OVARIAN FOLLICULAR DYNAMICS DURING IMMEDIATE POST-INSEMINATION PERIOD AND SUBSEQUENT CONCEPTION IN GIR AND CROSSBRED CATTLE

K.K. HADIYA[1], A.J. DHAMI[2]*, J.A. PATEL[3], P.M. LUNAGARIYA[4] AND S.V. SHAH[5]

Department of Animal Reproduction Gynaecology and Obstetrics
Anand Agricultural University, Anand - 388 001

Received: 14.10.2016 Accepted: 18.11.2016

ABSTRACT

Transrectal ultrasonography aided ovarian follicular dynamics of 20 cattle (9 Gir, 11 Crossbred) during 21-day post-insemination period was investigated to know the differences in cattle that subsequently conceived or failed to conceive. During this period, two follicular waves were observed in majority ($p>0.05$) of conceived (Gir, 66.7%; Crossbred, 80.0%) as compared to their non-conceived (Gir, 50.0%; Crossbred, 66.7%) counterparts. The linear growth and regression rate of 1st dominant follicle as well as the maximum diameter of 2nd dominant follicle were lower ($p<0.05$) in conceived cattle of both breeds compared to non-conceived cattle. Further, in the conceived crossbred counterparts, the 1st dominant follicle had delayed ($p<0.05$) beginning of regression phase (15.7±0.2 *vs.* 14.0±0.4 d) of shorter duration (4.7±0.6 *vs.* 7.0±0.4 d) as compared to non-conceived counterparts. In brief, a differential ovarian follicular dynamics exists during immediate post-AI period in dairy cattle.

Keywords: Cattle, Conception, Follicular dynamics, Gir, Ultrasonography

INTRODUCTION

It is well known that the normal non-pregnant cyclic cattle exhibit either two or three follicular wave cycle (Adams *et al*., 2008). The follicular dynamics remains similar during interovulatory interval and the first 21 days of pregnancy in heifers, whereas after day 25, the conceptus or products of conceptus had unilateral negative influence (Pierson and Ginther, 1987). Thus, after first 20 days of pregnancy, follicular growth slows down, diameter of largest follicle decreases and corpus luteum has a negative effect on follicular growth of ipsilateral ovary (Guibault *et al.*, 1986). The present study aimed to investigate follicular dynamics during 21-day post-insemination period with respect to subsequent successful conception in Gir and crossbred cattle.

MATERIALS AND METHODS

The study was carried out on gynaeco-clinical healthy normal cyclic postpartum Gir (n=9) and HF x Kankrej crossbred (n=11) cattle of University farm at Anand. These animals were inseminated between January and March, 2014. All the animals were loosely housed in the same shed with free access to clean drinking water and managed under identical nutritional conditions. Estrus detection was carried out twice daily by visual observations, each lasting for an hour in the morning and in the evening. The cattle in estrus were confirmed by palpation per rectum and by transrectal ultrasound scanning. Artificial insemination was done with good quality frozen-thawed semen. In all these cattle, transrectal ultrasound examination was performed daily over entire cycle till day 23 post-AI and then on day 28, 35 and 42 post-AI using a real time B-mode ultrasound scanner (M-5 Vet, Mindray, China) equipped with a 5.0-8.5 MHz linear array transducer. The scanning of both ovaries was accomplished in several planes to identify the follicles >4 mm diameter and the corpus luteum. The uterine horns were scanned for uterine contents (Ginther, 1995). The cattle diagnosed pregnant on day 28 and day 42 by

[1]Assistant Professor, [2]Professor and Head, [3]Professor; [4]Assistant Research Scientist, [5]Associate Research Scientist and Head, Livestock Research Station; *ajdhami@aau.in

transrectal ultrasonography was confirmed by per rectum examination on day 60. The wave patterns for first 21 days post-AI were compared with those that did not conceive by employing students' 't' test.

RESULTS AND DISCUSSION

During the immediate 21-day post-insemination period, the occurrence of two follicular wave pattern was recorded in 66.7% of conceived (n=3/9) and 50% of non-conceived (n=6/9) Gir cattle (Table 1). In crossbred cattle, 80% of conceived (n=5/11) and 66.7% of non-conceived (n=6/11) had two-wave follicular pattern (Table 1). The remaining cattle of both the breeds had three-wave follicular pattern, however, the one-wave follicular growth reported during first 21 days of pregnancy in Mehsana buffalo (Awasthi *et al.,* 2011) was not evident in the present study. A regular wave-like pattern of follicular growth was also observed during first 60 days of pregnancy in an earlier study in cattle (Taylor and Rajamahendran, 1991). Nevertheless, this study confirmed that majority of the Gir and crossbred cattle that conceived subsequently had two-wave follicular pattern during the immediate post-AI period.

During the growth phase of first dominant follicle, there was no difference in the emergence and end day of 1st dominant follicle with respect to subsequent conception status in the cattle of both breeds (p>0.05, Table 1). However, the duration of growth phase of

Table 1: Characteristics of two-wave follicular cycle during immediate post-insemination period in cattle that subsequently conceived (C) or failed to conceive (NC)

Characteristics	Gir (n=9)		Crossbred (n=11)	
	C (n=3)	NC (n=6)	C (n=5)	NC (n=6)
Cattle with 2 waves	2 (66.7%)	3 (50.0%)	4 (80.0%)	4 (66.7%)
First Dominant Follicle				
Growth phase				
• **Beginning**, d	0.5±0.5	0.3±0.3	0.7±0.3	0.5±0.3
• **End**, d	10.5±0.5	8.3±0.3	9.2±0.5	8.2±0.2
• **Duration**, d	10.0±0.0*	8.0±0.6	8.5±0.5	7.7±0.5
• **LGR**, mm/d	0.73±0.09*	0.95±0.10	0.9±0.07*	1.21±0.12
Static Phase				
• **Duration**, d	5.5±0.5	5.3±0.3	4.5±0.5	5.7±0.2
• **Max diameter**, mm	11.7±0.2	12.5±0.3	11.7±0.2*	14.4±0.2
Regression phase				
• **Beginning**, d	15.5±0.5	13.7±0.7	15.7±0.2*	14.0±0.4
• **End**, d	19.5±0.5	18.7±0.3	20.5±0.2	21.0±0.0
• **Duration**, d	4.0±0.0	5.0±0.6	4.7±0.6*	7.0±0.4
• **LRR**, mm/d	-0.96±0.12*	-1.20±0.15	-1.07±0.07*	-1.39±0.09
Second Dominant Follicle				
Growth phase				
• **Beginning**, d	11.0±1.0	9.3±0.9	10.2±0.2	9.0±0.7
• **End**, d	21.0±0.0	20.7±0.3	21.2±0.2	21.0±0.1
• **Duration**, d	10.0±0.7	11.3±0.7	11.0±0.4	12.0±0.7
• **LGR**, mm/d	0.54±0.09	0.64±0.01	0.89±0.07	0.9±0.07
• **Max diameter**, mm	11.6±0.2*	13.3±0.4	11.7±0.2*	16.4±1.0

*p<0.05, between conceived and non-conceived Gir or Crossbred cattle; LGR, Linear growth rate; LRR, Linear regression rate

1st dominant follicle was longer and the linear growth rate was lower in conceived cattle compared to their non-conceived counterparts ($p<0.05$, Table 1). The maximum diameter of 1st dominant follicle was lower in conceived cattle with the difference reaching significance for crossbred cattle ($p<0.05$, Table 1). Similar findings were reported in Holstein heifers (Ginther *et al.,* 1989 and Taylor and Rajamahendran, 1991). The beginning of regression phase of 1st dominant follicle was delayed and the duration of regression phase was shorter ($p<0.05$) in conceived crossbred cattle, however, the linear regression rate was lower ($p<0.05$) in non-conceived cattle of both the breeds (Table 1).

The growth phase dynamics of 2nd dominant follicle were similar ($p>0.05$) in both the breeds of cattle with respect to subsequent pregnancy status except the maximum diameter which was less ($p<0.05$) in conceived cattle (Table 1). This could be due to negative influence of conceptus or its product on follicular development. In a previous study, a major difference was reported between conceived and non-conceived cattle with regard to absence of large ovulatory follicle in conceived animals (Thatcher *et al.,* 1988).

It was thus concluded that the Gir and crossbred cows continued to have a regular wave-like pattern of follicular growth throughout first 21 days of pregnancy, and that most cows showed two-wave cycles during that period.

ACKNOWLEDGEMENTS

We thank Dean of the Faculty and the Research Scientist of the University Livestock Farm for the facilities and permission granted to take up this work.

REFERENCES

Adams, G.P., Jaiswal, R., Singh, J. and Malhi, P. (2008). Progress in understanding ovarian follicular dynamics in cattle. *Theriogenology*, **69**: 72-80.

Awasthi, M.K., Khare, A., Kavani, F.S., Siddiquee, G.M. and Dhami, A.J. (2011). Early pregnancy diagnosis in water buffaloes using trans-rectal ultrasonography.*Indian J. Anim. Reprod*., **32**(1): 47-79.

Ginther, O.J. (1995). *Ultrasonic imaging and animal reproduction: Fundamentals: Book1*. Equiservices Publishing, USA, pp. 148-149.

Ginther, O.J., Knopf, L. and Kastelic, J.P. (1989). Ovarian follicular dynamics during early pregnancy. *Biol. Reprod.,* **41**: 247.

Guibault, L.A., Dufour, J.J., Thatcher, W.W., Drost, M. and Haibel, G.K. (1986). Ovarian follicular development during early pregnancy in cattle.*J. Reprod. Fertil.,* **78**: 127.

Pierson, R.A. and Ginther, O.J. (1987). Follicular population during the estrous cycle in heifers. II. Influence of right or left sides and intraovarian effect of corpus luteum. *Anim. Reprod. Sci.,* **14**: 177-186.

Taylor, C. and Rajamahendran, R. (1991). Follicular dynamics and corpus luteum growth and function in pregnant versus non-pregnant dairy cows. *J. Dairy Sci.,* **74**:115-123.

Thatcher, W.W., Hansen, P.J. and Bazer, F.W. (1988). Role of conceptus in the establishment of pregnancy.*11th Int. Congress Anim. Reprod. A.I., Univ. Dublin,Ireland,* June 26-28, pp. 45.