



Genetics for Life®

# A2 Milk Popularity on the Rise

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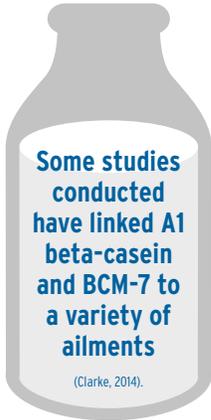
A hot topic in the dairy industry today is the growing popularity of A2 beta-casein milk among consumers and dairy farmers. Farmers in many regions of the world are being incentivised to produce A2 milk to meet the growing demand in what is considered to be a healthier alternative to conventional dairy (Zoetis, 2015). However the science behind this trend remains controversial and is not well understood by many consumers and producers. The goal of this article is to present an assessment of the facts as they are currently known and explain Semex's A2 brand.

Milk is composed of several solid components including minerals, lactose, fat and protein. There are three notable casein milk proteins: alpha, kappa, and beta-casein - the protein of interest to us in this article (Zoetis, 2015). There are several variants of the beta-casein protein with the most common ones being the recognizable A1 and A2 variants, as well as a B variant and some other rare variants (Pal, 2015). Research suggests that all cattle carried the A2 variant historically, but the A1 variant arose due to a mutation in European herds a few thousand years ago. The A1 variant is most commonly found in breeds with European ancestry, however, it has been introduced in some non-European cattle populations through crossbreeding (Pal, 2015). In the Holstein population the A1 and A2 variants are estimated to appear in approximately equal amounts. In Jersey, the A2 allele is slightly more prevalent (Woodford, 2007).

Beta-casein protein production is controlled by the combination of any two of these variants (ie. A1A2) as all cows carry two alleles. These alleles are co-dominant, meaning that cows that carry two different variants (heterozygous) will produce equal amounts of each protein that they carry, while cows that carry two copies of the same allele (homozygous) will produce only that protein (Woodford, 2007). This makes achieving a homozygous A2 herd exclusively through genetic selection a possibility for dairy producers. While a quick conversion to A2 would be possible via genetic testing and selective culling of A1 carriers, a more sound approach could be a step-wise approach of genetic selection for A2A2 sires in advance of conversion to mitigate the need for A1 culling.

## WHAT'S BEHIND THE GROWTH OF A2?

In preliminary research A1 and A2 milk proteins have been shown to behave differently during the digestive process due to an amino acid variation. The A1 beta-casein amino acid chain is susceptible to breakdown during normal enzymatic digestion, the peptide it breaks down to is a bioactive opioid; beta-casomorphin-7 (BCM-7). A2 beta-casein's amino acid



Some studies conducted have linked A1 beta-casein and BCM-7 to a variety of ailments

(Clarke, 2014).





chain is not as likely to experience this breakdown into BCM-7 (Clarke, 2014).

Some studies conducted have linked A1 beta-casein and BCM-7 to a variety of ailments, notably; dairy intolerance and digestive difficulties, heart disease, type-1 diabetes, as well as autism and schizophrenia (Clarke, 2014). The research however has not concluded that the population at large is at risk of experiencing these illnesses from A1 beta-casein consumption but that certain people with underlying health issues may experience an antagonistic effect from consuming A1 milk (Clarke, 2014).

Much of this research is considered to be preliminary, and has been cast into doubt by critics within the scientific community. Some of those have cited small sample sizes, unreliable methodologies, use of non-human test subjects, and the involvement of the A2 Corporation in the research as reasons to dispute or doubt these studies. Though some of detractors have noted there isn't likely to be any negative factors associated with A2 beta-casein, they also point out that if these studies were valid the implications would have far more reaching impact on the health and dairy industry (Truswell, 2005). The research and analysis on this subject is quite active and will likely continue for many years.

## WHAT IS SEMEX'S A2A2 BRAND?

Semex has noted the continuous growth in customer demand for homozygous A2 bulls, and in response we have developed our A2A2 brand to help breeders easily identify the bulls and traits they want to incorporate in their breeding programs. Semex's A2A2 lineup are bulls genetically tested as homozygous A2A2 carriers, so they will be guaranteed to pass on an A2 allele to their progeny. These bulls cover a wide range of our lineup including many Immunity+™ sires and top Genomax™ and proven bulls.

As part of the Semex A2A2 strategy, it has established an A2A2 logo that appears in sire inquiries at [www.semex.com](http://www.semex.com), on sire proof sheets and in the SemexWorks™ sire selection program offered globally. An A2A2 infographic accompanies this article that helps as a quick and easy reference to explain A2A2 for our global clients. For more information see the references listed below.



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### Further Reading and Sources:

Truswell, A.S. "The A2 milk case: a critical review." *European Journal of Clinical Nutrition* 59 (2005): 623-631. Web Document.

Pal, Sebely, et al. "Milk Intolerance, Beta-Casein and Lactose." *Nutrients* 7(9) (2015): 7285-7297. Web Document.

Clarke, Andrew, Malav Trivedi. "Bovine Beta Casein Variants: Implications to Human Nutrition and Health." *International Conference on Food Security and Nutrition*. Singapore. 2014.

Woodford, Keith. "A2 Milk, Farmer Decisions, and Risk Management." 16th International Farm Management Association. University College, Cork, Ireland. 2007.

Zoetis Genetics. "Identifying Milk Proteins in one Step with Clarifide." *ZoetisUS.com*. 2013. Web Jan. 2016.

The A2 Milk Company. "Beta-casein Variants and Digestive Wellbeing." *A2milk.com.au*. Web Jan. 2016.

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# A2A2

## HOMOZYGOUS A2A2 CARRIER SIRES



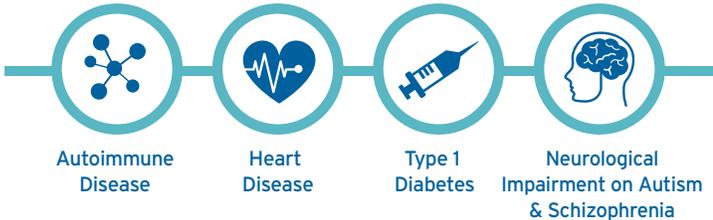
# A2A2

*A2A2 sires increase the prevalence of A2 milk on my dairy.*



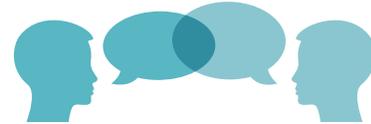
## BETA-CASEIN GENE INFLUENCES PRODUCTION OF MILK PROTEIN CASEIN WHICH HAS A1 & A2 VARIANTS

A2 MILK IS POTENTIALLY LINKED TO HEALTH BENEFITS ASSOCIATED WITH:

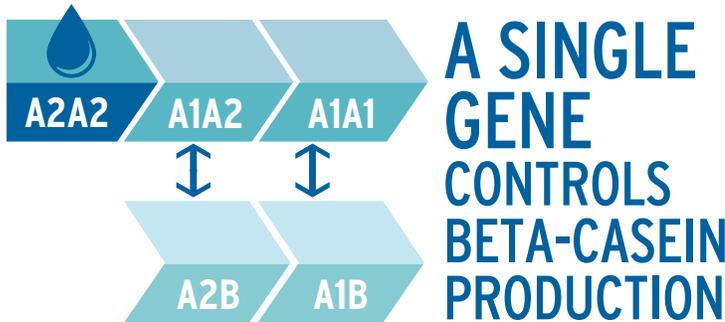


Laugesen and Elliott 2003, McLachlan 2001, Woodford 2006.

## HEALTH BENEFITS ARE STILL BEING DEBATED IN THE RESEARCH COMMUNITY



## A2 MILK IS SELLING AT A PREMIUM



\* B is a variant within the gene that can be inherited along with A1. For simplicity sake, it can be considered the same as A1.

S. Kaminski 2007 Journal of Applied Genetics.

A2 variant is becoming more common in Holstein sires.

# 40 SEMEX A2A2 SIRES > 2500 GTPI

December 2015

		A2A2 SIRE	
DAM	A2A2	100% A2A2	Produce 100% of A2 milk
	A1A2	50% A2A2	
	A1A2	50% A1A2	Produce 50% A1 milk & 50% A2 milk
	A1A1	100% A1A2	

Holstein Canada, 2015

Herds can convert to 100% A2 milk within 4 years using intensive selection.



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