

International Journal of Agriculture Extension and Social Development

Volume 9; Issue 9; September 2026; Page No. 15-20

Received: 14-06-2026
Accepted: 18-07-2026

Indexed Journal
Peer Reviewed Journal

Gender differentials in time-use patterns among dairy farming households in Tamil Nadu

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DOI: <https://www.doi.org/10.33545/26180723.2026.v9.i9a.4164>

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Abstract

The study was undertaken to analyse gender differentials in time-use patterns among dairy farming households across Madurai, Salem, Thiruvallur and Vellore districts of Tamil Nadu. A total of 360 adult respondents, comprising 146 women and 214 men, were interviewed using a structured 24-hour time-use schedule. Ten primary activity categories were recorded, with simultaneous activities captured separately. Gender differences were examined using Welch's independent-samples *t*-test and Cohen's *d*, while two-way analysis of variance was used to examine whether the gender differential in dairy-work time varied across districts. A paired sub-sample of 123 households was analysed to estimate the female, male and joint shares of household dairy-work time. Women spent substantially more time than men on dairy, household and care work, whereas men spent more time on agricultural, income/market-related activities, leisure and sleep/rest. The gender difference in dairy-work time was highly significant and remained consistent across the four districts. Women accounted for a mean share of 80.00 per cent of household dairy-work time, compared with 13.7 per cent contributed by men and 6.30 per cent performed jointly. The findings demonstrate a pronounced gendered allocation of time and highlight the need for extension interventions that reduce dairy drudgery, recognise women's contribution and promote more equitable sharing of unpaid household and care responsibilities.

Keywords: Time-use, gender, dairy farming, rural women, work burden, simultaneous activities, dairy work, Tamil Nadu

Introduction

Dairy farming is an important component of rural livelihoods in India, providing households with regular income, employment and nutritional security. Although women are extensively involved in livestock and dairy-related activities, much of their contribution remains inadequately reflected in conventional measures of work. This is partly because conventional labour statistics tend to emphasise economically recognised or market-oriented activities, while a substantial proportion of unpaid household, livestock and care work remains less visible. Time-use assessment provides a broader framework for capturing such contributions by documenting how individuals allocate their daily hours across productive, domestic and care-related activities (Hirway & Jose, 2011; National Statistical Office, 2020) [3, 9]. Within dairy farming, the distribution of responsibilities is often strongly gendered. Women are closely involved in routine activities such as animal care, fodder-related work,

milking and milk handling, whereas men are more frequently associated with activities linked to marketing, ownership and economic decision-making (Vijayamba and Swaminathan, 2024; Vijayalakshmy *et al.*, 2023) [16, 15]. Thus, the substantial involvement of women in the day-to-day functioning of dairy enterprises does not necessarily correspond with similar control over income or major production decisions. The physical nature of several dairy operations and the continued dependence on labour-intensive practices can further increase the time and effort required from women at the household level (Kumar *et al.*, 2026) [6]. Evidence from field studies also indicates that women dairy farmers continue to experience considerable work demands despite the presence of cooperative and institutional support systems (Lepcha *et al.*, 2023) [8].

An additional dimension of workload of women arises from the simultaneous performance of multiple activities in farm and home. In many rural households, dairy chores are

undertaken alongside cooking, childcare, cleaning and other domestic responsibilities rather than as a separate, uninterrupted activity. Such overlapping tasks can be difficult to capture through conventional single-activity approaches to time measurement, making explicit recording of simultaneous activities important for understanding the actual nature of daily work profile of women (Field *et al.*, 2023). Greater involvement in unpaid domestic and care responsibilities may consequently be associated with less time available for leisure, rest and personal activities, contributing to patterns of time constraints and time poverty reported among women engaged in agriculture (Khed and Krishna, 2023; Vemireddy and Pingali, 2021)^[5, 14].

Although gender inequalities in rural time allocation have been documented in the broader agricultural context, there is comparatively limited district-level evidence focusing specifically on dairy farming households and examining productive, domestic and care activities together. In particular, there is a need for evidence that simultaneously considers gender differences in dairy-work time, the broader allocation of daily time, concurrent performance of activities and the relative contribution of women and men to household dairy work. Such information is important for agricultural extension, because technologies and interventions intended to improve dairy productivity may not adequately address gender differences in workload unless they are informed by actual distribution within farm households.

Against this background, the present study examined gender differentials in time-use patterns among dairy farming households in selected districts of Tamil Nadu. The study specifically aimed to compare the daily allocation of time between women and men across major activity categories, assess whether the gender differential in dairy-work time was consistent across districts, and estimate the respective female, male and joint shares of household dairy-work time among paired households. The findings are expected to provide an empirical basis for developing gender-responsive extension interventions that can reduce dairy-related drudgery, recognise women's contribution to livestock production and promote a more balanced distribution of unpaid household responsibilities.

2. Methodology

2.1 Research design

The study followed a cross-sectional survey research design, wherein data on gendered time-use patterns among dairy farming households were collected from the selected respondents during a single study period using a structured interview schedule. The design facilitated comparison of daily time allocation between women and men and examination of gender differentials in dairy-work time across the selected districts.

2.2 Study area and sampling

The study was conducted in four districts of Tamil Nadu, namely Madurai, Salem, Thiruvallur and Vellore, which were purposively selected based on the relevance of dairy farming for the study. From each selected district, three blocks were covered, and two villages were selected from each block, resulting in a total of 24 sampled villages. Fifteen adult respondents were selected from each sampled village, giving an overall sample of 360 respondents. The sample comprised

146 women and 214 men from dairy farming households. At the household level, the 360 respondents represented 123 households where both husband and wife were interviewed, 91 households represented by male respondents only, and 23 women-only respondent households. The 123 paired households provided the basis for the within-household analysis of the gendered contribution to dairy-work time.

2.3 Data collection and time-use measurement

Data were collected using a structured 24-hour time-use schedule. The schedule was developed in consultation with subject-matter specialists and pre-tested among respondents outside the final sample to ensure clarity and suitability for field administration. The respondents were asked to recall and report their activities chronologically.

Time spent on ten primary activity categories was recorded, namely works related to dairy farming, agricultural activities, household chores, family care, income and market-related activities, institutional and community work, work-related travel, personal care, leisure and social activities, and sleep/rest. The primary activity categories were mutually exclusive and together accounted for the complete 24-hour time budget of the respondents. When two or more activities were performed concurrently, the secondary activity was recorded separately as simultaneous activity time and was not added again to the primary 24-hour time budget.

Within the overall sample, a paired sub-sample of 123 households in which both an adult male and an adult female respondent had dairy-work related time records was used to estimate the gendered distribution and contribution to household dairy-work time. For each paired household, the proportion of total recorded dairy-work time contributed by the male and female respondents, individually and jointly for the performed activities were calculated separately.

2.4 Statistical analysis

Data were summarised using arithmetic means and standard deviations and expressed primarily as hours per day. Gender differences in mean daily time allocated to each activity category were examined using Welch's independent-samples t-test, without assuming equal population variances. Cohen's *d* effect size was calculated to quantify the magnitude of gender differences.

The consistency of the gender differential in daily dairy-work time across the four districts under study was examined using a two-way analysis of variance (ANOVA) with gender, district and their interaction as sources of variation. A probability level of $p < 0.05$ was used to determine statistical significance throughout the analysis. All statistical analyses were performed using R statistical software, Version 4.5.1.

3. Results

3.1 Gender differentials in Daily Time Allocation

The study comprised 360 adult respondents, of whom 146 (40.6%) were women and 214 (59.4%) were men. As presented in Table 1, each of the four selected districts contributed an equal number of respondents ($n = 90$), while the gender composition varied across districts. The proportion of women ranged from 28.9 per cent in Vellore to 46.7 per cent in Thiruvallur, while the corresponding proportion of men ranged from 53.3 to 71.1 per cent. Vellore showed the greatest gender imbalance, with 71.1 per cent

men and 28.9 per cent women.

Table 1: Distribution of sample respondents by gender and district (n=360)

District	Women		Men		Total
	Frequency	Percentage	Frequency	Percentage	
Madurai	37	41.1	53	58.9	90
Salem	41	45.6	49	54.4	90
Thiruvallur	42	46.7	48	53.3	90
Vellore	26	28.9	64	71.1	90
Total	146	40.6	214	59.4	360

Table 2 presents the gender-wise distribution of daily time across the ten primary activity categories, together with the corresponding significance tests and effect sizes. Marked gender differences were evident across the different components of daily time allocation. Women devoted substantially more time than men to dairy work, household work and care work, whereas men spent more time on agricultural work, income and market-related activities, work-related travel, leisure and social activities, and sleep/rest. The largest differences were observed for household work, leisure and social activities, dairy work and care work. (Figure 1)

Women spent an average of 4 h 48 min per day on dairy work, compared with 1 h 04 min among men, resulting in a mean difference of 3 h 44 min ($p < 0.001$; Cohen's $d = 3.37$). Household work showed the largest gender gap, with women spending 7 h 10 min per day, compared with only 5 min among men, resulting in a mean difference of 7 h 05 min ($p < 0.001$; $d = 7.47$). Similarly, women spent 2 h 21 min per day on care work, compared with 4 min among men, with a mean difference of 2 h 17 min ($p < 0.001$; $d = 4.35$).

In contrast, men devoted more time to agricultural and income/market-related activities. Men spent 5 h 42 min per day on agricultural work, compared with 2 h 20 min among women, giving a mean difference of 3 h 22 min in favour of men ($p < 0.001$; $d = 1.29$ in magnitude). Time devoted to income and market-related activities was also higher among men (2 h 06 min) than women (52 min), with a mean difference of 1 h 14 min ($p < 0.001$; $d = 0.46$ in magnitude). Men also spent more time on work-related travel and personal care, whereas women reported slightly more time in institutional and community activities.

A pronounced gender difference was observed in discretionary time. Men reported 5 h 43 min per day on leisure and social activities, compared with 34 min among women, representing a mean difference of 5 h 09 min ($p < 0.001$; $d = 5.42$ in magnitude). Men also reported 6 h 06 min of sleep/rest, compared with 3 h 48 min among women, a difference of 2 h 18 min ($p < 0.001$; $d = 2.17$ in magnitude). When the seven work-related categories were considered together, women recorded 18 h 18 min of total work-related activity time per day, compared with 10 h 16 min among men. The resulting difference of 8 h 02 min was highly significant ($t = 56.761$, $df = 354.17$, $p < 0.001$; $d = 5.79$). Women also reported substantially greater simultaneous activity time, averaging 3 h 14 min per day, compared with 14 min among men ($t = 32.707$, $df = 167.22$, $p < 0.001$; $d = 4.09$), indicating a markedly greater involvement in concurrent activities.

Overall, the findings demonstrate a strongly gendered allocation of daily time, with women's time concentrated more heavily in dairy, domestic and care responsibilities, while men's time was more strongly associated with agricultural, market-oriented and discretionary activities.

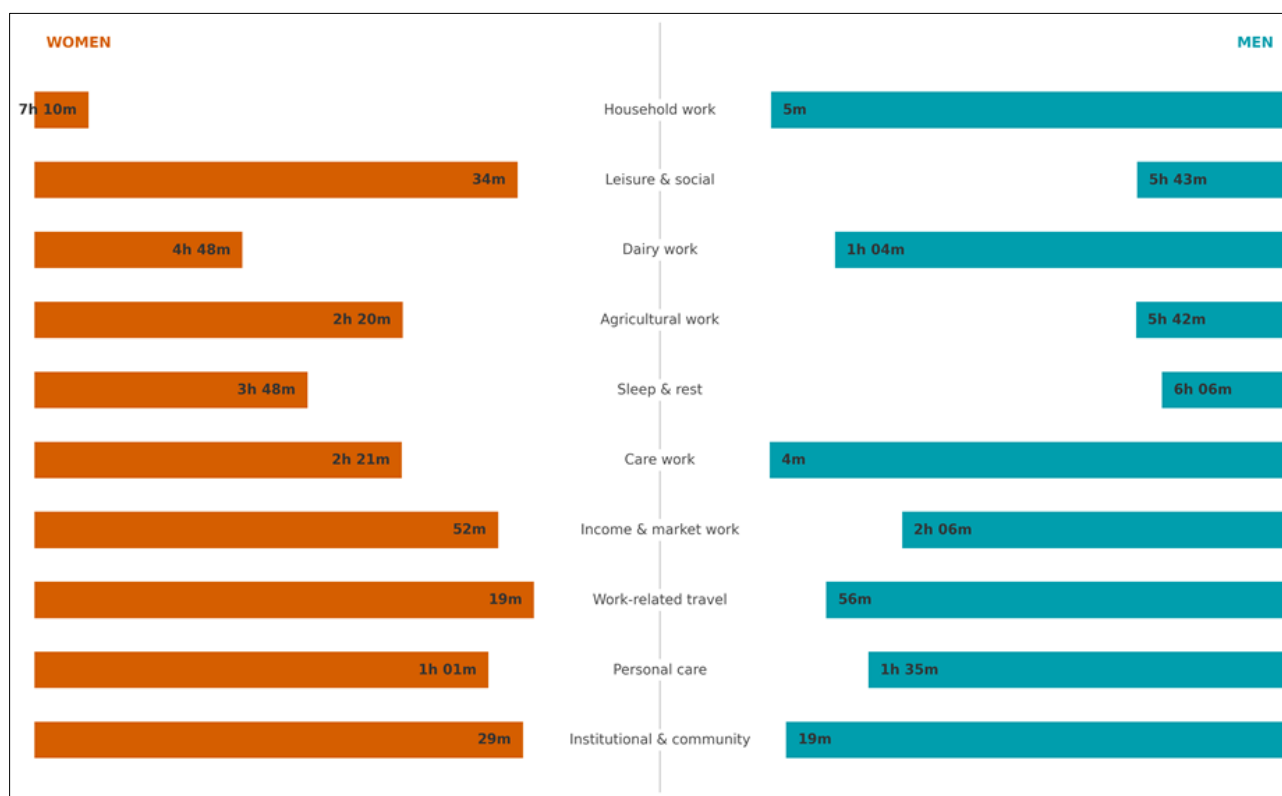


Fig 1: Gender-wise daily time allocation by activity (hours and minutes per day)

Table 2: Gender-wise mean daily time use (h/day) and test of significance

Category	Women (M±SD)	Men (M±SD)	Diff (W-M)	t	df	p	d
Dairy work	4 h 48 m ± 1.10	1 h 04 m ± 1.11	+ 3 h 44 m	31.473	313.63	<0.001	3.37
Agricultural work	2 h 20 m ± 1.22	5 h 42 m ± 3.22	-3 h 22 m	-13.912	292.36	<0.001	-1.29
Household work	7 h 10 m ± 1.46	5 m ± 0.22	+ 7 h 05 m	57.943	149.33	<0.001	7.47
Care work	2 h 21 m ± 0.79	4 m ± 0.20	+2 h 17 m	34.273	157.56	<0.001	4.35
Income/market work	52 m ± 1.25	2 h 06 m ± 3.30	-1 h 14 m	-4.982	293.36	<0.001	-0.46
Institutional/community work	29 m ± 0.55	19 m ± 0.35	+10 m	3.196	222.57	0.002	0.37
Work-related travel	19 m ± 0.41	56 m ± 0.49	-38 m	-13.200	344.29	<0.001	-1.37
Personal care	1 h 01 m ± 0.61	1 h 35 m ± 0.79	-34 m	-7.699	352.83	<0.001	-0.79
Leisure/social activities	34 m ± 0.44	5 h 43 m ± 1.18	-5 h 09 m	-58.259	291.67	<0.001	-5.42
Sleep/rest	3 h 48 m ± 0.96	6 h 06 m ± 1.12	-2 h 18 m	-20.807	339.52	<0.001	-2.17
Total work-related time	18 h 18 m ± 1.15	10 h 16 m ± 1.53	+8 h 02 m	56.761	354.17	<0.001	5.79
Simultaneous activity time	3 h 14 m ± 1.07	14 m ± 0.36	+3 h 01 m	32.707	167.22	<0.001	4.09

Note: Values are presented as mean ± standard deviation (SD). Mean time is expressed in hours and minutes, whereas SD is expressed in decimal hours. Welch's independent-samples *t*-test was used; positive differences indicate higher time allocation among women, while negative differences indicate higher time allocation among men. *d* = Cohen's *d*

3.2 District-wise consistency of the dairy-work differential

Women spent substantially more time on dairy work than men across all four sampled districts (Table 3). The mean dairy-work time among women ranged from 4.70 to 4.91 h/day, compared with 0.92 to 1.23 h/day among men. The highest mean among women was recorded in Madurai (4.91 h/day), while the lowest was observed in Salem (4.70 h/day). Among men, dairy-work time was highest in Madurai (1.23

h/day) and lowest in Thiruvallur (0.92 h/day).

The two-way analysis of variance revealed a highly significant effect of gender on dairy-work time, $F(1,352) = 979.74$, $p < 0.001$. In contrast, the main effect of district was not significant, $F(3,352) = 0.91$, $p = 0.436$. The gender × district interaction was also non-significant, $F(3,352) = 0.23$, $p = 0.875$, indicating that the observed gender differential in dairy-work time remained broadly consistent across all the four districts i.e., Madurai, Salem, Thiruvallur and Vellore.

Table 3: District-wise mean daily dairy-work hours by gender

District	Women (h/day)	Men (h/day)	Ratio (W:M)
Madurai	4.91	1.23	4.0
Salem	4.70	0.95	5.0
Thiruvallur	4.82	0.92	5.2
Vellore	4.77	1.12	4.3

Two-way ANOVA on daily dairy-work hours: Gender, $F(1,352) = 979.74$, $p < 0.001$; District, $F(3,352) = 0.91$, $p = 0.436$; Gender × District, $F(3,352) = 0.23$, $p = 0.875$.

The district-wise distribution of time-use categories further reinforced the consistency of the observed gendered pattern (Table 4). Across all four districts, women consistently devoted more time to dairy, household and care activities, while men allocated more time to agricultural and income/market-related activities. Men also recorded substantially greater leisure and sleep/rest time, whereas women reported considerably higher simultaneous activity

time in every district. Although some differences in the magnitude of individual categories were observed across locations, the overall direction of the gender differences remained similar. This suggests that the gendered allocation of dairy, domestic and care responsibilities was not restricted to a particular district but represented a broadly shared pattern across the sampled dairy-farming households.

Table 4: District-wise gender-wise pattern for selected time-use categories

S. No.	Time-use category	Madurai		Salem		Thiruvallur		Vellore	
		Women (n=37)	Men (n=53)	Women (n=41)	Men (n=49)	Women (n=42)	Men (n=48)	Women (n=26)	Men (n=64)
1.	Dairy work	4.91	1.23	4.70	0.95	4.82	0.92	4.77	1.12
2.	Agricultural work	2.51	5.75	1.93	5.87	2.60	4.57	2.25	6.37
3.	Household work	7.18	0.04	7.24	0.08	7.12	0.12	7.12	0.13
4.	Care work	2.34	0.05	2.48	0.04	2.27	0.12	2.31	0.05
5.	Income/market work	0.89	1.79	0.94	2.10	0.76	3.45	0.89	1.35
6.	Institutional/ community work	0.42	0.22	0.56	0.29	0.52	0.34	0.37	0.40
7.	Work-related travel	0.27	0.87	0.28	0.91	0.33	1.10	0.39	0.90
8.	Personal care	0.97	1.53	1.04	1.56	0.98	1.37	1.10	1.81
9.	Leisure/social activities	0.55	6.07	0.57	5.66	0.49	5.60	0.71	5.57
	Total work-related activity	18.51	9.93	18.12	10.23	18.43	10.61	18.08	10.32
	Simultaneous activity time	3.14	0.25	3.23	0.31	3.44	0.20	3.06	0.16

Note: Values represent mean hours per day. *n* indicates the number of respondents in each district × gender group. Total work-related activity time comprises dairy, agricultural, household, care, income/market, institutional/community and work-related travel activities

3.3 Gendered contribution to household dairy work

Among the paired sub-sample of 123 households, women accounted for a mean share of 80.00 per cent of total household dairy-work time, compared with 13.70 per cent contributed by men and 6.30 per cent performed jointly (Table 5). The mean total household dairy-work time was 6 h 16 min per day, comprising 4 h 48 min contributed by women, 1 h 00 min by men and 28 min through jointly performed activities. The household-level share of women ranged from 40.95 to 100.00 per cent, with a median of 83.93 per cent, indicating that women were the predominant contributors to recorded dairy-work time in the paired households.

Table 5: Gendered contribution to household dairy work among paired households

Contributor	Mean time (h/day)	Share of dairy time (%)
Men	1 h 00 min	13.70
Women	4 h 48 min	80.00
Joint	28 min	6.30
Total household dairy time	6 h 16 min	100.00

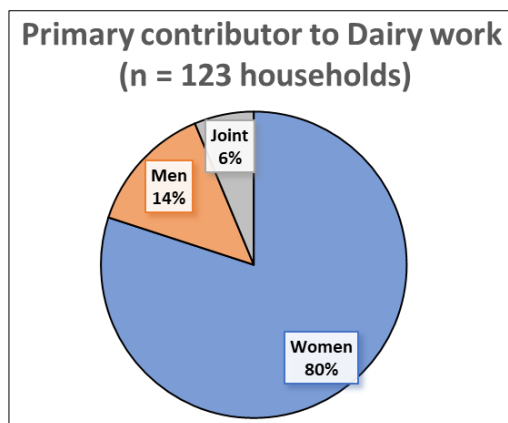


Fig 2: Contribution to total household dairy-work time by women, men and jointly performed activities (n = 123 households)

4. Discussion

The findings demonstrated a pronounced gendered allocation of daily time among dairy farming households. Women devoted substantially more time to dairy, household and care activities, whereas men allocated more time to agricultural and income/market-related activities. This pattern is consistent with broader evidence showing that rural women undertake a large share of unpaid domestic and care work alongside agricultural and livestock activities (Hirway & Jose, 2011; National Statistical Office, 2020) [3, 9]. Field observations shown that women were predominantly responsible for routine dairy operations such as milking, feeding and watering animals, shed cleaning, fodder-related work and milk handling, while men were more commonly involved in animal purchase, veterinary care, fodder transportation and marketing. Thus, women's dairy participation occurred alongside substantial domestic responsibilities, whereas men's dairy involvement was more often associated with activities involving mobility or direct economic functions.

The high household and care workload among women may be partly explained by the prevailing gender division of

household responsibilities. Field interactions indicated that household maintenance and caregiving were generally viewed as women's responsibilities, with limited sharing of these tasks by men. Women often combined dairy work with cooking, childcare, cleaning and care of older household members. Field observations indicated that workdays of women commonly began around 3:30–4:00 a.m. and continued until about 11:00–11:30 p.m., with evening milking, milk delivery, cooking and household cleaning extending into the night. Some women also undertook agricultural labour, MGNREGA work and village-based activities such as papad making, tailoring, wire-bag making and embroidery. This continuous sequence of responsibilities provides a plausible explanation for women's substantially lower leisure and sleep/rest time. Similar associations between unequal work allocation and restricted discretionary time among women farmers have been reported elsewhere (Khed & Krishna, 2023; Vemireddy & Pingali, 2021) [5, 14]. The substantially higher simultaneous activity time among women provides another dimension of their workload. Field interactions suggested that women frequently combined dairy responsibilities with domestic and caregiving tasks. For example, household activities and childcare could occur alongside dairy work, while agricultural work near grazing areas could be accompanied by collection of grass for cattle. Such overlapping responsibilities may not be adequately represented when daily schedules are interpreted only through primary activities. The present finding therefore supports explicit recording of simultaneous activities in time-use assessment, as highlighted by Field *et al.* (2023) [2].

Women spent substantially more time on dairy work than men in all four districts, and the non-significant gender × district interaction indicated that this differential was consistent across all the sampled locations. The regular and time-bound nature of routine dairy operations such as milking, feeding, watering and shed cleaning may partly explain this consistency. Among the paired households, women accounted for a mean share of 80.00 per cent of total recorded household dairy-work time, compared with 13.70 per cent contributed by men and 6.30 per cent performed jointly. Field observations were consistent with this result, as women were predominantly responsible for routine dairy operations, whereas men more commonly undertook animal purchase, veterinary care, fodder transport and marketing activities. This pattern is broadly consistent with evidence that women remain central to routine livestock activities while men tend to have greater involvement in market-oriented functions and decision-making (Vijayalakshmy *et al.*, 2023; Vijayamba & Swaminathan, 2024) [15, 16].

The field observations also identified fodder cutting, dung removal, milking, carrying water and shed cleaning as particularly tiring or time-consuming activities. Because these tasks were predominantly performed by women, the burden associated with them may contribute to their higher dairy-work time. This highlights the need for gender-responsive extension approaches that combine drudgery-reducing technologies, labour-saving dairy practices and ergonomically appropriate equipment with greater attention to the sharing of household and care responsibilities. In addition, the accessibility of milk collection centres appeared to influence gender roles in milk marketing: women commonly transported milk when collection points were

nearby, whereas men were more likely to undertake the task when greater travel was involved. Extension interventions should therefore consider not only productivity enhancement but also the time, physical effort and mobility requirements associated with dairy activities (Lepcha *et al.*, 2023; Singh *et al.*, 2011)^[8, 11].

Overall, the findings indicate that women's contribution to dairying is embedded within a broader and continuous pattern of productive, domestic and caregiving responsibilities. Gender-responsive dairy extension should therefore consider not only who performs a dairy operation, but also when it is performed, what other responsibilities occur simultaneously, how physically demanding the task is, and whether the activity can be made less time- and labour-intensive. Such an approach can make dairy development interventions more feasible, inclusive and responsive to the realities of rural dairy households.

5. Conclusion

The study demonstrated a pronounced gendered allocation of daily time among dairy farming households across the four sampled districts of Tamil Nadu. Women devoted substantially more time to dairy, household and care activities, whereas men allocated more time to agricultural and income/market-related activities and had greater time for leisure and sleep/rest. The gender differential in dairy-work time was highly significant and remained consistent across the four districts. Among the 123 paired households, women accounted for a mean share of 80.00 per cent of total recorded dairy-work time, compared with 13.70 per cent contributed by men and 6.30 per cent performed jointly. The findings underscore the need for gender-responsive dairy extension that goes beyond productivity enhancement to address women's time and drudgery burden. Animal Husbandry and Veterinary Services and Dairy Cooperatives should strengthen doorstep and women-friendly extension services, promote and demonstrate labour-saving technologies for fodder cutting, milking, water handling and shed cleaning, and improve the accessibility of milk-collection services. Krishi Vigyan Kendras and agricultural extension agencies can integrate gender-responsive dairy technologies with training on efficient labour and fodder management, while Self-Help Groups and local institutions for women can serve as platforms for technology demonstration, peer learning and collective access to services. Panchayats and local dairy institutions can support accessible collection infrastructure and convergence of dairy, livelihood and social-support programmes. A coordinated stakeholder approach involving extension personnel, veterinary services, dairy cooperatives, SHGs, Panchayats and women dairy farmers can help reduce the time and physical burden of routine dairy work while creating greater opportunities for women's rest, wellbeing and meaningful participation in dairy development.

Acknowledgement

The authors are thankful to the dairy households and stakeholders who participated in the study and shared their experiences. The authors also acknowledge the support and guidance received from Institution faculty during the conduct of the study.

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