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# The effect of a herbal anthelmintic (garlic and neem) on the production performance of Karan Fries cows

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**ABSTRACT**

The present study was conducted to evaluate the effect of a herbal anthelmintic (Garlic and Neem combination) on the production parameters of Karan Fries cows. For this study, a total of 28 freshly calved cows (1-3 parity), were divided into four groups with 7 cows in each group (T1, T2, T3, T4). The cows in T1 were kept as the control. In T2, a commercial dewormer was used, whereas in T3, a single dose of garlic and neem in the ratio of 1:5 @ 4g/kg BW was used 7 days post calving, and in T4, in addition to the first dose, a second dose was also supplemented on day 60 after calving. The milk samples were collected at 0, 1, 2, 3, 4, 5, 6, 7, 8 fortnights after the deworming treatment and analyzed for milk composition and SCC. From the 5$^{th}$ fortnight onwards, a significantly higher ($P \leq 0.05$) daily milk yield (kg) was observed in T1, T2, T3 groups compared to T1. The overall average Somatic Cell Count (SCC) was found to be significantly lower in T4 followed by T3, compared to T2, which was further significantly lower than T1. From the 3$^{rd}$ to the 8$^{th}$ fortnight, protein (%) was observed to be significantly ($P \leq 0.05$) higher in the anthelmintic treated groups (significantly higher in T4 followed by T2, T3) compared to T1. From the 4$^{th}$ to the 8$^{th}$ fortnight, fat (%) was significantly ($P \leq 0.05$) higher in T4 compared to T1. The overall SNF (%) in T2, T3 and T4 differed significantly ($P \leq 0.05$) from the control group (T1). The overall value of lactose (%) was found to be significantly higher in the T4 group compared to the other groups. During the 7$^{th}$ and 8$^{th}$ fortnight significantly higher ($P \leq 0.05$) lactose (%) was observed in the T4 group compared to the other groups. This study concluded that besides providing better anthelmintic effects in comparison to chemical anthelmintics, the garlic and neem combination might improve the production performance of dairy cows.

**Key words**: deworming; herbal anthelmintic; Garlic; Neem; Karan Fries cow

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## Introduction

The ultimate viability and success of a dairy enterprise depends upon the productive performance of the animals. Many managemental practices have been standardized to achieve the maximum productive efficiency of dairy animals, but certain challenges still exist in the dairy sector, and infections and parasites are one of the most consistent. Gastrointestinal parasitism is one of the major impediments in achieving optimum productive performance of animals in tropical conditions. Various studies throughout the world have reported that parasitic diseases cause heavy economic losses in the livestock/dairy industry and negatively affect the health, weight gain, feed utilization efficiency, milk production and reproduction of animals (RAJAKARUNA and WARNAKULASOORIYA, 2011; KUMAR et al., 2013). Helminths (a diverse group of parasitic worms, encompassing Nematodes, Cestodes and Trematodes) are a major constraint on livestock production in tropical climatic conditions (WALLER, 1997). Chemical anthelmintics have long been considered the only effective way of controlling parasitic infection. Besides their cost, availability, chemical residue and associated adverse toxicity effects, doubt also exists over the use of synthetic dewormers by most farmers due to the problem of development of resistance to them. Some commonly used anthelmintics, such as benzimidazole, levamisole and ivermectin have developed resistance in animals (FAO 2004; TERRILL et al., 2001; KAPLAN 2004). Therefore, an alternative approach is required to obtain the maximum production from dairy animals. Further, the COVID -19 pandemic has made us rely more on the locally available opportunities and thus opens the door to ethnoveterinary. Neem and Garlic are widely used across the world and are also known in every household for their wide range of uses. Neem (*Azadiracta indica*) is an evergreen tree, cultivated in various parts of the subcontinent. The Neem tree has long been listed as a fodder tree in India (SINGH, 1982). As part of use in animal feeding, the leaves of the neem tree are reported to be fed to ruminants in India and other parts of Asia during the dry season (SHUKLA and DESAI, 1988). Every part of the tree has been used as traditional medicine as household remedies against various human ailments. Neem has been used extensively in Ayurveda, Unani and Homeopathic medicine. It contains biologically active constituents such as azadirachtin which has antimicrobial and antifungal properties (KUDOM et al., 2011; RAMESH et al., 2011).

Garlic (*Allium sativum*) is a popular spice in Indian cuisine and has been reported to be a parasiticide, amebicide, acarifuge, vermifuge, larvicide, fungicide, and immuno-stimulant, besides other properties (DUKE, 2002). Many *in vitro* studies have reported the anthelmintic efficacy of Neem and Garlic. *In vivo* scientific validation of the anti-parasitic effects and possible side-effects of these plant products is necessary prior to their adoption as a novel herbal alternative to commercially available dewormers. The present study was conducted to evaluate the effect of herbal deworming with a Garlic and Neem combination on the production performance and milk composition of Karan Fries cows.

## Materials and methods

The present study was carried out at the Livestock Research Centre (LRC), National Dairy Research Institute (NDRI), Karnal (Haryana), India. Neem leaf powder was procured from the local market after assessing its quality in consultation with an ayurvedic practitioner and drug manufacturer. Garlic bulbs were purchased from the local market and were dried in the shade for a period of 15 days. After drying, the outer husks were removed and the bulbs were ground to fine powder using an electrical mixer. The herbal mixture was prepared after mixing the pulverized herbs in specific proportions. The dose was calculated for the respective animals based on body weight, then Garlic and Neem powder was weighed accordingly in a ratio of 1:5 (based on the dose rate obtained by *in vitro* standardization).

*Animal selection and management.* A total of 28 freshly calved crossbred Karan Fries (Tharparkar × Holstein Friesian) cows of first to third parity with the most probable production ability (MPPA) of 3312.13±87.18 kg milk producing were selected. None of them had been dewormed for at least six months before the start of the experiment. The

animals were maintained under a loose housing system. They were fed *ad-libitum* with green fodder (Maize, Jowar, Cowpea, Berseem and Oat) and a measured amount of concentrate diet (20% crude protein and 70% total digestible nutrients) according to the National Research Council (NRC) (2001) recommendations. The animals were provided with fresh, clean drinking water (*ad-libitum*) throughout the day. The animals were taken for the experiment around 15 days before the expected date of parturition and given an adaptation period of seven days. They were randomly divided into four (4) groups, viz: control, synthetic dewormer, single dose of herbal anthelmintic, and double dose of herbal anthelmintic. Animals in the control group (T1) were provided with the routine feeding practices of the farm without any kind of deworming. Animals in the treatment groups were fed the same ration as in the control group but were provided with dewormers as follows: in T2 group: the synthetic dewormer used was Macfen-plus™ which is a combination of Ivermectin and Fenbendazole. In T3 group: Garlic+Neem in the ratio 1:5 was given @ 4g/kg body weight as a single dose on day 7 after parturition. In T4 group: Garlic+Neem in the ratio 1:5 was given @ 4g/kg body weight as a single dose on day 7 after parturition and subsequently the same dose was repeated on day 60. The duration of the experiment was 7 days after calving to 120 days after parturition. The daily milk yield of individual cows was recorded. This data was used for calculation of the average milk yield of the different groups for different fortnights and periods.

*Data recording and sample collection.* The milk samples from each cow were collected after proper disinfection of the teat surface. Representative milk samples were analyzed for their composition (fat, protein, lactose and solid-not-fat) using a pre-calibrated Milk Analyzer (Lacto Star, FUNKE GERBER, Article No 3510, Berlin). The total solids in the milk were calculated by addition of SNF and fat values. The somatic cell counts of milk samples were measured with the help of a somatic cell counter (Milkotronic Ltd., Stara Zagora, Bulgaria).

The data obtained in the present study were analyzed by one way ANOVA (analysis of variance), and the significance of the differences between the mean values of various parameters were determined by Duncan's Multiple Range test using SPSS (version 20.0) computer software.

## Results

*The effect of herbal anthelmintic on the cows' milk production performance.* The average fortnightly values of daily milk yield (kg) are presented in Table 1, and the mean values of 120 days total milk yield (kg), peak yield (kg) and days to peak yield of the different groups are shown in Table 2. The daily milk yields before treatment (0 fortnight) are given for T1, T2, T3 and T4 groups, respectively (Table 1). The results revealed that up to the 4$^{th}$ fortnight, there was no significance difference between the groups for daily milk yield (kg), from the fifth fortnight onward, a significantly higher ($P \leq 0.05$) daily milk yield (kg) was observed in all the treatment groups compared to the control group. The average 120 days total milk yield was found to be significantly ($P \leq 0.05$) higher in all anthelmintic treated groups compared to the control group. However, the values of the T2, T3 and T4 groups did not differ significantly. The milk yield values were highest in the T4 group, although insignificantly compared to the T2 and T3 treatment groups. The average peak yield was not significantly different between the groups. The average days to attain peak yield did not differ significantly between the groups.

Table 1. Mean ±SE of daily milk yield (kg) of cows in different treatment groups

| Fortnights | T1 (control) | T2 (synthetic) | T3 (single dose) | T4 (double dose) |
|---|---|---|---|---|
| 0 | 9.93±1.26 | 9.21±1.31 | 7.07±1.04 | 9.21±2.14 |
| 1 | 11.39±1.30 | 12.72±1.19 | 11.19±1.59 | 12.06±1.61 |
| 2 | 12.97±1.22 | 13.32±1.07 | 15.37±1.77 | 15.37±1.67 |

Table 1. Mean ±SE of daily milk yield (kg) of cows in different treatment groups (continued)

| Fortnights | T1 (control) | T2 (synthetic) | T3 (single dose) | T4 (double dose) |
|---|---|---|---|---|
| 3 | 13.60±1.08 | 14.09±1.25 | 16.10±1.30 | 15.88±1.56 |
| 4 | 11.53±1.09 | 14.23±1.20 | 14.61±1.36 | 15.20±1.70 |
| 5 | $9.85^{a}$±1.12 | $14.06^{b}$±1.32 | $14.84^{b}$±0.99 | $13.99^{b}$±1.14 |
| 6 | $8.85^{a}$±1.27 | $13.80^{b}$±1.45 | $14.11^{b}$±0.81 | $13.05^{b}$±0.89 |
| 7 | $7.79^{a}$±1.05 | $13.17^{b}$±0.93 | $12.34^{b}$±0.99 | $14.23^{b}$±1.17 |
| 8 | $7.96^{a}$±1.39 | $11.85^{b}$±0.80 | $12.90^{b}$±0.73 | $13.49^{b}$±0.98 |
| Overall | $10.43^{w}$±0.45 | $12.94^{x}$±0.42 | $13.17^{x}$±0.50 | $13.61^{x}$±0.52 |

Means bearing different superscripts in a row differ significantly (P≤0.05)

Table 2. Mean ±SE of milk production parameters of cows in different treatment groups

| Treatment groups | 120 days total milk yield | Peak yield | Days to peak yield |
|---|---|---|---|
| T1 | $1200.50^{a}$±60.07 | 16.00±1.09 | 56.86±2.43 |
| T2 | $1545.93^{b}$±95.01 | 17.71±0.82 | 52.86±1.32 |
| T3 | $1558.09^{b}$±82.67 | 19.00±1.29 | 54.00±2.33 |
| T4 | $1696.40^{b}$±61.65 | 19.21±1.50 | 51.43±1.65 |

Means bearing different superscripts in a column differ significantly (P≤0.05)

*The effect of herbal anthelmintic on the Somatic Cell Count (SCC) in milk.* The average fortnightly values of milk somatic cell count (SCC× $10^5$/ ml) are presented in Table 3. The table illustrates that from the first fortnight onward, SCC was significantly lower (P≤0.05) in all the treatment groups compared to the control group. The overall average of SCC for the experimental period was significantly lower in the T4 group, followed by T3 compared to T2, which was further significantly lower than the control group.

*The effect of herbal anthelmintic on milk composition Protein.* The mean ± SE values for milk protein in the different groups at fortnight intervals are presented in Table 4. The protein (%) did not differ significantly between groups (P≤0.05) up to the second fortnight. In the third to eighth fortnights, the protein % was significantly (P≤0.05) higher in the treatment groups compared to the control group, indicating the positive effect of deworming on protein (%) in milk. The overall mean values for protein (%) were significantly (P≤0.05) higher in T2 and T3 compared to T1, and the protein (%) in T4 was further significantly (P≤0.05) higher than in T2 and T3.

*Fat.* The changes in fat% over the period of observation are presented in Table 5. The average mean value for fat% was significantly (P≤0.05) higher in T2 and T3 compared to T1, and the fat (%) in T4 was further significantly (P≤0.05) higher than in T2 and T3. There were no significant differences between the different groups for fat (%) up to the third fortnight. However, from the fourth to the eighth fortnight there was significantly higher (P≤0.05) fat % in T4 compared to the control group, but T2 and T3 did not differ significantly from the groups T1 and T4.

Table 3. Mean ±SE of Somatic Cell Count (×$10^5$/ml) of cows in different treatment groups

| Fortnights | T1 (control) | T2 (synthetic) | T3 (single dose) | T4 (double dose) |
|---|---|---|---|---|
| 0 | 3.60±0.19 | 3.78±0.20 | 4.23±0.78 | 3.58±0.31 |
| 1 | 4.06$^{b}$±0.43 | 3.35$^{a}$±0.21 | 3.57$^{a}$±0.62 | 3.18$^{a}$±0.36 |
| 2 | 3.54$^{b}$±0.39 | 2.98$^{a}$±0.23 | 2.95$^{a}$±0.47 | 2.67$^{a}$±0.27 |
| 3 | 3.19$^{b}$±0.38 | 2.63$^{a}$±0.22 | 2.62$^{a}$±0.28 | 2.10$^{a}$±0.18 |
| 4 | 3.08$^{c}$±0.31 | 2.66$^{a}$±0.29 | 1.84$^{a}$±0.34 | 1.73$^{a}$±0.32 |
| 5 | 2.58$^{c}$±0.29 | 2.59$^{b}$±0.16 | 2.02$^{ab}$±0.30 | 1.52$^{a}$±0.30 |
| 6 | 2.51$^{c}$±0.22 | 2.46$^{b}$±0.18 | 1.55$^{a}$±0.22 | 1.44$^{a}$±0.30 |
| 7 | 2.36$^{c}$±0.20 | 2.37$^{b}$±0.18 | 1.44$^{a}$±0.30 | 1.68$^{a}$±0.18 |
| 8 | 2.58$^{b}$±0.29 | 2.10$^{a}$±0.18 | 1.68$^{a}$±0.18 | 2.34$^{a}$±0.21 |
| Overall | 3.06$^{y}$±0.12 | 2.77$^{x}$±0.09 | 2.43$^{w}$±0.18 | 2.25$^{w}$±0.13 |

Means bearing different superscripts in a row differ significantly (P≤0.05)

Table 4. Mean ±SE of protein (%) of cows in different treatment groups

| Fortnights | T1 (control) | T2 (synthetic) | T3 (single dose) | T4 (double dose) |
|---|---|---|---|---|
| 0 | 3.31±0.04 | 3.33±0.05 | 3.34±0.06 | 3.49±0.10 |
| 1 | 3.19±0.08 | 3.21±0.06 | 3.16±0.08 | 3.07±0.09 |
| 2 | 3.14±0.04 | 3.20±0.07 | 3.27±0.05 | 3.11±0.05 |
| 3 | 3.06$^{a}$±0.09 | 3.27$^{b}$±0.06 | 3.30$^{b}$±0.09 | 3.36$^{b}$±0.04 |
| 4 | 2.89$^{a}$±0.06 | 3.17$^{b}$±0.07 | 3.26$^{b}$±0.06 | 3.31$^{b}$±0.07 |
| 5 | 3.01$^{a}$±0.06 | 3.14$^{ab}$±0.08 | 3.27$^{b}$±0.06 | 3.27$^{b}$±0.06 |
| 6 | 2.94$^{a}$±0.06 | 3.27$^{b}$±0.06 | 3.20$^{b}$±0.05 | 3.49$^{c}$±0.08 |
| 7 | 3.07$^{a}$±0.04 | 3.29$^{b}$±0.06 | 3.24$^{ab}$±0.06 | 3.59$^{c}$±0.08 |
| 8 | 3.24$^{a}$±0.06 | 3.51$^{b}$±0.07 | 3.41$^{ab}$±0.05 | 3.67$^{c}$±0.10 |
| Overall | 3.10$^{w}$±0.03 | 3.27$^{x}$±0.02 | 3.27$^{x}$±0.02 | 3.37$^{y}$±0.03 |

Means bearing different superscripts in a row differ significantly (P≤0.05)

Table 5. Mean ±SE of fat (%) of cows in different treatment groups

| Fortnights | T1 (control) | T2 (synthetic) | T3 (single dose) | T4 (double dose) |
|---|---|---|---|---|
| 0 | 6.27±0.39 | 6.71±0.36 | 6.46±0.49 | 6.86±0.44 |
| 1 | 4.87±0.32 | 5.53±0.31 | 5.17±0.33 | 5.41±0.30 |
| 2 | 3.93±0.27 | 4.31±0.32 | 3.93±0.28 | 4.26±0.20 |
| 3 | 3.10±0.24 | 3.37±0.24 | 3.30±0.29 | 3.30±0.22 |
| 4 | 3.36$^{a}$±0.16 | 3.50$^{ab}$±0.19 | 3.73$^{ab}$±0.24 | 4.21$^{b}$±0.12 |

Table 5. Mean ±SE of fat (%) of cows in different treatment groups (continued)

| Fortnights | T1 (control) | T2 (synthetic) | T3 (single dose) | T4 (double dose) |
|---|---|---|---|---|
| 5 | $3.66^{a}$±0.12 | $3.86^{ab}$±0.09 | $4.01^{ab}$±0.14 | $4.53^{b}$±0.17 |
| 6 | $3.89^{a}$±0.17 | $4.24^{ab}$±0.14 | $4.30^{ab}$±0.19 | $4.66^{b}$±0.08 |
| 7 | $4.09^{a}$±0.14 | $4.27^{a}$±0.11 | $4.19^{a}$±0.17 | $4.71^{b}$±0.09 |
| 8 | $4.04^{a}$±0.12 | $4.19^{a}$±0.07 | $4.29^{a}$±0.16 | $4.74^{b}$±0.09 |
| Overall | $4.13^{w}$±0.13 | $4.44^{x}$±0.14 | $4.37^{x}$±0.14 | $4.74^{y}$±0.14 |

Means bearing different superscripts in a row differ significantly (P≤0.05)

*Solid-Not-Fat (SNF).* The changes in Solid-Not-Fat % over the period of observation are presented in Table 6. The overall SNF % in all the anthelmintic treated groups (T2, T3 and T4) differed significantly (P≤0.05) from the control group. The SNF% was significantly (P≤0.05) higher in all the anthelmintic treated groups compared to the control group, suggesting the positive effect of deworming on SNF (%) in milk.

Table 6. Mean ±SE of Solid-Not-Fat (%) of cows in different treatment groups

| Fortnights | T1 (control) | T2 (synthetic) | T3 (single dose) | T4 (double dose) |
|---|---|---|---|---|
| 0 | 8.43±0.11 | 8.49±0.10 | 8.43±0.17 | 8.74±0.13 |
| 1 | 8.36±0.10 | 8.24±0.11 | 8.30±0.17 | 8.11±0.13 |
| 2 | $8.10^{a}$±0.10 | $8.20^{a}$±0.12 | $8.30^{ab}$±0.08 | $8.56^{b}$±0.12 |
| 3 | 8.10±0.14 | 8.33±0.13 | 8.23±0.11 | 8.33±0.06 |
| 4 | $8.06^{a}$±0.13 | $8.33^{ab}$±0.11 | $8.30^{ab}$±0.08 | $8.46^{b}$±0.03 |
| 5 | $7.97^{a}$±.09 | $8.10^{ab}$±0.09 | $8.40^{b}$±0.11 | $8.29^{ab}$±0.14 |
| 6 | $7.96^{a}$±0.07 | $8.31^{b}$±0.07 | $8.13^{ab}$±0.05 | $8.34^{b}$±0.08 |
| 7 | $7.76^{a}$±0.10 | $8.29^{b}$±0.05 | $8.20^{b}$±0.07 | $8.30^{b}$±0.13 |
| 8 | $7.94^{a}$±0.09 | $8.26^{b}$±0.02 | $8.33^{b}$±0.06 | $8.47^{b}$±0.11 |
| Overall | $8.07^{w}$±0.04 | $8.28^{x}$±0.0 | $8.29^{x}$±0.04 | $8.40^{x}$±0.04 |

Means bearing different superscripts in a row differ significantly (P≤0.05)

*Lactose.* The changes in lactose (%) over the period of observation are presented in Table 7. The overall value of lactose (%) was significantly higher in the T4 group compared to the other groups. At different observation intervals, no significant difference was found between the different groups for lactose (%) up to the sixth fortnight. At the seventh and eighth fortnights, there was significantly higher (P≤0.05) lactose (%) in the T4 group compared to the other groups. The results suggest that double dosing of herbal anthelmintic improved lactose (%) in milk. The higher lactose corresponds to the higher milk yield in the T4 group.

Table 7. Mean ±SE of lactose (%) of cows in different treatment groups

| Fortnights | T1 (control) | T2 (synthetic) | T3 (single dose) | T4 (double dose) |
|---|---|---|---|---|
| 0 | 8.43±0.11 | 8.49±0.10 | 8.43±0.17 | 8.74±0.13 |
| 1 | 8.36±0.10 | 8.24±0.11 | 8.30±0.17 | 8.11±0.13 |
| 2 | $8.10^{a}$±0.10 | $8.20^{a}$±0.12 | $8.30^{ab}$±0.08 | $8.56^{b}$±0.12 |
| 3 | 8.10±0.14 | 8.33±0.13 | 8.23±0.11 | 8.33±0.06 |
| 4 | $8.06^{a}$±0.13 | $8.33^{ab}$±0.11 | $8.30^{ab}$±0.08 | $8.46^{b}$±0.03 |
| 5 | $7.97^{a}$±.09 | $8.10^{ab}$±0.09 | $8.40^{b}$±0.11 | $8.29^{ab}$±0.14 |
| 6 | $7.96^{a}$±0.07 | $8.31^{b}$±0.07 | $8.13^{ab}$±0.05 | $8.34^{b}$±0.08 |
| 7 | $7.76^{a}$±0.10 | $8.29^{b}$±0.05 | $8.20^{b}$±0.07 | $8.30^{b}$±0.13 |
| 8 | $7.94^{a}$±0.09 | $8.26^{b}$±0.02 | $8.33^{b}$±0.06 | $8.47^{b}$±0.11 |
| Overall | $8.07^{w}$±0.04 | $8.28^{x}$±0.0 | $8.29^{x}$±0.04 | $8.40^{x}$±0.04 |

Means bearing different superscripts in a row differ significantly (P≤0.05)

## Discussion

The results of this study suggest that herbal anthelmintic treatment not only improved milk production but also sustained it at a higher level for a longer period. Our study is in agreement with previous studies, such as by MONIRUZZAMAN (2009) who reported the positive effect of neem as an anthelmintic on the milk yield of cows over four weeks. GROSS *et al.* (1999), and BORMAN *et al.,* (2016) also reported that anthelmintic treatment resulted in increased milk yield. SARKER *et al.,* (2016) provided Neem leaf @ 200 mg/kg live weight to cows, and observed an increase of 23.53% and 78.95% in milk yield compared to day one in the control and Neem treated groups, respectively, and there was no significant difference between the Neem treated and albendazole treated groups regarding the milk yield. Feeding with Garlic extract and organic minerals caused an increase in milk yield in treatment groups of HF cows in comparison to the control group (PRAYITNO et al., 2016). This improvement in milk production may be attributed to reduced worm load, the action of the phytochemicals in Garlic and Neem, and also better udder health, indicated by the low somatic cell count in the anthelmintic treated groups. There are reports which indicate an increase in milk yield with the intake of phytochemicals such as tannins and saponins. For instance, it was reported that milk production increased with an increasing intake of tannins and saponins contained in *Lotus corniculatus* (WANG et al*.,* 1996; TURNER et al*.,* 2005) and mangosteen peel pellets (NORRAPOKE et al*.,* 2012). Although there are also some contradictory reports such as BENCHAAR *et al.* (2008) and HOLTSHAUSEN *et al.* (2009) who reported that milk production and milk composition remained unchanged when the cows were supplemented with plants containing tannins and saponin. This indicated that concentrations, level of supplement, and the source of phytochemicals have an impact on animal production.

Herbal supplementation led to improvement in somatic cell profiles (lowered SCC levels) and improvement in udder health, as the milk SCC is considered an important indicator of mammary health. Many previous studies reported that herbal therapy potentiates udder immunity, augments the repair of mammary glands, and their firmness, and normalizes udder functioning with improved milk quality. PRAYITNO *et al.* (2016) observed a significant lower SCC in the Garlic treated group compared to the control group. SINGH *et al.,* (2019), provided 25 gm of a powder preparation

of a polyherbal mixture of Neem and Tulsi, and reported improvement in the SCC profile of milk in cows suffering from sub-clinical mastitis. The herbal mixture acts as a potential therapeutic agent against mastitis due to the anti-inflammatory activity of the polyphenolic compounds present in the herbal mixture, as reported in previous studies (JUNGBAUER and MEDJAKOVIC, 2012; FU *et al.,* 2014) using turmeric with curcumin, a polyphenolic compound, with strong anti-inflammatory activities. Although the exact mechanisms behind the positive effects of herbal dewormer on SCC levels in milk are not yet clear, it is possible that their administration might have alleviated the stressful conditions in cows brought about by poor mammary health.

Previous studies have also reported the beneficial effect of periparturient anthelmintic treatment on milk yield and protein percentage due to the reduction in GI parasitic load. Our results are in agreement with the study by BORMAN *et al.,* (2016). They found a significantly higher protein percentage in the periparturient anthelmintic treated group than the control group. However, some studies (OH *et al.,* 2013; PRAYITNO *et al.,* 2016) found no effect of herbal treatment on milk protein after treatment with Garlic as an anthelmintic. RAJ *et al.* (2016), did not find any significant change in milk protein (%) after detoxified Neem cake supplementation in cattle. The increase in protein (%) could be due to the effect of the condensed tannin in herbs, which has a beneficial effect by forming protein–tannin complexes, thus reducing worm load and improving dietary nitrogen utilisation, as well as microbial protein flow to the small intestine (MAKKAR, 2003; WANG *et al.* 2012). The increase in milk fat yield in this study might be due to a higher proportion of fatty acid intake being directly transferred to milk fat. Many previous studies have reported increases in fat (%) with Garlic and Neem supplementation. YANG *et. al. (*2007) observed 10% higher milk fat content with the Garlic diet than the control diet. PRAYITNO *et al.* (2016) in their study provided garlic extract and organic minerals in HF cows, and observed a significant increase in milk fat in the treated group. OH *et al.* (2013) observed that milk composition was not affected by treatment with Garlic (pulse dosed daily with 2 g/cow of garlic extract for 9 days). There was no significant difference in the percentage of milk components, except protein, with periparturient anthelmintic treatment (Nitroxynil) (BORMAN *et al.,* 2016). RAJ *et al.* (2016), observed that milk fat remained similar among groups, however, total fat yield (g/d) was significantly higher ($P<0.05$) in the dNC treated group and, compared to the initial values, total fat yield significantly increased in all the treatment groups. The increase in milk fat yield might be due to a higher proportion of fatty acid intake being directly transferred to milk fat. There was no significant effect on SNF in this study. PRAYITNO *et al.* (2016) and RAJ *et al.* (2016) also observed similar results. The overall value of lactose (%) was significantly higher in the T4 group compared to the other groups. However, some studies (YANG et al*.,* 2007; OH et al., 2013; BORMAN et al*.,* 2016) reported no effect on lactose (%) and its yield. Mastitis is also an important factor influencing milk yield and composition, and has also been reported to cause significant reductions in milk lactose percentage (HARMON, 1994). Therefore, the high lactose (%) in T4 could be associated with better udder health, as indicated by the low somatic cell count.

This study concluded that the Garlic and Neem combination as an anthelmintic might improve the milk production performance of dairy cows, as well as providing better anthelmintic effects in comparison to chemical anthelmintics.

## Conflicts of interest

The authors declare that there are no conflicts of interest

## References

BENCHAAR, C., T. A. MCALLISTER, P. Y. CHOUINARD (2008): Digestion, ruminal fermentation, ciliate protozoal populations, and milk production from dairy cows fed cinnamaldehyde, quebracho condensed tannin, or Yucca schidigera saponin extracts. J. Dairy Sci. 91, 4765-4777. DOI: 10.3168/jds.2008-1338

BORMAN, A., M. F. ISLAM, M. S. RAHMAN, M. F. HOQUE, S. KISPOTTA, M. A. HAQUE (2016): Effects of periparturient anthelmintic treatment on milk yield and quality in dairy cows. Asian J. Med. Biol. Res. 2, 409-413. DOI: 10.3329/ajmbr.v2i3.30111

DUKE, J. A. (2002): Handbook of medicinal herbs. CRC press, Boca Raton, FL, USA.

FAO, Food and Agriculture Organization, Rome, Animal Production and Health Division Agriculture Department. (2004): Guidelines, resistance management and integrated parasite control in ruminants. Book publication year, 2004. Rome, Italy.

FU, Y., R. GAO, Y. CAO, M. GUO, Z. WEI, E. ZHOU, Y. LI, M. YAO, Z. YANG, N. ZHANG, (2014): Curcumin attenuates inflammatory responses by suppressing TLR4-mediated NF-κB signaling pathway in lipopolysaccharide-induced mastitis in mice. Int. immunopharmacol. 20, 54-58.
DOI: 10.1016/j.intimp.2014.01.024

GROSS, S. J., W. G. RYAN, H. W. PLOEGER (1999): Anthelmintic treatment of dairy cows and its effect on milk production. Vet. rec. 144, 581-587.
DOI: 10.1136/vr.144.21.581

HARMON, R. J. (1994): Physiology of mastitis and factors affecting somatic cell counts. J. dairy sci. 77, 2103-2112.
DOI: 10.3168/jds.S0022-0302(94)77153-8

HOLTSHAUSEN, L., A. V. CHAVES, K. A. BEAUCHEMIN, S. M. MCGINN, T. A. MCALLISTER, N. E. ODONGO, P. R. CHEEKE, C. BENCHAAR (2009): Feeding saponin-containing Yucca schidigera and Quillaja saponaria to decrease enteric methane production in dairy cows. J. Dairy Sci. 92, 2809-2821.
DOI: 10.3168/jds.2008-1843

JUNGBAUER, A., S. MEDJAKOVIC (2012): Anti-inflammatory properties of culinary herbs and spices that ameliorate the effects of metabolic syndrome. Maturitas 71, 227-239.
DOI: 10.1016/j.maturitas.2011.12.009.

KAPLAN, R. M. (2004): Responding to the Emergence of Multiple-Drug Resistant Haemonchus contortus: Smart Drenching and FAMACHA©. College of Veterinary Medicine, University of Georgia, Department of Medical Microbiology and Parasitology, Athens.

KUDOM, A. A., B. A. MENSAH, M. A. BOTCHEY (2011): Aqueous neem extract versus neem powder on Culex quinquefasciatus: implications for control in anthropogenic habitats. J. Insect. Sci. 11, 1–9.
DOI: 10.1673/031.011.14201.

KUMAR, N., T. K. S. RAO, A. VARGHESE, V. S RATHOR (2013): Internal parasite management in grazing livestock. J. Parasit. Dis. 37, 151–157.
DOI: 10.1007/s12639-012-0215-z

MAKKAR, H. P. S. (2003): Effects and fate of tannins in ruminant animals, adaptation to tannins, and strategies to overcome detrimental effects of feeding tannin-rich feeds. Small Rumin. Res. 49, 241-256.
DOI: 10.1016/S0921-4488(03)00142-1

MONIRUZZAMAN, M. (2009): Effect of neem (*Azadirachta indica*) leaves on the performance of lactating cows under village condition M.Sc. (Hons.) Thesis, Dept. of dairy science, Bangladesh Agricultural University, Mymensingh.

NRC, National Research Council, (2001): Nutrient requirements of dairy cattle: 2001. National Academies Press.

NORRAPOKE, T., M. WANAPAT, S. WANAPAT (2012): Effects of protein level and mangosteen peel pellets (Magopel) in concentrate diets on rumen fermentation and milk production in lactating dairy crossbreds. Asian-Australas. J. Anim. Sci. 25, 971. DOI: 10.5713/ajas.2012.12053

OH, J., A. N. HRISTOV, C. LEE, T. CASSIDY, K. HEYLER, G. A. VARGA, J. PATE, S. WALUSIMBI, E. BRZEZICKA, K. TOYOKAWA, J. WERNER, S. S. DONKIN, Á. R. ELIAS, S. DOWD, D. BRAVO (2013): Immune and production responses of dairy cows to postruminal supplementation with phytonutrients. J. Dairy Sci. 96, 7830-7843.
DOI: 10.3168/jds.2013-7089

PRAYITNO, C. H., A. S. SUWARNO, A. JAYANEGARA (2016): Effect of garlic extract and organic mineral supplementation on feed intake, digestibility and milk yield of lactating dairy cows. Asian J. Anim. Sci. 10, 213-218.
DOI: 10.3923/ajas.2016.213.218

RAJ, D. N., J. V. RAMANA, S. B. N. RAO, D. KUMAR, M. V. A. N. SURYANARAYANA, Y. R. REDDY, I. J. REDDY, S. JASH, K. S. PRASAD (2016): Evaluation of detoxified Karanja (pongamia sp.) and Neem (*azadirachta indica*) cakes in total mixed ration (TMR) for dairy cattle–effect on nutritional, biochemical profiles. J, Vet. Sci. Res. 1, 000107.
DOI: 10.23880/OAJVSR-16000107

RAJAKARUNA, R. S., K. N. WARNAKULASOORIYA (2011): Gastrointestinal parasites in dairy cattle in Kandy district in Sri Lanka. Ann. Res. J. SLSAJ. 11, 92–99.

RAMESH, K. S., E. SUSAN P. F. DEVANAND (2011): Bioactive constituents and antimicrobial activity of cell cultures of Azadirachta indica. Int. J. Pharm. Bio. Sci. 2, 617–628.

SARKER, M. A. S., M. H. KHAN, M. RASHID, A. ISLAM (2016): Effect of azadirachta indica and annona reticulata leaf as natural anthelmintics and their effects on performances of zebu cow under subsistence farming condition in Bangladesh. Int. J. Phar Chem Bio Sci. 6, 16-21.

SHUKLA, P. C., M. C. DESAI (1988): Neem (Azadirachta indica, Juss.) as a source of cattle feed. Int.Tree Crops J. 5, 135-142.
DOI: 10.1080/01435698.1988.9752848

SINGH, K., K. K. MISHRA, N. SHRIVASTAV, S. K. MISHRA, A. K. SINGH, A. K. JHA, N. TIWARI, R.

RANJAN (2019): Therapeutic Efficacy of Indigenous Polyherbal Formulation on Milk pH, Somatic Cell Count and Electrical Resistance Profile in Healthy and Subclinical Mastitic Dairy Cows. Int. J. Curr. Microbiol. App. Sci. 8, 703-710.
DOI: 10.20546/ijcmas.2019.810.081

SINGH, R. V. (1982): Fodder trees of India. Oxford and IBH Publishing Co., New Delhi, India.

TERRILL, T., R. KAPLAN, M, LARSEN, O, SAMPLES, J. MILLER, S. Gelaye (2001): Anthelmintic resistance on goat farms in Georgia: efficacy of anthelmintics against gastrointestinal nematodes in two selected goat herds. Vet. Parasitol. 97, 261–268. DOI: 10.1016/s0304-4017(01)00417-4

TURNER, S-A., G. C. WAGHORN, S. L. WOODWARD, N. A. THOMSON (2005): Condensed tannins in birdsfoot trefoil (Lotus corniculatus) affect the detailed composition of milk from dairy cows. In Proceedings of New Zealand Society of Animal Production. 65, 283-289.

WALLER, P. J. (1997): Sustainable helminth control of ruminants in developing countries. Vet. Parasitol. 71, 95-207.
DOI: 10.1016/s0304-4017(97)00032-0.

WANG, J. K., J. A. YE, J. X. LIU (2012): Effects of tea saponins on rumen microbiota, rumen fermentation, methane production and growth performance-a review. Trop. Anim. health prod. 44, 697-706.
DOI: 10.1007/s11250-011-9960-8

WANG, Y., G. C. WAGHORN, W. C. MCNABB, T. N. BARRY, M. J. HEDLEY, I. D. SHELTON (1996): Effect of condensed tannins in Lotus corniculatus upon the digestion of methionine and cysteine in the small intestine of sheep. J. Agri. Sci. 127, 413-421.
DOI: 10.1017/S0021859600078576

YANG, W. Z., C. BENCHAAR, B. N. AMETAJ, A. V. CHAVES, M. L. HE, T. A. MCALLISTER (2007): Effects of garlic and juniper berry essential oils on ruminal fermentation and on the site and extent of digestion in lactating cows. J. Dairy Sci. 90, 5671–5681.
DOI: 10.3168/jds.2007-0369

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**ADHANA, M., S. S. LATHWAL, P. SINGH, I. DEVI, R. K. BAITHALU, A. KUMAR: Učinak biljnih antihelmintika (češnjaka i nima) na proizvodna svojstva krava pasmine Karan Fries. Vet. arhiv 93, 159-168, 2023.**

**SAŽETAK**

U ovom je istraživanju procjenjivan učinak biljnih antihelmintika (kombinacije češnjaka i nima) na proizvodne pokazatelje krava pasmine Karan Fries. U istraživanju je ukupno 28 netom oteljene teladi (paritet 1 – 3) podijeljeno u četiri skupine po sedam jedinki (T1, T2, T3, T4). Skupina T1 bila je kontrolna skupina, dok je u skupini T2 upotrijebljeno komercijalno sredstvo protiv glista. U skupini T3 životinjama je dana pojedinačna doza češnjaka i nima u omjeru 1 : 5 i u dozi od 4 g/kg tjelesne mase sedam dana nakon teljenja, a u skupini T4 toj je prvoj dozi dodana i druga doza, i to 60. dan nakon teljenja. Uzorci mlijeka prikupljeni su 0, 1, 2, 3, 4, 5, 6, 7, 8 dvotjednih vremenskih razmaka povezanih s davanjem antihelmintika, te je analiziran sastav mlijeka i broj somatskih stanica (SCC). Od petog dvotjednog razdoblja nadalje zapažen je znakovito povećan ($P \leq 0,05$) dnevni prinos mlijeka (kg) u skupinama T1, T2, T3 u odnosu na skupinu T1. Ukupan prosjek broja somatskih stanica (SCC) bio je znatno niži u skupini T4 te zatim u skupini T3 u usporedbi sa skupinom T2, koji je pak bio znatno niži nego u skupini T1. Od 3. do 8. dvotjednog razdoblja, postotak proteina bio je znakovito veći ($P \leq 0,05$) u skupinama tretiranima antihelminticima (bio je znakovito veći u skupini T4, a zatim u skupinama T2 i T3) u usporedbi sa skupinom T1. Od 4. do 8. dvotjednog razdoblja, postotak masne tvari bio je znakovito veći ($P \leq 0,05$) u skupini T4 u usporedbi sa skupinom T1. Ukupni postotak SNF-a u skupinama T2, T3 i T4 znakovito se razlikovao ($P \leq 0,05$) od kontrolne skupine (T1). Ukupna postotna vrijednost lakoze bila je znakovito veća u skupini T4 u usporedbi s drugim skupinama. Za vrijeme 7. i 8. dvotjednog razdoblja uočen je znakovito veći postotak laktoze ($P \leq 0,05$) u skupini T4 u usporedbi s drugim skupinama. U istraživanju je zaključeno da bi kombinacija češnjaka i nima, osim što ima bolje antihelmintičke učinke u usporedbi sa sintetičkim antihelminticima, mogla poboljšati proizvodna svojstva mliječnih krava.

**Ključne riječi:** antihelmintik; biljni antihelmintik; češnjak; nim; krava pasmine Karan Fries