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Constraints in milk production of dairy cattle: A review

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Abstract
To maintain a good livestock enterprise with steady income, it is essential to have animals with good reproductive status. India is the leading producer of milk worldwide and contributes 23% of the global milk production. 4-5% of India's economy is accounted for by the dairy industry which directly employs a large population of rural farmers. In spite of India having a high livestock population and milk production, the productivity per animal is low. In India, the most common factors affecting the reproduction include breeding management, feeding management and reproductive health of the animal. Various reproductive disorders, delayed uterine involution, and extended calving intervals result in decreased milk production, loss in the number of calves, and increased medication costs, which ultimately results in financial loss for the dairy sector. Overcoming these constraints will result in a good return from the livestock sector. Improvement in a range of livestock services such as health care, nutrition, breeding management, pharmaceutical supply and extension services are needed in order to allow the farmer to extract the full potential from livestock.

Keywords: Breeding management, feeding, reproductive health, milk production, constraints

1. Introduction
Animal husbandry involves the rearing of different animals via genetic modification and selective breeding. Rearing livestock is a sole source of income for around 20.5 million landless and marginal farmers in India. 57.3% and 14.7% of the world's buffalo and cattle population respectively lie in India. (20th livestock Census- 2019) [12]. Animal husbandry as an occupation provides a mode for wealth creation and prosperity of the rural community. In 1970, Operation Flood, helped numerous dairy owners to increase milk output and manage the growth of their farms. India's livestock and agriculture sector contribute 4.11% and 25.6% respectively to the total GDP. India's livestock sector is one of the leading livestock sectors of the world, and contributes about 11.6% of the world's livestock population. As per the 20th livestock census, India has 535.78 million livestock heads, which showed an increase of 4.6% over livestock census-2012. The total milch animals including cows and buffaloes are 125.34 million and shows a 6% increase from the previous census.

Production of milk and milk products are of great importance to the dairy farmers. Dairy industry contributes about 25% of India's agriculture and allied sectors GDP (Agriculture Today 2022). India accounts for 23% of worldwide milk production and ranks first worldwide. The government of India has taken several measures such as the Rashtriya Gokul Mission to increase the productivity of livestock. The milk production during 2019-20 was 198.44 million tonnes and 209.96 in 2020-21, showing a 6% annual growth rate. Per capita milk availability is around 427gms/day (Economic Survey report). As per CES, 2011-12 of NSSO, 78% of rural and 85% of urban population consumed milk. A significant demand for milk however still exists and this demand is expected to rise by 2030. 96% of milk in India is produced by cattle and buffaloes. Of this, 35% is contributed by buffaloes, 27% by cross bred cattle, 10% by indigenous and 11% by non-descript cattle. (GOI, Ministry of Fisheries, A.H and Dairying 2019) [12].

In spite of India having a high livestock population and milk production, the amount of milk produced per animal is low. When compared to the global average of 2238kg/year, Indian milch animals are producing only 1538kg/year. (Vijay *et. al.*, 2018) [36]. There are many constraints which do not allow the potential of milch animals be achieved.

2. Major Constraints which cause a decrease in milk production

Livestock farming is an integral part of agriculture and has the potential to improve the economic condition of marginal and small farmers, playing an extensive part in the socioeconomic growth of the rural household.

India's productivity per animal is very low due to various reasons such as neglected management, shortage of feed and fodder, lack of guidance to farmers and limited accessibility of livestock extension services. Bhoite and Shinde in 1987 [3], described the major constraints in livestock milk production to be Breeding, feeding and animal health practices.

- Breeding management
- Feeding management
- Reproductive health

3. Breeding management

Farmers faced major constraints in the rearing of milch animals, including infertility, a problem with high genetic merit bulls, a low rate of conception through artificial insemination, inability to bring the animal to the AI centre/ Hospital and non- availability of AI facilities.

A heifer or cow is referred to be a repeat breeder if it has failed to conceive for thrice or more back-to-back services. Repeat breeding has a negative impact on dairy farmer profitability because calving intervals are increasing, requiring farmers to incur additional feeding, treatment, and breeding costs. Research shows, that 64% of farmers who use artificial insemination have found that crossbreed and exotic cattle frequently suffer from repeat breeding due to low conception rates. As a result, the loss of one calf and longer calving intervals have a negative effect on total profitability (Sharma *et.al*., 2021) [31]. According to a study by, there is an insufficient availability of semen production centres, and frozen semen banks. Due to this lack of infrastructure and low success rate of AIs, only 20% of adult females are being artificially inseminated.

Another major challenge faced by the livestock sector is the low milk productivity particularly in indigenous cattle whose average milk yield per cattle per day is 3.85kg, while it is 11.67kg per animal per day for exotic breeds and 7.85kg for cross bred animals, as per DAHD Annual report for 2019-20. This average milk yield is much lower when compared to cattle of other parts of the world such as United States whose animals produce 33kg/day, Israel (40.08kg/day), United Kingdom (26.67kg/day) and European union (25.03kg/day).

4. Feeding management

Dairy farmers face a huge challenge to ensure the availability various feed stuffs to their livestock according to a study conducted by Sharma *et al*., in 2021 [31]. This study concluded that green fodder was not available to about 46% of dairy farmers during summer and winter seasons in the study area. About 38% of dairy farmers find difficulties in managing dry fodder specially during rainy season due to poor resources, excessive rains in the neighbouring states from where they were purchasing dry fodder.

Currently the country faces a great deficit of fodder. There is estimated to be a 35.6% deficit of green fodder, 10.95% deficit of dry fodder and 44% deficit of concentrate feed materials in India. (IGFRI Vision, 2050) [13]. Unavailability of green and dry fodder in Punjab alone was estimated to be 50% and 40% respectively, according to a study conducted by Dhindsa, in 2014 [10]. It is predicted that with the current rate of expansion in forage supplies, by 2050, India will experience a 18.4% deficiency in green fodder and 13.2% deficit of dry fodder. To meet this deficit the green fodder supply must increase by 1.69% per annum. Due to competition for the use of cultivable land for projects other than cultivation, an increase in the area of land used for cultivation of fodder crops is not viable. The total amount of cultivated land used for fodder production is only 4% (8.4 million ha) of the total cultivated land and this has remained consistent for the past few decades. (Dagar, 2017 ; Meena *et al*., 2018) [7, 22]. It is therefore essential to increase the productivity of the fodder crops on the same land so as to meet the country's deficit of fodder. (Dahiya and Kharb, 2003; Vijay *et al*., 2018) [8, 36].

Two-thirds of an animals' total cost of production accounts for purchase of feed and fodder (Ginwal *et al*., 2019) [11]. In Nagpur, 56.6 percent of dairy stockholders reported a lack of funds and an inability to find a low-cost concentrate mix for their animal (Patil A. P., 2009) [27]. Efforts need to be made to increase the availability of feed and fodder which will help in reducing the feed cost to the farmers (Ginwal *et al*., 2019) [11].

Estrus cyclicity is highly dependent on nutrition, and intake of low protein adversely affects the reproduction system and disturbs estrus cyclicity (Tomar and Arora, 1982) [35]. Low protein diet resulted in a prolonged post-parturient anoestrus period and increased number of services per conception as per a study conducted by Kaur and Arora in 1982 [16].

Dairy farmers are unaware of latest advancements in the field of animal nutrition, particularly in enhanced utilization of prevailing feed resources, augmentation of roughage-based diets, feeding of mineral mixture, common salt for enhancing the animal's milk production and reproductive health.

This lack of knowledge of the nutritional parameters of livestock feeding, results in the farmers providing a diet that is deficient in protein and various essential vitamins and minerals. This is one of the major causes of health problems such as malnutrition, various metabolic diseases and other vitamin and mineral deficiency-related diseases in livestock.

5. Reproductive health

Silent heat detection in buffaloes is a challenge that farmers commonly face. This problem which has an adverse effect on the farms' ability to produce one calf each year. There have been various advancements in the methods of heat detection in dairy animals.

Reproductive disorders in cattle consist of various conditions such as dystocia, retained fetal membranes, endometritis, metritis etc.

5.1 Dystocia: Refers to a prolonged or difficult labor in which the second stage of parturition is prolonged for more than 6 hours leading to the dam requiring assistance.

5.2 Endometritis: Refers to the mild chronic infection of the uterus characterized endometrial inflammation and reddish brown, white to yellow mucopurulent vaginal discharge.

5.3 Retained fetal membrane: When a cow fails to discharge her foetal membrane within 12 hours post parturition, the condition is known as retained foetal membranes (RFM).

According to a study conducted in Fateh sahib, Punjab, 77.91 and 81.32 percent of cows and buffaloes, respectively, had various reproductive abnormalities. (2014) (Dhindsa, 2014) [10]. For over 44% of dairy farmers, dealing with different

reproductive problems like retention of placenta (ROP), pyometra, trichomoniasis, endometritis, metritis, early deaths and late abortions, and dystocia was a serious hurdle, and these conditions negatively impact the nation's dairy industry.

6. Conclusion and Recommendations

Constraints refer to the difficulties faced by farmers while rearing milch animals and marketing their products for their dairy enterprise. Overcoming various constraints faced by farmers in the dairy industry is essential in order to improve reproductive health and milk production in animals. This would in turn result in increased profitability from the dairy sector and positively contribute to the nations GDP. Accurate management of cattle breeding, feeding and reproductive health is essential to deal with these various constraints faced by dairy farmers.

Artificial intelligence can be employed to monitor breeding programmes and track the progress of livestock. Various innovations in heat detection should be employed so that animals are inseminated at the right time which would improve conception rates. Sex sorting technology (use of sexed semen) and Embryo transfer technology can be adopted to produce more female calves. Programmes should be implemented for the conservation of indigenous breeds, as this will result in a population of hardy animals that can withstand the nations extreme climatic conditions unlike the exotic and crossbred animals. Farmers should be encouraged to take up buffalo rearing as they are better adapted to Indian climate, and since there is no ban on the slaughter of buffalo, they do not contribute to the rising stray cattle population which is proving to be a major issue in the country.

NDDB has developed INDUCHIP for cattle and BUFFCHIP for buffalo for estimating the breeding values and production potential of young bull calves and heifers for their early selection. NDDB has proposed distribution of bulls for semen production on the basis of genetic merit.

Efforts are to be made to increase the productivity of cultivated fodder crops in order to meet the country's requirement. Vertical expansion of arable lands, using non-arable land for pasture, and improving seed quality are some of means by which India can meet it's fodder demand (Dahiya and Kharb, 2003; Vijay *et al.*, 2018) [8, 36]. Alternative sources of feed should be explored like Azolla and hydroponic fodder production. Hydroponic fodder production involves growing of plants in a nutrient rich solution without soil for a short period of time in a greenhouse. Fodder that is hydroponically grown, grows upto 50% faster offering higher yields of fodder of better quality making it an eco-friendly and cost-effective method of fodder production (Kide *et al.*, 2015) [17]. This fodder is more nutritious, digestible and palatable than fodder that is traditionally grown. Fresh hydroponic fodder of 5-10kg per cow is advised as a supplement (Kumar, *et al.*, 2018) [20]. Azolla is recognised as a good source of protein, especially lysine, macronutrients such as calcium, magnesium, potassium and vitamins A and B12 (Leterme *et al.*, 2010) [21]. Azolla has been reported to increase milk production by 5-10% (Katole *et al.*, 2017) [15], and has proved to be one of the most economical livestock feed substitutes (Jain *et al*., 2019) [15]. The shortage of dry fodder in India can be addressed by efficient utilization of resources such as crop residues which are usually burned. New, innovative technology can be applied to improve palatability and nutritive value of these crop residues. Farmers should be made aware of the best wat to use rice and wheat straw to improve animal production and thereby close the demand-supply gap of dry fodder in India.

Various extension activities should be employed to teach farmers the importance of a balanced diet and supplementation of various vitamins and minerals. An animal's reproductive health is highly dependent on the availability of minerals in the diet. An excess or deficiency of minerals has been shown to affect reproduction. Minerals have a beneficial role in resuming the follicular activity and improving fertility in dairy animals. Therefore, a in order to avoid the chances of reproductive failure and other reproductive disorders adequate supplementation of minerals to the animals is required. Diets containing adequate protein according to the metabolic needs of the individual animals are also to be fed as low protein intake has been shown to decrease estrus cyclicity. National Dairy Developmental Board (NDDB) has initiated Ration Balancing Programme to educate farmers on balanced feeding of dairy animals. This programme has developed software that is compatible with various electronic devices such as mobile/laptop with whose help a balanced feed ration is formulated as per the animal's profile. (https://www.nddb.coop/information/ stats)

Total mix ration is more effective method of providing nutrients to dairy animals. Dry TMR has proved to be economical, has a long shelf life and is easily customisable to the animal's metabolic needs.

Routine examination of cows is essential during the pre and postpartum period, as most cows acquire reproductive problems during these periods. Strategic control measures for reproductive problems need to be formulated, including health education about the disease transmission, in order to reduce the incidence of reproductive disorders in the livestock population. Farmers should be educated appropriate farm management and animal care and on various hygienic practices that can be practiced to decrease the incidence of reproductive diseases in their farm. Cattle should be screened on a regular basis by a veterinarian for early detection and control of various diseases such as mastitis, brucellosis, and other disorders of the reproductive system that would cause a reduction in milk production.

Department of Animal Husbandry and Dairying (DAHD) has initiated veterinary services delivery at farmers' doorsteps through Mobile Veterinary Units. Around 4500 MVUs have been provided to the states which would aid in providing suitable veterinary care to animals.

In conclusion, a range of livestock services such as health care, nutrition, breeding management, pharmaceutical supply and extension services are needed in order to allow the farmer to extract the full potential from livestock.

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