REVIEW ARTICLE
JIVA 18 (1) April 2020

Received: 05-04-2020
Accepted: 30-04-2020

USAGE OF HERBS AND SPICES IN ETHNO-VETERINARY PRACTICE: A REVIEW

Puhle Japheth K.[1] and Kumaresan A.[2*]

[1]Assistant Professor, Livestock Production Management, IIVER, Rohtak-124001, Haryana,
[2]Principal Scientist, Theriogenology Laboratory, Southern Regional Station of ICAR-NDRI, Adugodi, Bangalore-560030, Karnakata, India.
**Corresponding author: A.Kumaresan@icar.gov.in*

ABSTRACT

In veterinary practice, especially in developing countries, antibiotics are being commonly used for treatment of different ailments. Owing to increased consumer awareness and scientific developments to quantify the antibiotic residue in animal products, and the implications of the antibiotic residue on human health and antibiotic resistance, now-a-days alternatives to antibiotics are being searched. Ethno-veterinary practice based on traditional wisdom might be an alternate for usage of antibiotics in veterinary practice. This is expected to facilitate clean, green and environment friendly animal production and reduce the usage of antibiotics to the maximum possible extent. Use of herbal ingredients as a feed additive or for treatment purpose is preferred due to its natural constituent of a variety of beneficial molecules, absence of residual effects, non-hazardous and eco-friendly with minimum problem of drug resistance. In this review, it is aimed to summarize the information on experimental knowledge on efficacy, possible modes of action, and aspects of application of phyto-medicine as feed additives in ruminant as well as on non-ruminant animals. The medicinal properties such as appetizers and digestion stimulant, galactagogue, growth promoter, anti-oxidant, anti-microbial, anti-inflammatory, immune-modulators, anti-cancer and the effects of various herbs on reproductive performance of animals are also discussed.

Keywords: Herbs, spices, anti-inflammatory, anti-oxidant, immune-modulation, farm animals

INTRODUCTION

In the last few years, there has been an increased demand for herbal medicine

because of their natural origin and less side effects. Many traditional medicines in use are derived from medicinal plants. The traditional and ethno-veterinary practices have been in use for centuries. These herbal products are easily accessible, easy to prepare and administer with little or no cost at all. Due to development of antibiotic resistance by the bacteria (Verma *et al*., 2007; Lambey *et al*., 2009; Kumar *et al.,* 2011; Verma *et al.,* 2012), efforts are being directed towards immune-modulation so that the animal combats the infection using the natural mechanism. Ethno-veterinary medicine deals with people's knowledge, skills, methods, practices and beliefs about the care of their animals and to keep them healthy, which are acquired through practical experience and has traditionally been passed down orally from generation to generation (Toyang *et al*., 2007). In the era of emerging antibiotic resistance and residual effects in food products, food safety concern, Ethno-veterinary medicine can play a substantial role for safeguarding health of humans and animals. Herbal medicines have always been a form of therapy for livestock among resource poor smallholder farmers in developing countries (Mizaei-Aghsaghali, 2012). The published information about uses of different herbs and spices to improve the immunity and as a treatment of different conditions in farm animals is compiled and discussed below.

Herbs and spices as appetizer and digestion stimulants

Different herbs and spices affect digestion processes differently. They have wide variety of active components; most of them stimulate the secretion of saliva. It has been reported that dietary supplementation of turmeric (*Curcuma longa*) in pigs improved feed conversion ratio (Laing and Wongtangtintharn, 2013). Dill (*Anethum graveolens*) has been reported to have properties such as carminative, stomachic and diuretic (Hosseinzadeh *et al*., 2002; Amin and Sleem, 2007). Cumin possesses numerous medicinal properties such as astringent that benefits the digestive apparatus and acts as stimulant of the sexual organs. There is evidence to suggest that herbs, spices and various plant extracts possess appetite and digestion-stimulating properties (Lavinia *et al*., 2009). Curcuma, cayenne pepper, ginger, anis, mint, onions, fenugreek, and cumin enhance the synthesis of bile acids in the liver and their excretion in bile, which beneficially effects the digestion and absorption of lipids. A majority of these spices stimulate the function of pancreatic enzymes (lipases, amylases and proteases), while few increase the activity of digestive enzymes of gastric mucosa (Frankic *et al*., 2009). It is also reported that supplementation of garlic, fenugreek,

Nigella sativa and camomile to Zaraibi goat improved the digestibility coefficients of dry matter, organic matter, and crude protein (Allam *et al*., 1999). Combination of herbal preparations (*Leptadenia reticulata, Nigella sativa, Foeniculum vulgare, Pueraria tuberose* and *Asparagus racemosus*) was evaluated and reported to be effective in curing digestive disorders and early restoration of normal milk production in lactating buffaloes (Kumari and Akbar, 2006). Further, it has been reported that combination of cinnamaldehyde, capsicum oleoresin and carvacrol was beneficial for the gastrointestinal ecosystem and gastric emptying in weaned pigs (Manzanilla *et al*., 2004).

Herbs and spices as growth promoter

Feed supplements possessing growth promoting activity increase stability of feed and beneficially influence the gastrointestinal ecosystem. A brown algae *Ascophyllum nodosum* could be a good feed supplement with growth promoting activity of pigs infected with *E. coli* (Turner *et al*., 2002). It was reported that feed conversion was significantly improved in broilers supplemented with a mixture of oregano, laurel, sage, anis and citrus essential oils, and the reason attributed was effective availability of nutrients due to the changes in intestinal ecosystem (Çabuk *et al*., 2006). In another study, the effect of supplementation of mixture of cinnamon, oregano, thyme, cayenne pepper and citrus extracts and a mixture of plant extracts and organic acids was compared with nutritive antibiotic avilamicin in broiler chicken. The authors found that chicken supplemented with plant extracts attained significantly higher body weight than the ones in the control or avilamicin group where higher body weight was attributed as a consequence of increased feed consumption (Lippens *et al*., 2005).

Herbs and spices as galactagogue

In modern Ayurvedic practices, the roots of Shatavari are considered to be effective galactogogue (Thomson, 2002). It is also reported that Shatavari has anti-oxytocic property which is responsible for stabilizing the foetus and preventing the abortion (Nagamani *et al*., 2012). Fenugreek seed is widely used as a galactagogue for nursing mothers to increase breast milk supply (Fleiss, 1988). Supplementation of Galactin® (50 gm/day/animal), a *Shatavari* based polyherbal galactogogue, in lactating crossbred cows showed improvement in milk production (Ramesh *et al*., 2000). It was inferred that the herbal preparation showed galactopoietics activity and could be considered as an alternative for lactogenic hormones for inducing and enhancing milk yield in crossbred cows (Singhal, 1995).

Herbs and spices as immune-modulator

During recent days, plant extracts are being widely investigated for their possible immune-modulator properties across the world. It has been reported that spices such as onion, garlic, mustard, red chilli, turmeric, clove, cinnamon, saffron, curry leaf, fenugreek and ginger have antimicrobial, antioxidant and immune-stimulating property (Rajendhran *et al*., 1998; Tilak and Devasagayam, 2006). The polysaccharides obtained from *Astragalus* root, *Isatis* root, *Achyranthes* root and Chinese Yam, are reported to considerably improve the antibody titre in vaccinated chicken (Hashemi and Davoodi, 2012). Ginseng with its steroidal saponine, has immune-stimulating properties including cytokine production (Interleukin–2, Interleukin-6, Tumor Necrosis Factor-α and Interferon-γ), macrophage activation and lymphocyte activity (Mahima *et al*., 2013). Neem oil can selectively activate the cell mediated immune response by activating macrophages and lymphocytes (Chauhan, 2010). *Withania somnifera* root powder has been reported to prevent cadmium-induced oxidative stress in chicken (Bharavi *et al*., 2010). It was also evident that Amla helps to reduce inflammation and oedema (Baliga and Dsouza, 2011). Oil from Tulsi seeds can modulate both humoral and cell-mediated immunity (Mediratta, 2002). It was suggested that *Angelica sinensis* modulates host immunity through anti-inflammatory, immunomodulatory, anti-oxidative and antithrombotic properties (Yin *et al*., 1980; Zhao and Moghadasian, 2008; Chao and Lin, 2011; Yang *et al*., 2012). The phenolic compounds of Argentinean herbs *Ilexpara guaiensis*, *Lippia integrifolia* and *Mentha piperita* possess antioxidant and antibacterial activities (Vaquero *et al*., 2010). The antioxidant activity of some phenolic compounds in herbs was due to their ability to quench lipid peroxidation, prevent DNA oxidative damage, and scavenge reactive oxygen species (Cao and Cao, 1999; Kahkonen *et al*., 1999). *Isatidis radix* has also been demonstrated to suppress the growth of *E. coli* and *H. pylori* and increased blood neutrophil phagocytosis (Chan *et al*., 2008). Herbal formulations (*Syzygium cumini, Trigonella foenum-graecum, Curcuma longa)* could re-establish the neutrophil functions and lymphocytes proliferation capacity pointing out that they can restore innate immune functions (Bernhardt and D'Souza, 2012).

Herbs and spices as antiinflammatory agents

Eicosanoids, have a major role in various physiological and patho-physiological processes of the body (Lesjak *et al*., 2011). Compounds which possess

antioxidant activity (including plant polyphenols) can exhibit anti-inflammatory activity through the termination of free-radical reactions which take part in arachidonic acid metabolism. Flavonoids have long been recognized to possess anti-inflammatory, anti-allergic, antiviral and anti-proliferative activities (Muanda *et al*., 2011) and helps in healing. Amla has been reported to possess antioxidant and anti-inflammatory property (Chang *et al*., 2012, Park *et al*., 2012). Extracts of curcuma, red pepper, black pepper, cumin, cloves, nutmeg, cinnamon, mint and ginger showed anti-inflammatory effect due to the major active molecules with anti-inflammatory action such as terpenoids and flavonoids that suppress the metabolism of inflammatory prostaglandins (Frankic *et al*., 2009).The roots of Shatavari are also considered to have effective anti-inflammatory activity (Thomson, 2002). Phenolic compounds play an important role in the anti-inflammatory activity of plants (Hyun *et al*., 2015; Jimenez, *et al*., 2015; Zhang *et al*., 2015; Nadpal *et al*., 2016). Turmeric also possesses anti-inflammatory activity and antioxidant activity (Devasagayam *et al*., 2001), and its anti-inflammatory action may be attributed to inhibition of pro-inflammatory leukotrienes, prostaglandins and arachidonic acid, as well as to its neutrophil function during inflammatory states.

Herbs and spices as anti-bacterial agents

The majority of herbal feed additives exert their antibacterial effect by acting on the bacterial cell wall structure, denaturing and coagulating proteins (Kumar *et al*., 2015). It was reported that several species derived from Croton such as *C. dracanoides, C. palanostigma* and *C. lechleri* possess inherent antimicrobial activity and limits the infection. Literature have also reported that dill possess pharmacological effects such as antibacterial (Singh *et al*., 2001; Lopez *et al*., 2005), and anti-mycobacterial (Stavri and Gibbons, 2005) activity. The alcoholic extract of cumin presented a significant inhibition of microorganisms, such as *Bacillus subtilis, Escherichia coli* and *Saccharomyces cerevisiae*. Also, cumin possessed antimicrobial activity as well as inhibits the growth of some fungi in the putrefaction of foods and controls mildew disease (Saksena and Saksena, 1984). Cuminaldehyde (p-isopropil benzaldehyde) present in the dried fruit of this plant possess antimicrobial activity. Minimum inhibitory concentration studies with isolated cuminaldehyde (compared with standard cuminaldehyde) indicate that it is effective upon different microorganisms, including bacterial strains, yeasts and fungi (De *et al*., 2003). The ethanol extract of

ginger also reported to have bactericidal effect, especially against gram positive bacteria (Alzoreky, and Nakahara 2003). Spices such as onion, garlic, mustard, red chilli, turmeric, clove, cinnamon, saffron, curry leaf, fenugreek and ginger also have antimicrobial, immune-stimulating and antioxidant property (Rajendhran *et al*., 1998; Tilak and Devasagayam, 2006).

Herbs and spices as anti-oxidants

It was reported that the antioxidant activity of polyphenols is mainly due to their redox properties that allow them to act as reducing agents, hydrogen atom donors, and singlet oxygen quenchers. Legumes such as soybean (*Glycine max L.*), common bean (*Phaseolus vulgaris L.*), pea (*Pisum sativum L.*), broad bean (*Viciafaba L.*), chickpea (*Cicer arietinum L.*), white lupin (*Lupinus albus L.*) and grass pea (*Lathyrus sativus L.*) were examined for their polyphenolic profile and found to possess antioxidant and anti-inflammatory activities (Sibul *et al*., 2016). Baczeka *et al*. (2017) found that the essential oil and extract of costmary (*Tanacetum balsamita L.*) exhibited strong antibacterial activity while tansy (*Tanacetum vulgare L.*) extracts possessd higher antioxidant potential. High antioxidant potential of tansy extract could be related due to the high content of caffeic, rosmarinic, and ferulic acids (Gulcin, 2006; Sato *et al*., 2011; Munoz-Munoz *et al*., 2013; Bakota *et al*., 2015; Baczeka *et al*., 2017). Metal chelating capacity is significant since it reduces the concentration of catalyzing transition metal in lipid peroxidation (Ilhami *et al*., 2005). Chelating agents (Fenugreek extract), which form o-bonds with a metal, are effective as secondary antioxidants, because they reduce the redox potential thereby stabilizing the oxidized form of the metal ion (Bukhari *et al*., 2008). The stable 1, 1-diphenyl-2-picryl-hydrazyl (DPPH°) radical has been used to evaluate antioxidants for their radical quenching capacity (Williams *et al*., 1995; Hong and Tang, 1997). It was also reported that a significant ($p<0.05$) decrease in the concentration of DPPH^{o} was observed due to scavenging activity of fenugreek extract (Bukhari *et al*., 2008). Curcumin is the main active ingredient in turmeric and its extracts act as free radical scavengers and make effective antioxidants by modulating against oxidative tissue damage through the inhibition of reactive oxygen species (ROS) generation, with no side effect (Osawa *et al*., 1995). The mixture of carvacrol, cinnamaldehyde and capsicum oleoresin was tested for its antioxidative properties and found effectively protected pig's blood lymphocytes against oxidative DNA damage (Manzanilla *et al*., 2004).

Herbs and spices having anticancer property

Several herbal preparations are proved to boost up the immune system and make the body to defend against future or existing cancer. Herbs such as *echinacea, aloe vera*, tulsi, turmeric, shatavar, garlic, aqueous extracts of black pepper and cardamom and their essential oils, derived from different parts of plants are claimed to possess therapeutic properties as an effective anticancer therapy (Boehm *et al*., 2012). Green tea or black tea which contains tumor growth inhibiting factors as well as other polyphenols, vitamin C, carotene, fluoride, zinc, selenium has been shown to have anticancer property (Mahima *et al*., 2012). Phenolic compounds of plants are hydroxylated derivatives of benzoic acid and cinnamic acids and have been reported to possess anti-oxidative and anti-carcinogenic effects. Curcumin inhibits growth of ovarian cancer cells and induce apoptosis in lung cancer cell lines. A mushroom called Ling Zhi (in Chinese medicine) possess anti-cancer property which contains triterpene as the active ingredient and exerted cytotoxicity due to alteration of proteins involved in cell proliferation and or cell death, carcinogenesis, oxidative stress, calcium signaling and endoplasmic reticulum (ER) stress (Majdalawieh *et al*., 2010). The alcoholic extract of *Tinospora cordifolia* has shown to have antitumor effect on the spontaneous T-cell lymphoma and may have some clinical implications (Singh *et al*., 2004).

Herbs and spices as reproductive stimulant

Anestrus

The combination of *Ficus bengalensis, Anethum sowa* and *Asparagus racemosus* contains steroids/ triterpenoids which play a major role in functional deviations responsible for infertility, and also due to presence of steroids along with other phyto-chemicals, plays a possible synergistic role which is important for fertility (Nagamani *et al*., 2012). Anestrous cows treated using Fenugreek at the dose rate of 200gm and *Saraca asoca* at the rate of 50gm resulted in oestrus induction in 83.33 percent of cows with the conception rate of 54.54 percent (Rajkumar, 2004). Further, higher level of estradiol was detected in treated group as compared to control group. The cows and buffaloes treated with Replanta® powder and Replanta® liquid showed post-partum first heat earlier after calving and reproductive cycle was found to be more regularized as compared to other drugs tested (Pandey and Raghuvanshi, 1992).

Uterine infection

Herbal therapy has been reported to be beneficial for the uterine involution following delivery (Ho *et al*., 2011; Chang *et al*., 2013). It was reported that herbal tincture treatment facilitated the uterine recovery process in cows by improving the uterine environment in consequence of an earlier placental detachment and a balanced uterine condition (Cui *et al*., 2014a). "Replanta®" an herbal product was reported to improve breeding efficiency, improved uterine tone and resolving reproduction problems like retention of placenta and other postpartum complications in cows (Koutecka, 1997).

Cyclicity

Recently it has been shown that supplementation of herbal formula (Sheng Hua Tang) consisting of *Radix Angelicae sinensis, Ligustici rhizoma, Semen persicae, Zingiberis rhizoma* and *Radix glycyrrhizae,* is known to be beneficial in alleviating postpartum diseases and facilitating a return to normal reproductive function in cows (Cui *et al*., 2014b). It was also reported that *Herba leonuri* can stimulate uterine contractions (Chan *et al*., 1983; Ma, 2000; Zhao *et al*., 2008), and modulate uterine hemorheology and microcirculation (Liu, 2008). It was also reported that Chinese herbal medicine, Sheng Hua Tang promoted uterine involution and ovarian activity in postpartum dairy cows (Lee *et al*., 2013).

Retention of foetal membranes

Retained foetal membrane is one of the most common puerperal disorders affecting the reproductive performance of dairy cows (LeBlanc, 2008). Herbal tincture extracted from a combination of *Herba leonuri, Angelicae sinensis Radix, Flos carthami, Myrrha* and *Rhizoma cyperi* by percolation with 70 percent ethanol to a concentration of 0.5 g crude herb/ml, facilitated expulsion of retained foetal membrane and improved subsequent fertility (Cui *et al*. 2014a). This could be result of the synergistic effect of *Herba leonuri's* ability to improve uterus conditions (Chan *et al*., 1983; Ma *et al*., 2000; *Angelicae sinensis radix* and *Flos carthami* having immunomodulatory, anti-inflammatory and antithrombotic properties (Zhao and Moghadasian, 2008; Chao and Lin, 2011; Jun *et al*., 2011; Yang *et al.,* 2012), *Myrrh* and *Rhizoma cyperi* having analgesic and anti-inflammatory properties (Dolara *et al*., 1996). The herbal formula of Shang Hua Tang (*Angelica sinensis*, 120.0 g; *Ligusticum chuanxiong*, 45.0 g; *Prunus persica*, 30.0 g; *Zingiber officinale*, 10.0 g; and *Glycyrrhiza uralensis*, 10.0 g.), when administered as a single dose to cows of 600-kg body weight (equal to

0.36 g crude drug per kg body weight) produced beneficial effects in reducing the incidence of retained placenta. It was also reported that, a mixture comprising of 2 kg of pearl millet grain (*Pennisitum americanum*), 100 gm of fenugreek (*Trigonellafoenum graecum*) seeds, 50 gm of *Lepidium sativum*, 25 gm of *Anetium graveolens* and 500 gm of jaggery, helps in expulsion of placenta (Vaghasiya, 2001).

Current scientific evidence suggests that there is significant potential to use plants to enhance immunity and health in animals. To gain advantageous effects of herbs and spices, they can be added to feed as dried plants or parts of plants and as extracts. Numerous researches focused on the classification of the biochemical structures and physiological functions of various feed additives of plant extracts. However, plant extract cannot be easily quantifiable and standardized due to their complex composition. Therefore, future study must be emphasized on quantification and standardization of plant extracts. The well proved beneficial effects of herbs and spices need to be taken to the end users so that they benefit in terms of prevention/ treatment of several ailments that leads to huge loss to them. This, not only would improve the animal health and production but also help the farmers to reduce costs associated with treatment besides reducing the development of antibiotic resistance.

REFERENCES

Allam,S.M., Hoda, M., El-Hosseiny, A.M., Abdel Gawad, S.A., El-Saadany, S.A. and Zeid, A.M.M. 1999. Medicinal herbs and plants as feed additives for ruminants. *Egypt J. Nutr. Feeds special issue,* 349–365.

Alzoreky, N.S. and Nakahara, K. 2003. Antibacterial activity of extracts from some edible plants commonly consumed in Asia. *Int. J. Food Microbiol.* **80:** 223-230.

Amin, W.M. and Sleem, A.A. 2007. Chemical and biological study of aerial parts of dill (*Anethumgraveolens*L.). *Egypt. J. Biomed. Sci.* **23** (1): 73-90.

Baczeka, K.B., Kosakowskaa, O., Przybyła, J.L., Pioro-Jabruckaa, E., Costac, R., Mondellod, L., Gniewoszb, M., Synowiecb, A. and Weglarz, Z. 2017. Antibacterial and antioxidant activity of essential oils and extracts from costmary (*Tanacetum balsamita L.*) and tansy (*Tanacetum vulgare L.*). *Ind. Crop. Prod* .**102**:154–163.

Bakota, E.L., Winkler-Moser, J.K., Berhow, M.A., Eller, F.J. and Vaughn, S.F. 2015. Antioxidant activity and sensory evaluation of a rosmarinic acid-enrichedextract of *Salvia officinalis*. *J. Food Sci.* **80**: 711–717.

Baliga, M.S. and Dsouza, J.J. 2011. Amla (*Emblica officinalisGaertn*), a wonder berry in the treatment and prevention of cancer. *Eur. J. Cancer Prev.* **20**: 225-239.

Bernhardt, V. and D'Souza, J.R.T. 2012. Immunomodulatory potential of herbal medicine in type 2 diabetes mellitus patients as evaluated by neutrophil phagocytic index, serum opsonisation and lymphocyte proliferation rate. *Asian J. Pharm. Clin. Res.* **5**(2): 36-41.

Bharavi, K., Reddy, A.G., Rao, G.S., Reddy, A.R. and Rao, S.R. 2010. Reversal of cadmium-induced oxidative stress in chicken by herbal adaptogens *Withania somnifera* and *Ocimum sanctum*. *Toxicol. Int.* **17**(2): 59.

Boehm, K., Bussing, A. and Ostermann, T. 2012. Aromatherapy as an adjuvant treatment in cancer care: A descriptive systematic review. *African J. Traditional Complementary Altern. Med.* **9**: 503-518.

Bukhari, S.B., Memon, S., Tahir, M.M. and Bhanger, M.I. 2008. Synthesis, characterization and investigation of antioxidant activity of cobalt–quercetin complex. *J. Mol. Struct.* **892**(1): 39-46.

Çabuk, M., Bozkurt, M., Alçiçek, A., Çatli, A.U. and Baser, K.H.C. 2006. Effect of a dietary essential oil mixture on performance of layinghens in the summer season. *S. Afr. J. Anim. Sci.* **36**(4): 215-221.

Cao, Y.H and Cao, R.H. 1999. Angiogenesis inhibited by drinking tea. *Nature* 6726.

Chan, B.C., Hon, K.L., Leung, P.C., Sam, S.W., Fung, K.P. and Lee, M.Y. 2008. Traditional Chinese medicine for atopic eczema: Penta herbs formula suppresses inflammatory mediators release from mast cells. *J. Ethnopharmacol.* **120**: 85−91.

Chan W.C., Wong Y.C., Kong Y.C., Chun Y.T., Chang H.T. and Chan W.F. 1983. Clinical observation on the uterotonic effect of I-mu Tsao (*Leonurus artemisia*). *Am. J. Chin. Med.* **11**: 77.

Chang, P.J., Tseng, Y.C., Chuang, C.H., Chen, Y.C., Hsieh, W.S., Hurng, B.S., Lin, S.J. and Chen, P.C. 2013. Use of herbal dietary supplement Si-Wu-Tang and health-related quality of life in postpartum women: a population-based correlational study. *Evid Based Complement. Altern Med*, doi:10.1155/2013/790474.

Chang, Y.P., Liu, C.H., Wu, C.C., Chiang, C.M., Lian, J.L. and Hsieh, S.L. 2012. Dietary administration of zingerone to enhance growth, non-specific immune response and resistance to *Vibrio alginolyticus* in Pacific white shrimp (*Litopenaeus vannamei*) juveniles. *Fish Shellfish Immunol.* **32**: 284-290.

Chao, W.W. and Lin, B.F. 2011. Bioactivities of major constituents isolated from *Angelica sinensis* (Danggui). *Chin. Med.* **6**(1): 29.

Chauhan, R.S. 2010. Nutrition, immunity and livestock health: Indian cow. *Scient. Econ. J.* **7:** 2-13.

Cui, D., Li, J., Wang, X.Xie, J., Zhang, K., Wang, X., Zhang, J., Wang, L., Qin, Z. and Yang, Z. 2014a. Efficacy of herbal tincture as treatment option for retained placenta in dairy cows. *Anim. Reprod. Sci.* **145** (1): 23-28.

Cui, D., Wang, X., Wang, L., Wang, X., Zhang, J., Qin, Z., Li, J. and Yang, Z. 2014b. The administration of Sheng Hua Tang immediately after delivery to reduce the incidence of retained placenta in Holstein dairy cows. *Theriogenology,* **81** (5): 645-650.

De, M., De, A.K., Mukhopadhyay, R., Banerjee, A.B. and Miro, Y.M. 2003. Antimicrobial activity of *Cuminum cyminum L. Ars.Pharmaceutica.* **44** (3): 257-269.

Devasagayam, T.P.A., Kamat, J.P. and Sreejayan N. 2001. Antioxidant action of Curcumin in micronutrients and health: Molecular Biological Mechanisms. Nesaretnam, K. and Packer, L. (Eds.), *AOCS Press,* U.S.A., p. 42-59.

Dolara, P., Moneti, G., Pieraccini, G. and Romanelli, N. 1996. Characterization of the action on central opioid receptors of furaneudesma-1,3-diene, a sesquiterpene extracted from myrrh. *Phytother. Res.***10**: 81–83.

Fleiss, P. 1988. Herbal remedies for the breastfeeding mother. *Mothering summer,* 68-71.

Frankic, T., Voljg, M., Salobir, J. and Rezar, V. 2009. Use of herbs and spices and their extracts in animal nutrition. *Acta. Agri. Slovan.* **92** (2): 95-102.

Gulcin, I. 2006. Antioxidant activity of caffeic acid (3,4-dihydroxycinnamic acid). *Toxicology,* **217**: 213–220.

Hashemi, S.R. and Davoodi, H. 2012. Herbal plants as new immuno-stimulator in poultry industry: A review. *Asian J. Anim. Vet. Adv.* **7**: 105-116.

Ho, M., Li, T.C. and Su, S.Y. 2011. The association between traditional Chinese dietary and herbal therapies and uterine involution in postpartum women. *Evid. Based. Complement. Altern. Med.* http://dx.doi.org/10.1155/2011/918291.

Hong, C.J. and Tang, H.C. 1997. Antioxidant activities of caffeic acid and its related hydroxycinnamic acid compounds. *J. Agric. Food Chem.* **45**: 2374–2378.

Hosseinzadeh, H., Karemi, G.R. and Ameri, M. 2002. Effects of *Anethumgraveolens L.* seed extracts on experimental gastric irritation models in mice. *JBMC Pharmacol.* **2** (1): 21-30.

Hyun, T.K., Ko, Y.J., Kim, E.H., Chung, I.M. and Kim, J.S. 2015. Anti-inflammatory activity and phenolic composition of *Dendropanax morbifera* leaf extracts. *Ind. Crop. Prod.* **74**: 263–270.

Ilhami, G.I., Haci, A.A. and Mehmet, C. 2005. Determination of *in vitro* antioxidant and radical scavenging activities of propofol. *Chem. Pharm. Bull.* **53** (3): 281-285.

Jimenez, N., Carrillo-Hormaza, L., Pujol, A., Alzate, F., Osorio, E. and Lara-Guzman, O. 2015. Antioxidant capacity and phenolic content of commonly used anti-inflammatory medicinal plants in Colombia. *In. Crop. Prod.***70**: 272–279.

Jun, M.S., Ha, Y.M., Kim, H.S., Jang, H.J., Kim, Y.M., Lee, Y.S., Kim, H.J., Seo, H.G., Lee, J.H., Lee, S.H. and Chang, K.C. 2011. Anti-inflammatory action of methanol extract of *Carthamus tinctorius* involves in hemeoxygenase-1 induction. *J. Ethnopharmacol.* **133**: 524–530.

Kahkonen, M.P., Hopia, A.I., Vuorela, H.J., Rauha, J.P., Pihlaja, K. and Kujala, T.S. 1999. Antioxidant activity of plant extracts containing phenolic compounds. *J. Agric. Food Chem.* **47**: 3954–3962.

Koutecka, L. 1997. Clinical assessment of "replanta" a herbal product for improving breeding efficiency in cows. *Indian J. Indigenous Med.* **19**: 29–33.

Kumar, A., Verma, A.K., Parul and Singh, V.P. 2011. Prevalence and antibiotic profile of bacteria isolates in chicken meat in western UP. *J. Vet. Pub. Health,* **9**: 111-114.

Kumar, M, Kumar, V, Roy, D, Kushwaha, R and Vaiswani, S. 2015. Application

of herbal feed additives in animal nutrition - A review. *Int. J. Livest. Res.* **4**(9): DOI 10.5455/ijlr.20141205105218.

Kumari, R and Akbar, M.A. 2006. Clinical efficacy of some herbal drugs during indigestion in buffaloes. *Buffalo Bull.* **25**: 3–6.

Laing, D. and Wongtangtintharn, S. 2013. Using turmeric (*Curcuma longa*) on the growth performance and carcass quality of monogastrics animal: Review Seminar in Animal Science, Faculty of Agriculture, KhonKaen University, Thailand.

Lambey, H.S., Verma, A.K., Jain, U., Mahima and Bist, B. 2009. Bacteriological quality of chevon and pork in mathura city. *J. Vet. Pub. Health,* **7**: 141-143.

Lavinia, S., Gabi, D., Drinceanu, D., Stef, D., Daniela, M., Julean, C., Ramona, T. and Corcionivoschi, N. 2009. The effect of medicinal plants and plant extracted oils on broiler duodenum morphology and immunological profile. *Rom. Biotechnol. Lett.* **14** (4): 4606-4614.

LeBlanc, S.J. 2008. Postpartum uterine disease and dairy herd reproductive performance: a review. *The Vet. J.* **176**: 102–114.

Lee, K.H., Lee, Y.T., Chen, T.C., Yeh, C.C., Liu, J.Y.Y. and Chi, C.H. 2013. Effects of Sheng Hua Tang on uterine involution and ovarian activity in postpartum dairy cows. *Asian Australas. J. Anim. Sci.* **26** (9): 1247-1254.

Lesjak, M., Beara, I., Orcic, D., Anackov, G., Balog, K., Franciskovic, M. and Mimica-Dukic, N. 2011. *Juniperussibirica burgsdorf*: as a novel source of antioxidant and anti-inflammatory agents. *Food. Chem.* **124**: 850–856.

Lippens, M., Huyghebaert, G. and Cerchiari, E. 2005. Effect of the use of coated plant extracts and organic acids as alternatives for antimicrobial growth promoters on the performance of broiler chickens. *Eur. Poultry Sci* .**6**: 48–56.

Liu, J.H. 2008. Study on the effect of *Herba leonuri* on the uterine micro-circulation in rat. *Proc. Clin. Med.* **1**: 546–548.

Lopez, P., Sanchez, C., Batlle, R. and Nerin, C. 2005. Solid and vapour-phase antimicrobial activities of six essential oils: susceptibility of selected food borne bacterial and

fungal strains. *J. Agric. Food. Chem.* **53** (17): 6939-6946.

Ma, Y., Yang, D., Tian, Z., Qu, S., Ding, Y. and Wei, Y. 2000. Effect of mother wort herb on the myoelectric activity of uterus in rats. *Chin. J. Chin. Mater. Med.* **25**: 364–366.

Mahima, A.M., Ingle, A., Verma, K., Tiwari, R. and Karthik, K. 2013. Immunomodulators in day to day life: A review. *Pak. J. Biol. Sci.* **16**: 826-843.

Mahima, Rahal, A., Deb, R., Shyma, K., Latheef, Samad, H.A., Tiwari, R., Verma, A.K., Kumar, A. and Dhama, K. 2012. Immunomodulatory and Therapeutic Potentials of Herbal, Traditional/Indigenous and Ethnoveterinary Medicines. *Pak. J. Biol. Sci.* **15**: 754-774.

Majdalawieh, A.F., Hmaidan, R. and Carr, R.I. 2010. Nigella sativa modulates splenocyte proliferation, Th1/ Th2 cytokine profile, macrophage function and NK anti-tumor activity. *J. Ethnopharmacol.* **131**(2): 268-275.

Manzanilla, E.G., Perez, J.F., Martin, M., Kamel, C., Baucells, F. and Gasa, J. 2004. Effect of plant extracts and formic acid on the intestinal equilibrium of early-weaned pigs. *J. Anim. Sci.* **82**: 3210–3218.

Mediratta, P.K., Sharma, K.K. and Singh, S. 2002. Evaluation of immunomodulatory potential of *Ocimum sanctum* seed oil and its possible mechanism of action. *J Ethanopharmacol.* **80**: 15-20.

Mizaei-Aghsaghali, A. 2012. Importance of medical herbs in animals feeding: A review. *Annals. Biol. Res.* **3**: 918-923.

Muanda, F.N., Soulimani, R., Diop, B. and Dicko, A. 2011. Study on chemical composition and biological activities of essential oil and extracts from Stevia rebaudiana bertoni leaves. *LWT-Food Sci. Technol.* **44**(9): 1865-1872.

Munoz-Munoz, J.L., Garcia-Molina, F., Ros, E.Tudela, J., Garcia-Canovas, F. and Rodriguez-Lopez, J.N. 2013. Pro-oxidant and antioxidant activities of rosmarinic acid. *J. Food Biochem.* **37**(4): 396–408.

Nadpal, J.D., Lesjak, M.M., Sibul, F.S., Anackov, G.T., Cetojevic-Simin, D.D., Mimica-Dukic, N.M. and Beara, I.N. 2016. Comparative study of biological activities and phyto-chemical composition of two

rose hips and their preserves: *Rosa canina L.* and *Rosa arvensis. Food Chem.***192**: 907–914.

Nagamani, J., Suresh, J. and Reddy, A.V. 2012. Comparative phytochemical screening of Vatashunga, Shatavari and Shatapushpa claimed for Prajasthapana activity. *Ann. Biol. Res.* **3**(3): 1294-1304.

Osawa, T., Suguyama, Y., Inayoshi, M. and Kawakisi, S. 1995. Anti-oxidative activity of tetrahydrocurcuminoids. *Biotechnol. Biochem.* **59**: 1609 – 1611.

Pandey, D.N. and Raghuvanshi, R.P.S. 1992. Comparative efficacy of replanta in dairy cattle and buffaloes. *Indian J. Indig. Med.* **8**(2): 33-37.

Park, S.H., Kyeong, M.S., Hwang, Y., Ryu, S.Y., Han, S.B. and Kim, Y. 2012. Inhibition of LPS binding to MD-2 co-receptor for suppressing TLR4-mediated expression of inflammatory cytokine by 1-dehydro-10-gingerdione from dietary ginger. *Biochem. Biophys. Res. Commun.* **419**: 735-740.

Rajendhran, J., Mani, M.A. and Navaneethakannan, K. 1998. Antimicrobial activity of some selected medicinal plants. *Geobios.* **25**: 208-282.

Rajkumar, R. 2004. Studies on estrus induction efficiency of certain medicinal plants and homeopathic drugs in anoestrus cows, *MV Sc Thesis*, IVRI, Izatnagar-UP, India.

Ramesh, P.T., Mitra, S.K., Suryanarayana, T. and Sachan, A. 2000. Evaluation of 'Galactin ®', an herbal preparation in dairy cows. *The Veterinarian* **24**: 15–17.

Saksena, N.K. and Saksena, S. 1984. Enhancement in the antifungal activity of some essential oils in combination against some dermatophytes. *Indian Perfumer* **28**: 42-45.

Sato, Y., Itagaki, S., Kurokawa, T., Ogura, J., Kobayashi, M., Hirano, T., Sugawara, M. and Iseki, K. 2011. In vitro and in vivo antioxidant properties of chlorogenic acid and caffeic acid. *Int. J. Pharm.* **403**: 136–138.

Sibul, F., Orcica, D., Vasicb, M., Anackovc, G., Nadpala, J., Savicb, A. and Mimica-Dukic, N. 2016. Phenolic profile, antioxidant and anti-inflammatory potential of herb and root extracts of seven selected legumes. *Ind. Crops. Prod.* **83**: 1–13.

Singh, G., Kapoor, I.P.S., Pandey, S.K., Singh, U.K. and Singh, R.K. 2001. Studies on essential oils: Antibacterial

activity of volatile oils of some spices. *Phytother. Res.***16**: 680-682.

Singh, S.K., Hawkins, C., Clarke, I.D., Squire, J.A., Bayani, J., Hide, T. and Dirks, P.B. 2004. Identification of human brain tumour initiating cells. *Nature,* **432**(7015): 396.

Singhal, S.P. 1995. Study on the effect of feeding Payapro on milk yield in lactating cows. *Dairy Guide,* **1**: 45–47.

Stavri, M. and Gibbons, S. 2005. The anti-mycobacterial constituents of dill (*Anethumgraveolens*). *Phytother. Res.* **19**(11): 938-941.

Thomson, M. 2002. Herbal Monograph – *Asparagus racemosus*, Phytomedicine, NSW, Australia.

Tilak, J.C. and Devasagayam, T.P.A. 2006. Indian Medicinal Plants: A potential reservoir in health and disease in contemporary perspectives on clinical pharmacotherapeutics, In : Kohli, K., M. Gupta and S. Tejwani (eds.), *Contemporary Perspectives on Clinical Pharmacotherapeutics,* Elsevier, New Delhi, pp. 29-43.

Toyang, N.J., Wanyama, M., Nuwanyakpa and Django, S. 2007. *Ethnoveterinary medicine: A practical approach for the treatment of cattle diseases in Sub-Saharan Africa*. (2nd Ed), Agromisa, The Netherlands, ISBN-13:9789190813668, 87p.

Turner, J.L., Dritz, S.S., Higgins, J.J., and Minton, J.E. 2002. Effects of *Ascophyllum nodosum* extract on growth performance an immune function of young pigs challenged with *Salmonella typhimurium.Sci. J. Anim. Sci.* **80**: 1947–1953.

Vaghasiya, M.P. 2001. Retention of placenta. *Honey Bee,* **12**: 26.

Vaquero, R.M.J., Serravalle, L.R.T., Nadra, M.C.M. and Saad, A.M.S. 2010. Antioxidant capacity and antibacterial activity of phenolic compounds from Argentinean herbs infusions. *Food Control,* **21**: 779–785.

Verma, A.K., Kumar,A., Dhama, K., Mahima, and Rahal, A. 2012. Pendimic preparedness for control of influenza viruses. In: *Compendium, International Symposium on one health: Way forward to challenges in food safety and zoonoses in 21 century and the XI Annual conference of Indian association of veterinary public health specialists*, 25th November, 2012, GADVASU, Ludhiana, India.

Verma, A.K., Sinha, D.K. and Singh,

B.R. 2007. Salmonella in apparently healthy dogs. *J. Vet. Pub. Health.* **5**: 37-39.

Williams, B.W., Cuvelier, M.E. and Berset, C.L. 1995. Use of a free radical method to evaluate antioxidant activity. *LWT-Food Sci.Technol.* **28**(1): 25-30.

Yang, J.Y., Chen, H.H. and Wu, J. 2012. Advances in studies on pharmacological functions of Ligustilide and their mechanisms (in Chinese). *Chin. Herbal. Med.* **4**: 26–32.

Yin, Z.Z, Zhang, L.Y. and Xu, L.N. 1980. The effect of Dang-Gui (*Angelica Sinensis*) and its ingredient ferulic acid on rat platelet aggregation andrelease of 5-HT. *Acta. Pharm. Sin.* **15**: 321–326.

Zhang, L.J., Huang, H.T., Huang, S.Y., Lin, Z.H., Shen, C.C., Tsai, W.J. and Kuo, Y.H. 2015. Antioxidant and anti-inflammatory phenolic glycosides from *Clematis tashiroi*. *J. Nat. Prod.* **78** (7): 1586–1592.

Zhao, D., Liu, W.N., Wang, W., Li, Y., Jiao, J. and Ren, L. 2008. Effects of *Herba leonuri* on contractile activity of the uterine smooth muscle isolated from normal, estrogen-treated or postpartum mice. *Herbal Med.* **6**: 640–642.

Zhao, Z.H. and Moghadasian, M.H. 2008. Chemistry, natural sources, dietary intake and pharmacokinetic properties of ferulic acid: a review. *Food Chem.* **109**: 691–702.