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Original Article**Factors affecting milk yield in dairy animals****D. M. Golher^{1*}, M. I. Syed² and M.R. Thul³**¹*Assistant Commissioner of Animal Husbandry and Dairying, AHD, Latur-413512(Maharashtra)*²*Dr. Syed Mohsin Syed Iqbal LDO, WATUR Ta. Mantha Dist. Jalna AHD, Maharashtra*³*Dr. Mayur Raju Thul, LDO, Karanja Ghadage Ta. Karanja Ghadage Dist. Wardha, AHD, Maharashtra***Corresponding Author: golherdurgesh17@gmail.com**Received: 26/09/2026**Accepted on: 02/10/2026***ABSTRACT**

Dairy animals are the economic backbone of milk production globally, with countries like India contributing over 25% of the world's total output. While the natural life expectancy of dairy cattle is around 20 years, physiological wear and tear, escalating veterinary costs, and declining reproductive efficiency limit their economically viable productive lifespan. This article examines the critical biological, genetic, and managemental factors that directly or indirectly influence milk yield in lactating dairy animals. Key parameters analyzed include the dry period—ideally 42–60 days for cows and 60–200 days for buffaloes—which is essential for mammary epithelium regeneration. Yield variations are heavily dictated by age and body weight at calving, showing a 30–40% increase up to the 3rd and 4th lactations before progressively declining. Furthermore, gestation restricts milk yield due to nutrient partitioning toward the growing fetus in the final trimester, while complex endocrine mechanisms, primarily governed by Growth Hormone (GH), Prolactin, and Cortisol, regulate cell population and metabolic pathways. Chronic stressors trigger the hypothalamic-pituitary-adrenal (HPA) axis, elevating Cortisol and reducing output by up to 50%. Understanding and optimizing these multi-faceted interactions is essential for dairy managers to maximize herd longevity and sustainable lifetime milk production. Balancing the dry period is vital; shortening it reduces subsequent production by 10–25%, while overextending it penalizes lifetime yields. Dairy animals achieve peak performance between their 3rd and 4th lactations, remaining profitable up to 5–7 lactations before age-related cell attrition declines output. Hormonal synergy between GH and Prolactin accounts for up to 85% of milk production capacity, whereas chronic stress and elevated Cortisol compromise cell survival and reduce yields by half. Dairy managers must actively mitigate physiological and environmental stressors to avoid premature culling of heavy, high-yielding animals. This text provides a thorough overview of biological, genetic, and stress-related pathways, but it lacks detailed field data on the remaining operational factors. Future expansions should systematically evaluate the impact of nutrition, milking intervals, ambient heat indices, and mastitis management to deliver a comprehensive, multi-factorial framework for modern dairy systems.

INTRODUCTION

Dairy animals are the backbone of milk production in developing countries. The dairy industry itself employed more than 80 million peoples across the country. India alone contributes more than 25 % of worlds total milk production in 2023-24 (Export Import Data, 2024). The normal life expectancy of dairy cattle is about 20 years (De Vries and Marcondes, 2020). Moreover their entire life on dairy farm is economically not viable due to wear and tear in their reproduction, production, and overall health of these dairy animals. On the other hand, annual veterinary cost per cow increased by an average of \$ 5 each lactation (Groenendaal et al., 2004). Therefore, dairy cows are used for milk production during their most economic and productive periods. Yield of the milk may be influenced many factors during the milk production. Therefore these factors can be considered while mitigating their effect on lactating dairy animals. These several factors which are listed below directly or indirectly affected the milk yield.

1. Dry period
2. Age and body weight at calving
3. Lactation number
4. Gestation
5. Genotype, Species and Breed
6. Hormones
7. Stress
8. Nutrition
9. Milking interval, milking frequency and Residual milk
10. Ambient temperature and Season of calving
11. Mastitis

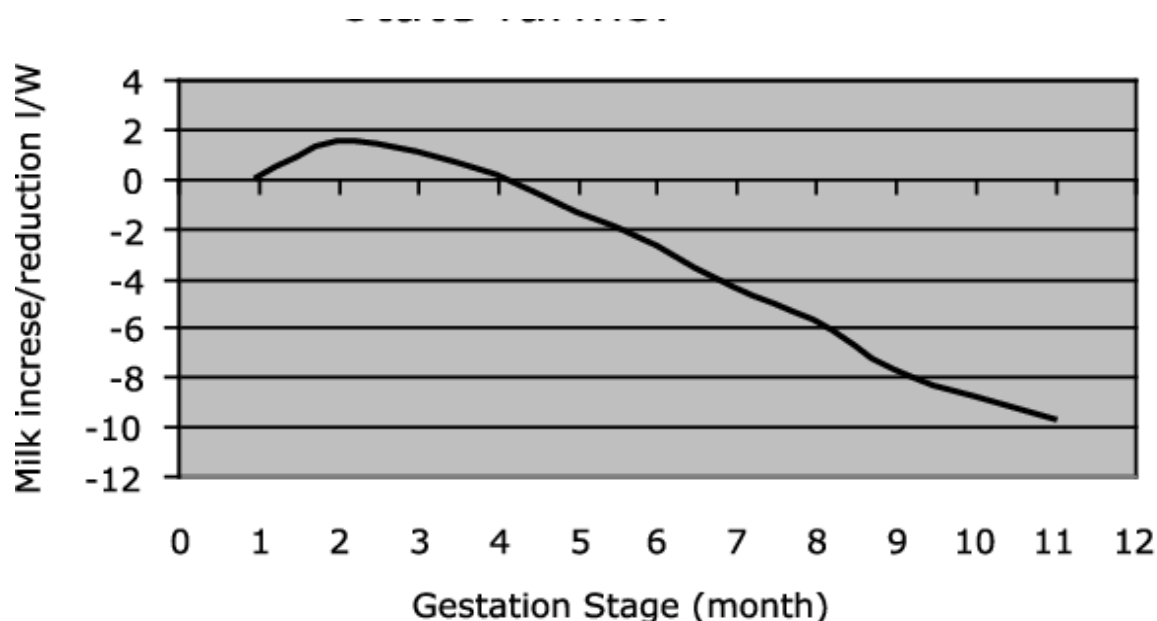
1. Dry period: The dry period ideally is around 42-60 in cows (Arnold and Becker, 1936 Boujenane, 2019) whereas in buffaloes it depends on many factors such as breed, yield, and geography; feeding etc it is around 60-200 days (Wahid, 1973). Lactating animal dry period is crucial for their entire productive life as it affect on total milk yield of the animal. Therefore it should be maintained at optimal level for obtaining best production potential of that lactating animal. As we shorten this period will lead to affect nearly 10-25 % on its production (Weber at el., 2014). In contrast if we lengthen this period the lifetime milk production decreases (Kuhn et al., 2006). We knew the milk synthesizing biological tissue require enough time to regenerate the secretory epithelium for subsequent lactation in dairy animals (Altman, 1945) for next lactation. Therefore to better understanding of dry period it gives the most production potential of these lactating animals.

2. Age and body weight at calving: Usually age defined the effect on production by influencing combining effect of multiplication, maturation of the milk producing cells in the udder of the lactating animal in subsequent lactation and decreases inversely proportional to aging after reaching the maximum level (Holodova et al., 2019). There is enormous increased up to 30-40 % in milk

production from first lactation towards 3rd and 4th lactation which is at the peak productive age of the animal later on with advancing age it decreased progressively. Generally the heavier animals producing more in his first lactation by reducing his body weight more than lighter animals (Han et al., 2021). However this high producer poses threat to culled earlier from the herd. Therefore high yielding heavier animals exposed earlier for culling and hence cumulative milk production from this animal produce less in his entire production cycle. Corroborating on age trends showed that initially it increased with age till the peak reached and later on decreased with advancement of age of the animal.

3. Lactation number: In the production life cycle of lactating animals profitable dairy farming can be economically viable lactations are differ in cattle and buffaloes because of their age of maturity, health and production are concerned. Mostly profitable dairy can be used these animals up to 5-7 lactations at most. During the journey of milk production these animals increased the milk production in early three lactations, 3rd and 4th remained stable in cattle and decreased from 5th and 6th lactations (Eski and Kurt 2020). Therefore a dairyman is really need to know about the lactation number for running profitable dairy farm.

4. Gestation: The gestation has profound effect on lactational milk yield in dairy animals. There are many factors which alter milk production during the gestation period such as growing fetus require nutrients more in the last trimester when the animals is dried off (Battaglia and Meschia 1978), a combination of hormonally mediated partitioning of nutrients away from milk production (Oltenacu et al., 1980), hormone concentrations, hormone receptors, growth factors, and binding proteins in blood; hormonal regulation of nutrient partitioning; and hormonally induced mechanisms of action within mammary cells possesses a due role in maintaining milk yield during different phased of gestation (Tucker, 2000). A brief reduction in milk yield was noticed in fig. during 3rd, 5th and 6th month of pregnancy in the animals conceiving at early, mid or late stages of lactation (Olori et al., 1997, Qureshi et al., 2016).



5. Genotype, Species and Breed: Milk production is controlled by several genes (Laodim et al., 2019). The production of milk also varies with species as it is genetically controlled and modified by their own genetic makeup and therefore there is variation among them in the production. Usually cattle produce more milk than buffaloes with low in fat while buffalo produced vice versa as compared the cattle. The best breed enhances in production over the years due to continuous selection for their specific trait of production and maximize genetic programmed to increase the milk production as with other traits.

6. Hormones: Hormones play vital role not only in production but also for persistent production of milk from lactating animals. Profoundly milk production affected by hormones like GH, Cortisol, IGF, T3, T4, insulin, estrogen, progesterone and oxytocin along with many factors. GH work with insulin-like growth factor 1 (IGF-1) and maintained milk production by maintaining cell population and their action on it. Only GH deficiency leads 15 % lower production in milk yield whereas prolactin deficiency during lactation decline it around 50% in milk yield. In combination of GH and prolactin attributes nearly 85 % lowered down in milk production (Tonner et al., 1995, Pal et al., 2019). Prolactin alone can prolong the lactation by direct influence on it. Initial normal secretion of Cortisol is necessary for development of the mammary gland but prolonged secretion of Cortisol will reduce milk production by 50 % due to chronic stress act on hypothalamic-pituitary-adrenal (HPA) by imparting action on blood flow towards the mammary gland (Ataallahi et al., 2023) which later on alter decreased the production of lactogenic and metabolic hormone which required for milk production. Cortisol interacts of receptors present within mammary gland which triggered for synthesis of milk normally made it tough for their regular milk synthesis components to work in harmony with other regulatory hormones. Sustainable high Cortisol exposure resulted into programmed cell death of mammary tissue which consequently lowered milk production by declining in number of active epithelial cells (Bomfim et al., 2022). Thyroxine act through metabolic pathway by regulating blood flow towards the mammary gland and potentiates the effect with prolactin on lactating animals. Estrogen and progesterone principally acts on mammary gland for tubule and myo-epithelial development before initiation of lactation while oxytocin come into picture during milking as it influenced let down effect in these animals.

7. Stress: There are several stressors in the life of lactating animals such as production, environment, social hierarchy, nutritional and so on. These can be coping up with HPA axis as we are already described in Cortisol action pathways in dairy animals. The stressors lowered the milk yield in the animals as to sustain for the enormous load on their physiology due to production, reproduction and environment equally disrupts their natural physiological pathway during lactation. Therefore we can be minimizing external stress from them by providing better managerial practices which ultimately not severe alterations in milk yield of these animals.

8. Nutrition: Nutrition and environment contributes approximately 70% of their production. The milk production requires each and every components of the ration at optimum as it directly influenced on milk yield and it is showed in Table. 1

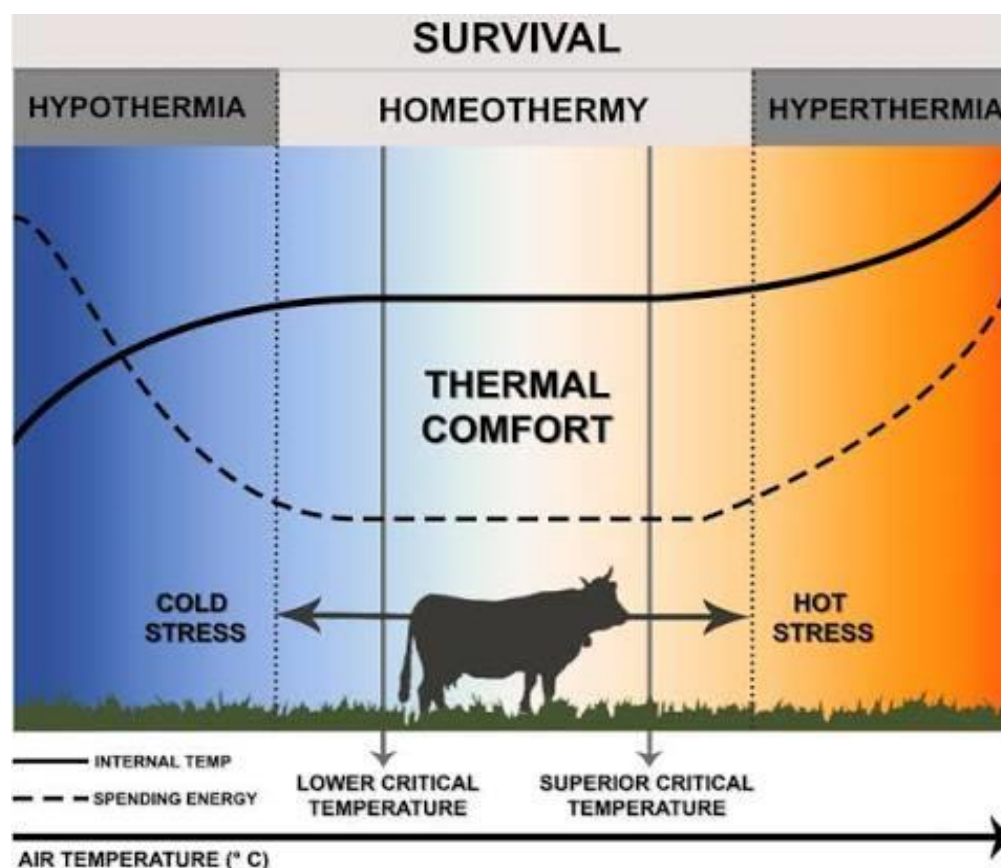
S.N.	Nutrient	Required amount	Authors
1.	Water	92-138 L/day	Murphy et al.,1983
2.	Protein (on DM) basis	RDP-10 %	NRC, 2001
3.		RUP- 5.5 to 6 %	
4	Carbohydrates on DM basis	50 % of	Erickson and Kalscheur, 2020
5.	Fat on DM basis	1 %	Erickson and Kalscheur, 2020
6.	Calcium on DM basis	0.61-1 %	NRC, 2001
7.	Phosphorous on DM basis	0.32-0.42 %	
8.	Potassium on DM basis	1.5 %	
9.	Magnesium on DM basis	0.2 %	
10.	Sodium on DM basis	0.24%	
11.	Chloride on DM basis	0.34 %	
12.	Sulphur on DM basis	0.2 %	
13.	Copper per kg of milk	0.15 mg	
14.	Iodine per 100 BW	1.5mg	
15.	Iron per kg of DM	24 mg	
16.	Mn per kg on DM basis	40 mg	
17.	Mo per kg on DM basis	10 mg	
18.	Zn per kg on DM basis	22.8 mg	
19.	Se per kg on DM basis	0.3 mg	Erickson and Kalscheur, 2020
20.	Vit. A per kg BW	110.25 IU	Ferreira and Weiss 2017
21.	Vit. D A per kg BW	30.87 IU	NRC, 2001
22.	Vit.E per day	500 IU	Erickson and Kalscheur, 2020
23.	Vit. Niacin per day	12 g	Ferreira and Weiss 2017
24.	Vit. Biotin per day	22 mg	NRC 2001
25.	Ionophores		McGuffey et al., 2017
26.	Probiotics		Uyeno et al., 2015
27.	Rumen buffers free choice basis	227 g	Erickson and Kalscheur, 2020
28.	Sodium butyrate		Rice et al ., 2019

9. Milking interval, milking frequency and Residual milk: Uneven milking interval affected milk production and its composition especially in high yielding lactating animals milking frequency

has significant effect on its production. Increased milking frequency from twice to thrice a day raised milk yield around 10-25 % and up to four times milking might be add another 8-12 % increased in high yielding animals (Damane et al.,2016). Moreover reduction in milking frequency once in a day caused loss of production about 22 % of milk and affected persistency of lactational yield in negatively (Mcnamara et al., 2008).we often discuss regarding residual milk is a milk which remain inside the udder after complete milking of the animal. Residual milk lowered down the fat as well milk synthesis in subsequent milking. Therefore it is necessary evacuate the complete udder for highest yield and quality of milk in lactating animals.

10. Ambient temperature and Season of calving:

The ambient temperature influenced direct and indirect relation on milk production. The ambient temperature on either cold or hot would create stress on physiological pathways which ultimately affect the milk synthesis in lactation animal which decreased the amount by imparting its energy to mitigate the stress effect on its own by HPA axis. Indirectly it imparted profound effect on nutritional supply and social hierarchy of theses animals through extreme climate. Therefore provide them thermo neutral zone for best lactational production depicted below adapted from (Morgan 1998).



11. Mastitis: The inflammatory and permanent changes in milk production unit caused production loss in milk production in lactating animals. There is enough loss during early 2 weeks of infection around 1.0-to 2.5 kg per day and nearly about 110-555 kg over the entire lactation cycle (Rajala-Schultz et al., 1999). After occurrence of mastitis to theses productive animals

could not reached their actual production during their later entire lactation. So we need to control the infection for getting highest production from these animals.

CONCLUSION

Maximizing dairy profitability requires transitioning from a focus on short-term high production to cumulative lifetime efficiency. These factors consider at the time of lactational yield and managed accordingly for excellent production from them. Dairy managers must actively mitigate physiological and environmental stressors to avoid premature culling of heavy, high-yielding animals.

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