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Relationship between Lithuanian White and Black cows body condition and reproduction

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Summary

Cows reproduction and fertility is one of the most subtle physiological functions that depends on the health of the whole organism. It is a crucial indicator, influencing the profitability of dairy herds. Results of the poor management of reproduction are most often observed after half a year or even later and the correction of these mistakes also takes a good deal of time. Consequently, cattle breeders are looking for new methods that could help to avoid reproduction problems. One of the best methods is assuring the recommended body conditions for cows during all production phases, especially at calving. The objectives of this study were to determine the relationship between body condition score (BCS) and some fertility parameters: days to first observed heat (DFH), days to first service (DFS), conception at first service (FSC), calving interval (CI) and weight of newborn calves (WC). The research was carried out from 2006 to 2007 during indoor and pasturable periods. According to the BCS of dry cows, 3 investigated groups of cows were formed, each containing 22 Lithuanian White and Black cows of 1 to 5 lactations: control group (n = 22), experimental group I (n = 22) and experimental group II (n = 22). The body condition of the experimental cows was scored 6 times a year at critical lactation and dry periods according to the system that uses a scale from 1 to 5 for the body condition cows by Jones and Heinrichs, which evaluates regions of cows' back, rump, loin and tailhead.

The worst fertility indexes were determined mostly in fat cows group. Cows of group II B had the longest CI (429 d.), the lowest conception at first insemination (CFI) (31.81%), the longest period between the first and the last heat (88.86 d.) ($p < 0.05$), they required more breedings to conceive (2.05) ($p \geq 0.1$). The authors think one of the reasons was that the biggest fall of BCS was also noted in the fat cows group (II B) at peak lactation. In group II B we detected a positive correlation between BCS at dry off and WC and also the service period.

In order to avoid fertility problems it is important periodically to BCS cows and to warrant the correct BCS, especially at dry off. BCS should be used to identify cows at risk for failure to conceive at first AI and it could be a potential selection criterion for the fertility of cows.

Keywords: body condition score, fertility, conception

Cow reproduction is considered to be one of the most subtle physiological functions, which depends on the health of the whole organism. It is the most important indicator, according to which cow storage strategy is organized. Fertility is another no less important factor influencing the profitability of dairy herds (25). In recent years a progressive worsening of fertility indices in dairy cow herds has been observed (8). Problematically inseminated cows, many rebreedings, and long service period cause great disadvantages for cattle breeders. Due to these problems the number of calves decreases, effectivity of forage use is reduced, productivity of the farm declines. Sterility of cows is determined by the poor management of reproduction, incorrect feeding of cows during early lactation and often by bad cattle holding condition (17, 18). Results of poor management of reproduction are mostly observed after half a year or even later and correction of these mistakes also takes a good deal of time. Therefore, cattle breeders are looking for new methods which could help solve or avoid reproduction problems. One of the best methods is assuring recommended body conditions for cows during all production phases, especially at calving (19, 20). Body condition scoring (BCS) of cows is a management tool that is used to monitor the amount and mobilization of body adipose (9, 12). The level of fatness or BCS at key periods in lactation, as well as BCS changes over early lactation, could affect the resumption of estrous cycles and reproductive success (23). Previous studies of Heuer et al. (11) revealed that BCS at calving and the worsening of body condition during early lactation were related to health, fertility and milk yield. Therefore, too

intensive mobilization of body adipose in early lactation has a reverse effect on cows' fertility and health (6). Calving and the period after calving is one of the greatest stress experienced by cows. The health of cows and some fertility parameters are closely related to BCS at calving and changes of condition during early lactation (18, 21). Cows become infertile when they become somewhat obese or emaciated. Cows with incorrect BCS have a prolonged time of normal ovulatory cycle, later ovulation, suppressed growing of folicles, pure fertility and possible early ruin of embriones (2, 12, 23, 24).

Artificial insemination (AI) usually starts when daily milk yield approaches its peak, while energy balance and BCS are declining. This pattern suggests that BCS at about the time cows are being inseminated might be a more informative fertility predictor than BCS at other stages of lactation (1, 12).

While stressing the importance of diagnostic reproduction system means, Roche et al. (24) note that reproduction indexes are a direct criteria of herd evaluation. Therefore, periodical body condition scoring and analyzing would enable cattle breeders to diagnose disorders of cow health and fertility earlier.

The objectives of this study were to determine the relationship between Lithuanian White and Black cows body condition scores (BCS) and some fertility parameters: days of the first heat (DFH), days of the first service (DFS), conception at first insemination (CFI), calving interval (CI) and weight of newborn calves (WC).

Material and methods

The research was carried out from 2006 to 2007 during the indoor and pasturable periods. The duration of the research was one year. According to the BCS of dry cows, 3 investigated Lithuanian White and Black cow groups, each containing 22 cows of 1 to 5 lactations, were formed: a control group (C) (n = 22), experimental group I (I E) (n = 22) and experimental group II (II E) (n = 22). The BCS of dry (–20 ± 10 d.) Lithuanian White and Black cows in group C was normal – 3.39, BCS in group I E was less by 21.53% and in group II E it was higher by 23.30% than in group C ($p < 0.0001$) (tab. 1). The characteristics of the investigated cows body conditions are shown in tab. 1.

The investigated cows calved without difficulties, placentas were severed in time (during 5-6 hours after calving), cows did not demonstrate any inflammation of reproductive organs, which could have caused disorders of the reproductive cycle. During the stable period the ration of each cow contained 15 kg of haylage, 15 kg of maize silage, 2 kg of hay, 0.15 kg of vitamin-protein-mineral additive, 0.15 kg of chalk, 0.25 kg of molasses, 2 kg of barley flour, 0.3 kg (3 months after calving – 0.35 kg) combined feed per 1 L milk. During the pasturable period the ration of each cow contained 0.3 kg of combined feed, mainly 60 kg of grass, 10 kg of saladine, 0.1 kg of vitamin-protein-mineral additive, 0.15 kg of chalk. The daily ration was prepared according to required feed standards (13). Dairy cows were fed individually, roughage mixture was produced and given by the van-mixer OptiMix™ (5).

The BCS of the experimental cows was scored 6 times a year after morning milking: at calving (1-2 days in milk (DIM)), at early lactation (20 ± 10 DIM), at peak lactation (90 ± 10 DIM), at middle lactation (150 ± 10 DIM), at late lactation (250 ± 10 DIM) and at dry off (–35 ± 10 DIM) according to the system that uses a scale from 1 to 5 to body condition cows by Jones and Heinrichs (14) evaluating regions of cows' back, rump, loin and tailhead (tab. 1).

All reproductive events were recorded and fertility measures calculated including the data of the DFH, DFS, FSC, CI and WC. WC was recorded at 24 h postpartum by electronic balance HL 120 (Avery Berkel, United Kingdom).

The research data were evaluated statistically according the program Win Excel (16). The results are considered to be reliable when $p < 0.05$.

Results and discussion

Due to incorrect BCS at calving and in early lactation, cows can have a wide range of reproductive problems. A condition of too low or too high BCS at calving and in early lactation causes weakened reproduction (22).

The investigation of CI revealed that in group C this interval was 389 d., in the thin cows' group (I E) the CI interval was longer – 429 d. and in the fat cows group (II E) this interval tended to be the longest – 450 d. ($p < 0.05$) (fig. 1). The cycle of cows reproduction is considered to be normal if the calving interval is 12 months (14). In our case, due to the unbalanced fertility of thin and fat cows, CI in groups I E and II E was longer 40 d. and 61 d. ($p < 0.05$) respectively than in group C (fig. 1).

Having analyzed the results of our experiment, the authors can conclude that DFH in all groups of the investigated Lithuanian White and Black cows was different: cows of group C became on heat after 81.86 d. after calving. In groups I E and II E estrus was detected later, accordingly after 101.09 d. ($p < 0.05$) and 86 d. ($p \geq 0.1$) after calving (fig. 1). DFH in cows of group C and II E was observed on time (tab. 1), but CFI in group II E was less by 50.01% ($p < 0.05$) than in the control group. These results coincide with the proposition that cows with a higher body condition may require more breedings to conceive (7, 23). An increased duration of negative energy balance in cows with high BCS has been suggested to con-

Tab. 1. Body condition scores of investigated Lithuanian White and Black cows and suggested scores for cows by stage of lactation

Stage of lactation	DIM	BCS			Recommendable BCS (Jones C. and Heinrichs J., 2004) Goal (Min-Max)
		Group C	Group I E	Group II E	
Dry off	–20 ± 10	3.39	2.66	4.18	3.50 (3.25-3.75)
Calving	0-2	3.14	2.61	3.69	3.50 (3.25-3.75)
Early Lactation	20 ± 10	2.86	2.38	3.18	3.00 (2.75-3.25)
Peak Milk	90 ± 10	2.59	2.18	2.92	2.75 (2.50-3.00)
Mid Lactation	150 ± 10	2.86	2.42	3.14	3.00 (2.75-3.25)
Late Lactation	250 ± 10	2.95	2.51	3.22	3.25 (3.00-3.75)

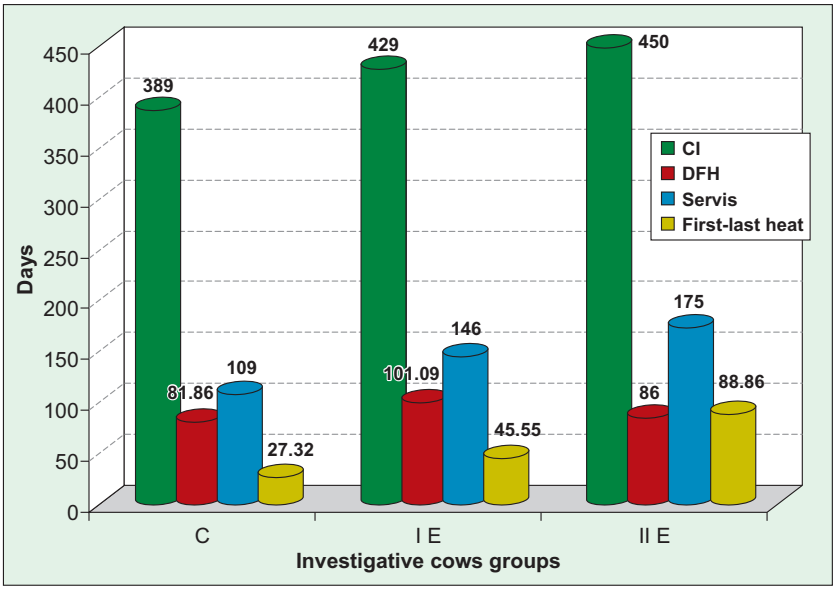

Fig. 1. Differences in investigated groups of Lithuanian White and Black cows among CI, DFH, service period and time from the first to the last heat

tribute the decreased fertility (23, 27). In group I E DFH was detected 18.87 days ($p < 0.05$) later than in the control group and CFI was less by 18.19% than in the control group. However, these results were not statistically reliable. Nevertheless, these results only confirm the results of Stevenson (26), who stated that lactating thin cows are less fertile than cows with normal BCS.

Unfortunately, body energy is at its lowest when AI has just started, often leading to fertility problems particularly in high-yielding cows (1). A negative energy balance also has an influence on the endocrine system; therefore when the amount of energetic matter becomes low, synthesis of hormones is lowered and reproduction decreases (4). Consequently, the authors think not all Lithuanian White and Black cows became impregnated after the first AI. CFI of group C was 63.64%. CFI of group I E was 45.45% ($p \geq 0.1$) and in group II E only 31.81% ($p < 0.05$) of cows became impregnated after the first AI (fig. 2).

Excessive mobilization of body reserves may have adverse effects on cow fertility and health (4, 6). Butler (2) reports that conception rate ranges between 25% and 53% when BCS decreases 0.5 and 1.0 units. In our case the greatest loss of BCS (0.55 points) was determined in group II E during peak lactation. The lowest BCS of cows in this group was 2.92 ($p < 0.0001$) (tab. 1).

This period coincided with the first heat. Therefore, the authors think that intensive lowering of BCS could be the reason of the low conception rate. The results confirmed the proposition that the greatest fall of BCS during lactation is observed in fat cows. Consequently, fat cows (II E) were inseminated to coincide 0.6 more times than the cows of the group C. However, these data were not statistically reliable.

The period between the first and the last heat in group C was 27.32 d. but in experimental groups I and II this period lasted longer: 45.55 d. ($p \geq 0.1$) and 88.86 d. ($p < 0.05$) respectively.

The average amount of AI in group C was 1.45, in group I E was 1.77 and in group II E was 2.05. However, these data were not statistically reliable. The low conception rate during first AI was determined by too long a service period. During our research, the authors found out that in group II E the service period tended to be the longest – 175 d. (fig. 1). For cows of group C this period lasted 109 d., while for thin (I E) and fat (II E) cows this period was longer by 37 d. and 66 d. ($p < 0.05$) respectively than in group C (tab. 1).

The reproductive performance of cows, particularly the probability of conception, may be associated negatively with the magnitude and severity of the negative energy balance in early lactation (3, 22). Meanwhile it is reputed that the optimal service period is 60 d. to 80 d. Then it is possible to get the maximum milk yield and number of calves (15). Consequently, the reproductive goal of breeders is for cows to become pregnant within 110 days of lactation (8).

Analyzing WC from the investigated groups of Lithuanian White and Black cows the authors can draw the conclusion that it was different: calves from group II E cows weighed the most: by 6.23 kg ($p < 0.0001$) more than calves from group I E cows and by 3.32 kg ($p < 0.0001$) more than calves from group C cows (fig. 3). According to our results the BCS of investigated cows at dry off had an influence on the weight of newborn calves (fig. 4, 5). In groups I E and II E the authors estimated a positive correlation between BCS at dry off and WC ($r = 0.71$; $p < 0.001$ (fig. 4) and $r = 0.53$; $p < 0.05$ (fig. 5) respectively.

In group C the authors found a positive correlation ($r = 0.34$; $p < 0,05$) between BCS at dry off and service

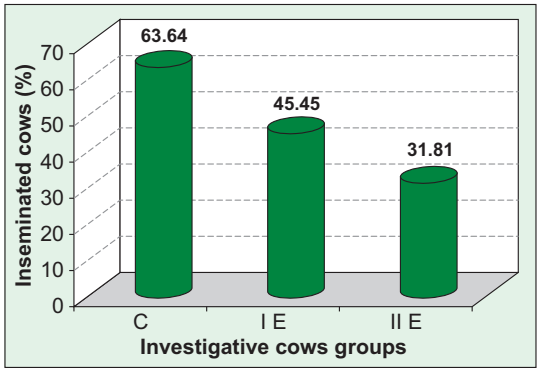

Fig. 2. Conception rate (%) after the first AI

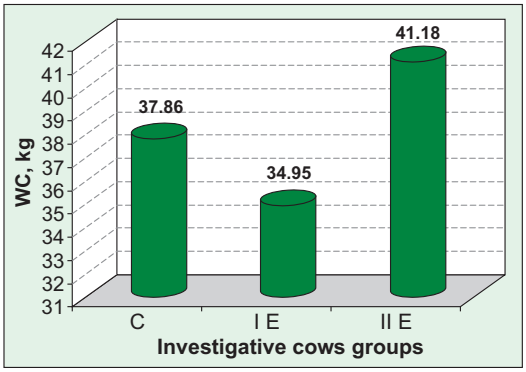

Fig. 3. WC in investigated groups of Lithuanian White and Black cows

period (fig. 6). An analogous positive correlation ($r = 0.32$; $p < 0.05$) was estimated in group II E (fig. 7).

In conclusion it is possible to state that the worst fertility indexes were determined mostly in the fat cows group. Cows of group II E had the longest CI (429 d.), the lowest CFI (31.81%), the longest period between the first and last heat (88,86 d.) ($p < 0.05$), ant they required more breedings to conceive (2.05) ($p \geq 0.1$). The authors think one of the reasons was that the most evident fall of BCS was also noted in the fat cows group (II E) at peak lactation.

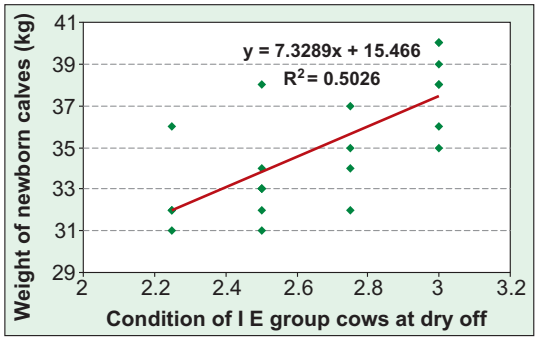

Fig. 4. Correlation between BCS of Lithuanian White and Black cows from group I E at dry off and WC

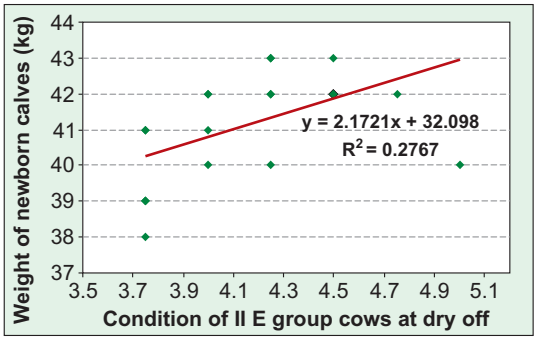

Fig. 5. Correlation between BCS of Lithuanian White and Black cows from group II E at dry off and WC

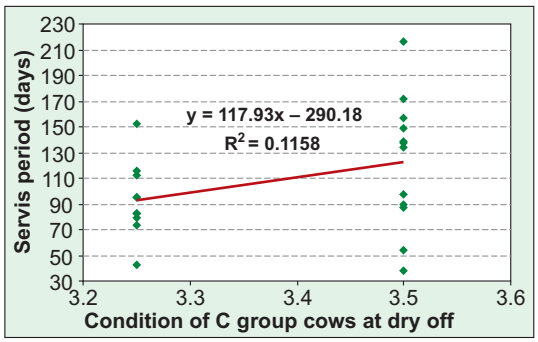

Fig. 6. Correlation between BCS of Lithuanian White and Black cows from group C at dry off and service period

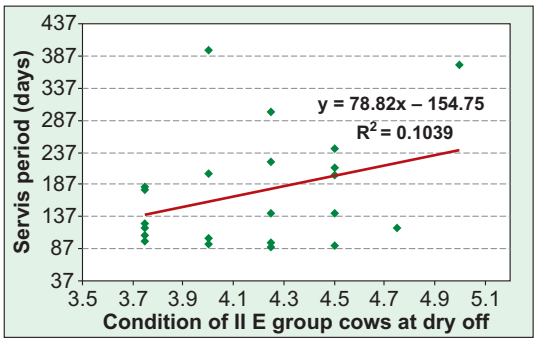

Fig. 7. Correlation between BCS of Lithuanian White and Black cows from group II E at dry off and service period

Consequently, in order to avoid fertility problems it is important to periodically BCS cows and to warrant the correct BCS, especially at dry off. BCS should be used to identify cows at risk for failure to conceive during the first AI and it could be a potential selection criterion for the fertility of cows.

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