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Effect of Herbal Liver-tonic Supplements on Production Performance in HF Dairy Cattle

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A study was conducted to observe the influence of herbal liver-tonic supplementation on milk production, liver function and feed intake in HF crossbred dairy cattle at field level. This study was carried out in 24 HF cattle and these were randomly grouped into three groups viz. Group 1 served as control group, Group II served as Treatment -I (supplemented with polyherbal liver tonic @

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30ml/day) and Group III as Treatment-2 (supplemented with polyherbal liver tonic @ 45ml/day). Day 1 to 7 is considered as before treatment, Day 8 to 17 as treatment period and day 18 to 32 as after treatment. The blood collected during study period and stored at -20 °C until further analysis. The data were also regularly recorded for milk production, SNF Content of milk, feed intake. Statistical analysis of result revealed that herbal liver-tonic supplementation showed non-significant (P>0.05) difference on liver enzymes profile. Statistically no significant difference is also noted on milk production, milk fat and SNF Content in HF Cattle at field conditions.

Keywords: Liver-tonic supplements; liver function; SNF content; milk production; HF dairy cattle.

1. INTRODUCTION

India has the world's largest cow population, with an estimated 187 million heads of cattle as of 2020 and it is the world's largest milk-producing country. Dairy industry is now focusing more over the quality milk production which is safe for human consumption without any negative impact over the health and performances of dairy animals (Chandra et al. 2017, Sriranga et al. 2021). Higher milk yield and prolificacy of the modern dairy cattle requires high metabolism activities to support (Sammad et al. 2020). The liver plays a crucial role in removing toxins from the bloodstream and involved in the metabolism of proteins, lipids, glucose, amino acids, vitamins, and hormones (Tian et al. 2016). The alterations in liver function may occur during calving in healthy dairy cows (West et al. 1989). Ensuring optimal liver health in dairy animals is crucial for a seamless and trouble-free transition. Reduced feed intake accounts for approximately 35%–50% of the decline in milk yield (Wheelock et al. 2010).

The use of herbal medicines dates back thousands of years to ancient civilizations. In Ayurvedic medicine, herbs were used to promote health and prevent disease. Today, in animal health care, herbal remedies have been used to treat livestock for various conditions. In adult ruminants, a polyherbal mixture with phosphatidylcholine (PCho) and other nutraceutical metabolites results in improved performance and health (Crosby et al. 2017). Liver-tonic is a nutritional supplement contains a blend of vitamins and minerals that are essential for liver function. The World Health Organization (WHO) defines traditional medicine (herbal medicine) as "the sum total of the knowledge, skills, and practices based on the theories, beliefs, and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness". Feeding of herbal liver-tonic products improves liver functions to increase appetite, feed consumption, digestion, absorption and nutrient metabolism in the body, ultimately leading to higher growth rate and body weight gain (Crosby et al. 2010).

Transition management of dairy animals for improved post-partum performances has been a prime focus of most of the animal scientists. Never the-less, supplementation of herbal preparations emerged as useful and efficient possible substitute for use of antibiotics and hormones in dairy animals during late dry period and initial lactation period for desired production performances (Sriranga et al. 2021). During intense lactation, the liver may struggle to detoxify and metabolize dairy feed. Liver-tonic replenishes liver enzymes and antioxidants, reducing the risk of liver dysfunction and promoting overall health. Higher milk yield and prolificacy of the modern dairy cattle requires high metabolism activities to support them with this intention the current study initiated with the objectives of improve the milk production and quality by promoting a healthy liver during lactation period in dairy cattle. The aim of current study is to evaluate the liver-tonic effect on production parameters, liver function and feed intake in cattle.

2. MATERIALS AND METHODS

The study consisted of 24 Holstein crossbred cattle in their third to fifth lactation which were raised in a closed type cowshed and data were collected before treatment, during treatment and after treatment. Selected animals were randomly divided into three equal groups, viz., before supplement as Control group, Treatment-1 and Treatment-2.

During experiment, all the study animals were fed with basal diet constituted of concentrate feed, mineral mixture and roughage. The liver-tonic consisted a mixture of Capparis spinosa, Terminalia arjuna, Cichorium intybus, Solanum

List 1. Design of experiment

Treatment	Before Treatment (7 days)	During Treatment (10 days)	After Treatment (15 days)
Control (n=8)	Basal diet	Basal diet	Basal diet
Treatment-1 (n=8)	Basal diet	Basal diet + Polyherbal Liver-tonic @ 30 mL/cow	Basal diet
Treatment-2 (n=8)	Basal diet	Basal diet + Polyherbal Liver-tonic @ 45 mL/cow	Basal diet

Table 1. Composition of basal diet

Ingredients	DM %	Water %	Proportion for 8 cows	Proportion per cow	DM offered per Cow
GNC	95	5	16	2	1.9
Maize	90	10	30	3.75	3.375
Silage	28	72	120	15	4.2
Green Grass	22	78	110	13.75	3.025
Ragi Straw	95	5	28	3.5	3.325
Mineral Mixture	100	0	0.1	0.0125	0.0125
Salt	100	0	0.5	0.0625	0.0625
Total				38.075	15.9

nigrum, Tephrosia, Shatavari, Curcuma, Ginger. The liver-tonic is mixed with concentrate mixture and fed to animal during forenoon. Data for milk yield, milk components and feed intake were recorded in the cattle before treatment, during and after treatment on daily basis. Blood sample were collected at day-17 and day-32 for analyzing liver enzymes.

The basal diet provided for cattle includes ingredients like GNC (Groundnut Cake), maize, silage, green grass, ragi straw, mineral mixture, and salt. These ingredients are selected to provide a balance of proteins (from GNC), carbohydrates and energy (from maize and ragi straw), fiber and essential vitamins (from green grass and silage), and minerals (from the mineral mixture and salt) to support the overall growth, health, and milk production of cattle. Additionally, in the Karnataka region, area-specific feeds such as ragi straw, maize and green grass are locally available and often used to meet the unique dietary needs of ruminants, ensuring they receive adequate nutrients that are regionally abundant and affordable.

Production parameters: The milk sample is collected every day and milk fat and Solid not fat was recorded during study period. The milk yield is recorded daily in the morning and evening.

Liver function test: Within two days of blood sample collection the activities of aspartate transaminase (AST), alanine transaminase (ALT) was analyzed using STAR 20 clinical chemistry analyzer (Rapid Diagnostic Group of Companies Pvt. Ltd., Bengaluru, India) as per the recommendations of the manufacturer of the reagent test kits.

Aspartate aminotransferase (AST) and Serum alanine aminotransferase (ALT): Aspartate aminotransferase activity in serum was determined by modified International Federation of Clinical Chemistry (IFCC) method using commercially available reagent kits manufactured by Erba Lachema marketed by Transasia Bio-medicals, Ltd., Mumbai, India.

3. RESULTS AND DISCUSSION

3.1 Production Parameters

The results showed that the liver-tonic supplementation did not significantly ($p < 0.05$) influence milk production, milk fat and Solid not fat (SNF) in HF crossbred dairy cattle. The results were agreeing with the (Sriranga et al. 2023) observed non-significant differences in weekly milk production and milk fat in HF Cattle fed with herbal mixture supplementation. This study confirms previous reports in dairy cattle of

a non-substantial impact of the liver-tonic supplementation on milk yield and its composition. There was also no discernible difference in the productive efficiency of dairy animals when eugenol and cinnamaldehyde were combined (Sriranga et al. 2021).

The current findings were not in conformity with the results of Thomas et al. 1988 who found higher amount of milk fat in animals supplemented with poly-herbal mixture which is attributed to better availability of butyrate and lesser lipid mobilization in body. Milk fat content and total solids were higher in transition animals fed with poly-herbal mixture along with butyrate (Chandra et al. 2017). Milk constituents such milk fat, milk solids-not-fat, and protein in-creased in transition cows supplemented with herbal vita-min E and selenium complex (Koujalagi et al. 2020).

Table 2. Average (Mean ± SE) of milk yield (Kg)

Milk yield	Before Treatment	During Treatment	After Treatment
Control	12.94 ± 1.41	12.80 ± 1.42	12.89 ± 1.24
Treatment -1	13.13 ± 1.18	13.26 ± 1.22	13.45 ± 1.28
Treatment -2	11.48 ± 1.28	11.78 ± 1.36	12.00 ± 1.32

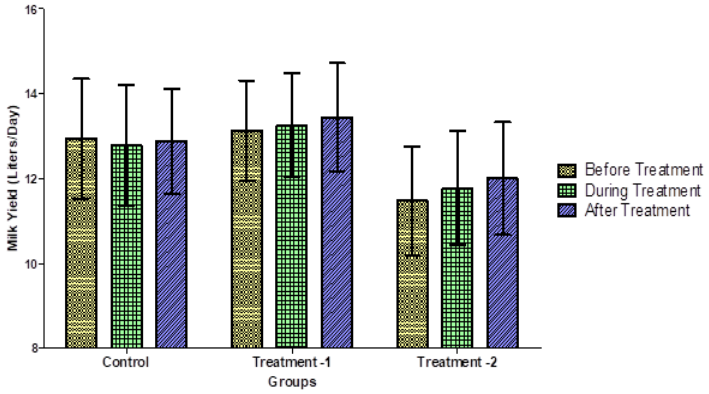

Fig. 1. Average (Mean ± SE) of milk yield (Kg)

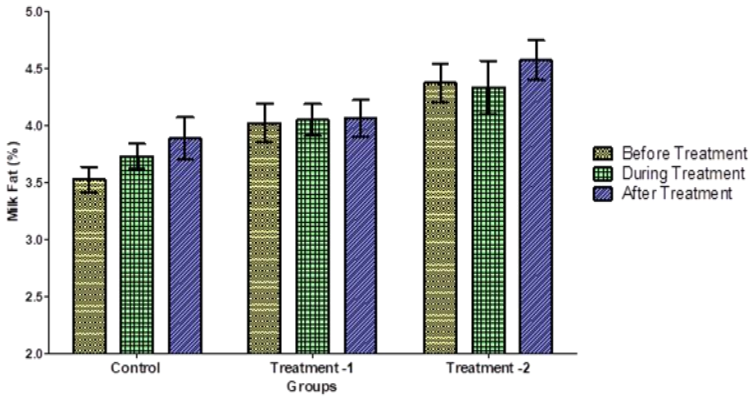

Fig. 2. Average (Mean ± SE) of milk fat percentage

Table 3. Average (Mean ± SE) of milk fat percentage

Milk fat	Before Treatment	During Treatment	After Treatment
Control	3.53 ± 0.11	3.73 ± 0.11	3.89 ± 0.18
Treatment -1	4.03 ± 0.17	4.05 ± 0.14	4.06 ± 0.16
Treatment -2	4.38 ± 0.17	4.34 ± 0.23	4.58 ± 0.18

Table 4. Average (Mean ± SE) of SNF (%)

Milk SNF	Before Treatment	During Treatment	After Treatment
Control	8.51 ± 0.14	8.55 ± 0.12	8.44 ± 0.08
Treatment -1	8.70 ± 0.09	8.68 ± 0.12	8.50 ± 0.08
Treatment -2	8.58 ± 0.12	8.68 ± 0.06	8.54 ± 0.06

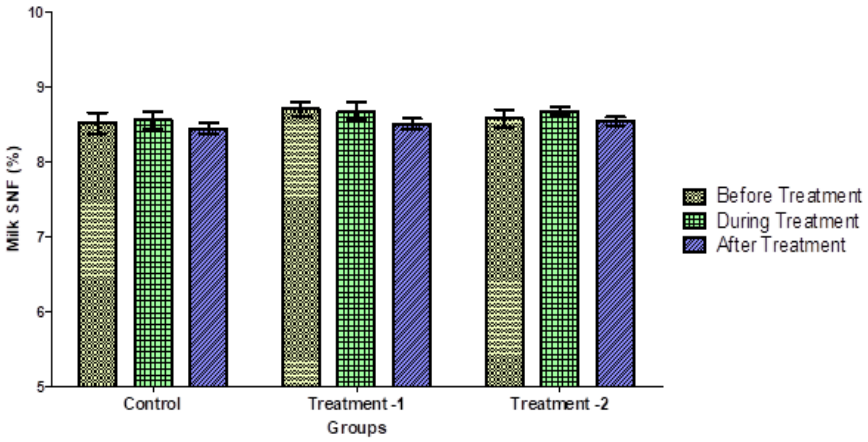

Fig. 3. Average (Mean ± SE) of SNF (%)

Table 5. Average (Mean ± SE) of Feed intake

Feed intake	Before Treatment	During Treatment	After Treatment
Control	36.30 ± 0.77	36.37 ± 0.82	36.38 ± 0.83
Treatment -1	37.23 ± 0.49	37.26 ± 0.48	37.41 ± 0.58
Treatment -2	34.63 ± 1.12	34.73 ± 1.16	34.81 ± 1.18

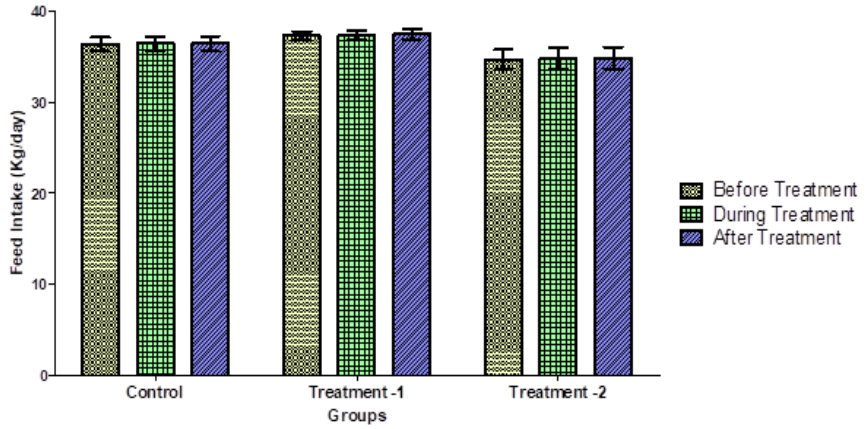

Fig. 4. Average (Mean ± SE) of Feed intake

Table 6. Effect of liver-tonic supplementation on liver function (AST activity) parameters. (IU/L)

AST	Before Treatment	After Treatment
Control	53.85 ± 3.41	54.13 ± 4.10
Treatment -1	53.55 ± 4.24	51.66 ± 4.96
Treatment -2	54.55 ± 4.00	52.30 ± 3.25

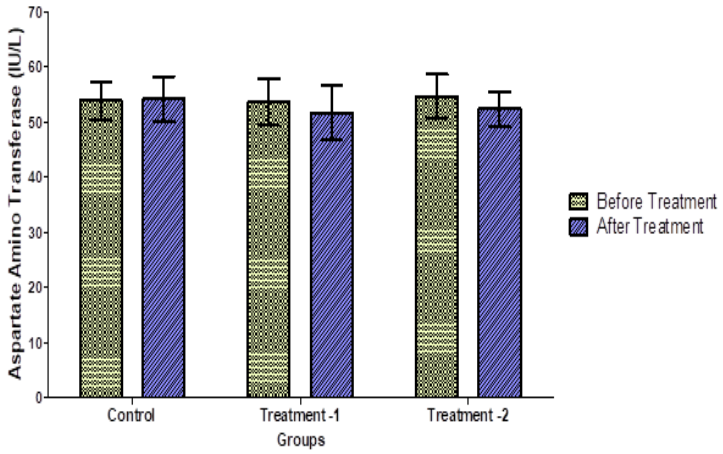

Fig. 5. Effect of liver-tonic supplementation on liver function (AST activity) parameters. (IU/L)

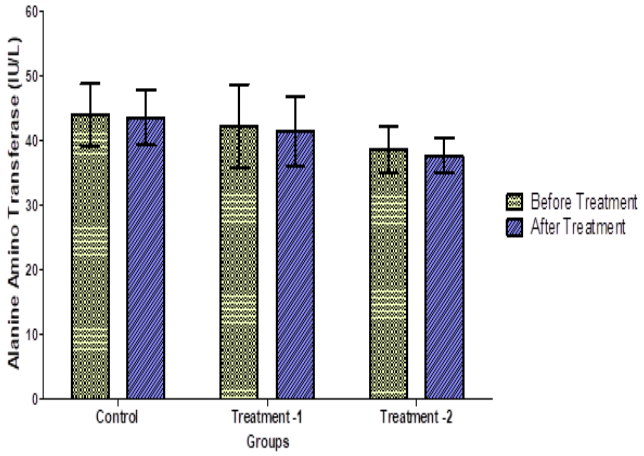

Fig. 6. Effect of liver-tonic supplementation on liver function (ALT activity) parameters

Table 7. Effect of liver-tonic supplementation on liver function (ALT activity) parameters

ALT	Before Treatment	After Treatment
Control	43.89 ± 4.76	43.48 ± 4.27
Treatment -1	42.23 ± 6.41	41.43 ± 5.37
Treatment -2	38.58 ± 3.60	37.59 ± 2.72

Liver function test: There were non-significant (P>0.05) differences in serum AST and ALT activity among supplemented groups during before treatment and after treatment. The main serum indicators used to evaluate liver alterations include AST(GOT), and ALT were not altered by the treatment with polyherbal mixture, confirming that the liver was not damaged in dairy calves (Galvan et al. 2021). Liver-tonics help to increase the secretion and flow of bile for better digestion. They help to maintain the liver parenchyma in healthy state and regulate liver functions like detoxification of metabolic products, toxic drugs and chemicals and treatment of hepatic dysfunction (Dwived et al. 1986). Liver tonics act as a hepato-protective, hepatic stimulant to regenerate damaged liver cells, helps to eliminate toxins and restores liver functions to optimize secretion of bile and certain digestive enzymes for increasing appetite, efficient digestion of feed nutrients and potentiate feed assimilation and utilization in the body leading to healthy growth and weight gain (Madhukar et al. 2023).

Herbal preparation containing Curcumin can thus eliminate lipid radicals in the cell membrane and become a phenoxyl radical, so it is considered a very strong lipid-soluble antioxidant (Gulcin et al. 2008). Curcumin was found to inhibit lipid peroxidation and neutralize ROS (superoxide, peroxyl, hydroxyl radicals) (Martin-Aragon et al. 1997) and RNS (nitric oxide and peroxynitrite) (Rao et al. 1997). The protective effect of curcumin against oxidative stress was previously described in vitro and *In vivo* (Jha 2015, Tekippe et al. 2013).

4. CONCLUSION

By incorporating Liver-tonic into their lactation diet, dairy farmers can optimize milk production and reduce liver dysfunction. Poly-herbal liver-tonic feed supplementation showed non-significant results production parameters. So further research is required with different doses and environmental conditions in lactating cattle.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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