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Original Article

Reproductive management of dairy cows: an existing scenario from urban farming system in Bangladesh

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ABSTRACT

Background: Reproductive management practices play crucial roles to maximize the reproductive performance of cows, and thus contribute to farm profitability. We aimed to assess the reproductive management of cows currently practiced in the dairy farms in an urban farming system.

Methods: A total of 62 dairy farms were randomly selected considering all size of farms such as small (1-5 cattle), medium (6-20 cattle) and large farms (> 20 cattle) from selected areas of Dhaka city in Bangladesh. The reproductive management-related parameters viz. estrus detection, breeding method, pregnancy diagnosis, dry cow and parturition management, vaccination and treatment of reproductive problems etc. were obtained in a pre-defined questionnaire during the farm visit.

Results: The visual observation method was only used (100.0%; 62/62) for estrus detection irrespective of size of the farms; while farmers observed cows for estrus 4-5 times a day, but only for 20-60 seconds each time. Regardless of farm size, 89.0% (55/62) farms used artificial insemination (AI) for breeding the cows. Intriguingly, all farms (100.0%) routinely checked the cows for pregnancy at 35-40 days post-breeding using rectal palpation technique by registered veterinarian. However, only 6.5% (4/62) farms practiced dry cow management. Notably, all farms (100.0%) provided nutritional supplements (Vit D, Ca and P) during late gestation. However, proper hygiene and cleanliness during parturition was not practiced in 77.4% (48/62) farms; even though 96.7% (60/62) farms treated cows by registered veterinarian for parturition-related problems.

Conclusions: While farmers used AI service for breeding and timely check their cows for pregnancy; however, they need to increase observation time (30 minutes/observation, twice in a day: early morning and early night) for estrus detection, consider dry cow management and ensure hygienic parturition for maximizing production.

Keywords: Bangladesh, dairy cow, Dhaka, reproductive management, urban farming

INTRODUCTION

Reproduction management is the most important consideration in the economics of cattle production. In the absence of regular breeding and calving at the appropriate time, dairy farming will not be profitable. Birth of a healthy calf each year or every 12-14 months interval is the primary goal for the profitable dairy farming (LeBlanc, 2010). This is possible only by increasing the reproductive efficiency of the cattle. The successful reproduction encompasses cows come to estrus or heat, the ability to mate, the capacity to conceive and to accept and nourish the embryo in the uterus and delivery of a viable calf at the end of a complete gestation period (Burns et al., 2010; Talukder et al., 2020). In fact, interruption in this chain of events leads to failure of the cow either to conceive or the embryo to die or to have a premature delivery of the fetus. The reproductive efficiency is a complex phenomenon controlled by both genetic and non-genetic factors, the non- genetic factors being climate, nutrition, and level of management etc. (Paul et al., 2013). The reproductive efficiency varies not only between species and breeds but also among the animals within the same breed. Even the best feeding and management cannot coax performance beyond the genetic limit of an inferior animal. Improving the genetic merits of livestock populations is important at all levels of management. A sound breeding program is a necessary part of the total animal production system. It is imperative to improve the productive capacity and physical appearance of the animal population (Donaldson, 2008). Dairying is a good source of income to the small and marginal farmers. The feeds required for milk production can be met from their limited land resources as most of the milch animals are ruminants and most of their food can be derived from forages, coarse roughages and byproducts not utilized by human beings, without incurring much additional cost (Nasir et al., 2014).

Cows are the major livestock and hold a very important place in the national economy of Bangladesh. Dairying is a subsidiary occupation of almost all farmers in Bangladesh. More than 60% of the families involved in dairying consist of small and marginal farmers and even agricultural laborers (Shamsuddoha and Edwards, 2000). Reproductive efficiency of cows plays pivotal roles in a profitable dairy farming system. Reproductive efficiency of cows greatly relies on the reproductive management practices used in the dairy farms (LeBlanc, 2010). The better performance regarding the reproductive efficiency of the heifers and cows include age at the first service and calving, calving to service interval, number of services per conception, conception rate and calving interval etc. The various factors such as milk yield, age, and body condition score (BCS) of cows influence the onset of estrus and the subsequent fertility after calving (Rahman et al., 2019). The reproductive performances of the crossbred cows may differ from that of the indigenous ones living in different geographical areas where harsh environmental condition exists. The productivity of cattle depends largely on their reproductive performances. Any abnormality in reproductive system and faulty management can interrupt animal production performance.

Dairy farming is practiced mostly in the rural areas of Bangladesh because of available farming space, land for fodder cultivation and grazing, and available labors for cattle management (Rahman et al., 2019). Now a day, dairy farming is also practiced simultaneously in the different urban areas of Bangladesh particularly in the capital city, Dhaka. This is because the price of milk, meat and other value-added products from milk and meat is higher in the Dhaka city than rural areas of Bangladesh. Therefore, the demand of dairy and beef farming is increasing immensely in Dhaka city of Bangladesh, where milk and meat demands are certainly very high. There is a dearth of information on actual number of dairy farms currently exist across the Dhaka city in Bangladesh. Recently, it was reported that approximately 2,000 farmers have been engaged in milk production in various pockets of Dhaka city to fulfill the growing demand for milk among residents and sweetmeat shops (Halder, 2021). However, the reproductive management of cows currently used in the dairy farms of Dhaka city have not yet been studied. Therefore, the present study was carried out to illustrate the actual scenario of reproductive management of cows currently practiced in the dairy farms of Dhaka city in Bangladesh.

MATERIALS AND METHODS

Study areas

The present study was carried out in selected areas from north-eastern region of Dhaka city in Bangladesh such as Badda, Khilkhet, and Uttara (Fig. 1) during the period

from November 2021 to January 2022.

Study farms and their general management

A total of 62 dairy farms were randomly selected in the study areas. All types of farms such as small (1-5 cattle), medium (6-20 cattle) and large-sized farms (> 20 cattle) were included in the present study. Most of the farm had tie-stall housing system, while few of them had free-stall housing system for cows. Farms had no grazing land and therefore a variety of feedstuffs were used in the diet: water hyacinth, straws, concentrate, salts and vitamins and minerals supplements with ad libitum water.

Data acquisition

1) Development of a questionnaire

A predefined structured questionnaire (Supplementary Table 1) was developed according to the objectives of the study and was designed in a simple way so that farmer could understand easily. The questionnaire includes information about farms and farmers, and reproductive management practices (methods of estrus detection, methods and timing of breeding, pregnancy diagnosis, dry cow management, management of cows during parturition and postpartum period, voluntary waiting period, vaccination and treatment of reproductive diseases and disorders etc.) currently used in their farms.

2) Visiting the farms and interviewing with farmers

Each farm was visited in person and farmers were kindly requested to take part in the interview for research purpose of the present study. The data were then collected and recorded from direct interviewing of the farmers and/or from register of the farms, whenever required.

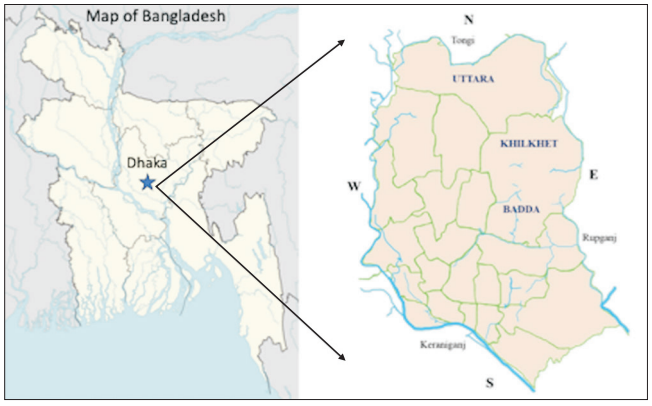

Fig. 1. The selected study areas in Dhaka city of Bangladesh (Adapted from: Wikipedia).

3) Personal observation

Body condition score (BCS) of cows was evaluated on a 1 to 5 scale basis by visual inspection according to a protocol described in a previous study (Wildman et al., 1982). The breed of cows was determined by observing the phenotypic characteristics of the breed as well as by observing farm register. The age of cows was determined from the register book or by interviewing the owner and/or by observing dentition where necessary. The parity of cows was also determined by interviewing the farmer and by noting from farm register. Conditions of floors were observed by visual inspection to check whether the floor was made of concrete or brick. Hygienic conditions like dry, wet, dry and soiled with dung, wet and soiled with dung etc. were checked and recorded properly. The ventilation system was noticed, as it is an important aspect of farm management. Some farms had natural ventilation system, whereas others had air inlet or fan system.

Statistical analysis

The data were entered into a Microsoft Excel Workbook 2010 and then exported to the SPSS software, version 26.0, NY, Chicago, USA for statistical analyses. Descriptive statistics were used for calculation of mean and percentages (%).

RESULTS

Description of the farmers, cattle reared and housing pattern of the farm

The results from 62 farms reveal that most of the farmers received primary education (32.0%) followed by graduation (21.0%), secondary school certificate, SSC (19.0%), junior school (8.0%), higher secondary school, HSC (5.0%) (Fig. 2A). Notably, 16.0% farmers were not educated in the study areas. On the other hand, although a higher percentage (84.0%) of farmers are educated in study areas at least at the primary level, but trainings relating to dairy farming were received by only 5.0% farmers (Fig. 2B).

The size of cattle herd was ranged from 2 to 65, while most of the herd size comprised of 15-25 cows in medium to large-sized farms. Of note, the percentage of lactating

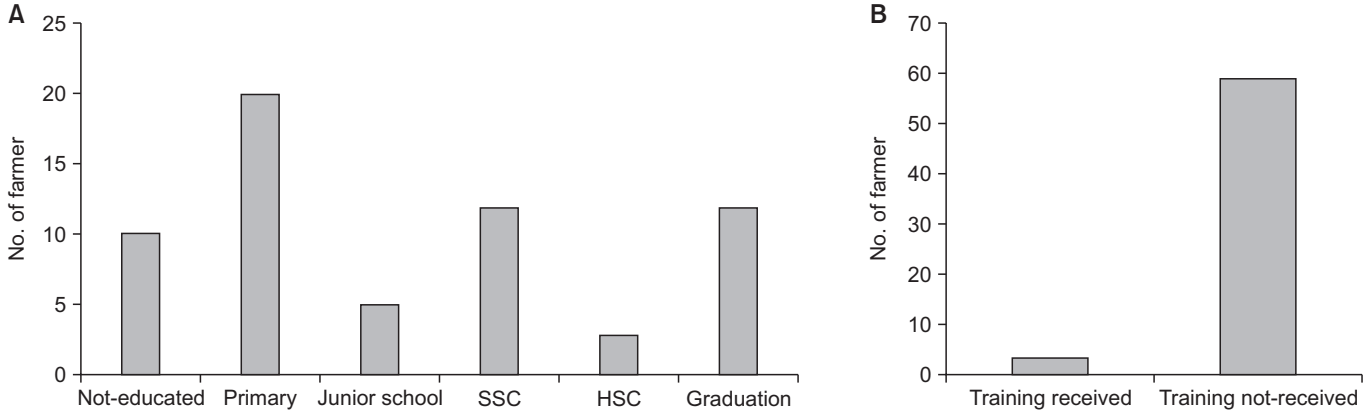

Fig. 2. Farmers information (A) Education level of the farmers, and (B) Training received by the farmers.

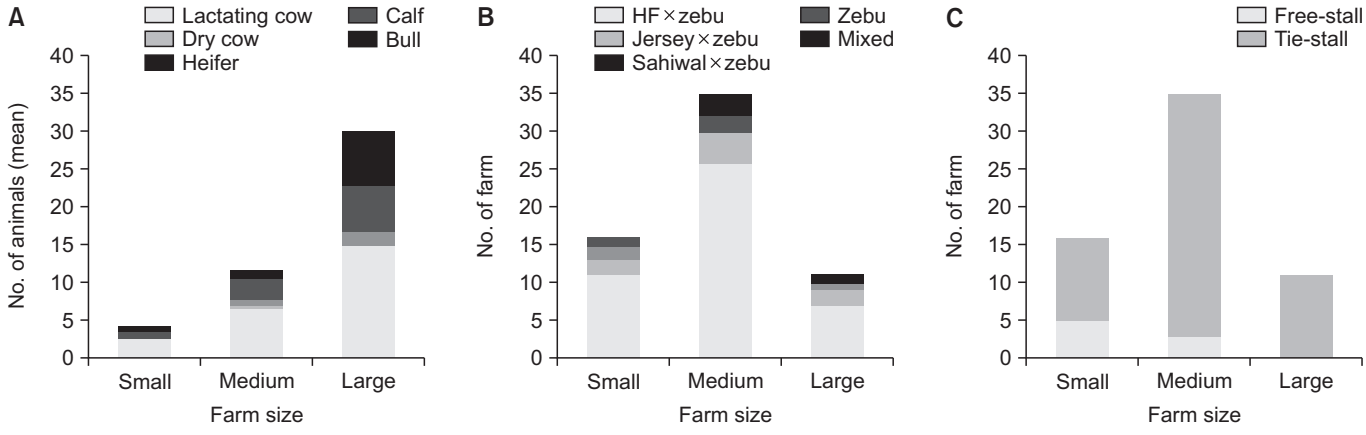

Fig. 3. Information of animals and housing of the farms. (A) Different types of cattle reared in the farm, (B) Different crossbred cattle reared in the farm, and (C) Housing type of the farms.

cows were 50.0% regardless of the size of the farm (Fig. 3A). The number of Holstein-Friesien (HF) crossbreds were higher than the other crossbred animals (Jersey × zebu, and Sahiwal × zebu) and zebu cattle (Fig. 3B). Most of the farms (95%) maintained tie stall and only 5% used free stall housing systems for dairy cattle rearing (Fig. 3C).

Estrus detection

The visual observation of estrus signs was used for estrus detection in all farms irrespective of the farm size (Table 1). Farmer used neither estrus detection aids nor video monitoring using close circuit camera for estrus detection in the selected farms. The farmers observed their cows for estrus several times (4-5 times) a day, but only 20-60 seconds each time regardless the farm size. Moreover, hormonal estrus synchronization was not practiced in any of the farms.

Breeding

Regardless of the farm size, 89% percent farms used artificial insemination (AI) and remaining 11% farms used combination of AI and natural service for breeding the cows (Table 2). Importantly, all the farms maintained the exact time schedule (10-12 hours following estrus detection) for breeding and eventually kept breeding records. However, almost all the farms (98.3%, 61/62) were not aware of using the breeding and/or gestational calendar, only one large-sized farm (1.7%, 1/62) maintained breeding calendar for cows.

Pregnancy check

In the present study, all the farms (100%, 62/62) checked their cows for pregnancy routinely by the registered veterinarian. Pregnancy diagnosis of cows was done between 35 to 40 days after breeding. The rectal palpation method was used to diagnose pregnancy in all the farms regard-

Table 1. Estrus detection method, time spent for estrus detection and application of estrus synchronization in the farms

Practices	Categories	Farm size			Total (n = 62)
		Small (n = 16)	Medium (n = 35)	Large (n = 11)	
Methods estrus detection	Visual observation of estrus signs	16	35	11	62 (100.0%)
	Estrus detection aids	0	0	0	0 (0.0%)
	Video monitoring by close-circuit camera	0	0	0	0 (0.0%)
How many times does farmer observe cows for estrus in a day?	Two times (early morning and early evening) in a day	0	0	0	0 (0.0%)
	Several times in a day	16	35	11	62 (100.0%)
How long does the farmer observe cows for estrus each time?	Time (seconds)	30-60	20-60	20-60	20-60
Does the farmer apply hormonal synchronization for estrus induction?	Yes	0	0	0	0 (0.0%)
	No	16	35	11	62 (100.0%)

Table 2. Breeding methods and timing used in the farms

Practices	Categories	Farm size			Total (n = 62)
		Small (n = 16)	Medium (n = 35)	Large (n = 11)	
Methods breeding	Artificial insemination	16	33	6	55 (88.7%)
	Natural service	0	0	0	0
	Combination	0	2	5	7 (11.3%)
Timing of breeding	Hours following detection of estrus	10-12	10-12	10	10-12
Does the farmer keep record for breeding service of cows?	Yes	16	35	11	62 (100.0%)
	No	0	0	0	0 (0.0%)
Does the farmer use breeding and/or gestational calendar for cows?	Yes	0	0	1	1 (1.7%)
	No	16	35	10	61 (98.3%)

Table 3. Diagnosis of pregnancy in cows

Practices	Categories	Farm size			Total (n = 62)
		Small (n = 16)	Medium (n = 35)	Large (n = 11)	
Does the farmer check cow for pregnancy?	Yes	16	35	11	62 (100.0%)
	No	0	0	0	0 (0.0%)
If Yes, when does the farmer check cow for pregnancy?	Days after breeding	35-40	35-40	35-40	35-40
Methods of pregnancy diagnosis	Rectal palpation	16	35	11	62 (100.0%)
	Ultrasonography	0	0	0	0 (0.0%)
	Others	0	0	0	0 (0.0%)

less of the farm size (Table 3).

Dry cow management

Only a few numbers of farms (6.5%, 4/62) maintained the dry period for their milch cows irrespective of the farm size (Table 4). Among the dry cow-maintaining farms, dry period of milch cows was maintained for the period of 30-45 days before parturition. Regardless of maintaining proper dry period, all the farms (100%, 62/62) provided vitamin-mineral supplements such as Vit D, Ca and P during the last stage of gestation period.

Parturition and postpartum period

The management of dairy cows during parturition and postpartum period are summarized in Table 5. In the present study, only 22.6% (14/62) farms maintained hygienic condition as well as clean environment during parturition and postpartum period. In all the farms, cows

Table 4. Management of dry period in milch cows

Practices	Categories	Farm size			Total (n = 62)
		Small (n = 16)	Medium (n = 35)	Large (n = 11)	
Does the farmer maintain a dry period for pregnant milch cows?	Yes	0	3	1	4 (6.5%)
	No	16	32	10	58 (93.5%)
If Yes, how long does the farmer maintain dry period for cows?	Days before parturition	0	30–45	45	30–45
Does the farmer provide vitamin-mineral (Vitamin D, Ca, and P) supplements during the last month of gestation?	Yes	16	35	11	62 (100.0%)
	No	0	0	0	0 (0.0%)

Table 5. Management of cows during parturition and postpartum period

Practices	Categories	Farm size			Total (n = 62)
		Small (n = 16)	Medium (n = 35)	Large (n = 11)	
Does the farmer maintain hygienic condition (neat and clean environment, hygienic assistance by person) during parturition of cows?	Yes	0	6	8	14 (22.6%)
	No	16	26	3	48 (77.4%)
What is the body condition of cow, maintained by the farmer, at calving?	1–5 scale	3.5–4.0	3.5–4.0	4.0	3.5–4.0
Does the farmer call a vet if parturition is delayed/ abnormal (dystocia)?	Yes	15	34	11	60 (96.7%)
	No	1	1	0	2 (3.3%)
Does the farmer call a vet if placenta is not expelled within 12 hours of parturition?	Yes	16	35	11	62 (100.0%)
	No	0	0	0	0 (0.0%)
Which types of suckling does the farmer maintain for the cow?	Free	5	4	0	9 (14.6%)
	Restricted	11	31	11	53 (85.4%)

Table 6. Voluntary waiting period for reproductive management of cows

Practices	Categories	Farm size			Total (n = 62)
		Small (n = 16)	Medium (n = 35)	Large (n = 11)	
Does the farmer use voluntary wait period (VWP) for parturient cows?	Yes	0	0	0	0 (0.0%)
	No	16	35	11	62 (100.0%)
If Yes, how long the farmer maintains the VWP?	Days since parturition	0	0	0	0

were maintained with a good body condition score (BCS: 3.5–4 on 1 to 5 scale) during postpartum period. Most of the farms (96.7%, 60/62) called registered veterinarian when the parturition was delayed (dystocia). The retained placenta was treated by the registered veterinarian in all the farms. In terms of suckling type adopted in the farms, 85.4% (53/62) maintained restricted suckling of cows by the calf to induce milk let down.

Voluntary waiting period

The strategies for voluntary waiting period (VWP) for breeding parturient cows is shown in Table 6. There were no farms found, which maintained VWP for their dairy cows during the study period regardless of the farm size.

Vaccination against reproductive diseases

Only 8.9% (5/62) farms used vaccination against tuberculosis (TB) disease. Cows were not vaccinated against other infectious reproductive diseases caused by bovine viral diarrhoea (BVD), infectious bovine rhinotracheitis (IBR), brucellosis, leptospirosis in any of the farms studied (Table 7).

Treatment strategies against reproductive diseases and disorders of cows

Cows with any abnormal vaginal discharge were treated

Table 7. Vaccination of cows against reproductive diseases

Practices	Categories	Farm size			Total (n = 62)
		Small (n = 16)	Medium (n = 35)	Large (n = 11)	
Does the farmer use a programme for testing, screening and vaccination against reproductive diseases (BVD, IBR, Brucellosis, Leptospirosis, TB etc.)?	Yes	0	4*	1*	5 (8.9)
	No	16	31	10	57 (91.9%)

*Indicates vaccinations against TB.

Table 8. Treatment strategies for reproductive diseases and disorders of cows

Practices	Categories	Farm size			Total (n = 62)
		Small (n = 16)	Medium (n = 35)	Large (n = 11)	
Do cows with abnormal vaginal discharge examined and treated by veterinarian?	Yes	16	35	11	62 (100.0%)
	No	0	0	0	0 (0.0%)
Does the farmer call a vet to examine cows not conceived after 3 consecutive services?	Yes	16	35	11	62 (100.0%)
	No	0	0	0	0 (0.0%)
Who is responsible for treatment of reproductive problems of cows?	Registered vet	11	32	10	53 (85.4%)
	Veterinary assistant/ farm owner	0	0	0	0
	Combined	5	3	1	9 (14.6%)

with registered veterinarian in all the farms (Table 8). Registered veterinarian was also called to check cows that failed to conceive after three consecutive services in all the farms. Of note, cows with reproductive health problems were treated with both registered veterinarian and veterinary assistants/farm owners in 14.6 % (9/62) farms, while 85.4% (53/62) farms treated the cows with registered veterinarian only.

DISCUSSION

Dhaka is the capital city of Bangladesh, where the substantial numbers of dairy cows exist to fulfil the demand of milk and meat for rapidly increasing population of the city. Reproduction management practices play important roles for maintaining optimum production in the dairy farms. The present study explored the reproduction management of cows currently employed in the dairy farms of Dhaka city in Bangladesh.

In the current study, visual observation for estrus signs was the only method which was used for estrus detection in cows in the farms studied. Farmers used neither any estrus detection aids nor video monitoring using close circuit camera for purpose of estrus detection. This might be due to the smaller number of animals in the farms and the costs involved in the use of such estrus detection aids and close circuit cameras. In contrast, dairy farmers used estrus detection aids (Fodor et al., 2019) in the developed countries, where 75% farmers use estrus detection aids and/or cameras and remaining 25% farmers detect estrus by visual observation. In our study, all the farmers observed their cows for estrus several times (4-5 times) a day, but only 20-60 seconds each time indicating lack of farmers knowledge about estrus detection. Ideally, cows should be observed for estrus twice in a day, one in the early morning and other in the early night with 30 minutes each time (Hansel, 1961). However, it is also reported that several times observation increase the estrus detection efficiency (Van Schyndel et al., 2019). In this study, even though farmers observed cows several times in a day for estrus, however, they did not pay attention for sufficient time, which warrants further improvement by the farmers in the study area.

Artificial insemination was mainly used for breeding the cows in the study areas. Only 11.0% farmers used natural breeding in addition to AI service in only the cases where chance of conception was less. Consistent with our findings, Khan et al. (2010) observed that 87% cows were artificially inseminated and remaining 13% were bred by both AI and natural service in Mymensingh district of Bangladesh. Moreover, Hossain et al. (2004) stated that 93% cows were inseminated artificially, and 7% cows re-

ceived combined insemination. The appropriate time for breeding the cows is 10-12 hours after estrus detection (Mee et al., 1999). In our study, all the farms maintained the exact time schedule to breed the cows in appropriate time. Keeping breeding record is crucial to maintain reproductive performance of dairy cows (Herath and Mohammad, 2009). Intriguingly, breeding record of cows was maintained in all the farms of present study, even though farmers were not concerned about using any breeding and/or gestational calendar for this purpose.

Pregnancy diagnosis of cows following insemination is very important for monitoring the breeding success and predicting the time of parturition (Bekele et al., 2016). In this study, all the farms routinely checked the cows for pregnancy between 35 to 40 days after breeding, which was very appropriate to diagnose the non-pregnant cows so that they can be rebred or treat within short time to avoid subsequent prolonged calving interval. In the study area, rectal palpation method was only used for pregnancy diagnosis in cows. This might be due to unavailability of ultrasonography (USG) and other methods to diagnose pregnancy in cows. In Canadian dairy industry, it was reported that 52.3% farms used USG, 37.6% farms used rectal palpation, and remaining 10.1% used other methods for pregnancy diagnosis in cows (Luby et al., 2020).

Maintaining dry period replenishes body condition and regenerate milk-secreting tissue in cows (Grum et al., 1996). Research has shown that a dry period of at least 60 days is the most economical and optimum for health, fertility and milk production in cows (Gulay et al., 2003; Beever, 2006). In the present study, only a few numbers of farms (6.5%) in the study area maintained dry period of 30-45 days for their milch cows, which needs to be considered by the farmers in the study area. However, all the farms provided vitamin-mineral supplements such as Vit D, Ca and P during the late gestation because this period is very crucial for final growth and development of the fetus, and preparation of mammary tissue for milk synthesis in dairy cows.

Parturition with proper hygiene in a clean environment may ensure to reduce bacterial load into the uterus which in turn can play significant role in preventing uterine disease (Potter et al., 2010). Our findings indicate that 77.4% farms did not maintain a clean and hygienic environment during parturition and postpartum period which requires to be improved in the study area. However, registered veterinarians were called in all the farms, if cows needed any assistance in case of delayed parturition and retained placenta. In addition, most of the farms maintained very good BCS (3.5-4.0 on a 1 to 5 scale) of cows during preparturient period, which would help to prevent cows from negative energy balance that is likely to happen in cows with BCS $\leq$ 2.0 (Butler, 2005). There is a strong association exist between good BCS and improved reproductive performance of cows (Pryce et al., 2001). Pre-calving body condition influences post-calving breeding performance (Dyer, 2009). A clear effect of BCS on pregnancy rate at the first AI was observed only for the cows having BCS < 2.5 (López-Gatius et al., 2003).

The voluntary waiting period (VWP) is the post-partum period during which cows are deliberately not inseminated even estrus is seen (Chen et al., 2015). In general,

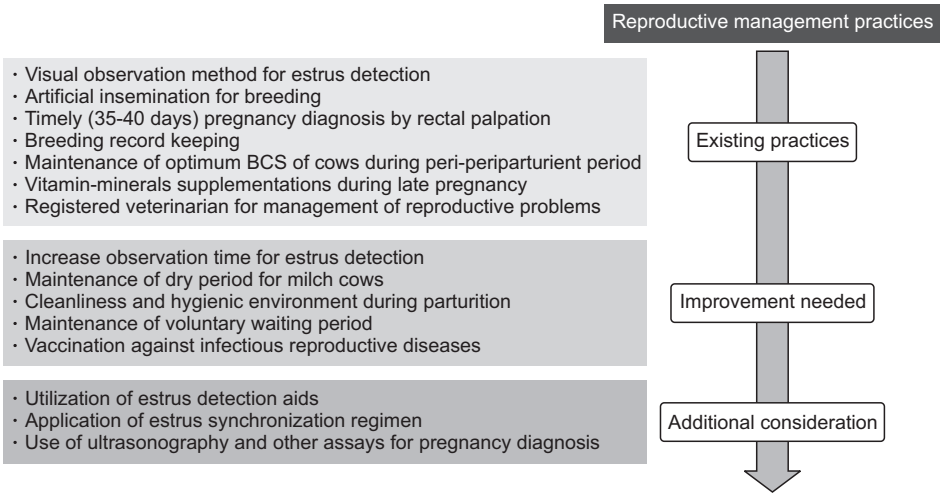

Fig. 4. Summary of key findings representing the existing management practices for reproduction, areas for improvement and additional consideration in the studied dairy farms.

a minimal VWP of 45 to 60 days post-partum is recommended, allowing for complete uterine involution and resumption of ovarian cyclicity to improve the rate of successful conception after insemination (Inchaisri et al., 2011). In addition, this allows cows to get sufficient time to recover from negative energy balance (NEB) (Chen et al., 2015). In the present study, farmers were not aware to maintain VWP that needs to be taken into account by the farmers.

Up to 50% of pregnancy losses in cattle are associated with infectious diseases, such as infectious bovine rhinotracheitis (IBR), bovine viral diarrhea (BVD), and leptospirosis (Khodakaram-Tafti and Ikede, 2005). Therefore, vaccination against such infectious reproductive diseases can be performed to improve the reproductive performance in cows (Pereira et al., 2013). As part of a sound vaccination program, Wardnyski (2013) recommended that replacement cattle should receive their first reproductive vaccinations at six to eight months of age, then a booster dose two to four weeks later and again prior to breeding season at 13 to 15 months of age. In the current study, only 8.9% farms provided vaccine against only one disease (TB) to their cows, which needs improvement for better herd health management. Unlike the vaccination, all the farms irrespective of farm size were very conscious about the treatment management for the reproductive diseases and disorders as they have harmfull effect on farm profitability. Every farm called registered veterinarian once a cow found with abnormal vaginal discharge, and/or when a cow failed to come in estrus after three successive services.

CONCLUSION

To sum up, most of the dairy farms used visual observation method for estrus detection, artificial insemination for breeding, used rectal palpation for timely (35-40 days) pregnancy diagnosis, maintained breeding record, optimum BCS and supplemented vitamin-minerals during late pregnancy and parturition as well as used registered veterinarian for management of reproductive problems (Fig. 4). However, farmers need to maintain dry cow period, cleanliness and hygienic environment during parturition, voluntary waiting period, and vaccination against infectious reproductive diseases to ensure improved fertility of cows. In addition, application of estrus detection aids, estrus synchronization program, ultrasonography and other assays for pregnancy diagnosis can be helpful to foster the reproductive performance of cows.

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SUPPLEMENTARY MATERIALS

Supplementary material can be found via https://doi.org/10.12750/JARB.38.4.215

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