FOLLICULAR DYNAMICS DURING ESTROUS CYCLE IN POSTPUBERTAL AND POSTPARTUM GIR CATTLE

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ABSTRACT

The follicular dynamics of an entire estrous cycle was monitored daily between two consecutive estruses in 6 postpubertal Gir heifers and 6 postpartum Gir cattle using an ultrasound. The Gir heifers indicated the presence of 2-follicular wave (n=4) and 3-wave (n=2) estrous cycle. The second wave appeared earlier with 3-wave than with 2-wave ($p<0.05$). The linear growth rate, persistence and duration of regression phase of first dominant follicle were longer in 2-wave cycle ($p<0.05$). The maximum diameter of ovulatory follicle (OF) was higher in 3-wave cycle, whereas its linear growth rate was higher in 2-wave cycle ($p<0.05$). The follicular turnover in postpartum Gir cattle was also characterized by 2- and 3-waves in equal frequency. The linear growth rate and persistence of OF was more and persistence was less in 3-wave cycle ($p<0.01$). All other parameters of 2- and 3-wave cycle of Gir cattle were similar. The study concluded that 2-wave cycles are more common with slightly shorter cycle length in Gir heifer than the pluriparous Gir cattle.

Keywords: Dominant follicle, Estrous cycle, Follicular dynamics, Follicular waves, Gir

INTRODUCTION

Use of ultrasound technology in animal reproduction has an important role to reveal ovarian follicular dynamics (Ginther *et al*., 1996). During normal estrous cycle in bovines, two (Ginther *et al*., 1989) or three (Savio *et al*., 1988) follicular waves are common (Satheshkumar *et al*., 2011). The mechanisms that control follicular dynamics during estrous cycles need to be understood to optimize reproductive efficiency especially in zebu cattle. Gir cattle are slow breeders and have extended postpubertal and postpartum anestrous period, compared to their temperate counterpart and crossbred. The present study was aimed to understand the follicular dynamics in postpubertal Gir heifer and postpartum Gir cattle.

MATERIALS AND METHODS

Six postpubertal Gir heifers (>2.5 year) and six postpartum Gir cattle (60-90 day cyclic) maintained at Livestock Research Station, Anand were monitored for their follicular dynamics on each day of an entire estrous cycle between two consecutive estruses. Ultrasound examination was performed using a real-time B-mode ultrasound scanner (M-5 Vet, Mindray, China) equipped with a 5.0 to 8.0 MHz linear array transducer designed for intra-rectal placement. The transducer was placed over ovary through rectal wall and scanning was accomplished in several planes using 7.5 MHz frequency to identify all follicles >4 mm in diameter as well as the corpus luteum. The dominant follicle defined as the follicle that grew at least 10 mm and exceeded the diameter of other follicles. The subordinate follicles, follicular wave and ovulation has been defined earlier (Ginther, 1995 and Ramana *et al.*, 2013). The day of emergence of follicular wave was the day when first follicle grew >4 mm. The individual follicle growth period was the time from attaining 4 mm diameter till the day when maximum diameter was recorded. The atresia period was defined as time from decline in maximum diameter until last measurable diameter. The growth rate was calculated by subtracting minimum diameter (>4 mm) from maximum

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diameter and dividing by growth period. The desired images were frozen on screen and measurements were taken using a built in caliper system. The data generated were analyzed statistically using 't' test.

RESULTS AND DISCUSSION

The present study revealed two as well as three follicular wave estrous cycle in postpubertal Gir heifer as well as postpartum Gir cattle (Table 1 and 2). Others have reported one to four wave pattern of follicular development in heifers (Fortune *et al.,* 1988; Patel *et al.*, 2006 and Sichtar *et al.*, 2010). The day of emergence of first wave was similar between two and three wave cycle (p>0.05, Table 1). The second wave appeared earlier in three wave estrous cycle than two wave in Gir heifers (p<0.05, Table 1) as reported earlier (Baruselli *et al*., 1997). The second wave dominant follicle of a three wave cycle becomes incapable of suppressing follicle stimulating hormone (FSH) and thereby allowing FSH to surge for early emergence of third wave (Adams *et al.,* 1992).

In Gir heifer, the persistence of first dominant follicle (DF) and duration of regression phase was longer in two wave than in three wave cycle (p<0.05, Table 1). However, In case of first dominant follicle, the duration of growth and static phases, the last day of growth phase and beginning of its regression phase as well as the maximum diameter was similar between two wave and three wave cycle in Gir heifers (p>0.05, Table 1). However, in Gir heifers, the maximum diameter of ovulatory follicle was greater in 3-wave as compared to 2-wave pattern (p<0.05, Table 1). Also, the 2- and 3-wave cycles were similar with respect to the mean length of intervals between two consecutive estruses and between ovulations in Gir heifers (p>0.05, Table 1). A longer length of 3-wave cycle was observed in a previous report of HF cattle (Chasombat *et al.*, 2014). In Gir heifers, the linear growth rate of first dominant follicle and ovulatory follicle was higher in 2-wave as compared to 3-wave cycle (p<0.05, Table 1) as reported earlier (Ahmed *et al.*, 1997). In regression phase, the end day of regression phase was higher and linear

Table 1:Characteristics (mean±SE) **of dominant follicle of each wave in two-(21.50±0.29 D) or three-(22.00±0.00 D) waves estrous cycle in Gir heifer** (n=6)

	First DF		Second DF		Third DF
	2 wave (n=4, 66.7%)	**3 wave**	**2 wave** (OF)	**3 wave** (n=2, 33.3%)	**3 wave** (OF)
Growth phase					
Beginning day		0.50 ±0.50	10.00±0.58^{g}	9.00±1.0	16.5±0.5^{h}
End day	8.25±0.47	8.50±0.50	20.50±0.29^{e}	13.00±1^{f}	21.5±0.5
Duration, day	7.75±0.25	8.00±0.00	10.50±0.65^{e}	4.00±0.0^{f}	5.00±0.0
LG Rate, mm/day	1.09±0.19^{c}	0.46±0.11^{d}	0.79±0.11^{g}	0.57±0.3	0.67±0.1^{h}
Max dia of OF, mm	-	-	12.55±0.27^{g}	-	13.7±0.1^{h}
Static phase					
Duration, day	5.00±0.00	4.50±0.50	-	4.00±0.0	-
Max dia, mm	11.07±0.29	10.85±0.45	-	10.2±0.1	-
Regression phase					
Beginning day	13.75±0.62	14.50±0.50	-	16.5±0.5	-
End day	21.00±0.0^{e}	19.50±0.5^{f}	-	22.5±0.5	-
Duration, day	7.25±0.62^{e}	5.00±0.00^{f}	-	6.0±0.0	-
LR Rate, mm/day	-0.86±0.1^{e}	-1.52±0.22^{f}	-	-1.46±0.2	-
Persistence of 1st DF, day	20.25±0.2^{e}	19.00±0.0^{f}	-	-	-
Persistence of 2nd DF, day	-	-	-	13.5±0.4	-

DF, Dominant follicle; OF, Ovulatory follicle; LG Rate, Linear growth rate; LR Rate, Linear regression rate; $^{c\ vs\ d,\ e\ vs\ f}$p<0.05, within a row of each DF; $^{g\ vs\ h}$p<0.05, within a row of each OF

Table 2: Characteristics (mean±SE) **of dominant follicle of each wave in two-(21.33±0.33 D) or three-(22.66±0.33 D) waves estrous cycle in Gir cattle** (n=6)

	First DF		Second DF		Third DF
	2 wave (n=3, 50%)	**3 wave**	**2 wave** (OF)	**3 wave** (n=3, 50%)	**3 wave** (OF)
Growth phase					
Beginning day	0.33±0.33	0.33 ±0.33	9.33±0.88^{g}	8.00±0.0	14.3±0.3^{h}
End day	8.33±0.33	8.33±0.33	20.66±0.3^{e}	13.66±0.3^{f}	22.0±0.0
Duration, day	8.00±0.57	8.00±0.58	11.3±0.7^{eg}	5.65±0.33^{f}	7.66±0.3^{h}
LG Rate, mm/day	0.95±0.10	0.93±0.12	0.64±0.09^{ie}	1.24±0.12^{f}	0.7±0.13^{j}
Max dia of OF, mm	-	-	13.26±0.43	-	13.1±0.4
Static phase					
Duration, days	5.33±0.33	5.33±0.67	-	3.66±0.33	-
Max dia, mm	12.50±0.35	12.23±0.49	-	12.23±0.47	-
Regression phase					
Beginning day	13.66±0.67	13.66±0.88	-	17.33±0.33	-
End day	18.66±0.33	19.00±0.58	-	20.00±0.00	-
Duration, day	5.00±0.58	5.33±1.45	-	2.66±0.33	-
LR Rate, mm/day	-1.20±0.15	-1.22±0.11	-	-1.78±0.14	-
Persistence of 1st DF, day	18.33±0.33	18.66±0.66	-	-	-
Persistence of 2nd DF, day	-	-	-	12.00±0.00	-

DF, Dominant follicle; OF, Ovulatory follicle; LG Rate, Linear growth rate; LR Rate, Linear regression rate; $^{e\ vs\ f}p<0.05$, within a row of each DF, $^{g\ vs\ h,\ i\ vs\ j}p<0.05$, within a row of each OF

regression rate was lower of first dominant follicle 2-wave cycle than in 3-wave cycle in Gir heifers ($p<0.05$, Table 1).

The follicular dynamics in Gir cattle demonstrated 2- and 3-wave estrous cycle (Table 2) as observed previously (Baruselli *et al.*, 1997). There was no difference in 2- and 3-wave cycles with regard to the day of the emergence of the first wave ($p>0.05$, Table 2). The second wave appeared earlier with 3-wave than with 2-wave cycle ($p<0.05$, Table 2) and corroborated with earlier report (Baruselli *et al*., 1997).

Furthermore, In Gir cattle, the persistence, duration of growth, static and regression phase, the last day of growth phase as well as linear growth rate of the first dominant follicle were similar between 2-wave and 3-wave cycles ($p>0.05$, Table 2). The results also demonstrated that 2- and 3-wave cycles were similar with respect to the maximum diameter of both the first dominant follicle and the ovulatory follicle ($p>0.05$, Table 2). These results are in contrast to an earlier study (Baruselli *et al*., 1997), but agreed with the observations of others (Figuelredo *et al*., 1997).

In Gir cattle, the linear growth rate of ovulatory follicle was higher in 3-wave, whereas the persistence of ovulatory follicle was higher in 2-wave cycle ($p<0.01$, Table 2), and corroborated well with previous observations (Ahmed *et al.*, 1997). The estrous cycle length or intervals between two estruses was similar between 2- and 3-wave cycle ($p>0.05$, Table 2) as reported earlier (Patel *et al.*, 2006).

From the study it is inferred that follicular dynamics is a very good tool to understand mechanism of follicular development and regression/ ovulation in zebu cattle. Two wave cycles are more common with slightly shorter cycle length in Gir heifers than pluriparous cattle.

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