



Physical Characteristics and Production Performance of Gir Cattle in India

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Abstract

Gir is dairy type Indian zebu cattle, well known for its inherent heat tolerance and disease resistance capacity. This breed has unique physical characteristics and mostly bred by the professional nomadic pastoral breeders. Udder was observed bowl or round shaped, whereas teats were cylindrical in nature. Recorded mean maximum lactation and standard yield were 2810 and 2573 kg, respectively. Mean lactation length ranged from 281 to 380 days. Wet and herd average of elite Gir cows were 8.6 and 5.0 liter/day, respectively. Elite Gir cows had mean peak yield of 15.8 liter/day with maximum recorded peak yield 22.9 liter/day. In Gir cows, peak yield reached during 6-8 weeks after calving and had mean weekly persistency of 97.7%. Average dry period length ranged between 80 and 138 days. Gir cows milk composed of maximum mean milk fat, solid-not-fat, protein and lactose content of 5.38, 9.60, 3.85 and 5.29%, respectively. Gir cows in their productive life of 4.5 years produced 9989 liters milk. Gir heifers had maximum growth rate of 494 gm/day with weight at first calving 369 kg. The mean herd life of Gir cows was 8.5-9.4 years. Heritability estimates for production traits like lactation yield (0.06-0.18), standard lactation yield (0.17-0.20), lactation length (0.05-0.28), peak yield (0.04-0.12) and dry period (0.01-0.42) were low in Gir cattle; indicate huge scope for improvement through managerial interventions. Taken together it may be concluded that Gir cattle has huge production potential owing to unique physical characteristics along with inherent heat and disease tolerance capacity.

Keywords: Gir Cattle, Growth, Physical Characteristics, Production Performance

Introduction

Gir is a pure dairy breed of zebu cattle named according to its origin from Gir forest and hills situated in southern part of Saurashtra region of Gujarat particularly Junagadh, Gir-Somnath, Amreli, Bhavnagar, Porbandar, Rajkot and Jamnagar districts. Gir cattles are also found in other parts of Gujarat, Rajasthan and Maharashtra states. There are several synonyms such as Kathiawari, Sorthi, Bhodali, Desan, Gujarati and Surati used for the Gir breed in different parts of its breeding tract (Gaur, 2003; Anonymous, 2017). Gir breed is mostly bred by professional breeders like Rabaris, Bharwads, Maldharis, Ahirs and Charans. These professional breeders follow more or less nomadic pastoral life, they move from one place to another along with their cattle when grazing resources exhaust. The religious organizations like Shri Bhuvaneshwari Pith at Gondal (Rajkot) and Swaminarayan Sanstha are also playing significant role for the conservation and sustainable improvement of this breed (Kohler-Rollefson, 2000). These religious organizations are maintaining high yielder elite Gir cows which are also registered under Central Herd Registration Scheme. This breed has unique inherent physical characteristics which enable it for better heat-tolerance and tropical disease-resistance capacity. Gir is a hardy breed which performs well under extreme stress and sub-optimal nutrition and is well known for its longer herd life (Gajbhiye *et al.*, 2016; Anonymous, 2017). The wet average of this breed during extreme summer (April-June) remained similar to that of winter season (December-February) i.e. 6.1-6.4 versus 5.8-6.3 liter/day (Anonymous, 2019). This breed has also been imported by Brazil, Mexico, USA and Venezuela, where through crossbreeding and proper selection Gir has achieved huge production potential (Sanders, 1980). The knowledge of unique physical characteristics and production performance of this breed is the need of the hour to prevent indiscriminate breeding and to maintain sustainable productivity. Therefore, this review focusses on physical characteristics and different production traits of Gir cattle in India.

Physical Characteristics

Colour

Pure Gir cattle (Fig. 1A and 1B) have wide range of body coat colour. Red colour is the most predominant colour in 80% animals. In some animals red colour is speckled with white colour or vice-versa. Some animals also have yellowish light to dark red coat colour. The coat colour of complete white or complete black or yellowish red is rare (Joshi and Phillips, 1953; Anonymous, 2017). The coat colour of males is always darker than the females (Anonymous, 2017).



A



B

Figure 1: Pure Gir cattle (A-Gir Cow and B- Gir Bull)

Horns

Horns of pure Gir cattle curve in a peculiar fashion. Unlike other cattle breeds, they emerge from below the head. After emergence, they take downward and backward curve, again incline a little upward and forward taking a spiral inward sweep. Finally, the horns end in a fine taper, thus they look like a half moon shape (NBAGR, 2020).

Ears

Ears are long (upto 30 cm), pendulous and folded like a leaf. They are excellent fly and insect swatter. The ears open to the front and forward. There is a notch near the tip; the tips turn inward or medial aspect. In young animals the ear tips meet each other under the jowl (Joshi and Phillips, 1953; Gaur, 2003).

Head, Face, Eyes and Nostrils

Gir cattle have prominent, convex and broad forehead, which form a bony shield. Broad forehead overhangs eyes in such a way that they appear to be partially closed (eye lids cover almost half of the eyes) and thus giving the animals a sleepy appearance (Joshi and Phillips, 1953; Anonymous, 2017). Fore head is more developed in male, but in females though prominent less strongly marked. Face is long and narrow below the eyes. The eyes are almond shaped. Black nostrils are the characteristics feature, but animals with yellow nostrils are not preferred (Anonymous, 2017).

Brisket, Dewlap, Sheath, Skin and Tail

Brisket is proportionately large in Gir cattle, but covered with thin skin. Dewlap is moderately developed, soft and swinging in appearance (Anonymous, 2017). Prepuccial sheath is large and pendulous in males. The skin is loose, smooth and pliable with short and oily hairs leading to glossy appearance (Joshi and Phillips, 1953; Gaur, 2003). Tail is long and whip like, even in few animals, it also touches the ground level. Switch of tail is clustered and black in colour (Anonymous, 2017).

Hump, Hip Bones, Hoof, Udder and Teats

In Gir breed, hump is largest among the all indigenous cattle breeds (Anonymous, 2017). This breed has prominent hip bones with well proportionate body. Hooves are medium in sized with black colour. Cows have well developed round shaped udder. Teats have also round shaped distal end (Gaur, 2003).

Body Weight and Morphometric Characteristics

Body Weight and Growth

Body weight and average daily gain of Gir cattle maintained at Cattle Breeding Farm (CBF), Junagadh are presented in Table 1 and Table 2, respectively (Anonymous, 2019). Weight of males was comparatively higher than females. Weight of males and females at one year were 145.9 and 141.9 kg, respectively. Weight of heifers at puberty and first calving were 233.3 and 368.8 kg, respectively. The body weight of Gir cattle during 2015-2017 (Table 1) is comparatively higher than the weight during 1997-98 in the same farm (Gaur, 2003). This reflects implementation of proper selection process for the Gir cattle. Gaur (2003) reported body weight of male and female calves at birth as 22.0 vs. 20.2 kg and at one year as 138.5 vs. 135.7 kg, respectively. Weight of female cattle at puberty and first calving was 241.3 and 284.9 kg, respectively.

Table 1: Body weight (kg) of Gir cattle during 2015-2017 at CBF, Junagadh

Age	Male	Female	Overall
Birth	25.8±0.3 (222)	21.6±0.2 (194)	23.7±0.3 (416)
3 months	47.7±0.9 (145)	47.1±0.5 (154)	47.4±0.7 (299)
6 months	95.2±1.2 (129)	92.2±0.7 (140)	93.7±0.9 (269)
12 months	145.9±2.4 (94)	141.9±1.6 (84)	143.9±2.0 (178)
Puberty	-	233.3±4.6 (121)	233.3±4.6 (121)
At 1 st calving	-	368.8±2.4 (108)	368.8±2.4 (108)

Values within parenthesis indicates number of observations

In Konkan region of Maharashtra, mean weight of female Gir calves (n=226) at birth and puberty were reported 23.82±0.20 and 288.48±1.44 kg, respectively (Mayekar *et al.*, 2017). Weight at first calving in Gir heifers (n=113) maintained at Kasturba Gram Dairy Farm, Indore was 402.22±1.28 kg (Sawant *et al.*, 2016). As per report of

NBAGR (2020) adult body weight for male and female Gir cattle is 544 and 310 kg, respectively. The overall growth rate of Gir cattle during birth-3 months, 3-6 months and 6-12 month were 349.3, 494.4 and 314.4 gm/day respectively. During suckling period (birth-3 month) growth rate of female calves is comparatively higher than the male calves but later, comparatively lower up to one year (Table 2). Growth rate of Gir heifers up to puberty has been reported 300g/day in Konkan region of Maharashtra (Mayekar *et al.*, 2017).

Table 2: Growth rate (gm/day) of Gir cattle during 2015-2017 at CBF, Junagadh

Age duration	Male	Female	Overall
Birth - 3 months	346.3±16.5 (156)	352.1 ±12.1 (152)	349.3 ±13.9 (308)
3 - 6 months	495.3±8.2 (120)	493.5 ±11.9 (121)	494.4 ±9.9 (241)
6 - 12 months	315.5±10.7 (97)	313.4 ±8.7 (103)	314.4 ±8.8 (200)

Values within parenthesis indicates number of observations

Body Linear Traits

Mean height at wither, body length and chest girth were 159.84, 137.51, and 201.41 cms for male and 130.79, 131.40, 166.47 cms, for female Gir cattle respectively (NBAGR, 2020). These linear traits increased with increase in parity. Mean height at wither increased from 128.12±1.34 to 135.30±1.53 cm at 1st to 3rd parity, thereafter no such improvement was observed. However, mean body length increased from 123.59±1.25 to 129.59±1.08 cm and mean chest girth from 159.52±1.16 to 170.31±1.29 cm at 1st to ≥4th parities. The average height at wither, body length and chest girth of Gir cows (n=100) were observed 130.60±1.65, 126.24±1.37 and 165.13±1.67 cm, respectively (Singhai *et al.*, 2013).

Udder Shape and Measures

Tripathi *et al.* (1982) studied the udder shape on 240 adult Gir cows and observed three types of udder like bowl (59.6%), round (39.5%) and goaty (0.90%) shaped. In another study on 100 Gir cows, different shapes of udder observed were round (35%), trough (27%), pendulous (23%) and bowl (15%) by Singhai *et al.* (2012). Mean udder length, width and depth of Gir cows (n=100) were observed 45.9±2.1, 20.5±0.1 and 20.3±1.0 cm, respectively (Singhai *et al.*, 2013). However, Modh *et al.* (2017) reported higher value of udder length, width and depth in 150 Gir cows (61.9±1.2, 62.9±1.2 and 25.6±0.4 cm, respectively). Parity effect on teat morphometry is not conclusive among different studies. Udder length in Gir cows increased with increase in parity *i.e.* from 40.9±1.4 to 51.7±1.7 cm at 1st to ≥4th parity (Singhai *et al.*, 2013) and from 50.9±4.3 to 65.4±5.7 cm at 1st to ≥5th parity (Modh *et al.*, 2017). The mean udder width and depth of Gir cows ranged from 18.6±0.9 to 24.6±1.5 and from 17.4±0.9 to 24.1±1.2 cm, respectively in different parities with lower and higher values in 2nd and 3rd parity cows, respectively (Singhai *et al.*, 2013). However, Modh *et al.* (2017) observed gradual and significant increment of mean udder width (53.8±3.9 to 72.5±5.9 cm) and depth (24.2±1.2 to 30.4±3.1 cm) from 1st to 5th and above parity Gir cows. Udder shape also had significant (P<0.05) effect on the udder measures like length, width and depth in Gir cows. Cows with bowl shaped udder had lower value of udder length, width and depth, whereas measurements of such traits were higher in pendulous udder (Singhai *et al.*, 2012). The heritability estimates for udder length, width and depth were observed 0.76, 0.63 and 0.57, respectively in Gir cows (Qureshi *et al.*, 1980).

Teat Shape and Measures

Tripathi *et al.* (1982) reported three types of teats such as cylindrical (31.5 and 27.5%), funnel shaped (15.4 and 21.2%) and bottle shaped (3.1 and 1.4%), respectively for fore and rear teats. They also studied teat length (7.28 cm), diameter (2.88 cm) and placement (3.11 cm). Mean distances between two front teats and between two rear teats were 5.57±0.22 and 2.09±0.12 cm, respectively. Similarly, in another study, Singhai *et al.* (2012) observed teat shape in 35, 24, 21 and 20% Gir cows (n=100), respectively as cylindrical, funnel, bottle and pear type. Singhai *et al.* (2013) observed mean teat length and diameter as 6.2±0.3 and 3.1±0.1 cm, respectively in Gir cows (n=100) with significant parity effect on these traits. Teat length and diameter ranged from 6.2±0.3 to 8.3±0.4 cm and from 3.1±0.1 to 3.9±0.1 cm, respectively in different parities with significant increment from 1st to ≥4th parity. In a study on 150 Gir cows, non-significant effect of parity on fore and rear teats length and fore and rear teats diameter were observed by Modh *et al.* (2017). Mean length of fore and rear teats was 9.3±0.2 and 8.6±0.2 cm, whereas mean diameter of fore and rear teats was 3.7±0.1 and 3.7±0.1 cm, respectively.

Production Performance

Total Lactation Milk Yield

Total milk yield per lactation in Gir cows shows wide variation depending on their genetic potential and environmental factors as well as lactation length. Total mean yield of Gir cows at CBF (Junagadh) during 1966-1988 was observed 1755.0±59.3 kg/ lactation by Ulmek (1990). However, later during 1987-2010, Dangar and Vataliya (2015) reported 2276.6±171.3 kg yield/ lactation in Gir cows at CBF. Gadariya *et al.* (2017b) reported lactational milk yield of Gir cows as 2006.3±48.8 liter during 1991-2010 at CBF (Junagadh). Recent report of CBF, cited 2355.4±88.8 liter yield/ lactation (253 lactation records) during the year 2015-2017 and 2810.4±147.8 liter yield/ lactation (80 lactation records) during the year 2018 in Gir cows (Anonymous, 2019). This indicates gradual improvement in milk production due to proper selection as the farm has been following progeny testing program. The annual report data on performance of Gir cattle at CBF during 2001-2013 cited that total lactation yield ranged from 1760 to 2549 liters (Gajbhiye *et al.*, 2016). In a field study at five districts (Amreli, Bhavnagar, Jamnagar, Junagadh and Rajkot) of Saurashtra region of Gujarat, Mathur and Khosla (1994) reported 2194.9±10.5 kg yield/ lactation in Gir cows. Bhadoria *et al.* (2003, 2004) in a study at Kasturba Gram Dairy Farm (KGDF), Indore, Madhya Pradesh (720 lactation records from 301 Gir cows spread over 38 years from 1960 to 1997), reported mean lactation yield of 1882.5±37.0 kg. The first lactation yield ranged from 1699.2±69.4 liter (316 records during period 1991-2010, Gadariya *et al.*, 2017b) to 2706.4±204.2 liter (76 records during period 2015-2017, Anonymous, 2019) indicating significant improvement of yield at CBF, Junagadh (Table 3).

Table 3: Total/ standard lactation milk yield and lactation length of Gir cows

Location	Period	No of Records	No. of Parity	Total Yield (kg or liters)	300/305 DMY (kg or liters)	Lactation length (days)	References
Indore	1960-1997	291	1	1743.2±45.7	-	328.6±5.0	Bhadoria <i>et al.</i> (2003, 2004)
Indore	1960-1997	720	All	1882.5±37.0	-	292.4±4.3	
Indore	1995-2012	113	1	1664.9±280.7	-	343.5±10.3	Sawant <i>et al.</i> (2016)
Saurashtra	1982-1984	1475	All	2194.9±10.5	-	292.8±0.6	Mathur and Khosla (1994)
Junagadh	1991-2010	316	1	1699.2±69.4	1427.5±51.4	247.3±9.0	Gadariya <i>et al.</i> (2017b)
Junagadh	1991-2010	1363	All	2006.3±48.7	1819.7±45.4	281.0±4.5	
Junagadh	1997-1998	62	All	2063.0±114.0	1930.0±95.0	326.0±11.0	Gaur (2003)
Junagadh	2009-2012	67	1	1714.2±101.1	1444.1±79.3	366.5±15.6	Vataliya <i>et al.</i> (2019)
Junagadh	2009-2012	194	All	1838.2±64.9	1637.8±50.5	337.6±7.9	
Junagadh	2001-2015	342	1	-	1554.2±49.3	369.1±5.3	Savaliya <i>et al.</i> (2016)
Junagadh	2001-2015	1352	All	-	1917.3±28.5	360.1±3.1	
Junagadh	2015-2017	67	1	2706.4±204.2	1927.3±109.4	396.1±17.2	Anonymous (2019)
Junagadh	2015-2017	253	All	2355.4±88.8	1988.3±56.5	340.0±7.4	
Junagadh	2018	80	All	2810.4±147.8	2309.3±85.2	380.5±12.7	

In a study on 377 lactation records spread over 45 years (during period 1965-2010) at CBF, first lactation milk yield of Gir cows was observed 2104.9±125.8 liter (Gajbhiye *et al.*, 2016). Bhadoria *et al.* (2004) cited first lactation yield of Gir cows as 1743.2±45.7 kg during 1960-1997 at Kasturba Gram Dairy Farm (KGDF), Indore. Moreover, at the same KGDF farm first lactation yield of 1664.9±280.7 liter had been observed during 1995-2012 (Sawant *et al.*, 2016). Under field conditions at Saurashtra region of Gujarat, Mathur and Khosla (1994) reported first lactation milk yield of 2215.64±17.36 liter. Bhadoria *et al.* (2004) analysed lactation records of 1st-4th parities in Gir cows during 1960-1997 at KGDF and observed highest yield in 3rd parity (1941.74±59.89 kg). In another study, considering 1744 lactation records of Gir cows from 1965 to 2010 at CBF, Gajbhiye *et al.* (2016) observed significant parity effect on lactation yield. They observed maximum yield of 2132.0±123.4 liter in 2nd lactation, then gradual reduction of yield during later parities (Figure 2). However, Dangar and Vataliya (2015) and Gadariya *et al.* (2017b) observed gradual increase in milk yield up to 5th parity (maximum yield of 2694.20±184.94 kg and 2423.65±106.34 liter/ lactation, respectively) and there after gradual reduction of yield (Fig. 2). Heritability estimate

is lower for lactation milk yield of Gir cows *i.e.* 0.12 (Ulmek, 1990), 0.06 (Bhadoria *et al.*, 2004) and 0.18 (Dangar and Vataliya, 2015). The heritability estimate for first lactation milk yield in Gir cows was 0.11 (Sawant *et al.*, 2016).

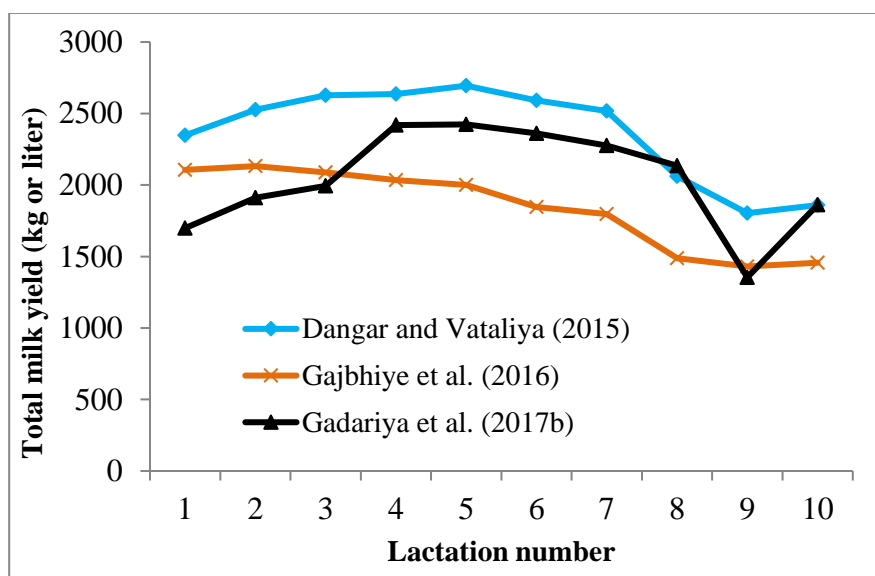


Figure 2: Total milk yield (kg or liter) of Gir cows in different lactation

Standard Lactation Milk Yield

Standard lactation yield *i.e.* first 305-day (or 300-day excluding 5 days non-saleable period or colostrum period) milk yield is considered as an important trait for selection and culling of cows. Mean standard lactation yield of Gir cows during 1991-2010 (1363 lactation records) was 1819.7 ± 45.4 liter at CBF (Gadariya *et al.*, 2017b). Standard lactation yield improved gradually in Gir cows at CBF during last two decades. Average standard yield of Gir cows was 1917.3 ± 28.5 liter/ lactation during the period 2001-2015 (Savaliya *et al.*, 2016). Later, during 2015-2017 and in 2018, the Gir cows at CBF produced 1988.3 ± 56.5 and 2309.3 ± 85.2 liter milk, respectively during their first 300 days of lactation (Anonymous, 2019). Annual progress report data at CBF during 2001-2013 revealed 300-day yield of Gir cows within the range between 1509 and 2247 liter (Gajbhiye *et al.*, 2016). Elite Gir cows (about 40% cows of the total herd) at CBF had maximum standard yield of 2710 liter (Gadariya *et al.*, 2017b).

The standard lactation yield at CBF also improved in first parity Gir cows from 1427.5 ± 51.4 liter during the period 1991-2010 (Gadariya *et al.*, 2017b) to 1927.3 ± 109.4 liter during the period 2015-2017 (Anonymous, 2019). Singh *et al.* (2019) analysed first lactation 305-days milk yield data of 222 Gir cows during 2013-2017 under progeny testing program in Gujarat. First standard lactation yield ranged between 865 and 5148 kg with overall mean of 2572.18 kg. Moreover, as per NDDB report, 305-days milk yield of Gir cows under field condition in Gujarat ranged from 752 kg to 5956 kg across different lactations, with mean yield of 2573.19 kg (standard deviation of 726.66 kg) (records of 1118 lactations during 2012-2015, Anonymous, 2017). Parity had significant effect on standard lactation yield in Gir cows, but this trait differed markedly in different studies (Table 4). As per large data set spread over 45 years (1965-2010) at CBF, standard yield of Gir cows improved gradually with advancement of parity and reached maximum production in 4th lactation (*i.e.* 1823.40 ± 100.98 liter), thereafter declined gradually (Gajbhiye *et al.*, 2016). However, in another study at CBF during 1991-2010 highest yield of 2303.05 ± 87.24 liter was reported during 5th lactation (Gadariya *et al.*, 2017b). During the period 2001-2015 at CBF, Savaliya *et al.* (2016) observed highest standard lactation yield in 4th lactation (2081.68 ± 68.15 kg). Moreover, NDDB report cited maximum yield during 2nd lactation in field progeny testing programme (Anonymous, 2017). Elite Gir cows owing to selective breeding also produced more than 4500 kg milk during first 305-days of lactation in India (Anonymous, 2019). The heritability of 300 days milk yield is low in Gir cows (0.17, Ulmek, 1990 and 0.20, Dangar and Vataliya, 2015).

Lactation Length

Mean lactation length of mixed parity Gir cows ranged from 281 (Gadariya *et al.*, 2017b) to 380 days (Anonymous,

2019) among different studies. Gajbhiye *et al.* (2016), based on lactation records from 2001 to 2013 reported that lactation length of Gir cows at CBF ranged from 299 to 365 days. However, in first parity cows, this trait varied on an average between 247.3 days (Gadariya *et al.*, 2017b) and 396.1 days (Anonymous, 2019) (Table 3). Gadariya *et al.* (2017b) observed desired lactation period of 270-330 days only in 17% Gir cows and about 34% cows had less than 210 days lactation period. They also stated that 27% cows produced milk beyond 360 days. Parity wise data analysis during 1965-2010 (1744 lactation records) revealed that 1st parity Gir cows at CBF had longer lactation length, but later gradually the duration declined up to 9th lactation (Table 4, Gajbhiye *et al.*, 2016).

Table 4: Standard lactation milk yield and lactation length of Gir cows during different parities

Lactation / Parity	Standard lactation milk yield (kg or liters)				Lactation length (days)		
	1	1681.95 (377)	1554.3 (342)	1427.49 (316)	2535.05 (212)	366.00 (377)	369.08 (342)
2	1652.32 (362)	1931.6 (314)	1697.90 (261)	2711.28 (278)	331.46 (362)	359.6 (314)	293.18 (262)
3	1812.51 (294)	1981.3 (256)	1870.52 (169)	2686.88 (235)	312.86 (294)	356.6 (256)	319.12 (169)
4	1823.40 (243)	2081.68 (164)	2207.12 (82)	2655.89 (90)	307.13 (243)	357.3 (164)	252.33 (82)
5	1814.89 (175)	1931.4 (126)	2303.05 (112)	2627.62 (35)	297.86 (175)	351.9 (126)	333.59 (112)
6	1694.47 (120)	2033.7 (154)	2111.11 (64)	2113.05 (09)	291.64 (120)	366.3 (154)	237.92 (64)
7	1594.05 (75)	-	2029.04 (90)	-	289.92 (75)	-	335.69 (90)
8	1486.95 (50)	-	1951.89 (48)	-	275.93 (50)	-	230.58 (48)
9	1377.61 (29)	-	1294.81 (66)	-	251.09 (29)	-	335.11 (66)
10	1355.89 (19)	-	1689.97 (154)	-	280.65 (19)	-	280.69 (154)
References	Gajbhiye <i>et al.</i> (2016)	Savaliya <i>et al.</i> (2016)	Gadariya <i>et al.</i> (2017b)	Anonymous (2017)	Gajbhiye <i>et al.</i> (2016)	Savaliya <i>et al.</i> (2016)	Gadariya <i>et al.</i> (2017b)

Figures within parenthesis indicates number of records; Standard lactation yield (either 300-days or 305-days yield excluding or including 5 -days colostrum period)

However, during 1991-2010 at CBF, Gadariya *et al.* (2017b) reported longest (*i.e.* about 350 days) lactation length in 7th and 9th lactation and shortest (*i.e.* about 230 days) in 8th lactation. Savaliya *et al.* (2016) during 2001-2015 in the same herd observed maximum lactation length in 1st parity, while shortest period in 5th parity (369 vs. 352 days). Bhadoria *et al.* (2004) analysed 720 lactation records of 1st-4th parity Gir cows during the period 1960-1997 at KGDF. They reported longest and shortest lactation length in 1st (328.6 days) and 4th (273.7 days) parity cows, respectively. However, under field condition (n=1475 lactation records) in the breeding tract (Amreli, Bhavnagar, Jamnagar, Junagadh and Rajkot), Mathur and Khosla (1994) observed almost similar lactation length among 1st, 2nd, 3rd and 4th parity Gir cows (293.3, 291.1, 292.8, 295.6 days, respectively). The heritability of lactation length has been observed 0.10 by Ulmek (1990), 0.28 by Bhadoria *et al.* (2004) and 0.05 by Dangar and Vataliya (2015) which indicates lower value in Gir cows. The heritability estimate for 1st lactation length in Gir cow was 0.17 (Sawant *et al.*, 2016).

Wet and Herd Average

Mean wet average and herd average of Gir cows during 2001-2010 were observed 6.7±0.1 and 3.8±0.1 liter/day, respectively at CBF (Gadariya *et al.*, 2017a). Annual progress report data of the same herd from 2001 to 2013 cited that wet and herd average ranged from 5.3 to 7.7 and 2.5 to 4.7 liter/day, respectively (Gajbhiye *et al.*, 2016). However, recent data of the same farm showed wet average of 5.6-6.6 liter/day with overall mean of 6.1±0.01 liter/day and herd average of 3.0-4.8 liter/day with overall mean of 3.7±0.2 liter/day during the year 2018 (Anonymous, 2019). The wet and herd average of elite Gir cows in 2016 at CBF were observed 8.9±0.3 kg (8.6 liter) and 5.2±0.3 kg (5.0 liter), respectively (Singh *et al.*, 2018). Migratory Gir cow in Akola district of Maharashtra produced on an average 5.09±0.75 litre/day (Gaikwad *et al.*, 2011). Gaur *et al.* (2003) reported 5.0±0.3 liter milk yield per day of calving interval in Gir cows (n=44) during 1997-98 at CBF. Ulmek and Patel (1993) reported mean yield per day of 1st lactation length and 1st calving interval as 5.5±0.1 and 4.2±0.1 liter, respectively, based on lactation records of 378 Gir cows. Parity wise data analysis revealed average daily milk yield of 7.5±0.1, 7.5±0.1, 7.5±0.1 and 7.2±0.1 kg, respectively from 1st to 4th lactation with overall mean of 7.5±0.1 kg in Gir cows (n=1475) in their breeding tract (Mathur and Khosla, 1994). Vataliya *et al.* (2019) reported comparatively lower milk yield

per lactation in primiparous as compared to pluriparous cows (4.4 vs. 5.9 liter/day) with overall mean of 5.4 liter/day at CBF. Similarly, in another study, higher milk yield was observed by Vora *et al.* (2019) in multiparous Gir cows than their primiparous counter parts (6.81±0.41 vs. 5.63±0.13 kg/day).

Peak Yield and Days to Attain Peak Yield

Peak yield of pure Gir herd maintained at CBF during 1966-1980 was 9.53±0.14 kg/day, attained on 61.25±2.50 days (Singh, 1983). In another study, mean peak yield of 211 Gir cows was observed to be 10.0±0.10 kg/day, which was achieved on 47±0.83 days in milk (Nanavati and Qureshi, 1996). Vataliya *et al.* (2019) reported peak yield of Gir cows at CBF about 10.29±0.22 liter/day, reached on 58.73±0.65 days after calving. Elite Gir cows (n=66) produced on an average peak yield of 15.8±0.4 liter/day with maximum yield of 22.9 liter/day at CBF. It was reported that a cow with peak yield of 22.9 liter/day produced about 4538 liter milk during first 300 days in her 2nd parity (Anonymous, 2019). Parity also affected daily peak yield and days to attained peak yield. The 5th parity cows produced higher peak yield than 1st parity cows (10.40 vs. 8.38 kg/day, Singh, 1983). However, days to attain peak yield was higher in 1st parity cows (84.24 days), which gradually reduced and reached minimum in 6th parity cows (32.81 days), indicates gradual reduction in days to attain peak in Gir cows (Table 5, Singh, 1983). Highest peak yield of Gir cows was observed in 1st parity (10.47 kg), whereas lowest value in 4th parity (9.45 kg) in their breeding tract (Mathur and Khosla, 1994). However, Singh *et al.* (2018) observed increased average peak yield from 1st to later lactation (13.70 to 14.80 kg) in Gir cows during 2016 at CBF. Similarly, mean peak yield in primiparous cows was observed lower than pluriparous cows (9.26 vs. 10.83 liter/day) and took comparatively more days (58.31 vs. 55.65 days) to attain the peak (Vataliya *et al.*, 2019). Low heritability estimate was observed for peak milk yield in Gir cattle by Ulmek (1990) and Dangar and Vataliya (2015) *i.e.* 0.04 and 0.12, respectively.

Persistency of Milk Yield

Studies on lactation persistency in Gir cows are very scanty in India. Mean persistency of Gir cows was reported 97.67%. Persistency varied among different lactation significantly between 96.69% in 5th parity and 98.67% in 1st parity (Table 5, Singh, 1983; Singh and Shukla, 1986). Weekly rate of reduction of milk yield from peak yield to 43rd week of lactation ranged between 0.45 kg/week (in 1st parity) and 1.03 kg/week (in 6th parity) with overall mean of 0.85 kg/week (Rankja, 2004). Season of birth had no effect on persistency. Similarly, dry period length does not affect the persistency during subsequent lactation in Gir cows (Singh, 1983). Mayekar *et al.* (2017) calculated persistency index of Gir cows (defined as ratio of standard lactation yield in liter to peak yield in liter) and observed overall mean of 184.09±0.92.

Table 5: Daily peak yield, days to attained peak yield and persistency of Gir cows in different parities

Lactation/ Parity	Number of Records	Peak Yield (kg)	Days to Peak Yield (day)	Persistency (%)	Number of Records	Peak yield (kg)
1	175	8.38±0.15	84.24±7.79	98.67±0.19	353	10.47±0.10
2	145	9.39±0.19	63.55±4.95	97.89±0.20	428	10.09±0.11
3	109	9.72±0.21	51.29±4.77	96.95±0.23	318	10.12±0.12
4	84	10.09±0.25	46.53±5.09	97.05±0.23	194	9.45±0.22
5	60	10.92±0.34	37.91±3.64	96.69±0.31	-	-
6	22	10.40±0.56	32.81±4.37	96.78±0.46	-	-
Overall	595	9.53±0.14**	61.25±2.50**	97.67±0.19**	1475	10.15±0.07
References	Singh (1983); Singh and Shukla (1986)				Mathur and Khosla (1994)	

** significant at 1%

Dry Period Length

Annual Report of PDC in 1997-98 cited average dry period length of 123.0±14.0 days in Gir cows at CBF (Gaur *et al.*, 2003). Dry period length in Gir cattle ranged from 96 to 165 days as per annual progress report data of 13 years (2001-2013) at same CBF herd (Gajbhiye *et al.*, 2016). Overall mean for dry period at CBF during 2001-2015 was 110.80±4.35 days, where the longest (130.63±7.06 days) dry period was in 1st parity and shortest (98.50±11.02 days) in 6th and above parities cows in the same herd reflects significant parity effect (Savaliya *et al.*, 2016). Moreover, in a recent report the mean dry period length was cited as 114.1±7.1 days during 2015-2017 and

80.4±11.7 days during 2018 at CBF, Junagadh (Anonymous, 2019). In KGDF herd, Bhadoria *et al.* (2004) analysed 720 records of 1st-4th parity Gir cows during 1960-1997 and observed longest and shortest dry period in 1st (145.36±4.60 days) and 4th (132.64±8.12 days) parity cows, respectively with overall mean 137.94±4.04 days. Similarly, at same KGDF herd, 1st mean dry period was 177.29±10.59 days (Sawant *et al.*, 2016). Mayekar *et al.* (2017) reported 87.74±0.95 days dry period in Konkan region of Maharashtra (1090 lactation records spread over 25 years from 1981 to 2005). The heritability estimate of dry period was observed to be 0.01 by Ulmek (1990), 0.06 by Bhadoria *et al.* (2004) and 0.13 by Dangar and Vataliya (2017) in Gir cows. However, the heritability estimate for 1st dry period in Gir cow was 0.42 (Sawant *et al.*, 2016).

Milk Constituents

Mean fat, solid not fat (SNF) and protein content of milk from Gir cows (n=100) were 4.54, 8.53 and 3.85% respectively at CBF (Singhai *et al.*, 2013). In the same CBF herd study, the overall milk fat, SNF, protein and lactose content were observed 4.15, 8.85, 3.28 and 4.83%, respectively (1649 milk samples from 172 cows, Gajbhiye *et al.*, 2019). Average milk fat percentage ranged between 4.69±0.04 and 4.97±0.02% (Gaur *et al.*, 2003). Under field condition (1998-2000 survey report) in the breeding tract of Gir cows (Junagadh, Rajkot and Bhavnagar), fat content was observed as 4.65, 4.60 and 4.55%, respectively (Gardharia *et al.*, 2000). Similarly, field progeny testing report of NDDDB (7207 test-day fat% records during 2012-2015) cited average milk fat as 5.08% (Anonymous, 2017). In migratory Gir herd in Akola district of Maharashtra mean values of fat, SNF, and TS were 4.29±0.21, 8.24±0.09 and 13.23±0.25%, respectively (Gaikwad *et al.*, 2011). In a recent study (n=43), Dora *et al.* (2020) reported mean milk fat, SNF, protein, lactose and TS content as 4.39±0.02, 8.63±0.02, 3.17±0.0, 4.58±0.01 and 13.03±0.03%, respectively. Parity wise milk fat, SNF, protein and lactose content ranged from 3.87 to 5.38%, 8.32 to 9.60%, 2.94 to 3.48% and 4.64 to 5.29%, respectively in Gir cows (Gajbhiye *et al.*, 2019). Though stage of lactation and parity affected the milk fat constituent significantly in Gir cows, such effect were not observed on SNF, protein and lactose content (Gajbhiye *et al.*, 2019). Moreover, Singhai *et al.* (2013) observed significant effect of parity on milk protein but not on milk fat and SNF content in Gir cows.

Herd Life, Productive Life and Life Time Production

Choudhary (1999) studied life time performance traits of Gir cows (n=268) at CBF, and observed total herd life, productive herd life, lactation number and life time milk yield as 3418.80±79.48 days (9.37 years), 1641.99±71.81 days (4.5 years), 3.37±0.16 kg and 7380.36±420.81 kg, respectively. Gadariya *et al.* (2017b) reported mean herd life of 3107.87±81.40 days (8.51 years) in Gir cows (n=309) at CBF. In the herd, 19% cows had more than 12 years (mean 14.6 years) herd life, whereas 6% cows had herd life of 10 to 12 years. They also observed lifetime mean number of calvings 4.25±0.15 and only 25% cows remained in the herd up to 6th lactation, but very few cows (about 10%) had herd life beyond 8th lactation. Lactating Gir cows were mostly disposed of from the organised herd after 6th lactation due to old age (Gadariya *et al.* (2017a). Mean life time milk production of Gir cows in an organised herd (CBF, Junagadh) was 9988.71±649.08 liter and 31% cows produced more than 14000 liters milk in their herd-life (Gadariya *et al.*, 2017b).

Conclusion

Gir cattle have unique physical characteristics which enable them for better heat tolerance and disease resistance under tropical climate. Productivity of cows has been gradually improving in organised farm as well as under field conditions, reflecting implementation of better selection and management programmes for this breed. Highest recorded peak yield of Gir cows was 22.9 liters/day in organised herd with standard 305 lactation yield of 4538 liters. Under field condition highest standard lactation yield of 5956 kg was recorded. Mean maximum milk fat, SNF, protein and lactose contents were 5.38, 9.60, 3.85 and 5.29%, respectively. Gir cows produced 9989 liters milk in her productive life and had recorded mean productive and herd life of 4.5 and 9.4 years, respectively with average number of 4.25 lifetime lactations. Hence, due to the better performance under tropical and sub-tropical climate more effort must be given to conserve this indigenous breed in their breeding tract in a sustainable manner.

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Conflict of Interests

There is no conflict of interest.

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References

1. Anonymous (2017). Approaches and experiences of NDDDB in development of Gir a promising Indigenous milch breed. *National Dairy Development Board*, pp.1-30.
2. Anonymous (2019). Annual Progress Report-2018, Cattle Breeding Farm, Junagadh Agricultural University, Junagadh, Gujarat. 15th Meeting of AGRESCO Sub-committee on Animal Science & A.H. and Fisheries Science, February 12-13, 2019. pp. 1-70.
3. Bhadoria, H.B.S., Khan, F.H., Tomar, S.S. & Yadav, M.C. (2003). Sources of variation in production traits and phenotypic and genetic correlations among themselves in Gir cattle. *The Indian Journal of Animal Sciences*, 73(11), 1256-1259.
4. Bhadoria, H.B.S., Khan, F.H., Tomar, S.S. & Yadav, M.C. (2004). Genetic study on some of the production traits in Gir cows. *The Indian Journal of Animal Sciences*, 74(10), 1075-1078.
5. Chaudhary, P.R. (1999). Culling and disposal of cattle in Gujarat state. *M.V.Sc. Thesis*, Gujarat Agricultural University, S.K. Nagar, Gujarat.
6. Dangar, N.S. & Vataliya, P. (2017). Heritability of production and reproduction traits in Gir cattle. *Indian Veterinary Journal*, 94(07), 46-48.
7. Dangar, N.S. & Vataliya, P.H. (2015). Factors affecting lactation milk yield in Gir cattle. *Indian Veterinary Journal*, 92(7), 71-73.
8. Dora, D.S., Chourasia, S.K., Sahu, S.S., Paikra, D. & Bara, S. (2020). Relationship between different milk constituents of Gir cow. *Journal of Entomology and Zoology Studies*, 8(2), 551-553
9. Gadariya, M.R., Vataliya, P.H., Murthy, K. S., Savsani, H.H. & Gajbhiye, P.U. (2017a). Herd structure, performance traits, pattern of calving and culling in an organized large herd of Gir cattle. *Indian Journal of Veterinary Science and Biotechnology*, 13(3), 21-26.
10. Gadariya, M.R., Vataliya, P.H., Murthy, K.S. & Gajbhiye, P.U. (2017b). Breeding and lactation efficiencies, production profile, productive herd life and lifetime productivity of Gir cows in their home tract. *Indian Journal of Veterinary Science and Biotechnology*, 13(2), 26-30.
11. Gaikwad, J.S., Jadhav, R.M., Torawane, Kranti B. & Todmal, S.B. (2011). Productive and reproductive performance of Gir cow in Akola district. *Asian Journal of Animal Science*, 6(2), 94-96.
12. Gajbhiye, P.U., Ahlawat, A.R., Sharma H. A. & Parikh, S.S. (2019). Effect of stage, season and parity of lactation on milk composition in Gir cattle. *International Journal of Current Microbiology and Applied Science*, 8(3), 2419-2425
13. Gajbhiye, P.U., Gadariya, M.R., Ahlawat, A.R & Dongre, V.B. 2016. Present status and future prospects of Gir cow. *Indian Journal of Animal Sciences*, 86(5), 553-558.
14. Gardharia, H.B., Gadariya, M.R., Dutta, K.S. & Tajane, K.R. (2000). Report on survey of animal genetic resources of Gir cattle (1998–2000), GAU, Junagadh.
15. Gaur, G.K., Kaushik, S.N. & Garg, R.C. (2003). The Gir cattle breed of India - characteristics and present status. *Animal Genetic Resources Information*, 33, 21-29.
16. Joshi, N.R. & Phillips, R.W. (1953). Gir. *In: Zebu cattle of India and Pakistan*. FAO, Rome, Italy. pp.153-167.
17. Kohler-Rollefson, I. (2000). Management of animal genetic diversity at community level. GTZ Programme on 'Managing Agrobiodiversity in Rural Areas' Eschborn, Germany. pp.1-16.
18. Mathur, A.K. & Khosla, S.K. (1994). Gir cows in their breeding tract. *Indian Journal of Animal Sciences*, 64(11), 1207-1218.
19. Mayekar, A.J., Yadav, D.N., Kumar, S., Desai, B.G., Burte, R.G. & Dhekale, J.S. (2017). Evaluation of reproduction performance of Gir cattle (*Bos indicus*) reared in Hot-Humid condition of Konkan region. *Journal of Livestock Biodiversity*, 7(2), 93-98.
20. Modh, R.H., Islam, M.M., Patel, Y.G., Modi, R.J. & Wadhvani, K.N. (2017). Effect of parity on udder and teat biometry and its association with milk yield in Gir cows. *International Journal of Science, Environment and Technology*, 6(3), 2068-2073.

21. Nanavati, S. & Qureshi, M.I. (1996). Study of peak yield and peak day in Gir cattle. *Indian Veterinary Journal*, 73, 762-765.
22. Qureshi, M. I., Taylor, C. M. & Singh, B. N. (1984). A note on teat measurements and shape of udder and teat and its correlation with milk yield in Gir cows. *Indian Veterinary Journal*, 61, 255-258.
23. Rankja, N.J. (2004). Comparative efficiency of algebraic models for lactation curves in Gir cow. *M.Sc. (Agri) Thesis*. Junagadh Agricultural University, Junagadh, Gujarat.
24. Sanders, J.O. (1980). History and development of Zebu cattle in the United States. *Journal of Animal Science*, 50(6), 1188-1200.
25. Savaliya, B.D., Parikh, S.S., Gamit, P.M. & Gajbhiye, P.U. (2016). Environmental factors affecting economic traits in Gir cattle. *International Journal of Science, Environment and Technology*, 5(4), 2467-2475.
26. Sawant, P., Singh, B., Sawant, D., Yadav, S.P. & Bhinchhar, B.K. (2016). Effect of genetic and non-genetic factors on first lactation traits in Gir cows. *Indian Journal of Animal Research*, 50(6), 872-876.
27. Singh, B., Sawant, P., Sawant, D., Todkar, S. & Jain, R. (2016). Factors affecting weight and age at first calving, first lactation milk yield in Gir cows. *Indian Journal of Animal Research*, 50(5), 804-807.
28. Singh, J. & Shukla, K.P. (1986). Relationship of lactation persistency with some economic traits in Gir cattle. *Indian Veterinary Journal*, 63, 494-499.
29. Singh, J. (1983). Persistency of milk production in Gir cattle. M.Sc. Thesis. Anand Agricultural University, Anand, Gujarat.
30. Singh, U., Raja, T.V., Alyethodi, R.R. & Murthy, K.S. (2019). Genetic evaluation of Gir bulls under associated herd progeny testing programme. *Indian Journal of Animal Sciences*, 89(5), 567-568.
31. Singh, U., Raja, T.V., Alyethodi, R.R., Gajbhiye, P.U., Prakash, B. & Bhasin, V. (2018). Genetic improvement programme in Gir cattle for enhancing milk productivity. *Indian Journal of Animal Sciences*, 88(1), 21-25.
32. Singhai, S.K. (2012). Phenotypic characteristics of udder and teat vis-à-vis milk yield and milking traits in Gir cows. *M.V.Sc. Thesis*. Junagadh Agricultural University, Junagadh, Gujarat.
33. Singhai, S.K., Ravikala K., Murthy, K.S., Gajbhiye, P.U., Vataliya, P.H. & Savsani, H.H. (2013). Udder teat morphology and body measurements and their relationship with milk yield and milking traits in Gir cows. *Indian Journal of Animal Production and Management*, 29(1-2), 5-11.
34. Tripathi, G.S., Koul, G.L. & Katpatal, B.G. (1982). Biometrical studies on shape and size of udder and teats and their relation with milk yield in Gir cattle. *Indian Journal of Dairy Science*, 35, 539-43.
35. Ulmek, B.R. & Patel, M.M. (1993). Milk production efficiency in Gir cattle. *Journal of Dairying, Foods and Home Sciences*, 12, 53-56.
36. Ulmek, B.R. (1990) Genetic studies of production traits in Gir Cattle. *Ph.D. Thesis*, Gujarat Agricultural University, S.K. Nagar, Gujarat
37. Vataliya, P.H., Gadariya, M.R., Murthy, K.S. & Gajbhiye, P.U. (2019). Effect of non-genetic factors on lactation and reproductive performance of Gir cows. *Indian Journal of Animal Production and Management*, 35(1-2), 6-13.
38. Vora, R., Patel, N., Mayank, G. & Patel, P. (2019). Milking behaviour responses of primiparous and multiparous Gir cows in early lactation. *International Journal of Livestock Research*, 9(5), 75-82.
