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ABSTRACT: Sarcoptic mange in sheep, causes heavy losses in quantity and quality of wool and meat production. The present investigation aimed at evaluating the oxidative stress-antioxidant defense and erythrocytic membrane responses during sarcoptic mange in sheep. A bio-organic therapy (BT) was evaluated for its efficacy. Tocopherol was assessed for its antioxidant adjunctive potential. Materials and Methods: Nineteen sheep with sarcoptic mange (aged 9-12 months, with lesions ascribed to Sarcoptes scabiei var. ovis) were divided into 2 groups of 8 (group 1) and 11 (group 2) respectively. Group 1 was sprayed with the BT (Topicure: Natural Remedies Private Limited, Bangalore, India; containing extracts and distillates of Eucalyptus globulus, Cedrus deodara and Pinus longifolia). In Group 2, BT plus tocopherol (E-care Se: Health Line Private Limited, Bangalore, India; containing tocopherol-50mg, selenium-1.5mg; two intramuscular injections at 7 days gap) were advocated. The animals were free from other pathogenic microorganisms. Ecto-parasites were identified by standard procedures. (a) Response to treatment: was noted each day through grade codes (0 to 4). (b) Mite count: Skin scrapings were examined for mites on 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 14, 21 and 28 days post treatment (PT). (c) Oxidative stress-antioxidant defense, erythrocyte membrane responses: In erythrocytes (days '0' and 28 PT), lipid peroxidation (LP), reduced glutathione (GSH), catalase, superoxide dismutase, glutathione-s-transferase, adenosine triphosphatases (total ATPase, Na⁺ K⁺-ATPase and Mg²⁺-ATPase) & protein were estimated. (d) Haematology: total erythrocyte count (TEC), haemoglobin (Hb) and hematocrit (H) were estimated in blood (days 0 and 28). (e) Statistical analysis was as per standard procedures. Results: (a) Clinical observations: BT was effective and with tocopherol it was effective just within 2 days of start of therapy with an effectiveness of 77.5%. (b) Mite count: BT was good and with tocopherol it was effective against mites within 2 days of start. (c) Oxidative stress-antioxidant defense; erythrocyte membrane and haematological responses: effect of (BT) and BT plus tocopherol on biochemical parameters of sheep erythrocytes and hematology (Mean±SD) indicated significant (*P<0.05; **P<0.01; ***P<0.001) increase in LP**, total ATPase**, Mg²⁺-ATPase***, significant decrease in Na⁺ K⁺-ATPase**, catalase**, GST**, PCV**, TEC***, Hb*** and a non significant decrease in GSH in the diseased. BT was effective as it could bring these values towards healthy control group values of normalcy. Tocopherol as adjunct therapy proved beneficial. No reappearance was observed with respect to all the studied parameters during the period of observation. Conclusions: Eucalyptus globulus & Cedrus deodara are antimange. Pinus longifolia has antiseptic action. Anemia may be a result of mites consuming erythrocytes escaping from capillaries and lowered erythropoietin production due to liver involvement. Haemoglobin may be reduced due to low erythrocyte counts and haematocrit and may be due to toxaemia caused by mites. Lipid peroxidation indicates oxidative damage to tissues. In diseased sheep erythrocytes are under oxidative stress which may be due to decreased catalase activity. Increase in ATPases in diseased sheep may be due to increased need of energy under oxidative stress. Glutathione-s-transferase (GST) protects cells against various electrophilic, hydrophobic compounds by catalyzing the formation of glutathione conjugates. Tocopherol with BT was better with respect to (GST). Erythrocyte membrane is rich in polyunsaturated fatty acid and thus are prone to oxidative insult by pro-oxidants. It is concluded that during sarcoptic mange in sheep, there is an oxidative stress and an adverse effect on erythrocyte membrane functioning. The tried herbal acaricide could improve the animal with respect to adverse effects. Tocopherol could exhibit a good antioxidant potential in treating this infection. Thus, herbal acaricides may provide a better
avenue to overcome a menace such as mange in animals and can be better from safety, environmental pollution and efficacy point of view. Further, tocopherol as adjunct antioxidant therapy may be advisable.

Keywords: oxidative stress-antioxidant defense, erythrocytic membrane responses, sarcoptic mange, bio-organic therapy.

INTRODUCTION

Sarcoptic mites causing mange, are common ectoparasitic disease in sheep causing heavy losses in wool and meat production, both qualitatively as well as quantitatively. Sheep are usually reared in groups and not as single or double animals, so it is difficult for owners to bring diseased animals to Veterinary hospitals and thus many a times they use ectoparasiticidal drugs by their own. Under such circumstances, the indigenous preparations which are advocated to be less risky and easy to use, can be the preferred therapies. About 80% of the world population uses indigenous or herbal products at one or the other moment. Lack of proper hygiene, housing and nutrition are favouring factors for the entry of ectoparasitic infestations, their multiplication and continued existence in a flock. Sarcoptic mites are important disease entities in sheep and produce anaemia, weakness, protein and nutritional (including mineral) deficiencies, decreased fertility and losses in production to considerable extents.

The therapeutic measures have also not always been explained at length. Decrease in weight gains (Kettle and Pearce, 1974) and hemoglobin values (Mehrotra and Singh, 1982) have been reported in sheep suffering with ectoparasites. The disease is stubborn and mostly can not be prevented/controlled for longer durations with chemical application. However, varying degrees of success have been achieved by treatment with acaricides like Diazinon, malathion and amitraz.

Because of the projected toxicities and high cost of allopathic drugs along with health risk to humans exposed to such drugs, it is high time to access and evaluate herbal preparations in the treatment of mange. Further, these days, already the use of some ectoparasiticidal chemicals has been highly reduced or not recommended because of the risk of human exposure. In animals, the use of herbs in therapy of mange is in its various stages of development but still the possibility for development of a highly effective herbal preparation is to be explored. Various trials are being conducted to evolve highly effective preparations. Ruprah et al.(1980), reported a complete cure of psoroptic mange in buffalo calves with Cedrus deodara in 17 days. Singh and Satija (1989) used it effectively in psoroptic mange in buffalo calves.

Individual drugs have been reported to be effective but they have not been used with tocopherol. Increasing amounts of vitamin E in foods increases serum and cutaneous concentrations of vitamin E and these increases are likely to be beneficial. However, the relationship between increases in serum and skin vitamin E concentrations and the prevention, development and treatment of skin disease remains to be elucidated by intervention studies (Jewell et al., 2002). Vitamin E has been used both as immunomodulator and antioxidant under varying conditions in animals (Hatfield et al., 2002, Sarlos et al., 2002), but it has not been evaluated for these two functions in treating mixed sarcoptic mange infection in sheep. For treatment, though literature is available on the use of individual oils (Nadkarni, 1954) against mange but the present investigation aimed to evaluate comparative efficacy of oils, both alone and in combination with tocopherol. No report is available on the erythrocyte membrane responses in such infections.

The present investigation aimed at evaluating the oxidative stress-antioxidant defense and erythrocytic membrane responses during sarcoptic mange in sheep. A bio-organic therapy (BT) (containing extracts and distillates of Eucalyptus globulus, Cedrus deodara and Pinus longifolia) was evaluated for its efficacy. Tocopherol was assessed for its antioxidant adjunctive potential.

Materials and Methods

Nineteen sheep with sarcoptic mange (aged 9-12 months, with lesions ascribed to Sarcoptes scabiei var. ovis) were divided into 2 groups of 8 (group1) and 11(group2) respectively.Group1 was sprayed with the BT (Topicure: Natural Remedies Private Limited, Bangalore, India; containing extracts and distillates of Eucalyptus globulus, Cedrus deodara and Pinus longifolia).In Group2, BT plus tocopherol (E-care Se: Health Line Private Limited, Bangalore, India; containing tocopherol-50mg, selenium-1.5mg; two intramuscular injections at 7 days gap) were advocated.The animals were free from other pathogenic microorganisms. Ecto-parasites were identified by standard procedures (Soulsby, 1968).

(a)Response to treatment: was noted each day through grade codes (0 to 4).
(b) **Mite count:** Skin scrapings were examined for mites on 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 14, 21 and 28 days post treatment (PT).

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(d) **Haematology:** total erythrocyte count (TEC), haemoglobin (Hb) and hematocrit (H) were estimated in blood (days 0 and 28) (Jain, 1986). Statistical analysis was as per standard procedures (Snedecor and Cochran, 1967).

**Results and Discussions**

Oil of *Cedrus deodara* has been found effective against sarcoptic mange in swine (Galhotra et al., 1980), sheep (Lal et al., 1976, Sharma et al., 1997), sub-clinical mastitis (Sharma et al., 2000), psoroptic mange in rabbits (Maske and Kolte, 1999). It has immuno modulatory activity (Shinde et al., 1999).

*Eucalyptus globulus* has activity against mange of rabbits, canines, goats and swine and ticks, fleas and lice of canines (Magi and Sahk, 2003).

(a) **Clinical observations:** BT was effective and with tocopherol it was effective just within 2 days of start of therapy with an effectiveness of 77.5%.

(b) **Mite count:** BT was good and with tocopherol it was effective against mites within 2 days of start.

(c) **Oxidative stress- antioxidant defense; erythrocyte membrane and haematological responses:** effect of (BT) and BT plus tocopherol on biochemical parameters of sheep erythrocytes and hematology (Means\(\pm\)SD) indicated significant (*\(P<0.05\); **\(P<0.01\); ***\(P<0.001\)) increase in LP**, total ATPase***, Mg\(^{2+}\)-ATPase***, significant decrease in Na\(^+\) K\(^{-}\)-ATPase**, catalase**, GST**, PCV**, TEC***, Hb*** and a non significant decrease in GSH in the diseased. BT was effective as it could bring these values towards healthy control group values of normalcy. Tocopherol as adjunct therapy proved beneficial. No reappearance was observed with respect to all the studied parameters during the period of observation.

**Conclusions**

*Eucalyptus globulus* & *Cedrus deodara* are antimange. *Pinus longifolia* has antiseptic action. Anemia may be a result of mites consuming erythrocytes escaping from capillaries and lowered erythropoietin production due to liver involvement. Haemoglobin may be reduced due to low erythrocyte counts and haematocrit and may be due to toxaemia caused by mites. Lipid peroxidation indicates oxidative damage to tissues. In diseased sheep erythrocytes are under oxidative stress which may be due to decreased catalase activity. Increase in ATPases in diseased sheep may be due to increased need of energy under oxidative stress. Glutathione-s-transferase (GST) protects cells against various electrophilic, hydrophobic compounds by catalyzing the formation of glutathione conjugates. Tocopherol with BT was better with respect to (GST). Erythrocyte membrane is rich in polyunsaturated fatty acid and thus are prone to oxidative insult by pro-oxidants. It is concluded that during sarcoptic mange in sheep, there is an oxidative stress and an adverse effect on erythrocyte membrane functioning. The tried herbal acaricide could improve the animal with respect to adverse effects. Tocopherol could exhibit a good antioxidant potential in treating this infection. Thus, herbal acaricides may provide a better avenue to overcome a menace such as mange in animals and can be better from safety, environmental pollution and efficacy point of view. Further, tocopherol as adjunct antioxidant therapy may be advisable.

**REFERENCES**