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Medicinal Plants and their Role in Wound Healing

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Plants and their extracts have immense potential for the management and treatment of wounds. The phyto-medicines for wound healing are not only cheap and affordable but are also purportedly safe as hyper sensitive reactions are rarely encountered with the use of these agents. These natural agents induce healing and regeneration of the lost tissue by multiple mechanisms. However, there is a need for scientific validation, standardization and safety evaluation of plants of the traditional medicine before these could be recommended for healing of the wounds.

KEY WORDS

Wound healing, plant extract, phyto-medicine

INTRODUCTION

Wound is defined simply as the disruption of the cellular and anatomic continuity of a tissue (Bennet, 1988). Wound may be produced by physical, chemical, thermal, microbial or immunological insult to the tissue. The process of wound healing consists of integrated cellular and biochemical events leading to reestablishment of structural and functional integrity with regain of strength of injured tissue. Clinically, one often encounters non-healing, under-healing or over healing. Therefore the aim of treating a wound is to either shorten the time required for healing or to minimize the undesired consequences (Myers *et al*, 1980). Attention should be directed towards discovering an agent, which will accelerate wound healing either when it is progressing

normally (Mather *et al*, 1989), or when it is suppressed by various agents like corticosteroids (Ehrlich & Hunt, 1968), anti-neoplastics (Raju & Kulkarni 1986), or non-steroidal anti-inflammatory agents.

Medical treatment of wound includes administration of drugs either locally (topical) or systemically (oral or parenteral) in an attempt to aid wound repair (Savanth & Shah, 1998). The topical agents used include antibiotics and antiseptics (Chulani, 1996), desloughing agents (chemical debridement, e.g. hydrogen peroxide, eusol and collagenase ointment) (Savanth & Mehta, 1996), wound healing promoters (e.g. Tretinoin, *aloe vera* extract, honey, comfrey, benzoyl peroxide, *chamomilia* extract, dexpanthenol, tetrachlordecaxide solution, clostebol acetate and the experimental cytokines.

Various growth factors like platelet derived growth factor, macrophage derived growth factor, monocyte derived growth factor (Mather *et al*, 1989) etc. are necessary for the initiation and promotion of wound healing. Many substances like tissue extracts (Udupa *et al*, 1991), vitamins & minerals and a number of plant products (Dahanukar *et al*, 2000) have been reported by various workers, to possess pro-healing effects. Wound healing herbals encourage blood clotting, fight infection and accelerate the healing of wounds.

Plants or chemical entities derived from plants need to be identified and formulated for treatment and management of wounds. In this direction a number of herbal products are being investigated at present. Various herbal products have been used in management and treatment of wounds over the years. A few plants/plant products with promise are discussed in this paper.

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Aloe vera

Aloe, a native to Africa, is also known as “lily of the desert” or the plant of immortality. Its name was derived from the alloeh meaning “bitter” because of the bitter liquid found in its leaves. Egyptians recorded use of this herbal plant in treating burns, infections and parasites as early as 1500 B.C. Its clear gel has a dramatic ability to heal wounds, ulcers and burns by forming a protective coating on the affected areas and speeding up the healing process. The fresh plant contains 96% of water and rest is essential oil, amino acids, minerals, vitamins, enzymes and glycoproteins. Various constituents of *Aloe vera* have been shown to have anti-inflammatory activity. They also stimulate wound healing. Some clinical reports suggest topical *Aloe vera* gel is useful in healing minor burns and that such application of the gel is harmless as hypersensitive reactions to it are rare. However, in some severe burns, aloe gel may actually impede healing (Schmidt & Greenspoon, 1991).

Azardica indica

It is commonly called as Neem and the plant has diverse medicinal properties. Neem oil contains margosic acid, glycerides of fatty acids, butyric acid and trace of valeric acid. Various active principles are nimbidin, nimbidal, azardirachtin, nimbin, azadirine, gedunin, salanin. They have diverse medicinal activities. Neem oil is especially beneficial for curing skin ailments. Oil is used for dressing for foul ulcers, eczema and skin diseases like ringworm, scabies and mange in dogs. It is a powerful insect repellent, anti-bacterial, anti-fungal, anti-viral, anti-inflammatory and also strengthens the body's overall immune responses. Neem oil contains fatty acids which build collagen, promote wound healing and maintain the skin's elasticity. The active ingredients of neem oil help in the process of wound healing and the skin is able to retain its suppleness as the wounds heal. Neem oil has a high content of essential fatty acids. They keep the site moist and give a soft texture to the skin during the healing process. Alcoholic extract of

neem is useful in eczema, ringworm and scabies. Neem leaf extracts and oil from seeds has proven anti-microbial effect. This keeps any wound or lesion free from secondary infections by microorganisms. Clinical studies have also revealed that neem inhibits inflammation as effectively as cortisone acetate, this effect further accelerates wound healing.

Lantana camara

Lantana camara Linn, a shrub native of tropical America has completely been naturalized in many parts of India as an ornamental plant. The plant has abortifacient, antimalarial, anti-inflammatory and wound healing properties. The hydro-alcoholic extract and fresh juice of leaves have favoured wound contraction (Kurian, 1995). The plant is potentially toxic and its toxicities include nephrotoxicity, hepatotoxicity, photosensitization, dermatitis, intestinal haemorrhage, therefore, the use of this plant in whole or any part thereof needs to be carefully regulated until the alarming toxic principles of the plant are properly identified and removed.

St. John's Wort (Hypericum spp.)

St. John's wort is a bushy perennial plant with numerous yellow flowers. It is native to many parts of the world including Europe and the United States. It has an age old history of safe and effective usage in many folk and herbal remedies. It is claimed to be useful in mental depression, anxiety, sleep disorders, menstrual cramping, sciatica and arthritis. The blossoms have been used in folk medicine to relieve patients suffering from ulcers, gastritis, diarrhea and nausea. This plant has an antiseptic action, relieves inflammation and promotes healing when used externally on cut surfaces of the body. The tincture of *Hypericum* spp. when given orally has a remarkable effect in lacerated and suppurred wounds with restoration of tissue vitality (Fayazuddin, 1981). Pro-healing action of *Hypericum* spp. tincture is evidenced by enhanced epithelization phase with an increase in wound contraction rate and granulation tissue breaking

strengths (Rao *et al*, 1991).

Tridax procumbens

The plant is a native of tropical America and naturalized in tropical Africa, Australia and Asia including India. Leaf of *Tridax procumbens* mainly contains crude protein (26%), crude fiber (17%), soluble carbohydrate (39%) and calcium oxide (5%) (Chadha,1976). The juice of the leaves of this plant is used by villagers to arrest bleeding from cuts and bruises in animals. This juice accelerates two phases of healing namely epithelization and collagenization; however it retards scar formation and granulation (Diwan *et al*, 1983).

Tridax procumbens antagonized anti-epithelization and tensile strength depressing effect of dexamethasone without affecting its anti-contraction and anti-granulation action. (Diwan *et al*, 1983). The effect of various extracts (whole plant extract, aqueous extract, butanol extract and ether fraction) of this plant has been studied in dead space wound models. Compared to various extracts, the whole plant extract has the greatest pro-healing activity with increase in tensile strength and lysyl oxidase activity. Aqueous extract was also effective in increasing lysyl oxidase but to a lesser degree (Udupa *et al*, 1991). Leaf extracts of this plant also promote wound healing in both normal and immuno-compromised (steroid treated) rats in dead space wound model. The plant increased not only lysyl oxidase but also, protein and nucleic acid content in the granulation tissue, probably as a result of increase in glycosamino glycan content (Udupa *et al*, 1998).

Chromolaena odorata:

Chromolaena odorata was first identified in Central America and Vietnam. The aqueous extract and the decoction from leaves of this plant have been used throughout Vietnam for the treatment of soft tissue wounds and burn wounds. Aqueous extracts of *Chromolaena odorata* enhances hemostatic activity (Akah, 1990) and stimulates granulation tissue and re-epithelization

processes (Lee, 1995). The extract also inhibits wound contraction reversibly. Therefore, the plant can be of much therapeutic value in minimizing post burn scar contracture and deformities.

Hydnocarpus wightiana

The oil of *Hydnocarpus* spp. has been used for several years as anti-leprosy drug and as an anti-parasitic drug in the treatment of guinea worm infestation. The oil of *Hydnocarpus* spp. when given orally or administered topically helped to heal the wounds and gangrene faster in leprosy and diabetic patients (Manjrekar, 1996). The wound healing effect of oil of *Hydnocarpus* spp. was studied with reference to collagenation and the strength of scar tissue (Oomen *et al*, 1999). The drug treated group showed a significant increase in strength of scar tissues in the incision wound model and also increased the strength of collagen tissue and hydroxyl-proline content in the dead space wound model. *Hydnocarpus* oil administered orally promoted epithelization, but not wound contraction (Oomen *et al*, 2000). External application of oil of *Hydnocarpus* spp. and its paste significantly shortened the epithelization period when compared to control group. Oil may act as adjuvant in healing of wounds and ulcer in leprosy patients and therefore, may be clinically useful.

Helianthus annus Linn.

An ornamental annual herb, with erect, rough and hairy stem is common in Indian Gardens in swampy areas. In traditional medicine the plant is used by tribals for inflammation of eyes, sores, dysuria, colic, tiger bites and bone fractures (Jain & Tarafdar, 1970). In a study the alcoholic extract of whole plant of *H. annus* applied in the form of an ointment on the excised wound of rat led to a significant reduction in total healing period. This has been confirmed by histology where earlier appearances of fibroblasts were seen. Early appearance and higher accumulation of mucopolysaccharides has been stated as indicators of hastened repair (Deshpande *et al*, 1965).

Jasminum auriculatum

A small herb found in south India and the western peninsula. The alcohol free defatted extract of *J. auriculatum* leaves has been reported to contain lupeol and jasminol (Deshpande & Upadyaya, 1967). Juice of leaves of *J. auriculatum* has been shown to be beneficial in wound healing. The juice when applied in the form of jelly, locally on linear uniform excised wound in rats is found to promote wound healing. This has been assessed by histological, biochemical and contraction rate studies (Deshpande *et al*, 1965). Fresh juice of the leaves showed an increase and early gain of the tensile strength in the linear wounds in rats. The study indicated that collagenation contributed to improved tensile strength in the early phase of healing. Such effect was also reported by Deshpande & Pathak (1966). Ghee medicated with *J. auriculatum*, on topical application accelerated the healing time of second degree burn wounds in rats up to six days. The mucopolysaccharide accumulation was significantly higher in group treated with medicated ghee (Deshpande & Pathak 1966).

Ginkgo biloba

Ginkgo biloba (*Salisburia aduatifolia*) is also known as maiden hair tree. The genus ginkgo originated 200 million years ago and is considered as a living fossil (Hori *et al*, 1997). Extracts of leaves have been used therapeutically for centuries (Newall *et al*, 1996). *Ginkgo biloba* exhibits a variety of interesting pharmacological activities such as increase in blood fluidity, antioxidant, membrane stabilizing, improvement in cognition and pro-healing (Bairy & Rao, 2001). Its preparations promote epithelization without altering wound contraction. In case of dead space wounds *Ginkgo biloba* has increased granulation tissue breaking strength without altering granulation tissue mass weight. However, it did significantly enhance the content of hydroxyl-proline of granulation tissue. The main constituents of *Ginkgo biloba* are flavonoids and terpene trilactones and the pro-healing action of the *Ginkgo biloba* is due to the presence of

flavonoids (Bairy & Rao, 2001).

Curcuma longa Linn.

Commonly known as turmeric and haldi in Hindi. *C. longa* has been reported to possess antibacterial, anti-fungal and anti-inflammatory activities (Chopra *et al*, 1986). The part used are rhizomes and it contains curcumin (diferuloyl methane), turmeric oil or turmerol and 1,7-bis, 6-hepta-diene-3, 5-dione. Curcumin has potent anti-inflammatory and analgesic activities (Srimal *et al*, 1971). Volatile oil isolated from *C. longa* also exhibits antibacterial and potent anti-inflammatory activity. *Curcuma longa* also contains protein, fats, vitamins (A, B, C etc) all of which have an important role in wound healing and regeneration. Turmeric has been used for treating the wounds in the rats (Rao *et al*, 2003). The anti-inflammatory property and the presence of vitamin A & proteins in turmeric result in the early synthesis of collagen fibers by mimicking fibroblastic activity (Kumar *et al*, 1993). Juice of the fresh rhizome is commonly applied to recent wounds, bruises & leech bites. A paste of turmeric & leaves of *Justica adhatoda* with cow urine is rubbed on skin affected with prurigo & eczema. It can also be mixed with ginger oil to prevent skin eruptions.

Centella asiatica

Centella asiatica (Brahmi) also known as “gotu kola”, is the main herb in Ayurveda for nervous system, it is used in the repair of nervous tissue from crushing trauma, such as spinal injury, neuromuscular disorders, and to increase general brain function and memory concentration. It is used extensively in the treatment of leprosy, a host of skin conditions including cellulites, varicose vein and wounds. The active principles of *Centella asiatica* are triterpenes and asiaticoside which are responsible for promotion of rapid wound healing (Shukla *et al*, 1999). Aqueous extract of *Centella asiatica* suspended in 5% propylene glycol promoted wound healing on topical administration in experimentally induced open wounds in rats as compared to other extracts

(alcoholic, petroleum ether and chloroform). This was evidenced by the increase in collagen content and thickness of epithelium (Rao *et al*, 1996). However, Suguna *et al* (1998) demonstrated that alcoholic extract of *Centella asiatica* orally or topically improved the rate of wound healing in rats. Topical administration of the aqueous extract increased cellular proliferation, promoted the collagen synthesis at the wound site as evidenced by the increase in DNA, protein, collagen content of granulation tissue and in tensile strength. The treated wound epithelized faster as compared to control. Among the various formulations (ointment, cream and gel) of aqueous extract, the process of healing was better with gel formulation.

Cedrus deodara

Its oil has been reported to possess anti-inflammatory and anti-microbial activities. *Cedrus deodara* has also shown wound healing properties and is particularly useful in infective wounds (Dikshit & Dixit, 1982).

MISCELLANEOUS PRO-HEALERS FROM PLANTS

The healing effects of *Ocimum sanctum*, and *Begia odorata* on infected experimental wounds in laboratory animals have been reported. All these plants, notably *Ocimum sanctum* promote healing (Thaker & Anjaria 1986). The aqueous extract *Euphorbia nerrifolia* when applied topically facilitates the healing of surgically produced cutaneous wounds in guinea pigs. It increases the gain in tensile strength, DNA content and promoted epithelization (Rasik *et al*, 1996). Alcoholic extract of *Indigofera aspalathoides* has analgesic, anti-inflammatory and wound healing effect. The crude betal nut extract and its polyphenols promoted healing of incision and dead space wounds (Padmaja *et al*, 1993). Fresh leaves of *Kalanchoea integra* showed encouraging results in healing inflammatory conditions associated with wounds. Mango butter which is extracted from the seeds of *Mangifera indica* is known to have wound healing

properties. It is commonly applied in ulcerations, fissures of lips, hands and on chapped skin. Anecdotal evidence, some clinical observations, animal model studies and few randomized clinical trials support the efficacy of honey in managing wounds (Molan, 1999).

POLY HERBAL PREPARATION

Various combinations like extracts of *Balsamodendron mukul* (guggul), *Maharasanadi kwath*, *Phyllanthus embica*, *Tinospora cordifolia*, *Rubia cordifolia*, *Glycyrrhiza glabra* and shanka bhasma which are claimed to have wound healing action. Poly-herbal preparations containing these herbs have been claimed to be useful in treating Gram negative and Gram positive infections. These herbal preparations have been reported to promote gain in tensile strength in incision wound model, but do not modify the granulation phase of healing (Udupa *et al*, 1989). These herbs have also been reported to promote epithelization and wound contraction in cases of excision wound models (Nadakarni & Nadakarni, 1954). This property may be due to the effect of these herbs on migration and mitosis of epithelial cells and promotion of contraction of myo-fibroblasts. These myo-fibroblasts are responsible for wound contraction (Gibbiani *et al*, 1972).

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Prevalence of Gastrointestinal Parasitic Infestation in Equines of Kashmir Valley

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A study of parasitic infestations in equines under unorganized husbandry practices was carried out in Kashmir valley of Jammu & Kashmir state by faecal samples examination. The overall infestation was found as high as 93.26%. Trichonema sp. (96.78%) dominated other types of parasites, Strongylus sp. (81.19%), Triodontophorus sp. (41.39%), Dictyocaulus sp. (14.10%), Oxyuris sp. (9.40%), Paranoplocephala sp. (8.14%), Strongyloides sp. (6.19%), Parascaris sp. (4.01%), Amphistome sp. (0.91%) and Eimeria sp. (0.34%) were also recorded.

KEY WORDS

Equines, Helminths, Kashmir

INTRODUCTION

Equines as a means of transport for men and material provide livelihood to a large number of rural and semi-urban populace of Kashmir. Horses do suffer from a number of diseases. Parasitic infestation is a major cause of illness. Documentation of parasitic infestation of horses in Kashmir valley is lacking. Therefore, the present study was undertaken to identify and assess their prevalence.

MATERIALS AND METHODS

Faecal samples from 935 equines were examined to identify gastrointestinal parasites.

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For identification of larval stages the samples were subjected to both sedimentation and floatation techniques (Soulsby, 1982). Third stage larval *Strongyle* species were identified after incubation of the pooled positive samples at 25-28° C ($\pm 1^\circ$) for ten days as per the procedure described by Soulsby (1965) and Anonymous (1971). The seasonal prevalence of various parasites was then calculated.

RESULTS AND DISCUSSION

A total of 935 faecal samples were collected from equines of Kashmir valley, a total of 872 (93.26%) were found to harbour various types of gastro-intestinal parasites. Most of the horses were having more than one type of parasitic infestation simultaneously. The results obtained in the present study during different months and seasons are depicted in Table 1.

Overall infestation with *Trichonema* sp. (96.78%) was most common followed by *Strongylus* sp. (81.19%), *Triodontophorus* sp. (41.39%), *Dictyocaulus* sp. (14.10%), *Oxyuris* sp. (9.40%) and *Parascaris* sp. (4.01%). Among *Strongylus* sp. (81.19%), *S. edentatus* and *S. equinus* were the species identified on the basis of coproculture. Only one cestode *Paranoplocephala* sp. (8.14%) and one trematode *Paramphistomum* sp. (0.91%) were recorded in the present study. *Eimerian* oocysts present in 0.34% samples belonged to a single specie i.e. *E. lukharti*.

Sengupta and Yadav (1997) have observed high prevalence *Strongylus edentatus*, *S. equinus* and *Triodontophorus* in the equines of Tarai region of UP. The prevalence of these parasites in our study is also high. In the present study only one type of

cestode *Paranoplocephala* sp. was recorded, however, Aydenizoz (2004) has identified two genera of equine cestodes; *Anoplocephala* and *Paranoplocephala* from horses of Kirikkale, Turkey. The trematode identified in the present study is similar to the one identified by Sengupta and Yadav (2001).

The only species of *Eimeria* identified as *E. leukharti* was in accordance with the specifications mentioned by Bhatia (2000).

CONCLUSION

High prevalence of gastrointestinal parasites in equines of Kashmir is evident from this study. It is therefore recommended that broad spectrum anthelmintic drugs must be given to the horses on mass campaign basis. The dosing schedule should be followed as per seasonal prevalence and parasitic load. Four dosings per year should also include an anti cestodal drug.

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Table 1

Month & season	Samples examined	Samples +ve	A	B	C	D	E	F	G	H	I	J
December	46	43	41	38	22	-	7	-	-	2	-	-
January	60	40	40	40	15	-	6	-	-	2	-	-
February	46	39	31	16	19	-	7	-	5	4	-	-
Winter	152	122 (80.26)	112 (91.80)	94 (77.04)	56 (45.90)	-	20 (16.39)	-	5 (4.09)	8 (6.55)	-	-
March	80	80	80	80	60	2	17	20	40	15	3	-
April	78	78	74	60	48	6	4	18	2	4	4	3
May	60	60	60	60	-	7	21	6	-	17	1	-
Spring	218	218 (100)	214 (98.16)	200 (91.73)	108 (49.54)	15 (6.88)	42 (19.26)	44 (20.18)	42 (19.26)	36 (16.51)	8 (3.66)	3 (1.37)
June	109	94	92	58	23	13	15	-	10	10	-	-
July	178	164	163	106	20	6	16	3	3	1	-	-
August	81	77	74	68	37	1	20	1	-	4	-	-
Summer	368	335 (91.03)	329 (98.20)	232 (69.25)	80 (23.88)	20 (5.97)	51 (15.22)	4 (1.19)	13 (3.88)	15 (4.47)	-	-
September	76	76	76	65	18	-	-	2	-	2	-	-
October	63	63	57	63	45	-	-	-	-	-	-	-
November	58	58	56	54	54	-	10	4	22	10	-	-
Autumn	197	197 (100)	189 (95.93)	182 (92.38)	117 (59.39)	-	10 (5.07)	6 (3.04)	22 (11.16)	12 (6.09)	-	-
Overall	935	872 (93.26)	844 (96.78)	708 (81.19)	361 (41.39)	35 (4.01)	123 (14.10)	54 (6.19)	82 (9.40)	71 (8.14)	8 (0.91)	3 (0.34)

Figures in parenthesis represent positive percentage

Legend: A=Trichonema, B=Strongylus, C=Triodontophorus, D=Parascaris, E=Dictyocaulus, F=Strongyloide, G=Oxyuris, H=Paranoplocephala, I=Paramphistomum, J=Eimeria

Effects of Breeding Practice and Sex on Growth of Black Bengal Goats under Village Conditions of West Bengal

S. Bera†, A. K. Samanta†, A. K. Santra†* and S. K. Maiti†

The growth performance of Black Bengal goats reared under village condition of West Bengal was studied. The overall growth rate from first week to 24th weeks of age was found to be 42.88 g/day. The growth rate of first three weeks of age ranged from 49.3 to 71.83 g/day. The lowest growth rate was observed in between 8 and 13 weeks of age. Further observation revealed that the overall growth rate up to 24th weeks was almost similar in both treatment (44.09 ± 2.14 g/day) and control groups (43.05 ± 1.95 g/day). The pattern of growth rate of first two weeks was higher in both the groups. Males were found to be higher daily gain in body weight (48.62 ± 1.98 g/day) than females (37.60 ± 1.67 g/day). The growth rate according to sex was found to differ significantly ($p < 0.01$).

KEYWORDS

Bengal goat, growth rate, breeding practices, sex, village condition

INTRODUCTION

The wide distribution of goats in the tropics and subtropics due to their ability to adapt to a wide variety of environments and their flexible feeding habits reflects that they can be managed under all types of animal husbandry from the intensive and sophisticated to the most extensive forms of nomadic grazing (Acharya, 1992). Goat farm is an

essential component of farming system of rural people.

Few reports are available on the performance of goats under village conditions and are inadequate to take up area specific goat improvement programme. Growth rate in terms of change in body weight is directly associated with the weight at marketing age which leads to economic return. The Bengal breeds of goat known for producing excellent quality meat and superior skin to other breeds are widely distributed in West Bengal, Assam, Jharkhand and adjoining areas. Keeping in view of its importance for socio-economic development of poor people as well as to need assess potential of local breeds of goat under village condition a study was conducted to find the effects of breeding practices and sex on growth performance of Bengal goats reared under village conditions.

MATERIALS AND METHODS

The study was conducted in three different villages namely Ayeshpur-Panchpota, Ganguria and Hatikanda-Daluipur in the Nadia district of West Bengal. The goats are managed by the farmers by extensive grazing system. They are generally taken out for grazing during day light. The data on growth rates were recorded from 71 kids. Weekly average daily gain in weight up to 24 weeks of age was calculated based on the formula (Brody, 1945). The body weights of kids up to 24 weeks of ages were recorded individually in the morning before the kids were fed. The information pertaining to the present study was collected by PRA technique (Schonuth *et al.*, 1995). Data were classified according to breeding

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practices followed and sex on average daily gain in weight. Breeding practices were classified in to two groups: treatment and control groups. Treatment groups were those where kids were born by mating of selected group of bucks, whereas kids born by mating of unselected group of bucks were from control group. The data were subjected to statistical analysis according to Snedecor and Cochran (1968).

RESULTS AND DISCUSSION

The present findings on daily weight gain per week up to 24th weeks are presented in Table 1. The overall growth rate from first week to 24th week of age was found to be 42.88 g per day. It was also observed that the growth rate of first three weeks of age ranged from 49.3 to 71.83 g. From 4th to 7th week of age the rate was varied from 41.30 to 43.46 g. However, the growth rate was lowest in between 8 and 13 weeks of age followed by increased growth rate ranging from 39.63 to 47.24 g up to 24th weeks of age. The variations in body weights at different age groups might be due to differences in the genetic make up of the individuals and management practices followed by farmers in different villages. The present findings are closely related to the earlier workers (Kumar and Singh, 1983; Husain *et al*, 1992).

The effect of breeding practices on growth rate is presented in Table 2. The results indicated that the overall growth rate up to 24th weeks were close in both treatment (44.09 ± 2.14 g/day) and control groups (43.05 ± 1.95 g/day). The pattern of growth rate of first two weeks was higher in both the groups. The lowest growth rate was observed in 10th weeks of age in treatment group (25.67 g/day) while it was found lowest (33.20 g/day) in 4th weeks of age. The study also revealed that the growth rate up to 24th weeks age was not significant ($p < 0.01$) between two groups. The previous worker (Husain *et al*, 1996) however observed significantly higher daily gain in selected groups.

Daily gains in body weight according to sex are tabulated in Table 3. It was found that males had a

higher daily gain in body weight (48.62 ± 1.98 g/day) from birth to 24th weeks of age than the females (37.60 ± 1.67 g/day). The highest and lowest weight gain in males was observed as 69.96 g/day and 40.63 g/day in first week and 13th weeks respectively. However, in females the highest growth (73.55 g/day) was observed in first week, while the lowest gain (26.73 g/day) was in 10th weeks of age. The anabolic effect of male sex hormone could be one of the factors for this difference (Hafez, 1962). The analysis of variance showed significant variation of weight gains between male and female ($p < 0.01$). The present study was close to those reported earlier (Singh and Singh, 1998; Singh and Singh, 2000; Singh *et al*, 2002).

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Table 1
Mean values of daily weight gain (grams) at weekly intervals
from birth to 24th week on total basis

Weight gain	No. of observations		No. of weeks																										
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Overall		
71.83±3.35	71	1																											
59.31±3.35	71	2																											
49.3±3.28	71	3																											
42.35±2.55	71	4																											
43.46±2.71	71	5																											
42.25±2.51	70	6																											
41.30±2.68	69	7																											
38.61±2.59	69	8																											
37.60±2.78	68	9																											
33.51±3.19	68	10																											
36.56±3.55	68	11																											
38.76±3.01	68	12																											
34.86±3.32	67	13																											
42.3±3.32	64	14																											
42.0±3.24	63	15																											
43.20±4.25	62	16																											
39.63±3.68	62	17																											
40.55±3.83	62	18																											
43.09±3.52	61	19																											
47.24±2.92	59	20																											
45.76±2.85	59	21																											
46.87±3.04	57	22																											
43.23±3.51	57	23																											
40.48±3.15	57	24																											
42.88±1.44	71																												

Table 2: Mean Values of Daily weight gain (grams) at weekly intervals in kids under different breeding practices

Breeding Practices	Number of Weeks																								Overall	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Control	68.82±.55	62.16±4.42	44.40±5.03	33.20±3.57	44.2±4.20	41.89±3.47	35.32±3.08	35.91±3.79	40.61±4	40.82±4.11	36.12±3.78	44.9±4.11	34.24±5.38	38.09±3.46	41.07±4.47	41.94±6.69	35.94±5.87	41.93±6.27	51.91±4.29	45.95±3.67	43.57±3.91	49.29±4.74	41.19±4.62	39.76±3.50	43.05±1.95	
	No. of observation	37	37	37	37	37	36	36	35	35	35	35	34	33	32	31	31	31	30	30	30	30	30	30	30	37
Treatment	75.11 ± 4.36	56.2±5.09	54.62±4	52.31±2.81	42.65±3.39	42.64±3.68	47.84±4.25	41.56±3.48	34.42±3.83	25.76±4.62	37.01±5.68	32.25±4.19	35.5±3.93	46.77±5.74	42.96±4.77	44.47±5.35	43.32±4.43	39.17±4.50	34.56±5.16	50.0±4.61	48.03±4.18	44.18±3.72	45.50±5.39	41.27 ± 5.46	44.0 ± 1.14	
	Weight gain (g)	34	34	34	34	34	33	33	33	33	33	33	33	33	31	31	31	31	31	30	29	29	27	27	27	34
	No of obs.																									

Table 3: Mean values of daily weight gain (grams) at weekly intervals in male and female kids

Sex	No of obs	No. of weeks																								Overall
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Male	34	69.96±4.48	60.19±4.74	58.40±5.01	45.38±3.36	47.05±4	49.13±3.78	45.89±3.53	40.69±4.5	41.99±4.52	40.69±4.42	43.94±4.62	43.07±4.18	40.63±5.59	48.85±4.82	47.96±5.04	53.1±5.92	44.76±5.23	49.52±4.59	47.62±4.53	53.45±3.68	50.25±3.92	53.45±4.39	50.0±5.57	47.04±5.08	48.62 ±1.98
Female	37	73.55±5.2	58.49±5.3	40.93±4.8	39.58±4.8	40.15±4.7	36.10±4.8	37.10±4.8	36.71±4.0	33.47±4.3	26.73±5.0	29.59±5.2	34.69±5.0	29.59±4.6	36.15±5.0	36.58±4.7	33.93±5.6	34.82±5.3	32.14±5.6	38.71±5.4	42.62±4.8	41.43±4.7	40.05±4.5	36.22±4.5	33.67±4.1	37.60 ±1.67

Anthelmintic Efficacy of Fenbendazole Feed Pellets against Porcine Ascariasis

S. K. Maiti†, S. K. Chaurasia† and Neelesh Sharma‡*

A study was conducted to ascertain the efficacy of fenbendazole feed pellet against natural porcine ascariasis. Twenty middle Yorkshire pigs 7 to 12 months old, of either sex suffering from naturally infected ascaris infection were divided into two groups. Efficacy of the feed pellet was evaluated on the basis of EPG count of fecal sample of all treated animals before and after treatment. Fenbendazole (7.5 mg/kg body weight) feed pellet supplementation for two consecutive days showed 100% efficacy against ascariasis on 7th and 14th day after treatment. Result showed that the EPG count of treated group was reached zero (0) on day 7th post treatment. No apparent untoward effects of drug administration were noticed.

KEYWORDS

Pig, Ascariasis, Fenbendazole, Vetfen 600

INTRODUCTION

Ascariasis, the commonly prevalent helminthic infection of pig causes economic loss to pig industry due to digestive disturbances and poor growth. It also has public health significance (Lord and Bullock, 1982). The disease has an enormous significance in pig rearing as eggs of *Ascaris* sp. remain viable in soil for years together (Korkin, 1980).

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Therefore, present study was undertaken to ascertain the efficacy of fenbendazole feed pellets against porcine ascariasis. Perusal of literature from India provides little information about the use of fenbendazole in pellet form in India an easiest way of antihelminthic administration.

MATERIALS AND METHODS

For this study, 20 middle Yorkshire pigs of 7 to 12 months age of either sex weighing 30 to 40 kg and suffering from naturally acquired ascaris infection were selected from college piggery unit. The animals were randomly divided into two groups viz. A and B, each comprising 10 animals. Pigs of group A served as untreated control whereas pigs of group B were administered two fenbendazole 7.5 mg/kg body weight on two consecutive days in the form of feed pellets containing 600mg fenbendazole per gram (Vetfen 600® - Indian Immunologicals Limited, Hyderabad, India). Eggs per gram (EPG) of feces were determined using Stoll's dilution technique (Soulsby, 1982) before treatment (0 day) as well as on day 3, 7, and 14 post treatment to assess the parasitic load. The efficacy of the drug was evaluated on the basis of reduction or absence of eggs in the feces.

RESULTS AND DISCUSSION

The result of Antihelminthic trials with fenbendazole feed pellet for two consecutive days showed 100% efficacy against *Ascaris suum* infections in pigs.

The efficacy of fenbendazole feed pellet (Vetfen 600®) in pigs naturally infected with *Ascaris suum* is presented in Table 1. The mean EPG

pretreatment of group B pigs was 2422 ± 63.25 and it ranged between 2100 to 2620. On day 3 post treatment mean egg count reduced from 2422 ± 63.25 to 766 ± 28.72 per gram feces (Table 1). Ova were not detected in the feces of the pigs on 7th and 14th day post treatment and the EPG values reduced to zero (0). On the other hand in group A, '0' day mean EPG was 2207 ± 105.13 which increased to 2285 ± 110.68 and 2355 ± 109.29 on 7th and 14th day of observation respectively. No symptoms that could be attributed to the drug as its side effects were apparent up to the end of the study. Batte *et al* (1976) reported that fenbendazole @ 5 mg/kg body weight for 3 consecutive days was 100% effective against *A. suum* as compared to single dose of treatment. Bali and Singh (1979) evaluated the efficacy of fenbendazole @ 5-10 mg/kg body weight in naturally infected pigs and reported 100% efficacy. Stewart *et al* (1981) also observed 100% effectiveness of drug when administered in the feed for 3 consecutive days. The observations of the present study are in agreement with those of previous workers. Vetfen 600® a feed supplement containing fenbendazole is acceptable to animals because of its palatability and is an easy way of antihelminthic treatment.

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Table 1

Mean eggs per gram (EPG) and percentage reduction of eggs treated with Fenbendazole (7.5 mg/kg body weight) feed pellets

Group	Day			
	0	3	7	14
A (Control)	2207±105.13	2285±110.68	2309±113.26	2355±109.29
B (Treated)	2422±63.25	766±28.72	00.00	00.00
Percent reduction in EPG	00.00	68	100	100

Management of Bovine Papillomatosis with Autogenous Vaccine

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Successful treatment of papillomatosis in cattle using autogenous vaccine is reported and discussed.

KEYWORDS

Papillomatosis, bovine, autogenous vaccine

INTRODUCTION

Papillomatosis is a neoplastic disease caused by papilloma virus. It occurs more frequently in bovines than other domestic animals (Smith and Jones, 1970). In cattle, cutaneous papilloma can be encountered on almost any part of body. Some papillomas are topographically specific and caused by distinct virus having different antigenic reactions and D.N.A Composition. Therefore a vaccine providing immunity to one of them does not confer immunity to the other. Although, cutaneous papillomas are usually benign but those of alimentary tract may become malignant (Canipo, 1980 and Shrivastava and Sharma, 1991). Successful treatment of papillomatosis has been a great challenge for field practitioners. Surgical intervention may not be possible if a large area is involved and some times aggravates the condition. The present clinical report pertains to the use of an autogenous vaccine in cattle.

MATERIALS AND METHODS

A cow aged 7 years having developed multiple, irregular warts on teat surface and its suckling calf with cauliflower like rough multiple growths on lips were presented for treatment.

Samples from older growths under aseptic conditions and local analgesia were resected and processed separately. They were finely minced, suspended in saline, filtered through muslin cloth and treated with formalin (by adding 0.5ml of 10% formalin to 100ml of mother solution) to inactivate the virus (Blood *et al*, 2002). Antibiotic (Strepto penicillin 2 mg/ml) was also added to each vial. The auto vaccine was administered @ 1 ml/20 kg body weight intra-dermally. Three injections were given fortnightly to each animal.

RESULTS AND DISCUSSION

The multiple growths on the teats of the cow were interfering with the milking procedure. The calf had contracted infection possibly through direct contact during suckling (Blood *et al* loc. cit). Administration of autogenous vaccine caused sloughing of the warts from the affected areas. In both the cases complete recovery took two months. Autogenous vaccine has also been tried for such domestic animals and poultry by Page, (1967) Calnek *et al* (1991), Chawdry (2004) and Blood *et al* loc. cit.

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