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# Clarification on common misconceptions about dairy

## Introduction

Consumer interest in the role of food for health and wellbeing is ever expanding, which naturally increases the public's demand for information on nutrition and food origin. When sourcing information on general nutrition and health, consultation with a healthcare professional is typically not the first or most accessible choice for the majority of healthy individuals. Therefore, despite the Department of Health's Healthy Eating Guidelines, food choice is increasingly being influenced by popular trends, food blogs and media articles. Understandably, with so many diverse sources, some can lack scientific accuracy leading to widespread confusion regarding which dietary choices are best to follow.

A desire for self-management of health and wellbeing has seen a burgeoning of mobile health applications for smartphones in recent years. The current Consumer and Lifestyle Trends Report in Ireland indicated that a vegan and gluten-free cooking app was the third most downloaded in 2015 and the highest number of new product launches for the UK was in the gluten-free market.

Genuine food allergies or intolerances can be serious and it is important that they receive appropriate dietary management. However, specially formulated foods are no longer the preserve of those who are unable to consume standard products and this is indicated by a surge in food marketing terms such as 'free-from'. Celebrity testimonials regarding their personal lifestyle choices of exclusion diets have undoubtedly added to a trend towards banishing particular foods in place of what is often portrayed as a 'purer', 'cleaner' or 'alternative' diet.

Despite the well-established nutritional benefits of dairy foods and their role as part of a healthy balanced diet, it is a food group that is often subjected to unnecessary dietary exclusion. The decision to remove dairy is often driven by misinformation regarding production practices, health impact or simply due to popular food and lifestyle trends.

Dairy farming practices vary across the global jurisdictions; Irish dairy is largely pasture-based, with its reputation for quality among the top international standards. Milk is also a natural source of calcium, protein, riboflavin, vitamin B12, iodine, phosphorus and potassium, which all play various roles in good health. Its affordability and versatility make dairy a convenient source of nutrients and excluding it from the diet could potentially lead to negative nutritional consequences.

Variety and choice are important values for all consumers when it comes to food selection. Ideally, consumers could make their own informed choices based on trusted and accurate, scientific information.

The purpose of this edition of *DN Forum* is, therefore, to examine the science and provide clarity on the most common dairy misconceptions, which can result in vulnerable individuals needlessly avoiding a highly nutritious food group.

## EDITORIAL

Welcome to this issue of *DN Forum*. Together with our partners at Food for Health Ireland (FHI), we have compiled a double edition to provide you with a comprehensive resource on a range of topical dairy misconceptions that influence consumer perception and, in turn, consumption.

Healthcare professionals and representatives of the dairy industry are often questioned on the health and ethical aspects of consuming dairy. This edition aims to provide a summary of the scientific research in these areas, giving clarity on a range of topics.

This review, written by experts in the field, explores the areas of milk allergy and intolerance; explaining the cross-over relationship between dermatological and respiratory symptoms, which independently can have many other causes. Additionally, it provides an overview of the myths surrounding fat and sugar; and clarifies misconceptions that have been suggested about dairy and cancer. Finally, experts in the area of milk production provide an insight into the high standards of animal welfare and food safety adhered to in the Irish dairy industry.

We hope you enjoy this edition of *DN Forum* and look forward to any feedback or comments you wish to share: nutrition@ndc.ie

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# Cow's milk allergy and intolerance – clarification

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The correct medical terminology used to describe an adverse reaction to food is generally not used in everyday language, which often results in any undiagnosed reaction being described as an 'allergy'.
'Food hypersensitivity' is the appropriate umbrella term used to describe any adverse reaction to a particular food[1]. For hypersensitivities relating to dairy, there are specific categories:
1. cow's milk protein allergy (CMPA); and
2. lactose intolerance (hypersensitivity to milk carbohydrate).
**CMPA and lactose intolerance are two very distinct conditions, which require expert diagnosis in order to avoid unnecessary or inappropriate dietary manipulation.** Removal of cow's milk, especially from a child's diet, for whatever reason, is a major decision, which can have significant nutritional and family consequences.

## Cow's milk protein allergy

CMPA is an adverse immune reaction to one of the several proteins within cow's milk. **In developed countries, the incidence of CMPA is 2-3% in early childhood but the prognosis is very good with a remission rate of 85-90% by age three[2].** Therefore, the prevalence in adulthood is very low.
A focused clinical history, detailing the presenting symptoms, is the most important tool for diagnosis and differentiating the types of CMPA. Table 1 below outlines the typical differences between immediate and delayed CMPA.
The principal treatment for CMPA is avoidance of cow's milk and any foods containing it as an ingredient. Foods containing milk that infants and young children commonly come into contact with include: baby cereals or biscuits, yogurt, ice-cream, chocolate or cheese.
The optimal milk feed for all infants is breast milk. When breastfeeding is not an option and where the infant also has CMPA, specialised formulae such as extensively hydrolysed or amino acid varieties are the preferred choice. Soy formula may be suitable for infants over six months once there is no concomitant risk of soy allergy.
The following are *not* suitable for the management of CMPA in infants under six months:

- whey or casein infant formula;
- hungry formula;
- stay-down formula;
- lactose-free formula;
- colic/constipation/comfort formula;
- soy formula;
- milk from other mammals: goat, sheep, camel, donkey, horse;
- plant-based, ready-to-drink 'milks' such as soy, rice, oat, almond, hazelnut, or coconut.

The use of baked-milk products is well established as a form of 'immunotherapy' to promote and support tolerance of milk protein in a systematic way. There is no rational scientific basis or proven role for hair analysis, isolated IgG testing, kinesiology, vega-testing or enzyme potentiated desensitisation for diagnosing or managing milk allergy or intolerance[5]. For more information on diagnosing and managing milk allergy please visit www.ifan.ie for references, treatment algorithms and the 'Milk Ladder'[6].

## Lactose intolerance

Lactose intolerance is a non-allergic food hypersensitivity that results from a reduced ability to digest lactose, the primary sugar naturally present in cow's milk. Intestinal absorption of lactose requires the enzyme lactase for digestion and deficiency or insufficiency of lactase results in malabsorption of lactose.
If a considerable amount of lactose is not absorbed in the small intestine, it moves on to the large intestine and colon where it is fermented by normal gut bacteria, producing gases such as hydrogen, carbon dioxide and methane. This fermentation causes

| Classification | Immediate cow's milk allergy[3] | Delayed cow's milk allergy[4] |
|---|---|---|
| **Onset** | Rapid, usually within minutes | Delayed, usually after two hours and up to 72 hours |
| **Symptoms** | *Gastrointestinal:* mainly vomiting<br><br>*Dermatological:* facial hives (urticaria), facial swelling (angiodema)<br><br>*Respiratory:* breathing problems and wheeze<br><br>Anaphylaxis can occur in severe cases | *Gastrointestinal:* diarrhoea, constipation, trapped wind, crampy pain.<br><br>*Dermatological:* Itch (pruritus), redness (erythema), eczema<br><br>There is no risk of anaphylaxis |
| **Aetiology** | Antibody mediated (usually IgE) | Cell-mediated (usually T-cell) |
| **Diagnosis** | Testing for specific IgE to cow's milk (by skin prick or blood test), combined with allergy focused clinical history | There is currently no validated test for confirmation; clinical history is vital<br>Clinically supervised exclusion of all milk followed by mandatory milk reintroduction (for two-four weeks) is the optimal diagnostic tool |
| **Management** | Exclusion of milk-based foods. For infants, continue breastfeeding if in place (mother may need to avoid milk); or<br>Use a specialised formula as advised by medical practitioner | Milk avoidance until symptoms have resolved.<br>Breasfeeding mothers may not need to eliminate milk. |
| **Prognosis** | Usually resolves by age five | Usually resolves by age three |

▲ Table 1 Differences between immediate and delayed cow's milk protein allergy.

gastrointestinal upset, including bloating, cramps, flatulence (wind), diarrhoea and, in some cases, vomiting. The severity of symptoms depends on the amount of lactose ingested and malabsorbed. There is a misconception that lactose intolerance requires absolute avoidance of all dairy and lactose-containing foods, but tolerance depends on the specific individual's presentation.
There are three presentations of lactose intolerance:

- **Congenital absence of intestinal lactase** is a rare but severe condition. It presents in the neonatal period with loose stools from initial exposure to either breast or formula milk; both contain lactose. Diagnosis is usually confirmed by determination of the lactase activity in a small bowel biopsy. There is subsequent potential for failure to gain weight, with poor growth and lifelong symptoms. Management involves lifelong lactose avoidance.

- **Primary lactase deficiency** is a relatively common condition worldwide, caused by a deregulation of lactase gene expression. **In Ireland and other northern European countries, however, only about 4-5% of the population are affected[7]. It is believed that lactase persistence arose as an evolutionary benefit in response to the nutritional benefits of being able to digest the milk of farm animals.** The hydrogen breath test and lactose tolerance test are used for diagnosis and for the majority of patients symptoms may not develop until late childhood or adulthood. **Primary lactase deficiency is not an absolute condition and, in most instances, individuals can tolerate daily doses of 12-15g[8,9].** A standard 200ml glass of milk contains approximately 9-10g lactose. The content in yogurt and cheese is considerably less (5.9g in 125g pot of plain whole milk yogurt and 0.03g in 25g of cheddar cheese), due to the metabolism of lactose during the fermentation and ripening processes. Dietary intake can be adapted to match the tolerance of individual patients.

- **Secondary lactose intolerance** occurs in those who have previously tolerated lactose without difficulty. It occurs as a result of inflammation or structural damage to the small intestinal mucosa due to bacterial or viral illness. It is this type of lactose intolerance that usually affects infants. It is transient and usually resolves within a few weeks. Diagnosis is more difficult because it depends on self-reported symptoms, not all of which can be assessed objectively. The diagnosis is usually made based on the presenting history and trial of lactose elimination for two to four weeks. Normal diet should be resumed once symptoms have resolved. Invasive testing is rarely needed. There is no indication for discontinuing breastfeeding in favour of lactose-free infant formula unless medically indicated.

In cases of lactose intolerance, 'over the counter' lactase enzyme supplementation may facilitate the continuation of milk consumption[4]. Lactose-free, 'off-the-shelf' dairy products may negate the need for dairy avoidance. Lactose-free infant formula is available but not always needed.

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# Do dairy products influence eczema or acne?


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## Eczema

A question that is often posed by patients or parents of children with eczema (atopic dermatitis) is whether dietary intake of dairy products affect the incidence or severity of the condition. **Eczema is an inflammatory skin condition, which can vary from mild to severe. The causes are not fully understood but genetics, immune function and environmental irritants can all play a role.**
Many articles in the literature have suggested that diet can be a factor in some cases of eczema. Although data is limited, it has been estimated that up to a third of children with moderate to severe eczema have confirmed IgE-mediated food allergies[1]. Cow's milk allergy is among these and its prevalence in childhood ranges from 2-3% of the general population in developed countries, with skin symptoms in approximately half of cases. Avoidance of the allergen is an important and vital management strategy. However, allergy resolution is positive with remission of up to 90% by age three[2].
When food allergy is suspected as a causative factor in provoking an eczema flare-up, accurate diagnosis of allergy by a medical professional is key. As not all food allergies are IgE mediated, elimination diets followed by re-introduction through a closely monitored food challenge is promoted as the gold-standard in diagnostics[3].
Few studies have specifically addressed the effect of milk elimination diets in patients with eczema. No randomised controlled trials have addressed this, though six randomised controlled trials have examined combined egg and milk exclusion diets and did not find a benefit for patients with eczema[4]. **In one study, 41 infants and young children with eczema had milk eliminated from their diet and then later re-introduced, with no effect on their eczema severity[5].**
When considering the effect of diet on eczema, it must be borne in mind that the basic problem in this chronic condition is a defect in the skin barrier function. **It is important to note that foods are not the single cause or cure for eczema and unnecessary dietary manipulation, which is not based on a medical diagnosis, can be nutritionally harmful, particularly for young children.**

## Acne (Acne vulgaris)

Many of those who suffer from acne question whether diet is a contributory cause. This question seems more relevant because of the often-erratic dietary habits of teenagers, the time when acne is most prevalent. **Although some patients report a specific flare of their acne when they eat certain foods, acne is not a condition that is caused by food intake.**
The basic problem in acne is an overproduction of oily secretions (sebum) by the glands (pilosebacous) primarily of the facial skin. This overproduction of sebum is combined with hyperkeritinisation of the follicular orifices causing obstruction of outflow and stagnation. Finally, there is an overgrowth of bacteria (*Propionibacterium acnes)*. **Such changes occur primarily in teenage years and are often hormone sensitive. Standard management is either with topical or systemic medical treatment, or sometimes a combination of both.**

There are basic pathophysiological mechanisms at work that are unlikely to be changed by dietary manipulation. However, certain dietary constituents may exacerbate or alleviate the problem and several randomised controlled trials have shown that diets with a low glycaemic load are helpful for improving the symptoms of acne[6].

Some observation studies suggest that reducing dairy products may decrease acne symptoms. A retrospective study of over 45,000 women in the Nurses Health Study II indicated that high intake of total milk was associated with teenage acne[7]. However, this study has limitations as it was based on retrospective data in which the subjects were asked to self-report their dietary patterns 15-30 years later. To clarify whether or not dairy products can influence the frequency or severity of acne, prospective randomised controlled trials are needed before recommendations can be introduced into daily clinical practice. However, it is established that the nutrients provided by milk such as iodine and riboflavin, have substantiated roles in the maintenance of normal skin.

## Conclusion

**The evidence is currently not strong enough to recommend changes to the intake of dairy products for the management of either eczema or acne.** In clinical practice, skin specialists often recommend that patients with acne or eczema keep a food diary of their skin activity and their dietary intake to determine if there are flares in their skin condition that can be related to specific dietary elements. In particular individuals, who repeatedly demonstrate a link between these factors, eliminating such dietary elements may reduce the flares of their skin condition. The underlying pathological process remains unchanged, however. **It is important that orthodox treatments should not be neglected in favour of dietary manipulation.**

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# Dairy, asthma and mucus production

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Niamh Hunt

Wheezing, mucus production and nasal congestion are common symptoms across several conditions such as asthma and allergic rhinitis.

**Mucus is essential for our bodies, serving to protect the epithelial cells of our respiratory, gastrointestinal, urogenital, visual and auditory systems from external pathogens.** However, during an infection (such as a cold), an asthma attack, or with allergies, its production in the respiratory tract increases and becomes irritating. Despite a lack of scientific evidence, many people uphold a strong belief that there is a link between an increase in mucus and drinking milk.

**Allergic rhinitis is generally caused by the inhalation of an airborne allergen, with dust mites, animal dander and pollen being amongst**

**the most common of these.** Some people who have cow's milk protein allergy (CMPA) may also experience an increase in mucus production, usually resulting in a runny nose[1]. Where this occurs, milk consumption triggers an immune response to harmless proteins such as whey and casein. Mast cells, a type of immune cell, are activated and go on to induce inflammation of the airways and release histamine, which can lead to a range of allergy symptoms including excess mucus production[2]. This allergy may contribute to the misconception that milk leads to worsening asthma symptoms or an overproduction of mucus.

However, the prevalence of cow's protein milk allergy (CMPA) is low at about 2-3% in infants and has a remission rate of up to 90% by age three[3]. Therefore, in reality, this cohort makes up a small percentage of those that suffer from excess mucus production.

In addition, due to the sensory qualities of dairy products, their consumption can alter the mouthfeel of saliva, which can be mistaken for mucus, further contributing to this perception. However, this is not unique to dairy and other foods and drinks with similar characteristics create the same mouthfeel[4].

**In spite of the sparse research in this area, scientific studies have demonstrated that milk does not worsen cold and asthma symptoms.** One of these studies confirmed that no such relationship was detected between milk intake and mucus production in healthy adults with rhinovirus infection (a common cold)[5]. In addition, no association was shown between milk consumption and the onset or exacerbation of asthma-related symptoms[6]. As the long-term use of steroid medication by asthma sufferers increases the risk of osteoporosis, the avoidance of dairy may be particularly unhelpful, given that it contains important nutrients that contribute to bone health maintenance. Research also indicates that vitamin D suppresses airway inflammation in patients with asthma[7], with many types of milk now fortified with vitamin D. The Asthma Society of Ireland advocates a healthy, balanced diet, including dairy, in its guide to living well with asthma[8].

**It is not advised to remove milk from the diet for the alleviation of asthma or allergic rhinitis symptoms, except in the rare cases of medically diagnosed cow's milk allergy.** Needless avoidance of dairy products can lead to compromised nutritional status among vulnerable individuals.

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# Dairy and cancer – clarification

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With cancer being among the leading causes of death worldwide, it is unsurprising that the interest in possible causes, preventative measures and cures stretch beyond the medical field. **Some media stories linking dairy consumption to cancer, coupled with advice from alternative healthcare practitioners, have perpetuated the myth that it plays a causative role in cancer.** However, this is not supported by an extensive review of the scientific literature, which concluded: **"Overall, the *proven* health benefits of dairy foods greatly outweigh the *unproven* harm"[1].** In addition, the leading cancer authorities worldwide, including the World Cancer Research Fund, do not advocate the dietary exclusion of dairy for cancer prevention or treatment.

Such misconceptions stem mainly from the suggestion by some that hormonal residues or casein proteins in cow's milk might have a carcinogenic impact. Hormones can play a driving role in some cancers, such as breast, ovarian, endometrial and prostate cancer.

In Ireland and the EU there is a total ban on the use of artificial hormones in cows or cattle. It has been speculated by some that naturally occurring oestrogen in cow's milk may be responsible for the development of breast cancer. However, oestrogen exposure by consuming the recommended daily servings of dairy is negligible. It is important to have perspective when assessing dietary intake in the context of circulating levels and biological significance. For example, in an investigation into the oestrone (E1) and 17 ß-oestradiol (E2) content of milks, it was indicated that premenopausal women generally produce 35,000 times as much E1 and 163,000 times as much E2 daily, than would be consumed in a standard (237ml) glass of 2% fat milk[2]. This amount is less than 1% of the tolerable upper limit of acceptable daily intake as set by the World Health Organisation[3]. In addition, these hormones have very low bioavailability and, following digestive metabolism, only 0.01% of this tiny amount of ingested E2 can be detected in plasma[2]. **Therefore, it is acceptable to conclude that oestrogen exposure by consuming the recommended daily servings of dairy is negligible.**

Insulin like growth factor-1 (IGF-1) is a naturally occurring hormone in our bodies, playing an important role in growth and development. Circulating levels are naturally higher during puberty and lower in the ageing population, when anabolic metabolism is reduced. High levels have been associated with the promotion of breast cancer cell growth[4,5]. Minute amounts of IGF-1 are naturally present in cow's milk. However, like other dairy proteins, IGF-1 is broken down by proteolysis during digestion. The amounts absorbed following ingestion are considered negligible in relation to endogenous production and are reported to have no biological impact[6]. **Therefore, the hypothesis that IGF-1 in milk is related to cancer is refuted.**

Casein is the primary source of essential amino acids in cow's milk, with the casein micelles providing a unique delivery vehicle for important minerals (calcium and phosphate). Some media have speculated about a possible link between this protein and cancer without any convincing scientific substantiation. In fact, in a wide review of the peer-reviewed literature, casein emerges as having anti-carcinogenic effects[1]. **Dietary protein, in general, plays an essential role as part of a healthy diet and is also particularly important for cancer patients that are at risk of nutritional depletion.**

In a comprehensive review by the World Cancer Research Fund and the American Institute for Cancer Research, it was suggested that milk consumption of 200g per day may decrease colorectal cancer risk by 9%[7]. Conversely, the report also alluded to a positive correlation between high calcium intakes and increased risk of prostate cancer. It must be noted however, that such high intakes in excess of 1,500mg of calcium, equate to approximately six servings of dairy per day and not the recommended three servings, which equates closer to 700mg.

Overall, these findings support the message of moderation and a balanced diet where extreme intakes or exclusion of any nutrient is unwise. In conclusion, the Department of Health's recommendations of three servings from the 'milk, yogurt and cheese' food group each day remains apt for maintenance of good health.

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# Dairy fats and health

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Many people believe that dairy foods are high in fat and may avoid or opt for low-fat versions. Indeed, the fat content of dairy products varies widely, with low-fat yogurts ranging between 0-2% fat and low-fat milk containing, on average, <2% fat. However, even whole milk is just 3.5% fat, meaning that an average 200ml glass contains just 7g of fat, while a 25g serving of cheddar cheese contains, on average, <9g fat. Typically, a 2,000kcal diet should contain about 70g of fat, accounting for about 30% of total calories. **In fact, in Ireland, dairy foods (milk, yogurt, cheese, cream and butter) account for only 13% of total fat intake[1], even though over 99% of the Irish population consume dairy[2].**

There is a prevailing view that saturated fat is associated with increased risk of heart disease[3] although, at present, the evidence remains inconclusive[4,5]. Since dairy fat is approximately 60% saturated[6], current dietary guidelines advise choosing lower-fat dairy products where possible[7]. However, the most recent evidence suggests that the food source of the saturated fat is important and can influence the impact on heart health[8]. In fact, intakes of saturated fat from dairy products have not been associated with the same cardiovascular disease risks of saturated fats from other sources[9]. **It is also important to consider that when dairy fat is consumed, it is consumed as part of a nutritious matrix of other nutrients, including unsaturated fats, protein and calcium, that may influence the effect of its saturated fat on health.**

As the food source is important when considering the health effects of saturated fat, the same appears true for trans fats[10]. Trans fatty acids in the diet arise from two main sources: industrially produced trans fats, which are present in foods such as some margarine, fast-food, commercially fried foods and baked goods; and ruminant trans fats (produced naturally by bacteria in the gut of ruminant animals such as cows and sheep), which are present in foods such as dairy products and meat.

Trans fatty acids, particularly at high levels of intake, have long been negatively associated with heart health. While this remains true for industrial trans fats, numerous studies have emerged recently showing no significant association between naturally occurring, ruminant trans fats in the diet and increased risk of heart disease[10]. **In fact, research indicates that dairy consumption as part of a balanced diet, may be beneficial for cardiovascular health[11].**

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# Is there sugar in my milk?

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Sugar seems to have become the new 'fat' when it comes to concerns about diet. This is largely due to the publicity generated by the World Health Organization's (WHO) recommendation to consider halving the average population intake of free sugars to 5% of total dietary energy[1]. This was reinforced by the UK's Scientific Advisory Committee on Nutrition (SACN) following its report on *Carbohydrates and Health*[2]. Both SACN and the WHO have focused on restricting added or free sugars, generally defined as 'all monosaccharides and disaccharides added to foods by the manufacturer, cook or consumer, plus sugars naturally present in honey, syrups and unsweetened fruit juices'.

With heightened awareness around sugar, particularly in beverages, questions are emerging on social media about the sugar content of milk. Whole and low-fat milk naturally contain about 4.8g/100g of the naturally occurring milk sugar lactose and plain yogurt about 4.7g/100g. By law this is declared on the nutrient label as 'sugars' because lactose is a disaccharide and the label does not distinguish between naturally occurring and added sugars. **As health professionals, it is important that we communicate clearly that when it comes to sugar, the restriction does not apply to lactose naturally present in dairy products.** With 42% of teenage girls and 23% of teenage boys in Ireland lacking sufficient calcium in their diets[3] we need to ensure that confusion with added sugar does not compromise calcium intakes further by driving teenagers away from dairy at a critical stage of bone development.

Why is lactose in dairy not included? Milk and dairy products are far from 'empty calorie' foods. They are a nutrient-rich food group providing significant contributions to intakes of protein, retinol, vitamin B12, riboflavin and calcium intakes in Irish diets[4]. **In terms of chronic disease, evidence suggests that lactose in milk is not associated with dental caries[5] and there is no association between dairy product consumption and an increased body weight or risk of type 2 diabetes[6,7].** In fact, for people with a healthy body weight who reduce their added sugars intake, SACN have recommended that to maintain carbohydrate intake, added sugar should be replaced by starches, sugars contained within the cellular structure of foods (e.g. whole fruits and vegetables) and by lactose naturally present in milk and milk products for those that consume dairy. Of course, any sugar added to sweeten dairy products, e.g. flavoured milk, sweetened yogurts, counts toward daily sugar recommendations and consumers can look to the ingredients list as a way of checking if sugars have been added. Ingredients like glucose syrup, invert sugar, dextrose, honey and corn syrup are all indications that sugar has been added, although it does not reveal how much. Finally, it is worth noting that the sugar recommendations do not apply to individuals in need of therapeutic diets or who are malnourished. For patients with diabetes who are carb-counting to manage blood sugar levels, all carbohydrate needs to be considered, including lactose.

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# Pasteurisation and its nutritional impact

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Dr Phil Kelly

Raw milk can potentially contain a wide range of disease-associated microorganisms. **Pasteurisation is a simple heating process that can effectively destroy these pathogens and is, therefore, a food safety measure that is enacted as part of the milk production process.** It usually involves heating milk at 72ºC for 15 seconds and as a result, changes to the sensory characteristics are scarcely noticeable. Equally, the impact at a physico-chemical level is quite modest with only 5% of milk's whey protein content being denatured during pasteurisation. In addition, no difference in protein efficiency ratio and protein digestibility between raw and pasteurised milk has been observed[1].

A systematic scientific review of 40 studies investigating the effect of pasteurisation on vitamins A, B1, B2, B6, B12, C, E and folate in milk, found that the process did not significantly affect the concentrations of B1 or B6 in milk, but did lower the levels of B2, folate and vitamin C[2]. No quantification of effect could be established in the case of vitamins A, E and B12 due to considerable variability in measurements among the different studies. The significant decrease in vitamin C and folate in milk should be considered in context, i.e. the concentration of both vitamins in milk is already relatively low, so that any change due to milk pasteurisation has a minimal impact on an individual's diet. For example, with a recommended daily intake (RDI) of 45mg for vitamin C, raw milk provides only 0.1mg extra vitamin C per serving compared to pasteurised milk. Even after taking into consideration that there is a 9% loss in vitamin B2 during pasteurisation, milk is still a significant contributor (~40% of RDI) of vitamin B2[1]. Furthermore, vitamin B2 is light sensitive and without adequate packaging its content will diminish during storage regardless of pasteurisation. **No difference in the bioavailability of milk minerals has been established between pasteurised and raw milks, which is important in the context of milk being a significant source of calcium and phosphorus in the diet.**

Perceived nutritional or health benefits from the consumption of raw milk are not scientifically substantiated[3]. Furthermore, the Food Safety Authority of Ireland recommends that the sale of raw milk for direct human consumption should be prohibited. **Globally, the evidence that heat treatment is an efficient method to reduce microbiological risk without affecting the nutritional value of milk is compelling.**

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# Irish milk: Antibiotic free and use of hormones forbidden

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The quality of Irish dairy is internationally renowned, with aspects such as safety and integrity being of paramount importance to consumers. The quality and safety of milk are judged by a broad range of criteria, relating to composition, hygiene and testing for residues of veterinary medicines, including antibiotics. The Department of Agriculture, Food and the Marine (DAFM) is the designated competent authority for enforcement of milk quality and safety legislation relevant to on-farm production, with farm inspections conducted routinely. In consultation with the Food Safety Authority of Ireland, DAFM's veterinary inspectorate is responsible for the design and implementation of a national milk residue monitoring plan, as required under EU Directive 96/23/EC. Animals, like humans, need medical intervention from time to time. With regard to the use of veterinary medicines, regulations are in place regarding the use of veterinary drugs, including those classified as B1 substances (antibiotics and sulphonamides). The use of B1 medicines are available to dairy farmers by veterinary prescription only. **Where they are used, specific withdrawal periods are designated to ensure that milk from antibiotic-treated cows does not enter the food chain.** Samples are initially screened using a microbial inhibition test. In positive samples, chromatographic methods are then used to identify and confirm the identity and quantity of antibiotic present. Milk processors (purchasers of the milk) are responsible for checking the quality and safety of milk at the time of initial processing and prior to allowing the milk through to the product manufacturing line. Samples are taken from every milk tanker and if the milk doesn't pass, it doesn't get through, ie. there is no risk that Irish consumers would ever buy commercial milk which contains antibiotics.

**Unlike some other jurisdictions, in Ireland and the European Union, there is a *total ban* on the use of artificial hormones**. There is a misconception however, that cows may transfer harmful levels of hormones to the milk, particularly if they are pregnant. In reality, the actual concentration of hormones naturally present in milk are negligible and, for the most part, are destroyed by proteolysis during digestion. To put this into biological perspective, it is estimated that the typical intake of the hormone, IGF-1 from a standard glass of milk is approximately 0.03% of the body's own daily production[1]. Quality and safety continue to be paramount in the Irish dairy industry.

## References


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# Good animal welfare

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Animal welfare can be judged on the basis of an animal's access to the 'five freedoms' ie. animals should be (i) free from hunger and thirst, (ii) free from discomfort, (iii) free from pain, injury or disease, (iv) free to express normal behaviour, and (v) free from fear and distress. With regard to the dairy industry in Ireland, Irish cows have a greater opportunity to access the five freedoms than their international counterparts. **For example, the majority of Irish cows are fed on a pasture-based diet and, as such, are in a more natural environment to express normal behaviour than cows housed indoors for all, or the majority, of their lifetime.**

Farmers of dairy cows are ethically obliged to provide a good standard of welfare for the livestock in their care and it should be noted that both animals and farm profitability can benefit from this as **cows reared under good standards of welfare are more highly productive.**

The payment scheme for the Irish dairy system is based on milk fat and protein content, as opposed to milk volume.

Genetic selection of dairy cows in Ireland, therefore, has moved away from selecting for high milk yield to selecting for a more fertile and healthier cow. This will benefit Irish dairy cow welfare in the long-term. It must be noted, however, that, although Irish cows benefit from more natural living conditions, intensification of the pasture-based system is increasing, which needs to happen in a sustainable way. A number of initiatives (such as CellCheck) are underway in Ireland to ensure that this intensification does not increase the incidence of conditions such as mastitis and lameness, the main health issues that impact dairy cow's welfare.

Milk production in Ireland is split into two cycles: spring or winter and cows only supply milk for one of these cycles (the majority are in the spring/summer cycle while grass is growing). In the spring milk production cycle, the cow is bred between April and June and continues to produce milk until the drying off period around November. **This allows between two and three months of non milking before calving and, once managed correctly, has no negative impacts for the cow or calf.** Instead of calving in the spring, some cows are calved in the autumn, ensuring a supply of milk during the winter months. Autumn calving cows require extra nutrition as they are housed for a proportion of their milking season, due to weather conditions. In order to ensure sufficient nutrition is given to the cows, they are fed formulated foods (nutrient-rich concentrates) in addition to silage. When cows are 'dried-off', in other words, when milk production ceases, cows may be treated with antibiotoics and/or anthelmintics to protect against disease. As no milk is being produced there are no concerns about residues in the milk.

When calves are born, the first milking, called colostrum and the subsequent five milkings called transition milk, are not incorporated into the milk pool and are generally fed to the calf. Separation of the cow and calf at birth is good practice from a nutritional and disease prevention point of view. The dairy cow udder is often not anatomically suitable to feed correctly and many dairy cows have poor mothering ability. Calves are generally cared for in the company of other calves, therefore housed separately from the rest of the herd to prevent the risk of exposure to illness when they are young. Such herd-health practices also helps to prevent diseases such as Johne's in the calf or mastitis in the cow.

**Irish cows have the opportunity to benefit from higher standards of welfare than their international counterparts, given the pasture-based farming system that predominates in Ireland.** However, farmers and their service providers must remain vigilant in continuing to ensure that Irish dairy cows benefit from the five freedoms of animal welfare.

A summarised version of this edition of *DN Forum* is also available as an e-book.

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Mission: To deliver real and unique value to Irish dairy farmers by protecting and promoting the image, quality, taste and nutritional credentials of Irish dairy produce to a wide variety of audiences in a clearly defined, focused, unique and effective manner.

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Mission: To leverage the world-class capabilities of the Irish academic partners, with the market expertise of the industry partners, into a pipeline of innovative, nutritional functional ingredients/products for the global food industry.