

The use of ethnoveterinary medicine in treating cattle's milking diseases

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World Journal of Advanced Research and Reviews, 2022, 14(01), 075–079

Publication history: Received on 26 February 2022; revised on 30 March 2022; accepted on 01 April 2022

Article DOI: <https://doi.org/10.30574/wjarr.2022.14.1.0282>

Abstract

Ethnoveterinary medicines deal with the beliefs, knowledge, methods, practices, and skills of the people in maintaining the health of the animals. Ethnoveterinary medicine includes the use of medicinal plants or herbs to prevent and treat the diseases of livestock. The practice of the traditional system is very common in areas where the availability of modern veterinary medicines is rare. For decades the use of antibiotics is preferred for treating mastitis, but the use of such drugs is associated with human health concern. So, an alternative approach of using herbal drugs for treating bovine mastitis is preferred. In the cattle business, herbal plants are utilized for the treatment of dairy cattle sicknesses. Ethnoveterinary medicines can offer many chances in the development of new drugs and hence additional research is required for proper analysis of medicinal plants to be used as ethnoveterinary medicines. The current review paper has explored many data on the uses of herbal plants in ethnoveterinary practices for treating mastitis of dairy lactating cows. This study provides scope in understanding the concepts of traditional veterinary practices and the potential of herbal plant-based crude drugs.

Keywords: Dairy cow; Galactagogue; Herbal products; Mastitis; Milk production

1. Introduction

Milk obtained from an animal source especially a cow has been used as food by people all around the world. So, it is considered as one of the important products in food industry. Dairy products contain a lot of essential nutrients which is required for a healthy and balanced diet. The nutrients in dairy products includes vitamins, minerals, oleic acid, omega-3 fatty acids and bioactive compounds like antioxidants. All these sources help in maintaining growth, development and certain physiological functions of the body (1). The increase in consumption of milk by humans has increased the demand of the high quality of feed for the lactating dairy cows. In India the milk production is still very low when compared to other countries and that is due to certain factors like poor farming practices, non-availability of quality feed to the dairy cows and small-scale production units (2). Mastitis is known to be the most expensive and predominant diseases which occurs in dairy cattle around the world. Various species of bacteria, yeast and, algae are known to be the causative agent for mastitis. The mastitis disease is characterized by swelling of the mammary glands which can be of short period or extended till the completion of lactation periods, resulting in decreased production of milk. Mastitis causes a major loss to the dairy industry by reduced yield of milk, poor quality of milk, extra labor and, additional expenses on the treatment of the affected cattle (3). The usage of milking machines also causes trauma to the teat tissues and acts as a major factor for mammary glands infection. Treatment of mastitis infection is carried out by antibiotics in feed in order to improve animal performance however antibiotic feed and injection have caused concern to consumers due transmission of antibiotic residues in milk. So, the use of antibiotics in animal feed is banned in many countries due to concern of antimicrobial resistant factors from milk products to consumers (4). So, an alternative approach like the use of various herbal preparations, drugs, mineral supplements and, hormones have gained interest to restore animal productivity and to gain more profits. Galactagogues are medications which helps in maintaining the

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quality and efficiency of milk. They can be of synthetic, plant derived or endogenous origin. Various therapeutics have been used for the treatment of mastitis which includes medicinal plants, nanoparticles, bacteriocins, and homeopathy. But there is a need for continuous monitoring of dairy products to maintain consumer's health because most of the hazardous compounds enter into the dairy food chain either by intake of contaminated feed or by administration of veterinary drugs. Certain plant compounds also enter the food chain some of them may be harmful to humans while some may be useful (5). So, the objective of this review is to describe and discuss about the ethno veterinary drugs in treating clinical and sub-clinical mastitis. Additional information on the improvement of milk production, detection of bovine mastitis causing pathogens and other treatments for bovine mastitis which is currently being used is also discussed.

2. Bovine Mastitis

Mastitis is a common disease of dairy cows which is widespread not only during the lactation period but also during dry period. It is broadly divided into two types: 1) Clinical mastitis and 2) Subclinical mastitis and the methods used to monitor these two types of mastitis includes: Clinical inspection and somatic cell count. Clinical mastitis is a common disease of cattle which causes harmful effects on dairy herds. It is characterized by some visual signs like hardness and swelling of the teats and clotting of milk which gradually decreases milk reduction and alter the quality of milk. Subclinical mastitis is an inflammation of the udder, there will no visible changes that is the cows do not show any symptoms. It is one of the major causes for reduced yield and poor quality of milk causing economic loss to the farmers (6). Mastitis is mainly caused by some pathogenic microorganisms which is found in the environment and these microorganisms reduces the quality of milk and on severe cases leads to death of the cattle which cause a huge loss to the dairy industries (7). *Streptococcus sp.*, and *Staphylococcus aureus* are contagious pathogens that survives and proliferates on the skin and teat wounds, whereas other environment microorganisms like *Escherichia coli*, *Streptococcus uberis* and other coliforms are not retained on the skin. These bacteria release toxins and damage the mammary gland cells of the dairy cows (8). In case of mastitis the somatic cells (epithelial and leucocyte cells) that is secreted in the milk increases due to the migration of neutrophils and the increased number of somatic cells in the milk is monitored using California Mastitis Test kit. Recently, Nagasawa *et al.*, 2020 (9) generated an Immuno Chromatographic Strip (ICS) coated with anti-ribosomal protein L₇/L₁₂ for detecting bovine mastitis causing *Staphylococcus aureus* from milk sample. This type of ICS can rapidly detect highly sensitive *S. aureus*. These on-going studies on the development of new ICS method can contribute to rapid diagnosis of bovine mastitis disease.

3. Ethnoveterinary Medicines

Ethnoveterinary medicines is a form of traditional knowledge that is being used in maintaining the health of the cattle. Rural people of India completely rely on the use of traditional medicines for their well-being and to treat diseases. This traditional knowledge is passed through verbal communication from one generation to the other. Different types of herbal plants have known to play an important role in Indian medication. Utilization of plants to cure various diseases of human beings and animals is in practice since decades as plants have the ability to act against several types of diseases. Ethnoveterinary herbal medicines relies upon the use of whole plant, seeds, leaves, roots, fruits and flower (10). Herbal extracts can act as antioxidant, antibacterial, antifungal, and anti-carcinogenic factors in preventing the livestock's disease and thereby increasing the quality and quantity of milk. The antimicrobial activity and the effects of some herbal extracts is given in (Table 1). These herbal substances which increase the supply of milk are known as galactagogues. The term galactagogue was termed by Bergman and Turner in 1940 as the substance which induces lactation. Galactagogues can be synthetic or plant derived substances which is becoming more popular due to drawbacks of using antimicrobial growth promoters in animal feed (11). Herbal formulations can be made using crude extracts, alcoholic extracts, different parts of plants, essential oil, purified phytochemicals, alkaloids, flavonoids and lipid rich extracts. Based on the effectiveness of each herb, they can be combined to obtain a better therapeutic for treating bovine mastitis. A wide range of traditional herbs like *Silybum marianum*, *Pimpinella anisum*, *Euphorbia lancifolia* and *Linum usitatissimum* are used as galactagogues to improve milk production. But certain herbs called as anti-galactagogue can be toxic as their constituents are excreted in milk residues (12) (4). There are a number of herbal extracts which is universally recognized for the treatment of clinical and sub-clinical mastitis in dairy lactating cows of which the most reported herbal plants include *Allium sativum*, *Curcuma longa*, *Brassica oleracea* and *Ocimum sanctum*. The Essential oil obtained from these herbal plants has the ability to increase cell membrane permeability and can cause cytoplasmic coagulation which finally results in cell lysis (6). So, herbal products obtained from various sources are considered as safe, eco-friendly and cost effective with no side effects. It can be used to improve milk products and can also treat various diseases of cattle. In developing countries use of medicinal plants in treatment of livestock's disease is significant due to less or minimum access to modern medicines. Thus, ethnoveterinary medicines poses an easier, and sustainable alternative to synthetic and pharmaceutical drugs.

Table 1 Recent study on the antimicrobial activity and effects of herbal extracts

S. No	Herbal product	Mode of extract	Antimicrobial activity	Effects of herbal product	Ref
1	<i>Moringa oleifera</i> /Turmeric/ Common salt & <i>Ocimum sanctum</i> /Honey/Lemon juice	Leaf extract	<i>Pseudomonas aeruginosa</i> , <i>Staphylococcus aureus</i>	Increased fat content in milk and increased haemoglobin	(13)
2	<i>Angelica dahurica</i> and <i>Rheum officinale</i>	Ethanol extract	<i>Streptococcus spp.</i> , <i>Escherichia spp.</i> , <i>Staphylococcus spp.</i> , <i>Streptococcus dysgalactiae</i>	Helps to maintain normal histopathology of mammary gland, Detoxifying and heat-clearing properties	(8)
3	<i>Brassica oleracea</i>	Purified phytochemical	<i>Staphylococcus aureus</i> , <i>Escherichia coli</i> , <i>Klebsiella pneumoniae</i>	Can be used as mammalian herbal cocktail to treat mastitis by interfering in mechanism of MTOR and TP53	(14)
4	<i>Sauropus androgynus</i> , <i>Curcuma xanthorrhiza</i> , <i>Alpinia galanga</i> , <i>Curcuma domestica</i> , <i>Piper betle</i>	Leaf extract	Bacteria	Ensures high safety and quality of milk	(4)
5	<i>Allium sativum</i> , <i>Oryza sativa</i> , <i>Triticum aestivum</i> & <i>Bunium persicum</i>	Plant extract	<i>Staphylococcus aureus</i> , <i>Escherichia coli</i> , <i>Klebsiella pneumoniae</i>	Can act as a potential candidate in developing new veterinary drugs with less side effects and reduced cost	(15)
6	<i>Ocimum sanctum</i>	Hydro-alcoholic extract	<i>Staphylococcus aureus</i> , <i>coagulase negative Staphylococcus (CNS)</i> , <i>Escherichia coli</i> , <i>Corynebacterium spp.</i> , <i>Streptococcus sp.</i> , <i>Klebsiella spp.</i>	Can act as therapeutic in treating mastitis in lactating dairy cows	(16)
7	<i>Glycyrrhiza glabra</i> , <i>Curcuma longa</i> , <i>Tinospora cordifolia</i> , <i>Psoralea corylifolia</i> , <i>Argemone Mexicana</i> , <i>Asparagus racemosus</i> , <i>Vermonia anthemintica</i> , <i>Emblica officinalis</i> & Neem extract	Plant extract	Coagulase positive <i>staphylococci</i> , Coagulase negative <i>staphylococci</i> , <i>Bacillus spp.</i> , <i>Corynebacteria spp.</i>	Elimination of intramammary infection	(17)
8	<i>Thymus vulgaris.</i> , <i>Origanum vulgare.</i> , <i>Origanum majerana.</i> , <i>Mentha piperita</i> & <i>Allium ursinum</i>	Stem, leaves and inflorescence	<i>Prototheca zopfii</i>	Possess anti-algae activity and used as natural agent for prophylaxis in animals	(18)

9	<i>Aloe barbadensis</i>	Methanolic extract	<i>Staphylococcus aureus</i> , <i>Escherichia coli</i> , <i>Streptococcus uberis</i>	Used in the development of pharmaceutical formulations for bovine mastitis	(19)
10	<i>Terminalia chebula</i>	Ethyl acetate extract	<i>Staphylococcus aureus</i> , <i>Pseudomonas aeruginosa</i> , <i>Escherichia coli</i> , <i>Bacillus sp.</i>	Can be used as an alternative to antibiotics for sub-clinical mastitis	(20)

4. Other Treatments for Bovine Mastitis

Nanotechnology is a fast-growing field in science due to its promising antimicrobial activity. Nanoparticles can be used in the treatment of mastitis as they are less toxic to mammary gland tissue. There are many types of nanoparticles used as antimicrobial agents in treating mastitis of which metallic nanoparticles are the most promising substitute possessing good antimicrobial properties and it currently draws interest in researchers due to the increased development of resistant strains (21). Similar alternative therapy for clinical and sub-clinical mastitis is the use of bacteriocins. Bacteriocins are proteinaceous antimicrobial compounds which is produced by various Gram-positive and Gram-negative bacteria to fight against other microorganisms. Bacteriocins are released extracellularly and it can inhibit the growth of disease-causing strain. Nisin compound has been approved by FDA to be used as a disinfectant in dairy cattle. Bacteriocins are widely preferred in veterinary medicines for preventing intramammary infections of cattle caused by *Streptococcus uberis*, *Streptococcus dysgalactiae* and *Staphylococcus aureus* (22). Another alternative treatment for mastitis is the administration of homeopathic medicines which offers a great advantage as it can be added in drinking water or feed thereby avoiding stress on animals. Intake of homeopathic medicine stimulates the immunity thereby increasing the quality of milk and reduces somatic cell count, other microorganisms present in the milk and percentage of clinical and sub-clinical mastitis. These findings offer a potential benefit in controlling mastitis of dairy cows (23).

5. Conclusion

Dairy production was found to be the important source of economy that contributes in improved food safety and increased nutrition of consumers. The demand of dairy products occurs due to various reasons which includes increased cost of feed, high cost of veterinary medicines and occurrence of various diseases in dairy cattle which gradually decreases dairy production. Mastitis in dairy cattle is one among the major diseases affecting the production of milk, so there is an immediate need for alternative therapies for treating bovine mastitis. In this direction extensive studies are required in discovering the potential of various medicinal plants around the world. Plant based drugs acts as a promising source in producing new antimicrobial agents against bovine mastitis as plants possess excellent antioxidant, anti-inflammatory and antimicrobial activity thereby increasing the immunity of cattle against various pathogens. From the overall view obtained by this study shows that the herbal preparations can be utilized as an alternative for bovine mastitis in enhancing the efficiency of milk yield and overall health performance of the livestock.

Compliance with ethical standards

Acknowledgments

The authors would like to thank for all the support rendered by Department of Science and Technology (DST) and Thiruvalluvar University.

Disclosure of conflict of interest

The authors certify that they have no conflict of interest exist in the subject matter or materials discussed in this manuscript.

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