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Effect of polyherbal mixture supplementation during transition period on colostrum composition of sahiwal cows

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Abstract
The present investigation was conducted at LRC, ICAR-NDRI, Karnal to find out the effect of polyherbal mixture supplementation on colostrum production and SCC of the Sahiwal cows during the transition period. For that 32 multiparous Sahiwal cows were selected and divided into four groups, Eight cows in each group. Control (T_0) group of cows were offered the ration as per the standard feeding schedule (NRC, 2001). The treatments group (T_1, T_2 and T_3) cows were offered the same ration and with additionally in T_1 group 200 g poly-herbal (50 g each Shatavari, Methi and Jeera; 25 g each Dalchini and Tulsi; added with 250 g jaggery) mixture was offered for 30 days before and 60 days after calving and in T_2 group 150 g poly-herbal (25 g each Ajwain, Fennel, Ginger, Black cardamom and Black seeds, 20 g Turmeric and 5 g Clove; boiled with 25 g Black salt and jaggery) mixture was offered from parturition to 7 days postpartum and in T_3 group the poly-herbal mixture combination was given as a treatment. The colostrum yield and SCC of Sahiwal cows were recorded on 1st, 3rd and 5th day after calving. The analysis of variance of data revealed that, the cows of T_1, T_2 and T_3 groups had significantly ($P \leq 0.05$) higher lactose percentage on 5th day when compared to control. However, colostrum fat %, protein %, solid not fat (SNF) % and total solid (T S) % of treatment groups (T_1, T_2 and T_3) were more or less similar, if compared with the control group. The combination of polyherbal supplementation had better effect on the colostrum composition of the Sahiwal cows during the transition period.

Keywords: Transition period, polyherbal mixture, colostrum fat, colostrum protein, colostrum lactose, colostrum solid not fat, colostrum total solid and Sahiwal cow

Introduction
India is leading country in milk production worldwide. For this the National Dairy Plan-I (NDP-I) has been launched by the government of India (GOI) with the aim to double milk production in the country by 2020. At present the milk production is 176.3 million tonnes with 375 gm/d per capita availability of milk (dahd.nic.in, 2017-18) and contributing 4.11% to GDP. Our country owns 192.49 million of total cattle population that contributes 35.94% of the total livestock (2019 Livestock census).

The percent of cattle contributing 22% from indigenous and 18% from crossbred or exotic cows. The population of Sahiwal cattle in the country is nearly 2.75 million (GoP, 2006). India possess best indigenous breeds like Gir, Sahiwal, Tharparkar and Red Sindhi. Out of which Sahiwal (Bos indicus) is considered to be one of the best milch cattle breed in the tropics of India. Because they are well known for disease resistance, heat tolerance and bred naturally (Leroy and Marchot, 1987) [10]. As milk is an important component of diets for all humans especially for vegetarians, as it is high in essential amino acids that are most likely to be deficient in diets based on vegetable protein. The demand of indigenous cow's milk rising due to the good quality protein. Milk from the Sahiwal breed (*Bos indicus*) is of A_2 variety, with the best Beta Casein protein and 22 soluble minerals. Our indigenous cattle faced discrimination due to their low milk productivity and short lactation period. This problem can be minimized by giving more attention during transition period. According to the FAO, the lack of drugs to treat diseases and infections causes loss of 30 to 35% in the animal breeding sector of many developing countries (Confessor *et al*., 2009) [5].

Antibiotics are costly and residues in milk on development of antibiotic resistance are burning issue for health (Lee *et al*., 2004) [9]. To ensure more net return and to minimize high expenditure on feed are the main challenges, for which many research strategies have been practiced such as introducing feed supplements and feed additives (Pervez, 1992) [13]. Ethno-veterinary medicines having multiple beneficial advantages have been used since long for strengthening body and its immune system and to keep away or fight against diseases (Rios and Recio, 2005) [14]. It is estimated that the exclusion of antibiotic growth promoter (AGPs) from ruminant feed increases production costs by up to 5%.

Keeping in view the above-mentioned fact, an alternative approach toward potentiating the colostrum composition during transition period in Sahiwal cow with the use of natural ingredients.

Materials and Methods

The study was conducted at the Livestock Research Centre, National Dairy Research Institute (NDRI), Karnal, India which is located at 29° 42" 20 sec N and 76° 58" 52.5 sec E at an altitude of 834 feet above mean sea level. Minimum and maximum ambient temperature ranged from near freezing point in winter to 45 ℃ in summer with an annual rainfall of 700 mm. The experiment was conducted during February, 2017 to end of November, 2017 with daily minimum and maximum temperature averaging 5.6 ℃ and 40 ℃, respectively. The sample analysis was done in Feed Processing and Quality Control Laboratory and Precision Instrument Laboratory of Dairy Cattle Nutrition Division, NDRI, Karnal. This study was conducted after getting approval from the Research Committee and Institutional Animal Ethics Committee of ICAR - National Dairy Research Institute, Karnal, Haryana, India, the experiment was approved by the Institutional Animal Ethical Committee National Dairy (IAEC) of Indian Council of Agricultural Research (ICAR) National Dairy Research Institute (NDRI) constituted as per article 13 of the CPCSEA rules, laid down by the Govt. of India (Regd no-1705/GO/al/13 CPCSEA) dated 3/7/2013 A the ethical guidelines were followed during the course of the experiment.

The experiment was carried out to study the effect of polyherbal mixture in transition Sahiwal cows. Thirty-two pregnant dairy cows in second to fifth lactation with most probable production ability (MPPA) of around 2000-2500 L milk production were selected from the herd, maintained at Cattle Yard, NDRI, Karnal. The MPPA or Expected Producing Ability (EPA) was computed on the basis of formula given by Lush (1945) as follows:

$$MPPA = \frac{nr}{1 + (n-1)r}(P - A)$$

Where, A = Population mean
N = Total number of animals
R = Repeatability of lactation milk record
P = Milk yield in previous lactation

Thirty-two (32) Sahiwal cows were randomly divided into four (4) groups based on their MPPA and lactation number. Their requirements were fulfilled by feeding concentrate mixture, green fodder (sorghum, maize, oats, sugar graze) and dry roughage (wheat straw) (NRC, 2001).

Individual herb was procured from local market after assessing their quality in consultation with ayurvedic practitioner and drug manufacturer. Each herb was pulverized separately. The Polyherbal mixture was prepared after mixing pulverized herbs in specific proportion.

Table 1: Experimental design of poly-herbal mixture supplementation during transition period

Group	Experimental Design
Control (T_0)	Basal diet without supplementation (ICAR Feeding standard)
T_1	Basal diet with poly-herbal mixture (200 g) - Shatavari, Methi, Jeera (50 g each) + Dalchini and Tulsi (25 g each) + along with this mixture jaggery (250 g) were fed 30 days before and 60 days after parturition.
T_2	Basal diet with poly-herbal (kadha) mixture (150 g)- Ajwain, Fennel, Ginger, Black cardamom and Nigella sativa (25 g each) + Turmeric (20 g) + Clove (5 g) + along with this polyherbal mixture Black salt (25 g) + Jaggery (250 g) were fed immediately after parturition for 7 days.
T_3	Basal diet with combination of 200 g/d poly-herbal mixture (30 days before and 60 days after parturition) + 150 g/d Polyherbal (kadha) mixture (immediately after parturition for 7 days).

To determine the colostrum composition about 50 ml of colostrum sample from individual cattle was collected on 1st, 3rd and 5th day after calving, in a properly clean sample bottle. The colostrum constituents (fat, protein, lactose, SNF and TS) were analyzed by using Automatic milk analyzer. The total solid values were estimated by adding fat and SNF values.

The data obtained in the present study were analysed by Two Way ANOVA (analysis of variance) and the significance of the difference between the mean values of various parameters was determined by Duncun Post-hoc test using SPSS (version 16.0) computer software.

Results and Discussion

Effect of polyherbal mixture supplementation on colostrum composition of sahiwal cows

1. Effect of polyherbal mixture supplementation on colostrum lactose (%)

The mean values of colostrum lactose (%) were ranged from 2.95 ± 0.13 to 4.10 ± 0.09 in control (T_0), 3.27 ± 0.13 to 4.45 ± 0.09 in T_1, 3.05 ± 0.10 to 4.24 ± 0.12 in T_2 and 3.32 ± 0.15 to 4.57 ± 0.04 in T_3 (Table 2). The overall mean ± SE values of colostrum lactose percentage were 3.57 ± 0.11, 3.83 ± 0.12, 3.66 ± 0.12 and 3.91 ± 0.12 in T_0, T_1, T_2 and T_3 respectively.

The overall mean values of colostrum lactose % was differ significantly ($P \leq 0.01$) between the periods and it was higher in T_3 followed by T_1, T_2 and T_0. The colostrum lactose (%) was higher ($P \geq 0.05$) on 1st and 3rd day of collection but it was significantly higher ($P \leq 0.05$) on 5th day of collection.

Table 2: Colostrum lactose (%) of Sahiwal cows

Days	T_0	T_1	T_2	T_3
1	$2.95^{a*} \pm 0.13$	$3.27^{a*} \pm 0.13$	$3.05^{a*} \pm 0.10$	$3.32^{a*} \pm 0.15$
3	$3.65^{b*} \pm 0.07$	$3.77^{b*} \pm 0.05$	$3.68^{b*} \pm 0.09$	$3.84^{b*} \pm 0.02$
5	$4.10^{c*w**} \pm 0.09$	$4.45^{c*xy**} \pm 0.09$	$4.24^{c*wx**} \pm 0.12$	$4.57^{c*y**} \pm 0.04$
overall mean	$3.57^{w} \pm 0.11$	$3.83^{x} \pm 0.12$	$3.66^{w} \pm 0.12$	$3.91^{x} \pm 0.12$

Values with different superscripts abcd and wxyz differ significantly in a column (period wise) and in a row (group wise). Data represented as mean ± SE ($^{*}P \leq 0.01$, $^{**}P \leq 0.05$)

The similar lactose (%) findings were in accordance with Berhane and Singh, 2002 [3] in crossbred cows, Patel *et al.*, 2013 [12] in Surti buffaloes, Mishra *et al.*, 2008 [11] in crossbred cows, Chandra *et al.*, 2017 [4] in Murrah buffaloes and Barjibhe, 2016 [2] in Sahiwal cattle where the herbal feeding in lactating animals had shown significantly higher milk lactose percentage than the non- supplemented group animals.

2. Colostrum fat (%)

The mean values of colostrum fat (%) were ranged from 5.32 ± 0.26 to 4.82 ± 0.34 in control (T_0), 5.64 ± 0.30 to 5.12 ± 0.12 in T_1, 5.37 ± 0.32 to 4.95 ± 0.18 in T_2 and 5.97 ± 0.34 to 5.18 ± 0.26 in T_3 (Table 3). The overall mean ± SE values of colostrum fat % were 5.05 ± 0.19, 5.40 ± 0.13, 5.19 ± 0.16 and 5.66 ± 0.19 in T_0, T_1, T_2 and T_3 respectively. The mean values of colostrum fat (%) were higher ($P \geq 0.05$) in T_3 followed by T_1, T_2 and T_0 and it were not differing significantly between the periods and groups.

Table 3: Colostrum fat (%) of Sahiwal cows

Days	T_0	T_1	T_2	T_3
1	5.32 ± 0.26	5.64 ± 0.30	5.37 ± 0.32	5.97 ± 0.34
3	4.99 ± 0.40	5.44 ± 0.22	5.25 ± 0.32	5.84 ± 0.36
5	4.82 ± 0.34	5.12 ± 0.12	4.95 ± 0.18	5.18 ± 0.26
overall mean	$5.05^{w} \pm 0.19$	$5.40^{wx} \pm 0.13$	$5.19^{wx} \pm 0.16$	$5.66^{x} \pm 0.19$

Values with different superscripts wxyz differ significantly in a row (group wise). Data represented as mean ± SE ($P \leq 0.05$)

3. Colostrum protein (%)

The mean ± SE values of colostrum protein (%) were ranged from 11.95 ± 0.31 to 4.80 ± 0.36 in control (T_0), 13.11 ± 0.56 to 5.37 ± 0.31 in T_1, 12.01 ± 0.50 to 5.05 ± 0.36 in T_2 and 13.15 ± 0.55 to 5.64 ± 0.46 in T_3 (Table 4). The overall mean ± SE values of colostrum protein % were higher in T_3 (8.74 ± 0.80) followed by T_1 (8.53 ± 0.79), T_2 7.96 ± 0.73 and T_0 (7.77 ± 0.71) and in, T_3 respectively but it was almost similar in all groups of animals. The mean values of colostrum protein % were differ significantly ($P \leq 0.05$) between the periods.

Table 4: Colostrum protein (%) of Sahiwal cows

Days	T_0	T_1	T_2	T_3
1	$11.95^{c} \pm 0.31$	$13.11^{c} \pm 0.56$	$12.01^{b} \pm 0.50$	$13.15^{b} \pm 0.55$
3	$6.55^{b} \pm 0.45$	$7.12^{b} \pm 0.60$	$6.82^{a} \pm 0.84$	$7.42^{a} \pm 0.93$
5	$4.80^{a} \pm 0.36$	$5.37^{a} \pm 0.31$	$5.05^{a} \pm 0.36$	$5.64^{a} \pm 0.46$
overall mean	7.77 ± 0.71	8.53 ± 0.79	7.96 ± 0.73	8.74 ± 0.80

Values with different superscripts abcd differ significantly in a column (period wise). Data represented as mean ± SE ($P \leq 0.01$)

4. Colostrum solid not fat (%)

The mean ± SE values of colostrum solid not fat (%) ranged from 17.57 ± 0.41 to 8.35 ± 0.11 in control (T_0), 18.97 ± 0.46 to 8.54 ± 0.09 in T_1, 17.51 ± 0.51 to 8.41 ± 0.07 in T_2 and 19.02 ± 1.02 to 8.58 ± 0.05 in T_3 (Table 4). The overall mean values of colostrum SNF percentage were 11.72 ± 0.95, 12.67 ± 1.05, 12.05 ± 0.91 and 12.81 ± 1.10 in T_0, T_1, T_2 and T_3 respectively. The overall mean values of colostrum SNF % were higher in T_3 followed by T_1, T_2 and T_0, but they were almost similar in all groups of animals. The colostrum SNF % was found significant ($P \leq 0.01$) difference between the periods.

Table 4: Colostrum solid not fat (%) of Sahiwal cows

Days	T_0	T_1	T_2	T_3
1	$17.57^{b} \pm 0.41$	$18.97^{c} \pm 0.46$	$17.51^{c} \pm 0.51$	$19.02^{b} \pm 1.02$
3	$9.25^{a} \pm 0.64$	$10.51^{b} \pm 0.77$	$10.22^{b} \pm 0.52$	$10.84^{a} \pm 0.99$
5	$8.35^{a} \pm 0.11$	$8.54^{a} \pm 0.09$	$8.41^{a} \pm 0.07$	$8.58^{a} \pm 0.05$
overall mean	11.72 ± 0.95	12.67 ± 1.05	12.05 ± 0.91	12.81 ± 1.10

Values with different superscripts abcd differ significantly in a column (period wise). Data represented as mean ± SE ($P \leq 0.01$)

4. Effect of polyherbal mixture supplementation on colostrum total solid (%) of Sahiwal cows

The mean ± SE values of colostrum total solid percentage on 1st, 3rd and 5th day of collection ranged from 22.90 ± 0.58 to 13.18 ± 0.37 in control (T_0), 24.61 ± 0.28 to 13.67 ± 0.13 in T_1, 22.88 ± 0.69 to 13.37 ± 0.18 in T_2 and 25.00 ± 1.33 to 13.77 ± 0.27 in T_3 (Table 5). The overall mean ± SE values of colostrum total solid percentage were 16.78 ± 1.04, 18.08 ± 1.09, 17.24 ± 0.95 and 18.48 ± 1.19 in T_0, T_1, T_2, T_3 respectively. The mean values of colostrum didn't differ

significantly between the periods. The overall mean values of colostrum T S (%) were higher ($P \geq 0.05$) in T_3 followed by T_1, T_2 and T_0, but there was almost similar in all groups of animals.

Table 5: Colostrum solid not fat (%) of Sahiwal cows

Days	T_0	T_1	T_2	T_3
1	$22.90^{b} \pm 0.58$	$24.61^{c} \pm 0.28$	$22.88^{c} \pm 0.69$	$25.00^{b} \pm 1.33$
3	$14.25^{a} \pm 0.94$	$15.95^{b} \pm 0.87$	$15.48^{b} \pm 0.59$	$16.68^{a} \pm 1.08$
5	$13.18^{a} \pm 0.37$	$13.67^{a} \pm 0.13$	$13.37^{a} \pm 0.18$	$13.77^{a} \pm 0.27$
overall mean	$16.78^{w} \pm 1.04$	$18.08^{xy} \pm 1.09$	$17.24^{wx} \pm 0.95$	$18.48^{y} \pm 1.19$

Values with different superscripts abcd and wxyz differ significantly in a column (period wise) and in a row (group wise). Data represented as mean ± SE ($P \leq 0.01$)

Similarly, Kumar *et al.* (2014) [7] were found that colostrum fat ($P \geq 0.05$), protein, SNF and total solids (%) ($P \leq 0.05$) were increased in shatavari supplemented groups of crossbred cows than the control. Hendawy *et al.* (2019) [6] found that colostrum fat, protein, SNF and total solids % were higher ($P \geq 0.05$) in the ewes after supplementation of Black seed and ginger. However, in our study it was increased not significantly. Kumari, (2015)[8] also found that, the polyherbal mineral mixture supplementation improved milk yield without affecting the milk composition during early lactation of crossbred cows. The present study showed that, polyherbal mixture improves the quality of colostrum of Sahiwal cows.

Conclusions

Poly-herbal supplementation containing the combination of 200 g polyherbal mixture –Shatavari, Methi, Jeera (50 g each) + Dalchini and Tulsi (25 g each) along with this mixture jaggery (250 g) were fed 30 days before and 60 days after parturition and 150 g polyherbal (kadha) mixture - Ajwain, Fennel, Ginger, Black cardamom and Nigella sativa (25 g each) + Turmeric (20 g) + Clove (5 g) + along with this polyherbal mixture Black salt (25 g) + Jaggery (250 g) were fed immediately after parturition for 7 days reduced peri-parturient stress and improved colostrum composition of Sahiwal cows.

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