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Assessment of Test-Day Milk Yield and Milk Composition in Tharparkar Cattle

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Abstract

This study evaluated test-day milk yield and selected milk-quality traits in Tharparkar cattle using an observational dataset covering 91 animals and 237 animal-date recording observations collected between 07 March 2025 and 21 July 2026. The dataset contained four lactation classes (1–4) and records with and without calf suckling. Overall mean test-day milk yield was 5.48 ± 1.63 kg/day (range 2.06–11.61 kg/day). Mean milk fat, protein, SNF and lactose were 4.10%, 3.27%, 8.80% and 4.88%, respectively. One-way ANOVA did not detect a significant difference in mean test-day milk yield among lactation numbers ($F=1.12$, $P=0.343$). In contrast, records with calf suckling had higher observed milk yield than records without suckling (5.92 vs 5.19 kg/day); the unadjusted Welch test was significant ($P=0.0006$). A mixed-effects model accounting for repeated observations within animal also retained a significant positive association between calf-suckling status and recorded milk yield ($\beta=0.90$ kg/day, $P<0.001$). Milk fat showed a weak negative correlation with milk yield ($r=-0.174$, $P=0.0074$), whereas protein, SNF and lactose were not significantly correlated with yield. These findings provide a useful baseline for Tharparkar performance monitoring; however, the observational nature, unequal repeated records, and absence of detailed information on feed, days in milk, parity management, and suckling intensity limit causal interpretation.

Keywords: Tharparkar cattle; test-day milk yield; milk composition; calf suckling; lactation number; fat; protein; SNF; observational study

Introduction

Tharparkar is an important indigenous dairy cattle breed adapted to the hot and relatively harsh environments of north-western India. Its value in dairy development is associated with adaptability, resilience and useful milk production. Published studies have reported substantial variation in lactation yield and production efficiency depending on herd, management, lactation stage and environmental conditions. For example, ICAR-NDRI reports a wet average of approximately 7.3 kg/day and a herd average of approximately 5.2 kg/day for Tharparkar cattle, with average fat and SNF values of 5.3% and 9.1%, respectively, under its farm conditions. Milk recording at the animal level is important for identifying superior animals, monitoring feeding and management responses, and supporting genetic improvement programmes. Milk composition is equally important because changes in fat, protein, lactose and SNF influence the nutritional and economic value of milk. The present dataset provides repeated field/farm observations on Tharparkar cattle and therefore offers an opportunity to quantify test-day performance and explore associations with lactation number and calf-suckling status. The specific objectives were: (i) to describe test-day milk yield in Tharparkar cattle; (ii) to quantify major milk components; (iii) to compare milk yield across lactation numbers; (iv) to examine the association between calf-suckling status and recorded milk yield; and (v) to assess simple relationships between milk yield and milk composition.

Materials and Methods

Data source and study population

The analysis used the supplied Excel dataset containing 1383 component-level rows. All animals were identified as Tharparkar cattle.

The original data covered 07 March 2025 to 21 July 2026. After collapsing repeated component rows, each unique Animal ID × Record Date combination was treated as one test-day observation, yielding 237 observations from 91 animals. Data recording was undertaken under the Enhance Genetics Project by BAIF in Jodhpur district of Rajasthan State.

Variables

The primary outcome was total milk yield (kg/day), calculated in the source data from morning, afternoon and evening entries. Milk-quality variables included fat (%), protein (%), solids-not-fat (SNF, %), lactose (%), and added water (%). Lactation number was classified as 1st, 2nd, 3rd or 4th lactation. Calf-suckling status was recorded as Yes or No.

Statistical analysis

Descriptive statistics included number of observations, number of animals, mean, standard deviation and range. One-way analysis of variance (ANOVA) was used to compare test-day milk yield among lactation numbers. Welch's independent-samples t-test was used for the unadjusted comparison of records with and without calf suckling. Because multiple observations were available for some animals, a linear mixed-effects model was additionally fitted with AnimalID as a random intercept and lactation number and calf-suckling status as fixed effects. Pearson correlation coefficients were calculated between total milk yield and individual milk components. Statistical significance was assessed at $P < 0.05$.

The analysis is observational. Therefore, statistically significant associations should not be interpreted as evidence that calf suckling caused an increase in milk yield. Important potential confounders such as days in milk, feed intake, season, parity-specific management, body condition and suckling frequency were not available in the supplied dataset.

Results

Table 1: Dataset characteristics

Parameter	Value
Breed	Tharparkar
Unique animals	91
Animal-date observations	237
Original component-level rows	1383
Recording period	07-03-2025 to 21-07-2026
Lactation classes	1st–4th
Calf suckling: Yes	94
Calf suckling: No	143

Table 2: Overall milk yield and composition

Trait	N	Mean	SD	Minimum	Maximum
Total milk (kg/day)	237	5.48	1.63	2.06	11.61
Fat (%)	235	4.10	0.97	2.20	6.68
Protein (%)	237	3.27	0.26	2.14	4.00
SNF (%)	235	8.80	0.65	5.82	10.09
Lactose (%)	232	4.88	0.35	3.53	5.80
Added water (%)	211	0.76	2.69	0.00	16.00

Table 3: Milk yield by lactation number

Lactation	Records	Animals	Milk (kg/day)	Fat %	Protein %	SNF %	Lactose %
1	42	21	5.61 ± 1.85	3.93	3.20	8.64	4.83
2	65	29	5.23 ± 1.53	4.11	3.26	8.79	4.87
3	58	27	5.38 ± 1.54	3.96	3.29	8.91	4.89
4	72	30	5.70 ± 1.65	4.30	3.31	8.82	4.89

Mean test-day milk yield ranged from 5.23 kg/day in the 2nd/rd lactation group to 5.70 kg/day in the 4th lactation group. However, the overall lactation-number effect was not statistically significant ($F=1.12$, $P=0.343$).

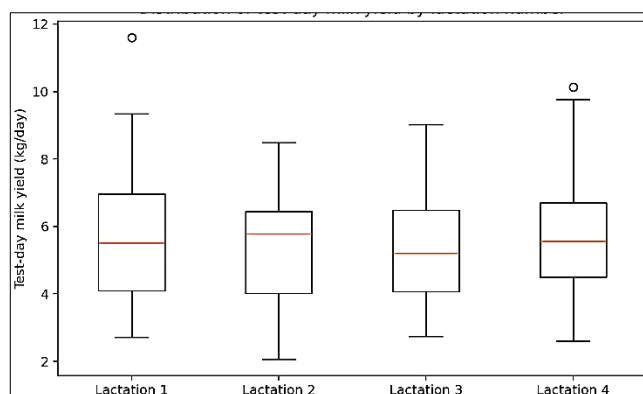


Fig 1: Distribution of test-day milk yield by lactation number

Table 4: Association of calf suckling with milk yield

Suckling	Records	Animals	Milk (kg/day)	Fat %	Protein %	SNF %	Lactose %
No	143	78	5.19 ± 1.64	4.34	3.30	8.89	4.92
Yes	94	68	5.92 ± 1.52	3.74	3.23	8.66	4.81

Observed milk yield was higher in records with calf suckling than in records without suckling (5.92 vs 5.19 kg/day; difference 0.72 kg/day). The unadjusted Welch t-test indicated a significant difference ($t=3.47$, $df=209.3$, $P=0.0006$). In the animal-level mixed model, the estimated association remained positive ($\beta=0.90$ kg/day, 95% CI 0.53 to 1.27, $P<0.001$).

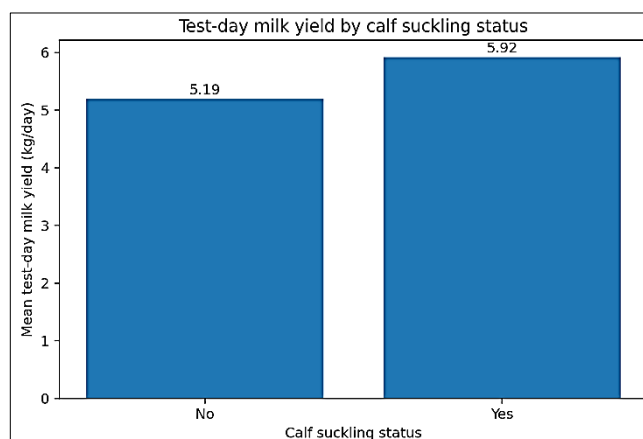


Fig 2: Mean test-day milk yield according to calf-suckling status.

Table 5: Relationship between milk yield and milk components

Component	N	Pearson r	P-value
Fat (%)	235	-0.174	0.0074
Protein (%)	237	-0.078	0.2321
Solids Non-Fat (SNF) (%)	235	-0.024	0.7169
Lactose (%)	232	-0.000	0.9984
Added Water (%)	211	0.024	0.7343

Milk fat showed a weak but statistically significant negative association with total milk yield. Protein, SNF, lactose and added water did not show statistically significant linear relationships with total milk yield in this dataset.

Discussion

The overall test-day milk yield observed in the present dataset (5.48 kg/day) is broadly comparable with the herd-average performance reported for Tharparkar cattle at ICAR-NDRI, although direct comparison should be made cautiously because the present dataset contains test-day observations rather than complete lactation yields and may represent different management conditions. Published ICAR work has demonstrated that Tharparkar cattle can maintain useful production under varied environmental conditions, supporting their importance in sustainable dairy systems. The mean fat (4.10%) and SNF (8.80%) values in the present data were within the range reported in published Tharparkar studies, although the observed fat percentage was lower than the 5.3% reported for the ICAR-NDRI herd. Differences can arise from lactation stage, nutrition, season, milking practice, herd management and analytical procedures.

The absence of a significant overall lactation-number effect on test-day yield should not be interpreted as evidence that lactation number has no biological importance. The dataset includes only one to seven observations per animal and does not provide a complete lactation curve. A larger longitudinal dataset with days-in-milk information would be better suited to estimating lactation-specific trajectories and mature-equivalent production.

The positive association between calf-suckling status and recorded milk yield differs from several controlled cow-calf studies in which suckling systems reduced saleable or machine-recorded milk and could alter milk fat. Such differences are plausible because the present field variable is simply a Yes/No status and does not describe suckling frequency, duration, timing relative to milking, or whether the recorded milk represents saleable milk, machine/milking yield, or a combined management measure. Consequently, the current finding should be treated as an empirical association that warrants targeted follow-up rather than a causal effect. The weak negative correlation between milk yield and fat is biologically plausible because dilution effects can occur as milk volume increases. Nevertheless, the correlation is small, indicating that most variation in milk yield was not explained by fat percentage alone. Protein, SNF and lactose were comparatively stable with respect to yield in the available observations.

Conclusion

The analysis of 237 animal-date observations from 91 Tharparkar cattle demonstrates an overall test-day milk yield of 5.48 ± 1.63 kg/day, with mean milk fat, protein, SNF and lactose of 4.10%, 3.27%, 8.80% and 4.88%,

respectively. Lactation number was not significantly associated with test-day milk yield in the available records. Calf-suckling status was positively associated with recorded milk yield even after accounting for repeated observations within animal, but this result requires cautious interpretation because the dataset lacks information on suckling intensity and other important management and biological covariates. For future research, the recording system should capture animal-wise days in milk, parity, calving date, body condition score, feed and fodder intake, season, milking method, suckling frequency/duration, and health events. A larger longitudinal dataset analysed using mixed-effects or random-regression models would allow more robust estimation of lactation curves and management effects.

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