

Effect of cows' body condition during periparturient period and early lactation on post parturient development of ovarian follicles and size of corpus luteum

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Summary

The aim of the study was to establish the effect of body condition in the period before parturition on the dynamics of follicular waves, the appearance of the first dominant follicle and the corpus luteum and on the number of ovarian follicles during the first 36 days after calving. In the study the analysis was conducted on 23 cows, which were divided into three groups depending on their body condition before calving. Groups I, II and III included cows with body condition scores ≤ 3.0 , 3.01-3.5 and > 3.5 points, respectively. In all cows, starting from days 14-16 post partum up to days 34-38 post partum thorough ultrasound examinations (USF) of ovarian surface were performed at 2-3-day intervals. No significant effect of BCS before calving was found on the cumulative number of ovarian follicles detected in the first 36-38 days after calving, although in cows from group III this number was slightly higher than in cows from group I. No effect of the body condition of cows before calving on the date and frequency of FDF and FCL was found in this study. However, the dominant follicle and the corpus luteum in cows from group I were detected later than in cows with body condition scores corresponding to groups II and III.

Keywords: cows, body condition score, post partum period development of follicles, corpus luteum

The dynamics of follicular waves after calving, the date of the formation of ovarian follicles and ovulation have a significant effect of the fertility of cows (2, 16). A marked increase in FSH concentration after parturition, occurs immediately before the appearance of the first postpartum follicular wave, as a result of which the dominant follicle (PD) with a diameter of over 9 mm is formed (4, 15). Under physiological conditions it occurs, at the earliest, after day 12 post partum (13). However, on average, its presence is detected approx. 3 weeks pp. In cows ovulation manifested by fully-developed oestrus symptoms occurs from the second, and more frequently from the third and fourth waves (1). Ovulation in contemporary cattle occurs later than it used to around two decades ago. Most frequently it is observed between day 22 and 38 pp (4, 9). Postpartum ovarian activity may depend on several factors, e.g. breed and purpose type of cows, lactation rank (primiparous vs. multiparous), productivity, energy supply, etc. (4, 12, 17).

Body weight loss and a deterioration of body condition are as a rule bigger in cows exhibiting excessive body condition during the drying-off period. This contributes to an exacerbated negative energy balance, reduced yields, intensifying immune deficit and metabolic disorders, such as ketosis, retention of the placenta and displaced abomasum, which as a consequence leads to a deteriorated fertility in cows (3, 6, 11, 17, 18). A higher culling risk of cows with excessive body condition before calving was reported by many authors (12, 13). Much less is known on the dynamics of ovarian follicles and the date of the first corpus luteum pp in cows differing in body condition in the antepartum period. It results from scarce studies on the subject that body condition influences the maintenance of a persistent first wave dominant follicle in dairy cattle (3).

The aim of the study was to establish the effect of body condition in the period before parturition on the dynamics of follicular waves, the appearance of the first dominant follicle and the corpus luteum as well as the

number of ovarian follicles during the first 36 days after calving.

Material and methods

A total of 23 multiparous cows came from one stanchion barn. Their average milk yield during lactation was 7 thousand litres. Animals were fed maize silage supplemented with an addition of concentrate and fodders. Body condition score was assessed according to the scale proposed by Edmondson et al. (5). Two weeks before parturition all cows, depending on their body condition (BCS), were divided into three groups. Group I consisted of these cows whose body condition score (BCS) before calving was < 3.0 (2.5), while groups II and III consisted of cows with BCS of 3.01-3.5 (3.0) and > 3.5 (3.5), respectively.

Ultrasound examinations. Ultrasound examinations were initiated between day 14 and 16 after calving and they were continued at 2-day intervals up to day 36 post partum. Measurements were performed using a Pie medical Scanner 450, equipped with a 5 MHz linear probe and a scanning apparatus. An appropriately protected probe was inserted into the previously cleaned rectum and placed in the immediate vicinity of the examined ovaries. In the examinations the number of functional structures, i.e. ovarian follicles, corpora lutea and ovarian cysts, was counted and next their size was measured on the ultrasound scanner screen. Only follicles with diameters of over 4 mm, clearly visible on the ultrasound scanner screen, were included in the analysis. Follicles with diameters of over 10 mm were considered dominant.

Statistical analysis. Collected numerical material was analyzed using the one-way analysis of variance with an ABS-10 algorithm including further PC modifications.

Results and discussion

The average antepartum body condition of cows included in the studies on the development of structural elements on the surface of ovaries post partum was BCS 3.27. Table 1 presents the date of the development of the first large ovarian follicle (FDF) and the corpus luteum (CL) in cows after calving, depending on their body condition ante partum. The first large follicle (with a diameter of over 10 mm) after calving was recorded on average at day 20.5 pp (within the range of 17 to 37 days pp). Large follicles after calving in the first, second and third groups were recorded at days 23.2, 21 and 17.1, respectively, and they were detected in 87.5,

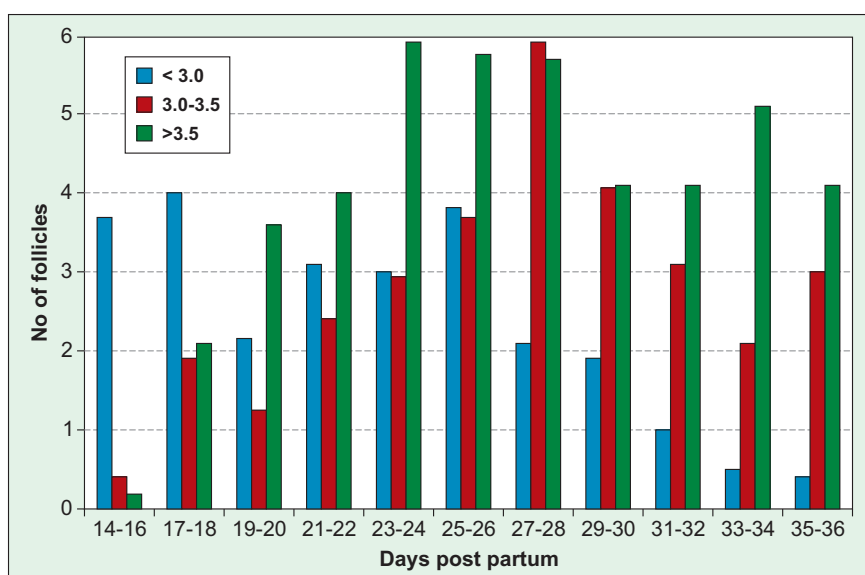


Fig. 1. The total mean number of ovarian follicles detected using the ultrasound technique after calving depending on body condition before calving

100 and 85.7% cows, respectively. The first CL pp was recorded on average at day 21.9 after calving in 60.9% cows, whereas in cows from groups I, II and III it was recorded at days 26.3, 25 and 17.5 in 42.8, 62.5 and 75% cows, respectively. The mean diameter of the first CL after calving in all cows was 16.1 mm, while in analogous groups of cows it was 15.8, 17.9 and 15.5 mm in group of cows with BCS 2.5, 3.0 and 3.5, respectively.

Figure 1 presents the mean total number of ovarian follicles diagnosed using the ultrasound method after calving depending on the body condition of cows ante partum. The biggest number of follicles during the entire period of observations was recorded in the cows from group III, with a systematic increase in the number of follicles in this group of cows (from the mean 0.4 follicles at days 14-16 pp to 4.9 follicles at days 22-24 pp), next the period of maintenance of a relatively large number of follicles was observed between days 22-24 and 26-28 pp (4.9 to 4.1 follicles) and after a slight reduction of their number to 2.2 at days 28-30 pp, a repeated increase in their number to 3.2 and 3.3 and 2.9 in the successive time intervals. Similar dynamics concerning the total number of follicles could be observed in group II. Also in these cows the number of follicles increased successively from the mean 0.6 at days 14-16 pp to 4.7 at days 26-28 pp, next it decreased to a minimum of 2.3 follicles recor-

Tab. 1. The date of the first developed follicle and corpus luteum in cows after calving depending on their body condition ante partum

Body condition score (BCS)	No. of cows	Detected follicle with diameter > 10 mm (day) $\bar{x} \pm s$	Percentage of cows in which developed follicle was detected during puerperium	Detected corpus luteum (days) $\bar{x} \pm s$	Corpus luteum diameter (mm) $\bar{x} \pm s$	Percentage of cows in which corpus luteum was detected during puerperium
2.5	8	23.2 ± 1.87	87.5	26.3 ± 3.05	15.8 ± 4.1	42.8
3.0	8	21.0 ± 1.65	100	25.0 ± 1.06	17.9 ± 1.8	62.5
3.5	7	17.1 ± 0.63	85.7	17.5 ± 0.72	15.5 ± 4.4	75.0
Total	23	20.5 ± 0.94	91.3	21.9 ± 1.57	16.1 ± 3.8	60.9

ded at days 32-34 pp, then it increased again to 3.0 at days 34-36 pp. In cows from group I the highest number of ovarian follicles, amounting to 3.8 and 4.0, was recorded at days 14-18 after calving. After a slight decrease to 2.3 at days 18-20 pp this number increased again to 3.8 at days 24-26 pp. In turn, at days 26-28 up to days 34-36 pp a consistent decrease was recorded in their number from the mean 2.3 to 0.5.

The effect of body condition in cows before calving on the development of ovarian follicles and the date of corpus luteum development turned out to be limited. Numerous authors reported delayed ovarian activity in cows with a lower BCS (3, 8, 14). Delayed oestrus caused e.g. by maternal nursing or an extended period of insufficient energy balance may occasionally result in the appearance of 14 follicular waves which did not end in ovulation (16). Also cows with excessive body condition (BCS > 4.0) had a significantly extended interval between calving and the postpartum oestrus in comparison to leaner cows (5). Body condition of cows ap had a significant effect on blood progesterone concentration. At the same time in fat cows before calving, in contrast to lean cows, a higher blood cholesterol level was recorded – the substance being a substrate to progesterone synthesis (10). A lower progesterone concentration in cows with excessive body condition may change LH secretion (2). Changes in metabolism and the endocrine status connected with excessive and insufficient body condition in cows may lead to changes in the dynamics of ovarian follicles and oocyte development and quality (5). In investigations conducted by the authors of this study no significant effect of body condition ap was observed on the number of ovarian follicles post partum, or the date when the first large follicle and the corpus luteum developed, although a large follicle after calving appeared earliest in cows whose body condition ante partum was above 3.5 points. Similarly, the corpus luteum was detected slightly earlier in this group of cows. Moreover, these corpora had larger diameters. However, it needs to be stressed that in the analyzed population of animals the mean body condition was medium, the score amounting to 3.2 points. At the same time there were no females with extreme body condition, either excessively fat or thin. Thus it may not be excluded that a considerable diversification of cows in terms of body condition ante partum could guarantee more reliable results. On the other hand, it needs to be added that Polish Holstein-Friesian cattle is characterized by relatively high genetic variation. Its average productivity is also lower (7). As a result, in Holstein-Friesian cattle there are cows with body condition scores higher than those generally assumed for different periods in the reproduction cycle. Despite that fact, in Poland the effect of excessive body condition of cows ante partum on the frequency of certain disorders post partum and fertility was ambiguous and difficult to confirm (13). The first conception rate in cows whose body condition ap was 3.0 and 4.0 >, respectively, was 40.5 and 46.3%, while the interpregnancy period in the

second group was by 7.1 days longer than in the first one. The observed results are to a considerable degree consistent with the above observations. Moreover, it may hardly be excluded that due to lower yields in Polish cows with body condition scores higher than average ante partum, a deep energy deficit with its adverse consequences is observed less frequently than in Holstein-Friesian cows, for years subjected to rigorous selection towards productivity. Energy deficit might also possibly be compensated for at an earlier stage, not being manifested in ovarian function disorders.

In conclusion, in Polish Holstein-Friesian cattle varied body condition before calving did not have a significant effect on the dynamics of ovarian follicles after calving, or the date of development of the first large ovarian follicle and the corpus luteum.

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