

Comparative analysis of management practices of calves of dairy animals under organic and non-organic farming system

Saikat Maji¹, B S Meena², Neela Madhav Patnaik³ and Priyajoy Kar⁴

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Abstract: Dairy farming provides livelihood and nutritional security to the vast majority of families throughout rural India. In this livelihood system dairy calves play a very important role as most of the farming families carefully raise the young calves to become efficient producers in terms of milk or as a source of drought power. For organic farmers, the necessity of proper calf management assumes more importance due to restrictions on diet choice and also due to more stress on welfare-based animal rearing. In this context, the present study was undertaken in Uttarakhand, one of the leading states in organic farming, as a part of a larger study on dairy-based organic farming. A number of organic and non-organic farmers compulsorily have either cattle, buffalo, or goats as dairy animals or any combination of these enterprises, selected as per the sampling plan presented in the main text, and were surveyed, Calf management practices were studied from the context of recommended practices of organic farmers. It was found that variation existed between organic and non-organic farmers in plain and hilly regions and also for different species of dairy animals. Keeping the calf separate from the respective mother was the most common practice at least for a few days after birth. Mutilation practices like castration were higher in hilly regions irrespective of the farming system especially for cattle than in buffalo. Disbudding was also practiced by many organic farmers in violation of organic standards. Under miscellaneous management practices, colostrum

feeding after birth was found to be followed by all organic farmers in plain and hilly regions. Also, the paper shed some light on varied probability (increasing or decreasing) of practicing/compliance to various calf management practices if farmers moved from non-organic to organic farming. The calf mortality pattern between organic and non-organic management was not found to be significantly different.

Keywords: Calf mortality; Housing Management; Mutilation practices; Non-organic farmers Odds ratio; Organic farmers

Introduction

Calves play an important role in the development of the dairy sector, as the future of the dairy herd solely depends upon the successful raising of young calves thus transforming them into a future efficient producer. With many constraints in terms of shortage of fodder, lack of high-yielding breeds, inability to give quality feed, *etc.*, affecting the ability of dairy producers, timely management and healthcare like preventive measures, deworming, and timely treatment right from the calf stage is a prerequisite to ensure proper health of animals that promote their productivity despite of various shortfalls (Singh *et al.* 2007; Ahirwar *et al.* 2011; DAHD 2018). Thus, understanding the livestock management practices adopted by the farmers is necessary to identify the strength and weaknesses of the rearing systems and to formulate suitable intervention policies (Gupta *et al.* 2008). Among these management practices calf management practices is one of the most important one to be followed diligently. Poor management practices lead to economic losses to the farmers in terms of higher calf mortality, poor growth rate, delayed maturity, and poor productivity. Further, not feeding colostrum to newborn calves reduces the immunity of calves and makes them susceptible to diseases (Maousami *et al.* 2013; Sabapara *et al.* 2015) which increases the cost of rearing and farmers to face economic loss by calf mortality. Ensuring proper management of calf assumes even more significance under an organic farming regime not only for transforming a calf into a sustainable producer or efficient worker but also for the utmost importance placed on the welfare of animals under organic dairy farming principles. Especially, the scale and intensity of livestock farming have increased significantly over the past few decades.

¹, I.Ag.Sc., Banaras Hindu University, Varanasi (UP), 221005

² Dairy Extension Division, ICAR-NDRI, Karnal, Haryana, 132001

³ ICAR-MGIFRI, Piprakothi, Bihar, 845429

⁴ ICAR-NRC Pig, Garbhanga F.V., Assam, 781015

Saikat Maji (✉)

Email: saikatm@bhu.ac.in

Despite having many positive aspects, this intensive dairy farming has also negatively affected the factors like sustainability including animal welfare (Cardoso et al. 2019; Henschion et al. 2022). On the other hand, consumers are now becoming increasingly sensitive towards aspects like how their food is produced, cruelty towards animals, and psychological well-being (like freedom of grazing, etc.) of farm animals. Thus, the interest in organic crop and livestock farming reemerges in recent times across the world along with India, given the adverse environmental, social, and economic impacts of so-called modern agriculture. But unlike organic crop farming the concept and practice of organic dairy farming is relatively new (Oruganti, 2011). Organic Dairy farming means rearing cattle on organic feed (*i.e.*, feed crops cultivated without the use of fertilizers or pesticides), having access to pasture or outside, along with the restricted usage of antibiotics and hormones. It deliberately avoids the use of synthetic inputs such as drugs, feed additives, and genetically engineered breeding inputs. The welfare of animals is also of prime importance in the organic dairy farming system (Chander et al. 2013; Wolde and Tamir, 2016).

Uttarakhand, which is one of the leading organic states in India, has a predominance of mostly traditional integrated crop-livestock farming (Subrahmanyeswari and Chander, 2008). A vast number of farmers practicing organic farming and the state have a well-developed structure for promoting organic farming as well as for marketing of organic products. With dairy farming acting as one of the most important means of providing livelihood and nutritional security to the vast majority of rural masses (Srivastava, 2011) studying the calf-rearing practices followed by organic farmers was of utmost importance not only to ensure increased productivity but also to ensure the integrity of organic system. The calf-rearing practices followed by non-organic farmers and calf mortality patterns were also studied not only to have a comparative view of calving and calf-rearing practices of organic and non-organic farms but also for gaining knowledge of existing calf management practices prevalent in the study region which in turn will help in better policy intervention for the development of the overall dairy sector of the state.

Research Methodology

Multistage random sampling was followed in the selection of ultimate sampling units. The field survey was conducted across four districts of the Uttarakhand namely; Haridwar, Udham Singh Nagar (as a plain region) and Tehri and Pithoragarh (as a hilly region) selected purposively based on the number of organic farmers and area under organic cultivation (as per data available in Uttarakhand Organic Certification Board (UOCB) Website, 2018). Two blocks from each district, thus, a total of eight blocks were selected randomly for surveying the farmers. Farmers having rice-wheat-dairy animals (Cattle buffalo or goat along with at least a pair of drought animal) as a component of the farming system was selected for final data collection which include both

registered organic farmers (registered with UOCB as per guideline of APEDA) and non-organic farmers. The selection method differed between farm types though the basic criteria for entry into the list of farmers to be surveyed were indifferent. The organic farms had to be certified for at least three years. Non-organic farmers were selected in the vicinity of organic farms to minimize bias in the farming system based on geographic location advantages. The presence of cattle, buffalo or goat, or any combination of them was also the essential criteria for selection for both groups of farmers across two regions (*i.e.*, plain and hilly). The selected farmers were classified based on the type of dairy animal reared. A farmer has multiple types of dairy animals included in multiple categories thus not mutually exclusive in the sample. The sample distribution is presented in Table 1. The interview schedule was developed based on calf-rearing practices recommended under the organic farming regime in national standards with an appropriate mix of local traditional welfare-based practices. Previous studies and expert opinion were considered for the construction of the interview schedule item which was part of a larger study on dairy-based organic farming. Frequency data was further subjected to a chi-square test to find out whether calf-rearing practices were significantly different for cattle, buffalo, and goats between organic and non-organic farmers in the plain and hilly regions of the state separately. Before applying chi-square, the sample data has been adjusted for differential sample size between comparing sample groups.

$$\chi^2 = \sum_i (O_i - E_i)^2 / E_i$$

where,

$\div 2$ = Chi-Square value

O_i = Observed frequency

E_i = Expected frequency

The odds ratio was calculated to find out the probability of compliance with each practice as the farming system changed from non-organic to organic system (organic farmers/non-organic farmers).

$$Probability (p) = \frac{Odds\ ratio}{(1 + Odds\ Ratio)}$$

If the odds ratio is less than one there will be decreasing the chance of following a particular practice as farmers moved from non-organic to organic management and if the odds ratio is more than one probability to follow particular practice increases as farmers moved from non-organic to organic management.

Results and Discussion

Management practices adopted for calves of cattle, buffalo, and goats have been presented in sections *viz.* housing arrangement for calves, mutilation practices, and miscellaneous management practices for caring for newborns which are often applied when animals are in their early ages for large animals especially. Mortality patterns among calves and their reasons were also presented to enquire into the common belief of high calf mortality under the organic system as compared to the non-organic system among the researchers (ICROFS, 2016; Wilhelm et al. 2017)

Housing Arrangement Practices

The majority of organic farmers in plain regions used to keep their newborn cattle and buffalo with their dam separately (53.13 % and 73.81 %, respectively) for some period after birth (Table 2). In the case of non-organic farmers in plain regions, the practice of keeping newborns with their mothers separately was also followed by the majority of farmers (65.51 and 76.47 %, respectively) similar to those with organic farming systems but with a higher number of cases. In the case of hilly regions majority of organic reported keeping their cattle and buffalo calves with the dam separately (59.65 % and 66.67, respectively). But in hilly regions, though the majority of non-organic farmers reported keeping their newborn cattle and buffalo calve with their dam separately (55 and 60 %, respectively) at early stages but the proportion of farmers was lower than those of their organic counterparts. The tendency to keep newborns with a dam was higher in the case of buffalo than cattle in both plain and hilly regions. The higher mortality rate of buffalo calf and less milk production in case of separation of dam and calf in buffalo was reported as the reasons. A comparatively higher number of organic farmers in Hill also reported keeping their calf in a common shed (21.05 % and 22.22 % of cattle and buffalo farmers, respectively) but not immediately after birth. The lack of space for separate arrangements in hilly patches was the main reason for this. Some comparatively wealthy farmers in plain and hilly regions also had the facility to keep newborns in separate pens but often inside the same shed in the case of hilly regions. The number of non-organic farmers with the facility of separate pens was comparatively higher in both plain and hilly regions than their organic counterparts in respective regions. In the case of goats also the majority of organic farmers in plain and hilly areas (75 and 77.78 %, respectively) keep their newborns with other calves. In the hilly region, 22.22 percent of organic farmers and 16.67 percent of non-organic farmers reported to keep the goat kids in the common animal shed which was not found to be practiced by

any organic farmers in plain regions. Possession of a higher number of goats compared to large animals and the birth of often up to 4 kids at one delivery in the case of goats was the natural reason to place goat kids with other kids.

The chi-square analysis as presented in Table 3 did not find any significant difference in any of the housing management practices between organic and non-organic farmers in both plain and hill ecosystems except in the case of keeping calves in a common shed between organic and non-organic farmers in plain region. None of the non-organic farmers reported keeping their cattle in the common shed as compared to 6.25 percent of organic farmers in this case. For keeping the newborn calf separately with the dam which is the recommended practice for an organic system it was found that as farmers moved from non-organic to organic management the probability to keep the calf separately with the dam decreased by 37.34 percent and 45.86 percent, respectively for cattle and buffalo in the plain region. Contrary to this in the case of the hilly region as farmers moved from non-organic to organic management the probability to keep the calf separately with the dam increased by 54.73 percent and 42.86 percent, respectively for cattle and buffalo rearers.

Mutilation Practices

The proliferation of modern dairy farming for exclusively business purposes has resulted in the use of animal husbandry practices that are painful, like castration and debudding, removing calves from their dams, etc. which interfere with ‘the natural behavior of animals (Regan et al. 2022). Such mutilation practices are largely prohibited under the organic regime except for medical necessity. But despite of that some of the practices were found to be applied to dairy animals, especially at the calf stage by organic farmers as well as non-organic farmers in the same region (Table 2). Castration of male calves was done by 53.12 percent of cattle owners and 33.33 percent of buffalo rearers, having an organic farming system especially when the calves were intended to be used as drought animals in the future. Cases of castration of male calves were found to be higher in the case of cattle as well as buffalo in plain regions (53.12 % and 33.33 %, respectively) under the management of organic farmers than their non-organic counterparts. Less dependence as well as no compulsion for non-organic farmers to use animal drought power may be the reason non-organic farmers are less prone to have the male calf for future use as a bullock. Whereas, in hilly regions, the percentage of farmers who followed castration was almost similar between organic and non-organic farmers (57.89 % and 58.33 %

Table 1: Sample distribution under the study

Sl. No.	Type of farming system	No of selected farmers based on the type of animal reared by them*					
		Cattle rearer		Buffalo rearer		Goat rearer	
		Plain	Hill	Plain	Hill	Plain	Hill
1.	Organic system	32	57	42	9	4	9
2.	Non-organic system	29	60	34	15	0	12

*Not mutually exclusive

for cattle, 22.22 % and 20.00 % for buffalo under organic and non-organic systems, respectively). The castration of male calves was higher in hilly regions and especially higher for male calf of cattle where bullocks are the main source of drought power often irrespective of the farming system. A higher rate of castration was reported by Subrahmanyeswari and Chander, 2008 where 69.44 percent of organic farmers in Uttarakhand hills were found to be applying castration to their draft animals. Castration of male goats at an early age is done by all organic farmers in plain and 44.44 percent of organic farmers in the hilly region for getting better physical growth to be sold as slaughtered animals in the future. Docking or cropping was not common in this region and was neither reported by any organic as well as non-organic farmers in both plain and hilly regions. Among the organic farmers, 71.87 percent of cattle rearers in the plain region and 19.29 percent in the hilly region subjected their cattle to dehorning/disbudding practices which are often used for both male and female animals and containing the aggressiveness was reported as the main reason. 25.00 percent of organic farmers in plain and 33.33 percent in hilly regions reported disbudding of their goat calf.

The chi-square analysis as presented in Table 3 indicates a significant difference in castration and dehorning/disbudding practices between organic and non-organic farmers in the plain region. As farmers moved from non-organic to organic farming systems the probability to use castration and dehorning/disbudding increased by 81.25 and 88.92 percent. It is against the regulation and spirit of organic farming and thus needs to be controlled if the government decided to promote specialized organic dairy farming in the state in the line of organic farming. Contrary to this, in the hilly region there was a significant difference in the use of dehorning/disbudding practice in cattle but the probability to use dehorning/disbudding decreased by 20.38 percent as farmers moved from non-organic to organic farming system which is welcoming sign. The use of castration and dehorning/disbudding practices in the case of small dairy animals (goats) was also significantly different between organic and non-organic farmers in the hilly regions where, as farmers moved from non-organic to organic system the probability of subjecting goats to castration and dehorning/disbudding practices decreased by 6.80 percent and 4.30 percent, respectively. For buffalo, there were no significant differences between organic and non-organic farmers in the use of these mutilation practices in both plain and hilly regions.

Miscellaneous Management Practices

In the case of other important management practices ranging from cleaning of calf immediately after birth to the vaccination of the calf have been documented in Table 4. It was found that in the case of cattle all farmers in plain region (both organic and non-organic farmers) practice cleaning of calf immediately after birth with old clothes and asses or husk to keep it worm. It was

also followed by the vast majority of both organic and non-organic farmers in the plain region for buffalo (92.85 % and 82.35 %, respectively) and goat (75.00 %). Whereas, in Hill, a relatively lower number of organic farmers deliberately clean newborn calves (57.89, 33.33, and 22 %, respectively for cattle, buffalo, and goat) leaving the calf to be cleaned by licking of their concerned mother. In the case of non-organic farmers in the hilly region also the cleaning of a newborn using cloths or ash was practiced by a smaller number of farmers (55.00 %, 26.67 %, and 25.00 % of cattle, buffalo, and goat owners, respectively) compared to plain farmers and also their organic counterparts in the same region. The result was in agreement with the findings of Meena et al. 2008; who reported only 29 percent of cases in the Kumaon hills of Uttarakhand where such cleaning is done. But, Tiwari et al. 2018, found the complete opposite result of this when they reported only 8.00 percent of farmers used to clean their calves using old rags immediately after birth in the Tarai region (plain) of Uttarakhand.

Cutting the naval cord and applying of any type of disinfectant was practiced by only 34.37 percent of organic farmers in plain regions for cattle and half of the organic farmers for buffalo. Whereas, proper cutting and disinfection of naval cord using iodine solution or other antibiotic solution was followed by 65.61 percent cases for cattle and 88.23 percent cases for buffalo by non-organic farmers in plain regions which was higher than their organic counterparts in the same region. But these differences are somewhat attributed to better socio-economic conditions of non-organic farmers who got selected in the sample. Similarly, Cutting the naval cord and applying any type of disinfectant was lower in the case of organic farmers in the hilly region (29.82 % and 33.33 % for cattle and buffalo, respectively) than their non-organic counterparts in the hill (41.67 % and 46.67 % for cattle and buffalo, respectively). From an overall sense, the use of cutting and disinfection of naval cords was lower in the case of hill farmers than the farmers in plain regions. Such practice in the case of goats was not common either in plain or hilly areas of the state.

Colostrum feeding immediately after birth was universal for all farmers in both regions for all species of dairy animals. But continuing feeding of colostrum in sufficient quantity (up to 4 days after birth) was not followed by all farmers in hilly regions for all species. 87.77 percent of organic farmers and 68.33 percent of non-organic farmers in Hill continue to feed colostrum to cattle up to four days after birth. Meena et al. 2007 reported that 89.00 percent of hill farmers used to continuously feed colostrum for up to 7 days whereas others ceased to do so after the first day. In the case of goats, 25.00 percent of organic farmers in plain and 66.67 percent of non-organic farmers in hill keep feeding the newborn goat with colostrum up to four days after birth.

Weaning is not common in India under the traditional mixed crop-dairy farming system. In the study area, weaning was not practiced

Table 2: Housing arrangement and Mutilation practices for calves of various dairy animals followed by farmers across regions and farming systems {n= number of farmers having a particular type of dairy animal}

Sl. No	Management Practices	Cattle				Buffalo				Goat			
		Plain		Hill		Plain		Hill		Plain		Hill	
		Org n=32	Non-Org n=29	Org n=57	Non-Org n=60	Org n=42	Non-Org n=34	Org n=9	Non-Org n=15	Org n=4	Non-Org n=0	Org n=9	Non-Org n=12
Housing Arrangement Practices													
1.	Separate pen	9.37	13.80	5.27	10.00	4.77	5.88	0.00	6.67	0.00	-	0.00	0.00
2.	With other calves	31.25	20.69	14.03	18.33	11.90	11.77	11.11	20.00	75.00	-	77.78	83.33
3.	With the dam separately	53.13	65.51	59.65	55.00	73.81	76.47	66.67	60.00	25.00	-	0.00	0.00
4.	In common shed	6.25	0.00	21.05	16.67	9.52	5.88	22.22	13.33	0.00	-	22.22	16.67
Mutilation practices													
1.	Castration	53.12	20.68	57.89	58.33	33.33	17.70	22.22	20.00	100	-	44.44	91.67
2.	Docking	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00
3.	Cropping	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00
4.	Dehorning/Disbudding	71.87	24.13	19.29	48.33	0.00	0.00	0.00	0.00	25.00	-	33.33	91.67

Table 3: Significance of differences in Housing arrangement pattern and Mutilation practices for calves and probability of compliance across regions and farming systems

Practices	Org. Plain vs. Non-org. Plain		Org. Hill vs Non-org. Hill		p (%)	Odds Ratio	p (%)
	χ^2	Effect Size (Phi)	χ^2	Effect Size (Phi)			
Separate pen	.292	-.069	.924	-.089	37.89	.609	33.33
With other calves	.877	.120	.397	-.058	63.58	1.746	42.09
With the dam separately	.966	-.126	.258	.047	37.34	.596	54.73
In common shed	53.50*	-.936	.368	.056	-	-	57.13
Castration	6.814**	.334	.002	-.004	81.25	4.334	49.54
Dehorning/Disbudding	13.87**	.477	10.95**	-.306	88.92	8.032	20.38
						Buffalo	
Separate pen	.047	-.025	.626	-.162	44.44	0.8	-
With other calves	.000	.002	.320	-.115	50.24	1.01	33.33
With the dam separately	.071	-.031	.107	.067	45.86	.867	42.86
In common shed	.343	.067	.320	.115	62.74	1.684	64.99
Castration	2.384	.177	.017	.026	69.70	2.333	53.34
						Goat	
With other calves	-	-	-.103	.070	-	-	41.17
In common shed	-	-	.103	.070	-	-	58.83
Castration	-	-	5.619*	-.517	-	-	6.80
Dehorning/Disbudding	-	-	7.875**	-.612	-	-	4.30

(-) On at least one case, the value of the weight variable was zero, negative, missing or not computed due lack of comparison
 (*) Significant at 1 % level, (**) Significant at 5 % level, (#) Significant at 10 % level (p) Probability

Table 4: Miscellaneous management practices in case of calves of various dairy animals followed by farmers across regions and farming systems {n= number of farmers having particular type of dairy animal}

Sl. No.	Practices	Cattle			Buffalo			Goat					
		Plain		Hill	Plain		Hill	Plain		Hill			
		Org n=32	Non- Org n=29	Org n= 57 Non- Org n= 60	Org n= 42 Non- Org n= 34	Org n= 9 Non- Org n= 15	Org n= 4 Non- Org n= 0	Org n= 9 Non- Org n= 12					
1.	Cleaning of new born	100	100	57.89	55.00	92.85	82.35	33.33	26.67	75.00	-	22.22	25.00
2.	Cutting and disinfection of naval cord	34.37	65.51	29.82	41.67	50.00	88.23	33.33	46.67	0.00	-	0.00	0.00
3.	Colostrum feeding (Within 1 hr of birth)	100	100	100	100	100	100	100	100	100	-	100	100
4.	Colostrum feeding (Up to 4 days)	100	100	87.77	68.33	100	100	100	100	25.00	-	100	66.67
5.	Weaning	21.87	48.27	10.52	18.33	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00
6.	De-worming	75.00	72.41	43.85	28.33	83.33	88.23	22.22	40.00	0.00	-	0.00	8.33
7.	Vaccination	84.33	93.10	40.35	26.67	73.80	73.52	11.11	40.00	0.00	-	0.00	0.00

Table 5: Significance of difference in miscellaneous management practices for calves and probability of compliance across regions and farming systems

Practices	χ^2	Org_Plain vs. Non-org_Plain			p (%)	χ^2	Org_Hill vs Non-org_Hill		
		Effect Size (Phi)	Odds Ratio	Odds Ratio			Effect Size (Phi)	Odds Ratio	p (%)
Cleaning of new born	-	-	-	-	.100	.029	1.125	1.125	52.94
Cutting and disinfection of naval cord	5.903*	.311	.276	21.63	3.825 [#]	.187	.459	.459	31.45
Colostrums feeding (up to 4 days)	-	-	-	-	6.356*	.233	3.310	3.310	76.79
Weaning	4.697*	.277	.300	23.07	1.435	.111	.524	.524	34.38
De-worming	.053	.029	1.143	53.33	3.062 [#]	.162	1.976	1.976	66.39
Vaccination	1.141	.137	.400	28.57	2.463	.145	1.860	1.860	65.03
Cleaning of new born	1.986	.162	2.786	73.58	.121	.071	1.375	1.375	57.89
Cutting and disinfection of naval cord	12.444*	.405	.133	11.73	.411	.131	.571	.571	36.34
De-worming	.365	.069	.667	40.01	.800	.183	.429	.429	30.02
Vaccination	.001	.003	1.015	50.37	2.272	.308	.188	.188	15.82
Cleaning of new born	-	-	-	-	.022	.032	.857	.857	46.15
Colostrums feeding (up to 4 days)	-	-	-	-	3.706 [#]	.420	1.50	1.50	60.00
De-worming	-	-	-	-	.787	.194	1.09	1.09	52.15

(-) On at least one case, the value of the weight variable was zero, negative, missing or not computed due lack of comparison

(*) Significant at 1 % level, (**) Significant at 5 % level, (#) Significant at 10 % level (p) Probability

Table 6: Mortality pattern of calves in case of various dairy animals across regions and farming systems {n= number of farmers having particular type of dairy animal}

Sl. No.	Practices	Cattle						Buffalo						Goat					
		Plain			Hill			Plain			Hill			Plain			Hill		
		Org n=32	Non- Org n=29	n=57	Org n=60	Non- Org n=42	n=34	Org n=9	Non- Org n=15	n=4	Org n=4	Non- Org n=0	Org n=9	Non- Org n=9	n=12				
Experienced Calf Death in last 10 Years																			
1.	Diseases	43.75	27.59	56.14	58.33	45.23	55.89	66.67	73.33	50.00	-	77.78	75.00	75.00					
2.	Accidents	57.15	37.50	59.37	48.57	36.85	31.57	50.00	45.45	100	-	57.15	55.55	55.55					
3.	Snake bites	0.00	0.00	12.50	5.71	10.52	0.00	0.00	0.00	0.00	-	14.28	11.11	11.11					
4.	Wild animal injury	14.28	12.50	9.37	5.71	15.78	10.52	0.00	0.00	0.00	-	0.00	11.11	11.11					
5.	Abortion and Breeding time complications	0.00	0.00	0.00	2.87	0.00	5.27	0.00	0.00	0.00	-	28.57	22.23	22.23					
		28.57	50.00	18.75	37.14	36.84	52.63	50.00	54.55	0.00	-	0.00	0.00	0.00					

for buffalo and goats across farming systems and regions. But, the practice of weaning is reported to be used by a few farmers in the plain region for cattle calves. Despite being organic farmers 21.87 percent of cattle owners in plain and 10.52 percent in hilly regions reported weaning of calves which are prohibited under the organic doctrine. The practice of weaning was comparatively higher under non-organic management in the respective region. Subrahmanyeswari and Chander, 2008 reported a sufficiently high number of organic farmers used to feed their newborn calves with colostrum (86.00 %) but not by cent percent farmers found this research but the percentage of organic farmers who practiced weaning was almost similar (18.80 % in hilly regions).

De-worming through tablets was practiced by a vast number of organic farmers in the plain region (75.00 % and 83.33 % of cattle and buffalo owners). The trend was found to be almost similar in the case of their non-organic counterparts in plain regions in terms of the percentage of farmers. Deworming was not common in the case of goats across the regions and farming systems. Tiwari et al. 2018, reported deworming practices used by 75 percent of farmers in the Tarai region of Uttarakhand for large dairy animals. A similar trend of deworming practice was also reported by Pawar et al. 2006; Prajapati et al. 2015.

Vaccination, mostly for Foot and Mouth Disease (FMD) and Hemorrhagic Septicemia (HS) was continually done by 84.32 percent of cattle and 73.80 percent of buffalo owners in plain regions having organic systems. Vaccination was higher in the case of non-organic counterparts in plain regions for cattle (93.10 %). Vaccination was comparatively lower in hilly regions. When compared across farming systems in hilly regions, vaccination was done by a higher percentage of organic farmers in the case of cattle (40.35 %). The lack of access to animal health facilities fueled by difficult terrain and lack of awareness was the main reason behind the lower use of different animal health instruments by farmers in hilly regions. Also, less production potential of animals used mainly for home consumption often subconsciously de-motivate some farmers to use these preventive health measures as felt by the researcher during interaction in the process of data collection. But the percentage of farmers who use vaccination was found to be increased from the level reported by Subrahmanyeswari and Chander, 2008, where they found only 7.22 percent of hill organic farmers using vaccination in their dairy calves.

Differences in the use of some of the miscellaneous management practices (as presented in Table 5) *i.e.*, for “Cutting and disinfection of naval cord” and “Weaning” was found to be significant in the plain region for cattle, as farmers moved from non-organic to organic farming there will be 21.63 percent and 23.07 percent of less probability to use above two management practices, respectively. Whereas, in hilly regions, organic and non-organic farmers were significantly different in the case of

the use of Colostrum feeding (up to 4 days after birth) along with “Cutting and disinfection of naval cord” and “Deworming”. Also, as farmers moved from non-organic to organic systems there will be 31.45 percent less probability to use cutting and disinfection of naval cord after birth. But in contrary to plain region there will be 76.79 percent and 66.39 percent increased probability to use Colostrum feeding (up to 4 days after birth) and Deworming, respectively as farmers moved from non-organic to an organic system of farming in hilly regions. Thus, it represents a more suitable ecosystem to adopt organic dairy farming in cattle in hilly regions. The use of different management practices in the miscellaneous category was not significantly different between organic and non-organic farmers for buffalo across regions except for the use of cutting and disinfection of naval cords in plain regions. The value of the odds ratio indicates as farmers moved to the organic system there will be an 11.73 percent less probability to use the practice for buffalo rearing. In the case of the goat significant difference in rearing practices was only found in the case of colostrum feeding (up to four days after birth) between organic and non-organic farmers in hilly regions with a 60 percent increase in probability to comply as farmers move to organic farming.

Mortality Pattern among Dairy Calves

The incidence of calf mortality was experienced by all farmers across the region and farming system in the last 10 years from the time of data collection (Table 6). For cattle buffalo and goat calf mortality was experienced by 43.75, 45.23, and 50 per cent of organic farmers in the plain region. For the non-organic counterpart calf mortality was reported by 27.59 and 55.89 per cent of farmers in the plain region for cattle and buffalo, respectively. In the hilly region, calf mortality was reported by 56.14, 66.67, and 77.78 percent of organic farmers for cattle, buffalo, and goat, respectively, and by 58.33, 73.33 and 75.00 per cent of non-organic farmers for cattle buffalo and goat, respectively. Calf mortality was comparatively lower in the case of the plain region than in the hilly region for all species of dairy animals and particularly higher for buffalo and goats in the hilly region. The trend is not surprising as calf mortality in India was mainly attributed to diseases like diarrhea, pneumonia, and septicemia, the primary cause of which is unhygienic shed conditions. Other faulty managerial practices like delayed and inadequate first colostrum feeding, not deworming of the pregnant dam, parasitic infestations (both internal and external), and meteorological factors of harsh weather conditions. (Yadav et al. 2019; Patbandha et al. 2023). The incidence of these faulty practices is more in hilly regions as discussed in the previous section too including harsher weather which led to higher calf mortality.

When comparing between organic and non-organic farmers in each region and animal species separately no significant difference in distribution was found through chi-square statistics. Available research data indicates no conclusive evidence about higher or

lower mortality rates under organic systems. Studies by Alvasen et al. 2012; Van Wagenberg et al. 2017 reported lower mortality in organically managed herds. Whereas, Kijlstra and Eijck, 2006; Akerfeldt et al. 2020 reported a higher mortality rate among newborns especially before weaning. Table 6 also indicates higher calf mortality due to disease factors in the case of organic farmers in the plain region and due to abortion or breeding-related factors in the case of non-organic farmers in the same region for both cattle and buffalo. But in the case of the hilly region, the dominant factor was diseases in the case of cattle and goats under both organic and non-organic systems whereas abortion or breeding-related factors in the case of buffalo. In organic animal production systems, the animals are particularly at risk due to outdoor rearing and the ban on prophylactic medication (Hermansen, 2003; Maji et al. 2017). Mortality due to wild animal injury was found to be the second dominant factor behind calf mortality for small animals (goats) in hilly regions for both organic and non-organic farming systems. But the significance of these unique observations in terms of the distribution of mortality across mortality factors could not be established when compared between organic and non-organic counterparts in respective regions for each animal species separately.

Thus, the practice followed by organic and non-organic farmers varied between regions as well as different species of dairy animals. Variations existed in mortality patterns also some of which could be attributed to health-related practices retrospectively. For some practices, organic farmers' approaches were found to be more in line with the doctrine of animal welfare leaving rest parameters where practices followed by non-organic farmers were more geared towards animal welfare often unknowingly. But, an increase in the probability of following some recommended practices as extracted from odds ratio calculation as farmers moved towards an organic system is of quite importance for the future proliferation of organic dairy farming in the state or similar conditions in other states.

Conclusions

From the result presented in the above section, it may be concluded that some of the practices followed by organic and non-organic farmers varied not only between plain and hilly regions but also among cattle, buffalo, and goats. But this variation could not be solely attributed to the type of farming system they followed but to the geographic location and socio-economic status of the farmers. Though for some parameters organic farmers' approaches to calf management were found to be more in line with the doctrine of animal welfare, but sanction violation in terms of commonly used practices was also noticed. Thus, promoting organic dairy farming among organic farmers and also among non-organic farmers required intensive awareness and knowledge creation campaigns supported by mass media to make the farmers aware about do and don'ts of organic farming. Only after these primary stimuli, further material

support could be initiated to convert the farmers into successful organic dairy farmers throughout the state.

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