Review of Medicinal Plants Used in the Management of Bovine Mastitis in Southern Africa

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ABSTRACT

Bovine mastitis is internationally standard as the greatest shared and expensive infection distressing dairy herds. The infection reasons massive financial harms to dairy businesses by reduced production and milk worth, deaths and discarding of affected cows and also by related treatment expenses. Antibiotics are measured to be the primary excellent in the cure of the infection. Nevertheless, the difficult of antibiotic excess and antimicrobial struggle, in accumulation to the effect of antibiotic misuse on public health, leads to many limitations on unrestrained antibiotic treatment in the dairy sector globally. Therapeutic plants with their entrenched past are an exceptional natural product reserve used as an substitute therapy. Antibacterial agents from plants can act as significant foundations of innovative antibiotics, efflux propel inhibitors, mixtures that target bacterial virulence or can be used in combination with current treatments. The plants procedure an indispensable element of ethno-veterinary medicine practise in the cure of diverse infections like bovine mastitis.

INTRODUCTION

Bovine mastitis is the inflammation of the mammary glands in dairy cows, began by incursion and obliteration of the milk making tissues by pathogenic microorganisms [1]. Mastitis reasons for monetary costs to dairy industries through reduced milk return, poor milk worth, improved discarding and also due to additional expenditures on treatment and extra labour [4,6]. Mastitis is a multifactorial inflammatory infection of the mammary gland categorised as one of the periparturient ailment of dairy cows [8]. This intramammary infection is greatest generally initiated by bacteria such as Streptococcus agalactiae, Streptococcus dysgalactiae, Streptococcus uberis, Staphylococcus aureus, Corynebacterium bovis, Staphylococcus epidermidis, Escherichia coli, Klebsiella sp., Enterobacter aerogenes, Mycoplasma sp. and coagulase negative Staphylococcus [2,3,5,7]. Periparturient infections remain to be the highest challenge to both farmers and dairy cows. They are related with a reduction in production, lower profitability and have a negative influence on cows' health as well as public health [9,10]. Mastitis is primarily accomplished by means of injectable and intermammary quantities of antibiotics throughout contagion and also through the drying period [6]. Nevertheless, the confidence on antimicrobials for the treatment and control of mastitis has occasioned in increasing anxiety over the hazard of antimicrobial resistance (AMR) and overview of antibiotic deposits into the food chain [13]. Further, growing public attentiveness and monitoring consideration focussed toward food security concerns highlights the necessity for the dairy industry to proactively discourse and remove emerging food security productions that may destructively effect the image of dairy products [7,11]. As such, due to public health concerns, as microbial struggle and antibiotic remains connected with dairy herds, animal agriculture must prudently scrutinize on how antimicrobials are castoff and adopt good stewardship practices intended to decrease the risk of evolving resistant bacteria that could be transferred among animals and to humans [3]. The increase in challenges in the dairy marketplace principals to lessons to intensification on food refuge and environmentally maintainable production. From

this perception, the usage of mountable substitute foundations, such as plant extracts and essential oils (EOs), may symbolise a favourable marginal to artificial treatments. The objective of this analysis is to deliberate the use of plant extracts and EOs as replacements for the control of mastitis in dairy cattle, with a focus on effectiveness of studied plants and plant based products and possible implications on the use of these products in the veterinary area.

LITERATURE SEARCH

The Prisma strategies to do our literature examination were followed [2]. I precisely evaluated the scientific literature composed from the Scopus, Science Direct, PubMed, Ovid and Research4Life databases with search complemented with Google Scholar progressive exploration. The investigational articles painstaking were from 2016 to 2023 covering the antibiotic resistance disaster period which christened for collaborate global explanation to antibiotic resistance generating widespread inquiry. The period preceded the 'Stewardship era' with powerful activity to pursue ground-breaking replacements to contest resistance concerns [1].

Economic significance

The damages due to mastitis were roughly 49% due to loss of charge of milk and 37% remaining to veterinary expenditures. The price of pay for an treatment animal embraces charge of drug (31%) and services (5.5%). Losses were relatively greater in cross-bred cattle due to their extraordinary production possible that was affected throughout mastitis period. In South Africa, in the year 2015, it is projected that an yearly milk damage of 46 190 L treasured at ZAR 205 544.84 occurred in a specific people anywhere all the lactating cows have raised somatic cell counts (SCC) [14] . A study has also exposed an approximation of the total cost per mastitic cow per year in South African dairy farms to be on regular ZAR 919.96 with an average incidence of 0.9 cases/cow/year [13].Further current statistics are not enthusiastically accessible, perhaps owing to the observation that in most countries, including South Africa, clinical mastitis cases are not extensively and customarily recorded [13].Existing assessments of the prevalence and predominance of mastitis in the population are a criterion for the valuation of its tangible cost to the dairy industry

Diagnosis

Precise analysis of mastitis is crucial in the dairy industry, equally for public health and monetary explanations, and for animal wellbeing. To avoid the onset of the infection, the analysis must be premature, precise, and swift, as essential administration and treatment. There are two types of investigative tests, predictable and progressive. Predictable diagnostic tests are frequently qualitative, with lower specificity and sensitivity, while advanced tests are quantitative, highly specific, and sensitive [18]. Diagnosis encompasses two steps, the determination of the incidence or lack of the infection and then the documentation of the aetiological agent [19]. In the case of clinical mastitis, the diagnosis is less multifaceted because infection eminence is indicated by the swollen quarters and poor milk eminence; mutually can be distinguished by agriculturalists [20]. Subclinical mastitis cannot be visually established and on-farm screening tests are used traditionally, such as somatic cell count (SCC), California mastitis test, and Surf field mastitis test [21,22]. Given the widespread assortment of pathogens that source mastitis, premature and correct identification of the bacteria involved is critical for both control of the disease's spread and proper antibiotic choice for beneficial resolutions [7]. Nowadays, thanks to the improvement in sensitivity and specificity, PCR is considered the gold standard, while in the past microbial culture has been used [23].

Prospecting medicinal plants

Prospecting is the finding of natural yields that have a beneficial pharmacological application [20]. In numerous circumstances, bioprospecting encompasses the exploration for advantageous biological complexes in regular harvests like microorganisms, plants, and fungi that grow in great environments, such

as rainforests, deserts, and hot springs [21]. Natural products customarily replaced as main foundation for extra than 80% of the medication materials and even today hold an significant place in the medicine.

Chemical sub stain in medicinal plant that used

The discovery, substantiation and isolation of alkaloids from poppy, ipecacuanha, strychnos, quinine, pomegranate, and other plants, followed by the isolation of glycosides, marked the beginning of scientific pharmacy (Petrovska, 2012). With the upgrading of the chemical methods, other active substances from medicinal plants were also discovered, such as tannins, saponosides, etheric oils, vitamins, hormones, etc (Richardson, 2022). Some examples of bioactive compounds are carotenoids, flavonoids, carnitine, choline, coenzyme Q, dithiolthiones, phytosterols, phytoestrogens, glucosinolates, polyphenols, and taurine. Since vitamins and minerals elicit pharmacological effects, they can be categorized as bioactive compounds as well.The phenolic compounds are one of the main and most ubiquitous groups of plant metabolites [16]. They acquire biological properties such as antiapoptosis, antiaging, anticarcinogen, antiinflammation, antiatherosclerosis, cardiovascular fortification and enhancement of endothelial function, as well as inhibition of angiogenesis and cell proliferation activities [17]. More than a few studies have described the antioxidant properties of medicinal plants which are rich in phenolic compounds [18,19]. Ordinary antioxidant primarily come from plants in the form of phenolic compounds such as flavonoid, phenolic acids, tocopherols etc [20]. Tannins bind to proline rich protein and interfere with protein synthesis. Flavonoids are hydroxylated phenolic substances known to be synthesized by plants in response to microbial infection and they have been found to be antimicrobial substances against wide range of microorganisms in vitro. Their action is probably due to their capacity to complex with extracellular and soluble proteins and to complex with bacterial cell wall [21]. The plant extracts were also exposed to contain saponins which are known to produce inhibitory effect on inflammation [25]. Saponins has the possessions of precipitating and coagulating red blood cells. Some of the quality of saponins include formation of foams in aqueous solutions, hemolytic activity, cholesterol binding properties and bitterness [26,24]. Steroids have been reported to have antibacterial properties [27] and they are very important compounds especially due to their relationship with compounds such as sex hormones [28]. Alkaloids have been coupled with medicinal uses for centuries and one of their common biological properties is their cytotoxicity [29], and its absence in 66% of water extracts justify the belief about the safety of water as a main solvent in traditional medicine. Several workers have reported the analgesic [30,14], antispasmodic and antibacterial [26,30] properties of alkaloids. Glycosides are known to lower the blood pressure according to many reports [27]. Since various phytoconstituents such as tannins, saponin, flavonoids, and alkaloids are present in the present study, which singly or in combination show the potential defences mechanism against pathogens [30].

Antimicrobial studies of plants or plant derived molecules against mastitis

Though plants are extensively used against diverse animal infections containing bovine mastitis, there are restricted reports accessible on the pharmacological study of medicinal plants used in the control of mastitis. Further down contemporary a momentary assembling of some of the literature reports available on the consideration of therapeutic plants for their probable use against bovine mastitis.

Ethnoveterinary Herbal Medicines Used Against Mastitis

Plant	Pathogen	Source
Acacia nilotica (bark and leaves), Aloe arborescens (leaves), Crassula multicava (whole plant), Tetradenia riparia (flowers and leaves),	Staphylococcus aureus, Streptococcus agalactiae, Streptococcus uberis, Staphylococcus chromogenes, Staphylococcus epidermidis, Klebsiella pneumonia,	[13]

	Pseudomonas aeruginosa, Proteus mirabilis, Proteus vulgaris, Enterobacter aerogenes	
Antidesma venosum, Elaeodendron croceum, Erythrina caffra, Indigofera frutescens, Pleurostylia capensis, Searsia lancea, Searsia leptodictya, Trichilia emetica and Ziziphus mucronata	Staphylococcus chromogenes Staphylococcus haemolyticus Staphylococcus epidermidis	[24]
Maytenus undata, Maurocenia frangula, Kalanchoe gunniae and Bryophyllum pinnatum	S. epidermidis S. aureus	[12]
C. microphyllus and P. chinensis	S. aureus	[14]
Ximenia caffra Sond. Myrothamnus flabellifolius Welw. Allium sativum L, and Cinnamomum verum J.Presl.	Staphylococcus aureus and Klebsiella pneumoniae.	

Studies

In current centuries, investigation group has remained working on the assessment of customarily used therapeutic plants of South Africa in the control of bovine mastitis. Throughout these primary studies, have weighed some therapeutic plants for their antimicrobial potential against important mastitis pathogens.

Future scope

Widespread bioprospecting studies are desirable in this bearing to determine the wonderful medicinal potential of numerous plant species from biodiversity rich areas of the world. The therapeutic plants used as an different therapeutic decision against bovine mastitis can act as antibacterial, anti-inflammatory or immune-modulatory agents which need to be discovered. As significant oxidative impairment happens in the mammary glands during bacterial contagion in mastitis, there are also likely.

Declarations

N/A

Ethical approval

Not applicable

Consent for publication

I am the only author

Availability of data and material

N/A

Competing interest

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Only ones author work to the study

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