)

Iodine

Iodine (I) is an essential element utilized by living organisms in a range of biological functions. Iodine concentrations are low in most foods, except seafood, and the World Health Organisation (WHO) recommends iodine fortification of table salt to address this (WHO 2015). Iodine fortification of cattle feeds is also used widely to increase iodine concentrations in both organic and conventional milk.

However there is a relatively narrow margin between dietary iodine deficiency (<140 µg/day) and excessive intakes (> 500 µg/day) which can lead to thyrotoxicosis. Optimising iodine intake is therefore challenging.

In the USA, China, Brazil and many European countries, where iodine fortified salt is widely used, high levels of iodine in milk may increase the risk of excessive intake for individuals with high dairy consumption. For this reason the European Food Safety Authority (EFSA) has proposed a reduction in the permitted level of iodine in cattle feed from 5 to 2 mg iodine per kg of feed.

Countries like the UK, where iodized salt is not widely available, rely more on milk and dairy products for adequate iodine supply (see UK Scientific Advisory Committee 2014 and Chambers 2015 for further information on iodine).

Why was organic milk lower in iodine?

Concentrate feeds for dairy cows have been fortified with iodine for over 60 years to increase iodine supply to cows and consumers.

Both organic and conventional farmers supplement dairy diets with minerals, although this tends to be at lower levels on organic farms, which is thought to be the main explanation for the lower iodine levels in organic milk.

Iodine concentrations in organic milk can be raised by increasing the iodine supplementation of the cows' diet and/or by switching to the use of iodine based teat disinfectants during milking.

In recent years, the UK's Organic Milk Suppliers Cooperative (OMSCo) has increased iodine fortification of organic dairy feeds. In February 2016, OMSCo reported that levels of iodine in organic milk are now on a par with those in conventional milk.

(www.omscoco.uk/_clientfiles/pdfs/omscoco-iodine-levels.pdf)

What does this mean for the consumer?

By presenting evidence that choosing food produced using organic standards can lead to better nutrition, the new findings make an important contribution to the information currently available to consumers.

Higher concentrations of polyunsaturated and omega-3 fatty acids

A range of poly-unsaturated fatty acids (PUFA) have been linked in scientific studies to a reduced risk of cardiovascular disease. This includes **(a)** linoleic acid (LA, the main omega-6 fatty acid found in meat), **(b)** α -linoleic acid (ALA, the main omega-3 fatty acid found in milk) and the very long chain (VLC) omega-3 fatty acids **(c)** eicosapentaenoic acid (EPA), **(d)** docosapentaenoic acid (DPA), and **(e)** docosahexaenoic acid (DHA).

EPA, DPA and DHA have also been linked to other health benefits – improved foetal brain development, delayed decline in cognitive function in elderly men, and reduced risk of dementia (especially Alzheimer's disease).

The European Food Safety Authority (EFSA) estimates that average dietary intakes of VLC omega-3 fatty acids account for less than half of what we need for optimum health. To reduce cardiovascular disease risk, European and North American agencies therefore currently advise consumers to increase fish and especially oily fish

consumption to increase their VLC omega-3 intake. Unfortunately implementing these recommendations widely across the human population is impossible, since most of the world's fish stocks are already fully or overexploited.

Lower omega-3/omega-6 ratio in milk fat

The ratio of omega-6 fatty acids relative to omega-3 fatty acids in typical Western diets is thought to be too high (Wijendran & Hayes 2004; Simopoulos AP 2002). Consequently, reductions in omega-6 especially linoleic acid (LA) intakes have been recommended, since high LA intakes were linked to an increased risk of obesity, neurodevelopmental deficits in young children and chronic diseases such as certain cancers, autoimmune and cardiovascular diseases.

Lower concentrations of iodine

A recent analysis of published iodine concentrations in UK milk summarised the impact of lower iodine concentrations in UK milk as “400 ml of organic milk would provide enough iodine to meet the UK recommendation of 140 µg/day, compared to about 300 ml of conventional milk – so organic milk consumers would need to consume a third more milk than conventional consumers” (Chambers 2015). The analyses also pointed out that food other than milk is estimated to account for between 53 and 78% of iodine intake in the UK, which means that approximately 200 ml of organic milk and 150 ml of conventional milk would provide sufficient iodine in a standard UK diet.

Chambers (2015) therefore suggested consumers of organic milk with an increased risk of iodine deficiency due either to low milk consumption (e.g. 11-18 year old girls) or increased iodine requirement (pregnant and breastfeeding woman) consume “a small amount of extra milk or another iodine rich food ... to balance iodine intake”.

Recommending increased organic milk/dairy consumption to address iodine deficiency may have additional benefits such as:

- increasing VLC omega-3 fatty acid intake (see above) for which there is also an increased requirement during pregnancy/breastfeeding (see above) and
- reducing the risk of male genital deformations in boys and eczema in infants, as suggested by recent mother and child cohort studies (Kummeling *et al.* 2008; Christensen *et al.* 2013; Brantsæter *et al.* 2015)

Into the future

This latest analysis is the most extensive and reliable carried out so far comparing the nutrient content in organic and conventionally produced milk and provides clear evidence of significant compositional differences.

The big unknown remains the agrochemical residue burden in conventional meat and milk - whether that is toxic metals such as cadmium from mineral P-fertilisers, pesticide in feeds, growth hormones which are widely used in North America, or antibiotics and other veterinary treatments used excessively in conventional animal production.

Further research needed

Future research is required to allow compositional differences for milk from other livestock species (e.g. sheep, goat, buffalo) and in dairy products (e.g. cheese, butter, yogurt, kefir) to be quantified accurately. There is also a need to assess in future studies a much wider range of **(a)** undesirable compounds (pesticides, growth hormones, antibiotics and other veterinary treatments, and toxic metals such as cadmium) and **(b)** nutrients for which milk is an important dietary source (e.g. B-vitamins such as riboflavin and B12) (Haug *et al.* 2007).

There have now been several studies linking the extensive use of antibiotics in conventional livestock production to a higher risk of antibiotic resistant strains of bacterial pathogens such as *Salmonella* and *E. coli* being present in livestock (Hoyle *et al.* 2004; Leifert *et al.* 2008). Further research is needed to confirm these results and investigate potential health impacts.

There is also a need to gain a greater understanding as to what extent grazing/feeding regimes, husbandry methods and breed choice affect compositional differences in milk.

There is limited evidence on the effects of eating organic food on animal and human health, and research to identify such effects is not easy. However, two relatively new scientific human cohort studies (where the health of large groups of people eating organic food is compared to those eating non-organic) have been published. These found that eating organic vegetables or dairy products was associated with positive health impacts including a 58% reduced risk of genital deformation in boys (Brantsæter *et al.* 2015) and a 21% lower risk of pre-eclampsia during pregnancy (Torjusen *et al.* 2014).

An earlier human cohort study in the Netherlands showed that switching to organic milk consumption reduced the risk of eczema in children younger than 2 years by 36% (Kummerling *et al.* 2008). The authors suggested that this may have been caused by the higher n-3 fatty acid concentrations in organic milk, since there is increasing evidence for anti-allergic effects of n-3 fatty acids (Calder *et al.* 2010).

The findings from the Newcastle University-led review and these human cohort studies clearly demonstrate the urgent need for further research to identify and quantify the health impacts of switching to organic milk consumption.

Finding out more

To read the full paper, as published in the *British Journal of Nutrition*, go to: <http://research.ncl.ac.uk/nefg/QOF>

This includes further information, annexes and summary information in Chinese, English, French, German, Italian, Polish, Portuguese, Spanish, Russian and a range of other languages.

Srednicka-Tober D. *et al.* (2016) Higher PUFA and n-3 PUFA, conjugated linoleic acid, a-tocopherol and iron, but lower iodine and selenium concentrations in organic milk: a systematic literature review and meta-and redundancy analyses. *British Journal of Nutrition* February 2016 published open access on-line doi:10.1017/S0007114516000349

The authors of this latest study welcome continued public and scientific debate on this important subject.

The entire database generated and used for this analysis is freely available on the Newcastle University website (<http://research.ncl.ac.uk/nefg/QOF>) for the benefit of other experts and interested members of the public.

Links

www.nealsyardremedies.com

www.soilassociation.org

www.sheepdrove.com

REFERENCES

- Brantsæter, A.L. *et al.* (2015) Organic food consumption during pregnancy and Hypospadias and Cryptorchidism at birth: The Norwegian Mother and Child Cohort Study (MoBa). *Environmental Health Perspectives* **on line**, doi 10.1289/ehp.1409518
- Butler, G. *et al.* (2009) CLA isomer concentrations in milk from high and low input management dairy systems. *Journal of Science of Agriculture and Food*, **89**, 697-705.
- Calder P.C., *et al.* (2010) Is there a role for fatty acids in early life programming of the immune system? *Proc Nutr Soc* **69**, 373-380.
- Chambers, L. (2015) Iodine in milk – implications for nutrition? *Nutrition Bulletin* **40**, 199-202.
- Christensen, J.S. *et al.* (2013) Association between organic dietary choice during pregnancy and Hypospadias in offspring: A study of 306 boys operated for hypospadias. *The Journal of Urology* **189**, 1077-1082
- Dangour, A.D., *et al.* (2009a) Nutritional quality of organic foods: A systematic review. *Am J Clin Nutr* **90**, 680-685.
- Dangour AD, Dodhia S, Hayter A *et al.* (2009b) *Comparison of composition (nutrients and other substances) of organically and conventionally produced foodstuffs: a systematic review of the available literature. Report for the Food Standards Agency.* Nutrition and Public Health Intervention Research Unit London School of Hygiene & Tropical Medicine.
- European Food Safety Authority (2010) Scientific opinion on dietary reference values for fats, including saturated fatty acids, polyunsaturated fatty acids, monounsaturated fatty acids, trans fatty acids and cholesterol. *EFSA Journal* **8**, 1561 http://www.efsa.europa.eu/sites/default/files/scientific_output/files/main_documents/1461.pdf. accessed 21 January 2016
- Flachowsky G, Franke K, Meyer U *et al.* (2014) Influencing factors on iodine content of cow milk. *Eur J Nutr* **53**, 351-365.
- Haug, A., *et al.* (2007) Bovine milk in human nutrition. *Lipids in Health and Disease* **6**, 25.
- Hoyle D.V. *et al.* (2004) Age related decline in carriage of ampicillin-resistant *Escherichia coli* in young calves *Appl Environ Microbiol* **70**, 6927-6930.
- Hu, F.B., *et al.* (2001) Types of dietary fat and risk of coronary heart disease: a critical review. *J Am Coll Nutr* **20**, 5-19.
- Kummeling, I., *et al.* (2008) Consumption of organic foods and risk of atopic disease during the first 2 years of life in the Netherlands. *Br J Nutr* **99**, 598-605.
- Lawson R.E., *et al.* (2001) The role of dairy products in supplying conjugated linoleic acid to man's diet: a review. *Nutr Res Rev* **14**, 153-172.

Leifert, C. *et al.* (2008) Control of enteric pathogens in ready-to-eat vegetable crops in organic and 'low input' production systems: a HACCP-based approach. *J Appl Microbiol* **105**, 931-950.

Scientific Advisory Committee on Nutrition (2014) SACN statement on iodine and health. <https://www.gov.uk/government/publications/sacn-statement-on-iodine-and-health-2014>

Srednicka-Tober D. *et al.* (2016) Composition differences between organic and conventional meat; a systematic literature review and meta-analysis. *British Journal of Nutrition* February 2016

Stergiadis, S., *et al.* (2012) Effect of feeding intensity and milking systems on nutritionally relevant milk components in dairy farming systems in the north east of England. *Journal of Agricultural and Food Chemistry* **60**, 7270-7281.

Stergiadis, S., *et al.* (2015a) Impact of US Brown Swiss genetics on milk quality from low-input herds. *Food Science* **175**, 609-618

Stergiades, S., Leifert, C., Seal, C.J., Eyre, M.D., Larsen, M.K., Slots, T., Nielsen, J.H., and Butler, G. (2015b) A 2-year study on milk quality from three pasture-based dairy systems of contrasting production intensities in Wales. *Journal of Agricultural Science The Journal of Agricultural Science* **153**, 708-731

Torjusen, H., *et al.* (2014) Reduced risk of pre-eclampsia with organic vegetable consumption: results from the prospective Norwegian Mother and Child Cohort Study. *British Medical Journal (BMJ) Open* 2014 doi 10.1136/bmjopen-2014-006143

Whigham, L.D., *et al.* (2007) Efficacy of conjugated linoleic acid for reducing fat mass: a meta-analysis in humans. *Am J Clin Nutr* **85**, 1203-1211.

Wijendran V & Hayes KC (2004) Dietary n-6 and n-3 fatty acid balance and cardiovascular health. *Annu Rev Nutr* **24**, 597-615.

Simopoulos AP (2002) The importance of the ratio of omega-6/omega-3 essential fatty acids. *Biomed Pharmacother* **56**, 365-379.

WHO (2008) Fats and fatty acids in human nutrition. FAO Food and Nutrition Paper 91 www.who.int/nutrition/publications/nutrientrequirements/fatsandfattyacids_humannutrition/en/ accessed 21 January 2016

WHO (2015) Iodization of salt for the prevention and control of iodine deficiency disorders. www.who.int/elena/titles/salt_iodization/en/ and accessed 21 January 2016



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“The crucially important thing about this research is that it shatters the myth that how we farm does not affect the quality of the food we eat.”

Helen Browning OBE, Chief Executive, Soil Association



Neal's Yard Remedies is a proud supporter of the Newcastle University-led study and its findings

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