Effect of herbal feed additives on performance parameters of ruminants and especially on dairy goat; a Review

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Abstract; Over 90% of the goats in the world are owned by rural households, which are characterized by poverty, low input agricultural practice, lack of modern management skills, poor feeding and housing practices, inappropriate breeding practices and inadequate adoption of technologies essential to improve the productivity. According to the FAO, the lack of drugs to treat diseases and infections causes losses of 30 to 35% in the breeding sector of many developing countries, where poor animal health remains the major constraint to breeding. There are two principle reasons behind the changes in legislation on the use of in-feed antibiotic growth promoters. The first is to try to combat the development of microbial resistance to antibiotic drugs and the consequences on human health. The second is a response to consumer pressures to eliminate the use of all non-plant xenobiotic agents from the diets of animals, so natural resources of medicine like phytomedicines can help smallholders in rural areas to manage their only income resources from diseases and mortality.

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1. Introduction

1.1 Importance and current state of dairy goat production

Goats (scientific name: *Capra hircus)* are widespread worldwide due to their nutritional and environmental adaptability. The goat was the first farm animal to be domesticated (8000 BC, in Ganj Darech, today known as Iran).The vicinity of the place in which the species was domesticated with the cradle of the first known civilizations (Mesopotamia), contributed to the direct participation of the goat in all walks of life of the people who created and developed the civilisations in the area now referred to as the Middle East. The presence of the goat and its involvement in all aspects of ancient societies has not only been uninterrupted, but is of particular significance. The goat is present in religion, economy, nutrition, customs, everyday habits, etc. (Cannas and Pulia, 2008).

Goats are among the smallest domesticated ruminants and have served mankind longer than cattle or sheep. They thrive in arid, semi tropical and mountainous countries. More than 460 million goats in the world produce over 4.5 million tons of milk and 1.2 million tons of meat annually, besides mohair, cashmere, leather, and dung for fuel and fertilizer. Goats are friendly animals; with proper attention, they maintain good health and can be managed easily even by children (Attfield *et al*., 1990).

For centuries, humans have used goats for many purposes (milk, meat, fibre, skin and even work) under various conditions. Although goats are present on all continents, It is observed that the goat sector has been significantly less supported publicly and academically than other animal production sectors like cow milk, beef meat, poultry, pigs or horses. China (30% of total world production), India, Nigeria and Iran are among the top six goat meat producing countries of the world (67% of the total). China has increased quickly its production by almost 1 million tons during the last 20 years (was only 135,000 tons and 9% of world production) (Dubeuf *et al*. 2004).

Dairy goat production is an alternative livestock enterprise suitable for many small-scale or part-time livestock operations (ADGA, 2008). In recent years, demand for goat products has increased in both developing and developed countries. Goat production (particularly dairy), however, is negatively affected by several factors, including infectious and parasitic diseases (Rinaldi *et al.*, 2007). Decreasing farm sizes as a result of human population growth increasingly creates opportunities for promoting dairy goats through improvement initiatives (Bett *et al*., 2009).

The world's dairy goat production has grown partly because of a trend toward increasing self sufficiency by people in many countries. As the interest in dairy goats continues to rise, it is important to address many misconceptions and exaggerated claims (Attfield *et al*., 1990). A review of production systems in harsh and dry environments of West Asia, Central Asia and the Inter-Andean valleys of Latin America reveals that while goats are an important component of a considerable number of vulnerable and resource-poor production systems, the production performance and potentials have not been sufficiently characterized nor documented (Iñiguez, 2004).

Over 90% of the goats in the world are owned by rural households, which are characterized by poverty, low input agricultural practice, lack of modern management skills, poor feeding and housing practices, inappropriate breeding practices and inadequate adoption of technologies essential to improve the productivity (Lebbie, 2004).

1.2. Effect of herbal feed additives on animal performance

The first world medical conference under the patronage of Anoushiravanwas convened at 550 CE in Cteciphon. Hundreds of physicians and Mobeds, and physicians from other countries were in attendance in this congress. Ferdowsi has versified this historical event in Shah Nameh. Khosrow dispatched the famous Iranian physician, Borzoya (Borzouyeh) to India, who brought medical and scientific books, chess, herbal plants and Indian doctors with him (Fezana, 2005).

Normal nature of herbs causes more compatibility with body and removes side effects. Herbs are more compatible with body because of their normal nature and having medicine homologues components together; and usually lack unwanted side effects; therefore they are most suitable, especially in cases of long consumption as well as in chronic diseases (Borimnejad, 2008).

One of the most important determinants of research conducted is the availability of funding. There are three areas in which it is most likely that appreciable goat research funding opportunities will be available in the foreseeable future: biotechnology, medical research and food safety. For example there may be genetic engineering techniques developed for inserting specific genes into animals to overcome many human health problems or to study specific disease problems. Though there is still need for further research on traditional topics such as relating to levels and efficiencies of production. Unfortunately it is doubtful that there will be greater support in the future, and lower levels of funding seem more likely (Sahlu *et al*. 2005).

Ethno-veterinary is a science that involves the popular practical knowledge used to treat and prevent animal diseases. Although a number of ethno biological inventories concerning the use of medicinal plants and animals in human health have been realized, the Ethno-veterinary medicine (EVM) is poorly described. This scarce description of the EVM resources is in stark contrast to the problems of livestock rearing, where the lacking regular access to essential medicines greatly hampers productivity. According to the FAO, the lack of drugs to treat diseases and infections causes losses of 30 to 35% in the breeding sector of many developing countries, where poor animal health remains the major constraint to breeding (Confessor *et al*. 2009).

Several forms of organic farming are being successfully practiced in diverse climate, particularly in rain fed, tribal, mountains and hill areas of the India. Much of the Natural plant products with economic importance like herbs, medicinal plants by default come under this category (Mangala Rai, 2005). Livestock raisers and healers everywhere have traditional ways of classifying, diagnosing, preventing and treating common animal diseases. Many of these "ethno-veterinary" practices offer viable alternatives or complement to conventional, western style veterinary medicine - especially where the latter is unavailable or inappropriate.

The non-nutrient bioactive principles in plants are essentially the secondary metabolites. They are differing from the ubiquitous primary metabolites (e. g. carbohydrates, proteins, fats, nucleic acids) in that their distribution is limited. Plant secondary metabolites are a natural resource that is largely unexploited in conventional animal production system. Essential oils are complex mixture of secondary metabolites consisting of low-boiling point, phenylpropens and terpens. They are particularly associated with plants defined as herbs and spices (Greathead, 2003).

Recent and continuing changes to legislation controlling the use of animal feed additives have stimulated interest in bioactive secondary metabolites as alternative performance enhancers. There are two principle reasons behind the changes in legislation on the use of in-feed antibiotic growth promoters. The first is to try to combat the development of microbial resistance to antibiotic drugs and the consequences on human health. The second is a response to consumer pressures to eliminate the use of all non-plant xenobiotic agents from the diets of animals. Some essential oils like carvacrol and thymol oils, have been reported to inhibit the growth of *E. coli*, decrease the intracellular ATP concentration of *E. coli*, while simultaneously increase the extracellular ATP concentration. It is the lipophilic character of essential oils that enables them to disrupt cell walls, as they consequently accumulate in membranes (Greathead, 2003). The rumen protozoa are proteolitic and actively ingest rumen bacteria. They are considered to be the most important cause of bacterial protein turnover in the rumen and therefore can have a major effect on the efficiency of rumen N metabolism (Wallace and Macpherson, 1987).

There is, therefore, considerable interest in trying to improve the efficiency of N metabolism through manipulation of rumen microflora. Arguably the simplest method of delivering bioactive plant secondary metabolites to animal outdoors is growing relevant plants in the field and let to the animals graze them under controlled manner, but it is doubtful, because there is no control for dosage of inter-plant variability in secondary metabolites content. Currently, the only way to ensure controlled dosage is to use characterized dried plant material, plant extracts or isolated bioactive secondary metabolites. These sources could be incorporated as natural additives into supplemented concentrate feeds (Greathead, 2003).

In general, gram-positive bacteria appear to be more susceptible to inhibition by plant essential oil compounds compared with gram-negative bacteria (Davidson and Naidu, 2000). This effect has been related to the presence of an outer membrane on gram-negative organisms, which endows them with a hydrophilic bacterial surface that acts as a strong impermeability barrier (Nikaido, 1994). Essential oils are steam-volatile or organic-solvent plant extracts, used traditionally by man for many centuries for the pleasant odour of the essence, its flavour or its antiseptic and/or preservative properties. The word 'saponin' is derived from the Latin word sapo (soap) and traditionally saponin-containing plants have been utilized for washing. Saponins, like essential oils, cover a wide variety of chemical compounds and, also like essential oils, man has made use of their properties for centuries (Hostettmann & Marston, 1995, Wallace, 2004).

The sensitivity of ciliate protozoa towards saponins may be explained by the presence of sterols in protozoal, but not in bacterial, membranes (Williams & Coleman, 1992).Thus, the sterol-binding capability of saponins (Hostettmann & Marston, 1995) most probably causes the destruction of protozoal cell membranes. Plants and their extracts have important potential as manipulators of rumen fermentation for productivity and health benefits. They have specific effects on members of the rumen microflora and fauna that can be beneficial to animal productivity and health (Wallace, 2004). Gastrointestinal parasitism has been classified as a major health and welfare problem for ruminants. Parasitism, especially by helminth parasites, impairs health by causing inappetance, diarrhea, anemia and in severe cases, death (Athanasiadou *et al*, 2004).

It is obvious from plant secondary metabolites (PSM) biochemistry that PSM have a wide range of biological activities and enormous potential for uses in agriculture that requires in-depth investigation and evaluation in the context of domesticated livestock production, particularly now that the use of conventional antibiotics is being reduced or eliminated from livestock production.

The complexity and the bioactivity of PSM have the potential to reduce the likelihood that microorganisms or parasites will develop resistance, and their effectiveness is such that concentrations as low as 0.1 g/kg feed may be sufficient. In some cases they may already be components of feedstuffs Nevertheless, issues such as toxicity, photosensitivity, residues, taint, allergenicity and cost effectiveness still need to be addressed before these compounds will gain widespread acceptance in the agricultural industries. Furthermore their use as prepared compounds will need to be agreed by the registration authorities within the countries in which they will be used or in which the products from livestock will be sold and consumed (Acamovic and Brooker, 2005).

The use of medicinal plants constitutes major part of ethno-veterinary medicine. Scientific validation and use of EVM can play a role in poverty reduction by improving productivity of animals through convenient, accessible and economical use of EVM practices. The fact that medicinal plants are predominantly harvested in an unregulated manner undermines the whole industry. Yield from the wild is wholly unpredictable. Supplies are at the mercy of the weather, pests, and other uncontrollable variables. Farming these species would help even out the supply, regularize the trade, provide certifiable products of uniform quality, and make available to rural areas new sources of income. This would also indirectly help in poverty alleviation (Iqbal *et al.*, 2005).

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Summary of potential cellular targets for PSMs is shown in Figure 1.

3. Shatavari: distribution and use - bioactive ingredients and nutritional value

Asparagus racemosus (*Shatavari*) is recommended in Ayurvedic texts for prevention and treatment of gastric ulcers, dyspepsia and as a galactogogue. *A. racemosus* has also been used successfully by some Ayurvedic practitioners for nervous disorders, inflammation, liver diseases and certain infectious diseases. A study of ancient classical Ayurvedic literature claimed several therapeutic attributes for the root of *A. racemosus* (Hindi:-Shatavari) and has been specially recommended in cases of threatened abortion and as a galactogogue. Root of *A. racemosus* has been referred as bitter-sweet, emollient, cooling, nervine tonic, constipating, galactogogue, aphrodisiac, diuretic, rejuvenating, carminative, stomachic, antiseptic and as tonic. Beneficial effects of the root of *A. recemosus* are suggested in nervous disorders, dyspepsia, diarrhoea, dysentry, tumors, inflammations, hyperdipsia, neuropathy, hepatopathy, cough, bronchitis, hyperacidity and certain infectious diseases (Goyal *et al*, 2003).

The genus *Asparagus* (Family Asparagaceae, with about 300 species) is a rich source of sapogenins and saponin, from various parts of the plant, (Lacaille-Dubois, 2000). Thatte and Dhanukar (1989) reported that Shatavari supplementation induced leucocytosis with predominant neutrophila associated with stimulation of phagocytic and bactericidal capacity of neutrophils and macrophages. Shatavari root has growth promoter property. Calves supplemented with shatavari root decoction at the rate of 100 mg/kg for a varying period of 4 weeks to 8 months showed 81.19 % weight gain as compared to 67.9% in control. It did not have any adverse effect on the progeny of the treated animals. The growth promoting effect can be ascribed to its adaptogenic property (Sharma *et al*., 1986). Visavadiya and Narasimhacharya (2005) reported that supplementation of shatavari root powder at 5 and 10% level reduces the plasma and hepatic lipid (cholesterol) levels and also decreases lipid peroxidation. Barhane and Singh (2002) reported that shatavari supplementation increases dry matter intake significantly in lactating crossbred cows.

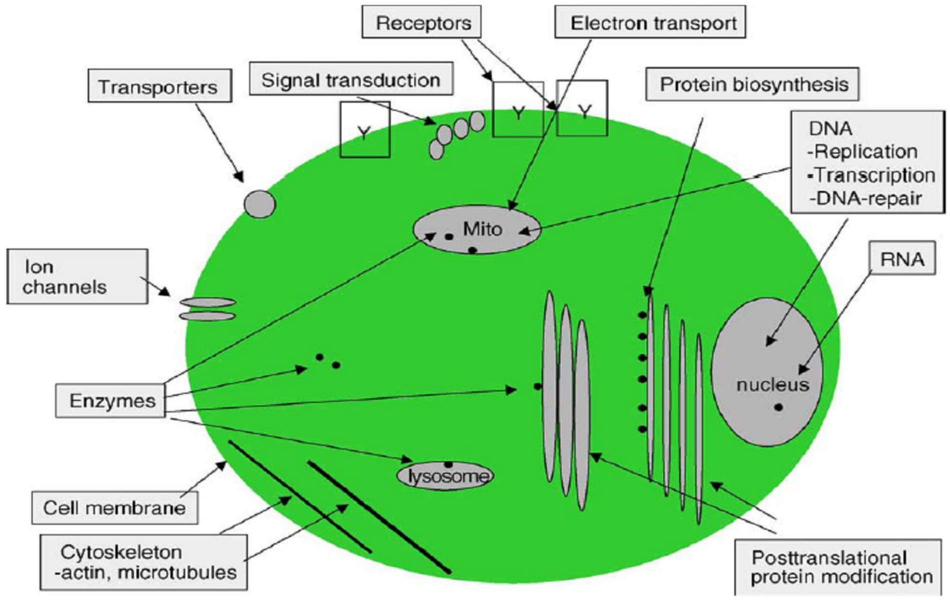

Figure 1. Summary of potential cellular targets for PSMs.

Supplementation of shatavari fresh root of at the rate of 500 g per day with concentrate at the time of milking significantly increased (p<0.01) milk yield of buffaloes (Patel and Kantikar, 1969). Mahantra *et al.* (2003) reported that, feeding herbal formulation containing 25% shatavari enhanced milk production (25.1%) significantly over control group. Somkuwar *et al.* (2005) and Tanwar *et al.* (2008) reported significant improvement in daily milk yield in buffaloes and crossbred cows, but response of supplementation of shatavari in buffaloes is higher than cows, but the reason was not explained. The dose of shatavari in dairy animal based on body weight or dry matter intake is not well standardized and supplementation of shatavari 100g/day/animal and 50g/day/animal irrespective of body weight have been found to increase milk production significantly (P<0.05) in crossbred cows (Mishra *et al*., 2008; Tanwar *et al*., 2008). However, Barhane and Singh (2002) found that supplementation of shatavari (100g on alternate day per animal) in freshly calved crossbred cows did not improved milk production. Similar result was also by Vihan, (1988) in lactating goats.Barhane, (2000) reported that supplementation of shatavari (100g on alternate day) postpartum alone led to 100% estrus and 75% conception in treatment group as compared to 50% in control crossbred cow within 90 days of calving. In addition, Hegde *et al.* (2002) reported that supplementation of shatavari root powder 100g + 10g Aloe dried pulp powder to cows following aartificial iinsemination per animal/day improved conception rate.

The presence of saponin in *shatavari* root has been written up (Jadhav and Bhutani, 2006). Besides saponin, root extract of *shatavari* contain flavonoids (6.7±3.9 mg/100ml), polyphenol including tannin (88.2±9.3 mg/100ml) and Vitamin-C (42.4 ± 5.1 mg/100ml) (Velavan *et al*., 2007). The presence of phyto-components in *shatavari* root such as phytosterols (0.79%), saponin (8.833%), polyphenols (1.692%), flavonoids (0.476%) and total ascorbic acid (0.762%) were also estimated by Visavadiya and Narasimhacharya (2007).

Mishra *et al.* (2005) reported that *shatavari* root contains 4.6 to 6.1% protein, carbohydrates 36.8 to 47.5%, phenols 3.1 to 5.2mg/g, tannins 4.8 to 5.1 mg/g, saponin 4.1% and ash 6.5 to 7.4%. Kamat and Venkatachalam (2004) accounted that *shatavari* root extract has different types of polysaccharide components such as galactose (54%), glucose (28%), Rhamnose (4%), xylose (5%) and arabinose (8%) and others (1%). Shatavari root contains 91% DM, 8.32% CF, 3.85% CP, 0.66% EE, 74.02% NFE and 13.15% ash. High content of NFE indicates that shatavari is a rich source of energy (Barhane, 2000).

Pandey *et al.*(2005), administrated Shatavari extract orally to adult pregnant female albino rats at a dose of 30 mg/100 g body weight, daily for 15 days (days 1-15 of gestation). The macroscopic findings revealed a prominence of the mammary glands, a dilated vaginal opening and a transversely situated uterine horn in the treated group of animals. The weight of the uterine horns of the treated group was found to be significantly higher (P < 0.001) but the length was shorter (P> 0.01). Microscopic examination of the treated group showed proliferation in the lumen of the duct of mammary gland. It was obliterated due to hypertrophy of ductal and glandular cells.

4. Jivanti: distribution and use - bioactive ingredients and nutritional value

Jivanti (*Leptadenia reticulata*), belonging to family Asclepiadaceae, well known for its tonic, restorative and stimulant property in the Indian system of medicine. This plant is distributed in the Southern parts of India. *L.reticulata* is a much-branched twining shrub. The bark is yellowish brown, corky, deeply cracked; the leaves are ovate-cordate, coriaceous glabrous above, more or less finely pubescent beneath; the flowers are in many-flowered cymes, greenish yellow; the follicles are sub-woody and turgid. The main constituents reported are stigmasterol, β –itosterol, flavonoids, pregnane glycosides and proteins. Presence of triterpenes and steroids were also reported. Aerial parts of *Leptadenia reticulata* is reported to contain tocopherol and possess several pharmacological activities such as galactogogue, antimicrobial and anti-inflammatory activity (Sathiyanarayanan *et al.,* 2007).

Jivanti is considered a stimulant and tonic in Ayurvedic literature. Its medicinal use dates back to 4500 to 1600 B.C, as mentioned in the Atharvaveda. Its lactogenic effect has been reported in various domestic animals (Dadarkar *et al.*, 2005). Jiwanti and a cocktail of herbs namely galog a proprietary product of Indian Herbs Research & Supply Co, are known for their lactogenic properties since the times of Atharveda Charak Sanhita. *Leptadenia Reticulata* has been shown to increase milk production without affecting milk composition (Anjuaria and Gupta, 1967). Galog is a herbal preparation which contain *Leptadenia Reticulata* as the main component and it may be attributed to certain metabolic changes in their body tissues and the mammary gland, where the absorbed nutrients are utilized more effectively (Thakur, 1977).

5. Jeera: distribution and use - bioactive ingredients and nutritional value

Cuminum cyminum Linn. (Umbelliferae) is a wild grassy plant with 15-50 cm height, widely used ingredient in Indian food. It has been used for a very long time in traditional medicine in the treatment of diarrhoea, dyspepsia and gastric disorders, and as an antiseptic agent. Cuminum cyminum, originates from the Greek kyminon (Banerjee and Mukhopadhyay*,* 2003; Sayyah *et al.,* 2002).

Cumin has been used as a preservative in spicy foods and other food products. It is known to inhibit the growth of some fungi in the putrefaction of foods and to control mildew disease. The plant possibly originates from the Mediterranean area, perhaps Egypt and Syria. Nowadays it grows extensively in Turkey and Iran. It seems to have been cultivated in Palestine for a very long time. Cumin bears fruit two months after seeding and is harvested when the plants begin to whiten and the seeds lose their yellow colouring (Banerjee and Mukhopadhyay*,* 2003).The seeds are threshed and "shaven" (the long hairs are eliminated). The essential oil of cumin is especially used as a carminative, stomach calmer and astringent. It is useful in diarrhea and dyspepsia treatments. It can be used topically in the form of a cataplasm in the elimination of stains and occasional pains. Cumin essential oil content, including cuminaldehyde as main component and other aldehydes, varies between 2 to 6%. This oil is responsible for the strong aroma and taste of cumin (Banerjee and Mukhopadhyay*,* 2003). Cumin has many applications in veterinary medicine. Recently, in female albino rats, cumin fruit has been observed as having anti-fertility effects. The Department of Biochemistry and Nutrition in the Central Food Technological Research Institute of Mysore(India), has highlighted the antidiabetic activity of the presence of cumin fruit in diets in rats with streptozotcocin induced diabetes (Banerjee and Mukhopadhyay*,* 2003).

6. Kolonji: distribution and use - bioactive ingredients and nutritional value

Nigella sativa L., commonly known as black seed or black cumin, is used in folk medicine as a natural remedy for a number of disease and condition such as asthma, hypertension, diabetes, inflammation, cough, bronchitis, headache, eczema, fever, dizziness and gastrointestinal disturbances (Ali and Blunden, 2003). Furthermore, modern pharmacological and toxicological studies have demonstrated that crude extracts of the seeds and some of its active constituents (volatile oil, thymoquinone—TQ) might have protective effect against nephrotoxicity and hepatotoxicity induced by either disease or chemicals (Ali and Blunden, 2003).Nigella sativa oil (NSO) has also antipyretic, analgesic, anti-inflammatory, antimicrobial, and antineoplastic activity (Ali and Blunden, 2003). Thymoquinone, active constituent of *N. sativa* seeds, is a pharmacologically active quinone, which possesses several properties including analgesic and anti-inflammatory actions (Abdel-Fattah et al., 2000; Houghton et al., 1995). Protection against chemical induced carcinogenesis (Hassan and El-Dakhakhny, 1992; Worthen et al., 1998), and the inhibition of eicosanoids generation (Houghton et al., 1995). Moreover, it has been reported that TQ prevents oxidative injury in hepatocytes induced by carbon tetrachloride or tert-butyl hydroperoxide in various in vitro (Daba and Abdel-Rahman, 1998) and in vivo (Mansour et al., 2001; Nagi et al., 1999) hepatotoxicity models, as well as acetic acid-induced colitis in rats (Mahgoub, 2003). It has been suggested that TQ may act as an antioxidant agent and prevent the membrane lipid peroxidation in hepatocytes (Mansour et al., 2002).

Dadarkar *et al*., (2005) reported that ethanotic extract of *Artemisia herba-alba, N. Sativa, Punica granatum* possessed the most outstanding in vitro antibacterial activity, with maximum inhibition zone of

18-22.4 mm. The lowest MIC value was measured in *Punica granatum* as 0.01 mg/ml against MRSA. The results showed that the ethanolic extract had better antibacterial effect than the aqueous extract and the anti-staphylococal activity of the ethanolic extract of plants against MRSA, was better than MSSA strains. Tawab and Nasreen (2006) treated Fe (III) solution with extract of *N. sativa* as well as two other active biological reductants, hydroquinone and hydroxyl ammonium chloride and found that *N. sativa* is stronger reducing agent than hydroxyl ammonium chloride and weaker than hydroquinone. Treatment protocols in rats with *N. sativa* inhibited ROS production induced by experimental autoimmune encephalomyelitis (EAE) indicated by diminished levels of MDA of both brain and medulla spinalis tissues and NO in brain only. When *N. sativa* was given alone to the rats, no changes were shown in brain, medulla spinalis, and serum oxidant/antioxidant parameters. In conclusion, *N. sativa* may protect brain and medulla spinalis tissues against oxidative stress induced by EAE. In addition, *N. sativa* display its antioxidant and regulatory effects via inflammatory cells rather than the host tissue (brain and medulla spinalis) for EAE in rate (Ozugurla et al 2005).

7. Vidarikand; distribution and use - bioactive ingredients and nutritional value

Pueraria tuberosa (Roxb. ex. Willd.) DC. (Fabaceae), one of the important plants used in Indian medicine, is commonly known as Vidarikand. The tuberous roots of P. tuberosa are used to relieve symptoms of dysmenorrhoea, dysfunctional uterine bleeding and menopausal syndrome. It possesses spasmolytic, anti-inflammatory, anti-implantation, anti-hyperglycaemic, oestrogenic and contraceptive properties. Studies have been conducted on the chemistry and therapeutic effect of various parts of the plant. Phyto-compounds like β-sitostreol, stigmasterol, daidzein, puerarin, puerarone and coumestan, isoflavone C-glycoside-4,6-diacetyl-puerarin (root),pterocarpintuberosin(roots and tubers), puetuberosanol and hydroxytuberosone have been isolated and characterized from the species (Devaiah and Venkatasubramanian, 2008).

8. Effect of polyherbal supplementation on performance of dairy goats and their kids

Anjaria and Gupta (1967) reported that ‘Leptaden tablet containing shatavari as a major component enhances milk production significantly in buffaloes and cows but not in goat and sheep. Chauhan *et al.* (1971) also reported similar result in crossbred cows. Arora *et al.* (1978) reported that supplementation of ‘’Galog’’ a herbal preparation having shatavari, enhanced milk production significantly and persistency throughout lactation in the treatment group. Similarly, supplementation of shatavari based herbal formulation ‘Payapro enhanced milk production significantly. The increase in milk production was on an average 30.85 percent. It has been concluded that herbal preparation showed galactopoietic activity and can be considered as an alternative of lactogenic hormones for inducing and enhancing milk yield in crossbred cows (Singhal, 1995).

Ramesh *et al.* (2000) evaluated the effect of supplementation of ‘Galactin (50 g /d/animal), a shatavari based polyherbal galactogogue, in lactating crossbred cows and reported significant improvement in milk production over control group. Similarly, supplementation of ‘’Ruchmax’’ increased milk production significantly in buffaloes (Baghel, 2001). Phalphale *et al.* (1997) reported that herbal preparation ‘Ruchmax®’ was effective (87.50%) in anorexia in goat and it optimized the activity of the rumen microflora and other ruminal functions, thus, helped to improve the digestion and better utilization of feed by goats.Chatterjee (1994) studied the effect of herbal preparation immu-21, containing *Ocimum sanctum, Emblica officinalis, Withania Somnifera* and *Tinospora Cordfolia* on the immunological properties in rats and observed increased microbicidal activity of neutrophils and elevated antibody titers in both the primary and secondary immunity assays at dose rate of 20 mg/kg body weight. Cell-mediated immune response was potentiated at lower dose rate (20 mg/kg), but was suppressed at the higher dose (200 mg/kg). They also reported that this herbal preparation protected mice against Escherichia coli lipopolysaccharide-induced mortality.

Das and Chatterjee (1996) found no toxic symptoms like catatonia, disturbances in thermoregulation or abnormal activity in albino mice supplemented with polyherbal immunomodulator and immunorestorative product at doses of 200 and 400 mg/kg BW.Sahoo *et al.* (2001) evaluated the effect of supplementation of polyherbal immunomodulator (immu-21) to Black Bengal goats, in the last month of the pregnancy and / or kids and reported significantly higher birth weights, increased concentrations of blood protein and colostrum immunoglobulin and absence of kid mortality in the pregnant does and kids supplemented with polyherbal immunomodulator, respectively. They concluded that the supplementation of polyherbal immunomodulator during the later part of pregnancy in goats and to kids during the growth period is much more beneficial than administration at either stage alone.

Pradhan and Das (2004) evaluated the therapeutic potential of gentamicin alone and in combination with herbal preparations (Immu-21 and Himax) for the management of goat pox in Ganjam goats. 50 goats were included in this study, 40 were infected with goat pox and 10 were healthy. The results indicated that therapy with Immu-21, gentamicin and Himax ointment was the most efficient (90%), followed by gentamicin and Himax (80%), gentamicin and Immu-21 (70%) and gentamicin alone (50%). Kolte *et al.* (1999) compared the efficacy of intramammary application of Tilox (ampicillin + cloxacillin; 4 cows with 11 positive quarters) with the topical application of a paste containing roots of *Withania somnifera,* *Asparagus racemosus and Curcuma amada* and leaves of *Ocimum sanctum* (5 animals with 12 positive quarters) for treatment of subclinical mastitis and found both the preparations effective, as assessed by a return to normal biochemical milk profiles, but the plant preparation acted more slowly. Gomes and Dasgupta (2000) studied on effect of antihistaminic and antianaphylactic property of PulmoFlex (polyherbal supplementation) in mice. The results indicated that PulmoFlex significantly protected histamine aerosol induced collapse in guineapig and compound 48/80 induced histamine release from guineapig chopped lung preparation. PulmoFlex also exhibited significant protection in passive foot anaphylaxis and passive cutaneous anaphylaxis in albino mice. Bovine serum albumin induced anaphylactic shock in male albino mice was also antagonised by PulmoFlex.

A. racemosus in combination with other herbal substances in the form of 'Ricalex' tablets (Aphali pharmaceutical Ltd. Ahmednagar) has been shown to increase milk production in females complaining of deficient milk secretion. Gradual decrease in milk secretion, on withdrawl of the drug suggested that the increase in milk secretion was due to drug therapy only and not due to any psychological effect (Joglekar et al., 1967).Sholapurkar *et al.*(1969), reported, A. racemosus along with some other herbal substances in the form of a commercial preparation, lactare (TTK Pharma, Chennai) enhanced milk output in women complaining of scanty breast milk, on 5th day after delivery. A significant increase in milk yield has also been observed in guinea pigs and goats after feeding lactare which also increased growth of the mammary glands, alveolar tissues and acini in guinea pigs. Patel *et al.* (1969) have also shown galactogogue effect of roots of A. racemosus in buffaloes. However, Sharma *et al.*(1996) did not observe any increase in prolactin levels in females complaining of secondary lactational failure with A. racemosus suggesting that it has no lactogenic effect.

Randhawa et al.(1995) assessed the effect of herbal biostimulators in optimizing ruminal digestion and milk production and also their effect on various biochemical constituents in dairy cows. There was significant increase in milk yield in the three treatment groups with maximal increase being recorded in T2 (GALOG) group followed by T1 (HB STRONG) and T3 (LIVOL) groups as compared to control group. The average milk yield in all the treatment groups even at the termination of the experimental study was still significantly ($P<0.05$) higher than the base value. Further, the milk yield declined in control group (C) by 18.65 percent with the progress in the process of lactation and in normal lactation curve, whereas the treated groups showed steady increase in milk yield. Results showed gross overactivity of rumen microflora particularly of the predominance of cellulolytic bacteria with increased TVFA and normal pH of rumen liquor.

There was marked increase in protozoal concentration and motility in rumen liquor due to herbal feed additives especially HB STRONG which helped better digestion of the cellulose matter of the feed and thus renders energy supply for milk production followed by LIVOL and GALOG. There was also increase in molar proportion of propionic acid which is glucogenic. In the rumen there was faster rate of ammonia metabolism into microbial proteins.

There was gradual increase of blood glucose concentration with feeding LIVOL associated with marked increase in milk yield due to the stimulatory effect on liver functions and thus enhanced gluconeogenesis. The increase in blood glucose concentration was found steadily high due to increased synthesis even though there was increased demand for lactose synthesis to meet requirement for increased milk yield. An interesting finding was that with increased demand for conversion of blood glucose into lactose due to increased milk yield in all three feed additives groups, the plasma ketone bodies levels were within the normal range and even below base value throughout the period of study.

There was no adverse effect due to regular feeding of the herbal products and there were also no significant alterations in blood biochemical profile. The decline in electrical conductivity of the milk and lower somatic cell counts due to feeding of herbal products showed positive effects of the products in maintaining the integrity and health of the udder. The increased sustained milk production in all the three treatment groups was due to the galactopoietic effect of the feed additives which helped in better utilization of absorbed nutrients in the body tissues and lactopoietic system.

9. Effect of polyherbal supplementation on composition of colostrum and milk of dairy goat

Goat milk has less fat, higher vitamin A content, less lactose, TB virus resistant than cow's milk. The reaction of goat milk is alkaline, the same as Mother's milk. Cow milk produces an acid reaction. Normal milk from high producing Holstein or Friesian dairy cows is composed of water (87%),fat (3.8%), protein (3.4%), sugars (i.e., lactose, 4.5%) and other solids such as minerals (1.3%).Milk also contains a number of minor components including sloughed epithelial cells and white blood cells. High quality milk should be white in appearance, have no objectionable odors and be free of abnormal substances such as pesticides, added water or antibiotic and antiseptic residues. In most developed dairy countries milk quality is defined by the *somatic cell count (SCC)* and the *bacterial count ("standard plate count" or SPC*) in pre-pasteurized bulk tank milk. Somatic cells are composed of white blood cells (WBC) and occasional sloughed epithelial cells. Most cells found in normal bovine milk are a type of WBC (macrophages) that function as early warning signals when bacteria invade the udder (Roegg, 2001).

Thakur *et al* (2006), studied on effect of 10 herbal feed supplementations on the performance of lactating cows. Results showed that the herbal feed supplement did not have any significant effect on DM intake, digestibility of nutrition, live weight changes, whereas milk and FCM yield was improved ($P<0.01$) without affecting its composition. It was concluded that dietary supplementation of a commercial herbal feed additive 10g/d to lactating crossbred cow, increased the milk yield. Kholif, Abd-el-Gawad (2001), reported the effects supplementing lactating goats diet with fenugreek and *Nigella sativa* seeds galactogogue on milk yield and composition and its effect on Domiati cheese. Fenugreek significantly ($p<0.05$) increased milk yield and total nitrogen soluble nitrogen and salt contents ($p<0.01$).The acidity tyrosine and tryptophan in cheese increased significantly ($p<0.05$) compared with the control. However, a decrease ($p<0.01$) in total solids, fat and fat/total solids and total nitrogen/soluble nitrogen ($p<0.05$) was also observed in cheese over the control. However, *Nigella sativa* decreased total solids, fat ($P<0.01$) and total nitrogen soluble nitrogen and PH of milk ($P<0.05$). The organoleptic properties of treated cheese were better ($P<0.05$) than the control, except in colour, storage period significantly affected ($P<0.01$) organoleptic properties and cheese composition. It is concluded that fenugreek was economically better than the other groups.

Zeng *et al.* (1997), studied on twelve milking Alpine does to determine the daily variations of milk somatic cell counts (SCC), composition and production. Composite milk samples were collected daily at evening milking from mid-March (2–3 weeks in lactation) to mid-August (drying-off) in 1995. Milk samples were analyzed for SCC using a Fossomatic cell counter and for chemical composition using a Dairylab II milk analyzer. Both instruments were calibrated with goat milk standards. Concentrations of all milk composition variables (fat, protein, solids-non-fat and total solids), with the exception of lactose, were high (2.91 ± 0.16%, 3.27 ± 0.10%, 8.30 ± 0.11% and 11.20 ± 0.23%, respectively) in the first month after parturition, declined slightly and then remained constant until drying-off. Daily milk production increased steadily for the first 4 weeks following parturition and then decreased gradually. SCC in milk were high ($887 \pm 400 \times 10^3$ ml^{-1}) during the first 2 weeks of lactation. The lowest SCC was found in milk during the second month after parturition and then the SCC value increased as lactation advanced. Marked daily variations of SCC in goat milk were observed.

These observations indicate that consecutive monthly SCC data collected from the once-a-month sampling plan of the Dairy Herd Improvement Association testing program must be used if the SCC is to be a direct estimator of mastitic conditions in Alpine goats.

1. **Effect of polyherbal supplementation on SCC and IgG in goat milk and colostrums**

The white blood cells in milk, together with a relatively small number of epithelial cells from milk-secreting tissues, are known as somatic cells. These cells are an important part of the goat's natural defence mechanism. When udder tissue is injured or becomes infected, significant numbers of white blood cells accumulate in the milk. Normal goat milk has a higher cell count than normal milk from cows.This has long been a concern of goat owners because of regulatory standards and marketing problems. Current Grade A standards require that milk contain no more than 4,000,000 cells/ml. Despite this reduction for cow milk, regulatory standards for goat milk will remain at 1,000,000/ml. This is because somatic cell counts in goat milk may easily approach 750,000/ml and still be normal (Shearer *et al.*, 2008). Batra (1986), observed the relationship between somatic cell count and milk yield using the data of 2181 composite milk samples from 665 cows. The effect of genetic group, parity, stage of lactation, season of calving and SCC was significant for daily milk yield, average daily milk loss was 0.5 kg in first lactation and 0.7kg for later lactation in cows, when somatic cell count increased from $200*10^3$ to $400*10^3$ cells/ml, lactation milk yield losses perbunit increased in average log SCC was 74 kg in the first lactation and 88 kg for later lactation.

Jones (1986), suggested that SCC of 0.6 to 1 million cells/ ml were associated with 8 to 12% reduction in herd milk production. Randy *et al.* (1988) reported low and negative correlation coefficients between the milk yield and somatic cell counts. In addition, negative relationship between somatic cell counts and milk yield was reported.

Gill *et al.* (1990), Reported that there was highly correlation between the cumulative production of fat-corrected milk (FCM) over 305 day of lactation and category for bulk milk SCC (BMSCC). Herds within the low category had been highest milk production. As bulk milk somatic cell counts decreased, milk production increased ($p<0.0001$). The herd with a low $BMSCC<1.50*10^5$ cells/ml and had a mean cumulative FCM during 305 days of lactation of 8589 kg compared with 8072 kg for herd with a high BMSCC $2.51-4.00*10^5$ cells/ml. Therefore, per a decrease of $1.00*10^5$ cells/ ml in geometric mean of BMSCC, the mean cumulative 305 day FCM production was 272 kg higher. Mean annual milk production was different among the three BMSCC categories 460000, 537000, 504000 kg ($P=0.008$) for herd with low, medium and high BMSCC, respectively.

Hertet and Seegers (1998) test day level the average milk loss of 0.4 kg in primiparous cow and 0.6 kg in multiparous, by each 2-fold increase of SCC above 50000 cells/ml. At the lactation level, the average trend was a loss of 80 kg of milk in primiparous and 120kg in multiparous, by each 2-fold increase of the geometric mean of SCC above 50000 cell/ml.

Moreover, Acharya *et al.* (2002) assessed the synergistic effect of polyherbal immunomodulator along with the antibiotic therapy in the treatment of subclinical mastitis in cows. The immunomodulatory effect was evaluated based on the increase in absolute lymphocyte count (ALC) and immunoglobulin G (IgG) level along with clinical recovery. The curative effect was assessed based on the increase in milk yield and reduction in somatic cell count below 0.5 million cells/ml. Significant increases in ALC and IgG were observed in individual cows treated with polyherbal immunomodulators alone and in antibiotic combination. The immunomodulatory effect of the herbal immunomodulator was at par with that of levamisole. Polyherbal immunomodulator alone was found to be effective in 60% of subclinical mastitis cases and it was effective in 100% of the cases when used with antibiotics. Recently, the efficacy of a commercial herbal immuno-stimulant product (ImmuPlus) for prevention and effective treatment of clinical mastitis in bovines was evaluated (Das *et al*. 2003). The different groups of cows suffering from clinical mastitis and those which were more vulnerable to this disease were administered Immu-21 alone and in combination with antibiotics, to assess their comparative clinical and immunological benefits. When animals affected with clinical mastitis were treated with lmmu-21 alone they showed 20 percent clinical recovery along with significant rise in IgG levels.

In a European study of Petrova *et al.* (2008) the influence of different somatic cell counts (SCC) on the average daily milk production, composition and some properties of goat milk were evaluated. 110 lactating dairy goats (Bulgarian Dairy White) were investigated during the lactation period. No statistically significant differences were found (P>0.05) in the average daily milk production at 3.2% fat corrected milk (FCM) and at 3.0% protein corrected milk (PCM) between the number of SCC less than 400000/ml (275000/ml), SCC from 400000 to 1000000/ml (652000/ml) and SCC over 1000000/ml (3150 000/ml).

2. Effect of polyherbal supplementation on Glucose and TLC in goat blood

After calving, the initiation of milk synthesis and rapidly increasing milk production greatly increases demands for glucose for milk lactose synthesis, at a time when feed intake has not reached its maximum. Because much of the dietary carbohydrate is fermented in the rumen, little glucose is absorbed directly from the digestive tract. Consequently, dairy cows rely almost exclusively on gluconeogenesis from propionate in the liver to meet their glucose requirements (Drackley *et al*., 2001).

Limited feed intake during the early postpartum period means that supply of propionate for glucose synthesis also is limited. Amino acids from the diet or from skeletal muscle breakdown as well as glycerol from mobilized body fat contribute to glucose synthesis. Glucose supply to the mammary gland is also enhanced by the decreased oxidative use of glucose that accompanies the initiation of lactation (Drackley *et al*., 2001).

In turn, glucose is directed to the mammary gland by the low circulating insulin concentration because, in contrast to adipose and skeletal muscle, mammary uptake of glucose is insulin independent. During the first week after calving, the supply of glucose from fermentation of dietary carbohydrates consumed may fall short of glucose demands by as much as 500 g/dl (Drackley *et al*., 2001). Glucogenic amino acids and glycerol from body fat mobilization likely contribute to making up this shortfall. This results many fold increase in rates of muscle protein mobilization during the first week after calving compared with prepartum values (Overton *et al*., 1998). Negative energy balance during early phase of lactation is more intense in cattle than buffalo (Drackley 1999). Plasma glucose concentrations are lower during the catabolic phase of lactation, and are higher during the anabolic phase of lactation when energy intake is equal or superior to the energy release (Goff, 1999).

Grummer *et al*. (1995) reported that plasma glucose concentration and hepatic glycogen decreased, while the lipid was increased during the transition period. In addition, Howes *et al*., (1963) suggested that increase in protein concentration in cows whose protein requirements had already been met, triggers a more intense gluconeogenesis as depicted by higher glucose levels.The effect of *Leptadenia reticulate* powder and Leptaden tablets on lactogenic property of goats, sheep, cows and buffaloes was evaluated by Anjaria and Gupta (1967). The experiment was conducted on identical sets of animals in each group. Leptaden talets,4 twice daily in goats and sheep,10 twice daily in cows and buffaloes; and *Leptadenia reticulate* powder,536 mg, (equivalent to the *Leptadenia reticulata* content of 4 Leptaden tablets) in goats and sheep, 1340 mg (equivalent to the *Leptadenia reticulata* content of 10 Leptaden tablets) in cows and buffaloes were given for 12 days. Both drugs produced significant galactopoletic response in most of the experiments. No significant changes were produced in the contents of milk and blood of goats as shown by their analysis during the experimental period.

3. Effect of polyherbal supplementation on body weight of dairy goats

Wheeler *et al*. (1999), assessed the efficacy of herbal Nebsui as growth promoter feed additive for profitable of four pig production farms. Nebsui was incorporated in the ration 2 kg/ton of feed and no antibiotic or chemical growth promoter was used. The performance of the pigs was measured for daily live weight gain, feed conversion ratio (FCR), mortality percent and cost of production per kg of live weight. The inclusion of Nebsui in pig ration showed excellent effect on maintaining stable gut function and overall pig performance. The consistent and significant increase in daily liveweight gain, improvement in F.C.R., reduction in mortality percent and also lower cost of production per kg of live weight was observed with the use of Nebsui in all the four studies. Besides, Nebsui effectively controlled specific and non-specific scours and colitis in pigs. The product was found to be non-toxic, safe and without any residual or other side effect (Wheeler *et al*.1999).Nayak and Nayak(2001), studied the response of different therapeutic combinations against ketosis. 42 ketotic cows were selected at random and were divided into 7 groups (Grs. 1, 2, 3,4,5,6 and 7) having 6 cows in each. Gr. 1 was kept as non-treated control and the remaining (Gr.2 to 7) were utilized to study the efficacy, safely and cost-economics of different treatments. Before the commencement of therapy there was significant fall in serum glucose, insulin, cholesterol, plasma calcium phosphorus and magnesium and rise in serum ketone bodies in ketotic cows.

Rothra's test and Ross test were also positive for ketone bodies in urine and milk respectively. Six different therapeutic combinations were tried against ketosis. On 7th day post treatment all the parameters like blood metabolites returned to normal and ketone bodies in urine and milk were found negative. There was general clinical recovery and improvement in appetite and digestion,the milk yield increased by 30 to 50 percent in different treated groups. It is observed that the therapeutic regimen applied for the treatment of ketotic cows of Gr.3 with herbal antistress and metabolic and liver tonic products and MeboLiv** orally once daily for 7 days was found to be more scientific, rational, efficient, safe, economical and comparatively quicker in recovery without relapse of ketosis. There was steady increase in milk yield of the treated cows (Nayak and Kayak, 2001).

Sardar *et al.*(1996), evaluated the effect of different levels of G-5 (Galactogogue bolus of Indian Herbs, Saharanpur) viz 10,20,30 and 40 mg were tested for their effect on rumen fermentation and in vitro dry matter digestibility on three substrates i.e. concentrate, oats fodder and concentrate plus oats fodder. Results showed that the G-5 supplementation maintained the rumen pH within the normal range. The TVFA concentration was significantly ($P < 0.01$) affected by the nature of the substrate. Different levels of G-5 did not have any significant effect on TVFA concentration, NH3-N and molar proportions of Individual VFA. However, IVDMD was significantly ($P = 0.02$) affected by G-5 bolus supplementation at a level of 40 mg. At this level the digestibility increased from 68.27 (control) to 75.65 percent.

4. Effect of polyherbal supplementation on physiological parameters of dairy goats and their kids

Dalvi *et al.* (1990) used dried root of A. racemosus for dyspepsia. Oral administration of formulation of A. racemosus and has been found to promote gastric emptying in healthy volunteers. Its action is reported to be comparable with that of the synthetic dopamine antagonist metoclopromide. Dahanukar et al. (1983) reported that A. racemosus along with Terminalia chebula protect gastric mucosa against pentagastrin and carbachol induced ulcers, by significantly reducing both severity of ulceration and ulcer index. Decreased volume and increased pH of the secretions in drug treated rats, suggested a reduced responsiveness of the gastric parietal cells to secretogogues and narcotizing agents. Cytoprotective effect has been suggested to be due to increased output of mucus. Singh *et al.*(1986) showed that Shatavari promptly and persistently relieve the pain and burning sensation as well as other dyspeptic symptoms due to duodenal ulcer. Since Shatavari did not have antacid and anti-secretory properties, the observed mild reduction in acid secretion may be due to some changes in gastric mucosa.Shatavari has been suggested to heal the ulcers by potentiating defensive factors and many hypothesis have been put forward for its possible mechanism.

Dash *et al.* (1992), conducted three trials with Brown Swis and aged Holstein cows with Leptaden (extracts of plants—*Leptadenia reticulata* and *Breynia patens*) added to a standard ration. The cows were in late, early, and middle stages of lactation in Trials 1, 2, and 3, respectively. Following three weeks pretreatment, cows in the Leptaden group were administered 10 Leptaden tablets (268 mg/tablet) twice daily in the first trial and 15 tablets twice daily in the second and third trials for 21 days. This period was succeeded by a three week post-treatment period. Leptaden feeding did not produce any significant effect on average feed intake. Both control and experimental groups lost body weight during the trials, but there was no significant differences in weight change between the groups. Leptaden-fed cows did not increase in milk production or change in the content of fat or total solids in their milk compared to the controls. Heart rates, respiratory rates, and rectal temperatures of all cows were within normal ranges in all periods. The serum protein-bound iodine and blood glucose indicated that Leptaden did not impair thyroid activities of the cows. No significant differences were noted in other health related data between the Leptaden-fed and control cows (Dash *et al,* 1992).

Kanwar and Varshney (2003),studied on the effect of herbal ART-400 powder 20gm orally mixed in treacle daily to the male calves as III group, group II treated by diclofenac sodium and group I served as control, The elevated respiration and heart rate on 5th post-induction day, started declining and by 24th post-induction day, these parameters reached to near normal base values, however the rectal temperature remained within normal range in all the animals of different groups.Ghosh *et al.*(1994), studied on the therapeutic efficacy of CAFLON, a herbal product of INDIAN HERBS, Saharanpur, against non-specific respiratory disorders of goats,Treatment with CAFLON at the rate 10 gm/animal, twice daily orally for 5 days had given the best results (100 percent cure on 5th day of treatment), treatment with CAFLON only at the rate 10 gm/animal, twice daily, also had a remarkable positive response against the non-specific respiratory disorders in goats in comparison to the unmedicated group.

5. Effect of polyherbal supplementation on kids BCS and body weight

Patil *et al.* (2000) evaluated the effect of herbal feed supplement "MagaCal" in poultry. The overall results of the trial indicated that MagaCal supplementation @ 0.5 kg/ton of feed in general improved the performance of birds. Moreover, groups receiving lower levels of calcium and phosphorus showed significantly improved live weights due to MagaCal supplementation. Hence, it can be concluded that supplementation of MagaCal 0.5-0.75 kg/ton of feed is useful in improving calcium and phosphorus bio-availability in the birds and also in improving the growth performances.Rajkhowa *et al*. (2001),studied on the efficacy of two oral iron preparations, EHb-a herbo-mineral complex, and chelated iron, in the prevention and control of piglet anaemia. The haemato biochemical changes observed in the study included significant decrease in haemoglobin (HB), packed cell volume (PVC), total erythrocyte count (TEC) and serum iron (TSP) levels in untreated anaemic (control) piglets throughout the experimental period. A marked increase in haemato-biochemical parameters (except for TSP) was observed in all treated groups of anaemic piglets. In comparison to chelated iron preparation, the treatment with EHb 15 mg/kg body weight was found to be more effective in the prevention and control of piglet anaemia.

Sahoo *et al.,* (2001) evaluated the effect of Immu-21 (a herbal immunomodulator manufactured by M/s Indian herbs containing *Withania somnifera, Sphaeranthus indicus, Loranthus falcata, Scrophularia lielzzi, Panax ginseng, Nyctanthes arbor-tristis, Phyllanthus emblica, Mimosa tenuiflora, Ocimum tenuiflorum* and/or *Tinospora cordifolia* to Black Bengal goat in the last month of the pregnancy and kids. They reported significantly higher birth weight and absence of kid mortality in the pregnant does and kids supplemented with polyherbal preparation respectively. They concluded that the supplementation of polyherbal preparation during the later part of pregnancy in goats and to kids during the growth period is much more beneficial than administration at either stage alone. Singh et al. (2002), studied on four hundred eighty, day old commercial broiler chicks which were randomized into 2 groups (A and B) with 3 replicates each. All the groups alongwith replicates were housed in 6 pens of a poultry house randomly with standard and identical managemental, nutritional and environmental conditions. All the chicks were vaccinated as per the routine practice of the farm. Group A was offered basal diet of broiler starter and finisher rations whereas group B and its replicates received the same basal diet supplemented with LivoLiv at the rate 0.5 g per kg of feed from day one to six weeks of age. No other growth promoter or liver tonic was added in the feed or drinking water.

It was observed that significantly higher 6 week body weight (1471 g) was obtained with the diet containing LivoLiv as compared to control diet (1386 g), along with significant differences in the F.C.R. (1.91 Vs 2.09) and mortality (3.75 percent Vs 6.67 percent). Crude protein and energy retention were found significantly higher with the LivoLiv administered diet as compared to control diet. Similarly, significant increase in dressed and edible weight and reduction in liver, bursa and kidney weights were also observed. A net extra income of Rs.9.41 per dressed broiler was obtained from the LivoLiv administered group. It may be concluded that supplementation of LivoLiv is beneficial as it improved growth and F.C.R. and reduced mortality and incidence of liver disorders in broilers Singh et al. (2002).

15. Effect of polyherbal supplementation on reproductive performance of dairy goats.

Wheeler and Agrawal (1999) evaluated the effect of herbal Prajana SS Premix on synchronisation of oestrus and conception rate in cows. In experiment 1, all cows and heifers came in oestrus and were served by Al. Out of 9 cows and 5 heifers 86 percent became pregnant on first oestrus. The remaining two cows repeated 21 days later and became pregnant by natural service. In experiment 2, all the 20 cows came in oestrus, within 10 hours of each other, after 6 days of last Prajana SS administration. It was noteworthy that unlike with the use of Prostaglandins, the length of oestrus period was not reduced in the Prajana Premix treated cows, which made it possible to easily complete Al in the whole herd.Koutecka (1997), assessed the efficacy of "replanta" a herbal product for improving breeding efficiency in cows, it improved uterine tone when used for resolving reproduction problems like retention of placenta and other postpartum complications in cows. Replabta being purely herbal and biodegradable and with no problem of withdrawal time has big advantage over chemical treatments. Further, with the use of Replanta it is also observed that the service period and the interval of insemination can also be reduced alongwith faster uterine involution. Replanta also ensured early start of the ovarian cycle and insemination.

Pandey and Raghuvanshi (1992), conducted drug trial on 60 cows and 10 buffaloes which were divided randomly into five groups with equal number in each group including cows and buffaloes, out of those five groups, four groups were experimental and one served as control. Experimental groups were separately dosed with REPLANTA powder, REPLANTA liquid, Uterotone liquid and a cleansing drench containing ergot immediately after parturition and observations recorded. The cows and buffaloes treated with REPLANTA powder and REPLANTA liquid came early in first heat after calving and reproductive cycle was found to be more regularised as compared to other drugs tested. REPLANTA treated animals come to heat second time also.Paul *et al*. (1995), evaluated the efficacy of Replanta treatment on placental expulsion,lochial cessation, uterine involution and post partum oestrus in Murrah buffaloes. In all, 92.00 per cent buffaloes of Replanta treated group expelled their foetal membranes within a mean duration of 6.30 ± 0.51 hour as compared to 84.00 per cent buffaloes of control group within 7.38± 0.64 hour of parturition. Significantly earlier ($p < 0.05$) cessation of lochia and uterine involution was observed in Replanta treated group than the untreated control group of buffaloes. Eighty eight per cent buffaloes of Replanta treated group expressed first post partum oestrus with a mean duration of 78.23± 3.50 days as compared to eighty per cent buffaloes of control group within 87.00± 4.92 days post partum.

16. Effect of polyherbal supplementation on profitability and Green House Gases emission

A recent report from the Food and Agriculture Organization concludes that livestock are responsible for 18% of global anthropogenic greenhouse gas (GHG) emissions (Steinfeld *et al*., 2006).

Since 1999 atmospheric methane concentrations have leveled off while the world population of ruminants has increased at an accelerated rate. Prior to 1999, world ruminant populations were increasing at the rate of 9.15 million head/ year but since 1999 this rate has increased to 16.96 million head/ year. Prior to 1999 there was a strong relationship between change in atmospheric methane concentrations and the world ruminant populations. However, since 1999 this strong relation has disappeared. This change in relationship between the atmosphere and ruminant numbers suggests that the role of ruminants in greenhouse gases may be less significant than originally thought, with other sources and sinks playing a larger role in global methane accounting (IAEA, 2008).

In developing countries, some 2.3-2.6 billion people are supported by agricultural systems characterized by modern technologies brought about by the Green Revolution. These systems utilize good soils and usually have reliable access to water, and are close to the roads, markets and supplies of inputs. However, these systems are not applicable to the 1.9-2.2 billion people living in rain-fed, undulating and mountainous areas, which are largely untouched by modern technology. They tend to be in the poorer countries with little foreign exchange to buy external inputs. Their agricultural systems are complex and diverse, and are located in the humid and semi-humid lowlands, the hills and mountains, and the drylands of uncertain rainfall (Lylian, 1998). They are remote from services and roads, and they commonly produce per unit area only one-fifth to one-tenth of the food as farms in the industrialized and Green Revolution lands.The world population is growing very fast. In 1950 it was 2.5 billion and increased to 5.3 billion by 1990. The projections for 2030 show the world population rising to 8.9 billion. It is therefore a fundamental issue that any intervention involving livestock must be predicated on their synergistic role in benefit of the whole farming system rather than as producers of meat, milk or eggs using feeds which are in competition with human needs (Lylian, 1998).

Livestock contribute both directly and indirectly to climate change through the emissions of greenhouse gases such as carbon dioxide, methane and nitrous oxide. Globally, the sector contributes 18 percent (7.1 billion tonnes CO_2 equivalent) of global greenhouse gas emissions. Although it accounts for only nine percent of global CO_2, emissions it generates 65 percent of human-related nitrous oxide (N_2O) emissions and 35 percent of methane (CH_4) emissions, which have 296 times and 23 times the Global Warming Potential (GWP) of CO_2 respectively(ASK FAO). Methane emissions mostly occur as part of the natural digestive process of animals (enteric fermentation) and manure management in livestock operations. Methane emissions from livestock are estimated at about 2.2 billion tonnes of CO_2 equivalent, accounting for about 80% of agricultural CH_4 and 35% of the total anthropogenic methane emissions. Nitrous oxide emissions are associated with manure management and the application and deposition of manure. Indirect N_2O emissions from livestock production include emissions from fertilizer use for feed production, emissions from leguminous feed crops and emissions from aquatic sources following fertilizer application (ASK FAO). The livestock sector contributes about 75 percent of the agricultural N_2O emissions (2.2 billion tonnes of CO_2 equivalent).Carbon dioxide emissions from the livestock sector are related to fossil fuel burning during production of fertiliser for feed production, the livestock production process, processing and transportation of refrigerated products. Furthermore, livestock are a major driver of the global trends in land-use and land-use change including deforestation (conversion of forest to pasture and cropland), desertification, as well as the release of carbon from cultivated soils. The overall contribution of CO_2 emissions from the livestock sector are estimated at 2.7 billion tonnes of CO_2 (ASK FAO). Feed additives that manipulate the microorganisms living in the rumen to quicken microbial fermentation. There is currently interest in the role of plant secondary compounds such as saponins and tannins in reducing CH_4 emissions (Wallace, 2004; Patra *et al*., 2006). Saponins have been shown to possess strong defaunating properties both *in vitro* (e.g., Wallace *et al*., 1994) and *in vivo* (e.g. Navas-Camacho *et al*., 1993) which could reduce CH_4 emissions. Beauchemin *et al*. (2008) recently reviewed literature related to their effect on CH_4 and concluded that there is evidence for a reduction in CH_4 from at least some sources of saponins, but that not all are effective. Likewise they reported that there is evidence that some condensed tannins (CT) can reduce CH_4 emissions. Some legumes contain CT, but unfortunately these may reduce forage digestibility and the CT containing varieties tend to have weak agronomic performance. Extracts from plants such as rhubarb and garlic could decrease CH_4 emissions (McAllister and Newbold, 2008; BSAS, 2008). While there is insufficient evidence to conclude on the potential of plant secondary compounds or extracts as mitigation strategies, this is likely to be an area of significant research over the coming years.

Tiwari *et al.* (1993), tested an experiment on combination of certain herbs having galactogogue and stomachic actions to test its efficiency on milk production in jersey crossbred cows, fed diets according to NRC standard computed on fortnightly basis. The mean DM intakes per cow per day were similar in both the groups for the full lactation. It was observed that the cows of group II showed an increase in milk production by 74.0 kg given this combination of herbs over the control group, the effect was noticed mainly in the mid trimester($p<0.01$). The feed efficiency for milk production was 1.41 and 1.37 kg DM/.kg milk in group I and II respectively, showing better utilization of nutrient in the latter group.

Aliam *et al.* (1999) studied the effect of supplementing four medicinal herbs and plants (garlic, fenugreck, *Nigella sativa* and camomile) to Zaraibi goat ration on their performance. Results showed improvement($p<0.05$) in digestibility coefficients of DM,OM,CP and the nutritive value as TDN and DCP for all additive groups compared with control one.. Ration with NS showed the highest nutritive values, but milk Yield is increased in all treatment groups fed by supplementation compare to control group. It is concluded that medicinal herbs and plants improved feed conversion, economic return and decreased feed cost of 1kg milk compared with control group. Kumari and Akbar (2006) tested the clinical efficacy of some herbal preparations (The combination of *Leptadena reticulata,Nigella sativa, Foeniculum vulgare, Pueraria tuberosa* and *Asparagus racemosus*) and reported this supplementation was effective in curing digestive disorders and early restoration of normal milk production in lactating Buffaloes.

Randhawa *et al* (1994) studied on assessment of the effect of herbal biostimulators in optimizing ruminal digestion and milk production and also their effect on various biochemical constituents in dairy cows. There was significant increase in milk yield in treated groups with maximal increase being recorded group which it is fed by Galog. The average milk yield in all the treatment groups even at the termination of the experimental study was still significantly ($p<0.05$) higher than the base value. The increased sustained milk production in all the treated groups was due to the galactopoietics effect of the feed additives which helped in better utilization of absorbed nutrients in the body tissues and lactopoietic system.Max *et al.*,(1997), determined the effects of inclusion of certain herbal preparations in the feed used in commercial turkey production. The test group birds (those fed diets containing Indian Herbs products) performed better than the control group birds, this despite the test birds being given a diet contaminated with Vomitoxin at a level in excess of 5000 ppb for two weeks longer than the control birds. Also the test bird house experienced certain unforseenable accidents during the trial period that adversely affected performance and livability of the test birds when compared to the Control birds. The financial advantage of the test birds was between Pound 1.42 to 1.56 per bird over the Control birds at slaughter. The additional cost of including the herbal products in the test bird rations amounted to approximately 30 pence per bird.

Sapra and shingan(1991),assessed the effect of LIVOL to the quail hens in the manufacturer recommended doses. It was observed to be 44.35 and 48.76 percent in control and LIVOL fed groups respectively, indicating a statistically highly significant improvement in egg production in LIVOL fed birds. The differences in egg weight were, however, insignificant. The improvement in efficiency of feed utilization per dozen eggs produced in LIVOL fed group was observed to be 26.30 percent over control. A similar trend was observed in the improvement of feed utilization per kg of egg mass laid. The LIVOL fed group indicated an improvement by 12.21 percent over control group. It is, therefore concluded that feeding of LIVOL may be economical through better egg production and feed utilization in quail hens.Khurana *et al*., (1996), assessed the efficacy of the herbal galactagogue PAYAPRO in lactating buffaloes at an organised farm. Ten healthy Murrah buffaloes, calved 35 to 74 days earlier were fed Payapro @4 bolus daily for 16 days. The effect of increased milk yield was manifested within 7 days of treatment, reached its maximum level at day 21 and remained above pretreated level till day 35. However, the beneficial effect in arresting the decline in milk yield vis-à-vis untreated animals was seen till the last observation at day 49. The cumulative gain in milk yield in treated animals over the control animals during the 7 weeks observation worked out to 35.5 Kg. per animal. The economics of medication was highly favourable.Bhutadu (1996),evaluated the influence of the Payapro in twenty five crossbred cows, calved 60-89 days earlier were divided into 2 groups viz., treated (15 animals) and control group (10 animals), near identical in terms of body wt., calving and lactation status. The animals in treated group were administered Payapro @ 4 bolus per animal daily along with feed consecutively for 15 days while the control animals were given feed without Payapro. The daily milk yield was recorded at the start of trial and thereafter for each animal in both the groups for 49 days. The result indicated that Payapro administered in the declining phase of lactation resulted in both increased milk yield compared to pretreatment levels and persistence of lactational levels compared to the control groups. This was evident by Extra milk yield of 30.4 lit. per animal over a Seven weeks period in treated animals along with sustenance of increased milk yield for as long as 7 weeks. The treatment was also found highly cost effective with a cost benefit ratio of 1:3.

Conclusion

It is concluded that Ayurveda has been practiced for thousand of years in India with great success. Uses of medicinal plant for human being is already well documented and support its therapeutic use as a multi-purpose medicinal agent. But, only a few studies have been done on dairy animals particular for dairy goat, these herbs which are of pharmacological and chemical type. But, growing human awareness and demand of chemical residues free and clean milk, there is a need to carry bio-chemical work and more detailed studies on dairy animals. Utilization of phytomedicines will not only improve the reproductive efficiency and health of our animals but also support the farmer's income through production of more milk per animal.

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