
Building Bridges to Opportunity in Indian Economy



The white revolution - through the prism

By Madhukar Swayambhu

The White revolution of India, also known as the “Operation flood” – to make India self-sufficient in milk production, started off in 1970. One of the most successful projects in India, making India the largest milk producing country in the world, from a milk deficient nation.

Father of the Milk revolution, Padam Shri Verghese Kurien (26 November 1921 – 9 September 2012) was a renowned Indian social entrepreneur, was known for his ‘billion-liter idea’ (Operation Flood) – also the world’s largest agricultural development programme. India surpassed the United States of America in 1998, as the largest milk producing nation in the world, with about 17 percent of global output in 2010–11, which in 30 years doubled the milk available to every person. Dairy farming became India’s largest self-sustaining industry. Later on, he also made the country self-sufficient in edible oils too, taking the powerful and entrenched oil supplying lobby head-on.

He founded around 30 institutions of excellence (like AMUL, GCMMF, IRMA, NDDB) which are owned, managed by farmers and run by professionals. As the founding chairman of the Gujarat Co-operative Milk Marketing Federation (GCMMF), Kurien was responsible for the creation and success of the Amul brand of dairy products. A key achievement at Amul was the invention of milk powder processed from buffalo milk (abundant in India), as opposed to that made from cow-milk, in the then major milk producing nations. This led, the then Prime Minister Late Shri Lal Bahadur Shastri to appoint him the founder-chairman of National Dairy Development Board (NDDB) in 1965, to replicate Amul’s “Anand model” nationwide. He is regarded as one of the greatest proponents of the cooperative movement in the world, his work having lifted millions out of poverty in India, and outside.

That was the success story, which is undoubtedly commendable, incredible, astounding and outstanding which most of us know, and the next generation should also know, as a matter of pride to the nation. I respect Padam Shri Verghese Kurien for his die hard attitude, unrelenting passion for his work, uncompromising struggles and persistent effort to make India the largest milk producer of the World.

Now in the process of making this happen, a few changes happened in the Indian agro-dairy sector, which was rapidly shaping up into an industry of its own. The few major changes which happened were:

A huge import of European breeds of cows, considering them to have a much bigger production of milk.

Cross breeding of Indian & European breeds of cows.

Standards of milk selection in the co-operative dairies were set as the fat content of the milk and not the protein / mineral content of the milk.

But in the pursuit of attaining a larger goal, some of the finer details get skipped, and I guess that's what would've happened. Or maybe the norms got altered at the lower level at some point in time. Or maybe people overlooked, or it would've just happened unknowingly. What was missing was the "science of milk" or the difference between cow & buffalo, or Indian breed of Cow and the western cow breeds. The concept of milk proteins which changes the world in both the cases cited above – Indian & Western breeds of Cow or Cow & buffalo. The concept was first introduced to the world in a book called – "The Devil in the milk" written by Dr. Keith Woodford (Agriculture Scientist).

Most of us, outside of the Dairy Industry, do not know about the book and therefore I thought of brining awareness by writing this article.

"There's a devil in the milk, says agricultural scientist Dr. Keith Woodford in his book, and it has little to do with production methods. Woodford's startling thesis, backed up by a pile of research, is that a mutation many years ago created an aberrant protein in some European cows, called A1 cows to set them aside from all other cows, which are called A2. As a result, the milk from these cows has been linked to a host of maladies, including Type 1 diabetes, autism and heart disease."

The concept that Dr. Woodford has presented in his book, suggests that some 1000 years back or so, most of the western breeds of cows have undergone some sort of genetic mutation, due to which something changed within them, which differentiated them from the native Indian & African cow breeds. That difference has created – the Devil in the milk.

Many researches have been carried out across the globe to get into the root of the problem and understand what reality is and what fiction is. But Dr. Woodford was no Dan Brown to mix fiction with reality. And what was found in all the researches is what we'll be discussing in this article. But in order to understand this, we need to get the background first.

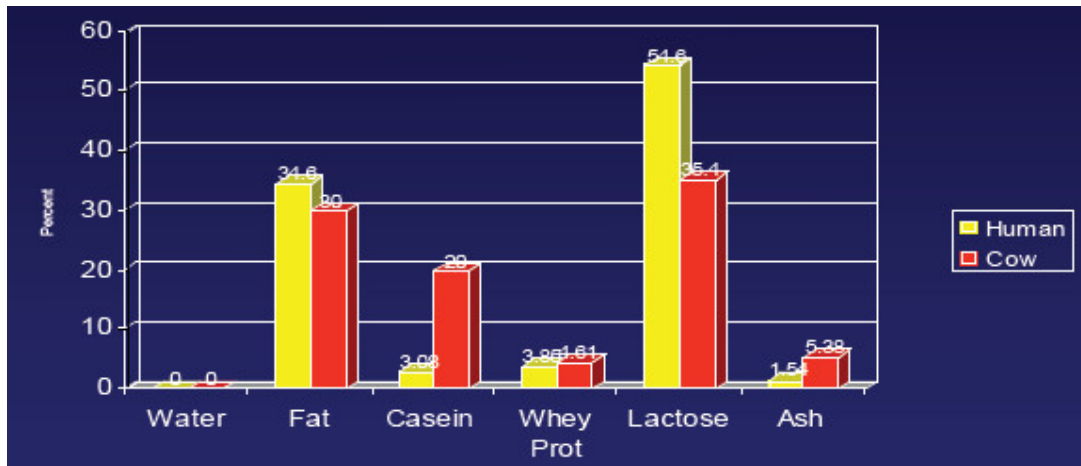
A research done by Marguerita B. Cattell, DVM, MS (Diplomate, ABVP-Dairy) & Arden J. Nelson, DVM (Diplomate, ABVP-Dairy), on the concept of A1 & A2 categories of milk, proposed by Dr. Woodford in his book "devil in milk". As the subject is milk, lets understand the composition of milk first.

Any milk is chemically the following composition;

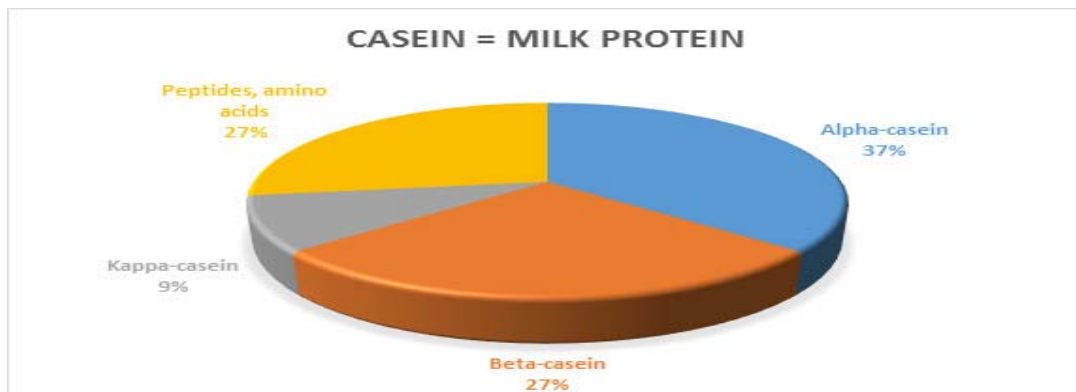
- 85% water
- 4.6 % lactose (milk sugar)
- 3.7 % triacylglycerol's (milk fat)
- 2.8% caseins (milk protein)
- 0.54% Minerals and 3.36% miscellaneous

As 85% of the ingredient is water which is harmless and common to all types of milk, we'll exclude that for all comparisons from now on in this article.

Primarily the below table gives the exact comparison between cow & human milk



Now from the study perspective the most important ingredient of the milk, that create the whole difference of A1 & A2 category of milk is the milk protein or caseins. So let's understand this aspect of milk in a bit deeper detail.



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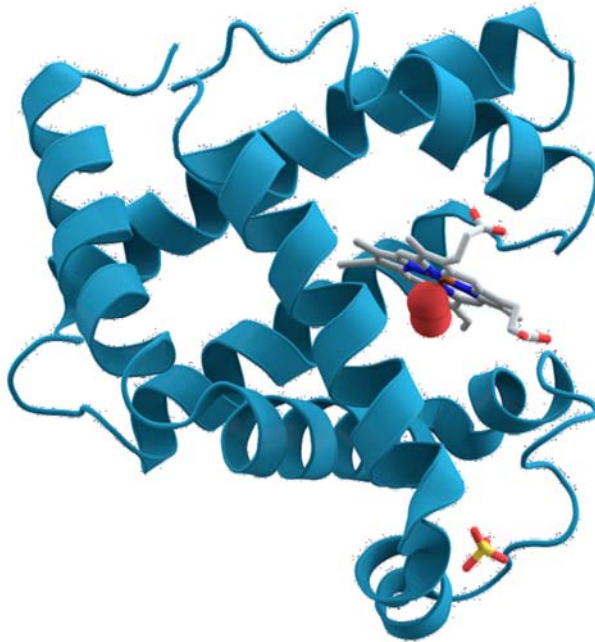
Now the key ingredient that changes the whole proposition for the milk is this 27% of Beta-casein. The Beta-casein history for the modern science is like this; we first have A, B & C categories of Beta-caseins in the recorded science, out of which the 1st type to be

known to the modern science is A1, the 2nd discovery was of A2 (that's why the names A1 & A2 type milk). But as all the researches happened in the west, the first discovery was of A1 only, in spite of the fact that A1 is the result of a gene mutation. The original Beta-casein is A2, which got discovered later by modern science when the study went global. A little later another variation was discovered which was named A3. But from our perspective both A2 & A3 are equivalent.

Now let's try to understand the difference.

In order to understand the difference between beta-casein A1 & A2, let's start from basics. As we all know by now beta-casein is a kind of casein, which is the key ingredient of milk protein. So let start from understanding "proteins".

The most common definition, as per wiki is "Proteins are large biomolecules, or macromolecules, consisting of one or more long chains of amino acid residues. Proteins perform a vast array of functions within living organisms, including catalysing metabolic reactions, DNA replication, responding to stimuli, and transporting molecules from one location to another. Proteins differ from one another primarily in their sequence of amino acids, which is dictated by the nucleotide sequence of their genes, and which usually results in protein folding into a specific three-dimensional structure that determines its activity."



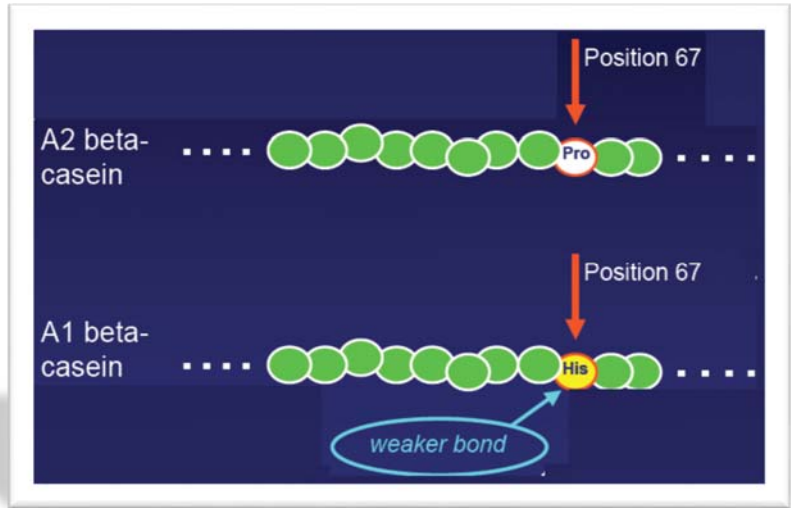
A representation of the 3D structure of the protein myoglobin showing turquoise alpha helices. This protein was the first to have its structure solved by X-ray crystallography. Towards the right-centre among the coils, a prosthetic group called a heme group (shown in grey) with a bound oxygen molecule (red).

Sound quite complex, right. Now as it's not a biology class, let's stick on to just one concept that Proteins are chain of amino acids stick together due to chemical bonds between the amino acid molecules.

Now, as we know that Genetic Mutation Changed A2 into A1 beta-casein, we need to understand the prime difference between both the types. Beta-casein is 209 amino acids long (1972) milk protein, in which the position 67 change from proline to histidine to create A1 beta-casein. Now histidine basically has a chemical property of making a very loose bond which is susceptible to the environmental conditions too. Therefore, the loose chemical bond

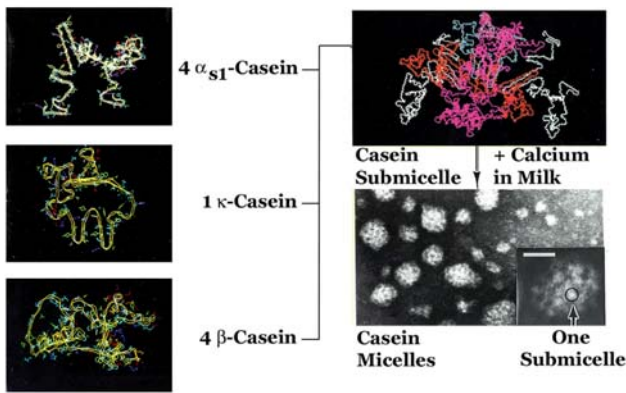
changes to the slightest of the difference in temperature, viscosity or any other change that might happen to the milk. For example when you boil it or cool it or pasteurize it, or even simple drink it, the one amino acid difference allows the formation of beta-casomorphin-7 (BCM7) via digestion, as the bond gets broken and a new substance is formulated by default.

Now let's understand this BCM7 which is the key culprit. The beta-casomorphine is nothing but a type of peptide, broken away from the casein molecule due to environmental changes like heating the milk / pasteurization / fermentation / cooling / digestion etc. But at the same time the same peptide is also a type of



“morphine”. Morphine is an analgesic and narcotic drug obtained from opium and used medicinally to relieve pain. It acts directly on the central nervous system (CNS) to decrease the feeling of pain. It can be used for both acute pain and chronic pain. Morphine is also frequently used for pain from myocardial infarction and during labour. Maximum effect is around 20 min when given intravenously and 60 min when given by mouth while duration of effect is between three and seven hours.

Predicted Three Dimensional Structures for Bovine Caseins



This is the “Devil in the milk”

Now this beta-casein / BCM7, if taken for a long, can create various health hazards. Like autism / schizophrenia, type-1 diabetes, Ischaemic heart disease, and even Cancer (as morphine is an identified carcinogen). A detailed study on this was carried out by Murray Laugesen and Robert Elliott; published in NZ Med J 24 January 2003; vol 116, no. 1168, available @ www.nzma.org.nz/journal.

The excerpts of the conclusion of the above mentioned report in the medical journal says “Cow A1 β -casein per capita supply in milk and cream (A1/capita) was significantly and positively correlated with IHD in 20 affluent countries five years later over a 20-year period

– providing an alternative hypothesis to explain the high IHD mortality rates in northern compared to southern Europe. For DM-1, this study confirms Elliott’s 1999 correlation on 10 countries for A1/capita,1 but not for B β -casein/capita. Surveys of A1 β -casein

consumption in two- year-old Nordic children, and some casein animal feeding experiments, confirm the A1/capita and milk protein/capita correlations. They raise the possibility that intensive dairy cattle breeding may have emphasized a genetic variant in milk with adverse effects in humans. “

Conclusion

Now as Indian or African cow breeds never had this issue of genetic mutation, we were never required to be worried about these issues, but now that the world is becoming flat, and a lot of population keeps travelling from east to west and vice-versa, it is important to know that the milk here and milk there are different.

Moreover the cross breeding due to white revolution, has also effected the quality of milk. Till the time, we don't switch back 100% to Indian cow breeds, we can't be sure of A2 milk consumption.

And finally, we need to understand that the “judgment of quality” parameter should be of A2 category, not of A1 category.