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# Lactose, an important nutrient: Advocating a revised policy approach for dairy and its intrinsic sugar

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# Lactose, an important nutrient: Advocating a revised policy approach for dairy and its intrinsic sugar

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**Lactose, an important nutrient: Advocating a revised policy approach for dairy and its intrinsic sugar**

## ABSTRACT

Milk and milk products have an important role in the diet and their consumption is recommended as part of food-based dietary guidelines around the world. Their health effects are related to the unique package of important nutrients that interact in a complex matrix. Scientific evidence has linked dairy consumption to various health benefits and reduced risk of several non-communicable diseases (NCDs).

Reducing the consumption of foods and beverages that increase the risk of developing weight gain has been of particular importance to health authorities in an effort to curb the increase in NCDs. As a result, many countries have implemented public health measures aimed at reducing populations' sugar intake. Public health experts agree that consuming excess added and free sugars from energy-dense, nutrient poor foods may contribute to weight gain and the development of NCDs.

Lactose is a disaccharide that occurs naturally in all mammalian milk. This Bulletin summarizes the scientific evidence on the nutritional and health properties of lactose as naturally found in milk and other dairy foods. It outlines the key role that milk and dairy products have in a healthy diet and argues that lactose, as an inherent sugar, forms an important part of the dairy matrix. Milk and milk products should therefore not be penalised in policy measures designed to reduce the intake of added sugar.

**Keywords:** *lactose; inherent sugar; added sugar; free sugar; policy makers, public health, healthy diet; health benefits*

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**Annexure A:**




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# FOREWORD

Milk, cheese, yoghurt and other cultured/fermented dairy products are composed of complex structures and are important sources of several key nutrients. As part of their nutrient-rich package, dairy foods also contain the naturally occurring sugar, lactose.

When naturally present in milk or milk products, lactose is in some countries considered as an added/free sugars by health organizations or authoritative bodies. Furthermore, despite the distinction made between naturally occurring and added/free sugars, some polices have been proposed to evaluate the health benefits of foods by looking at the total amount of sugars, including lactose.

Dairy products have long been recognized as an important part of a balanced diet, and there is a wealth of scientific evidence that supports the beneficial effects of milk and other dairy products on health. Lactose, as a naturally occurring sugar in milk, is associated with some specific health properties such as enhancing intestinal calcium absorption in infancy and possibly in the elderly. In addition, recent studies have shown that unabsorbed lactose could have prebiotic-like effects in the digestive tract.

Recognising the important need to raise awareness of the benefits of lactose, and the need to avoid penalising milk and dairy products in policy measures designed to reduce added sugar intakes due to their inherent lactose content, this bulletin summarizes the scientific evidence on lactose naturally present in milk and other dairy foods and its nutritional and health properties based on the science available and outlines the key role that milk and dairy products play in a healthy diet.

I hope you find it informative reading.

Caroline Emond
IDF Director General

# 1 INTRODUCTION

Milk and milk products play an important role in the diet and their consumption is recommended as part of food-based dietary guidelines around the world [19]. A growing body of scientific evidence has linked dairy consumption to several health benefits and reduction in the risk of several non-communicable diseases (NCD) [14, 72, 25, 27, 6].

Milk, cheese, yoghurt and other cultured/fermented dairy products are composed of complex structures (i.e., the food matrix) and are important sources of several key nutrients [22]. As part of their nutrient-rich package, dairy foods also contain the naturally occurring sugar, lactose. Lactose is a disaccharide composed of a glucose and galactose unit and is the principal carbohydrate in milk (approximately 4.7% of cow's milk is composed of lactose).

Many countries have implemented public health measures aimed at reducing population sugar intakes due to concerns around chronic disease risk. Public health experts generally agree that consuming excess added, or free sugars (especially when found in energy-dense, nutrient-poor sources) may have a negative impact on weight and dental health. However, there is no evidence linking naturally occurring sugars, including lactose in dairy products with non-communicable disease (NCD) risk [86].

It is important to note that lactose, when naturally present in milk or milk products, is not considered to be added/free sugars by health organizations or authoritative bodies [46, 86]. Despite the distinction between naturally occurring and added/free sugars by the World Health Organisation and the Food and Agriculture Organization of the United Nations, some polices have been proposed to evaluate the health benefits of foods by looking at the total amount of sugars. However, considering total sugar content alone does not differentiate between naturally occurring and added/free sugars, nor does it consider the food source of the sugar, or the possible effects of the food matrix. There are some indications that the health benefits associated with the consumption of whole foods are linked to their food matrix. This should be taken into account when defining policy measures intended to lower the intake of nutrients of concern so that consumption of nutrient-dense core foods such as milk and yoghurt are not unfairly discouraged [84]. A one-sided focus on sugars as the cause of the chronic disease epidemic, which may induce consumers to select foods and diets on the basis of the sugar content alone, ignoring other nutritional characteristics, should be avoided [84].

Dairy products have long been recognized as an important part of a balanced diet. There is a wealth of scientific evidence that supports the beneficial effects of milk and other dairy products on health and lactose, the naturally occurring sugar in milk, is associated with some specific health properties such as enhancing intestinal calcium absorption in infancy and possibly in the elderly [78, 33]. In addition, recent studies have shown that unabsorbed lactose could have prebiotic-like effects in the digestive tract [78, 32].

This paper summarizes the scientific evidence on lactose naturally present in milk and other dairy foods and its nutritional and health properties. Based on the science, this paper outlines the key role that milk and dairy products play in a healthy diet and argues that they should not be penalised in policy measures designed to reduce added sugar intakes due to their inherent lactose content.

# 2 LACTOSE CONTENT IN MILK AND DAIRY PRODUCTS

As part of their nutrient-dense package, dairy foods naturally contain lactose. Lactose is a unique sugar which is naturally produced in the mammary gland of mammals and the lactose content can range anywhere from 0.1% in seal milk to 7.5% in human milk [63, 18].

Cow's milk naturally contains approximately 4.7% lactose. The lactose content varies in other dairy products, for example, in fermented cow's milk products such as yoghurt, buttermilk and other cultured dairy products, lactose content is generally lower than in fluid milk because of the conversion of lactose to lactic acid by lactic acid bacteria. Cheeses contain very low levels or no lactose, with a few exceptions depending on the production process (Table 1). Lactose reduced or lactose free products contain low levels or no lactose.

**Table 1. Lactose content of milk products, adapted from Gille et al. (2018).**

| Dairy products | Type | g/100g |
|---|---|---|
| **Milk** | | |
| | Whole (3.5% fat) | 4.7 |
| | Skimmed (0.1%) | 4.9 |
| | Semi-skimmed (1.5% fat) | 4.9 |
| **Cheese** | | |
| | Hard cheese | traces |
| | Semi-hard cheese | traces |
| | Soft cheese | traces |
| | Fresh cheese | 0.7–4.6 |
| | Cottage cheese | 1.8 |
| | Mozzarella | 0.7 |
| | Cream curd cheese | 3.6 |
| **Yoghurt/fermented milk** | | |
| | Low fat (0.1% fat) | 3.3 |
| | Semi-skim (1.5% fat) | 2.8 |
| | Whole milk (3.5% fat) | 3.3 |
| | Greek Style (10% fat) | 3.0 |
| | Bifidus yoghurt semi-skim (1.5% fat) | 4.2 |
| | Bifidus yoghurt (3.5% fat) | 3.2 |
| **Butter** | | 0.75 |
| **Cream** | | |
| | Half cream (25% fat) | 3.7 |
| | Cream (35% fat) | 3.3 |

# 3
# SUGARS IN FOOD REGULATION AND POLICIES

## 3.1. CLASSIFICATION OF SUGARS

From a chemical perspective, dietary carbohydrates are usually classified according to their molecular size and monomeric composition (Table 2). This chemical classification defines three main groups of carbohydrates [65]:

- Sugars (1–2 monomers, chemically known as mono- and disaccharides),
- oligosaccharides (3–9 monomers),
- polysaccharides (more than 9 monomers).

The two last categories are chemically known as malto-oligosaccharides, digestive starch and fibers, and are commonly referred to as complex carbohydrates.

**Table 2. Dietary simple and complex carbohydrates classification, adapted from Cummings & Stephen 2007.**

| | Class | Sub-groups | Components |
|---|---|---|---|
| Simple | Sugars (DP 1–2) | - Monosaccharides | - Glucose, galactose, fructose, tagatose |
| | | - Disaccharides | - Sucrose, lactose, maltose, isomaltulose |
| | | - Sugars alcohols (polyols)[1] | - Sorbitol, mannitol, xylitol, erythritol. Maltitol, isomalt, lactitol |
| Complex | Oligosaccarides (DP 3–9) | - Malto-oligosaccharides | - Maltodextrins (hydrolysed starch) |
| | | - Non digestible oligosaccharides | - Raffinose, stachyose, fructo- and galacto-oligosaccharides polydextrose, inulin |
| | Polysaccharides (DP >9) | - Starch | - Amylose, amylopectin, modified starches |
| | | - Non-starch polysaccharides | - Cellulose, hemicellulose, pectins, hudrocolloids (gums, ß-glucan) |

DP: degree of polymerization;
[1] Regulatory-wise, polyols are not labeled as "sugars".

*(Scientific Advisory Committee on Nutrition, Carbohydrates and Health Report, 2015).*

Sugars are a group of sweet substances which provide fuel for the body and brain. Sugars occur naturally in fruits, milk, honey and most vegetables, while other sources of sugars in the diet are those added during manufacturing, cooking and at the table. They are regarded as safe and highly versatile ingredients, adding sweetness, texture, flavour, colour and preservative properties to many different foods and beverages.

Lactose is a disaccharide (composed of one glucose and one galactose unit) and is therefore classified as a simple carbohydrate.

In addition to their chemical classification, sugars are also classified based on their natural occurrence in food, or by their addition during food processing. According to the World Health Organization, the term ‘total sugars’, or ’sugars’, includes:

- inherent sugars, which are those naturally present within the structure of intact fruits and vegetables and in plain milk, and;
- free sugars, which are defined as:
    - added sugars: monosaccharides and disaccharides added to foods and beverages by the manufacturer, cook or consumer, and;
    - sugars which are naturally present in honey, syrups, fruit juices and fruit juice concentrates. [86]

## 3.2. ADDED AND FREE SUGAR REGULATIONS

While variations in the definitions of total, added and free sugars can be found between different regulatory or health bodies (Annex A), they are consistently excluding inherent lactose from the definition of an added/free sugar when naturally present in foods. This distinction is relevant for public health because research generally associates added/free sugars with an increased risk of developing non-communicable diseases (NCDs) [35]. Lactose naturally present in milk and dairy products is not a concern for public health because, as stated by WHO [86], “there is no reported evidence of adverse effects of consumption of inherent sugars and sugars naturally present in milk”.

A summary of the public health bodies’ recommendations regarding reduced free or added sugar consumption is highlighted in **Table 3**.

### 3.2.1. Public Health Recommendations related to free or added sugar content

Globally, NCDs such as cardiovascular diseases (CVD), diabetes and cancer are the leading causes of death [86]. Considerable attention has been given to the effects of added sugars in the development of the global obesity epidemic [61, 39, 77]. While there is still some debate over the exact role of sugar in the development of obesity [40], it is clear that sugar intake can easily contribute surplus energy to the diet which may result in overweight or obesity.

Foods and beverages that increase the risk of developing weight gain and NCDs (energy dense foods) are of particular importance to health authorities when trying to reduce this trend. These foods (often energy-dense, nutrient-poor, sugar sweetened beverages) may increase energy intakes and replace nutrient-dense foods in the diet.

In 2015, the WHO reaffirmed its recommendations to limit the intake of added or free sugar to less than 10% of total energy intake. This was based on moderate evidence that suggested that higher intakes were associated with an increased risk of dental caries and in adults, overweight and obesity [58]. As a precautionary measure the WHO also included a conditional recommendation to further limit the amount of added or free sugars to no more than 5% of daily energy for additional health benefits, although the quality of the evidence to support this is regarded as very low [86].

**Table 3. Definitions and recommendations on sugars from Health organizations/authorities.**

| | Free sugars | | Added sugars | |
|---|---|---|---|---|
| | Definition | Recommendations | Definition | Recommendations |
| WHO, 2015<br>(WHO. Guideline, 2015) [86] | Monosaccharides and disaccharides added to foods and beverages by the manufacturer, cook or consumer and sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates | Free sugars under 10% of calories. Ultimate goal of reducing free sugar consumption<br>⇨ lactose naturally occurring in milk is not included | | |
| SACN, 2015<br>(Nutrition, S. S. A. C. O. Carbohydrates and Health Report, 2015) [65] | All monosaccharides and disaccharides that are added to foods by the manufacturer, cook or consumer, as well as sugars naturally present in honey, syrups, fruit juice and concentrates | Upper limit of free sugars at 5% of calories.<br>⇨ lactose naturally occurring in milk is not included | | |
| NAM, 2015 / 2005<br>(Institute of Medicine, 2005) [35] | | | All sugars (mono- and disaccharides) and syrups that are added to foods during processing or preparation | Upper limit of added sugars of 25% of total calories<br>⇨ lactose naturally occurring in milk is not included |
| EFSA, 2010 [15] | | | Sucrose, fructose, glucose, starch hydrolysates (glucose syrup, high-fructose syrup) and other isolated sugar preparations used as such or added during food preparation and manufacturing | Available data do not allow the setting of a Tolerable Upper Intake Level for total or added sugars, neither an Adequate Intake nor a Reference Intake range |
| FDA, 2016 [75] | | | Sugars that are either added during the processing of foods, or are packaged as such, and includes sugars (free, mono- and disaccharides), sugars from syrups and honey and sugars from concentrated fruit or vegetable juices that are in excess of what would be expected from the same volume of 100% fruit or vegetable juice of the same type | |
| DGAC, 2020<br>(Dietary Guidelines Advisory Committee. Scientific Report of the 2020–2025 Dietary Guidelines Advisory Committee) [74] | | | All sugars that are either added during the processing of foods, or are packaged as such, and include sugars (free, mono- and disaccharides), syrups, naturally occurring sugars that are isolated from a whole food and concentrated so that sugar is the primary component (e.g., fruit juice concentrates) and other caloric sweeteners | Maximum 10% of total calories from added sugars per day<br>⇨ lactose naturally occurring in milk is not included |
| American Heart Association (2009) [38] | | | Sugars and syrups put in foods during preparation or processing, or added at the table | ≤ 150 kcal of added sugars/d (males)<br>≤ 100 kcal of added sugars/d (females)<br>lactose naturally occurring in milk is not included |
| NNR (Nordic nutrition recommendations) 2012 [54] | | | Refined sugars such as sucrose, fructose, glucose, starch hydrolysates (glucose syrup, high-fructose syrup), and other isolated sugar preparations used as such or added during food preparation and manufacturing | Added sugars under 10% of total calories<br>⇨ lactose naturally occurring in milk is not included |

WHO: World Health Organization
SACN: Scientific Advisory Committee on Nutrition
AHA: American Heart Association
DGAC: Dietary Guidelines Advisory Committee
NAM: National Academy of Medicine
EFSA: European Food Safety Authority
NNR: Nordic Nutrition recommendations
FDA: Food and Drug Administration

## 3.3. LABELLING OF 'TOTAL SUGAR' AND 'FREE OR ADDED SUGARS'

Regulations for Nutrition Information Panels (NIP) generally require the declaration of total sugar and total carbohydrate content and the natural occurring lactose in dairy products is encompassed within this. Only a few countries include provision for added sugar labelling in the NIP, for example, the USA [75]. The IDF would propose the exclusion of lactose from total sugar declaration on NIP.

Focussing only on the total sugar content of a food is not consistent with broader health strategies designed to reduce added sugar intakes and the risk of diet related NCDs. Without a clear differentiation between inherent and added sugar content of foods, certain foods with a 'high' total sugar content could be regarded as having a negative impact on health, while they might, in fact, have a beneficial role. This is notably the case of plain milk and some yoghurts. Therefore, confusing sugar which is naturally present in milk with added sugars might result in discouraging foods that are recommended in food-based dietary guidelines (FBDGs).

# 4
# LACTOSE AND HEALTH

Much of the scientific literature on lactose and health has focussed on lactose maldigestion, however, generally, the role of lactose in health and nutrition is not well understood. Lactose in milk provides energy (especially in newborns as it provides glucose), participates in the cerebral development of the child and assists in the absorption of different nutrients (such as proteins, calcium) [56]. In addition, recent studies show that unabsorbed lactose could also have a prebiotic effect at the level of the digestive tract [78, 32].

## 4.1. LACTOSE DIGESTION AND ABSORPTION

Much of the focus on lactose and health has been on lactose digestion. The intake of milk and other dairy foods contribute to the consumption of numerous essential nutrients. However, lactose malabsorption or intolerance can pose a barrier to milk and dairy consumption by individuals, which could lead to nutrient deficiencies. In this context, several international health organizations and others bodies such as the National Medical Association (NMA), National Institutes of Health (NIH), European Food Safety Agency (EFSA) and the FAO recommend individuals with lactose intolerance need not entirely remove dairy foods from their diet in order to prevent these possible nutrient deficiencies [5, 68, 16, 18]. They state that milk and milk products do not necessarily have to be eliminated from the diet as lactose consumption can be tolerated very well in most individuals with lactose malabsorption. They advise instead, that individuals should adapt their lactose consumption to their individual tolerance.

Lactose tolerance varies widely among individuals with lactose maldigestion. A single threshold of lactose for all lactose intolerant subjects cannot be determined owing to the great variation in individual tolerances. Although symptoms of lactose intolerance have been described after intake of less than 6 g of lactose in some subjects, evidence indicates that most individuals diagnosed with lactose intolerance can tolerate up to 12 g (10 to 15 g of lactose - typically the amount found in ~240 mL milk) as a single dose with no, or minor symptoms. Higher daily doses (20 to 24 g) may also be tolerated if distributed throughout the day and consumed together with other nutrients during meals. In addition, most individuals with lactose maldigestion are able to consume yoghurt owing to the bacteria found in yoghurt which improves the digestion of the inherent lactose [16]. Individuals with lactose maldigestion will also be able to consume most cheeses as they contain naturally low or no lactose (Table 1).

The hydrolysis of the disaccharide lactose into its simpler components (glucose and galactose) requires the enzyme lactase which digests lactose to glucose and galactose. Lactase belongs to a group of intestinal disaccharidases located on the brush border of the small intestine. The abundance of lactase is highest in the mid-jejunum and progressively declines towards the ileum. The lactase enzyme contains two distinct enzymatically active sites: the β-galactosidase site and the glycosyl ceramidase site. The β-galactosidase site forms the lactase domain which hydrolyses lactose to glucose and galactose [20]. See Figure 1.

Lactose digestion in humans is variable and can change with the age of the individual. In most humans, intestinal lactase activity is high at birth but can start to progressively decline after weaning. The decrease in the synthesis of lactase is referred to as primary lactase deficiency or lactase non-persistence [78, 29, 45, 8]. In contrast, lactase persistence occurs in the descendants of populations who traditionally practice cattle domestication and is associated with children and adults who continue to synthesize lactase and therefore maintain the ability to digest milk and other dairy products into adulthood [69].

In lactase persistent individuals, lactose is hydrolysed and its component monosaccharides are digested in the small intestine. In lactase-non-persistent individuals, there is a degree of lactose malabsorption which results in some lactose being released into the terminal ileum and colon where it is fermented by intestinal microbiota [20, 78, 69].

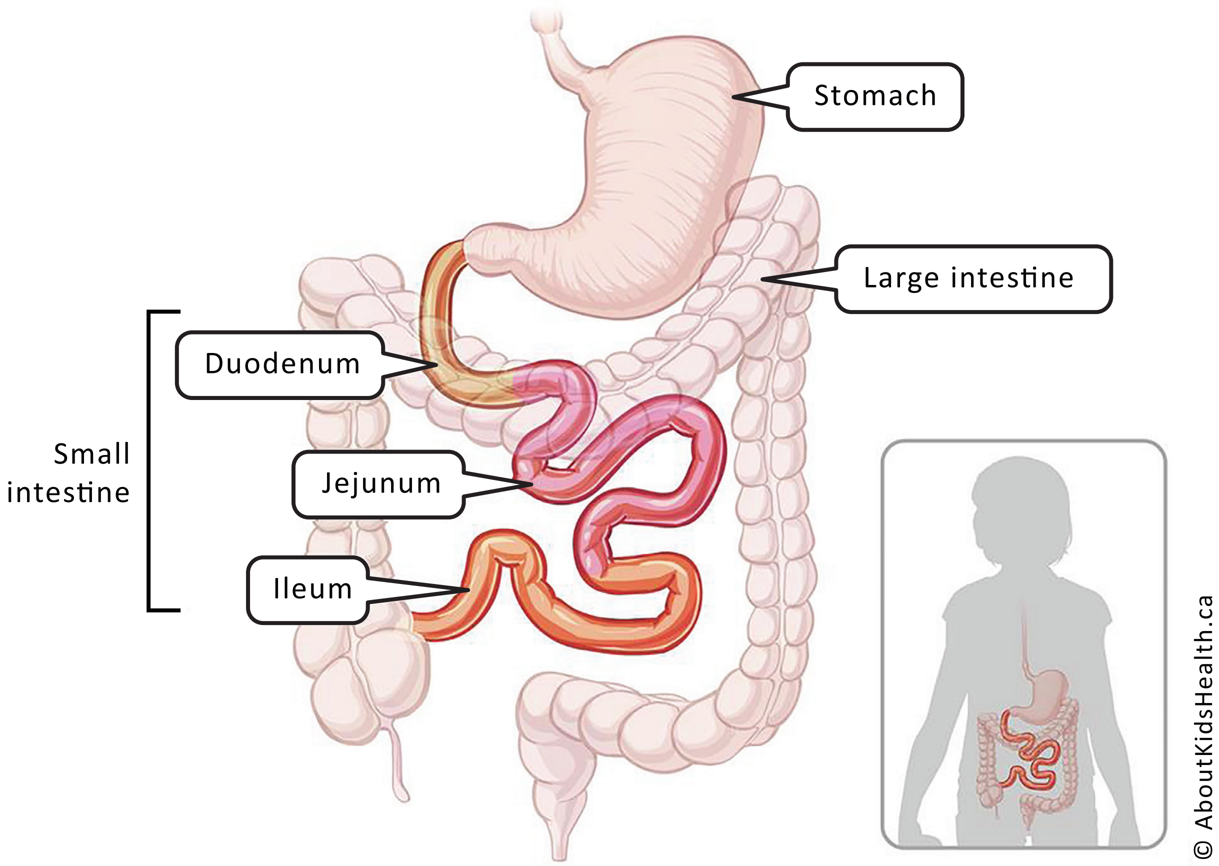


Figure 1. Digestive tract schematic diagram.

The majority of individuals with lactose malabsorption do not have symptoms of lactose intolerance [68]. However, in some consumers the bacterial fermentation of lactose can result in adverse gastrointestinal symptoms including flatulence, osmotic diarrhoea or intestinal cramps. These symptoms are collectively referred to as lactose intolerance [20, 78, 45, 69]. While lactose-free dairy products are becoming more widely available [11], Heine, 2017 indicated that most lactose-intolerant individuals should be able to consume up to 12–24 g of lactose daily if the amount is staggered over the course of the day and consumed as part of a meal to slow the release of lactose in the small intestine without causing symptoms. In addition, hard or matured and certain soft cheeses only have traces of lactose (Table 1) due to the fact that lactose is lost when whey is removed plus the bacterial cultures which are added during the production process of cheese consume lactose and as a result produce lactic acid. This process increases with maturation and with enough ageing, all the lactose is converted into lactic acid. The lactose in yoghurt is digested more efficiently than other dairy sources of lactose because the bacteria in yoghurt assist with its digestion [62].

The majority of people with lactose malabsorption do not have clinical lactose intolerance [68]. Undigested lactose in the colon can also act as a food source for gut microbiota, and can stimulate growth and activity of beneficial microorganisms comparable to prebiotic oligosaccharides - as discussed in 4.2.

## 4.2. LACTOSE AS A POTENTIAL PREBIOTIC

The microbiome of a healthy person is relatively constant, however poor lifestyle and diet can disturb the gut microbial dynamics. According to Singh [67], Valdes [76] and Wilson [81], diet and dietary components play a significant role in shaping the microbiome. In other words, what people eat directly influences the symbiotic and pathogenic microorganisms living in the gut, which, in turn has biological effects on metabolism, immunity and neuro-behavioural traits. This ultimately impacts on well-being and the risk of disease [31, 76, 17, 59, 42, 88]. It is not simply the microbes themselves that have an impact on health, but also the products of their metabolism.

In a case of lactase non-persistence, lactose is not fully digested and, in consequence, proceeds to the colon. In lactase-persistent persons, most lactose will be digested in the small intestine, although some might still reach the large intestine [43].

The colonic microbiota ferments the lactose and oligosaccharides from the dairy foods within the colon, producing metabolites such as short-chain fatty acids (SCFAs) (primarily acetate, propionate and butyrate) and gasses [79]. The SCFAs that are produced have several very important functions. They are metabolised by the colonocytes; promoting colon motility, reducing inflammation, increasing visceral irrigation, inducing apoptosis and inhibiting tumour cell progression. Furthermore, SCFAs have been shown to protect against diet-induced obesity, probably through an effect on gut hormones which reduces appetite and food intake. SCFAs can also be absorbed into the portal circulation and transported to the liver, where they could have beneficial systemic effects [78, 70].

Szilagyi [70] suggests that regular dairy food consumption by lactase non-persistent people could lead to colonic adaptation by the microbiome. This process might mimic a prebiotic effect which allows people with lactose malabsorption to consume more dairy foods as a result of positive changes in the microbiome.

Further studies are required to confirm the effect of lactose on the composition of the microbiome in different populations. Research in this area might well provide insight into the potential for positive health benefits of lactose consumption.

## 4.3. GLYCAEMIC INDEX (GI) OF LACTOSE IN DAIRY AND ITS IMPLICATIONS ON METABOLIC HEALTH

There is evidence to support the consumption of low GI diets and that the glycaemic load of a meal can improve glycaemic control in type 1 and 2 diabetes. These diets are also associated with a reduced risk of type 2 diabetes, which may be helpful in the reduction of total body fat mass and in weight management [4]. Postprandial glycaemia is thus recognized as a relevant factor in overall health. Taking dietary approaches which slow carbohydrate absorption into consideration might, therefore, be a useful tool in lowering the risk of major chronic diseases and related risk factors [4]. The glycaemic index (GI) has been characterized as a reliable, physiologically based classification of carbohydrates and foods according to their postprandial glycaemic effect [21]. Lactose-containing dairy products are, therefore, recommended as part of an energy- and nutrient-balanced diet.

The GI is the measure of the glucose response compared to that of a reference, most commonly white bread or glucose. The value of 100 represents the standard and there are three ratings for GI: low (55 or less), medium (56–69) and high (70 or more) [21].

The GI of lactose has been reported to be 46, a substantially lower blood glucose response than that to glucose (100). This indicates that lactose falls into the low GI category (see Table 4). Regarding the management of diabetes, lactose is considered to be a more acceptable carbohydrate than sucrose and glucose [82, 34]. In contrast, there is a growing body of scientific evidence that indicates that dairy significantly reduces the risk of type 2 diabetes [64, 47, 24, 72, 3].

**Table 4. Glycaemic index of sugars and dairy foods (adapted from Foster-Powell et al., 2002).**

| Nutrient/food | Glycaemic Index (GI)[1] |
|---|---|
| **Glucose** | 99 ± 3 |
| **Fructose** | 19 ± 2 |
| **Lactose** | 46 ± 2 |
| **Maltose** | 105 ± 12 |
| **Sucrose** | 68 ± 5 |
| **Milk (full fat)** | 27 ± 4 |
| **Skim milk** | 32 ± 5 |
| **Yoghurt** | 36 ± 4 |
| **Low fat, fruit, sugar, yoghurt** | 33 ± 7 |

[1] Glucose was used as the reference food.

## 4.4. DENTAL HEALTH

Dental caries occur due to tooth demineralization by organic acids produced by the combination of orally fermentable carbohydrates (e.g., glucose, sucrose, digestible oligosaccharides and starches) and dental plaque bacteria [49]. Therefore, the cariogenic potential of a given sugar or complex carbohydrate is linked to its fermentability by specific bacteria in the oral cavity [73].

Sucrose is identified as the most cariogenic of the fermentable sugars. By contrast, lactose is considered as a low cariogenic sugar because it does not serve as a substrate for plaque formation and is not rapidly fermented by oral microorganisms [2, 55, 48, 49]. Both chronic and acute studies show that lactose elicits a less detrimental effect on dental health than sucrose, glucose, fructose and maltose because of its lower acidogenicity [60, 41, 7, 85, 53, 9]. Therefore, lactose is not thought to have significant adverse dental effects [2, 66].

Beyond lactose per se, milk and dairy products are well known for their beneficial effects on dental health [28, 85] and this is attributed to many factors including their content of minerals and quality of protein [37, 36].

# 5
# DAIRY FOODS AND HEALTH

A wealth of scientific evidence supports the importance of milk, cheese, yoghurt and other fermented dairy foods as part of a healthy eating plan. Awareness of the benefits of milk and other dairy foods for bone health [23] and for dental health [49] is significant, but more recently a large body of evidence has linked dairy intake to other health benefits. Importantly, these benefits include reducing the risk of stroke, hypertension and type 2 diabetes [14, 6]. In fact, evidence also suggests that consumption of dairy foods is neither associated with an increased risk of cardiovascular disease [14] nor weight gain in either adults [1] or children [13] as is popularly believed.

The beneficial health effects of dairy foods are linked to the complex way in which the nutrients and their physical and chemical structures can interact with one another in the body and how the body digests and absorbs these nutrients. This is known as the dairy matrix.

Dairy foods are complex structures housing macronutrients, micronutrients and various other components including an abundant supply of high-quality protein, carbohydrates (in the form of lactose), calcium, phosphorus, potassium, iodine and B vitamins as well as various fatty acids and bioactive components.

There is growing recognition that dietary guidance should be based on evaluation of the health impact of the entire food matrix and this is especially true for whole dairy foods where the collective, synergistic effects appear to be stronger than that of individual nutrients [71]. The assessment of how healthy a food is should be based on an evaluation of the health effects of the entire food matrix, not just single nutrients [52]. Despite the many established health benefits, the entire dairy matrix is often overlooked in favour of a single 'risk' nutrient focus, such as focussing on sugar or fat content [51].

# 6 CONCLUSION

Dairy products have long been recognized as an important part of a balanced diet. This should be taken into account when defining policy measures intended to lower the intake of nutrients of concern, such as added sugars, fats and salt.

Lactose provides a source of energy, is low GI, could act as a prebiotic and is less cariogenic compared to other sugars.

Importantly, foods are a complex matrix of nutrients, which interact in a multitude of ways to influence health outcomes. Nutrition is not only about nutrients but also about having a balanced diet. Therefore, when measures are set aimed at fighting NCDs, thoughtful consideration should be given to not impeding the consumption of nutritious and healthy foods.

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# ANNEXURE A:

**Classification of free and added sugars according to the definition of official bodies.**

| | | Polyols | Lactose naturally present in milk and milk products | Fructose in whole fruits | Fructose in fruits juices | Sugars in fruit concentrates | Starch hydrolysates | All others mono- and disaccharides and syrups that are added to foods during processing and preparation[1] | Low caloric sugars [2] |
|---|---|---|---|---|---|---|---|---|---|
| | **Chemical classification** | | | | | | | | |
| FAO/WHO | Sugars | x | x | x | x | x | x | X | X |
| | **Chemical classification** | | | | | | | | |
| Codex | Total sugars Nutrition labelling | | x | x | x | x | x | x | X |
| WHO/SACN | Free sugars | | | | x | x | (x)[3] | x | (x)[3] |
| IOM | Added sugars | | | | | | | x | X |
| EFSA[4] | Added sugars | | | | | | x | x | X |
| FDA/DGAC | Added sugars | | | | | x | (x)[3] | x | x |
| Codex[5] | "Non-addition of sugars" | | | | x | x | x | x | (x)[3] |

1 These usually include (non-exhaustive list): white sugar, brown sugar, raw sugar, corn syrup solids, high-fructose corn syrup, malt syrup, maple syrup, pancake syrup, fructose sweetener, liquid fructose, honey, anhydrous dextrose, crystal dextrose.

2 Examples of low caloric sugars:allulose, tagatose, xylose, arabinose.

3 (X) No status is provided in the definition.

4 EFSA definition from 2010 - "The term "added sugars" refers to sucrose, fructose, glucose, starch hydrolysates (glucose syrup, high-fructose syrup) and other isolated sugar preparations used as such or added during food preparation and manufacturing".

5 None of these sugars should be present in the food products to bear the "Non-addition of sugars" claim.
From Codex: Guidelines For Use of Nutrition and Health Claims. CAC/GL 23-1997.
These guidelines state that claims regarding the non-addition of sugars to a food may be made provided the following conditions are met:
(a) No sugars of any type have been added to the food (Examples: sucrose, glucose, honey, molasses, corn syrup, etc.);
(b) The food contains no ingredients that contain sugars as an ingredient (Examples: jams, jellies, sweetened chocolate, sweetened fruit pieces, etc.);
(c) The food contains no ingredients containing sugars that substitute for added sugars (Examples: non reconstituted concentrated fruit juice, dried fruit paste, etc.); and
(d) The sugars content of the food itself has not been increased above the amount contributed by the ingredients by some other means (Example: the use of enzymes to hydrolyse starches to release sugars).
Available at http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXG%2B23-1997%252FCXG_023e.pdf.

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