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Understanding the value of indigenous livestock and poultry genetic resources and strategy for their conservation

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Abstract

For generations, indigenous livestock species have coexisted alongside humans as significant providers of food, money, socioeconomic status, and cultural significance. Today's livestock scenario is driven by demand rather than resources, which were formerly determined by local habitats and conditions. As a result, in new, high-input agricultural methods, specialized features of indigenous animal breeds with poor productivity are disregarded. This has caused high-yielding breeds to gradually displace traditional multipurpose ones, and farming has shifted to one that is more focused on profits. Given that native livestock cannot out-produce industrial livestock systems, it seems logical to concentrate on their distinctive qualities for the sake of conservation and as a source of income. Fortunately, there is a vast but frequently unrealized potential for many indigenous breeds and species to generate goods that consumers value and demand. Numerous indigenous breeds possess distinctive attributes such as vibrant wool, immunity to disease, patterned hides, ultra-fine fiber, exceptionally tasty meat, or milk that has medicinal or health benefits. Local breeders can create distinctive goods that have the potential to create large amounts of demand and save endangered breeds from extinction.

Keywords: Coexisted, endangered, extinction

Introduction

In today's economy, raising native livestock breeds is typically less profitable than maintaining high-yielding commercial types. Immediate focus is needed on the characterization of indigenous germplasm, particularly product quality features, since this could improve native breeds' standing in the current consumer environment. In certain affluent nations, the significance of regional breeds for producing exquisite gourmet dishes is widely recognized. In Europe, specific breeds are linked to a variety of specialty cheeses and meats. Local-breed products are frequently processed using customary methods. Cheese and sausages with distinctive flavours have been created as a result of the necessity to preserve milk or meat without refrigeration. The promotion of cheeses, sausages, wool, and other specialized goods has boosted rural economies, strengthened local identities, and helped preserve native breeds in these nations. However, there are few instances of this strategy in developing nations. Recognizing and recording traditional livestock, their products, and their processing techniques are essential. It is also necessary to value these breeds genetically in order to employ biomarkers associated with particular features for breeding purposes and sustainable conservation. Additional examination of the goods' unique traits in terms of their nutritional value, therapeutic benefits, and sensory aspects is required. An approach like this will lead to: Inventory of currently produced traditional goods and ways of processing from the chosen breeds can help to better understand the technological needs for creating goods that are suited to the tastes of urban consumers a sense of consciousness within groups. Policy makers and private industry peoples on the potential and promise as well as requirements for a unique label or brand for products; insights into the economic opportunities inherent in the local breeds. The following is a compilation of recent scientific research supporting the quality attributes of Indian livestock that can be used to increase their value and encourage sustainable utilization.

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Indian Livestock and Poultry as Potential Sources of Dairy and Meat

Excellent Milk from Native Cow

The belief among consumers that milk from Indian or Desi cows is different from that of taurine cattle and their crossbreds is linked to this impression. Many international studies have studied the milk content of native and widely used breeds, including crossbreds, from various regions of the world. Asia, including India, has a dearth of information in this area.

The nutritional profile of milk from native cattle kept solely on grazing was superior to that of cows kept under an intensive management method (Sharma *et al.*, 2018; 2018a) [24]. The medium-chain fatty acid group (15.1%) was primarily responsible for the decreased proportion of saturated fatty acids (SFA). (61.40%) Total unsaturated fatty acids (UFA, 38.6%) including MUFA (31.4%) and PUFA (7.2%) were also higher in the milk. In grazing milk, the n-6/n-3 ratio (2.7) and the atherogenic index (33.9) were much lower.

The mineral concentrations (Zn, Fe, P, Cu) and vitamin concentrations (all except vitamin B5) were considerably greater ($P < 0.05$) than those of calves receiving intensive care. There was more than twice as much β -carotene, vitamin A, C, and E and these are nutritionally valuable because they are antioxidants and help lower oxidative stress. Additionally, consumers find the yellow colour of cheese and butter which is a result of the carotenoids in milk fat to be appealing. It is regarded as definitive proof that the product came from cows that were fed a diet rich in grass. Indian zebu cows (*Bos indicus*) were valued for their milk quality rather than their higher milk yield; this is a folklore concept. The stated health benefits of milk may have originated from the practice of nearly complete pasture feeding in the past. The global movement toward organic milk production, which places a strong focus on grazing, portends well for native cows kept on pasture.

Milk with the highest fat Content

The Bhadawari breed's milk is known for having a high fat content. The Yamuna, Chambal, and Utangan river canyons in Madhya Pradesh and Uttarakhand are home to Bhadawari buffaloes. Despite a reduced overall lactation yield, records show that milk fat content can reach 13%. The breed produces 1294 kg of milk on average per lactation, with an average fat percentage of 7.88 (with a yield range of 540–1400 kg per lactation and a fat percentage of 6–12.8).

Longer Shelf Life for Curd

The chilika buffalo is a unique species, found exclusively in the vicinity of Chilika Lake in the Odisha districts of Khordha, Puri, and Ganjam. Its neck-deep, brackish waters are home to seaweed, which is their primary food source. It's possible that the animal's diet's high salt content contributes to the milk's deliciousness and ability to keep for days without refrigeration. The milk itself is gaining popularity, as are other dairy products like curd. It is commonly known and documented that chilika curd has a longer shelf life, and this has been verified by science. 64 distinct microbial strains were obtained from samples of milk and curd that were gathered from Chilika (Nanda *et al.*, 2013) [19]. Remarkably, eight of the aforementioned *Lactobacillus* isolates were discovered to have anti-fungal properties against the test organism *Candida* species. This finding is associated with the preservation of curd against fungal deterioration and the

extension of its shelf life. These isolates can be employed as a starter to produce curd that has a longer shelf life. Extended shelf life products can be helpful in countries like India, where a large portion of the population lives in villages without access to refrigeration and where a cold chain is not required for delivery.

Source of Bio-defensive Milk Peptides

According to Pal and Chakravarty (2020) [20] buffaloes are thought to be more disease-resistant than cattle, yet there is not much empirical data to back up this claim. Nonetheless, a study comparing the transcriptomics patterns of milk somatic cells from Murrah buffaloes and Sahiwal cattle was carried out (Ahlawat *et al.*, 2021) [2]. In buffaloes, there has been a noteworthy enrichment of genes related to innate and adaptive immunological responses, as well as different host defense peptides like lysozyme, defensin β , and granzymes.

It was found that the expression of lysozyme C, or LYZ1, was seven times higher in buffalo milk than in cattle milk. As a bacteriolytic enzyme present in bodily fluids such milk, saliva, and tears, lysozyme plays a crucial role in mammal mucosal immunity (Masschalck *et al.*, 2001) [16]. According to Meade and O'Farrelly (2019) [17] β defensin, CD8 T cells and natural killer (NK) has the ability to act as a natural antibiotic. The cells release granzymes, which cause the programmed cell death of aberrant or contaminated target cells. These findings suggest that buffalo milk offers new possibilities for the creation of innovative and successful treatments by providing a variety of bio defensive milk peptides that may be extracted from it in the future.

Therapeutic Possibilities

Goat milk has more calcium, vitamin B6, vitamin A, potassium, niacin, copper, and the antioxidant selenium than cow milk, but overall the vitamin and mineral contents of the two milks are quite similar. Goat milk has 13% more calcium, 25% more vitamin B6, and 47% more vitamin A than cow's milk. Potassium, phosphorus, and calcium are all abundant in goat milk. Iron, sodium, and magnesium are also abundant in it. Goat milk provides numerous health advantages over cow's milk, including greater digestion, increased alkalinity, lower α s1 casein, and less allergenicity. Because of its enhanced ability to buffer acids, it is also helpful in the treatment of ulcers. Goat milk is alkaline, which is beneficial for those who struggle with acidity, in contrast to cow milk, which has a faint acidic flavour. Because of its smaller globules, consistent protein distribution, dispersed fat, and lower lactose content, it is more easily digested.

Enhanced functional meat qualities

The only black meat chicken breed registered in India is the autochthonous Kadaknath out of the 19 registered breeds, and it has protein-rich, black coloured flesh. Primarily, this special backyard poultry is maintained by the indigenous communities of Bhil and Bhilala. Due to the deposition of melanin pigment, this breed is unusual in that all of the bird's internal organs are black. This condition is known as "fibromelanosis" and is said to have aphrodisiac and therapeutic qualities. The assertions regarding the nutritional and therapeutic qualities of Kadaknath meat, however, are not well supported by the research. The meat of Kadaknath is an enhanced source of functional macromolecules (carnosine, anserine, and creatine). according to a recent study. Compared to Cobb broiler, its carnosine level in breast meat was more than twice as high (Sharma *et al.*, 2022) [25]. Given that

Carnosine Synthase 1 and Solute Carrier family 36 Member 1 expressions were found in considerable quantities in the Kadaknath breast, the genetic background may be a major contributing factor. The higher ability to block the production of advanced glycation end products and the meat's antioxidant capacity (Sehrawat *et al.*, 2021) [22] confirmed Kadaknath meat's superior functional characteristic. The discovery of largely undiscovered nutritional and functional benefits of Kadaknath meat has the potential to alter perceptions about meat eating. It will assist in creating a brand identity for Kadaknath products, which will boost its market share and ultimately contribute to the preservation of this rare and endangered strain of poultry germplasm.

Synergy between the aroma and Wellness of goat meat

Livestock meat is a great source of protein and essential elements like zinc, iron, iodine, and vitamin B12. According to Ivanovic *et al.* (2016) [10] goat meat has a lower level of saturated fatty acids, fat, and cholesterol than chicken, lamb, beef, and pork. This will provide it an advantage when marketed as a healthy diet for cardiovascular disorders. The greatest meat breed is the Barbari, a dual-purpose animal that can produce both milk and meat (Paramasivam *et al.*, 2002; Mandal *et al.*, 2016) [21, 15]. Barbari muscles have been found to have reduced cholesterol levels among Indian goat breeds (Das and Rajkumar, 2010) [8].

Thus, compared to chevon from other breeds, goat meat or chevon from breeds like Barbari offers a healthier choice. Barbari goats are known for producing high-quality chevon, which is why commercial goat farming prefers this breed (Das and Rajkumar, 2010; Umaraw *et al.*, 2017) [8, 27]. According to Kumar *et al.* (2021) [14] functional genomics research on Barbari muscles has also shown important genes and pathways linked to lipid metabolism and triacylglycerol production, supporting the meat's superior organoleptic qualities.

Esteemed delight on sheep meat

Customers like mutton from the Karnataka-bred Bandur sheep breed because of its distinct flavour, and it fetches a greater price than other local varieties. Studies showed that Bandur animals have thicker back fat than native sheep. The Bandur sheep had a higher degree of tenderness in various muscles, including the bicep, semimembranosus, psoas major, semitendinosus, and the longissimus dorsi. The study of fatty acids and amino acids showed noticeably greater levels of histidine and oleic acid in Bandur (Arora *et al.*, 2019; Kumar *et al.*, 2018) [4, 13]. Higher oleic acid content has been linked to improved palatability overall, however histidine is an important amino acid that must be consumed. The increased fat content, muscle sensitivity, oleic acid, and histidine found in the meat of Bandur sheep will increase its value. HSPB1, DNAJB5, HSPA6, and other genes linked to muscular soreness were also overexpressed in Bandur sheep. The highly connected genes identified by transcriptomics (CNOT2, CNOT6, HSPB1, HSPA6, MAP3K14, and PPARD) and miRNA form potential biomarkers for unique muscle traits of Bandur sheep (Kaur *et al.*, 2020; 2020a; Arora *et al.*, 2021) [11, 12, 3]. The phenotypic and genetic analysis of Bandur sheep's mutton quality features has provided the scientific rationale for the high quality and flavour of Bandur sheep mutton, which will support long-term conservation of this breed.

Potential use of Indian breeds wool and fiber

A) Pashmina Fibre

Pashmina is renowned for being soft, warm, and fine. Superior to superfine merino wool, it is warmer, softer, and more opulent. The word "pashm," which in the regional tongue means "soft gold," is where the name "pashmina" first appeared. The fiber is mostly used to create shawls that are adorned with motifs created by Himachali and Jammu and Kashmiri artists. There are two goat breeds that produce pashmina in India: Changthangi and Chegu. The Changthangi breed is domesticated in the Himalayan regions of Ladakh, Jammu and Kashmir, and Chegu, Lahul, Spiti, and Kinnaur. The best values of resilience and compression for fine wool were found by the physic-mechanical evaluation of pashmina fiber, confirming pashmina's superiority over other wool fibers in terms of softness and fullness (Bumla *et al.*, 2012) [7]. The genes and processes associated with the formation of pashmina have been identified by recent research using the skin transcriptome (Ahlawat *et al.*, 2020; Bhat *et al.*, 2021) [1, 6]. When the skin transcriptomes of Changthangi and meat-type goats were compared, it was found that the Changthangi goat had higher expression levels of genes linked to fine fiber. The white pashmina is the most expensive tint overall. The analysis of genes that were found to be differently expressed in Changthangi goat skin samples with black, white, and brown skin samples showed that the ASIP gene was more abundant in white skin than in brown or black skin samples (Bhat *et al.*, 2019) [5]. There haven't been many systematic or scientific methods for raising Pashmina productivity and output both qualitatively and quantitatively. The majority of the pashmina production system is an open range system that relies on pastures.

B) Lustrous Wool

The Magra sheep, historically referred to as the Bikaneri breed, holds significant value in Rajasthan. Magra sheep are known to be suited for arid regions since they can survive with just twice weekly irrigation without experiencing negative impacts on body weight. The sole breed in India that produces lustrous carpet wool is this unusual one (Dass *et al.*, 2003) [9]. According to Mehta *et al.* (2004) [18] this breed can be utilized to enhance other Indian sheep that produce wool.

Prospective and Action Points

The idea of creating a value chain using local livestock products is becoming more and more popular worldwide. The goal of developing niche markets is to increase the value of regional goods and promote small-scale, sustainable production systems that are regional in scope. India has a wealth of livestock biodiversity, which presents a tremendous chance to generate a range of practical livestock products with added value and to increase livestock sector income. By identifying qualitative qualities, products from conventional farming methods can be made more valuable. Growing customer preferences for locally produced goods and food of the highest calibre indicate possible markets for these goods. The goal should be to add value to animals through processed goods. Milk from sheep and goats can be used to make cheese, yogurt, personal care items, and household goods. Their wool and hair can be used to make traditional carpets and clothing. In the current era of expanding organic farming, dung can be a source of revenue. Ghee and processed cow urine are expected to be in high demand because they are used in traditional medicine. In India, there is a lot of room for the processing of milk and beef into value-added goods like ready-to-eat and ready-to-cook items for the country's

expanding population and rapidly urbanizing and changing lifestyle. By adjusting the location, timing, and product form of livestock farming to meet market demands with an inventive attitude following a careful analysis of customer preferences, the industry can become more profitable. Farmers must seize the opportunity to increase their revenue from the same number of animals they already own.

State government agencies can help farmers with skill enhancement training that they occasionally conduct to prepare value-added processed livestock products, with product labelling and packaging, and with providing market support and incentives to communities for the sale of value-added material. Finding a fit between the characteristics of the native breeds, the attributes of a certain product, and the needs of a certain market can be achievable with targeted efforts. For those working in the value chain, completing this match will support breed conservation efforts while also offering employment opportunities. In contemporary agriculture, this conservation approach may create a new role for native breeds.

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