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Heritage healing: Investigating ethno-veterinary practices for reproductive disorders in Indian livestock

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Abstract
The wealth of knowledge on animal care, health management, and illness treatment can be found in ancient Indian literature, including the sacred Vedas, Puranas, Brahmanas, and other epics. Ayurveda offers fascinating knowledge on herbal remedies, animal ailments, and disease cures. The world's first veterinarian, Shalihotra, wrote a text and was an authority on both medicine and horse husbandry. In the era of the Mahabharata (1000 BC), the two Pandava brothers, Nakula and Sahadeva, were proficient in the care of horses and cattle, respectively. The skilled preserver and guardian of cow husbandry was Lord Krishna. The world's first veterinary hospitals were built by the renowned king Ashoka in 300 BC. In his empire and the neighboring kingdoms, he organized the production of herbal remedies for both humans and animals. Human knowledge, expertise, techniques, customs, and beliefs regarding animal care are all included in EVM. The practice of ethnoveterinary medicine is maintained, albeit in a restricted number of communities, by the strong belief that some people, especially those from tribal communities, hold. Therefore, it becomes imperative to increase public awareness of the significance of ethnoveterinary practices. This review tries to share information about traditional animal healthcare methods related to reproductive issues. Although reviewing all documented ethnoveterinary practices is beyond the scope of this study.

Keywords: Heritage healing, ethno-veterinary practices, livestock

Introduction
The reproductive performance of the animals is the main concern of dairy farmers because the economy of the farmers is directly related to the reproductive efficacy of animals. The concern for the reproductive health of animals is more in India because of the highest bovine population in the world (303.6 million) (Livestock Census 2019) with limited resources and facilities to control reproductive disorders. The world's largest producer of milk, India, produced 194.8 million tons of milk in 2020 out of 906 million tons (FAO, 2021) [18]. This high production contributed to the world's largest population of dairy animals, which as of the 2019 livestock census stood at 193.5 million cattle and 109.8 million buffalo. This is in contrast to many developed countries when population and production are compared. The main reason for the low productivity of animals in India is the high prevalence of reproductive disorders. (Khan *et al.*, 2016) [29], and according to a slaughterhouse study, a higher incidence of reproductive disorders is found in buffalo, i.e., 37.5 (Sharma *et al.*, 1993) [58]. In developed nations, reproductive disorders account for the annual culling of 3-6% of the herd. The culling rate of cattle due to infertility and sterility in India is 18-40% (Kaikini, 2002) [28].
The exact cost or economic losses due to reproductive disorders are difficult to estimate because they may be influenced by other factors or manifest with other diseases (Dijkhuizen 1997) [14]. Reproductive health characterization is made more difficult by the lack of data recording systems, particularly in smallholder dairy farms (Lindgren *et al.*, 2017) [36]. In addition, uncertainty in the presence of disease in animals makes cost estimation more difficult. Deka *et al.* (2021) [10] estimated that reproductive disorders cause an annual economic cost of INR 3963.1 million (USD 59 million) in Assam and INR 30500 million (USD 453.9 million) in Bihar. According to an Indian economic estimate, the livestock industry lost USD 3.4 billion due to brucellosis, with the dairy industry accounting for USD 3.2 billion (95.6%) of the losses (Singh *et al.*, 2015) [62].

However, there is a lack of precise data regarding the financial losses caused by infertility in Indian livestock. (Gurucharan Singh *et al.*, 2003, Singh *et a1*., 2003, Das *et al.*, 2004) [21, 60, 8]. Patel and Ponnusamy (2018) [46] proved that anestrus and repeat breeding ranked first and second in reproductive disorders in Haryana state, whereas repeat breeding, anestrus, and late sexual maturity are major concerns in Madhya Pradesh. Kumar and Singh (2018) [34] revealed an infertility rate of 80.10% due to various reproductive disorders in Himachal Pradesh. Roughly 63% of anestrus was observed in the animals of Punjab (Dey *et al.*, 2020) [13]. Kondre *et al.* (2015) [30] reported that estrus was highly incidental (68.26) followed by metrits (15.57%), repeat breeding (5.99%), prolapse (5.99%), retention of placenta (4.19%) in the Marathwada region of Maharashtra. Gujrathi *et al.* (2019) [69] found the highest prevalence of placental retention (28.75%) followed by abortion (21.42%,), repeat breeding (14.88%), and anestrus (14.88%) in the Nashik and Pune regions of Maharashtra.

In this modern era, with the advancement of technology, therapeutic measures for reproductive disorders include many hormonal preparations such as GnRH, ECG, and progesterone but the result of these hormonal treatments in infertility are suboptimal (Perumal *et al.*, 2013) [48]. Another limitation of the use of hormonal therapy is its high cost and nonavailability of commercial preparations in the market (Kaikini, 1989) [27]. Infective reproductive disorders such as uterine infections are treated with the indiscriminate use of antibiotics, which leads to the emergence of resistance strains (Perumal *et al.*, 2013) [48]. Poor quality of allopathic medications, the emergence of chemoresistance in animals, and unwanted adverse effects such as elevated hormone and antibiotic residues in milk and other animal products are among the drawbacks of modern veterinary practice (Mathias *et al.*, 2004) [38].

To get around these problems, more affordable, secure, and environment-friendly solutions must be found. Ethnoveterinary practice offers an alternative treatment approach, given that the constituent ingredients of ethnoveterinary medicine are readily accessible, simple to prepare, and administer. Moreover, it has encompassed all areas of veterinary specialization and every type of livestock species. This review explores the traditional knowledge held by rural and tribal farmers concerning the application of ethno-veterinary practices to the treatment of reproductive disorders in animals.

Ethno-Veterinary Practice

Anestrous

Feeding a combination of cotton seed and jaggery has a success rate of 94% in cure of anestrous while feeding jaggery alone has a success rate of 84% (Dey *et al.*, 2020) [13]. Most Rajasthani farmers fed boiled Methi grain (*Trigonella foenum- graecum*) to dairy animals at the rate of 1 g for 5 days to eliminate anestrous (Chand *et al.*, 2021). Feeding powder of leaves of banyan, peepal tree, mango, neem, and Ashoka at 250 g/day for 5 days induces heat in animals (Seeralan 2004) [54]. The success rate of estrus induction in anestrous cows is 83.33% and 66.66% using Methi seed at a dose of 200/day/cow for 20 days and bark of Ashoka seed at a rate of 50 g/day/cow for 20 days, respectively (Rajkumar *et al.*, 2008) [50]. Anestrous cows can be effectively treated with a mixture of aloe vera, curry leaves, drumstick leaves, adamant creeper, and jaggery (Senthilkumar, 2021) [56]. The combined use of bajra (*Penisetum typhoidis*) and water in anestrous cases showed the highest ethnoveterinary medicine use index of 123 (Among 120 selected livestock owners as a respondent) and ranked first in the state of Rajasthan (Sharma *et. al.*, 2019) [57]. Farmers of Tamil Nadu use half of the coconut and rhizome of *Curcuma longa* (Haldi) 10 g for 10 days to anestrous cows orally (Devki *et al.*, 2021) [12]. Chaudhary *et al.* (2020) [70] revealed that the most effective treatment of anestrus buffalo heifer is feeding *on Randia dumetorum* (Mainphala) and *Tinospora cordifolia* (Giloy) along with a mineral mixture. Feeding of marmelos (Bael) leaves increases fertility in anoestrus goats and buffalo. *Aristolochia bracteate* (Kabir *et al.*, 2001) [26], *Leptadenia reticulate* and *Asparagus racemosus* (Koradia, 1995) [31], *Bridelia ferrugiana*, *Ficus elastica, and Gardenia ternifolia* (Ngeh *et al.*, 1995) [45] are all whole plants that can be used to cure anoestrous in bovines. The following are also used for curing anoestrous, as well, *Cucumber leaves* (Chander and Mukherjee, 1994) [4], *bamboo and Mann tree* (Gupta, 1993), leaf paste of *Murraya koenigii* (Sudarsanam *et al.*, 1995) [71], roots of *Abroma augusta* (*Kabir et al*., 2001) [26] and *Urtica dioica* (Mehrotra, 2002), seeds of *Nigella sativa* (Kabir *et al.*, 2001) [26] and *Semecarpus anacardium* (Bechardas, 1992) [2].

Repeat Breeding

Important ethno-practices for managing repeat breeding include feeding of water-soaked acacia bark, daikon, and cow milk in buffalo repeat breeders and vice-versa, gular and barley flour with khimp with the majority use of mehandi powder (Chand *et al.*, 2021) [3]. Sharma *et al.* (2019) [57] revealed that the use of ajwain (*Trachyspermum ammi*) with water is the most frequently used practice for the treatment of repeat breeding in the state of Rajasthan with an ethnoveterinary medicine use index of 82 (Among 120 selected livestock owners as a respondent). The trials of Andhra-Pradesh have unique ethno-veterinary practices for treating cases of repeat breeding. First, red mud is soaked in water, filtered, and then combined with egg white. This mixture is consumed orally. Second, the juice extracted from two stems of Aloe vera (Kalabanda) blended with sugar and given orally, repeated three times over five days. Finally, a ground mixture comprising *Aloe vera* (Kalabanda), *Piper betle* (Kammeru), *Asclepias asthmatica* (Kukkapallakku), and *Aristolochia bracteata* (worm killer/bracteated birthwort) was prepared and orally administered over a 5-day period, three times in total.

Retention of the placenta

Feeding buds of marigold (*Calendula officinalis*) after 6 hours of parturition gives excellent results in the case of retained placenta (Das and Tripathi 2009) [9]. For easy and safe removal of placenta seeds, the paste of *Tribulus terrestris* (Gokharu) is given orally (Mishra and Patro, 2010) [43]. In rural Punjab during natural calving, farmers were fed Desi Karrah comprising Ajwain (*Trachyspermum ammi*), dried ginger (*Zingiber officinale*), and jaggery for easy placental expulsion. (Dey, Sarkar and Paul 2020) [13]. Tribes of Banswara district of Rajasthan prepared a mixture of 5-10 kg of chaffed leaves of sugarcane (*Saccharum officinarum*) mixed with 1-2 kg of grounded rice (*Oryza sativa*) and about 500 g of grounded seed of mahua (*Madhuca indica*) and fed to the animal that helps in expulsion of retained placenta (Yadav *et al.*, 2016) [68]. Rasika *et al.* (2017) [72] documented the use of *Anacardiaceae* (Ambada) in curing a case of retained placenta. Feeding bamboo leaves gives excellent results in the retention of the placenta (Devki *et al.*, 2021) [12].

The Konar community in Tamil Nadu uses green fodder made of Pedalium murex and Sesamum indicum leaves to treat placental retention (Jaykumar *et al.*, 2018) [24]. Juice of Sesamum indicum leaves is given to the animal to avoid the retention of the placenta after parturition in the Kashmir area (Jamwal and Kant 2008) [23]. According to Sehgal *et al.* (2013) [55], traditional farmers of the Hamirpur district of Himachal Pradesh fed leaves *of Bambusa aundinaceae* (Bambu), leaves and stem of *Dendrocalamus hamiltonii Nees* & *Arn*, leaves and stem of *Chenopodium album*, and roots of *Achyranthes aspera* and *Achyranthes bidentata* for the expulsion of placenta in cases of retention of placenta after parturition. For curing the delayed expulsion of the placenta, cows are fed with buds of marigold (*calendula officinalis*) just after 6 hours of parturition. The placenta is expelled within 6 hours of feeding (Das *et al.*, 2009) [9].

Prolapse

Excellent results are seen when feeding boluses of ground styani seed and khand (Desi sugar) soaked in ghee or oil and when feeding pumpkin in case of prolapse. Feeding of a mixture of 100 g of seeds of *Salanum xanthocarpum* mixed with an equal quantity of wheat flour and 150 g of ghee once daily for a week to cows results in uterine prolapse. Roasted and ground paste of *Cuminum cyminum* L. (Apiaceae) and *Brassica rapa* L. (Brassicaceae) seeds in a 1:1 (v/v) ratio, mixed with water, is administered to pregnant animals to prevent uterine prolapse before delivery (Mishra, 2015) [42]. Meena *et al.* (2023) [61] documented an ethno-veterinary practice of curing prolapse that included feeding a paste of *Areca catechu* (Supari) with a small quantity of ghee for days, a paste of *Lagenaria siceraria* (Dudhi), and feeding a paste of *Zezyphus sativa* for 2 days. To treat prolapse, the roots of *Butea monosperma* (Palas) are crushed, boiled in water, and administered orally; root powder is combined with *Tridax procumbens* (Kambarmodi); *Ziziphus nummularia* roots are boiled in a root powder mixture; and leaves are boiled in water and applied topically. In the Maharashtra region, flower liquor is used for prolapse (Kulkarni *et al*., 2014) [32]. Farmers of Kashmir fed the leaves of *Ulmus villosa* to avoid prolapse (Dutta *et. al.* 2021) [16]. Therapy for prolapse of the vagina, cervix, and uterus in cows has included the oral administration of crushed *cactus* mixed with buttermilk K (Vankar, 1994) [66], fruit juice of Citrus medica mixed with powdered *Cuminum cyminum* fruits (Ali, 1999) [1], paste of the entire plant of *Gomphrena serrata* (Ali, 1999) [1], leaf paste of *Trichodesma indica*, and decoction of root suckers of *Phoenix acaulis* (Ali, 1999) [1].

Endometritis

Therapy with *Cuminum cyminum and Raphanus sativus* is highly effective in subclinical endometritis, whereas its efficacy is reduced in clinical cases of endometritis (Elamaran *et al.*, 2018) [17]. Endometritis is widely treated with *Tinospora cordifolia*, and administration of 50 ml (3000 mg total dose) of aqueous extracts of *Tinospora cordifolia* to endometritic cows for 3 consecutive days has recovery and conception rates of 66.67% and 27.27%, respectively (Kumar *et al*., 2004 and Sharma *et al.*, 2018) [33, 58]. Rautela *et al*. (2018) [52] proved that in endometritic dairy cows, feeding with *Aegle marmelos* (Bael) and *Morraya koenigii* (Kadipatta) decreases inflammation and bacterial load while simultaneously raising endogenous antioxidant levels. Appropriate proportions of *Samudri jhaga* and *Curcurbitmo schotopoir* (Kashiphal) are used to counter endometritis (Singh *et al.*, (2021) [16].

Abortion

Paste prepared from bark of *Bridelia retusa* (L.) Spreng is given orally to cattle to prevent abortion (Lakshminarayana *et al*., 2013) [35]. Leaf paste of *Corchorus depressus* (Bahuphali) mixed in water with flour of *Hordeum vulgare* (Barley) and orally fed to avoid abortion. Roots of *Trifecta pentandra* are used in abortion in the Marathawada region of Maharashtra (Deshmukh *et al*., 2011) [11]. In the Nandurbar district of Maharashtra, root decoction is mixed with rice and fed to cattle twice a day for 3 days to prevent abortion (Gavale *et al.*, 2020) [19]. Root, seeds, and oil cakes of *Brassica campestris* and *Gossypium arboretum* are used to check abortion in animals in Himachal Pradesh (Sehgal *et al.*, (2013) [55]. Plants such as *Pandanus odoratissimus* and *Viburnum foetidum* are used as prophylaxis for abortion (Nadkarni, 1954) [44].

Delayed puberty

To treat delayed puberty, the Konar community in Tamil Nadu fed a paste made from the leaves of *Citrullus colocynthis*, *Aloe vera*, *Aristolochia indica*, *Lawsonia inermis* (Mehndi), and *Leucas aspera* (Tamba) separately. According to the Konar community, a very effective way to cure delayed puberty is to feed cooked rice mixed with the rhizome paste of *Curcuma longa* or chop flowers of *Musa paradisiaca* (Keli) (Jaykumar *et al.*, 2018) [24]. In delayed pubertal cattle heifers, the addition of *A. marmelos* and *M. koenigii* (curry leaves) leaf powder resulted in a higher percentage of behavioral estruses (92.3%) in between days 4 and 26 after the start of treatment. (Dutt *et al.*, 2018) [15].

Promotion of ethnoveterinary practices

It is important of trained and equip ethnoveterinary practitioner with modern technique, practice and knowledge to promote the ethnoveterinary practice at community level (Toyang *et al.*, 1995) [45]. The conference on ethnoveterinary held in Pune on 4th to 6th November 1997 is a one of the first attempt in promoting the ethnoveterinary practice in India (Mathias *et al.*, 1999) [37]. In 2001 programme for revitalizing traditional ethnoveterinary practice has been initiated by Foundation for Revitalization of Local Health and tradition (FRLHT), Bangalore in collaboration with National Dairy Development Board (NDDB) and many field based non-governmental organizations in south part of India. With a focus on ethnomedicines for both humans and animals, governments should place a high priority on the revitalization, promotion, and support of community-based informal education that preserves cultural and traditional values. Other methods can be used to promote ethnoveterinary practice are Awareness campaigns, Training programmes, Research and Documentation, International collaboration etc.

Conclusion

Local knowledge and practices are being replaced by external development, leaving communities unable to afford or access new techniques. Unsustainable development programs have left locals in limbo, leading to a loss of indigenous knowledge. In addition, the problem of antibiotic and drug residue in food products is being caused by the indiscriminate use of allopathic practice, which is leading to the emergence of resistant strains of organisms. In addition to the financial obstacles faced by allopathic medicine, technological advancements, and other issues of this nature, ethno-veterinary practice can surpass them all. The native Indian

tribes of India have a wealth of knowledge regarding ethnoveterinary procedures, but this important information is kept within these communities. Thus, for the sake of both human and animal welfare, it is imperative that this knowledge be disseminated globally.

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