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A1/A2 Milk: The health battle, hypothesis or reality

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Abstract

Milk is complete food. It is rich source of protein, energy, and micronutrients. The beta (β) casein is second most abundant protein in the milk. A1 and A2 are most common variants among the 13 known β casein variants. In the present article health risk related to A1-A2 milk is discussed.

Keywords: Milk, β casein, A1- A2 milk, health

Introduction

Milk and milk products form a significant source of protein, energy and micronutrients like calcium to most populations, in human diet worldwide. Bovine milk protein comprised of 20% whey and casein contributes more than 80% of the total protein content. Among caseins, beta (β) casein makes second most abundant protein (30%) which accounts one third of total milk protein content (Boro P *et al.*, 2016, Bell S *et al.*, 2006, Sodhi M *et al.*, 2012)^[3, 2, 14]. The protein type and proportion vary with species and breed, and with countries (Chitra P, 2021)^[4].

In addition to its nutrient supplementation, milk has positive correlation with health conditions when included in diet. Most people prefer milk as a prime source of calcium to combat with osteoporosis, colon cancer; to promote weight loss (Zemel M *et al.*, 2004)^[18]. Research showed that A1 milk leads to the production of inflammatory compounds in human digestive system that can induce variety of symptoms from mild stomach pain to much worse.

Instead, health advantages of milk consumption over the time, now it has been going through the scrutiny for the progressive relationship with some diseases, chronic conditions and health hazards proposed. In addition, dairy products, along with gluten, appear to be responsible to worsen neurological conditions like autism and schizophrenia. Studies also suggested the other genetic variant A2 could be safe with none of above effects, good for lactose intolerant and better for overall health. We have been gone through the several milk raps in past of sugar content and fat content; antibiotic residues; the alternatives like soy milk and almond milk; now what if we have a question regarding the health safety and milk? (Bell S *et al.*, 2007)^[2].

The bond of A1/A2 milk and health risk, and our indigenous cattle breeds, is the nucleus of this article.

Bovine β Casein variants and Human Health

A1 and A2 variants are the most common among 13 known β Casein variants of cow's milk (Giglioti R *et al.*, 2020)^[5]. Recently, researchers have shown a keen interest in A1/A2 variants due to the hypothesis that high A1 β Casein consumption is positively associated with a range of human diseases. Both variants differ at 67th amino acid position with histidine in A1 and proline in A2. This polymorphism derives a key conformation change in β -casein protein's secondary structure. A1 variant produces a bioactive peptide 'opiod' beta casomorphin 7 (BCM-7) during the gastrointestinal digestion of milk, this BCM-7 has been suggested to be linked with human health hazards as it can potentially affect many opiod receptors in nervous, immune and endocrine system (Sodhi M *et al.*, 2012)^[14]. BCM-7 is also a known oxidant of low dietary lipoproteins (LDL) which is believed to be important in formation of arterial plaque. In A1 variant, histidine has weak bond with BCM-7 and thus releases it into milk, whereas, proline in A2 has a strong bond to BCM-7 to keep it out of the milk (Bell S *et al.*, 2006, Truswell A, 2005)^[2, 17].

BCM-7 was reported to be absorbed through newborn's and young infant's gastrointestinal tract, whereas, adults fail to indicate circulating BCMs. Newborn infant's gastrointestinal tract have greater permeability enabling the target candidates for the BCM's opiod effects (Sun Z *et al.*, 2003, Svedberg J *et al.*, 1985)^[15, 16].

When BCMs get absorbed through gastrointestinal tract, they must then get localized in the nervous tissue to affect endocrine and respiratory system.

Evidence of strong relation between A1 milk and health issues are expanding with the explanation of positive correlation with the conditions like type-1 diabetes (Merriman T *et al.*, 2008) [10], cardiovascular diseases (IHD) (Laugesen M and Elliott R., 2003; Truswell A., 2005) [9, 17], delayed psychomotor development among children, autism, schizophrenia, sudden infant death syndrome (SIDS), auto immune diseases, intolerances and allergies (Şahin *et al.*, 2018) [13]. People with digestive disorders like celiac disease, ulcerative colitis, stomach ulcers, on long term antibiotic treatment are observed to be at higher risk than others (Sodhi M *et al.*, 2012, Jianqin S *et al.*, 2016) [14, 6]. Ischaemic/coronary heart disease (IHD) is one of the major cardiovascular diseases, and A1/A2 hypothesis claims, a high intake of A1 beta-casein is a risk factor for IHD (Kaminski S *et al.*, 2007) [7].

A2 milk solely contains A2 beta casein whereas A1 milk has either only A1 or both A1A2 type variant. Source for A1 variant is milk from crossbred and European cattle breeds, whereas A2 has its origin in indigenous cows and buffaloes of India (Asia as a whole). A2 is a milk brand of A2 Milk Company (A2 Corporation) and has its majority market in Australia, New Zealand, United Kingdom and other developed countries (Kaskous S., 2020) [8].

World scenario

Milk, all-over and everywhere was A2 type, a genetic mutation thousand years ago in some European cattle gave birth to A1 variant; and subsequent crossbreeding with Asian and African cattle in last few thousand years, might have led A1 genes in cross bred species. A1 variant is common in cattle of the western world, predominant in the North European region (Friesian, Holstein, Ayrshire and British Shorthorn).

A2 gene, on the other hand, is found only in a few old species of cows, which haven't been genetically altered - Channel Island cows, Guernsey and Jersey, Southern French breeds, Charolais and Limousin, Zebu original cattle of Africa and the Gir cow from India. Most dominant cows of today possess A1 genes, while the low yielding Indian Gir cow, on the verge of extinction, possesses the A2 genes. Human milk, goat milk, sheep milk and other species are 'A2- like'. The only way out for an individual is to look out for organic milk preferably from traditional Indian (Desi) cows.

Indian scenario

India is the world's largest milk producer. Now, we stand in first row to produce and export more milk than the entire combined EU. This was achieved by an integrated cooperative milk collection system; the white revolution in 1970s and crossbreeding of indigenous cows with that of European. The 1970's was a beginning that we go on choosing quantity over quality; this was also a beginning of extinction of the indigenous breeds. Venchur, one of the healthiest desi cows from Kerala is near to extinction. Now, more people are tracing back for milk procured from native breeds like Gir from Gujarat, Sahiwal from Punjab, and Tharparkar from Rajasthan.

Cow milk is described as 'Amrit', The Nectar, in our scriptures. In Indian Vedas, it is referred to improve Ojas, the factor improving body's immunity. A2 cow milk nourishes

body tissues, rejuvenates life expectancy with improved strength and intelligence; it acts as natural aphrodisiac, promote digestion and increases breast milk production in feeding mothers; with assistance in easy intestinal movements, it relieves tiredness, dizziness, excessive thirst and hunger (Reddy P *et al.*, 2016) [12].

Recent demonstrations of the National Bureau of Animal Genetics Research explained the qualitative superiority of milk from cattle breeds; with the scanning of 22 cattle breeds researchers concluded the 100% status of A2 gene in 5 high yielder native cattle breeds *i.e.* Red Sindhi, Sahiwal, Tharparkar, Rathi and Gir. Whereas exotic breeds was 60% and other Indian breeds was 94%. The pure Indian cow produces A2 milk with less Betacosmophorine-7 (BCM-7), unlikely to the hybrid cows which generally produce A1 milk (Bell S *et al.*, 2007) [2].

A study on 15 different Indian cattle breeds screened, only A2A2 and A1A2 genotypes were found and there was absence of A1A1 genotype. Interestingly and fortunately, the India native breeds including Gir, Tharparkar, Rathi, Red Sindhi, Sahiwal and dual purpose breeds *viz.* Kankrej, Harijana had only A2 variant (Mishra B *et al.*, 2009) [11].

Conclusion

Bovine milk and products have long been a main staple of the Indian diet. A little of analysis and manipulation with pedigree selection, as proved by Brazil and Argentina like countries, our indigenous cows can attain equal milk production as the best Indian bulls can be found and maintained there. Since major portion of total Indian milk production comprised of crossbred milk, AI bull screening is the immediate task to carry out amongst crossbred and exotic cattle populations, to draw an effective breeding policy which aims at minimizing the risk of A1 milk (Mishra B *et al.*, 2009) [11].

India, the country with predominance of vegetarians, milk is crucial source of nutrition. The hybrid cows produce mostly A1 protein milk which is known to cause digestive problems for some people. Our native Indian breeds are source of A2 protein milk which is easier to digest. A2 protein, share structural similarity to human milk, is the best alternative to mother's milk. Also, A2 milk contains more Omega-3 fatty acids which are good for our health. Regular milk exposes us to the risk of type-1 diabetes and coronary heart diseases. It causes gut inflammation and irritable bowel syndrome (Bell S *et al.*, 2007) [2]. Therefore, A2 benefits over A1 milk in all aspects. Although all evidence are not strong enough till date, drawn from ecological data, and should definitely be verified.

Now and obviously in near future we have a great scope for our indigenous pure breeds, thus pedigree selection and sustenance are key needs. A self-sustainable system of biogas-coupled organic farming needs to be in place for Indian dairies to solve the economic problems with livestock raising in India. Some initial studies have revealed that A1 allele is frequent in exotic cattle (taurine type) while Indian indigenous cow (Zebu type) has only A2 allele, and hence are safe milk source (Sodhi M *et al.*, 2012) [14].

Regardless of the conclusions drawn from numerous studies deserve further investigation. And if, the future data proves A2 milk role to reduce all possible health hazards, an arrangement to the milk supply chain can be made likewise. The same advantage has now been taken over by the A2 Milk Corporation Limited (A2C), to supply a2™ brand milk. A2 Corporation Limited (A2C) owns and commercializes unique

intellectual property rights (patents, trademarks, proprietary processes) relating to a2™ brand milk and related dairy products in international markets, particularly given the successful commercialization in Australia and the expansion into the UK. a2™ brand fresh milk is the fastest growing milk brand in Australia and has achieved more than 4.7% value share of market (Babidge G, CEO, A2 corporation presentation, April 2012)^[1].

The A1/A2 puzzle is actually engrossing and potentially significant for public health if in the right path. We are here in this battle, when we came to know the facts, know-how and health issues regarding A1/A2 milk consumption; just imagine what will be the picture when we unravel all milk factors, one after the other? Obviously, there is a great scope and call for deeper research and studies to overcome the doubts and prove the facts to make the consumers wise enough to choose the safe and healthy one. This will seriously require more animal trials, data on related human diet and health.

For now, the mixed attitude towards A2 genetics calls for a need of more research to focus on the scientific facts. As the A2 milk market has gear-up; consumers have reason to know the answer and hope for the health safeguard. As an awake consumer, we ought to ensure the health and nutrition of the milk we are drinking as a major protein source of our diet. You need to be aware, make right choices to seek the best one.

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