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Effect of feeding Jivanti (*Lepatadenia reticulate*) powder on production and composition of milk in crossbred cows

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Abstract
The present experiment entitled, "Effect of feeding Jivanti powder on production and composition of milk in crossbred cows" was conducted at RCDP on Cattle, Department of Animal Husbandry and Dairy Science, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist- Ahmednagar (M.S.). The cows were divided in four groups. Group T_0 was control group, in which the animals received experimental feed without any other feed supplements whereas the animals of experimental group 2 (T_1), group 3 (T_2) and group 4 (T_3) were fed a similar feed along with 40 g, 80 g and 120 g/day Jivanti powder, respectively. The study was conducted for a period of 60 days. Daily milk yield was also recorded. Milk composition of each animal was determined once every fortnight. Cows fed Jivanti powder (*Leptadenia reticlate*) produce more milk ($P \leq 0.01$), milk fat per cent, milk fat yield, milk protein per cent, milk protein yield, milk lactose per cent, milk lactose yield, milk solid not fat per cent, milk solid not fat yield, milk total solid per cent, milk total solids yield content ($P \leq 0.01$) than control cows. Results of the present study suggests that feeding of 40 g/day Jivanti (*Leptadenia reticlate*) powder daily to cattle is economical and beneficial for improving the milk yield and milk composition status in crossbred cows.

Keywords: Jivanti powder, milk production, milk composition, crossbred cows, feed supplementation

Introduction
The livestock sector significantly contributes to the rural economy by providing income and employment. India's milk production has steadily increased for a decade, and FAS New Delhi forecasts 2024 milk production at 212.7 million metric tons (MMT), up 3% from 2023, along with increases in non-fat dry milk (SMP) and butter production (Dairy and Products Annual, 2023). However, low productivity due to underfeeding, malnutrition, diseases, and stress hampers the dairy industry's potential (Kumari *et al.*, 2020) [28].

Herbal feed additives can improve nutrient utilization, milk secretion, and overall performance through their medicinal, antibacterial, immuno-stimulatory, and antioxidative properties (Alem, 2024) [1]. Ayurveda, a traditional herbal medicine system, emphasizes herbs like shatavari (*Asparagus racemosus*), jivanti (*Leptadenia reticulata*), and methi (*Trigonella foenum*) as galactogogues to enhance lactation without harmful residues (Bakshi *et al.*, 2004) [4]. These substances promote milk production by stimulating alveolar tissue and increasing prolactin secretion (Gabay, 2002; Ravikumar and Bhagwat, 2008) [14, 38].

Leptadenia reticulata (Jivanti), a plant from the Asclepiadaceae family, is known for its nourishing and rejuvenating properties. It is distributed across Asia, Africa, and parts of India and contains compounds like α-amyrin, β-amyrin, luteolin, and rutin (Krishna *et al.*, 1975; Jethva *et al.*, 2021) [25, 21]. Jivanti improves metabolism, digestion, and health, and is used for treating ailments like bleeding disorders, dehydration, and colitis (Kirtikar *et al.*, 1993) [22]. Its nutritional profile includes protein (35.80%), carbohydrates (23.40%), and minerals like calcium and magnesium (Hewageegana *et al.*, 2014) [19]. Supplementation with Jivanti-based products like Leptadenia tablets and Galactin-Vet bolus has shown improved milk yield in lactating cows and buffaloes (Moulvi, 1963; Sridhar and Bhagawat, 2007; Jain and Bais, 2016) [34, 52, 20].

Materials and Methods

Materials

The material required for research work was number of animals (20 Crossbred cows), animal shed, feeds and fodders, concentrates, supplementary feed i.e Jivanti (*Leptadenia reticulata*), milking machine, automatic milk analyzer.

Selection of Experimental Animals

The study was conducted at MPKV, Rahuri, using 20 crossbred cows of similar lactation stage and milk yield, divided into four groups of five. The cows were housed in a well-ventilated byre with individual feeding arrangements, provided fresh water thrice daily, and maintained under hygienic conditions. Prophylactic anthelmintic treatment was administered 15 days prior, and their health was monitored throughout the experimental period.

Experimental Feeds and Feeding Schedule

The crossbred cows were fed as per ICAR (2013) standards, with soybean straw offered ad libitum and Jivanti powder mixed in the concentrate after a 15-day adaptation period. Cows were divided into four groups: T_0 (control) received no Jivanti, while T_1, T_2, and T_3 received 40 g, 80 g, and 120 g/day of Jivanti powder, respectively, for 90 days. Deworming was done twice before starting the trial, and Jivanti powder was sourced from Shivanand Ayurvedalaya, Ahmednagar.

Table 1: Experimental feeds offered to crossbred cows in different groups

Experimental group	Experimental feed
T_1	Soybean straw + Farm made concentrate + Green Maize (without Jivanti powder)
T_2	Soybean straw + Farm made concentrate + Green Maize + Jivanti powder (40 g/day/animal)
T_3	Soybean straw + Farm made concentrate + Green Maize + Jivanti powder(80 g/day/animal)
T_4	Soybean straw + farm made concentrate + Green Maize + Jivanti powder (120 g/day/animal)

Collection of Feed Samples

Representative samples of feed stuffs offered and their residues left of each animal were collected for chemical analysis.

Collection of Milk Sample

The milking of cows was done twice daily at 4:00 AM and 4:00 PM by the milkers at the milking barn. Milk yields were recorded in kg by using digital weighing balance. The milk samples of crossbred cows were collected fortnightly on 0, 15, 30, 45, 60, 75 and 90 days in the morning and evening.

Estimation of Chemical Composition of Feeds and Fodders

Ground samples of roughage, concentrate were analyzed for proximate principles as per standard procedures (AOAC, 2005) [61] and fibre fractions were determined as per the standard procedure of Van Soest *et al.* (1991) [58].

Nitrogen free extract (NFE) has to be estimated indirectly with the following formula;

NFE (% on DMB) = 100 - (% CP + % EE + % CF + % TA)

The per cent organic matter in the sample was determined by subtracting per cent ash contents of the samples from 100;

Organic matter (per cent) = 100 - per cent total ash

NDF and ADF fractions were analyzed by method of Van Soest *et al.* (1991) [58].

Analysis of Milk Parameters

Daily milk yield of individual cattle was measured using digital weighing balance and milk composition of each animal was determined once every fortnightly. The samples of morning and evening milking were pooled proportionately and were subjected to further analysis

Milk Yield and Related Parameters

Under this following parameters were calculated: -

1. **Milk yield (kg):** Daily milk yield was recorded in kg at each milking and then fortnightly average milk yield was calculated.
2. **Milk fat (per cent):** The fat per cent in the milk was measured fortnightly for individual cow.
3. **Milk fat yield (kg):** The fortnightly milk fat yield was calculated by multiplying the fortnightly milk yield with fortnightly fat per cent and divided by 100.

Milk fat yield (kg) = Milk yield x Milk fat per cent / 100

4. **Milk solid not fat (percent):** The solid not fat per cent in milk was measured fortnightly for individual cow.
5. **Milk solid not fat yield (kg):** The fortnightly milk solid not fat yield was calculated by multiplying the fortnightly milk yield milk with fortnightly milk solid not per cent and divided by 100.

Milk solid not fat yield (kg) = Milk yield x Milk solid not fat per cent / 100

6. **Milk protein (per cent):** Milk protein per cent was calculated fortnightly for individual cow.
7. **Milk protein yield (kg):** The fortnightly milk protein yield was calculated by multiplying the fortnightly milk yield with fortnightly protein per cent and divided by 100.

Milk protein yield (kg) = Milk yield x Milk protein per cent / 100

8. **Fortnightly milk lactose (per cent):** Milk lactose per cent was calculated fortnightly for individual cow.
9. **Milk lactose yield (kg):** The fortnightly yield of milk lactose was calculated by multiplying the fortnightly milk yield with fortnightly lactose per cent and divided by 100.

Milk lactose yield (kg) = Milk yield x Milk lactose per cent / 100

10. **Milk total solids (per cent):** The milk total solids per cent was calculated fortnightly for individual cow.
11. **Milk total solids yield (kg):** The fortnightly yield of milk total solids was calculated by multiplying the fortnightly milk yield with fortnightly milk total solid per cent and divided by 100.

Milk total solids yield (kg) = Milk yield x Milk total solids per cent / 100 Milk composition *viz*. milk fat, milk protein, milk lactose, milk solid not fat and milk total solids was analysed by automatic milk analyzer FOSS Milkoscan ^{TM} FT_1.

12. **Milk Calcium content (mg/100 g):** The milk calcium content was calculated by Atomic Absorption Spectrometry (AAS).
13. **Milk Magnesium content (mg/100 g):** The milk magnesium content was calculated by Atomic Absorption Spectrometry (AAS).

Economics of Feeding Jivanti

To calculate the economics of milk production through Jivanti supplementation in crossbred cows, the fixed cost such as housing, depreciation value, cost of maintaining labour etc and other parameters which were common for all groups were not taken into account. But the variable cost incurred on all groups of animals was calculated as follows.

Total Input: DMI (kg/100 kg body weight), feed costs, and additional costs for Jivanti powder were calculated for a 90-day trial. Daily Jivanti costs per animal were Rs 800 (T_0), Rs 811 (T_1), Rs 822.4 (T_2), and Rs 833.6 (T_3). Total milk yield for 20 animals per group was recorded, with milk priced at Rs 45/kg. Net returns (gross income minus feed and supplementation costs) and net return per animal per day were calculated for all groups.

Statistical Analysis

Data were analyzed using analysis of variance (Snedecor and Cochran, 1994) [50]. Significant F-values at 5% and 1% probability levels were further tested using Duncan's New Multiple Range Test (Kramer, 1956) [23]. The appropriate statistical methods were applied to determine mean differences.

Results and Discussion

The results obtained in the study are given under the following points.

1. Proximate analysis of feed and fodder.
2. Qualitative and quantitative analysis of milk.
3. To estimate total cost.

1. Proximate Analysis of Jivanti (*Leptadenia reticulate*)

Proximate analysis of Jivanti (*Leptadenia reticulate*) powder on DM basis has been presented in table 2.

Table 2: Proximate analysis of Jivanti (*Leptadenia reticulate*) powder (% DM)

Sr. No.	Attributes	Jivanti Powder
1	DM	92.60
2	CP	7.76
3	EE	0.86
4	NFE	23.48
5	TA	10.2
6	CF	26.08
7	OM	89.8
8	NDF	76.6
9	ADF	62.8

Ingredient and Proximate Composition of Concentrate Mixture and Feeds

The concentrate mixture used in the experiment contained crushed maize, soybean/gram/tur, GNC, CSC, wheat bran, rice bran DOC, chelated minerals, and common salt in specified proportions. The proximate composition of feeds and fodders (on DM basis) offered to the lactating crossbred cows is detailed in the tables.3

Table 3: Proximate composition of the feeds offered to lactating crossbred cows (% DM)

Sr. No	Attributes	Green Maize	Soybean straw	Concentrate
1	DM	22.86	93.11	91.01
2	CP	17.00	5.10	20.53
3	EE	8.94	2.01	10.58
4	NFE	54.11	49.89	38.91
5	TA	16.05	08.00	8.99
6	OM	90.95	89.88	95.82
7	CF	3.9	35.00	20.99
8	NDF	65.71	24.12	26.35
9	ADF	44.6	16.21	14.65

The roughages used in this experiment were green maize (*Zea maize* L.) and Soybean straw (*Glycin max* L.). The average crude protein content in green maize, soybean straw and concentrate mixture was 11.76, 5.10 and 16.53 per cent, respectively. The average dry matter in green maize, soybean straw and concentrate mixture was 22.86, 93.11 and 91.01 per cent, respectively.

Table 4: Ingredient composition of concentrate mixture

Groups				
Ingredients	**T_0**	**T_1**	**T_2**	**T_3**
Crushed Maize	27	27	27	27
Soybean/ Gram/ Tur	23	23	23	23
GNC	9	9	9	9
CSC	14	14	14	14
Wheat Bran	15	15	15	15
Rice Bran (DOC)	9	9	9	9
Chelated Minerals	2	2	2	2
Common salt	1	1	1	1
Total	100	100	100	100
Jivanti powder as Feed Additives	----	40 g	80 g	120 g

Milk Yield and its Composition Parameters Daily Milk yield

Statistical analysis revealed a significant ($P \leq 0.05$) effect of treatment on daily milk yield. Group T_3 had the highest milk yield (5.38 kg), particularly on Days 0, 45, and 60, indicating its effectiveness for milk production. Group T_0 (control) remained stable, showing a significant increase at Day 90. Group T_1 showed an early increase but declined later, while T_2 remained steady with a peak at Day 75. Overall, T_3 had the highest mean yield (5.38 kg), followed by T_1 (4.58 kg), T_2 (4.30 kg), and T_0 (4.12 kg). These results align with previous studies (Ramesh *et al.*, 2000; Tanwar *et al.*, 2008; etc.) [3, 56].

Table 5: Fortnightly milk yield (kg) in lactating crossbred cows

Treatments	Days							Overall mean
	0	**15**	**30**	**45**	**60**	**75**	**90**	
T_0	4.12^b	3.75^b	3.77^b	3.42^b	3.19^b	2.96^b	7.63^a	4.12 b
T_1	4.00^b	6.47^a	6.53^a	4.18^b	3.95^b	3.56^b	3.37^b	4.58 a
T_2	4.04^b	3.97^b	3.95^b	3.58^b	3.77^b	7.41^a	3.39^b	4.30 a
T_3	6.27^a	4.95^{ab}	4.47^b	7.02^a	7.12^a	3.97^b	3.87^b	5.38 a
SE(m) ±	0.56	0.66	0.62	0.71	0.45	0.74	0.64	0.38
SE(d) ±	0.80	0.94	0.87	1.01	0.64	1.05	0.89	0.54
CD @ 5%	1.73	2.04	1.90	2.20	1.39	2.27	1.94	1.13
CV	27.30	30..96	29.42	35.23	22.53	36.75	30.86	

Means with different superscripts differ significantly within the column. NS: Non-significant

Milk Fat (%)

Statistical analysis revealed a significant ($P \leq 0.05$) effect of treatment on milk fat, with T_1 showing the highest milk fat production (4.61%) across most days. T_0 had a notable spike on Day 30 but overall performed lower than T_1. Treatments T_2 and T_3 showed steady increases but were less effective than T_1. The overall mean for T_1 was significantly higher than T_0, T_2, and T_3. These results align with previous studies by Soni *et al.* (2016) [51] and Saini (2018) [40], which also found increased milk fat in Jivanti-supplemented groups.

Table 6: Effect of feeding Jivanti powder on milk fat (Per cent)

Treatments	Days							Overall mean
	0	**15**	**30**	**45**	**60**	**75**	**90**	
T_0	2.78	3.32^b	5.14^a	3.76^b	3.46^b	3.58^b	3.38^b	3.63 b
T_1	3.88	4.38^a	4.44^{ab}	5.00^a	4.64^a	4.94^a	5.00^a	4.61 a
T_2	3.12	3.06^b	3.5^b	3.68^b	3.72^b	3.94^b	4.18^{ab}	3.60 b
T_3	3.5	3.02^b	3.14^b	3.58^b	3.62^b	4.02^b	4.08^{ab}	3.56 b
CD @ 5%	NS	0.6	1.4	0.75	0.72	0.94	0.98	0.51
CV	51.4	12.65	25.07	13.74	13.7	16.64	17.11	

The mean milk fat yield was highest for T_1 (0.20 kg), followed by T_3 (0.18 kg), T_2 (0.15 kg), and T_0 (0.14 kg). T_1 consistently showed the highest values on Days 15 (0.28) and 30 (0.29) and was significantly superior across most days. T_2 peaked on Day 75 (0.29), while T_3 showed moderate performance. T_0 displayed stable but lower values, with a peak on Day 90 (0.26). Results suggest T_1 as the most effective treatment for increasing milk fat yield, aligning with findings by Saini *et al.* (2018) [40] and Kumar and Kumar (2018) [26].

Table 7: Effect of feeding Jivanti powder on milk fat yield (kg)

Treatments	Days							Overall mean
	0	**15**	**30**	**45**	**60**	**75**	**90**	
T_0	0.11	0.13^b	0.19^b	0.13	0.11^b	0.11^b	0.26	0.14 b
T_1	0.16	0.28^a	0.29^a	0.21	0.19^{ab}	0.17^b	0.16	0.20 a
T_2	0.12	0.12^b	0.14^b	0.13	0.14^b	0.29^a	0.14	0.15 a
T_3	0.22	0.15^b	0.14^b	0.25	0.25^a	0.14^b	0.14	0.18 a
CD @ 5%	N.S	0.08	0.07	N.S	0.06	0.07	N.S	0.05
CV	50.0	32.31	27.70	39.76	25.65	30.04	40.31	

Means with different superscripts differ significantly within the column. NS: Non-significant

Solid Not Fat (SNF) %: The statistical analysis revealed a non-significant effect of treatment and period on SNF percentage. Mean SNF values were 7.24% for T_0, 7.90% for T_1, 7.70% for T_2, and 7.84% for T_3. T_1 showed the highest and most consistent improvement, with an overall mean of 7.90%. T_2 and T_3 performed well, peaking on Days 30 and 90, while T_0 had the lowest mean SNF at 7.24%, lagging behind the other treatments.

Table 8: Effect of feeding Jivanti powder on milk solid not fat (%)

Treatments	Days							Overall mean
	0	15	30	45	60	75	90	
T_0	6.42	7.26^{b}	7.54^{b}	7.55^{b}	7.28^{b}	7.33^{b}	7.32^{b}	7.24 b
T_1	6.7	7.94^{a}	8.00^{a}	7.98^{a}	8.19^{a}	8.32^{a}	8.20^{a}	7.90 a
T_2	6.04	8.06^{a}	8.02^{a}	7.82^{b}	8.04^{a}	7.88^{a}	8.10^{a}	7.70 a
T_3	6.76	7.78^{ab}	8.26^{a}	8.11^{a}	7.76^{ab}	8.04^{a}	8.18^{a}	7.84 a
CD @ 5%	NS	0.55	0.47	0.39	0.66	0.68	0.67	0.25
CV	15.19	5.22	4.33	3.67	6.15	6.28	6.14	

Milk Solid Not Fat Yield (kg)

Statistical analysis revealed a significant ($P \leq 0.05$) effect of treatment on SNF yield. The highest mean yield was observed in T_3 (0.42 kg), followed by T_1 (0.36 kg), T_2 (0.34 kg), and T_0 (0.30 kg). T_3 showed peaks on Days 0 (0.48 kg), 45 (0.57 kg), and 60 (0.55 kg), while T_1 recorded significant increases on Days 15 (0.51 kg) and 30 (0.52 kg). T_2 peaked on Day 75 (0.58 kg), and T_0 had the lowest overall mean with a peak on Day 90 (0.56 kg). The results suggest Jivanti supplementation significantly enhances milk SNF yield, aligning with findings by Sharma (2010) [44] and Soni *et al.* (2016) [51].

Table 9: Effect of feeding Jivanti root powder on milk solid not fat yield (kg)

Treatments	Days							Overall mean
	0	15	30	45	60	75	90	
T_0	0.31^{b}	0.27^{b}	0.28^{b}	0.26^{b}	0.23^{b}	0.22^{b}	0.56^{a}	0.30 b
T_1	0.31^{b}	0.51^{a}	0.52^{a}	0.33^{b}	0.33^{b}	0.30^{b}	0.28^{b}	0.36 a
T_2	0.32^{b}	0.32^{b}	0.32^{b}	0.28^{b}	0.30^{b}	0.58^{a}	0.27^{b}	0.34 a
T_3	0.48^{a}	0.38^{ab}	0.37^{ab}	0.57^{a}	0.55^{a}	0.32^{b}	0.32^{b}	0.42 a
CD @ 5%	0.13	0.15	0.16	0.18	0.10	0.17	0.17	0.09
CV	27.42	28.81	30.62	32.20	20.48	34.65	35.13	

Means with different superscripts differ significantly within the column. NS: Non-significant

Milk Protein (%)

Statistical analysis revealed no significant (P>0.05) effect of Jivanti powder on milk protein percentage. The mean protein values were 2.80% for T_0, 2.84% for T_1, 3.04% for T_2, and 2.99% for T_3. T_2 showed the highest overall mean and the most notable increases, particularly on Day 90 (3.46%). Treatments T_1 and T_3 also showed increases, while T_0 had the lowest mean with minimal variation. Although trends suggest Jivanti may improve protein assimilation, the differences were not statistically significant, aligning with findings by Kumar *et al.* (2014) [27] but contrasting with Soni *et al.* (2016) [51] and Saini (2018) [51, 40].

Table 10: Effect of feeding Jivanti powder on milk protein (Per cent)

Treatments	Days							Overall mean
	0	15	30	45	60	75	90	
T_0	2.50	2.92	2.7	2.94	2.82	2.84	2.94	2.80
T_1	2.22	2.4	2.86	2.92	3.1	3.26	3.18	2.84
T_2	2.58	2.96	2.98	2.88	3.04	3.4	3.46	3.04
T_3	2.42	2.9	2.9	2.96	3.12	3.46	3.18	2.99
CD @ 5%	NS	NS	NS	NS	NS	NS	NS	NS
CV	17.12	15.99	8.48	5.45	9.56	10.81	11.72	

Milk Protein Yield (kg)

Statistical analysis revealed a significant ($P \leq 0.05$) effect of treatment on milk protein yield. The highest mean yield was observed in T_3 (0.15 kg), followed by T_1 and T_2 (0.13 kg each), while T_0 had the lowest yield (0.11 kg). T_3 consistently performed well, peaking at 0.22 kg on Day 60. T_2 peaked at 0.25 kg on Day 75, and T_1 showed early increases, notably 0.19 kg on Day 30. T_0 showed minimal improvement, reflecting control conditions. The data suggest Jivanti powder positively influences milk protein yield, aligning with findings by Saini (2018) [40].

Table 11: Effect of feeding Jivanti powder on milk protein yield (kg)

Treatments	Days							Overall mean
	0	15	30	45	60	75	90	
T_0	0.11	0.11	0.10^{b}	0.10^{b}	0.09^{b}	0.08^{b}	0.21^{a}	0.11 b
T_1	0.09	0.16	0.19^{a}	$0.12b^{b}$	0.12^{b}	0.12^{b}	0.11^{b}	0.13 a
T_2	0.11	0.12	0.12^{b}	0.12^{b}	0.11^{b}	0.25^{a}	0.12^{b}	0.13 a
T_3	0.15	0.14	0.13^{ab}	0.21^{a}	0.22^{a}	0.14^{b}	0.12^{b}	0.15 a
CD @ 5%	N.S.	N.S	0.06	0.07	0.04	0.08	0.06	0.03
CV	34.26	35.88	31.49	36.22	22.42	41.94	32.63	

Means with different superscripts differ significantly within the column. NS: Non-significant

Milk Lactose (%)

The highest mean lactose was observed in T_2 (4.61%), followed by T_3 (4.43%), T_1 (4.33%), and T_0 (4.24%). T_2 consistently showed the highest values, peaking at 4.80% on Day 30. T_1 and T_3 also demonstrated improvements, especially during the initial stages. While trends suggest Jivanti supplementation may enhance lactose content, the effects were not statistically significant, aligning with Kumar *et al.* (2014) [27] but contrasting with Sharma (2010) [44] and Dangi *et al.* (2011) [12].

Table 12: Effect of feeding Jivanti powder on milk lactose (Per cent)

Treatments	Days							Overall mean
	0	15	30	45	60	75	90	
T_0	3.98	4.48^{ab}	4.20^{b}	4.22^{b}	4.36^{b}	4.16^{b}	4.32^{b}	4.24
T_1	3.32	4.56^{ab}	4.56^{ab}	4.62^{a}	4.48^{ab}	4.48^{ab}	4.32^{b}	4.33
T_2	4.10	4.76^{a}	4.80^{a}	4.42^{ab}	4.73^{a}	4.70^{a}	4.76^{a}	4.61
T_3	3.84	4.28^{b}	4.42^{ab}	4.54^{a}	4.70^{a}	4.74^{a}	4.50^{a}	4.43
CD @ 5%	NS	0.29	0.39	0.27	0.28	0.40	0.31	NS
CV	19.19	4.77	6.39	4.42	4.55	6.43	5.17	

Milk Lactose Yield (kg)

The average milk lactose yield was highest in T_3 (0.23 kg), followed by T_1 and T_2 (0.20 kg each), and lowest in T_0 (0.17 kg). T_3 showed consistent performance, while T_2 peaked at 0.35 kg on Day 75, and T_1 at 0.30 kg on Day 30. T_0 remained steady with minimal improvement. Although trends indicate positive effects of Jivanti powder on lactose yield, the differences were not statistically significant. These findings align with Kumar *et al.* (2014) [27] but contradict Sharma (2010) [44] and Soni (2016) [51], who reported significant effects of herbal supplementation on milk lactose production.

Table 13: Effect of feeding Jivanti powder on milk lactose yield (kg)

Treatments	Days							Overall mean
	0	15	30	45	60	75	90	
T_0	0.16	0.17	0.16^{b}	0.14^{b}	0.14^{b}	0.12^{b}	0.33^{a}	0.17
T_1	0.13	0.30	0.30^{a}	0.19^{b}	0.18^{b}	0.16^{b}	0.15^{b}	0.20
T_2	0.17	0.19	0.19^{b}	0.16^{b}	0.18^{b}	0.35^{a}	0.16^{b}	0.20
T_3	0.24	0.21	0.20^{b}	0.32^{a}	0.34^{a}	0.19^{b}	0.17^{b}	0.23
CD @ 5%	N.S.	N.S.	0.10	0.10	0.07	0.11	0.09	NS
CV	34.86	32.55	31.44	34.61	23.03	38.84	31.03	

Milk Total Solids (%)

The overall mean of milk total soilds (%) indicated that, the treatment T_1 was significantly superior (12.53%) over all the treatment. It was followed by treatment T_2 (11.61 %), T_3 (11.37%) and T_0 (11.01%) which were at par with each other. Overall, the table illustrates that feeding Jivanti powder (T_1) consistently enhances the percentage of milk total solids compared to the control and other treatment groups. This could imply nutritional benefits from Jivanti powder that may improve the quality of milk produced by the cows.

Table 14: Effect of feeding Jivanti powder on milk total solid (Per cent)

Treatments	Days							Overall mean
	0	15	30	40	60	75	90	
T_0	9.82	10.84^{b}	10.56^{b}	11.84^{b}	11.5^{b}	11.26^{b}	11.28^{b}	11.01^{b}
T_1	11.38	12.26^{a}	12.06^{a}	13.28^{a}	12.94^{a}	13.22^{a}	12.62^{a}	12.53^{a}
T_2	10.96	11.28^{b}	11.00^{ab}	11.58^{b}	12.32^{ab}	12.08^{ab}	12.08^{ab}	11.61^{b}
T_3	10.72	10.78^{b}	10.5^{b}	11.32^{b}	11.5^{b}	12.08^{ab}	12.70^{a}	11.37^{b}
CD @ 5%	NS	0.78	1.18	0.95	1.14	1.31	1.00	0.46
CV	14.82	5.03	7.76	5.79	6.91	7.84	5.99	

Milk Total Solids Yield (kg)

The average milk total solids yield was highest in T_3 (0.60 kg), followed by T_1 (0.57 kg), T_2 (0.49 kg), and lowest in T_0 (0.45 kg). T_1 showed early improvements, peaking at 0.80 kg on Day 15, while T_2 peaked at 0.86 kg on Day 75, indicating a delayed effect. T_3 maintained consistent performance with peaks on Days 45 and 60. T_0 remained the lowest throughout. Feeding Jivanti powder significantly improved total solids yield, particularly in T_1 and T_3, enhancing milk quality. These findings align with Soni (2016) [51], who reported significant effects of herbal supplementation on total solids production in cows.

Table 15: Effect of feeding Jivanti powder on milk total solid yield (kg)

Treatments	Days							Overall mean
	0	15	30	45	60	75	90	
T_0	0.40	0.41^{b}	0.40^{b}	0.41^{b}	0.37^{b}	0.34^{b}	0.85^{a}	0.45 b
T_1	0.46	0.80^{a}	0.79^{a}	0.56^{a}	0.51^{b}	0.47^{b}	0.43^{b}	0.57 a
T_2	0.44	0.45^{b}	0.44^{b}	0.41^{b}	0.46^{b}	0.86^{a}	0.41^{b}	0.49 a
T_3	0.68	0.54^{b}	0.47^{b}	0.81^{a}	0.81^{a}	0.47^{b}	0.47^{b}	0.60 a
CD @ 5%	N.S.	0.233	0.18	0.27	0.16	0.25	0.23	0.13
CV	32.34	30.94	25.49	37.03	22.11	34.40	30.97	

Milk Calcium Content (mg/100g)

The average milk calcium content was highest in T_3 (130.95 mg/100 g), followed by T_2 (119.64 mg/100 g), T_1 (117.87 mg/100 g), and T_0 (117.71 mg/100 g). T_3 peaked at 181.86 mg/100 g on Day 60, while T_2 showed a notable increase to 136.74 mg/100 g on Day 60. T_0 and T_1 remained stable with no significant peaks. Although the effects were not statistically significant, trends suggest that feeding Jivanti powder, particularly in T_2 and T_3, may enhance milk calcium content and nutritional value. Further studies are needed to confirm these findings.

Table 16: Effect of feeding Jivanti powder on milk calcium content (mg/100 g)

Treatments	Days							Overall mean
	0	15	30	45	60	75	90	
T_0	116.52	113.70	115.34	119.16	119.04	120.86	119.30	117.71a
T_1	116.38	117.24	117.8	118.18	118.34	118.48	118.68	117.87a
T_2	112.82	114.5	114.96	118.9	136.74	120.82	118.76	119.64a
T_3	125.56	122.6	122.7	123.1	181.86	123.5	117.34	130.95a
CD @ 5%	NS	NS	NS	NS	NS	NS	NS	17.04
CV	15.10	5.16	6.24	5.91	27.42	7.84	6.79	

Means with different superscripts differ significantly within the column. NS: Non-significant

Milk Magnesium Content (mg/100 g)

Milk magnesium content was highest in T_3 (25.76 mg/100 g), followed by T_2 (13.48 mg/100 g), T_1 (11.61 mg/100 g), and T_0 (10.40 mg/100 g). T_3 peaked at 23.4 mg/100 g on Day 90, showing a significant positive effect of Jivanti powder. T_2 maintained consistently high levels, while T_1 and T_0 had lower and less consistent values. Feeding Jivanti powder significantly enhanced milk magnesium content, particularly in T_3, suggesting its potential to improve milk's nutritional value.

Table 17: Effect of feeding Jivanti powder on milk magnesium content (mg/100 gm)

Treatments	Days							Overall mean
	0	15	30	45	60	75	90	
T_0	8.72	11.07	8.74	9.2	9.84	13.84	11.4	10.40b
T_1	12.36	10.09	11.76	12.94	10.22	10.6	13.36	11.61b
T_2	13.00	12.9	13.14	12.76	14.48	14.02	14.1	13.48b
T_3	19.22	19.46	19.50	19.98	20.00	20.58	23.4	25.76 a
CD @ 5%	NS	NS	NS	NS	NS	NS	NS	9.05
CV	57.19	39.23	198.4	58.53	57.53	52.53	41.16	

Means with different superscripts differ significantly within the column. NS: Non-significant

Economics of Jivanti

The feeding cost per cow was lowest in T_0 (Rs. 105.20) and highest in T_3 (Rs. 154.55). Total income was highest in T_3 (Rs. 31,306.50) and T_2 (Rs. 30,845.70), followed by T_1 (Rs. 29,070) and T_0 (Rs. 20,844). The B:C ratio was 2.20 for T_0, 2.60 for T_1, 2.57 for T_2, and 2.25 for T_3.

Cost of economics of Jivanti feed to different treatments

Sr. No.	Particulars	Groups			
		T_0	T_1	T_2	T_3
1	Cost of concentrate mixture (Rs)/Kg	23	23	23	23
2	Cost of green roughage (Rs)/Kg	2.0	2.0	2.0	2.0
3	Cost of dry roughage (Rs)/Kg	2.0	2.0	2.0	2.0
4	Labour cost per animal for 90 days (Rs)	3336	3336	3336	3336
5	Average concentrate mixture consumed (kg) / animal	196.77	200.15	195.63	192.68
6	Average green fodder consumed (kg) / animal	530.39	820.75	800.00	789.81
7	Average dry fodder consumed (kg) / animal	272.80	280.62	270.96	265.15
8	Cost of concentrate consumed (Rs) / animal	4525.71	4603.45	4499.49	4431.64
9	Cost of green roughage consumed/(Rs) / animal	1060.58	1641.50	1600	1579.62
10	Cost of dry roughage consumed/ (Rs) / animal	545.6	561.24	541.92	530.3
11	Cost of Jivanti(Rs)/ animal	00	1008	2016	4032
12	Total cost (Rs)/ animal	9467.89	11150.19	11993.41	13909.56
13	Total cost/day/animal (Rs)	105.20	123.89	133.26	154.55
14	Total Milk yield kg/ animal	463.2	646	685.46	695.70
15	Total Milk income/ animal (Rs)	20844	29070	30845.70	31306.5
16	Net Income/ animal (Rs)	11376.11	17919.8	18852.29	17396.94
17	B:C ratio	2.20	2.60	2.57	2.25

Conclusion: Feeding Jivanti powder had significant ($P \leq 0.05$) effect on milk production and highest daily milk yield was observed in group T_3 (5.38 kg) supplemented with Jivanti powder @120 g/day/ animal followed by the T_1 (4.58 kg) supplemented with Jivanti powder @ 40 g/day/ animal and T_2 (4.38 kg) supplemented with Jivanti powder @ 80 g/day/ animal groups. Effect of feeding Jivanti powder was found to be significant ($P \leq 0.05$) on milk composition and T_1 supplemented with Jivanti powder @ 40 g/day/ animal was most effective as compared to other. As compared to other treatments, T_1 Jivanti supplementation @

40 g/day/ animal was economically efficient having B:C ratio 2.60.

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