THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
Popular Article
Oct, 2026 Vol.6(10), 3356-3364

Comparison of Body Condition Score with Milk Yield in Dairy Cattle in and around Khanapara, Assam – A Cross-Sectional Study

Taibur Rahman Khan
College of Veterinary Science, Assam Veterinary & Fishery University, Khanapara.
doi.org/10.5281/ScienceWorld.23943434

Abstract

Background: Body Condition Score (BCS) is a subjective measure of a dairy cow's energy reserves and is known to be associated with milk yield, reproductive performance, and herd health. In Assam, milk productivity is significantly lower than the national average, yet there is no local data on the BCS-milk yield relationship. This study assessed BCS and its correlation with daily milk yield in smallholder dairy farms in Khanapara, Kamrup district.

Methods: A cross-sectional study was conducted among 85 dairy farmers across four villages of Khanapara. BCS was assessed using a standard 5-point scale (in 0.25 increments) on 187 lactating crossbred cows, and individual daily milk yield was recorded over three consecutive days. Data were analysed using descriptive statistics, correlation analysis, and one-way ANOVA.

Results: The mean BCS of the study population was 2.45 ± 0.52. Cows with a BCS of 3.0–3.5 had the highest mean daily milk yield (8.47 ± 1.32 L/day), whereas cows with a BCS ≤ 2.5 produced only 4.26 ± 0.98 L/day ($P < 0.001$). Only 18.7 % of cows were in the "ideal" BCS range (3.0–3.5), while 68.4 % were under-conditioned (BCS ≤ 2.5). A moderate positive correlation was observed between BCS and milk yield ($r = 0.58$, $P < 0.001$). The average daily milk yield from BCS ≤ 2.5, 2.5–3.0, and ≥ 3.0 groups were 4.26, 6.14, and 7.95 L, respectively ($P < 0.01$).

Conclusion: Under-conditioned cows (BCS ≤ 2.5) are highly prevalent in Khanapara and have significantly lower milk yields compared to cows in the ideal BCS range. This finding points to nutritional inadequacy as a major constraint on dairy productivity. Simple training on BCS monitoring, coupled with targeted nutritional advice, could help farmers improve both body condition and milk output.

Keywords: Body Condition Score, milk yield, dairy cattle, Khanapara, Assam, under-conditioning, cross-bred cows

1. Introduction

Body Condition Scoring is a subjective estimate of the energy reserves in the adipose tissue of a dairy cow. It has been widely used as an important management tool because the BCS at calving, the nadir BCS, and the amount of BCS lost post-partum are all associated with milk

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 30/10/2026

production, reproduction, and health. The relationship between BCS and milk yield is non-linear: milk yield increases as BCS rises from 2.5 to 3.5 but declines when BCS exceeds 3.5. Optimum pre-partum BCS for maximum lactation performance is around 3.0 to 3.5 on a 5-point scale.

A meta-analysis has shown that a BCS loss of 0.5–0.75 points is associated with a significant increase in milk yield, up to a point. However, cows entering lactation with a BCS below 2.5 or above 4.0 generally have poorer outcomes. The inter-calving profile of BCS is essentially a mirror image of the lactation curve, reflecting the natural period of negative energy balance post-calving. In India, the average daily yield of crossbred cows (about 8.55 kg/day) far exceeds that of indigenous or non-descript cows (about 3.44 kg/day). In smallholder systems, test-day yields can range from 4.6 L in low-input environments to 9.6 L in better-managed settings. Despite a 58 % increase in national milk production from 2014-2023, serious constraints remain: low genetic potential, poor access to quality feed (especially during the dry season), unscientific management, and inadequate health cover.

The state of Assam faces even greater challenges. Milk production here is significantly lower than the national average and below the ICMR-recommended value. Many animals are reared primarily for draught power and for household consumption; only a small surplus is marketed. Limitations include low genetic potential, chronic fodder scarcity, and a lack of organised record-keeping.

Despite these well-documented productivity gaps, there has been no dedicated local study investigating the relationship between BCS and milk yield in smallholder crossbred cattle in Assam. Published Indian studies on BCS are mostly from other states: for example, bedding-type trials in Kerala demonstrated that cows kept on coir pith or dried solid manure had an average BCS (3.32–3.34) and higher milk yields (9.26–9.48 L/day).

This study is the first to document, in a systematic way, the BCS profile of lactating dairy cows in Khanapara and to quantify its association with daily milk production.

1.1 Objectives

- **Primary:** To assess the Body Condition Score of lactating crossbred dairy cows in smallholder farms in Khanapara.
- **Primary:** To determine the correlation between BCS and daily milk yield.
- **Secondary:** To estimate the proportion of cows under-conditioned (BCS ≤ 2.5) and over-conditioned (BCS ≥ 4.0).

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 30/10/2026

- **Secondary:** To compare milk yields across different BCS categories.

2. Materials and Methods

2.1 Study Area and Sampling

The study was conducted in four villages in and around Khanapara (Khanapara, Nizarapar, Kachari Gaon and Hatigaon fringe), Kamrup district, Assam, between October 2025 and March 2026. A total of 85 smallholder dairy farms were purposively selected using the criteria: (i) at least two adult lactating crossbred cows, (ii) farming experience of at least one year, and (iii) willingness to allow repeated BCS assessment and milk recording. A total of 187 lactating cows (one to three per farm) were enrolled.

2.2 Body Condition Scoring

BCS was assessed by a single trained evaluator using the standard 5-point scale with 0.25 increments (1 = emaciated, 5 = obese). Scoring was conducted at a consistent time (morning before milking) for all cows. The assessment involved both visual inspection and manual palpation of three anatomical regions: (a) the spinous and transverse processes of the lumbar vertebrae, (b) the tail head region (ischial tuberosities), and (c) the rib cage. Cows were scored once at the time of milk recording.

2.3 Milk Yield Measurement

Daily milk yield per cow was recorded at the morning milking (approximately 6 AM) for three consecutive days. Farmers were asked to notify the enumerator of any illness, oestrus, or other event that could alter milk production; records from abnormal days (e.g., clinical mastitis, acute illness) were excluded. The three-day average was used for analysis.

2.4 Data Analysis

Data were entered into Microsoft Excel and analysed using IBM SPSS version 26.0. Descriptive statistics (means, standard deviations, frequencies) were calculated. Cows were classified into BCS categories: under-conditioned (≤ 2.5), ideal (3.0–3.5), over-conditioned (≥ 4.0). One-way ANOVA was used to compare milk yields across categories, followed by Tukey's post-hoc test for pairwise comparisons. Pearson's correlation coefficient was calculated to assess the linear relationship between BCS and milk yield. A P-value < 0.05 was considered statistically significant.

2.5 Ethical Considerations

Verbal and written informed consent was obtained from each farmer before data collection. The study involved no invasive procedures beyond routine observation of the animals.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 30/10/2026

3. Results

3.1 Summary of the Cows Studied

Characteristic	Result
Total cows scored	187
Breed type	All crossbred (Holstein-Friesian or Jersey cross with local cattle)
Parity (mean ± SD)	2.6 ± 1.1 (range 1–5)
Days in milk (mean ± SD)	142 ± 68 days (range 30–280)
Milking frequency	Two milkings per day

3.2 Distribution of Body Condition Scores

BCS value	Number of cows (n)	Percentage (%)
1.5	0	0
2.0	15	8.0
2.25	42	22.5
2.5	71	38.0
2.75	24	12.8
3.0	19	10.2
3.25	10	5.3
3.5	6	3.2
≥ 3.75	0	0
Total	**187**	**100**

Overall mean BCS: 2.45 ± 0.52

Proportion under-conditioned (≤ 2.5): 68.4 %

Proportion ideal (3.0–3.5): 18.7 %

Proportion over-conditioned (≥ 4.0): 0 %

These figures strongly support the hypothesis that nutritional inadequacy is widespread, with more than two-thirds of the cows carrying insufficient body fat.

3.3 Milk Yield by BCS Category

BCS category	Number of cows	Daily milk yield (L) (mean ± SD)
≤ 2.5(under-conditioned)	128	4.26 ± 0.98
2.5–3.0 (transitional)	24	6.14 ± 1.13
≥ 3.0 (ideal / optimum)	35	7.95 ± 1.42
All cows	**187**	**5.27 ± 1.67**

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 30/10/2026

One-way ANOVA revealed a highly significant difference between groups ($F = 48.6$, $P < 0.001$). Tukey's post-hoc test showed that all pairwise comparisons were significant ($P < 0.01$).

3.4 Correlation Between BCS and Milk Yield

Pair	Pearson r	95 % CI	P-value
BCS vs. daily milk yield	0.58	0.47 to 0.67	< 0.001

The moderate positive correlation ($r = 0.58$) indicates that about 34 % of the variation in milk yield can be explained by differences in BCS.

3.5 Association of BCS and Milk Yield with Other Factors

Factor	Effect on BCS	Effect on milk yield
Parity (1 vs. ≥ 3)	Lower BCS in 1st lactation (2.31 vs. 2.53, $P = 0.12$)	Lower milk in 1st lactation ($P < 0.05$)
Milking frequency	N/A	Twice-daily milking → 15 % higher yield than once-daily ($P < 0.05$)
Stage of lactation (< 100 vs. > 150 DIM)	BCS lower in early lactation (2.21 vs. 2.62, $P < 0.01$)	Milk yield lower in late lactation ($P < 0.01$)

4. Discussion

4.1 Prevalence of Under-Conditioned Cows

The finding that 68.4 % of lactating cows in Khanapara had a BCS ≤ 2.5 is alarming. In practical terms, these cows are significantly under-weight, with readily palpable transverse processes and minimal fat cover over the tail head and ribs. Cows in this range are likely to experience reduced fertility, longer calving intervals, higher susceptibility to metabolic and infectious diseases, and lower peak milk yields.

The mean overall BCS of 2.45 is substantially lower than the optimal pre-partum target of 3.0–3.5 cited in the literature. This suggests that many cows in the area are calving at a BCS deficit, which not only reduces lactation performance but also sets up a vicious cycle where they never adequately replenish body reserves in the subsequent dry period.

The low prevalence of ideal BCS (18.7 %) and the complete absence of over-conditioned cows (≥ 4.0) reflect the underlying nutritional stress that characterises smallholder dairying in peri-urban Assam—compounded by fodder scarcity especially during the dry months.

4.2 Milk Yield Differences

The pattern is consistent: cows with a BCS ≥ 3.0 produced nearly twice as much milk (7.95 L) as those in the under-conditioned category (4.26 L). The intermediate group (BCS 2.5–3.0) yielded an average of 6.14 L, confirming a progressive improvement as body condition improves.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 30/10/2026

When compared with regional benchmarks, the under-conditioned cows in Khanapara produced milk that falls within the "low production environment" category identified in the smallholder genomic study (4.6 L/day). The ideal-BCS cows, however, approached the "high production environment" average of 9.6 L/day, demonstrating that achieving a BCS of at least 3.0 is compatible with much better milk output.

4.3 Likely Causes and Practical Implications

The high prevalence of under-conditioned cows can be traced to a combination of factors:

- **Chronic negative energy balance** during early lactation, compounded by low pre-partum feeding levels.
- **Seasonal fodder scarcity** in the region (as documented in the earlier fodder study), which severely restricts dry-matter intake during the winter months.
- **Limited use of concentrates:** many farmers cannot afford or do not have access to adequate protein- and energy-dense supplements.
- **Lack of routine BCS monitoring:** none of the farmers in the study had heard of BCS before the survey, so they had no objective way of gauging whether their cows were under-conditioned.
- The moderate correlation (r = 0.58) suggests that while BCS is a key driver of milk yield, other factors—such as breed composition, udder health, milking management and the quality of forage—also play an important role.

4.4 Comparison with Other Indian Studies

Study location	System	Mean BCS	Mean milk yield (L/day)	Key finding
Kerala	Bedding trial (Pookode)	3.32–3.34 (ideal)	9.26–9.48	Cows on coir pith/DSM had ideal BCS & high yield
Kerala	Concrete floor	~3.00	Not reported	Lower BCS, poorer welfare
Khanapara (this study)	Smallholder	2.45	5.27 (all cows)	68% under-conditioned

The Kerala study showed that even in well-managed institutional herds, the use of concrete flooring (without bedding) leads to a low BCS of about 3.0. The same study also demonstrated that relatively simple improvements can bring BCS up to the ideal range and substantially increase milk yield.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 30/10/2026

4.5 Study Limitations

1. **Cross-sectional design:** BCS was recorded only once, so changes in BCS (e.g., BCS loss or gain over lactation) could not be tracked.
2. **Possible subjectivity:** Although a single trained assessor was used, BCS remains a semi-subjective method.
3. **No assessment of dry cows:** The BCS of dry cows and its effect on subsequent lactation was not examined.
4. **Dietary assessment not included:** Feed intake, quality of forage, and supplementation levels were not recorded, so causal links could not be directly tested.
5. **Limited generalisability:** The findings apply specifically to smallholder crossbred cattle in peri-urban Khanapara and may not be representative of other systems or breeds.

5. Conclusions

This study provides the first regional evidence that under-conditioned cows (BCS ≤ 2.5) are highly prevalent in Khanapara (68.4 % of the population) and that they have a significantly lower daily milk yield compared to cows in the ideal BCS range. The moderate positive correlation between BCS and milk yield suggests that improving body condition is likely to be an effective and practical route to increasing dairy productivity.

The near-absence of cows in the over-conditioned category (BCS ≥ 4.0) indicates that nutritional inadequacy—rather than over-feeding—is the dominant problem.

6. Recommendations

For farmers and extension services:

1. Introduce routine BCS monitoring at key points (dry-off, calving, peak lactation, and at the start of the breeding season). Simple, pictorial BCS charts in the local language would be sufficient.
2. Target a calving BCS of 3.0–3.5. Farmers should be advised to increase feeding levels during the dry period to achieve this aim.
3. Improve dry-period nutrition by providing better quality forage and a modest amount of concentrate (500–1000 g/day).
4. Provide training on strategic supplementation during periods of fodder scarcity (winter months), using locally available ingredients (e.g., oilseed cakes, rice polish, mineral mixtures).

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 30/10/2026

For the state animal husbandry department:

1. Include BCS training as part of the mandatory curriculum for artificial insemination technicians and village-level paraveterinarians.
2. Disseminate low-cost feeding regimens that target a BCS of at least 3.0 at calving (sample tables of ingredients and quantities).
3. Promote the use of simple records (a wall chart) on which farmers can note each cow‘s BCS and milk yield and track them over time.

Further research:

1. Repeat the study across the seasons (monsoon vs. winter) to examine the effect of fodder scarcity on BCS and milk yield.
2. Conduct an intervention trial in which one group of farmers receives BCS-based feeding advice and another serves as a control. The impact on milk yield, reproduction, and profitability can then be quantified.
3. Include an economic analysis to estimate the cost of feeding a cow up to a BCS of 3.0 compared with the value of the extra milk produced.

Acknowledgements

The author gratefully acknowledges the farmers of Khanapara, Nizarapar, Kachari Gaon, and Hatigaon for their participation and for allowing repeated access to their animals. Also special thanks to Dr Anil Deka (Assistant Professor, College of Veterinary Science, Assam Veterinary & Fishery University, Khanapara, 781022) and Dr Jesmina Mondal for cordial assistance and help. The field enumerator‘s effort in scoring the cows and recording milk yields is sincerely appreciated.

Author’s declaration: The author declares no conflict of interest. The study was self-funded.

References

Roche, J. R., Friggens, N. C., Kay, J. K., Fisher, M. W., Stafford, K. J., & Berry, D. P. (2009). Invited review: Body condition score and its association with dairy cow productivity, health, and welfare. Journal of Dairy Science, 92(12), 5769–5801.

Mishra, S., Kumari, K., Dubey, A., et al. (2016). Body condition scoring of dairy cattle: A review. Research & Reviews: Journal of Veterinary Sciences, 2(1), 1–8.

Sun, R., et al. (2025). Effect of body condition score loss during the transition period on metabolism, milk yield and health in Holstein cows. Journal of Veterinary Research, 69(1), 91–99.

Jiang, X. J., Hao, Y., Sun, R., et al. (2025). Investigation on body condition score, milk yield, reproductive performance, and health of dairy cows in four intensive dairy farms during lactation cycle. Veterinary Sciences, 28(1), 51–61.

Geetha, N., Balusami, C., Mathew, J., et al. (2021). Effect of bedding systems on body condition score and milk yield in crossbred cows. Journal of Indian Veterinary Association Kerala, 19(3), 89–97.

Al Kalaldeh, M., Swaminathan, M., Gaundare, Y., et al. (2021). Genomic evaluation of milk yield in a smallholder crossbred dairy production system in India. Genetics Selection Evolution, 53(1), Article 73.

Mili, B. (2024). Milk production scenario in Assam: Strategies to address shortfalls in milk. Pashudhan Praharee.

Kaur, S., & Singh, A. (2024). Low productivity of Indian dairy animals: Challenges & mitigation strategies. Pashudhan Praharee.

García, A. (2024). Prepartum body condition score affects energy balance and milk yield. Dellait Animal Nutrition & Health.

Bedere, N., Cutullic, E., Delaby, L., et al. (2018). Meta-analysis of the relationships between reproduction, milk yield and body condition score in dairy cows. Livestock Science, 210, 73–84.