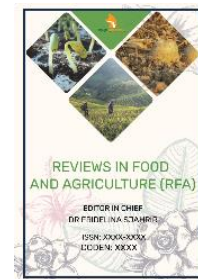


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## REVIEW ARTICLE

**A COMPREHENSIVE REVIEW ON MILK YIELD, LACTATION EFFICIENCY, MILK COMPOSITION AND MASTITIS INCIDENCE AT DIFFERENT PARITY IN MURRAH BUFFALOES**

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## ARTICLE DETAILS

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## ABSTRACT

Murrah buffaloes are the most important milch animal which has gained immense popularity due to its higher milk production capacity coupled with adaptation to wide ecological conditions and feed conversion efficiency. Milk yield, milk composition, lactation efficiency, and severity of mastitis varies with parity. The main objective of this article is to review the existing literature regarding the effect of parity on milk yield, lactation efficiency, milk composition, and mastitis in Murrah. Parity plays a crucial role in the productivity, profitability, and economic efficiency of Murrah buffaloes. Most of the researchers reported that parity has a significant effect on 305 MY, Total milk yield, milk composition while the non-significant effect on colostrums period, lactation length, and mastitis. Milk quantity and quality was superior in mid parity as compared to early and late parity. Days to reach peak milk yield, dry period, and mastitis incidence were reported minimum in mid parity. The milk of Murrah is mainly composed of water, lactose, fat, solid not fat, total solid, vitamins, minerals, casein, and protein. Milk constituents such as protein, casein, lactose were superior in mid parity except for milk fat and total solid due to reduced milk yield. However, the research paper regarding the effect of parity on most of these parameters is very scanty. So, further research should be conducted using a large sample size and wider agro-ecological zones to gain a better understanding and to obtain a more precise result.

## KEYWORDS

Parity, Milk yield, Milk composition, Mastitis, Lactation efficiency, Murrah.

## 1. INTRODUCTION

Buffaloes are the most important and indispensable component of livestock sector as it contributes remarkably towards meat production, draft power, dung for manure and fuel. There has been a significant increment in milk production from 155.5 million tonnes in 2015-16 to 165.4 million tonnes in 2016-17 accounting a growth of 6.4% (Basic Animal Husbandry Statistics, 2017). There are many indigenous breeds of buffalo among which Murrah is considered as the most superior one. Murrah is a breed of water buffalo originated in the Haryana state of India which is now distributed all over the world including Pakistan, Nepal, Philippines, Brazil, Colombia, Malaysia, Srilanka, China, Vietnam, Indonesia, and Venezuela. Indigenous buffaloes of India like Murrah, Surti, Nili-Ravi, Jafrabadi, Mehsana, e.t.c occupy 20.47% of the total livestock population and contribute 35% to total milk production in India (Surgeon and Pradesh, 2018). Murrah has a high capacity to tolerate adverse environmental conditions, resistant to diseases, and outstanding milk production. A Murrah set a new record of 26.335 kg of milk production in a single day during 5 days National Livestock Championship and Expo conducted on Jan 12, 2016 (Tribune India, n.d.). Milk production performance is an unarguably most vital consideration to determine the profitability of any farm. Murrah produces 305 MY ranging from 1371.90

± 234.47 Kg to 3409.00 ± 171.27 Kg and TMY ranging from 1474.10 ± 320.01 Kg to 3452.50 ± 186.79 Kg at different parities (Verma et al., 2017). It is crucial to develop an understanding of the factors affecting milk production, milk composition, mastitis, and lactation efficiency to increase the productivity of the milch animal.

Milk production trait is closely interlaced with parity. Several studies have shown that murrah with mid parity were superior in terms of dry period, total milk yield, milk composition, and have less incidence of mastitis (Thiruvankadan et al., 2014; Verma et al., 2017; Sarkar et al., 2015; Poudel et al., 2017). The incidence of mastitis in Murrah is very less (Jingar et al., 2014). The shape of the lactation curve is affected by parity and knowledge of the lactation curve is necessary for the estimation of total lactation yield, peak milk yield, expected time of peak production, and milk yield persistency (Anwar et al., 2009). Balanced milk composition is economically important to milk producers and dairy industries for producing better quality milk products. The milk of Murrah is mainly composed of protein, fat, water, lactose, minerals, vitamins, solid not fat, casein, and total solid which changes significantly with the change in parities (Sundaram and Harharan, 2013). Under this background, this review paper aimed to evaluate the effect of parity on Colostrums period, days to reach peak milk yield (DPYM), total milk yield (TYM), lactation

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length (LL), dry period (DP), 305 days MY, milk composition, and mastitis which remarkably influence the productivity of the Murrah buffaloes.

## 2. DISCUSSION

### 2.1 Milk Yield

Parity has influence on different milk yield traits such as 305 days milk yield, average milk yield, total milk yield (TMY), peak milk yield (PMY), first lactation milk yield (FLMY), e.t.c which ultimately determine the productivity of animals.

### 2.2 Effect of parity on 305 days milk yield

The study of LMY up to 305 days of lactation is of paramount importance as it is the most commonly used criteria for the selection of dairy animals (Thiruvankadan et al., 2014). The least mean square means of 305 milk varied from  $1371.90 \pm 234.47$  Kg to  $3409.00 \pm 171.27$  Kg at different parities in research performed (Verma et al., 2017). A group researchers found a significant effect of parity on 305 milk yield variation (Sarkar et al., 2015; Verma et al., 2017; Thiruvankadan et al., 2014). Researchers reported  $1750.91 \pm 28.62$  kg average first lactation 305-days or less milk yield in murrah with 43.31% coefficients of variation (Patil et al., 2012). Some researchers observed the highest 305 days milk yield and LMY in third to fourth parity which thereafter decreases (Thiruvankadan et al., 2014; Verma et al., 2017). 305 days milk yield and lactation milk yield obtained in first parity differed significantly than other parities according to all findings. 305 Milk yield was lowest in first parity, highest in fourth parity and optimum in third and fourth parity (Verma et al., 2017). Contrary to all these reports, the highest 305 days milk yield was observed

in fifth parity with no continuous increase or decrease over the advancement of parities (Pawar, 2012). Variation in the estimation of milk yield between all these researches might be due to sampling error, the genetic constitution of the herds, agro-climatic variations, and management conditions.

### 2.3 Effect of parity on Total milk yield

Milk Yield increases from second to fourth parity and decreases significantly in fifth parity (Yadav et al., 2013). This investigation corroborated with the report of (Thiruvankadan et al., 2014; Sundaram & Harharan, 2013; Verma et al., 2017; Hassan et al., 2017). Because they also claimed that there is an increment in milk production from first to fourth parity which afterwards decreases. However, some researchers observed that milk yield increases from first to fifth lactation, decreases in sixth lactation, and again increases in 7<sup>th</sup> lactation which may be due to maturity of mammary gland (Chaudhry, 1992). A group researchers observed least-squares means of TMY ranging from  $1474.10 \pm 320.01$  Kg to  $3452.50 \pm 186.79$  Kg (Verma et al., 2017). Most of the researchers found significant effect of parity on milk yield (Sundaram & Harharan, 2013; Verma et al., 2017; Poudel et al., 2017; Yadav et al., 2013; Sarkar et al., 2015). In contrast, few researchers found no influence of parity on total milk yield (Charlini & Sinniah, 2015; Pawar, 2012). A study concluded that increase in milk yield at fifth parity in their study may be due to maturation, increase in body weight, and well developed mammary gland (Pawar, 2012). Majority of the studies reported the highest total milk yield was in fourth parity (Verma et al., 2017; Thiruvankadan et al., 2014; Hassan et al., 2017). However, few researchers observed the highest total milk yield in third parity (Sundaram & Harharan, 2013).

**Table 1:** Effect of parity on milk yield traits in Murrah buffaloes

Parity effect				
Milk yield traits	Highest yield(Kg)	Lowest yield(Kg)	Significance	References
TMY 305 MY	2486.25± 116.25 (4) 2294.91± 96.24 (4)	2060.99±169.86(>6) 1892.32± 103.69 (1)	S	(Verma et al., 2017)
TMY 305MY	2610.45±68.14 (4) 2469.50±68.78(4)	2320.46±62.85 (1) 2106.90± 51.33(1)	S	(Sarkar et al., 2015)
305 MY MY per day PY	1913.9± 27.7 (3) 6.5± 0.08(4) 9.54 ± 0.12(4)	1619.7± 22.6(1) 5.38± 0.05(1) 7.73± 0.08 (1)	S	(Thiruvankadan et al., 2014)
305 MY MY per day	2291.48 ± 66.91(3) 8.842± 0.089(2)	2051.42± 64.190 (1) 7.413± 0.253(7)	S	(Sundaram and Harharan, 2013) (Yadav et al., 2013)
TMY 305 MY	2415.1 ± 122.7 (5) 2253.4±153.3 (5)	2032.5 ±291.6 (8) 1858.6±432.9(8)	NS	(Pawar, 2012)

Figures in parentheses indicate the respective order of parity. S-Significant: NS-Non-significant

### 2.4 Lactation efficiency

The effect of parity on various traits related to lactation efficiency including the Colostrums period, days to peak milk yield, lactation length, and dry period are briefly reviewed below:

#### 2.4.1 Effect of parity on Colostrums period

Colostrums, also known as liquid gold contains all necessary nutrients for better growth and health of calves. Some researchers reported lowest colostrums period in mid-parity (4.7 days) and highest in late parity (6.1 days) with a non-significant effect of parity in colostrums period (Poudel et al., 2017). Phagocytic activity was highest in colostrums in third parity which decreased significantly ( $P < 0.01$ ) in fifth day milking and then increased significantly in day 30 milk (Dang et al., 2010). A lower number of colostrums days indicates a higher economic return (Poudel et al., 2017).

#### 2.4.2 Effect of parity on Days to reach peak milk yield (DPMY)

A study reported a non-significant effect of parity on DPMY (Poudel et al., 2017). Researchers observed the highest DPMY at late parity i.e. above 4<sup>th</sup> parity (24.3 days) and lowest at mid-parity i.e. third- fourth parity (takes 21.1 days). Primiparous animals take more days to reach peak milk yield. Contrary to this report, a study revealed significant effect of parity on DPMY with the highest period in the first parity as well as observed decreased DPMY from first to fifth parity followed by a moderate increase in sixth parity (Thiruvankadan et al., 2014).

#### 2.4.3 Effect of parity on lactation length

The number of days from parturition to drying off is known as lactation length. A study reported an average lactation length of 323 days in Murrah (Yadav et al., 2013). A group researchers found that lactation length increased with an increase in parities (Poudel et al., 2017). Lactation length of buffaloes in early (1<sup>st</sup> to 2<sup>nd</sup>), mid (3<sup>rd</sup> to 4<sup>th</sup>), and late (above 4<sup>th</sup>) was found to be 333.75, 350.00, 355.71 days respectively with a variance 29.7% indicating a non-significant effect of parity on lactation length (Poudel et al., 2017). Similarly, maximum lactation length was observed in 4<sup>th</sup> parity ( $252.44 \pm 14.35$  days) as compared to those in the second and sixth ( $203.47 \pm 15.49$  and  $205.28 \pm 12.99$  days) (Hassan et al., 2017). Contrary to these literatures, several studies revealed a significant effect of parity on lactation yield where maximum lactation length was observed in 1<sup>st</sup> parity and minimum in late (5-6) parity, (M. A. Chaudhry, 1992; Thiruvankadan et al., 2014). Lactation length decreases sharply (3.09%) in second parity followed by a gradual decline later (Thiruvankadan et al., 2014). The longest lactation length was observed in Murrah when the dry period was less than 60 days which revealed negative correlation between dry period and lactation length (Charlini and Sinniah, 2015).

#### 2.4.4 Effect of parity on Dry period

A group researchers obtained overall mean of the dry period in Murrah buffalo of  $110.9 \pm 61.4$  days with a coefficient of variance 55.3% (Poudel et al., 2017). The dry period of buffalo with early parity was 135.00 days, mid parity was 87.14 days and late parity was 90.00 days indicating no significant effect of parity on the dry period (Poudel et al., 2017). This

investigation was similar to the report of (Hassan et al., 2017). Contrary to this, a study revealed significant effect of parity on the dry period and the obtained minimum least squares means of dry period i.e. (130.48±1.32 days) (Sanker et al., 2014). A group researchers observed a gradual decline of the dry period from third to fifth parities and the differences between

the mean were not significant (Thiruvankadan et al., 2014). A dry period longer than optimum is an indication of inappropriate management which could be the reason for reduced lactation length and increased incidence of mastitis (Charlini and Sinniah, 2015).

**Table 2: Effect of parity on lactation traits in murrah buffaloes**

Lactation traits	Parity effect			References
	Maximum days	Minimum days	Significance	
Colostrums period	6.1(>4)	4.7(3-4)	NS	(Poudel et al., 2017)
Days to reach peak milk yield	60.9±1.2(1)	50.0±2.1 (5)	S	(Thiruvankadan et al., 2014; Poudel et al., 2017)
	24.3(>4)	21.1(2-3)	NS	
Lactation length	355.71 (>4 )	333.75 (1-2)	NS	(Poudel et al., 2017; Thiruvankadan et al., 2014)
	310.4± 2.9(1)	284.3 ± 4.6(5)	S	
Dry period	135(1-2)	87.14(3-4)	NS	(Poudel et al., 2017; Sanker et al., 2014)
	157.65±1.39(1)	135.65±1.50(3)	S	

Figures in parentheses indicate respective order of parity. S-Significant; NS-Non-significant

## 2.5 Mastitis

### 2.5.1 Effect of parity on mastitis

Mastitis is a deadly inflammation of the udder tissue which decreases both quantity and quality of milk resulting in heavy economic loss. Parity, lactation stage, milk yield, anatomical abnormality of the udder and some management aspects including nutrition has a significant impact on mastitis incidence in murrah buffaloes. The effect of parity on mastitis was observed non-significant in Murrah and Tharparkar but significant in Sahiwal (Jingar et al., 2014). This investigation was similar to the report of (Khathe and Yadav, 2010). A group researchers recognized incidence of mastitis increased from 22.78% to 32.89% during different parities in Murrah with the highest incidence of mastitis in fourth parity (32.89%) and lowest in first parity (22.78%) (Jingar et al., 2014). The low incidence of mastitis in Murrah was due to tightly closed teat orifice which provides extra resistance against penetration of pathogen and less somatic cell count indicating minimum mammary stress (Jingar et al., 2014; Dang et al., 2010). Some researchers found only 18.91% of mastitis incidence indicating high resistivity of Murrah to mastitis (Khathe and Yadav, 2010). Research paper regarding mastitis incidence in murrah is very less. So, more research should be carried out to gain better understanding on effect of parity on mastitis in murrah.

## 2.6 Milk composition

### 2.6.1 Effect of parity on Milk composition

The desirable composition of milk can be obtained from animals at suitable parity fed with special ingredients in the dairy production system. Some researchers have reported a significant effect of parity in milk composition (Sundaram & Harharan, 2013; Yadav et al., 2013). However, a study found no significant effect of parity in milk composition (Verma et al., 2017). Some researchers found superior milk fat % and mean total solid % in first parity with 15.64% higher fat and 4.1% higher total solid % than the third lactation while mean Casein % and mean protein % was reported higher in third parity as compared to all other parities (Sundaram and Harharan, 2013). Contrary to this report, a study has found the highest lactation fat % and solid not fat % (SNF) in fifth parity (Verma et al., 2017). Similarly, researchers also claimed to observe the highest fat % in the fifth parity but with no persistent increase over the advancement of parities (Pawar, 2012). Moreover, Casein fraction and whey protein decrease with the increment in parities (Bonfatti et al., 2012).

Researchers noticed increment in milk protein from first parity (3.51±0.01 g %) to sixth parity (3.56±0.03 g%) and also observed increased milk lactose in second parity as compared to late i.e. fifth parity (Yadav et al., 2013). They concluded increased milk lactose in second parity was because of availability of more water for lactose synthesis due to higher milk yield in second parity. A group researchers also revealed positive relation of milk yield with protein and lactose while negative with milk fat (Yadav et al., 2013). A study reported a significant effect of parity on milk urea concentration which was highest (64.03±1.14) in first parity and lowest (55.67±1.22) in the sixth and above parity but found no significant effect of parity on milk protein content with the lowest protein content in first parity (Roy et al., 2003).

## 3. CONCLUSION

It is clear from the information presented in this review that parity has

influence on milk yield, lactation efficiency, milk composition, and mastitis. Most of the studies revealed a significant effect of parity on 305 MY, Total milk yield, milk composition, and non-significant effect on colostrums period, days to reach peak milk yield, lactation length, and mastitis. All these traits were superior in mid parity except for milk fat and total solid percentage. Parity is a physiological process that cannot be altered by improved husbandry practices. Although, feeding animals with a special diet or total mixed ration and better management practices should be carried out to reduce the stress factor. Also, it would be wise to cull animals at late parity as there will be not much production efficiency of animals at this parity.

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