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Adoption of Sustainable Dairy Management Practices among Peri-urban Dairy Farmers in Odisha

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ABSTRACT

The research was based on a survey done in 2019 across Odisha's eastern and southern coastal plain zones to assess sustainability among dairy farms based on various scientific management practices adopted by the farmers. The sustainability index was constructed using primary data acquired through a random sampling approach from 120 dairy households. The results reveal that 61 per cent of the farms belonged to the low sustainable category. The study area's peri-urban dairy farms had inadequate shelter management, feeding, and animal health practices, as seen by their mean sustainable scores. Space constraints, dung disposal, lack of expertise in planned systematic breeding, paucity of green fodder, lack of refrigerated storage, and timely vaccination were all issues that farmers in the study area faced. These problems can be solved by organizing various capacity building training programmes, creating awareness about the benefits of following various scientific management practices, finding alternative supplements of green fodder as well as encouraging farmers to cultivate green fodder at a commercial level.

INTRODUCTION

Indian dairy sector has undergone several changes since the advent of the white revolution and becoming a world front-runner in terms of milk production and the dairy sector is providing employment opportunities to a massive population (Aski & Hirevenkanagoudar, 2010; Das et al., 2020; Mandi et al., 2022). Despite largest producer of milk, the low productivity of dairy animals attributed to low adoption of scientific management practices by the farmers (Singh et al., 2015; Parihar et al., 2020). In this respect, ensuring domestic demand and enduring top most position in the world, India needs to produce 300-400 million tonnes of milk by 2050 (Vision 2050, 2015). For achieving this target a sustainable balance between dairy management practices, sustainable livelihood and environmental practices are need of the hour (Alvez et al., 2013).

Now a day's peri-urban dairy farming has become widespread as a consequence of the high price of milk in urban centres and insufficient milk marketing infrastructure which raises the demand for milk in urban areas (Gillah et al., 2012). Peri-urban dairies are mostly situated in and around cities for meeting the high demand for milk in urban areas (National dairy report, 2017). An easily accessible market is one of the major advatanges of these farms to increase their sale and making a profit (Bohra et al., 2004). The scarcity of land in urban areas makes peri-urban dairy farms zero-grazing type and farms are protected by a fence which restrict free movement of dairy animals (Tumutegyereize et al., 1999). Considering these things practicing scientific dairy management practices has become much more important for increasing productivity and assuring the sustainability of these dairy farms. Peri-urban dairy farms in Odisha now gaining importance due to

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the rising urban population and increasing milk demand for making traditional sweets.Currently, milk production in Odisha was 23.11 metric tonnes and per capita availability of milk was 145 gm/day which is far below the national average (NDDB, 2018-19). Despite increase in milk production over the year, the dairy development potential of the state is count to be among the lowest (Kale et al., 2016). There is a decrease in cattle population by 15.01 per cent in the state during the inter census period between 2012 to 2019 (20th livestock census report, 2019). Considering these facts sustainability of existing dairy farms is of prime importance for meeting the future demands of milk in the state which should be in line with the most widely accepted definition of sustainability i.e., "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987). Although the meaning of sustainability differs from context and its applicability by various persons (Shearman, 1990; Kelly, 1998). Therefore, sustainability in dairy farming should be measured in such a way that it considers all the activities performed by dairy farmers (Bosshard, 2000). Here, an index of sustainability was developed to identify sustainability among dairy farms and the adoption rate of various dairy management practices also calculated.

METHODOLOGY

The research was based on a survey done in 2019 across Odisha's eastern and southern coastal plain agro climatic zones. Based on availability of dairy farms two urban areas namely, Cuttack town (Cuttack district) and Bhubaneswar town (Khordha district) were selected for the study. Primary data was collected by using a pre-structured questionnaire from 120 peri-urban dairy farms (60 dairy farms from each urban area). Following complete enumeration, these dairy farms were divided into three categories using the cumulative square root frequency method: small (up to 18 milch animals), medium (18-24 milch animals), and large (above 24 milch animals) (above 24 milch animals).

At first, potential sustainable dairy management practices were identified through extensive literature review and consultation with experts. However, it was difficult to assess the sustainability status of different dairy management practices at the farm level as it was hard to derive an absolute measure of compliance (Calker, 2000). As a result, an index of sustainable dairy management practices was developed based on the weighted scores of different components of dairy management practices to make a comparative assessment. The 58 practices used by dairy farmers were divided into five categories: shelter management, breeding, nutrition, milking management, and animal health, with weights of 0.14, 0.20, 0.32, 0.12, and 0.22 assigned to each, depending on their relative relevance in guaranteeing sustainability. These differential weights were determined in collaboration with the scientists who worked on these issues. Following the preparation of the index, data on farming techniques was collected from the farmers. Following Kumar et al., (2011), the number of practices followed in each category were multiplied by the relevant weight and then totaled across all categories to generate a weighted score. Accordingly, each farm got scores based on the practices they were following. So, the sustainable dairy management practices index (SDMPI) was calculated by

$$\text{SDMPI} = \frac{\text{Obtained weighted Score}}{\text{Maximum Obtainable Score}} \times 100$$

Following the computation of sustainability ratings for each dairy farm, experts grouped the farms into three groups of sustainability levels: low (below 50 percentiles), medium (50 to 80 percentiles), and high (above 80 percentile). In order to see the association of different categories sustainable score in different herd size categories Chi-square test was used. Adoption rate of different dairy management practices was also calculated using the formula

$$\text{Adoption Rate (AR)} = \frac{\text{No. of respondents adopted a particular practice}}{\text{Total number of respondent}} \times 100$$

RESULTS AND DISCUSSION

In the study area, there were two types of peri-urban dairy farms: cattle farms and mixed farms. Cattle farms had solely crossbred cows, whereas mixed farms included both buffalo and cows. Table 1 reveals that about 25.83 per cent farms were pure cattle farms while 74.16 per cent farms were mixed farms. Number of crossbred cows was found to be more than that of buffaloes in the study area because cow milk (mostly jersey) is mostly preferred for traditional sweets preparation.

Assessing sustainability

Sustainability scores were obtained for each sample peri-urban dairy farms. Maximum obtainable score for given index was 300. Scores obtained out of 300 was converted into percentage. This percentage was used for classification of farms. Dairy farms were divided into 3 categories. The majority of the farms in the research region fall into the low-sustainability group, accounting for 61 per cent of all farms. About 38 per cent of farms were in the medium sustainable category. It shows that there is a very low level of adoption sustainable dairy management practices which represents very poor status of development of peri-urban dairy in Odisha. Only 8 per cent farms were found to be highly sustainable i.e., practices recommended by scientists were followed in these farms.

Dairy farms were distributed based on sustainability index among different herd size categories. It was observed (Table 2) that

Table 1. Distribution of peri-urban dairy farms according to type of animal and herd composition

Farm type	Small	Medium	Large	Overall
Cattle farms	23(46.93)	8(19.51)	0(0.00)	31(25.83)
Mixed farms (CB + Buffalo)	26(53.06)	33(80.48)	30(100)	89(74.16)
Total	49	41	30	120

Figures in parentheses indicate percentage of column total, CB-Crossbred Cow

Table 2. Distribution of dairy farms among herd size categories based on sustainability index

Farm Categories	Low	Medium	High	Total number of farms
Small	35(71.42)	14(28.58)	0(0)	49
Medium	14(34.14)	27(65.86)	0(0)	41
Large	12(40.00)	10(33.33)	8(26.66)	30
		Chi-square Value 39.11*		120

Figures in parentheses indicate percentage of row total, * signifies 1 per cent level of significance

71.42 per cent of the small farms were belongs to low sustainable categories and rest of the small farms belongs to medium sustainable category. In the case of medium farms 34.14 per cent of the farms were fall in low sustainable category while 65.86 per cent of the farms were in medium sustainable categories. None of the small and medium farms were found to be highly sustainable which indicates low adoption of sustainable dairy management practices in these farms. Chi-square test was used to see whether there was any effect of sustainability index on distribution of farms in different herd size categories. As the value of chi-square test is significant, it depicts the association between the peri-urban dairy farm size and level of sustainability on the basis of sustainability index.

Mean sustainable scores of dairy management practices across different herd size categories have been presented in Table 3. In the case of shelter management practices overall average score was 50.27 per cent. Large dairy farms were found to be better at shelter management practices with an average 65.63 per cent. Dairy farms in the study area were found to be better a performing breeding practices with an overall mean score of 67.75 per cent. Overall mean sustainable score was found to be lowest in case of nutrition i.e., 42.9 per cent. Small farms were found to have a lowest score of 42.27 per cent followed by medium (42.27%) and large farms (51.73%). It indicates that peri-urban dairy farms in the study area were very poor performance in animal nutrition which may account for low productivity of dairy animals. In the case of milking management practices overall mean score was 62.08 per cent. We can observe that farms among different herd size categories were performing well in terms of milk management practices. Overall mean score obtained in case of animal health was 51.26 per cent. Large farms (55.50%) were found to be good at performing animal health practices followed by medium (50.99%) and small farms (48.88%).

Adoption of various dairy management practices

The rate of adoption of desired scientific management practices have been presented in Table 4. It was observed that in the case of shelter management practices 20.83 per cent of the farmers were having location of shed separate from the dwelling house while rest of them have cattle shed close to dwelling house. Similar, findings were observed by Srivastav & Promila (1983) where only 18 per cent farmers have cattle shed separated from the dwelling house. It may be due to unavailability of cheap land and to save the additional construction cost for cattle shed near city (Sabapara et al., 2010). Most of the farms do not have facilities for manger feeding and a separate house for calving animals. Only 63.33 per cent farms were utilizing cow dung for various purposes like vermicomposting, bio-gas plant, farm yard manure etc. while other simply disposed it. It shows that 39.16 per cent of the farmers were following a planned systematic breeding practice. Most of the farmers (85.83%) were following artificial insemination with supporting results Ashwar et al., (2017). Quality germplasm from various government and private sources were available with 79 per cent of the farmers. Milk yield and various phenotypic characteristics were the important parameter for choosing semen for artificial insemination. Only 49.16 percent of farmers were aware of heat detection techniques such as bellowing, mucus discharge, frequent urination, mounting, and so on. Unawareness about various heat detection techniques increases the number of services per animals. Only 65.83 per cent of the farmers informed that their cow is served within 60-90 days after calving and 22.50 per cent reported a 12-month calving interval.

Dairy animals require a high-quality balanced diet, which is often unavailable, resulting in delayed maturity, protracted dry period, and a low conception rate. Peri-urban dairy farms in Odisha practices mainly stall feeding of animal, only 27.50 per cent reported both stall feeding and grazing of animal. It was observed that only 15 per cent of the farmer feed green fodder to the animal which means there is unavailability of green fodder in the study area as also reported by Hodshil et al., (2007). All the farms fed dry fodder, mostly paddy straw to the animals. It reveals that most of the dairy farms fed unchaffed fodder to the animals, only 6.66 per cent farmers do have chaffing machine. Similar findings reported by Sabapara et al., (2010). Mostly the farmers fed compound concentrate mixture to the animals while only 35.83 per cent of the farmers have the knowledge of feeding concentrate with proper nutrient proportion. It was found that 31.66 per cent of the farmers fed mineral mixture to the animal while 49.16 per cent of the farmer fed common salt to the animal. Colostrum feeding to newly born calf just after birth performed by 54.16 per cent of the farmer and

Table 3. Mean sustainability scores (%) of dairy management practices followed by the dairy farmer

Dairy management practices	Shelter management	Breeding	Nutrition	Milking management	Animal Health
Small Farm	41.44	65.34	38.03	58.04	48.88
Medium Farm	49.59	65.73	42.27	63.48	50.99
Large Farm	65.63	74.44	51.73	66.75	55.50
Overall	50.27	67.75	42.90	62.08	51.26

Table 4. Adoption Rate (AR) of dairy management practices by the farmer

S. No	Shelter management practices	AR	S. No	Breeding	AR	S. No.	Nutrition	AR	S. No	Milking management	AR	S. No.	Animal health	AR
1.	Location of shed separate from dwelling house	20.83	1.	Planned systematic breeding	39.16	1.	Both stall feeding and grazing of animals	27.50	1.	Full hand milking	19.16	1.	Consulting veterinary doctors for treatment of sick animals	45.00
2.	Loose housing as per BIS standard	23.33	2.	Artificial insemination	85.83	2.	Feeding green fodder to animals	15.00	2.	Calf is allowed to suckle before and after milking	22.50	2.	Purchasing veterinary aids from veterinary hospital	65.00
3.	Tie barn with adequate area and rope length	23.33	3.	Using Quality germplasm	79.16	3.	Feeding dry fodder to animals	100.0	3.	Stripping at the end of milking	50.00	3.	Following deworming measures	60.00
4.	Kutcha floor with proper drainage.	22.50	4.	Selection of breeding bull considering its milk yield and phenotypic characteristics	70.00	4.	Feeding chaffed fodder	6.66	4.	Milking at a separate and dry place	20.00	4.	Tik control	60.00
5.	Height of the roof shade 15ft. at the ridge and 8 ft. at side.	34.16	5.	Animal coming to heat within 90-120 days after parturition	33.33	5.	Feeding compound concentrate to the animals	76.66	5.	Cleaning udder and teats, washing hands with antiseptic solution	90.83	5.	Isolating sick animals from healthy ones	16.66
6.	Proper and permanent roof.	70.83	6.	Proper heat detection by visualizing animal behaviors	49.16	6.	Feeding concentrate with proper nutrient proportion	35.83	6.	Practicing drying off of animals	65.83	6.	Daily cleaning of animal shed water trough and mangers	46.66
7.	Manger feeding.	5.83	7.	Insemination during mid heat	34.16	7.	Concentrate feeding to lactating cow both at milking and mix with fodder	20.00	7.	Leaving animals to stand for sometimes after milking	40.83	7.	Daily cleaning of animals	71.66
8.	Proper ventilation.	18.33	8.	Insemination within 12 hours after heat detection	26.66	8.	Pretreatment of concentrate mixture like soaking and boiling	25.00	8.	Cleaning utensils & milk storage area with cleaning agent and water	75.83	8.	Practicing vaccination timely and regularly against contagious disease	50.00
9.	Separate housing of calving animal.	35.00	9.	Insemination performed by Veterinary officers	32.50	9.	Feeding mineral mixture to the animals	31.66	9.	Keeping milk harvested from sick animals separate from milk of healthy animals	25.83	9.	Vaccination by government agencies	15.83
10.	Proper utilization of cow dung without wasting.	63.33	10.	Cow served within 60-90 days after calving	65.83	10.	Feeding common salt to the animals	49.16	10.	Availability of refrigerated storage	21.66	10.	Diseased animal carcass gets properly treated with disinfectant before disposal and making provision to remain unapproachable for stray dog/jackal etc.	15.00
11.	Availability of hygienic water	91.66	11.	12 month calving interval	22.50	11.	Colostrum feeding to newly born calf just after birth	54.16						
						12.	Consultation with scientist/ veterinary officers about nutrient management	14.16						
						13.	Availability of enough fodder throughout the year	40.00						
						14.	Change in feed during rainy days	29.16						
						15.	Practicing conservation of fodder as hay/silage	12.50						
						16.	Own feed and fodder production	0.00						

only 14.16 per cent of the farmer consult scientists/veterinary officers about nutrient management of the animals. About 40 per cent of farmers have enough fodder throughout the year, while others suffer due to a lack of storage facilities, and only 12.50 per cent reported conserving fodder as hay/silage. These findings are similar to Kumar et al., (2006) & Nagalakshmi et al., (2007). Farmers do not have their own production so they have to purchase feed and fodder from outside which is adding extra cost to the farmer.

Effective milking management procedures aid in the production of clean milk. Farmers were found to be using full hand milking 19.16 per cent of the time, while others were using a faulty approach called knuckling and stripping. Due to space constraint most of the farmers do not have a separate dry place for milking, only 20 per cent farmer did milking at a separate and dry place. The majority of farmers (90.83%) found it necessary to clean the animal's udder and teats before and after milking, as well as to wash their hands with antiseptic solution. About 65 per cent of the farmer practices gradual drying off of animals rather than instantly stopping milking. Leaving animals to stand for sometimes after milking helpful in preventing mastitis known by 40.83 per cent of the farmers. Daily cleaning utensils & milk storage area with cleaning agent and water for maintaining hygienic condition practiced by 75.83 per cent farmers. It was observed that only 25.83 per cent of the farmer separated milk from healthy animals and sick animals. Only 21.66 per cent farmers were having refrigerated storage while other forced to dispose milk on the same day of harvesting otherwise it will be waste.

Socio-economic status of the farmers mainly responsible for their decision regarding animal health services (Kumar & Meena, 2021). It was observed that only 45 per cent of the farmer consulting veterinary doctors for treatment of sick animals while others are consulting quacks, stockman etc. It was found that various measures like deworming and tik control were performed by 60 per cent of the farmers. Only 16.66 per cent of the farmers were able to isolate sick animals from healthy one while others were not due to space constraint. About 46 per cent of farmers clean their animal sheds, water troughs, and mangers on a daily basis, whereas 71.66 percent clean their animals on a daily basis. Half of the sampled farmers were well aware about various contagious diseases of dairy animals and performing vaccination timely and regularly against contagious diseases. Diseased animal carcass gets properly treated with disinfectant before disposal and making provision to remain unapproachable for stray dog/jackal etc. performed by 15 per cent of the farmer while others leave it as such at a distant place for decay.

CONCLUSION

The study pronounced sustainability of peri-urban dairy farms on the basis of scientific dairy management practices. Results reveal that 61 per cent of the farm belonged to low sustainable category, 32 per cent belong to medium sustainable category while only 8 per cent farms found to be highly sustainable. The overall mean score results show that peri-urban dairy farms have a low performance in shelter management, nutrition and animal health management practices. Especially peri-urban dairy farms in the study area have challenges in space constraint, unawareness about planned systemic breeding practices, unavailability of green fodder, unavailability of refrigerated storage, problems in dung disposal and timely vaccination of animals. Therefore, farmers should be educated about the benefits of following various dairy management practices through various training programmes and government should make various policies for removing such barriers in peri-urban areas.

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