

The Unique Composition of a2[®] Branded Products and Associated Quality Systems

Dandan Chen ¹⁺

¹ A2 Corporation Ltd

Abstract. The digestion of A1 beta-casein can yield 7aa protein fragment or peptide termed beta casomorphin-7, or BCM-7; whereas the digestion of A2 beta-casein does not. BCM-7 is established and widely reported as an exorphin, or food derived fragment with the ability to bind opiate receptors. Therefore dairy products based on the A2 protein, excluding A1, more closely mimic mothers milk in terms of structure and breakdown, avoiding the chance of BCM-7 interrupting the body's natural processes and building towards improved long term health. A unique quality system has been designed to capture the benefit of A2 beta-casein and guarantee the delivery of foods containing only A2 beta-casein.

Keywords: A2 beta-casein, BCM-7, quality system

1. What is Beta Casein?

Casein proteins are the most abundant group of proteins in cow's milk, consists about 80% of total protein in milk. About 30% of the protein in cow's milk is beta casein (Fig.1); it is the second most abundant protein in cow's milk behind alpha casein. It transports essential mineral and nutrients such as calcium and phosphorous [1].

As well as providing nutrition and facilitating the absorption of minerals, it is well established that the digestion of beta casein can yield a host of fragments with biological or physiological potential [2]. Like many things in nature, bovine beta casein may be present as one or many variant owing to natural genetic variation [3].

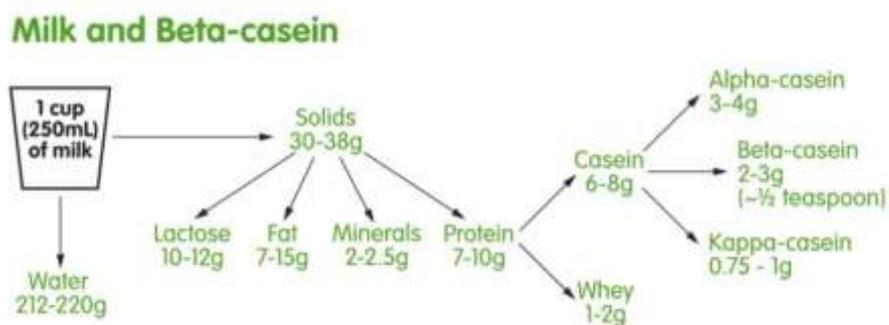


Fig. 1: Milk and Beta-casein

2. What is A2 Beta Casein?

Phylogenetic studies conclude that A2 is the original form of beta casein protein in domesticated cattle (Fig. 2) [4]. A1 beta casein arose in European cattle around 5000 years ago in the European ancestors of Holstein and Frisian animals (Fig. 3). It spread within the migration of man, and through interbreeding to

⁺ Corresponding author. Tel.: +61499077228.
E-mail address: dchen@a2corporation.com.

obtain higher volumes of milk associated with the black and white breeds. It is to note that other traditional breeds, such as Indian and African cattle breeds, now very minor in terms of global milk production, are producing only the A2 form of beta casein.

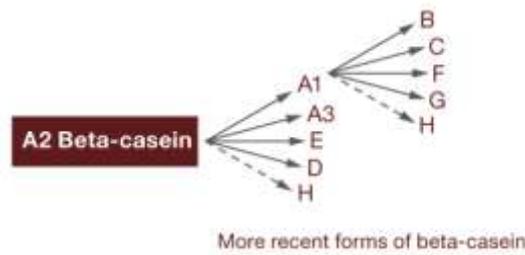


Fig. 2: Adapted from: Milk Protein Polymorphism: Detection and Diffusion of the Genetic Variants in Bos Genus, Annali della Facoltà di Medicina Veterinaria, Vol. XIX, 1999. Università degli Studi di Parma

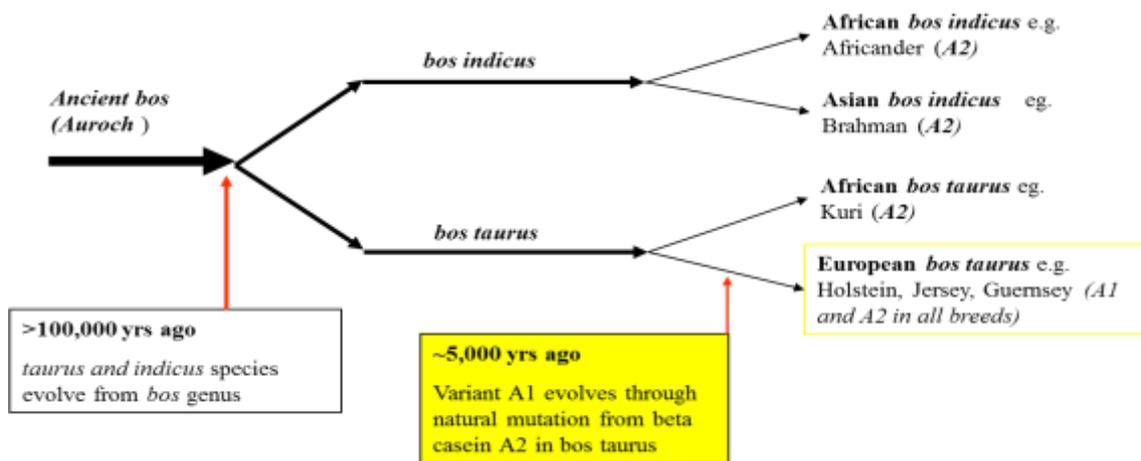


Fig. 3: Evolution of Cattle in beta casein selection[5][6]

The difference between A2 and the newer A1 variant is only a single amino acid in a chain of 209. This substitution of a proline with a histidine impacts the secondary structure of the protein. And this in turn affects how the proteins are digested. The digestion of A1 can yield 7aa protein fragment or peptide termed beta casomorphin-7, or BCM-7; whereas the digestion of A2 does not (Fig. 4) [7]. The adsorption and ability to break down BCM-7 varies significantly between individuals [8]. However, BCM-7 is established and widely reported as an exorphin, or food derived fragment with the ability to bind opiate receptors [9].

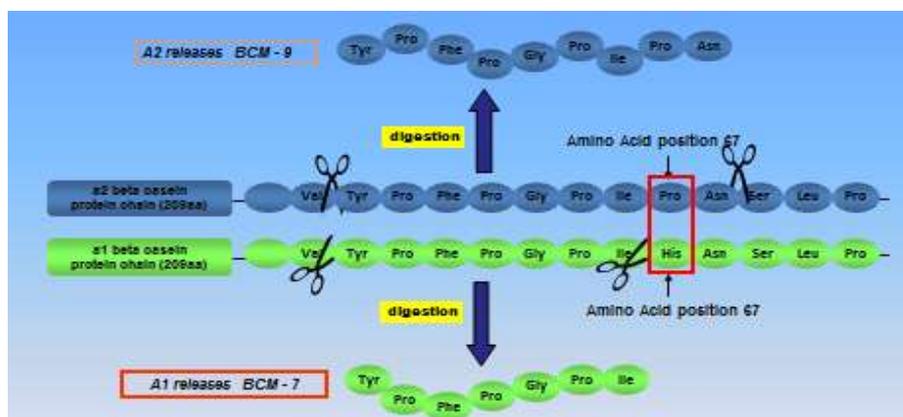


Fig. 4: Digestion of A1 and A2 beta casein.

It is of note that human, goat, sheep and every other characterized mammalian beta casein is A2 like on the basis of their ability to release BCM-7 upon digestion (Fig. 5) [10]. Studies on the human equivalent suggest that it is not released from digestion, but appears to be released in the milk before consumption [11], additionally research has shown that it only has no more than 10% of the strength of bovine BCM-7 in terms of opiate activity [12].

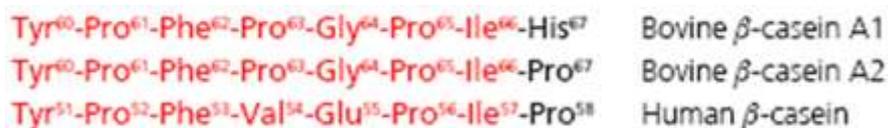


Fig. 5: Comparison of beta casein amino acid sequencing [13]-[16]

3. Why A2?

A growing body of scientific research indicates that maximizing the levels of A2 in dairy products at the exclusion of A1 could offer short and long term health advantages to some consumers[13]-[16].

The structure of A2, like human and all other known mammalian beta caseins, does not favour the release of the fragment beta casomorphin-7 (BCM-7) a bioactive with established opiate activity. Therefore dairy products based on the A2 protein; excluding A1, more closely mimic mother’s milk in terms of structure and breakdown, avoiding the chance of BCM-7 interrupting the body’s natural processes and building towards improved long term health.”

There is a deep and growing body of published research that reports that BCM-7 is an exorphin, or peptide with the ability to bind opiate receptors expressed throughout the body if produced and absorbed (Fig. 6)

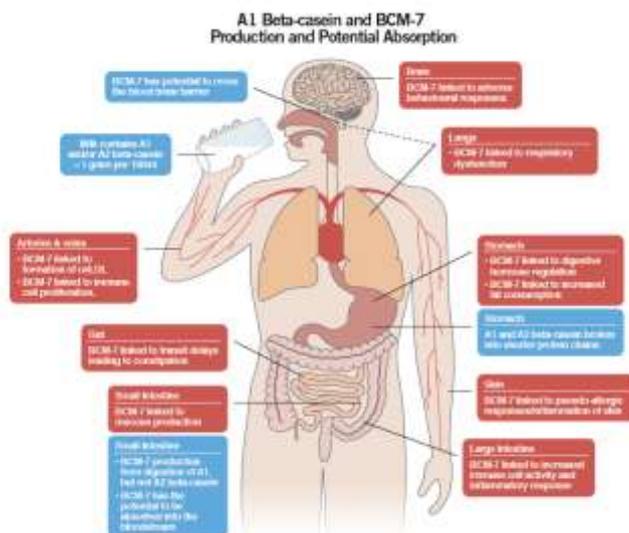


Fig. 6: Schematic representation of cells and tissues that BCM-7 has the potential to interact with [17]-[32].

4. A2 Quality Systems

The Codex Alimentarius Commission (Codex) is the international food standards setting body established by the United Nations Food and Agriculture Organization and World Health Organization. Codex develops international food standards, guidelines and codes of practice for an international food code that contributes to the safety, quality and fairness of food trade.

Codex standards are recognised by the World Trade Organization (WTO). They are not imposed on member countries. But as WTO members, Australia and New Zealand are obliged, where possible, to

harmonise their domestic regulations with Codex standards such as food additives, pesticide residues and veterinary drugs.

In Australia, dairy industry complies with The Primary Production and Processing (PPP) Standard for Dairy under Food Standard Code. PPP Standards aim to strengthen food safety and traceability throughout the food supply chain from paddock to plate. PPP Standards took effect in October 2008 and sets out a number of food safety requirements, including implementing documented food safety programs for dairy primary production, collection, transportation and processing that protect public health and safety and are cost effective across all jurisdictions.

In New Zealand, if you process or manufacturing dairy products, you will need a Risk Management Programme (RMP). An RMP is a written programme designed to manage the hazards, wholesomeness and labelling of animal material and products. Hazards may be biological, chemical or physical. A RMP describes how the processing steps and assesses the risk to ensure the products meet the requirement of Animal Product Act 1999. This is to ensure the products for sale are “fit for purpose”- safe, suitable and truthfully labelled.

5. Producing A2

As well as comply with local high standards, in order to become A2 certified supplier and producer, and there is a vigorous certification process (Fig. 7). And all steps must be verified by A2 under the True A2™ certification system. This system covers from milk supply to finished product to ensure only the highest quality product recognised by A2 company will be provided to consumer.

Milk supply

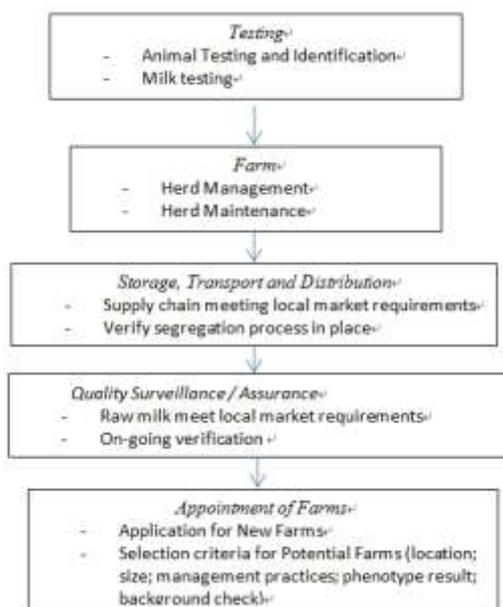


Fig. 7: A2 Milk Supply and Approval Process [2]

All genotyping results are controlled and maintained by A2. Standard test method, testing frequency and results must meet and exceed local regulatory requirements. In addition, protein testing or phenotypic analysis of the milk is a necessity and must meet A2 requirements at all time. Periodic inter-laboratory proficiency testing is conducted to check the validity and accuracy of the test results.

Any anomalies found during farm audit, herd testing as well as milk testing is to be immediately segregated and re-tested.

Milk Processing

Milk Powder

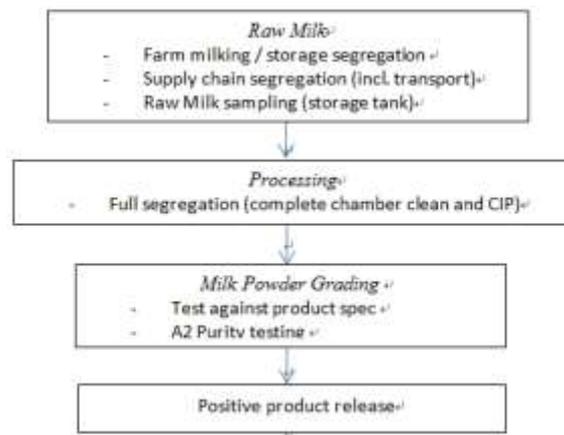


Fig. 8: Milk powder production process flow [33]

A2 has just entered the infant formula market. In order to ensure the True A2™ certification, all ingredients going into A2 formula undergo review and verification process to confirm their “non-A1 containing” status (example Fig. 8).

Finished products are tested to local as well as target market access requirement. In addition, A2 Purity is tested to maintain product A2 status.

6. References

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