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Effect of concentrate treated with linseed oil on body weight gain and production cost of calves

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Abstract
A research trial was conducted at the Livestock Instructional Farm, Department of Animal Husbandry and Dairy Science, Dr. P.D.K.V., Akola, during 2024-2025 to assess the growth performance and production cost of feeding to calves by concentrate treated with linseed oil. Among the treatment groups, calves receiving the T_3 diet exhibited the highest average daily weight gain (0.362 kg), followed by T_4 (0.342 kg), T_2 (0.311 kg), and T_1 (0.273 kg). The cumulative weight gains at the end of the trial were 24.65 kg for T_1, 28.07 kg for T_2, 32.62 kg for T_3, and 30.85 kg for T_4, indicating that concentrate treated with linseed oil positively influenced weight gain in calves. The feed cost per kilogram of body weight gain was found to be Rs. 210.99 (T_1), Rs. 190.72 (T_2), Rs. 171.58 (T_3), and Rs. 184.86 (T_4), respectively. The daily feeding costs per calf were calculated as Rs. 11.55 for T_1, Rs. 11.89 for T_2, Rs. 12.43 for T_3, and Rs. 12.67 for T_4. Despite a slightly higher daily feeding cost, the T_3 group achieved the highest weight gain of 32.62 kg, demonstrating its economic efficiency for calf rearing. Additionally, the cost per kilogram of weight gain per calf was the lowest in T_3 (Rs. 34.32), followed by T_4, T_2 and T_1, further confirming the economic benefits of including linseed oil in the concentrate for calves.

Keywords: Calf growth, feeding cost, linseed oil, body weight, dry matter

1. Introduction
India, being an agricultural nation, has around 65% of its population engaged in farming and related activities for their livelihood. Among these, animal husbandry serves as a significant allied sector, providing a steady income to farmers and playing a crucial role in strengthening the rural economy. The country possesses a vast livestock population, ranking first globally in both cattle numbers and milk production. As per recent statistics, the livestock sector contributed Rs. 6.54 lakh crore to the national economy in 2023-2024 (Anonymous, 2021-22) [2], while milk production reached 239.30 million tonnes during the same period. However, livestock are often maintained on low-nutrient crop residues and agricultural by-products, which restrict their productivity. Due to the extensive use of land for cultivating food grains, the availability of green and leguminous fodder remains limited across the country. In such conditions, incorporating vegetable oils into animal diets, like mustard oil, has shown to be an economical strategy for improving feed efficiency and overall productivity (Yadav *et al*., 2018) [7]. Linseed, commonly known as flax, is an ancient crop with diverse applications, and its oil, rich in alpha-linolenic acid (an essential omega-3 fatty acid), holds significant nutritional value. Adding linseed oil to calf diets can enhance the energy density of the feed while also supporting immune function (Yazdi & Fatahnia, 2015) [8]. Furthermore, research by Baba *et al*. (2024) [3] highlighted that supplementing calf diets with ethyl esters derived from linseed oil led to an increase in average daily weight gain by 55 grams per day in dairy calves, indicating its effectiveness in improving growth performance.

2. Materials and Methods
The current study entitled “Effect of concentrate treated with linseed oil on body weight gain and production cost of calves” was undertaken to assess the impact of concentrate treated with linseed oil on calf feeding. This section describes the materials used and the procedures followed.

The trial was conducted over a period of 90 days during 2024-2025 at the Livestock Instructional Farm, Department of Animal Husbandry and Dairy Science, Dr. P.D.K.V., Akola. A Randomized Block Design (RBD) was applied with four treatments and five replications. Twenty calves were selected based on similar body weight and age and were randomly allocated into four groups, each group consisting of five calves. The feeding treatments were:

- **T_1:** Soybean straw (ad lib) + 2 kg Green Fodder + concentrate
- **T_2:** Soybean straw (ad lib) + 2 kg Green Fodder + concentrate treated with 2% Linseed oil
- **T_3:** Soybean straw (ad lib) + 2 kg Green Fodder + concentrate treated with 4% Linseed oil
- **T_4:** Soybean straw (ad lib) + 2 kg Green Fodder + concentrate treated with 6% Linseed oil

(Linseed oil was added in the concentrate as above level at the time of feeding and Concentrate was provided on the basis of body weight of calves as per the thumb rule)

2.1 Body weight gain
Body weight gain was assessed by recording both daily increments and the overall weight gain of calves provided with concentrate treated with linseed oil.

2.2 Cost of production
The cost of production was evaluated by calculating the total expenditure, daily feeding cost per calf (Rs.), cost per kilogram of body weight gain for each treatment (Rs.), and cost per kilogram of body weight gain per calf (Rs.).

3. Results and Discussion
According to the findings in Table 1 and Figure 1, T_3 had the greatest daily body weight growth per calf (0.362), followed by T_4 (0.342), T_2 (0.311), and T_1 (0.273). The calves in the T_1, T_2, T_3, and T_4 treatment groups gained 24.65, 28.07, 32.62, and 30.85 kg of body weight overall during the 90 days experiment. This was significantly (p<0.05) impacted by the calves being fed concentrate treated with linseed oil. The highest average daily weight gain (0.362 kg/day) was observed in T_3, while T_1 recorded the lowest (0.273 kg/day). Similarly, T_3 exhibited the maximum total body weight gain of 32.62 kg during the experimental period. At the end of the experiment, the final body weights for calves in T_1, T_2, T_3, and T_4 were 56.26 kg, 58.18 kg, 64.45 kg, and 62.72 kg, respectively. Among these, T_3 showed a significantly higher final body weight (64.45 kg) compared to the other treatment groups. Similar results were reported by Abu El-Hamd *et al.* (2015) [1], who noted that flaxseed oil supplementation significantly influenced average daily gain (ADG) and live body weight (LBW) in calves. Their study showed that calves in group G2 exhibited a notable increase in live body weight compared to G1, with gains of 13.54% (p<0.05) at 5 weeks and 17.51% and 17.16% (p<0.01) at 10 and 15 weeks, respectively. Pawar *et al.* (2024) [6] reported that, the growth performance in BW of kankraj calves by supplementation of funnel seed powder, the total body weight gain was found 27.77 kg after 60 days. The total BW was increased from 40.78 kg to 68.55 kg.

Table 1: Effect of concentrate treated with linseed oil on average body weight gain of calves (kg)

Treatments	Initial body weight (kg)	Final body weight (kg)	Weight gain/day/calf (kg)	Total BW gain (kg)
T_1	31.61	56.26	0.273	24.65
T_2	30.11	58.18	0.311	28.07
T_3	31.83	64.45	0.362	32.62
T_4	31.87	62.72	0.342	30.85
F test	NS	Sig.	Sig.	Sig.
SE (M) ±	3.27	1.30	0.01	1.85
C.D. at 5%	-	4.00	0.03	5.57

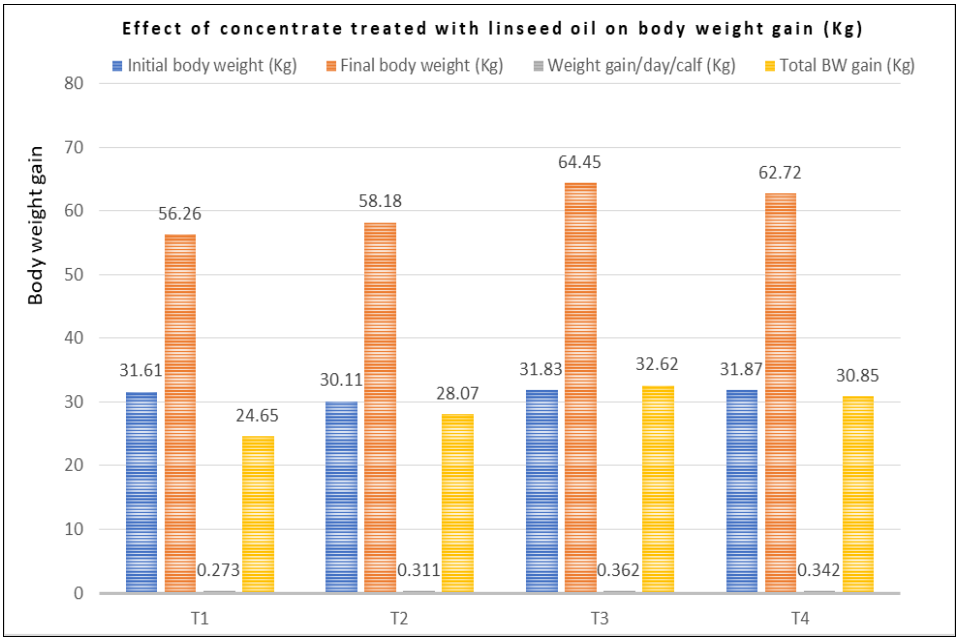

Fig 1: Total and daily body weight gain under different treatments (kg)

Table 2: Effect of concentrate treated with linseed oil on average body measurements gain of calves (cm)

Treatments	Average total gain in body length (cm)	Average total gain in chest girth (cm)	Average total gain in body height (cm)
T_1	14.40	15.60	9.20
T_2	15.80	17.80	9.60
T_3	18.60	18.60	11.00
T_4	18.00	17.20	9.80
F test	Sig.	Sig.	Sig.
SE (M) ±	0.29	0.22	0.34
C.D. at 5%	0.90	0.67	1.04

As shown in Table 2 and Figure 2, the average increase in body length for calves during the experimental period in treatments T_1, T_2, T_3, and T_4 was 14.40 cm, 15.80 cm, 18.60 cm, and 18.00 cm, respectively. Corresponding gains in chest girth were recorded as 15.60 cm for T_1, 17.80 cm for T_2, 18.60 cm for T_3, and 17.20 cm for T_4. Additionally, the average increase in body height at the withers was 9.20 cm (T_1), 9.60 cm (T_2), 11.00 cm (T_3), and 9.80 cm (T_4). Statistical analysis revealed significant differences among the treatment groups. These findings suggest that supplementing the concentrate treated with 4% linseed oil (T_3) contributed to improved body measurements in the calves during the experimental period.

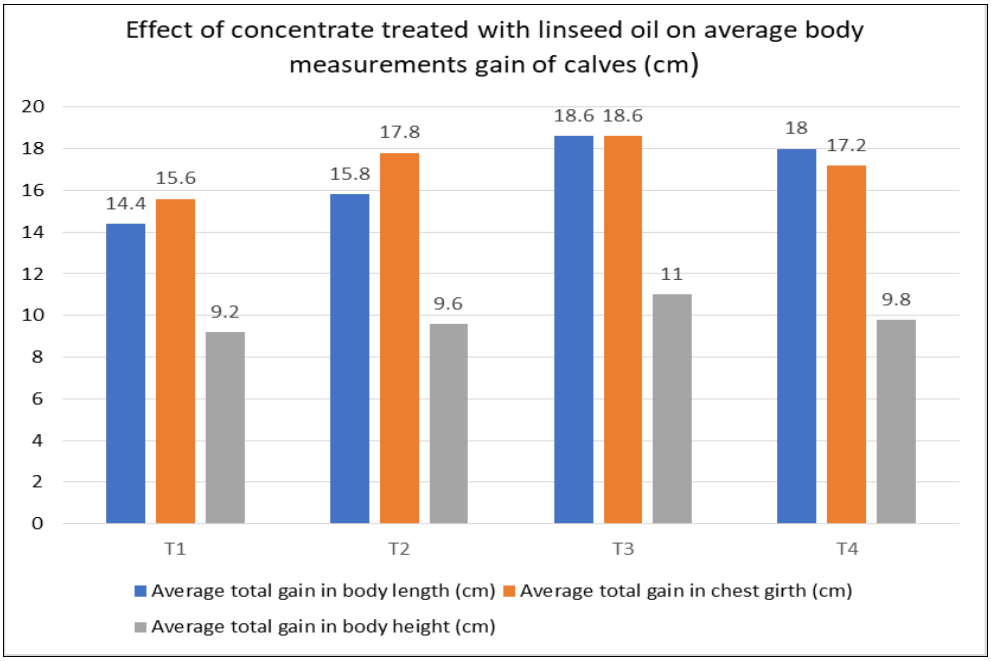

Fig 2: Average body measurements gain of calves under different treatments (cm)

3.2 Cost of production

Table 3 outlines the feed costs associated with each treatment during the study. Over the course of the trial, the total feed expenditure per calf amounted to Rs. 5200.92 (T_1), Rs. 5353.57 (T_2), Rs. 5597.05 (T_3), and Rs. 5703.10 (T_4). When evaluated per kilogram of body weight gained, the costs were Rs. 210.99 for T_1, Rs. 190.72 for T_2, Rs. 171.58 for T_3, and Rs. 184.86 for T_4. The daily feeding expenses per calf were Rs. 11.55 in T_1, Rs. 11.89 in T_2, Rs. 12.43 in T_3, and Rs. 12.67 in T_4. Although T_3 showed a slightly higher daily feed cost, it resulted in the highest weight gain of 32.62 kg, highlighting its economic advantage for farmers.

Table 3: Effect of concentrate treated with linseed on production cost of calves

Sr. No	Treatment	T_1		T_2		T_3		T_4	
	Particular	Quantity (kg)	Cost (Rs)	Quantity (kg)	Cost (Rs)	Quantity (kg)	Cost (Rs)	Quantity (kg)	Cost (Rs)
1	Soybean straw (Kg) @150 Rs/qt	88.92	133.3	99.45	149.7	131.85	197.7	120.6	180.9
2	Green fodder (hybrid Napier) Kg @100 Rs/qt	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0
3	Concentrate Kg @24.6 Rs/Kg	27.18	668.62	27.45	675.27	29.25	719.55	28.8	708.48
4	Linseed oil @24 Rs/100 gm	-	-	540	129.6	1.170	280.8	1.728	414.72
5	Labour charges @375/day	-	4219	-	4219	-	4219	-	4219
6	Total cost	-	5200.92	-	5353.57	-	5597.05	-	5703.10
7	Total cost (Rs)/calves over 90 days		1040.18		1070.64		1119.41		1140.62
8	Total cost/day/calf (Rs)	-	11.55	-	11.89	-	12.43	-	12.67
9	Total body weight gain (Kg)	24.65	-	28.07	-	32.62	-	30.85	-
10	Cost/Kg BW gain/group	-	210.99	-	190.72	-	171.58	-	184.86
11	Cost/Kg BW gain/calf	-	42.20	-	38.14	-	34.32	-	36.97

Additionally, the cost of gaining one kilogram of body weight per calf was lowest in T_3 (Rs. 34.32), followed by T_4 (Rs. 36.97), T_2 (Rs. 38.14), and T_1 (Rs. 42.20). Supporting these findings, Kahate *et al*. (2017) [4, 5] observed that, feeding different concentrate types to heifers led to feed costs of Rs. 126.73 (T_1), Rs. 105.64 (T_2), and Rs. 111.42 (T_3) per kilogram of weight gain, with T_2 being the most cost-efficient. Similarly, Mishra *et al*. (2017) [5] reported that, indigenous calves fed varying concentrate mixtures had corresponding costs of Rs. 130.12 (T_1), Rs. 115.75 (T_2), and Rs. 123.67 (T_3) per kilogram of weight gain, once again showing T_2 as the most economical treatment.

4. Conclusion

The findings of this study indicate that incorporating linseed oil into the concentrate feed for calves positively influences both weight gain and the cost of production. Calves receiving concentrate treated with 4% linseed oil (T_3) achieved the highest total weight gain of 32.62 kg during the experimental period. Additionally, the cost per kilogram of weight gain was found to be lowest in T_3 when compared to the other treatments. Overall, supplementing concentrate treated with 4% linseed oil proved to be beneficial for enhancing growth performance and maintaining the health of the calves.

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Conflict of Interest

Not available

Financial Support

Not available

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