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Study on trace mineral (Fe, Cu, Co and Zn) parameters of mite infested cattle treated with Polyherbal Acaricidal formulations

Kuldeep Kumar, AP Singh and Raj Kumar

Abstract
In this study, two Polyherbal formulations namely Polyherbal formulation-A (PHF-A) and Polyherbal formulation-B (PHF-B) which are prepared by center for ethno-veterinary practice and alternative medicine (CEVPAM), RAJUVAS, Bikaner, were used to evaluate effect of these formulations on trace mineral parameters of mite infested cattle. Trace minerals *viz.* iron, copper, cobalt and zinc were found significantly lower in mite infested cattle as compare to healthy control. Post-treatment trace mineral parameters were differed non-significantly as compare to healthy control. PHF-A and PHF-B were found very effective to normalize the trace mineral parameters in mite infested cattle.

Keywords: Mite infestation, trace minerals, herbal Acaricides and cattle

Introduction
India is an agricultural country with animal husbandry being an integral part of the agriculture. The overall contribution of livestock sector in total GVA of our country is nearly 4.19 per cent at current prices during 2018-19. According to livestock census (2019) [14], India has 302.79 million bovine populations, out of which 192.49 million are cattle. Rajasthan state has 13.9 million cattle and ranking at 6th position in the country. Ectoparasites and ectoparasites borne diseases to animals are major problem in development of socio-economic condition of farmers as they are related to ill health, reduced milk production, low graded milk, disease transmission, veterinary expenses and death of animals. Skin diseases mainly related to mite infestation cause mortality, decreased production and reproduction; in addition to these, currently skin diseases affecting the tanning industry very seriously causing enormous down grading and rejection of skin and hides (Bayou, 1998; Yacob, 2013) [6, 31].
However, management of ectoparasites heavily relied on the excessive use of synthetic chemical acaricides as they are fast acting and considered as modern approaches to combat these ectoparasites. Since, synthetic acaricides are expensive and can be detrimental to the environment: their use should be minimized and integrated with alternative approaches (Minjauw and Castro, 1999) [16].
Herbal medicines have gained importance due to their less toxicity, lesser side effect and being organic in nature. Herbal medicines generally do not pollute the milk and hence there is no milk withdrawal period. Even, World Health Organization (WHO) has emphasized on the use of medicinal plants as these are considered safe and effective than the synthetic drugs (Ahmad *et al.*, 2010; Ahmed *et al.*, 2011) [3, 4]. Plant products are becoming more popular than synthetic drugs even in developed countries. This is mainly attributed to their long-standing experience of exposure of these drugs in ethnic medicine systems like Ayurveda and many others. The earliest description of curative properties of medicinal plants were described in the Rigveda (2500-1800 BC), Charak Samhita and Sushruta Samhita. Herbal medicine remains one of the most common forms of therapy widely available throughout the world population (Gupta, 1994; Shukla *et al.*, 2000; Vaidya, 1994) [11, 22, 28].
In perspective, the present study was aimed to gather information about the effect of mite burden on cattle trace mineral (Fe, Cu, Co and Zn) parameters and response of these parameters in respect to polyherbal acaricidal treatment.

Materials and Methods
In this study, two polyherbal formulations namely polyherbal formulation-A (PHF-A) and polyherbal formulation-B (PHF-B) which are prepared by centre for ethno-veterinary practice

and alternative medicine (CEVPAM), RAJUVAS, Bikaner, were used to evaluate effect of these formulations on haematological parameters of mite infested cattle. For this trial, 32 mite infested and 8 apparently healthy cattle were included. mite infested cattle were randomly categorized in four groups (group I, group II, group III and group IV) comprising 8 cattle in each group. Cattle of group I and group II were sprayed with PHF-A and PHF-B, respectively, five applications with the interval of 24 hours. To compare the acaricidal efficacy of polyherbal formulations group III were treated with three topical applications of 25 per cent benzyl benzoate with the interval of 24 hours as positive control and group IV was left untreated as negative control. Apparently healthy cattle were used as positive control group for comparison of haematological parameters. For trace mineral parameters estimation, blood samples from mite infested cattle were collected on day 0 as pre-treatment and on day 15th as post-treatment from jugular vein in without anticoagulant vacutainers and rested for 30 minutes at 37 °C for blood clotting. Later on, blood clots were broken and tubes were centrifuged at 2500 rpm for 10 min. The serum samples were separated into small Pyrex tubes and kept immediately in the deep freeze at -20 °C till analysis.Trace minerals estimation of tick infested and apparently healthy cattle was done by using microwave digestion system (MDS) and ICP as per the manufacturer's subscribed procedure.

Results and Discussion

The pre-treatment (0 day) and post-treatment (15th day) mean±SE values of trace mineral parameters of apparently healthy control cattle and mite infested cattle are presented in Table 1.

Pre-treatment (0 day) mean±SE values of serum iron (µg/dl), copper (µg/dl), cobalt (µg/l) and zinc (µg/dl) concentration were found significantly ($p< 0.05$) lower in all mite infested cattle as compared to healthy control. Post-treatment (15th day) values of serum iron (µg/dl), copper (µg/dl), cobalt (µg/l) and zinc (µg/dl) concentration increased highly significantly in all treated groups of mite infested cattle as compare to pre-treatment value (0 day) of corresponding group and were found as similar to apparently healthy control cattle. On day 15 mean±SE value of iron decrease significantly and of copper, cobalt and zinc non-significantly in untreated group (G IV) mite infested cattle.

Lower serum iron concentrations in mite infested cattle may be attributed to the inability of the damaged liver to synthesize transferrin (Burtis and Ashwood 1996) [7]. Abdel-Saeed (2020) [2] reported lower serum iron concentration in sarcoptic mange in camel and concluded that it might be due to sequestration of iron into cells as a defensive mechanism during infection. Khatak and Khurana (2011) [12] reported low concentration of iron in sarcoptic mange infested dogs possibly resulted from lack of energy, malabsorption, stress conditions and interference of transportation of trace minerals produces by toxins of mites. Findings of current study also gain support with the findings of Anju and Rath (2006) [5] who recoded lower iron concentration in sarcoptic mange affected buffalo calves as compare to healthy control calves.

Lower serum copper concentration may reflect inability of the damaged liver to synthesize ceruloplasmin (Burtis and Ashwood 1996) [7]. FAO and WHO (2005) [10] stated that 70% of zinc and copper are bound with albumin and any alteration of albumin as in this study showed statistically significant decreased in mite infested cattle, led to decrease of these trace elements. These findings can be explained by other facts (Abdel-Saeed, 2020) [2] including decreased appetite and feed intake, increased phagocytic activity of immune cells and anti-oxidant defense exhaustion during infection leading to rapid depletion of serum copper and zinc.

Similar to present study, Kozat *et al.* (2005) [13] recorded lower copper concentration in mite infested cattle as compared to healthy cattle. Dede *et al.* (2003) [8] and Abdalrahman and Mustafa (2018) [1] reported decreased concentration of copper in mite infested goat as compared to healthy goat. Khatak and Khurana (2011) [12] reported low concentration of copper in sarcoptic mange infested dogs possibly resulting from lack of energy, malabsorption, stress conditions and interference of transportation of trace minerals produced by toxins of mites. Sinha *et al.* (2004) [23], Anju and Rath (2006) [5] and Abdel-Saeed (2020) [2] founded significant decrease in serum copper concentration in sarcoptic mange affected pigs, buffalo calves and camels as compare to healthy control, respectively.

Low concentration of cobalt in mite infested cattle possibly might have resulted from lack of energy, malabsorption, stress conditions and interference of transportation of trace minerals produced by toxins of mites. Cobalt deficiency may be responsible for reduced resistance to parasites and other infections (MacPherson *et al*., 1987) [15]. Cobalt deficiency could also be responsible for muscle wasting and an anaemia that is both normochromic and normocytic (Suttle, 1992) [25]. Findings of current study gain support with earlier work of Denizhan *et al.* (2017) [9].

Reduction of zinc concentration may be associated with inappetence or malnutrition (Vishe *et al.*, 2012) [29], hepatic insufficiency as (Takuma *et al*., 2010) [26] stated that, also as mentioned in FAO and WHO (2005) [10] that 70% of zinc and copper are bound with albumin and any alteration of albumin as in this study showed statistically significant decreased in mite infested cattle infested cattle, led to decrease of these trace elements.

Of all the essential trace minerals, zinc is referred as the most vital and skin disorders associated with dietary zinc deficiency ranged from hyperkeratosis (Radostatis *et al*., 2001) [20] to infertility (Patel, 2003) [18] and immunodeficiency (Prasad, 1966; Nockels and Blair, 1996; Tizzard 1998) [19, 17, 27]. Zinc is known to play an important role in the immune system and the protective shield of the skin as well as normal development and functioning of cells mediating nonspecific immunity (Shankar and Prasad, 1998) [21]. Severe zinc deficiency characterized by susceptibility to opportunistic infections as in dermatitis, enteritis and alopecia (Walsh *et al*., 1994; Zalewski, 1996) [30, 32].

In agreement to current study, Kozat *et al.* (2005) [13] and Vishe *et al.* (2012) [29] found significantly lower zinc concentration in mite infested cattle and buffaloes. Dede *et al.* (2003) [8], Abdalrahman and Mustafa (2018) [1] reported significant lower concentration of zinc in mite infested goats as compare to healthy goats. Singh *et al.* (2003) [24] and Abdel-Saeed (2020) [2] reported zinc deficiency in mange affected camel and concluded that it might be due to decreased appetite and feed intake, increased phagocytic activity of immune cells and anti-oxidant defence exhaustion during infestation might lead to rapid depletion of serum zinc. Sinha *et al.* (2004) [23], Anju and Rath (2006) [5] and Khatak and Khurana (2011) [12] recorded low serum levels of zinc in sarcoptic mange affected pigs, buffalo calves and dogs as compared to healthy control, respectively.

Table 1: Pre-treatment (0 day) and post-treatment (15th day) mean±SE trace mineral parameters of apparently healthy control and mite infested cattle

Parameters	Groups	0 Day	15th Day	Significance level
Iron (µg/dl)	Healthy	142.61±4.39	142.61±1.51	NS
	Group I	118.55±1.55	145.42±1.04	**
	Group II	120.98±1.85	144.74±1.40	**
	Group III	112.03±2.69	145.41±1.23	**
	Group IV	121.05±1.92	114.05±1.67	*
Copper (µg/dl)	Healthy	0.49±0.01	0.49±0.01	NS
	Group I	0.32±0.01	0.51±0.01	**
	Group II	0.33±0.01	0.51±0.02	**
	Group III	0.37±0.01	0.51±0.01	**
	Group IV	0.39±0.01	0.36±0.01	NS
Cobalt (µg/l)	Healthy	0.12±0.01	0.12±0.01	NS
	Group I	0.07±0.01	0.12±0.01	**
	Group II	0.07±0.01	0.13±0.02	**
	Group III	0.07±0.01	0.12±0.02	**
	Group IV	0.09±0.03	0.07±0.01	NS
Zn (µg/dl)	Healthy	1.17±0.02	1.17±0.02	NS
	Group I	1.01±0.02	1.19±0.02	**
	Group II	0.93±0.03	1.19±0.03	**
	Group III	0.99±0.03	1.18±0.02	**
	Group IV	1.02±0.03	0.95±0.03	NS

Conclusion

The results of current study indicated that iron, copper, cobalt and zinc were lower significantly in mite infested cattle as compare to healthy control. Statistical analysis of data revealed that trace minerals parameters of treated groups differed non-significantly as compared to healthy control. As similar to benzyl benzoate, PHF-A and PHF-B were found very effective to normalize the biochemical and trace mineral parameters in mite infested cattle. Since, synthetic acaricides (like deltamethrin) are expensive and can be detrimental to the environment, their use should be minimized and integrated with alternative approaches. Looking towards such importance of herbal acaricides, PHF-A and PHF-B can be used as best alternative of synthetic acaricides against mite infestation in cattle.

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