CONTROL OF OVULATION IN DAIRY CATTLE WITH HUMAN CHORIONIC GONADOTROPHIN AFTER TREATMENT WITH 6 α -METHYL-17 α -ACETOXY- PROGESTERONE

C. N. GRAVES* AND P. J. DZIUK†

*Departments of *Dairy Science and †Animal Science,
University of Illinois, Urbana*

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A degree of control of oestrus in cattle by progestagens is possible by either injection (Nellor & Cole, 1956), implantation (Dziuk, Cmarik & Greathouse, 1966) or feeding (Dhindsa, Hoversland & Smith, 1967). Following withdrawal of the progestagen, heat occurs in 2 to 9 days and each cow can be mated or artificially inseminated according to signs of heat (Hansel, Donaldson, Wagner & Brunner, 1966). In some instances, treated cows may ovulate but not show the characteristic manifestations of oestrus and thus are not inseminated (Van Blake, Brunner & Hansel, 1962). The objectives of the current study were two-fold: first, to determine if ovulation in the cow could be controlled precisely, and second, by insemination at some predetermined time to eliminate detection of oestrus, to determine if the eggs could be fertilized.

The forty-seven cows in this study were of mixed dairy breeding and discarded from the University of Illinois dairy herd either because they had failed to conceive to one or more services or because they no longer produced milk profitably. Before the experiment, all cows were either cyclic or were diagnosed non-pregnant by rectal palpation. Treatment was initiated in all animals within each group on the same calendar date without regard for their last heat date, thus treatment began at all stages of the oestrous cycle. One hundred and eighty milligrammes of 6 α -methyl-17 α -acetoxyprogesterone (MAP) were mixed daily with the morning grain ration of each cow for 15 to 18 days (Zimbelman, 1963). At predetermined times after withdrawal of the MAP, the cows were injected intramuscularly with 500 i.u. of human chorionic gonadotrophin (HCG), inseminated and then later slaughtered. If ovulation occurred, the eggs were recovered and examined both as fresh whole mounts and as stained, fixed preparations.

Table 1 shows the results obtained with the first group of five cows. In this trial, the only cows which ovulated, even at 78 hr after withdrawal of the MAP, had received HCG, therefore, in all subsequent trials HCG was administered intramuscularly at the times shown in Table 2. The results obtained with the two cows which received the HCG in the first trial (Table 1), but which had not ovulated by 39 hr after HCG, seemed to indicate that the interval between HCG and slaughter may have been inadequate.

Table 2 is a summary of the data from nine groups of cows. Several of the cows did not eat the MAP on 1 or more days because an excess of concentrate ration was fed, usually on the previous day. These cows which missed one or more feedings of MAP had not ovulated.

An injection of a horse anterior pituitary preparation (Gan-Tro-Peen provided by Al-Par Labs, La Grange, Illinois) did not cause ovulation in this experiment and therefore was not used further.

Three cows, killed 3 days after treatment, had normal fetuses 30 to 60 days old, indicating that the MAP-HCG treatment had no adverse effect on an existing pregnancy. Therefore, repeat treatments applied to a herd inadvertently containing pregnant animals would not be expected to be harmful.

Injection of HCG has been used previously to induce and synchronize ovulation in gilts (Dziuk & Baker, 1962) and sheep (Dziuk, Hinds, Mansfield & Baker, 1964), ovulation occurring 40 and 25 hr respectively after the HCG. In the cows in this study, ovulation apparently occurred about 40 hr after HCG. No cows killed less than 40 hr after HCG had ovulated. Eggs recovered

TABLE 1
EFFECT OF HCG ON OVULATION IN DAIRY CATTLE WHEN ADMINISTERED AT VARIOUS TIME INTERVALS AFTER WITHDRAWAL OF MAP

Cow no.	Interval from last MAP to HCG (hr)	Interval between HCG and slaughter (hr)	Interval from last MAP to slaughter (hr)	Results
14	36	41.5	77.5	Recent ovulation (spermatozoa on zona of egg)
17	38	39.8	77.8	Large follicle, no ovulation
19	40	38.5	78.5	Large follicle, no ovulation
62	No HCG	—	78	Large follicle, no ovulation
472	No HCG	—	78	Large follicle, no ovulation

from cows 41 to 45 hr after HCG were in the very early stages of fertilization, while eggs recovered at 45 to 60 hr after HCG were in the late pronucleate stage. The timing of ovulation was substantiated by the appearance of ovulation points. More definitive studies will be needed before the length of the HCG-to-ovulation interval can be established conclusively. The peak of LH activity in bovine peripheral plasma has been reported by Varian, Hendricks & Melampy (1967) to occur from 24 to 32 hr before ovulation. Further work may resolve these apparent discrepancies in this time interval.

The 60-hr interval employed in Groups 8 and 9 from withdrawal of MAP to the HCG injection coupled with an interval from HCG injection to insemination of 24 hr seemed to give the optimum results. In these two groups, eleven (79%) of the fourteen cows ovulated, with six (55%) of the eggs being fertilized. This fertilization rate is more than twice the conception rate reported previously by some workers (Fahning, Schultz, Graham, Donker & Mohrenweiser, 1966). Whether this fertilization rate would persist through to calving is not known and will require additional study.

The results of these experiments suggest that, in cows, a follicle sufficiently developed to be sensitive to HCG that has not already been stimulated by endogenous ovulating hormone ovulates about 40 hr after HCG. Resultant eggs

TABLE 2
OCCURRENCE OF OVULATION AND FERTILIZATION IN NINE GROUPS OF COWS FOLLOWING ADMINISTRATION OF MAP AND HCG

Group no.	No. of cows	Days of MAP feeding (no.)	Interval in hours from:			Cows ovul. (no.)	Eggs recovered (no.)	Eggs fertilized (no.)	Remarks
			MAP to HCG	HCG to insemination	HCG to slaughter				
1	5	18	36 to 40	17 to 22	38 to 41	1	1	1	Four cows had large follicles
2	3	17	60	Not inseminated	41	1	0	-	
3	1	17	59	26	45	1	1	1	
4	4	17	61	20	54	3	3	2	
5	1	18	58	24*	66	0	-	-	No MAP eaten on Day 12
	2	18	58	25	68	0	-	-	
	2	18	59	23*	42	0	-	-	
	2	18	58	23	41	2	2	1	
6	3	18	52	24	48-50	0	-	-	Two cows did not eat MAP on 14th day
7	5	18	62	39	62	3	2 (both from same cow)	2	Two cows did not eat MAP (one on 6th and 15th day, one on 4th and 12th day)
	5	18	74	26	50	3	1 (abnormal)	0	
8	10	16	60	25	48-52	7	3	3	Three animals had occluded oviducts, impossible to recover eggs
9	4	15	60	25	50-54	4	4	3	

* Horse pituitary preparation containing FSH as well as LH activity used rather than HCG (none of these animals ovulated).

are fertilizable. This precise control of ovulation time obtained in these preliminary studies indicates that large groups of cows may in the future be successfully inseminated at some predetermined time without detecting oestrus.

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