

STATUS AND PROSPECTS FOR THE DEVELOPMENT OF THE A2 MILK MARKET WORLDWIDE AND IN POLAND

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Abstract

In recent years, the number of people suffering from various types of food allergies, intolerances or diet-related diseases has been increasing, and unfortunately some of these problems are associated with milk consumption. The main causes of digestive discomfort are lactose intolerance and allergies to cow's milk proteins. In the 1990s, studies began to investigate the relationship between the type of milk – A1 or A2 – and certain chronic diseases. It was found that digestion of β -casein from A1 milk produces a polypeptide called β -casomorphin-7, which may contribute to the development or aggravation of symptoms of certain diseases in humans. BCM-7 has been associated with delayed gastrointestinal transit of milk, which may cause intestinal discomfort or inflammation. It has also been suggested that this peptide may exacerbate symptoms of autoimmune diseases and autism. Milk market forecasts indicate increasing global demand for milk and dairy products. However, adverse effects associated with conventional milk consumption may cause people with gastrointestinal disorders to stop drinking milk altogether or to seek alternatives such as plant-based beverages or milk from other animal species (e.g. goat milk). This may provide an opportunity to increase demand for A2 milk and A2 dairy products. Therefore, there is a need to investigate and promote milk from cows with the favorable β -casein type and products made from such milk. The aim of this article is to present the global A2 milk market, the mechanisms governing it, projected trends, and issues related to global production, including the efficiency and distribution of A2 milk.

Keywords: A2 milk, milk market, global trends

Introduction

Dairy products such as milk and yogurt are among the most commonly consumed foods worldwide. Milk is a healthy and nutritious component of the diet; however, the number of people who cannot consume dairy products because of health problems and food intolerances is increasing. It is estimated that discomfort resulting from lactose malabsorption may affect as much as 65% of the adult population worldwide (Semwal et al., 2022). This represents a very large group of consumers and has a major impact on demand for dairy products.

Milk contains two main types of protein: caseins and whey proteins. Casein accounts for approximately 80% of the protein in cow's milk. There are several casein subtypes, one of which is β -casein, accounting for about 30% of the protein in cow's milk. Medical studies on the

mechanisms and relationships between certain peptides formed during digestion and their effects on human health began as early as the 1980s. These studies included milk caseins. In the 1990s, research focused on the relationship between the type of milk – A1 or A2 – and certain chronic diseases. It was then found that digestion of β -casein from A1 milk produces a polypeptide called β -casomorphin-7. This results from differences in the amino acid composition of β -casein, which consists of 209 amino acids. In A1 milk, histidine occurs at position 67, resulting in the formation of the opioid β -casomorphin-7 during digestion. In milk classified as A2, proline occurs at position 67, and therefore the above-mentioned opioid is not formed. This milk is referred to as original A2 milk (Şahin et al., 2018). The β -casein variant present in cow's milk is genetically determined; therefore, genetic testing of cattle is used to identify it.

Effects of A1 and A2 milk on human health

Opioid peptides participate in various biological processes, including respiration, have analgesic effects, and also influence cognitive mechanisms in humans (Ng-Kwai-Hang and Grosclaude, 2003). β -Casomorphin-7 (BCM-7), a peptide with strong opioid activity, is considered capable of contributing to the development or aggravation of symptoms of certain diseases in humans. BCM-7 has been linked to delayed gastrointestinal transit of milk, which may cause intestinal discomfort or inflammation. It has also been suggested that this peptide may exacerbate symptoms of autoimmune diseases and autism.

Studies have shown that A1-type β -casomorphin-7 (BCM-7) may, among other effects, contribute to:

- delayed transit of milk through the gastrointestinal tract, which may lead to inflammation and gastrointestinal discomfort (Jianqin et al., 2016; Thiruvengadam et al., 2021; Semwal et al., 2022). By delaying gastrointestinal transit, BCM-7 promotes fermentation of lactose and many other oligosaccharides, which may result in irritation or inflammation of the large intestine (Pal et al., 2015);
- aggravation of symptoms associated with lactose intolerance (Jianqin et al., 2016). BCM-7 released from A1 β -casein in the jejunum may cause inflammation and gastrointestinal discomfort. It has been suggested that, in some cases, dairy intolerance perceived by many people as lactose or milk intolerance may actually result from consumption of A1 milk (Jianqin et al., 2016; Thiruvengadam et al., 2021);
- changes in immune responses and the induction of allergic reactions in children and adults. The presence of BCM-7 has been shown to alter immune responses, which may trigger allergic reactions (Thiruvengadam et al., 2021). In addition, through μ -opioid receptors, BCM-7 may influence nervous, digestive and immune functions (Fiedorowicz et al., 2014). Research in this area has been conducted mainly in animal models. Consumption of A1 β -casein has been reported to increase the inflammatory response, intestinal permeability and intestinal interleukin-4 levels through activation of the Th2 pathway (Haq et al., 2014);
- an increased risk of ischemic heart disease and a higher risk of mortality from cardiovascular events (Tailford et al., 2003). It has been suggested that consumption of milk containing A1 β -casein may contribute to an increased risk of ischemic heart disease and potentially lead to substantially higher mortality from adverse cardiovascular events. These conclusions were based on observations of dietary preferences in populations from different countries. Populations consuming A2 milk were reported to have a lower incidence of cardiovascular disease than Europeans (Semwal et al., 2022). However, it is very difficult to determine unequivocally the causes of cardiovascular disorders because many factors contribute to the development of these diseases;
- an immunosuppressive effect on the intestinal immune system (Haq et al., 2014);

- sudden infant death syndrome (Ganguly et al., 2013). BCM-7 molecules act as ligands for opioid receptors in the brain and may affect the respiratory system and lower blood pressure, potentially contributing to sudden infant death (Sun et al., 2003);
- aggravation of neurological symptoms such as autism and schizophrenia (Severance et al., 2010; 2012; Jarmołowska et al., 2019). The precise mechanism of this effect has not yet been fully elucidated. It has been suggested that BCM-7 from A1 milk, by causing an inflammatory reaction in the gastrointestinal tract of children, increases intestinal permeability, is absorbed and enters the bloodstream directly. This may be particularly relevant in infants and children, whose intestinal mucosa is still immature. The available studies cited by the authors indicate a positive effect of A2 milk consumption on reducing symptoms in people with autism. A direct correlation has been reported between autism and BCM-7 levels in both blood and urine in children (Sokolov et al., 2014). In the urine of autistic children consuming A1 milk, the concentration of β -casomorphin-7 was reported to be ten times higher than in children consuming A2 milk, suggesting potential benefits of A2 milk consumption for this group (Crawford et al., 2002);
- delayed transmission of stimuli and reduced speed and accuracy of information processing in the brain (Jianqin et al., 2016). Studies reported improved cognitive function in people consuming the A2 milk variant (Sheng et al., 2019), whereas consumption of A1 milk (Clarke and Yelland, 2017) or mixed A1/A2 milk (Semwal et al., 2022) was associated with poorer speed and accuracy of cognitive processing;
- impaired tolerance to food antigens and, consequently, a possible contribution to the development of type 1 diabetes (Chia et al., 2017). Despite varying results regarding the effects of BCM-7 on the human body, there is agreement concerning the beneficial effect of A2 milk in reducing symptoms of digestive intolerance that occur after consumption of A1 milk.

The A2 milk market worldwide

Milk market forecasts indicate an increase in global demand for milk and dairy products. However, compared with the 1970s, milk consumption has declined substantially, particularly in European Union countries and the United States (Nystrom and Winston, 2016; Bentivoglio et al., 2020). Therefore, new products are being introduced to increase the profitability of the dairy industry. One of these is A2 milk and products made from it (cheese, yogurt, cream). This type of milk was first introduced to the New Zealand market in 2003 and has since gained an increasing presence in other countries. The health benefits attributed to A2 milk have encouraged many farmers around the world to select and breed cows for A2 milk production (Mayer et al., 2021). In response to farmers' expectations, semen marketing companies have introduced the A2/A2 genotype into their bull catalogues as a value-added trait (Urrutia et al., 2019).

A2 milk production requires several conditions to be met. First, the β -casein variant present in the milk of individual cows must be identified. This trait is genetically determined, stable and can be identified by genetic testing of cattle. Unfortunately, not all farmers genotype their animals, although such tests are becoming increasingly available and relatively inexpensive.

Another barrier to A2 milk production is the need to separate A2 milk from milk produced by A1 cows. The cows must be milked separately, the milk must be stored in separate tanks and transported separately, and packaging or processing must be carried out without any risk of contamination with A1 protein.

For compliance with these requirements to be economically viable, A2 milk must be purchased at a higher price and there must be a sufficiently large market for A2 milk and its products. The A2 Milk Company, the largest company in the A2 milk market, states that it pays

its suppliers (farmers) in New Zealand, Australia and the United Kingdom approximately 5–7% more than for conventional milk (The a2 Milk™ <https://a2milk.nz/about-us/>).

Economic indicators of the global A2 milk market

Adverse effects of conventional milk consumption in people with health problems, especially gastrointestinal disorders, may contribute to increased demand for A2 milk as a possible alternative for these consumers. A growing number of consumers make conscious product choices, which may increase demand for A2 milk and A2 dairy products. According to a Precedence Research report, the global A2 milk market was estimated at USD 9.38 billion in 2021 and is projected to exceed USD 31.51 billion by 2030, corresponding to a CAGR of 18.6% during the 2022–2030 forecast period (<https://www.precedenceresearch.com/a2-milk-market>). According to Acumen Research and Consulting, the global A2 milk market was valued at USD 9,056 million in 2021 and is projected to reach USD 38,192 million by 2030, with a CAGR of 17.5% from 2022 to 2030 (<https://www.acumenresearchandconsulting.com/a2-milk-market>).



Source: <https://www.acumenresearchandconsulting.com/a2-milk-market>

Fig. 1. Global A2 milk market

Other reports on the A2 milk market also forecast an upward trend in global markets. Market Research Future forecasts growth of 17.75% in 2022–2030 (<https://www.marketresearchfuture.com/reports/a2-milk-market-6495>); Custom Market Insights (CMI) predicts that the global A2 milk market will grow at an annual rate of 12.2% in the coming years ([custommarketinsights.com](https://www.custommarketinsights.com)), while Fortune Business Insights forecasts growth of 11% (<https://www.fortunebusinessinsights.com/a2-milk-market-103212>).

Depending on the methodology used, the values reported differ slightly among market reports; however, all forecasts predict double-digit percentage growth in revenues generated by this sector. In addition, some reports, such as Future Market Insights, also forecast growth of 6.7% in the market for milk proteins derived from A2 milk and 7.9% for protein hydrolysates (<https://www.futuremarketinsights.com/reports/a2-milk-market>).

In the coming years, the Asia-Pacific region is expected to account for the largest share of the A2 milk market because of high milk production and demand and the increasing number of cows with the A2A2 genotype. With a share of approximately 50%, this region has dominated

the market and is expected to continue growing, with a compound annual growth rate of 19%. Europe ranks second in market share, mainly because of its modern dairy infrastructure. Rapid growth is also expected in North America owing to higher expenditure on premium food products, high awareness of the relationship between food and health, and a growing prevalence of lactose intolerance (<https://www.precedenceresearch.com/a2-milk-market>).

The key factors driving growth of the A2 milk market include:

- Growing consumer preference for A2 milk.
- Increasing use of A2 milk in infant formula.
- Rapid dissemination of knowledge related to health and well-being.
- Growth in disposable income and consumer spending in developing regions.
- Growing preference for sustainable and organic products.
- Launch of new products by multinational companies (<https://www.precedenceresearch.com/a2-milk-market>).

A2 milk distribution channels

Companies increase profitability by using multiple distribution channels, including grocery stores, supermarkets and hypermarkets, as well as online sales. In 2021, supermarkets and hypermarkets were the largest distribution channels for A2 milk. They captured the largest market share because of their continuously increasing number, the availability of a wide range of products, and controlled storage conditions at specified temperatures. Supermarkets and hypermarkets also use blockchain technology to track product information, including origin, production location and mode of transport. A growing number of consumers seek information on product origin and supply chains; through blockchain technology, customers can access label data on their mobile phones, allowing detailed tracking of information intended to ensure food quality. Hypermarkets and supermarkets also allow customers to purchase basic necessities at lower prices, which is expected to contribute significantly to the development of this segment in the coming years (<https://www.polarismarketresearch.com/industry-analysis/a2-milk-market>). Forecasts indicate that online distribution of A2 milk will be the fastest-growing segment over the next few years. Online shopping platforms and mobile applications are becoming increasingly popular because of convenience and safety. Digital platforms also offer lower product prices than other distribution channels.



Source: <https://www.acumenresearchandconsulting.com/a2-milk-market>

Fig. 2. A2 milk distribution channels

Fresh milk sales accounted for the largest share of A2 milk market revenue in 2021. Consumers generally prefer fresh milk because it contains nutrients such as calcium, vitamins and proteins and contains more phosphorus and selenium than powdered milk. Liquid milk is also more convenient and easier for consumers to use. For convenience, A2 milk is sold mainly in cartons worldwide and, according to forecasts for 2022–2030, this sales segment will continue to grow. This is due to the lower cost of this type of packaging, ease of transport, the

possibility of longer storage, and consumer convenience. Strong growth of the food and beverage industry in developing countries such as India and China is expected to create substantial opportunities for market expansion.

Development of the A2 milk market may be accelerated by the agreement concluded in 2018 between two companies: The a2 Milk Company (a2MC), a global leader in the A2 milk market, and Fonterra Cooperative Group Limited. Under the partnership, the pool of A2 milk will be increased by milk sourced from farmers in New Zealand. In addition, in May 2022, The a2 Milk Company and Lincoln University began cooperation to introduce a new programme promoting sustainable dairy cattle farming in New Zealand. A “Farm Sustainability Fund” was established for farms practising sustainable cattle production and having a positive and significant impact on society and the environment. These farms also supply milk to companies purchasing milk for products made on behalf of The a2 Milk Company. This initiative is expected to contribute to an increase in the supply of both A2 milk itself and products made from it (The a2 Milk™ <https://a2milk.nz/about-us/>). Companies operating in this market allocate substantial funds to research, which enables expansion of product ranges and product lines and further develops the A2 milk market. Various strategic initiatives are also undertaken to increase global reach, including mergers, agreements, acquisitions, investments and cooperation with organizations. One of the main business strategies is local production, which significantly reduces costs while expanding the A2 milk market sector.

The A2 milk market in Poland

The introduction of A2 milk to the Polish market has substantial potential and may provide an opportunity for Polish dairy farmers and milk processors. In the US market, milk and products made from A2 milk achieve prices almost three times higher than conventional products, which may offer an opportunity to improve the profitability of dairy production in Poland and increase export opportunities (Farmer, 2023).

An opinion survey commissioned by the Polish Federation of Cattle Breeders and Dairy Farmers showed that nearly 60% of respondents declared willingness to purchase dairy products that do not cause stomach or digestive discomfort. More than 52% of respondents without food intolerance problems stated that, if given the opportunity, they would choose milk and milk products with reduced allergenicity. Importantly, one in three respondents declared willingness to pay more for such products (Farmer, 2023). Similar trends were reported by Bentivoglio et al. (2020), who found that Italian consumers were willing to pay approximately EUR 0.20 more per litre of A2 milk than for fresh lactose-free milk. By contrast, Mendes et al. (2019) found that only 38% of Brazilian consumers would pay a higher price for A2 milk.

Summary

In the near future, the main factors determining the development of the A2 milk market are expected to include increasing demand for alternatives to conventional cow's milk, consumer preferences for organic and sustainable products, and growing demand for A2 milk in infant formula. Increasing consumer awareness of health and the health-promoting properties of food, together with willingness to spend more on such food, may stimulate development of the A2 market. Dairy companies are responding to these requirements by introducing an increasingly broad range of dairy products. Foods with confirmed health-promoting properties are priced higher than mass-market foods, creating profitability potential for the global A2 milk market. However, introducing A2 milk to the market requires farmers and entrepreneurs who can supply

the raw material; for them, in addition to the health-related attributes of A2 milk, the profitability and efficiency of specialized production and forecasts of demand for the raw material are important.

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SUMMARY

In recent years, the number of people suffering from various types of food allergies, intolerances or diet-related diseases has been growing, unfortunately, some of them are related to milk consumption. The main cause of digestive discomfort is lactose intolerance or allergies to cow's milk proteins. In the 1990s, research began on the relationship between the type of milk (A1 or

A2) and certain chronic diseases. At that time, it was found that during the digestion of β -casein from A1 milk, a polypeptide called β -casomorphin-7 was produced, which may contribute to the development or aggravation of symptoms of certain diseases in humans. BCM-7 has been linked to delayed milk digestive transit time, which can cause intestinal discomfort or inflammation. In addition, it is speculated that this peptide may also exacerbate symptoms of autoimmune diseases and autism. Milk market forecasts indicate an increase in global demand for milk and dairy products. However, the negative side effects of consuming conventional milk may cause people struggling with gastrointestinal disorders to abandon milk consumption altogether or seek alternatives in the form of plant-based beverages or milk from other animal species (such as goat milk). This could be an opportunity to increase demand for A2 milk and dairy products. Therefore, there is a need to research and promote milk from cows with the favorable β -casein type and products based on this milk. The purpose of this article is to present the global A2 milk market, the mechanisms that regulate it, the projected trends, and to introduce the issues related to global production, including its efficiency and distribution of A2 milk.

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