

## A Review on Factors Hindering the Milk Production of Dairy Animals in India

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### Abstract

Present article focuses on the challenges of Indian dairy sector and underlines factors hindering the milk production potential of dairy animals. Dairy sector in India plays crucial role in nutritional security, livelihood and sustainable development of the economy. Despite having largest population of livestock we are lagging far behind in terms of per animal productivity than other developed nation's viz. Israel and USA. There the milk production dairy animal is 10 times higher than India dairy animals. The key factors which are linked with lower milk yield of indigenous animals can be divided into physiological and environmental factors. Under physiological factors come the genetic potential, parity and frequency of milking. Due to absence of scientific breeding in large population of dairy animals and poor feed availability to the animal having good genetic potential, milk production remained lower. Frequency of milk has significant effect on milk yield, two times a day milking increases the milk production by 40% and three times a day milking further increase by 20 but at the same time increase the chances of mastitis. Parity or number of calving also has a direct effect over milk yield as calving number of calving ascends it leads to the development of milk secreting cells but only up-to 4<sup>th</sup>-5<sup>th</sup> of lactation then gradually decreases. In Indian conditions dairy farmers keep their animal for milk production even up-to 10-14 lactations. Among, environmental factors and that are greatly controlled by farmer comes managemental practices, under this thermal stress is the main factor that affects the animal most and have effect over milk yield. Lower milk production affects the individual farmer economic growth and country economy.

**Keywords:** Indian Dairy Sector; Milk Production; Physiological and Environmental Factors Affecting Milk Production

### Abbreviations

LL: Lactation Length; DP: Dry Period; THI: Temperature Humidity Index; TIM: Test Interval Method; GDP: Gross Domestic Production; E2: Estrogen; P4: Progesterone; AMS: Automatic Milking System; MY: Milk Yield

### Introduction

Dairy sector in India has been an important part of agriculture sector and milk is the commodity contributes highest to GDP than any other agricultural commodity. Dairy animals plays significant role in the nutritional security and livelihood of small and margin-

al farmers. Livestock sector in total provides employment for more than 1.3 billion people and contributes around 40% in the world's agricultural Gross Domestic Product (GDP). In India Buffalo is the major dairy animal in India as they contribute approximately 50% of the total milk produced in the country. India is the leading producer and consumer of milk across the globe but at the same time 75% of Indian dairy sector is typically unorganized (75%). Although, the proportion is decreasing as a result of rural-urban migration. Among the allied activities of agriculture, dairying has assumed greater importance in India due to its simple nature in generating additional employment and income for individual farm-

ers and plays important role in country GDP. India accounts for one sixth of cattle and half of buffalo population. Keeping and managing animals for milk production involves several management processes. The factors that affect production of milk are feeding, breeding and management of animals, age at first calving, season of calving, advancement of lactation, number of lactations, age of the animal etc. For improving the productivity of a dairy animal, it is essential that we develop an understanding of the factors affecting its milk yield. Milk production and milking or lactation length are two important parameters in dairy animals that depend on both genetic and non-genetic factors. Genetic improvement can be brought about by the selecting superior dairy animals in term of productivity. The non-genetic factors such as management, feed and fodder availability, season etc. also control milk yield and lactation length, and require to be assessed in a production set up. In order to enhance productivity of a dairy animal, it is necessary to develop an understanding of the factors affecting its milk production [1].

### Factors affecting milk yield in dairy animals

There are two main or key factors that hinder the milk production potential of physiological factors and environmental factors. Under physiological factors comes genetic factors [2], frequency of milking, parity or number of calving completed. Under the environmental factors- comes the climatic factor, season of calving, nutritional factor, managemental factors. The farmers keeping the animals have hardly any control over physiological factors but to some extent control over the environmental factors. So throughout understanding of dairy cattle have advantage in managing animals and maximizing the milk yield of animal. so "Extension education is must" and educate the farmers about the conventional rearing of animals and resolving the myths and provide best knowledge at scientific base that is going on nowadays. that will maximize their milk yield indirectly their economy and finally increasing the country economy and GDP. Under normal circumstance milk yield keep of increasing during first 6 wk of lactation. And then gradually decreases number of lactation has also a significant effect over the milk yield. But the actual amount of milk produced during the lactation affected by several underline factors.

Species of the animal \*Breed of the animal \*Individuality of the animal \*length of dry period \*parity/age of animal \*Body weight of the animal \*No. of lactation that animal has \*Animal is pregnant or not \*Season of calving \*Temperature and humidity of the environment \*Feed supply and water availability to the animal \*Milk-

ing intervals \*Milking frequency \*stress due to any condition \*hormones of the animal \*diseased condition of animal [mainly Mastitis] \*antibiotic abuse in diseased animal leads to future resistant \*Bad management practices can also decrease milk yield like poor milking technique.

### Physiological factors affecting MY

#### Breed and parity of the animal

The order of milk production potential in India is Exotic breed > cross breed> milch breed> dual purpose breed. Cow produces more milk than buffalo but buffalo yield more milk than pure indigenous cattle breeds. Generally but in present day market protein and fat content are important factors playing role. people are more concern about quality of milk than quantity. so in cow also Breed of the animal play major role. lactation length are different for different breeds. some superior breeds have higher gestation length hence their milk yield will be different. some indigenous breeds are good in resistant power against pathogens and disease. foreign breeds have higher milk yield but their resistant power is less as compare to indigenous so more prone to pathogens. pathogens decrease milk yield of total gestation length. Foreign breeds like Holstein Friesian, brown swiss yield more milk in total lactation length than indigenous. HF breed producing 25-30 L of milk per day they are native of "European union" and Switzerland respectively as their lactation length is shorter than indigenous breeds [like indigenous breed haryana milk yield is 1100 L/lactation] while milch breed such as "RED SINDHI" producing 1135-2600 L/lactation. but their milk yield is larger Lactation length is around = 260 days. These breeds are nowadays genetically modified by Israel and boost their milk availability and cull non productive and underproductive animals indigenous breeds have lactation length of around = 305 days but milk yield is comparatively on lesser side. So nowadays cross breeds are playing major role in our market that are having more resistant power and comparatively larger milk yield in their respective lactation length called as "Bos Taurus" like karan swiss, karan fries breeds. they are having shorter calving interval and increased productivity and more resistant to environmental conditions. it is important for satisfying the increasing demand day by day and to meet "per capita availability [3].

#### Individuality of the animal

Milk yield is also different for different animal irrespective of same species and same breed pool. Mainly depend upon body condition of that particular animal it's fat percentage and it's metabo-

lism, its rumen flora activity, and over managemental factors also like if animal is deworm time to time or not, frequently exposed to mastitis or not and as we know buffalo has no sweat glands so depends can't control body temperature so in that case time to time bathing is must. A cow secrete milk daily up-to 8% of its body weight so nutritional factor also play a great role, amount of concentrate given etc. animal is furious or not is also important factor like if handler changes milk yield is same as of its original or not.

### Effect of dry period on milk yield

In terms of milk production, the dry period (DP) is a non-productive time. In addition, the risk of mastitis increases. Dairy cows are generally dried of generally 2 months before parturition that differ in different animals. Here the important factor this rest period is necessary to maximize the milk yield in subsequent lactation. This dry period should not be too short otherwise milk yield is reduced in subsequent lactation. But it doesn't means that longer dry period leads to higher milk yield. Dry period more than 60 days may not significantly increase milk yield. When dry period is less than 40- days milk yield decrease by 25-30%. And longer dry period also decrease annual milk production as the inter calving interval is increased as it may go beyond 13-14 months and finally less milk yield at the end and economic loss to the farmer. Positive effects of shortening the DP on the reproductive performance were shown in several studies. The quality of the colostrum is also unaffected but if there is no drying off, the colostrum will be diluted [4].

### Age and body weight at calving

As we know amount of milk produced by animal increases with advancement of lactation due to increase in body weight and advancement in digestion as the digestive system and ruminal microflora grows with the time. and the udder size also increases with advancement of lactation so indirectly no. of secretory alveoli also increases in number so more milk is produced and increased amount of hormone is also their leads to more milk production. effect of recurring pregnancy also their and studies are going on these days over this. According to studies recurring pregnancy and lactation result in 30% increase in milk production from first to fifth lactation. And 20% increase in milk production due to body weight factor.

### Effect of lactation number over milk yield

As we know milk production increases with advancement of lactation number and it will become maximize in 4<sup>th</sup>-5<sup>th</sup> lactation.

This is due to development of udder and increase in its size due to increase in number of alveoli and body conformation also increases. And according to some studies we can also calculate maximum milk yield that can be achieved by individual animal.

- Milk yield in first lactation x 1.3 = possible milk yield in 4<sup>th</sup>-5<sup>th</sup> lactation
- Example- a cow milk yield in first lactation 1300kg then possible maximum yield in 4<sup>th</sup>-5<sup>th</sup> lactation can be  $1300 \times 1.3 = 1690$ .

### Effect of pregnancy over milk yield

Pregnancy has n always inhibitory effect over milk yield and most of the reduction in milk yield occur commonly after 5<sup>th</sup> month of pregnancy and before that there is very significant loss in milk yield and by the 8<sup>th</sup> month of pregnancy there is 20% loss in milk yield as compare to milk yield that is achieved 40-60 day after the previous gestation and according to some research going on, this pregnancy inhibitory is not due to the increased fetal requirement [3<sup>rd</sup> trimester] and due to studies increase in estrogen [E2] and elevated progesterone [P4] has inhibitory effect over the milk yield. Progesterone inhibit milk yield by inhibiting [alpha-lact albumin]. Cows with greater milk yield during early lactation have longer days open, and longer days open increases the subsequent yield. Longer day open in the previous lactation positively affect test-day milk and component yields. Cows with longer previous days open have greater milk yield in the subsequent lactation because they had more time to renew body fat yield that is used in the next lactation [5].

### Effect of season of calving on milk yield

This is likely due to interaction between day light and ambient temperature but this difference due to season is not much of significance if good feeding and better management is done in summer there is a down fall in milk yield and by late fall to spring season there is 8% inclination in milk yield.

The test interval method (TIM) can be used to calculate cumulative yields from test-day yields by linear interpolation. This method is, however, limited by its dependence on the intervals between the test-days and failure to take the pattern of production around the peak yield into account. For example, if the first two tests are taken before and after peak yield for a non-persistent cow, the mean yield in that interval, obtained by linear interpolation, will be lower than

the actual mean yield, resulting in a lower cumulative yield. With interpolation using the standard lactation curves, individual lactation curves are calculated for each cow. The individual lactation curves are based on derived daily yields on set fixed days-in-milk in addition to measured daily yields. The fixed days-in-milk are chosen at intervals of 20 days with the first on lactation day 10. This ensures that there are at least 15 test-day yields at intervals of at most 20 days for deriving each cow's lactation curve. The yield for each of the fixed test-days-in-milk is derived by interpolation from surrounding records for the fixed days before the last test. Yields on fixed days before the first test and after the last test are predicted. Standard lactation curves apply as a guide for the derivation of the daily yields on the fixed days. Therefore, to ensure that all cows had yields on the same test-days for subsequent analyses, daily milk, butterfat and protein yields were predicted for fixed days-in-milk for all cows not having an observed yield on that specific test-day. Yields were therefore predicted from day 10 to day 290 with 20 day intervals. Daily yields for those fixed days before the first test and after the last test were estimated by fitting a lactation curve function to the available test-day records of each cow. Lactations without test-day records after 230 days-in-milk were deleted.

#### Effect of temperature and humidity over milk yield

Mainly there is no effect on milk yield of these parameters when animal kept under good condition and best managerial practices are applied mainly it is a breed dependent phenomenon. Like Holstein and other larger breeds are more tolerant to lower temperatures and particularly small breeds like jersey are more tolerant to higher temperature. Optimum temperature of Holstein is about 10 degree and when it exceed over 27 degrees the milk production is significantly loss and this decrease in milk yield is a indirect phenomenon because with increase in temperature their I less feed intake by HF so decreased milk yield. Particularly, harmful due to peak of lactation and affect more those animals that are high milk producing [6].

A Cow was examined by comparing weekly milk production and Temperature-Humidity Index (THI) values over a two-year period. Production during weeks with relatively high THI values (70 or over) was higher than production in weeks with lower temperature-humidity stress. In autumn and winter when THI values were low, the quantity and quality of pasture available was inadequate to sustain high levels of milk production. Short-term (weekly) responses of milk output to changes in temperature-humidity condi-

tions above THI values of 70 were not consistent, either in terms of the direction or magnitude of production change. THI values may not have been high enough to adversely affect week-to-week production from predominantly Jersey herds, although some depression in lactation yields may have occurred. The reduction in digestibility and palatability of grasses during late summer appeared to be of greater importance in influencing production patterns than the direct effects of stressful temperature-humidity conditions on cows.

#### Effect of diseased condition over milk yield [Mastitis]

The most important disease that affect the milk yield of dairy cow is [Mastitis]. It destroy the secretory tissue or impair the ability of secretory tissue and the main point of concern here is that the decreased production of milk persist for a long time even after disappearance of clinical sign due to massive destruction to the secretory tissue. A general problem with previous research on the effect of diseases on milk yield is that the focus has been on the entire 305-d lactation curve. The 305-d milk yield cannot capture short-term fluctuations and drops in milk yield. Cows with mastitis are often higher yielding cows, and they yield more milk, even having contracted the disease, than do their healthy and generally lower yielding herd mates.

Disease occurrence was expressed as lactation incidence risk (LIR), which was calculated by dividing the number of cows with at least one episode of mastitis by the total number of cows at risk and multiplied by 100 (as it was presented as a percentage). Only the first occurrence of mastitis was considered in this study; later cases of mastitis were ignored.

#### Environmental factors affecting milk yield

##### Feed and water supply effect on milk yield

Inadequate feed nutrient limit the milk yield. [Galactoposis] is closely related to adequate feed intake by lactating animal. The most dramatic effect is brought about by the shortage of water because there is no means of storing water in cow withholding supply of water and unavailable to animal for few hours drastically reduce the milk yield.

A herd of lactating Holstein Friesian cows was divided into two equal groups. After 14 days during which all the cows had free access to water one group (restricted) was allowed only 50 per cent of the voluntary water intake of the other group (control). After

four days when the experiment was terminated, the milk yield of the restricted group had fallen to 74 per cent of that of the control group and their mean body-weight was reduced by 14 per cent. In the restricted group there were significant increases in the concentrations of urea, sodium, total protein and copper in serum, in the osmolality of serum, in the plasma activities of the enzymes [creatinase kinase] and [glutamate-oxaloacetate transaminase] and in the packed cell volume of blood. The restricted cows behaved very aggressively around their water trough and spent more time in its vicinity. They spent less time lying down than the cows of the control group and some of them were not seen to drink and were withdrawn from the experiment before the end of four days. In a second experiment half the herd was allowed approximately 90 per cent of the water intake of the control group for 14 days. Decreases in milk yield and body-weight.

#### Effect of milking interval and technique over milk yield

Most commonly cows are usually milked at equal intervals of 12 hr X 2 times a day. And those cows which are milked at unequal intervals or by different handler over different time have reduced milk yield. And this reduction in milk yield is more predominant in high producing cows compare to low producing once. And incomplete milking at unequal interval can permanently decreased milk yield for that entire lactation. and milking incompletely can also leads to some pathological conditions such as [Mastitis] which will also decrease milk yield due to in continuous high milk production. And wrong milking techniques also ply important role in that such as using of [Knucling] technique can damage teat and discontinued milk production. Milking time for most cows is 5- 6 minutes and it should not be less than it. And for good managemental animal not allowed to sit on ground at least 30-40 minutes prior to milking as in that time teat canal is open and pathogens can gain entry at this time and damage udder and finally decreased milk yield. Nowadays to ensure the milking frequency AMS [Automatic milking system] used. This technique is now extensively using in European countries to enhance milking so we have to use it in India also on a large scale level 38,000 units of AMS are sold and are in practice currently worldwide.

#### Advantage of using AMS

The main advantage of automated milking is to establish the frequency of milking, depending on the physiological state and milk production. There is abundant evidence that the rate of milk secretion is directly correlated with milking frequency, as a result of

the mechanisms related to the local control of milk secretion. Long intervals between milkings have been reported to decrease mammary blood flow and down regulate the ability of udder to extract nutrients from the blood.

#### Effect of milking frequency on milk yield

Usually milks twice a day. and the cow which is milk once a day yield 40% less milk than cow milking twice a day. And further increasing milking frequency by 3-times a day increases milk yield by [5-20%] more but chances of damaging teat and mastitis increases. This increase is predominantly for 1<sup>st</sup> lactating cow than older once.

#### Reasons for Increase Milk Yield if frequency Increases are

- Less intra mammary pressure generated with frequent milking.
- Increased stimulation of hormone activity necessary for the milk production.
- Less negative feedback of secretory cells due to accumulation of milk components in secretory cells. But there are several problems associated with 3X milking in a day these are as follows.
- It may increase the incidence of mastitis as the as the cow get exposed to the milking machine more often [AMS] or in individual milking also the duration for which the teat canal remain open is more so chance of pathogen entry increases.
- Never advisable practice poor manage herds as it can aggravates the present condition also.
- The managemental cost will be more because regular sanitation and disinfection of machine is necessary.

#### Effect of stress on milk yield [heat stress]

Heat stress exerts a substantial effect on dairy production. The temperature and humidity index (THI) is widely used to assess heat stress in dairy operations. Herein, we review the effects of high temperature and humidity on body temperature, feed intake, milk production, follicle development, estrous behavior, and pregnancy in dairy cows. Analyses of the effects of THI on dairy production have shown that body temperature is an important physiological parameter in the evaluation of the health state of dairy cows. Although THI is an important environmental index and can help to infer the degree of heat stress, it does not reflect the

physiological changes experienced by dairy cows undergoing heat stress. However, the simultaneous measurement of THI and physiological indexes (e.g., body temperature) [7] would be very useful for improving dairy production. The successful development of automatic detection techniques makes it possible to combine THI with other physiological indexes (i.e., body temperature and activity), which could help us to comprehensively evaluate heat stress in dairy cows and provide important technical support to effectively prevent heat stress. This indicates that heat production increases with an increase in ambient temperature, resulting in a concomitant increase in the body temperature of the cow. However, body temperatures that exceed normal values are not ideal, and cows have been shown to decrease their feed intake and heat exchange capacity accordingly. As a result, this leads to lower milk production.

### Growth hormone on effect on milk yield

There is always a positive correlation between the amount of growth hormone and milk production by the animal. Growth hormone causes redistribution of nutrients in the body and increase the utilization and availability of nutrients towards the milk production. However, not directly involved in increasing the milk production there are some allied factors also which not directly affect the milk production but also play a major role indirectly these are as follows :- 1. Antibiotic abuse nowadays 2. Vaccination of animals 3. Continuous use of oxytocin for milk let down nowadays.

### Antibiotic abuse

In current field practices in India there is extensive abuse of antibiotic by the uneducated practitioners or in the race of getting better result by educated practitioners. Treating a case of mastitis irrespective of finding the cause by culture sensitivity using of broad spectrum or for early result use of 4<sup>th</sup> generation antibiotic can cause [resistant] animal that will further not respond to any antibiotic in future and become useless and as individual farmer loss is unbearable. Example using ceftriaxone, cefepime, salbutamol this at last destroy milk yield and animal also.

### Vaccination of animals

Vaccination temporarily decrease the milk yield but it's necessary for animal not to expose from serious pathogenic infection that can cause more severe loss in milk yield as Vaccination stimu-

lates immune system to generate memory cells responsible for immunity against specific antigen. Milk production decreased by vaccination however milk composition not changes significantly and Risk of vaccination should not exceed the chances of contracting disease and also. Drop in milk production up to 10 days along with poor conception rate and reproductive efficiency is also reported in crossbred cows and buffaloes due to vaccination[8].

### Result

The reliable result of the study is that season of calving, milking intervals, inappropriate temperature, poor managerial practices can be corrected but the physiological factors can be corrected to some extent some milk yield damaging practices are also done by farmer themselves such as abuse of antibiotics and an excessive use of oxytocin. To some extent vaccination is also reducing the milk yield but it is necessary for not heavy loss or from making animal permanently damage. At last extension education for farmers is must about managerial related issues such as not to allow animal sit for at least 30 min after milking and to educate them about new technologies too. As is TIM test when 15 day test yield is used at 20 days interval a lactation curve is drawn for day 20-day 290 and results are found for season of calving effect and for temperature and humidity effect THI [Temperature humidity index is used] AMS as used in practice nowadays decreases chance that are created by milking interval over milk yield. So new technologies are stepping in industry that will vanish the managerial related problems soon.

### Conclusion

As of now we come to know in this study is that education farmers only can exclude maximum factors related with the management so extension education plays a major role in this. In this study we see some factors can be controlled to some extent only so we resolve this genetic issue or inferior breeds due to inbreeding depressing. To enhance the milking AMS [10.8] are been used now a days to ensure complete milking is done and it will adapt according to animal milking cycle but sanitation of milking machine is must as it will be exposed to animal very frequently. And at last but not the least it is affecting our country GDP because agriculture is major contributory factor in this and under that dairy sector is most important allied field that should be considered.

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