Effects of Some Environmental Factors on Buffaloes Milk Composition

Research project

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CHAPTER ONE

INRODUCTION

Milk represents an important article in the human diet. Water buffalos are the second most common source of milk source in many countries, and the raising of water buffaloes accounts for nearly 12% of the total worldwide milk production. There are two general types of water buffalo, which are the swamp water buffalo and the river water buffalo. The river water buffalo is the type that is more suitable for milk production .In addition to the production of milk, buffaloes are also commonly used as draft animals in rural areas of developing countries. Buffalo milk constitute an important source of protein for low-income farmers, and also serve as a significant source of income for rural economies (Soysal. 2015).

Milk production is a net result of interaction of genetic potential coupled with environmental effects. The relationship between the animal and its environment determines the degree to which animal remains in thermal equilibrium with its environment (Costa *et al*. 2020). The thermal environment has a strong influence on farm animals with air temperature having primary effect, but altered by wind, precipitation, humidity and radiation. The thermal environment is a major factor that negatively affects milk production of dairy animals, especially in animals of high genetic (Pawar *et al*.2013).

The purpose of the present review was to know effects of some environmental factors on buffaloes milk composition.

CHAPTER TWO

LITERATURE REVIEW

General composition of Buffalo milk

Buffalo milk (BM) is characterized by high levels of fat, lactose, protein, casein, and ash contents. Milk fat represents the major constituent of buffalo milk with a minimum and maximum of 6.6 and 8.8 $g \cdot 100\ g^{-1}$, respectively . Lactose is the second major constituent of buffalo milk with a minimum and maximum of 4.5 and 5.2 $g \cdot 100\ g^{-1}$, respectively. Changes in the composition of BM over the years is an important index for the combined effects of environmental and genetic factors (El-Salam *et al*. 2011).

The breed of buffalo has a significant ($P \leq 0.05$) effect on the milk composition and yield traits (Misra *et al*. 2008). Lactation number. The total solids, solids not fat, lactose, and ash content increased with the increase in the number of lactation while the fat and total protein contents were not affected (Sodhi *et al*. 2008).

Feeding buffaloes on a diet containing added fats increased milk yield and fat content and, in particular, with dietary tallow (Nawaz *et al*. 2009). A positive correlation has been found between the energy content of the diet and fat, milk protein and lactose contents of BM.

Buffalo milk vs. cow's milk

Both buffalo and cow's milk are highly nutritious and provide a great amount of vitamins and minerals, but buffalo milk packs more nutrients and calories per serving. Below is a comparison between 1 cup (244 ml) of buffalo and whole cow's milk (Sarwar *et al*. 2009).

Table.1. Buffalo and Cow milk comparisons

	Buffalo milk	**Whole cow's milk**
Calories	237	149
Water	83%	88%
Carbs	12 grams	12 grams
Protein	9 grams	8 grams
Fat	17 grams	8 grams
Lactose	13 grams	11 grams
Calcium	32% of the Daily Value (DV)	21% of the DV

Buffalo milk has more protein, fat, and lactose than whole cow's milk. Consuming milk with higher protein content increases your feelings of fullness. Buffalo milk also has more vitamins and minerals. It provides 41% of the DV for phosphorus, 32% of the DV for calcium, 19% of the DV for magnesium, and 14% of the DV for vitamin A, compared with 29%, 21%, 6%, and 12% in cow's milk, respectively .(Tufarelli *et al*. 2008).

Effect of season on milk composition

Yadav et at. (2013) investigated a seasonal effect on milk compositions of Murrah buffaloes. They resulted that the milk yield was estimated as 8.921±0.064, 7.3324±0.068 and 7.9276±0.0845 kg during winter (January to April), hot and humid (May to August) and autumn (September to December) seasons of the year, respectively, with an overall estimated milk yield level of 8.060±0.072 kg. Level of milk yield decreased by 9% during hot and humid months due to summer stress and increased by 10.6% during winter in buffaloes(Table 2).

Ambient temperature variation during the seasonal changes from winter to summer and vice-versa is likely due to an interaction between day light and ambient temperature. Milk production declines when environmental temperature exceeds. The reduction in milk yield is largely due to drop in feed intake. This effect is pronounced in high producing animals than low producers. The effect of season on milk yield (kg) was found to be significant ($P<0.05$).

Data on fat percentage showed higher fat content with a concomitant decrease in milk yield in buffaloes. Fat percentage decreases to minimum level during winter, i.e. 7.38±0.03g% compared with 7.94±0.03g% during summer-humid months. A decreasing trend in fat percentage associated with increased milk yield suggests there is a decrease in per unit volume of milk increase. Milk protein level was 3.4±0.24 g% and 3.55±0.20 g%, respectively, in calving during summer, winter-autumn seasons. This seasonal difference is significant ($P< 0.05$). Seasonal variation in buffalo milk constituents was significant ($P< 0.05$).

Table 2. Effect of season on milk composition in

Sources		Milk constituents		
	Milk yield	Fat %	Protein %	Lactose
(Jan-April) Winter	8.921±0.064	7.383±0.032	3.533±0.373†	4.484±0.298
(May-Aug) Summer	7.332±0.068	7.944±0.033	3.439±0.239	4.434±0.360
(Sept-Dec) Autumn	7.927±0.084	7.572±0.037	3.553±0.258†	4.544±0.298

Difference in mean±Std. Error with common superscript alphabets are nonsignificant (P<0.05).

Another study investigated the seasonal effect on the buffalos mil composition. Begum *et al*.(2021) resulted that milk constituents of fat, protein and total solids were found significantly (P<0.05) higher during winter season except higher milk urea in summer season of Tarai buffalo (Table 3). Seasonal variations influences the milk constituents of Tarai buffalo milk lactose and pH of Tarai buffalo milk remains unaffected by seasonal variations. Even though, Tarai buffaloes are more heat tolerant (Manjari *et al*., 2016), it is observed that most of the milk components are affected by summer and rainy seasons. This might be due to the fact that lactating buffaloes were subjected to high hot and humid environmental stress. Environmental stress along with poor management systems together hinders the milk synthesis and its components. In addition, exposure to high light-to-dark ratio leading to a reduction in percent buffalo milk fat and protein. This is probably as a consequence of a greater secretion of prolactin in plasma during summer than in winter seasons (Sevi *et al*., 2004).

Table.3. Variations in milk constituents due to different seasons in Tarai buffaloes

Milk constituents	Winter	Spring	Summer
Fat (%)	7.88^{b}±0.07	6.82^{a}±0.07	6.44^{a}±0.06
Protein (%)	5.87^{b}±0.05	4.90^{ab}±0.02	4.61^{a}±0.02
Lactose (%)	4.49±0.01	4.59±0.01	4.51±0.02
pH	6.82±0.01	6.73±0.01	6.65±0.02

a, b, cIndicates means±SE values with different superscripts within row differed significantly (P<0.05)

Effect of environmental stress and milk production

A study of Hussain (2016) on Iraqi buffaloes(*Bubalus bubalis*) presented that environment stress had a significant effect on milk production. Buffaloes were divided into non-stressed and stressed groups. First group were categorized as non-stressed buffaloes lived freely in abundant water regions and second group categorized as stressed buffaloes and were living in limited –water sources. The results revealed that buffaloes reared in abundant water and feeding recorded a significant higher milk production than buffaloes reared under limited regions of water and feeding. The average milk production of non-stressed buffalo was 25-30 Kg/day and 10-16 Kg/day in stressed buffalo group.

Heat stress affects directly milk production in females. It occurs when there is imbalance between heat production within the body and its heat dissipation. Reduction in milk output is the principal economic loss of environmental stress in buffaloes. In fact 35% of reduced milk production is due to decreased feed intake while the remaining 65% is attributable to direct effect of heat stress (Bashir *et al*. 2015).

Table.4. milk production (Kg) in stressed and non-stressed buffaloes

Group	Total daily milk production (Kg)/buffalo	Period of milk production(days
Stressed buffaloes	10-16	200
Non-stressed buffaloes	25-30	200

CHAPTER THREE

CONCLUSIONS

in the dairy production system, desirable composition of milk may be obtained from animals of appropriate physiological, management and environmental condition. Buffalo performances are affected by seasonal variations as indicated in milk composition variations .

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