THE EVALUATION OF POSTPARTUM PERIOD IN DAIRY COWS WITH NORMAL AND PERIPARTURIENT PROBLEMS

KOCAMUFTUOGLU M* and VURAL R**

*University of Mehmet Akif Ersoy Faculty of Veterinary Medicine, Dept. of Obstetrics and Gynecology, Burdur, Turkey; **University of Ankara Faculty of Veterinary Medicine, Dept. of Obstetrics and Gynecology, Ankara, Turkey

The evaluation of uterine diameter, bacterial flora, ovarian activity and fertility parameters was aimed in this study by means of clinical examination performed 20, 30 and 40 days after calving in dairy cows exhibiting normal (Group 1, n=30) and abnormal (Group 2, n=30) periparturient periods. On the 20th, 30th and 40th day postpartum; in Group 2, uterine horns had larger diameters compared to Group 1. In both groups, the rate of involution was determined to be higher between 20 and 30 days postpartum in previously gravid uterine horns, and between 30 and 40 days postpartum in non-gravid uterine horns. In Group 2, fluid accumulation in both uterine horns was determined to be high on the 20th and 30th day postpartum. Bacterial agents were isolated from 11 and 25 cows in Groups 1 and 2, respectively on the 20th day after calving. The most frequently found microorganisms were determined to be E. coli in the first and A. pyogenes in the second group. However an evident reduction in the number of bacteria was observed in the second group on the 40th day after calving. Among the animals included in Group 1, 10 were determined to have regular ovarian activity, 12 to have inactive ovaries, 2 to have resistant luteal structures, and 6 to have resistant follicular structures throughout the 40 days following calving. The numbers of animals in Group 2 detected to exhibit the same structures were determined as 7, 16, 4 and 3 cows, respectively. The interval from calving to the first service and the calving to conception interval were found to be prolonged in Group 2. The high level of fluid accumulation in the uterus, especially between days 20-30 postpartum, the difference between measurements of previously gravid uterine horns and the isolation of A. pyogenes were regarded as parallel findings.

Key words: bacteria, dairy cattle, fertillity, ultrasonography

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INTRODUCTION

Uterine involution, endometrial regeneration, elimination of intra-uterine bacterial contamination and the resumption of cyclic activity in the ovaries occur either concurrently or consecutively in dairy cows throughout the puerperal period (Arthur *et al*., 1992). Factors including dry cow nutrition and feeding management in the periparturient period, metabolic diseases, premature birth of live or dead calves, dystocia, prolapsus uteri, retentio secundinarum, septic metritis, cattle breed, lactation and number of parturitions have a significant influence on the resumption of uterine involution and ovarian activity (Hussain and Daniel, 1991; Arthur *et al*., 1992; Kindahl *et al*., 1999; Fourichon *et al*., 2000; Mateus *et al*., 2002). Nonetheless, bacterial infection caused by Arcanobacterium (Actinomyces) pyogenes, coliform microorganisms, haemolytic streptococci, *Gram (+)* and *Gram (–)* anaerobic bacteria also determine puerperal physiology (Hussain and Daniel, 1991; Dohmen *et al*., 2000).

Rectal palpation, ultrasonography, vaginal examination and a set of laboratory diagnostic methods (progesterone monitoring, biopsy, agent identification, liver function tests and other biochemical parameters) performed on 20, 30, 40 and 60 days postpartum serve for the evaluation of uterine involution and ovarian activity in the puerperal period. Longitudinal and cross sectional ultrasonographic measurements of the endometrium and stratum vascularis of the uterus performed between the 10th and 50th day of the puerperal period have revealed the diameters of uterine horns to range between 2-4 cm. Fluid accumulation in the described period was easily detected (Okana and Tomizuka, 1987; Holt *et al*., 1989; Zain *et al*., 1995; Bekana *et al*., 1996).

In this study, the evaluation of uterine involution, aerobic bacterial flora of cervix uteri, ovarian activity and intervals from parturition to first service, as well as from parturition to conception were studied by means of rectal palpation, ultrasonography and vaginal examination on the 20th, 30th and 40th day postpartum in dairy cows with normal and abnormal periparturient periods.

MATERIAL AND METHODS

Animals

This study was carried out on 60 dairy cows belonging to a private agricultural enterprise. The animals were reared within an open system and nutrition management was carried out by means of an automatic feeding system supported with software specifically developed for milking cows (Alfa Laval Agri). The feed of the animals was prepared as TMR (total mixed ration) and distributed to feeders in the stable twice a day, in the morning and evening. According to the calculated mean milk production value of 30 kg, the dry substance, NEL (net energy lactation) and digestible protein requirements of the studied animals previously determined to be in the early phase of lactation were met at 19 kg, 30.7 Mcal/day, and 2100 g/day, respectively. The dairy cows included in the study had a mean live weight of 650 kg and were fed to exhibit a daily weight loss of 280 g. These animals were maintained in a body condition status of 3 assessed

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according to a fivefold grading system. Forage given to the animals comprised of maize silage, dry clover and dry vetch gruel.

Grouping

The studed cows were allotted in two groups, each comprising of 30 animals cattle. Group 1 included dairy cows with normal and sound periparturient periods, whereas Group 2 comprised of animals with periparturient disorders including metabolic diseases, dystocia, acute metritis and endometritis, and retained placenta.

Rectal palpation and ultrasonographic examination were performed in both groups on the 20th, 30th and 40th day postpartum in order to determine the structures located on the ovaries and the level of uterine involution. Swab samples obtained from the cervix under sterile conditions were sent to the laboratory for possible isolation and identification of aerobic bacteria. Oestruses of the studied dairy cows included in both groups were recorded from the 40th day postpartum onwards and the rates of conception were estimated.

Ultrasonographic examination

A real-time B-mode ultrasound device (Pie-Medical, 100 Falco) and a linear multi-frequential 6-8 MHz rectal probe were used for ultrasonographic examination.

The longitudinal diameter of the anterior 1/3 section of both uterine horns, proximal to the corpus uteri, measured in the dorso-ventral direction was evaluated in each animal included in the study. Evaluation of uterus thickness was based on the distance between the upper and lower serosal layers, covering the endometrium and stratum vascularis, namely the external diameter. The amount and features of the fluid in the lumen of the uterus were evaluated in accordance with the obtained images.

Fluids detected to be present in the uterus by means of ultrasonography were graded as 0, +1, +2 according to the accumulated amounts. In this evaluation, the mentioned grades were regarded to be equivalent to the following amounts; 0: 0-0.9 ml; +1: 1-1.5 ml; +2: 1.6≤ ml.

Collection of swab samples and bacteriological evaluation

Samples obtained from the cervix with swabs (LP Italiana SPA, Stuart) were brought to the laboratory under cold chain conditions and grown on agar enriched with sheep blood. Following an incubation period of 48 h at 37°C, the haemolytic characteristics and macroscopic morphology of grown colonies were evaluated. Gram staining was performed for bacterioscopical examination and Gram positive bacteria were grown on Edwards medium. Biochemical characteristics were identified by means of catalase, coagulase, mannitol oxidation fermentation, CAMP, nitrate and urea tests. Gram negative bacteria were grown on Mac Conkey and EMB mediums for differentiation. Agent identification and determination of their biochemical characteristics were assessed in

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accordance with the results of oxidase, catalase, indol, H_2S, glucose oxidation fermentation, urea, nitrate, and methyl-red tests.

Collection of blood samples

Blood samples were collected by puncture of v. *subcutenea abdominalis* into vacuum tubes on the 20th, 30th and 40th day postpartum from each animal included in the study. Sera were harvested from collected blood samples by means of centrifugation at 3000 rpm for 10 minutes. Serum samples were transferred into eppendorf tubes and preserved at -20 ^{o}C until measurement of progesterone levels.

Monitoring of serum progesterone levels

Serum progesterone levels were assessed by radioimmunoassay (RIA) technique. Thawed sera and standard solutions provided with the kit were each transferred at volumes of 50 μL into tubes of the RIA progesterone kit. The fluid antigen labelled with iodine^{125} (I^{125}) was further added at a volume of 500 μL. After being thoroughly mixed on a vortex, the tubes were incubated in a shaker for an hour. At the end of the incubation period, the fluid part in the tubes was aspirated and each tube was read on a Gamma Counter for 1 minute. Values obtained with the standards were recorded in the computer in order to form a standard curve. After being transferred to the computer, sample values were converted into ng/mL values in accordance with the standard curve by the Berthold Immunoprocessing System, version 3.00.

Evaluation of Ovarian Activity

Ovarian findings were evaluated in the light of ultrasonographic examination results and serum progesterone levels detected in blood samples collected on the 20th, 30th and 40th day after calving. Following this evaluation, the examined animals were divided into four groups, including cows possessing regular follicular and luteal structures parallel to serum progesterone levels measured 20, 30 and 40 days after calving; cows possessing follicular structures of 0.5-0.9 cm diameter despite having no luteal structure and exhibiting serum progesterone levels below 1 ng/mL; cows exhibiting serum progesterone levels above 1 ng/mL in all examinations carried out on the 20th, 30th and 40th day postpartum and possessing luteal structures according to ultrasonography and finally, animals exhibiting serum progesterone levels below 1 ng/mL on the 20th, 30th and 40th day after calving, determined to possess follicular structures with a diameter larger than 1.5-2 cm and not having any luteal structures according to ultrasonographic examination.

Parameters of Fertility

In the presented study, the number of artificial inseminations and the interval from parturition to first service, as well as the interval from calving to conception, were taken into consideration as parameters of fertility (Alaçam, 1994; Smith and Wallace, 1998; Sheldon *et al*., 2000).

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In order to detect cows displaying oestrus 40-45 days after calving, animals were observed for behavioural oestrus, with the aid of an automatic electronic activity measurement device, rectal palpation and ultrasonography. The animals were observed for behavioural oestrus in the morning, afternoon and evening, i.e. three times a day, for half an hour. The physiological activities, daily feed consumption and milk production were evaluated by the aid of a computer by placing a radio transmitter on the neck of the observed cows. Animals determined to be in oestrus according to clinical signs and automatic electronic activity measurements were examined for return of heat prior to artificial insemination whereas animals in which oestrus was not detected with certainty were examined each morning by rectal palpation and ultrasonography. Animals determined to be in oestrus were artificially inseminated. Animals not displaying signs of oestrus within the expected time period were examined for conception, 40 days after being inseminated.

Statistical analysis

Clinical findings of the ovaries, fluid accumulation levels determined by ultrasonography on the 20th, 30th and 40th day after calving, the number of inseminations and non-pregnant cows in Group 1 and Group 2 were statistically analysed by the *chi-square test*, whereas the diameters of uterine horns measured with ultrasonography were analysed by means of *variance analysis of consecutive measurements*. On the other hand, the interval from parturition to the first service and the calving to conception interval were assessed by the *t-test* method.

RESULTS

Uterine involution

As seen in Table 1, the diameters of previously gravid uterine horns measured by ultrasonographic examination on the 20th day postpartum displayed signifikant differences between Group 1 and Group 2 (p<0.001). Measurements performed 30 and 40 days after calving revealed a proportional decline in comparison to the 20th day postpartum, in the diameters of previously gravid uterine horns both in Group 1 and Group 2. The decline in diameters was assessed to occur at levels of 0.665±0.684 cm and 0.336± 0.661 cm in Group 1 between days 20-30 and 30-40 postpartum, respectively, whereas declined at levels of 0.699±0.813 cm and 0.385±0.773 cm in Group 2 at the same time intervals. By the 40th day after calving, the diameters of previously gravid uterine horns were determined to display evident differences (Table 1). The rate of decline in the diameters of previously gravid uterine horns in the studied groups was determined to be lower between days 30 and 40 postpartum when compared to days 20 and 30 after calving.

Although the diameters of previously non-gravid uterine horns were found to be smaller in Group 1 in comparison to Group 2, a proportional decline was observed in both groups and by the 40th day postpartum, no significant differences were present between the two groups (Table 2). However, the decline

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in the diameters of previously non-gravid uterine horns was determined to be higher in Group 2 when compared to Group 1 between days 30 and 40 postpartum (Group 1, 0.222 ±0.682 cm; Group 2, 0.338±0.734 cm).

The diameters of previously gravid and non-gravid uterine horns were found to be similar in Group 1 on the 40th day after calving (Tables 1 and 2). In both groups, the degree of uterine involution was observed to be high in previously gravid uterine horns between days 20-30 postpartum, whereas between days 30-40 after calving in previously non-gravid uterine horns.

Table 1. The ultrasonographic evaluation of the diameters of previously gravid uterine horns

	Uterine horn (n: 30)	Group 1 [Highest / lowest] values	Group 2 [Highest / lowest] values
20th day	The diameter of previously gravid uterine horns	3.707 ±0.614 a* [5.03 / 2.69]	4.214 ±0.720 a* [6.37 / 2.72]
30th day	The diameter of previously gravid uterine horns	3.052 ±0.698 b* [4.84 / 1.88]	3.515 ±0.717 b* [5.27 / 2.1]
40th day	The diameter of previously gravid uterine horns	2.716 ±0.670 c* [4.54 / 1.8]	3.130 ±0.705 c* [5.08 / 2.22]

*a, b, c: Differences between mean values expressed with different letters in the same row or column are statistically significant (p<0.001).

Table 2. The ultrasonographic evaluation of the diameters of previously non-gravid uterine horns in the study groups

	Uterine horn (n: 30)	Group 1 [Highest / lowest] values	Group 2 [Highest / lowest] values
20th day	The diameter of previously non-gravid uterine horns (cm)	3.025 ±0.650 a* [4.6 / 2.15]	3.411 ±0.611 a* [4.84 / 2.2]
30th day	The diameter of previously non-gravid uterine horns (cm)	2.870 ±0.742 a-b* [4.33 / 1.67]	3.101 ±0.760 a* [5.46 / 2.12]
40th day	The diameter of previously non-gravid uterine horns (cm)	2.648 ±0.611 b* [4.12 / 1.61]	2.763 ±0.707 b* [4.62 / 1.64]

*a, b, c: Differences between mean values expressed with different letters in the same row or column are statistically significant (p<0.001).

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Fluid accumulation

Upon ultrasonographic examination of cows with normal periparturient periods on the 20th day after calving, fluid accumulation in the previously gravid uterine horns was determined to increase to a level of +2 in 21 dairy cows (70%) whereas a similar condition in previously non-gravid uterine horns was observed in only 12 cows (40%). Nonetheless, among animals with abnormal periparturient periods, fluid accumulation with a degree of +2 was determined in the previously gravid uterine horns of 29 (96,7%) and in the previously non-gravid uterine horns of 26 (86,7%) dairy cows. The difference between the two groups was significant (p<0.05). Fluid accumulation was observed to display a proportional decline between days 30-40 after calving in both groups. By the 40th day after calving, fluid accumulation was not detected in the previously gravid uterine horns of 8 animals included in Group 1. On the other hand, a fluid accumulation of a level of +2 was observed in 11 animals in Group 1 and 14 cows included in Group 2 (Table 3).

Table 3. The levels of fluid accumulation determined in the uterine horns by means of ultrasonographic examination

		20th day			30th day			40th day		
		0	1	2	0	1	2	0	1	2
Group 1	Previously gravid uterine horns (cm)	2	7	21	5	15	10	8	11	11
	Previously non-gravid uterine horns (cm)	3	15	12	4	17	9	6	16	8
Group 2	Previously gravid uterine horns (cm)	–	1	29	-	6	24	1	15	14
	Previously non-gravid uterine horns (cm)	–	4	26	1	7	22	2	17	11

Agent isolation

The number of animals from which bacterial agents were isolated on the 20th day postpartum were determined as 11 (36.7%) in Group 1, including animals with normal periparturient periods and 25 (83.3%) in Group 2, including dairy cows with disordered periparturient periods. The majority of the isolated agents were determined to be *E. coli* in Group 1 (9/11), whereas *A. pyogenes* (14/25) and *E. coli* (9/25) were observed to be dominant in Group 2 (Table 4).

Despite no significant decline in the number of isolated agents per animal on the 30th day postpartum in both groups, an evident decrease in comparison to the 20th day was observed in Group 2 by the 40th day after calving. *A. pyogenes* was isolated from 3 and *E. coli* from 5 dairy cows. On the 40th day after calving, *A. pyogenes* was not isolated in Group 1 and the number of isolated *E. coli* was found to be equal to the number assessed on the 30th day after calving (Table 4).

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Table 4. Aerobic bacterial agents isolated from cervix uteri in Group 1 and Group 2
on days 20, 30 and 40 postpartum

		20th day	30th day	40th day
Group 1	NO growth	19	22	23
	A. pyogenes	–	2	–
	E. coli	9	6	7
	Candida albicans	–	–	–
	Streptococcus spp	1	–	–
	S. epidermidis	1	–	–
	S. aureus	–	–	–
Group 2	NO growth	5	9	19
	A. pyogenes	14	11	3
	E. coli	9	8	5
	Candida albicans	–	–	1
	Streptococcus spp	–	1	–
	S. epidermidis	2	1	1
	S. aureus	–	–	1

Ovarian findings and parameters of fertility

Throughout the first 40 days after calving, normal ovarian functions were observed in 10 animals (33.3%) included in Group 1 whereas 12 cows (40%) were determined to have a serum progesterone level below 1 ng/mL and to lack active follicular development. Furthermore, 2 cows (6.7%) in Group 1 were detected to have resistant luteal and 6 cows (20%) to have resistant follicular structures. Among cows with an abnormal periparturient period (Group 2), 7 animals (23.3%) were determined to display regular ovarian activity. Furthermore, 16 cows (53.3%) were determined to have a serum progesterone level below 1 ng/mL and to lack active follicular development whereas 4 animals (13.3%) had resistant luteal and 3 cows (10%) resistant follicular structures (Table 5).

As seen in Table 6, the group including dairy cows with normal puerperium displayed superiority with regard to the number of animals determined to conceive upon the first and second service in comparison to Group 2.

The parturition to first service interval was prolonged and the number of non-pregnant animals after three inseminations (9/16) was assessed to be high in the animals with an inactive ovarian structure on days 20, 30 and 40 postpartum in Group 2.

The interval from parturition to first service displayed a significant difference in Group 1 ($p < 0.05$) when compared to Group 2 with regard to the parturition to conception interval (Table 7).

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Table 5. Serum progesterone levels measured and ovarian findings determined by means of ultrasonography in dairy cows with normal and disordered puerperium

	Cows with normal puerperium (Group 1)	Cows with disordered puerperium (Group 2)
Cows determined to have functional follicular and luteal structures within the first 40 days after calving.	10 (33.3%)	7 (23.3%)
Cows determined to have a serum P4 level below 1 ng/ml and to lack active follicular development within the first 40 days after calving.	12 (40%)	16 (53.3%)
Cows determined to have a serum P4 level above 1 ng/ml and to possess resistant luteal structures according to ultrasonographic examination.	2 (6.7%)	4 (13.3%)
Cows determined to have a serum progesterone level below 1 ng/ml and to possess resistant luteal structures with a diameter equal to or larger than 1 cm according to ultrasonographic examination.	6 (20%)	3 (10%)
Total	30	30

Table 6. Numbers of artificial insemination in dairy cows displaying normal and disordered periparturient periods

	Number of pregnant cows after first insemination	Number of pregnant cows after second insemination	Number of pregnant cows after third insemination	Number of non-pregnant cows
Group 1 (n=30)	10	11	4	5
Group 2 (n=30)	6	7	6	11

Table 7. The intervals from parturition to first service and from parturition to conception in dairy cows displaying normal and disordered periparturient periods

	Interval from parturition to first service (Mean, ±Standard Deviation) [Highest / Lowest values]	Interval from parturition to conception (Mean, ±Standard Deviation) [Highest / Lowest values]
Group 1	91.66 ±17.81 [122 / 60]	112.6 ±26.58 [170 / 70]
Group 2	117 ±33.54 [219 / 50]	144.15 ±36.93 [219 / 59]

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DISCUSSION

Failure of ruminal adaptation to feed rations specifically prepared for the transition to lactation and the incapacity to maintain normal calcemia, as well as immune system deficiencies, in periparturient dairy cows can cause metabolic and infectious diseases, retained placenta (Goff and Horst, 1997), dystocia, prolonged uterine involution and increased incidence of endometritis (Peeler *et al*., 1994) in the postpartum period.

According to the results of a study in which the postpartum uterine involution level was determined by means of measurement of the endometrium and stratum vascularis layer. Kamimura *et al.* (1993) have reported the diameter of the endometrium to decline to a minimum level in a mean of 41.5 days postpartum. Similarly, Okano and Tomizuka (1987), have reported uterine involution to be completed within 40 days in cows according to ultrasonography and have stated the diameters of gravid and non-gravid uterine horns to be 2.5 cm and 2.4 cm, respectively. In the presented study, the diameters of gravid and non-gravid uterine horns were determined to be very similar in dairy cows with normal puerperium, in agreement with the study of Okano and Tomizuka (1987). However, such a similarity was not observed in animals with puerperium disordered. Furthermore, evident difference was assessed between the diameters of previously gravid uterine horns of Group-1 and Group-2 on the 20th day postpartum. However, the diameter of previously non-gravid uterine horns in Group-2 was similar to that of Group-1 on the 40th day postpartum. Uterine involution was determined to occur faster between days 20-30 postpartum in comparison to days 30-40 after calving in both groups. Kindal *et al*. (1999) have reported the long-term secretion of prostaglandins in cows with normal puerperium to accelerate uterine involution whereas short-term $PGF_{2á}$ secretion due to postpartum disorders prolonges uterine involution.

Holt *et al*. (1989) have reported fluid accumulation to range between 4.5-11 mL, 3.5-4.5 mL and 2.5-3 mL on the 20th, 30th and 40th day postpartum, respectively, in cows with periparturient disorders and to be below 1 mL in cows with normal periparturient periods. In the presented study, fluid accumulation in the uterus was determined to occur at a level of +2 and to display an evident difference from the other group of cows with periparturient disorders on days 20 and 30 postpartum. However, the amount of accumulated fluid exhibited an evident decline by the 40th day after calving. Examination of the uterine microflora of animals with periparturient disorders revealed fluid accumulation to increase with *A. pyogenes* infections displaying a decline by the 40th day postpartum, parallel to the reduction in the number of bacterial agents. Hoedemaker (1998) has indicated the possibility of elimination of bacterial agents until the 6th week after calving despite the increase in susceptibility of the uterus to *A. pyogenes* infections due to periparturient disorders. Excessive leucocyte infiltration caused by *A. pyogenes* infection has been stated to prolong uterine tissue regeneration (Zain *et al*., 1995), as well as uterine involution by means of influence on synthesis and secretion of prostaglandin metabolites (Kindall *et al*., 1999; Usmani *et al.,* 2001).

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Nakao *et al*., (1992) have reported prolongation of the resumption of ovarian activity and 7-12 days extension in uterine involution, as well as 13-18% decline in the conception rate to first service period in cows determined to have metritis in the postpartum period. In comparison to cows with a normal puerperium, ovarian dysfunctions are observed more frequently. At the same time resumption of ovarian activity and uterine involution, as well as the parturition to conception interval, are prolonged and the conception rate to first service decreases in cows with disordered periparturient periods.

Kindall *et al*., (1999) have stressed the deleterious effects of impaired synthesis and secretion of prostaglandins from the uterus due to infectious agents on the resumption of ovarian activity and parturition to first service and parturition to conception intervals. Holt *et al*. (1989) have reported the parturition to conception interval to be 134 ± 11 days in cows with retained placenta, 118 ± 11 days in animals with metritis and 97 ± 12 days in cows with normal puerperium. Conception rates have been determined to be lower and parturition to conception intervals are prolonged in cows with disordered puerperium in comparison to animals with normal periparturient periods (McDougall, 2001).

In the presented study, the conception rates after the first and second services were higher in cows with normal puerperium in comparison to cows with disordered periparturient periods. Nonetheless, upon evaluation of the conception rates after 3 inseminations and the total number of non-pregnant animals by the end of the study, a significant difference between the two groups was not observed ($p>0,05$). Cows with a normal puerperium were superior regard to parturition to first service and parturition to conception intervals in comparison to animals with disordered periparturient periods ($p<0.05$).

It was concluded that the longitudinal ultrasonographic examination of the uterus provided a significant contribution to the evaluation of uterine involution throughout the periparturient period and that prolonged uterine involution and the parturition to first service and parturition to conception intervals and the development of fluid accumulation, were related to infections of *A. pyogenes* origin.

Address for correspondence:
Dr. Mesih KOCAMUFTUOGLU
Mehmet Akif Ersoy Universitesi Veteriner Fakultesi,
Dogum ve Jinekoloji Anabilim Dali,
15100 Burdur, Turkiye - Turkey
e-mail: mesih2005@yahoo.com, mesih2005@hotmail.com, mesih2005@gmail.com

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Acta Veterinaria (Beograd), Vol. 58. No. 1, 75-87, 2008.
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EVALUACIJA POSTPARTALNOG PERIODA KOD ZDRAVIH MLEČNIH KRAVA I KRAVA SA PROBLEMIMA U PUERPERIJUMU

KOCAMUFTUOGLU M i VURAL R

SADRŽAJ

U ovom radu su prikazani rezultati procene dijametara materice, njene bakterijske flore, aktivnosti jajnika i pojedinih reproduktivnih pokazatelja kod dve grupe od po 30 krava sa normalnim (grupa 1) i patološkim puerperijumom (grupa 2). Pregledi su vršeni 20., 30. i 40. dana nakon teljenja. Krave druge grupe imale su veće dijametre materice u svim ispitivanim intervalima. Stepen involucije uterusa je bio veći u obe grupe plotkinja između 20. i 30. dana u rogovima koji su nosili plod a između 30. i 40. dana u negravidnim. U drugoj grupi krava, 20. i 30. dana postpartum je registrovana veća količina sadržaja u materici. U ovoj grupi su kod 25 (od 30) krava izolovane bakterije sa predominacijom *A. pyogenes*. U prvoj grupi krava, bakterije su otkrivene u 11 slučajeva (od 30) a dominantna vrsta je bila *E. coli*. U drugoj grupi krava je zapaženo značajno smanjenje broja bakterija nakon 40. dana. U prvoj grupi je 10 plotkinja ispoljavalo normalnu aktivnost ovarijuma, kod 12 su jajnici bili neaktivni, kod dve su registrovana perzistentna žuta tela a kod 6 folikulinske cistte. U grupi 2, broj plotkinja sa ovim nalazima je bio 7, 16, 4 i 3 respektivno. Interval od teljenja do prvog estrusa i servis period su bili produženi u grupi 2. Veća akumalicija tečnosti u uterusu, razlike u dijametru materice i dokaz *A. pyogenes* se mogu smatrati paralelnim nalazima.