



The Characteristics that make A2 Dwarf Cows Advantageous for Dairy Farmers in India

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What is the difference between the A2 and A1 Cow?

To understand an A2 and A1 cow, we must first understand what type of milk A1 and A2 cows produce. The milk from dairy cows has been regarded as an important source for nutrients such as high-quality protein, carbohydrates and a variety of micronutrients. The milk of the cow is constituted of protein that is 95% made up of caseins and whey protein. Among these caseins, beta casein is the second-most abundant protein found in milk. The difference between the indigenous cows is that they produce pure A2 milk in comparison to the western cow breeds that produce A1 milk which is of pure A1 or a mixture of A1 and A2 variants. A2 milk is the milk that contains only the A2 type of beta-casein protein, whereas A1 milk contains only A1 beta casein or the mixture of A1/A2 type variant. A1 protein is commonly found in milk of the European breeds and the crossbreeds from these cattle, while, A2 protein is the milk that is distinctively found in the indigenous cows and buffaloes of Asia and Africa (Boro et al. 2016). The A1 type cow is a mutant variant which has the amino acid Histidine, while A2 cows have the amino acid Proline (Sodhi et al. 2012). This variant was developed due to a mutation in the normal A2 beta casein gene about 3,000 years ago in Europe. The indigenous cow breeds of India did not have this mutation. These cows are two different species of cow breeds : the Indian cow breeds that produce A2 milk have the genetics of the *Bos indicus* species and the western cow breeds that produce A1 milk have their genotype in the species *Bos taurus* (Sartori et al. 2015).

Varieties of A2 Dwarf Cows in India

The Government of India (2013) officially recognizes 37 indigenous breeds of cattle, of which are breeds with their own unique characteristics that stem from their different geographic origins in the country. However, in South India, a set of unique dwarf cow breeds is present that has been vastly ignored by the official cattle breed surveys. This was due to lack of research and study which created a large gap in information regarding these unique dwarf cattle. The list of the Indian indigenous dwarf variety cattle found in South India includes :

- Vechur
- Punganur
- Kasargod Dwarf
- High Range Dwarf (Idukki)
- Kuttampuzha Kullan
- Palakkad Ottapalam Dwarf
- Coorg Dwarf
- Vadakara Dwarf

(Natural Farmers Kerala 2013)

The probable reason for these varieties to have become smaller in body size would have been to adapt to the hot and humid conditions of the weather along with the mountainous

terrain of the region that suits lower body mass. Today, all the above breeds are on the threshold of facing extinction. This was due to bad judgement of laws by the government and lack of awareness of the immense qualities these cows had for the dairy industry. One such example was the *Livestock Improvement Act of 1961*, where the state government of Kerala decided to castrate the indigenous cattle breeds to introduce the western high yielding cattle breeds (Natural Farmers Kerala 2013). This had devastating effects on the population of the indigenous cattle breeds like the Vechur, which today are less than 3000 in number (Government of India 2013). Today, many parts of India are going back to their roots to understand the value of protecting the natural biodiversity. This revival has helped protect many of the indigenous A2 dwarf cattle breeds in India.

Advantages of Dwarf A2 Cattle for Dairy Farming

There are several benefits to the farmer from rearing A2 dwarf breeds, which are efficiency in management of the dairy farm, health benefits for consumers and higher economic value for A2 milk products.

1) Efficiency in Management

The introduction of imported Holstein-Friesian cattle to India in many ways has been a failure, because these breeds were not meant to perform under the harsher and hot weather conditions of India. Farmers are not achieving yields they would have expected in temperate zones, which are the climatic conditions that favor high milk output for the western breeds of cattle. While the Indian indigenous breeds may not produce as much as the western cows, they can withstand the heat and humidity of the Indian peninsula with ease. These breeds are not just hardy but are also much more resistant to local diseases (Shields et al. 2015).

The dwarf cattle breed Vechur has often been called the “zero maintenance” cow. This was further proven by a study conducted to understand the cows’ resistance to diseases. In the study it was found that the Vechur cow has the gene exon 9 (*SLC11A1*) that gave rise to a natural immunity system against pathogens such as Salmonella, Brucella, Mycobacterium and Leishmania by generating hydroxyl free radicals. Thus, the Vechur cow has been subject to lower incidences of diseases like parasites, mastitis, or mouth and foot diseases (Bosewell et al. 2016).

As India is a densely populated country, there is a lack of available land to cultivate feed for large-sized cattle since their consumption of food is higher. The dwarf cattle sized breeds require less feed energy input and thus more of such smaller variety of cattle can be grown in the farm per area. To understand this, in figure 1, a simple diagram details the input requirements for dwarf breed cattle. In the diagram, the Vechur cattle have

been used to compare with an average Indian crossbreed of cattle. The calculation indicates the feed input or the metabolizable energy required is proportionate to the body mass scale of the animal. However, the Vechur cow has significantly higher fat and SNF (solid non-fat) content in comparison to the cross-breed cattle.

The smaller size and body weight for the dwarf variety cattle breeds also has the advantage of causing less pug damage to the soil. Farmers who hold large numbers of cattle need often to deal with the damage to pastures caused by the heavy cows' constant treading over the soil that can destroy the soil structure and the pasture feed output (Victoria State Government 2017). Rearing dwarf cattle allows the farmer to maintain healthier pasture crops with less pugging due to the lower body mass and weight.

M.E. (METABOLISABLE ENERGY) REQUIREMENT CALCULATIONS FOR VECHUR & CROSSBREEDS

Figure 1.

	Vechur Cow (Vechur Conservation Trust 2016)	Cross breed (Singh, CV 2016)
Body weight in KG	130	550
Maintenance ME required in MJ	23	80
Production of milk in litres	4	30
Fat produced in %	6.70 %	4.20 %
Solids Non-Fat	8.9	3.8
Approx. Requirement of ME per litre of milk	9	5.5
Milk production ME required in MJ	36	165
Total ME requirement in 2nd month of lactation	59	245
Approx. ME requirement for 1 cow pa (305 days)	17000	80000

2) Healthier Alternative

In the last two decades, there have been ongoing debates in the scientific community on the impact of health-related issues with A1 milk. Keith Woodford was one of the first whistle blowers regarding the health issues related to A1 milk. In his book, '**Devil in the Milk**', he found research that suggested A1 beta casein protein found in A1 milk has had a significant relationship between its consumers and the incidence of type 1 diabetes and cardiovascular disease (Woodford, K 2009), while in regions of North Kenya, where the Masai and Samburu communities have a rich diet of A2 milk, there have been virtually no reported cases of heart-related diseases (Boro et al. 2016).

In a study comparing the effect of A1 and A2 beta casein on gastrointestinal physiology, it was found that the A1 beta casein milk caused digestive and inflammatory issues in the gastrointestinal system in the human body. Where A2 beta casein protein milk was tested on lactose tolerant and intolerant subjects, the test witnessed no issues to the digestion system or inflammatory-related problems (Jianqin et al. 2016).

Relying on A1 milk for calcium also gives rise to complications related to magnesium deficiency and imbalance. Magnesium provides anti-inflammation in the body, helps improve digestion, is involved in the functioning of nerve and muscle movement, helps as a de-toxifier, increases the alkaline level in the blood and improves flexibility of the tissues. The consumption of A2 milk did not evidence such deficiency and imbalances in magnesium in the human body (Boro et al. 2016).

Apart from the benefits of A2 milk, dwarf breed cattle like the Vechur have been found to have medicinal values from the cow itself. A study was conducted on the structural and functional use of the Bovine lactoferrin gene that was found in the milk of the Vechur cow. Bovine Lactoferrin, apart from its main biological function, namely binding and transporting of iron ions, also has antibacterial, antiviral, anti-parasitic, catalytic, anti-carcinogenic, and anti-allergic functions and properties (Chinnamma et al. 2015).

The dwarf cattle breed also has a difference regarding the composition of its milk, in the size of the fat globules and the level of saturated fatty acids when compared to other cattle breeds. In a recent study, the properties of the dwarf breed cattle's milk underwent cloning and characterization of gene encoding of the milk protein alpha-lactalbumin. The lactalbumin is a mammary gland of specific protein found in high concentration in milk of many species and has a role in regulating lactose synthesis. The lactalbumin gene of Vechur and other Indian indigenous dwarf breed cattle had close structural resemblance with that of human milk, reflecting high degree of amino acid sequence identity (Rajeev, M & Aravindakshan, TV 2009).

Vechur cow and other dwarf breed cattle have higher percentage of fat content and SNF (Solid Non-Fat) content in comparison to crossbred cows. But a more significant aspect is that the size of the fat globules present in the milk of the dwarf breed cattle. This means the size of the fat globule in the milk of the dwarf breed cattle (3.21 microns) are considerably smaller than that of the crossbred cows (4.87) (Venkatachalapathy, RT & lype, S 1996). The small size of fat globules means high phospholipid content because of greater surface area. Phospholipids are important in the development of brain and nerve tissues and play a vital role in the absorption and digestion of fat (Argov et al. 2008).

In another recent study conducted by the College of Veterinary and Animal Sciences in India, tests were conducted on Swiss-albino mice to investigate the immunomodulatory effects of the Vechur cow's urine. The result of the tests had positive results, the Vechur cow's urine showed evident immune protective activity by significant increase in the total lymphocyte count, leucocyte count, HA titre, number of antibody producing cells, bone marrow cellularity and delayed hypersensitivity responses in both immuno-suppressed and normal mice. This affect was also seen vastly superior to the crossbred cow urine. The results indicate that Vechur cow urine significantly reduced the cyclophosphamide induced immuno-suppression by stimulating both cellular and humoral immunity which need further research to validate the results clinically, and to perhaps possibly make use of the Vechur cow's urine in the treatment of cancer and in immuno-deficiency diseases such as AIDS (Naseema et al. 2014).

3) Economic Benefits

Considering today's growing trend and demand by consumers for A2 milk rather than A1, farmers in India have a comparative advantage to supply A2 milk since India is home to many indigenous breeds that naturally produce A2 beta casein protein milk. Switching from A1 to A2 milking cattle breeds would fetch farmers a better market price.

In addition to this, the farmer has a lot less difficulty in maintaining the indigenous breeds that are much less susceptible to disease and are much better suited to withstand the Indian climate, which will help save costs and increase total revenue. The argument that crossbred A1 cattle produce more milk is irrelevant when a farmer could be able to grow more indigenous A2 cows per area, since the total feed requirement is much less than the western mixed breed cattle.

Above all this, the importance of dwarf breeds cattle like Vechur, Kasaragod, etc. needs to be protected not just for sentimental reasons, but because they have unique therapeutic and medicinal qualities. The dwarf breeds also have a higher amount of fat content and SNF (Solid Non-Fat) content in their milk which makes them an excellent dairy source to produce value-added products like ghee, butter, yoghurt and cheese.

Conclusion

The revival of A2 milk in India and the rest of the world can be an opportunity to understand the immense value of these special dwarf cattle breeds in India. There has been a lot of work on the part of the Indian government to promote western crossbred cattle in India, without fully understanding the importance of protecting and preserving the indigenous cattle of the land. However, at the same time, more effort must be done to research and understand the different diverse cattle breeds of India. The greater our understanding of our natural biodiversity, the more we can not only help preserve a healthier eco-system, but also understand the key role this biodiversity plays in it.

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