

## **Effect of some factors on cow's body condition and fertility**

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The study was carried out in 2010/2011 on two farms located in the Kujawsko-Pomorskie province. The experiment included 204 Polish Black-and-White Holstein-Friesian cows kept in a loose-housing system and 66 cows of the same breed housed in a tie-stall system. Body condition according to Wildman et al. [16] was scored four times (in the spring, summer and autumn of 2010 and winter of 2011). It was found that the body condition of cows kept in the different systems was similar. The first calvers and second and third lactation cows received the highest body condition scores in the summer; fourth and fifth lactation cows in the spring, and those beyond the fifth lactation in the autumn, with the differences being statistically non-significant. Regardless of the season, the highest-yielding cows (>11000 kg milk per 305-day lactation and >40 kg test-day yield) had lower body condition scores compared to the cows from the other milk yield ranges. Successive months after calving had a significant effect on body condition. Regardless of the season, cows lost their body condition at the onset of lactation, but from the fourth month their body condition improved. Season of the year and body condition had no significant effect on the indicators of fertility, although cows with the highest body condition scores (4.00-4.25 points) were characterized by the longest interpregnancy period and calving interval, lower first insemination success and a shorter reproductive rest period.

**KEY WORDS:** dairy cows / body condition / season of year / fertility indicators

Body condition is a factor influencing milk production in cows. Thus body condition scoring facilitates an accurate assessment of energy requirement, which in turn is responsible both for the level of milk production during lactation and for fertility of cows. Both excessive fatness and emaciation hinder the accumulation of metabolic energy in the adipose and muscle tissues. Many factors affect body condition in cows. These factors include e.g. age of cows, management system, physiological condition, the phase of the production cycle, season of the year, etc. [2, 4, 10, 11]. Both excessive fatness and emaciation have an impact of fertility. Januś [9] showed that in fat cows (3.5-4.0 point score) the insemination success rate was inferior to that in cows with body conditions score of 2.5-3.0 points. It results from a study by Nogalski [14] that in cows with BCS of maximum 2.0 points an

increase was observed in the incidence rate of dystocia, retained placenta, stillbirths and culling. In turn, Domecq et al. [5] showed that calving interval was significantly extended if the body condition score during the first 30 days after calving was below 2.5 points. Heuer et al. [7] stated that in fat cows the conception rate for the first insemination was lower. According to Guliński [6], the highest conception rate may be expected at body condition score of 2.5-3.5 points.

The aim of this study was to assess the effect of season of the year, management system, lactation rank, number of days open and milk yield on body condition of cows. Moreover, the effect of season of the year and BCS on fertility indexes was also evaluated.

### **Material and Methods**

Investigations were conducted in the years 2010/2011 in two farms in the Kujawsko-Pomorskie province. Material for analyses comprised 204 Polish Black-and-White Holstein-Friesian cows kept in a loose housing system and 66 cows of that breed kept in a stall barn. In both farms the cows were fed TMR. In the loose housing system cows were divided into three lactation groups depending on their milk yield: group I – mean 40 kg milk, group II – mean 28 kg milk and group III – mean 16 kg milk. Feed rations were prepared for each group based on feeding standards, with the groups adjusted in terms of milk yields and body condition score. Body condition scoring according to Wildman et al. [16] was performed four times (in the spring, summer and autumn of 2010 and in the winter of 2011) accurate to 0.25 points. A total of 1080 body condition scores were recorded. In the analyses milk production in the 305-day lactation was that of the current lactation at the time of body condition scoring. Cows, which completed their lactations in June 2011 at the latest were selected, thus 588 records for that index were included in the analyses.

Statistical calculations included the effect of the following parameters on body condition in individual seasons of the year:

- housing system (stall vs. loose barn);
- lactation rank (1, 2-3, 4-5, >5);
- milk production in 305-day lactation (<5000 kg, 5001-7000, 7001-9000, 9001-11000, >11000);
- milk yield in test day milkings (<10 kg, 10-14.9, 15-19.9, 20-24.9, 25-29.9, 30-34.9, 35-39.9, >40);
- successive month after calving (1, 2-3, 4-9, 10 and further, drying off).

Moreover, the effect of the season and body condition on fertility was evaluated in cows, which completed their reproductive cycle by June 2011, in terms of calving interval, interpregnancy period, reproductive rest period, breeding window and insemination success rate. The effect of body condition on fertility was evaluated based on the results of body condition scoring until day 150 after calving, recorded in the spring for 96 cows, in the summer for 103 cows, in the autumn for 103 cows and in the winter for 46 cows.

The results were analysed statistically using the analysis of variance applying the least square method (SAS/STAT, 2008).

## **Results and Discussion**

Results concerning the effect of management system on body condition in cows indicate a trend to slightly higher values in cows kept in the stall barn compared to those in a loose housing system (Table 1). However, the differences were slight, thus confirming the study by Kowalski et al. [12], which showed comparable body condition of cows kept in different housing systems. In this study the greatest energy reserves were accumulated in cows kept in the stall barn during the summer (3.24 points), while for cows in a loose barn it was in the spring and summer (3.12 and 3.11 points). In turn, the lowest body condition score was recorded in both housing systems in the winter, amounting to 3.07 and 2.95 points. Similarly, Borkowska [2] reported that animals subjected to body condition scoring in the winter had smaller reserves of the adipose tissue in comparison to those evaluated in the summer. Different dependencies were observed by Januś [10], who recorded higher BCS in cows evaluated in the winter feeding period in comparison to the summer feeding period.

In the spring and summer the highest body conditions scores were recorded for cows in their 2<sup>nd</sup>-3<sup>rd</sup> lactations (3.19 and 3.23 points, respectively), in the autumn it was for the oldest cows (>5 lactations – 3.40 points), while in the winter it was for the first calvers (3.08 points) – Table 1. The lowest BCS of 2.90 points was recorded in the winter for cows in >5 lactations; however, it needs to be stressed that the group comprised only 5 animals. Borkowska et al. [4] stated that body condition was the lowest in primiparous cows and BCS was increasing with each successive lactation. In this study first-calvers compared to older cows had the lowest BCS only in the spring. Results concerning the effect of milk production and season of the year on body condition in cows indicate that at milk yield <5000 kg and >11 000 kg the highest body condition scores were recorded for cows during the winter feeding season, at BCS of 3.21 and 3.13. Cows in the other milk yield groups had the highest BCS in the spring. In the spring and summer the body condition scores were increasing with an increase in milk yields, while in the winter they were decreasing. Borkowska and Januś [3] and Borkowska et al. [4] reported that cows with higher milk yields had higher BCS in comparison to cows with lower milk yields. In an earlier study Jankowska and Sawa [8] stated that cows with a high milk yield do not always have higher BCS in comparison to cows with lower milk yields. Results concerning the effect of milk yields in test day milkings on body condition of cows confirm this statement. In the autumn and winter the highest body condition scores were recorded for cows with lower milk yields in test day milkings. In the spring the highest body condition score (3.43) was reported for cows with milk yields of 10-14.9 kg milk, while with an increase in milk yield this score dropped to 2.98 points. In the summer the highest body condition score (3.40) was reported for cows with milk yields of 15-19.9 kg and it also decreased to 3.04 points with an increase in milk yield. In the autumn a downward trend was recorded for the body condition score with an increase in daily milk yield. A decrease in body condition in the winter with an increase in milk yield in test day milkings was confirmed statistically.

Irrespective of the season of the year cows experienced losses in body condition starting from the onset of lactation, with this trend persisting in the 2<sup>nd</sup>-3<sup>rd</sup> months of lactation, while from the 4<sup>th</sup>-9<sup>th</sup> month body condition was increasing again (Table 2). In the sum-

**Table 1**  
Effect of some factors on cow's body condition according to season

Treatments		Number of cows	Season			
			III-V	VI-VIII	IX-XI	XII-II
			LSM	LSM	LSM	LSM
Housing system	tie-stall system	204	3.16	3.24	3.15	3.07
	loose-housing system	66	3.12	3.11	3.04	2.95
Lactation number	1	105	3.08	3.21	3.12	3.08
	2-3	134	3.19	3.23	3.12	3.02
	4-5	26	3.14	3.12	3.08	3.00
	>5	5	3.10	3.15	3.40	2.90
Milk production level (kg)	<5000	15	3.00	3.10	3.10	3.21
	5001-7000	34	3.04	3.27	3.26	3.16
	7001-9000	52	3.11	3.22	3.10	3.07
	9001-11 000	35	3.08	3.21	3.11	3.13
	>11 000	11	2.84	2.95	3.00	3.13
Test-day milk yield (kg)	<10	10	3.12	3.20	3.32	3.30 <sup>A</sup>
	10-14.9	15	3.43	3.20	3.32	3.31 <sup>Ba</sup>
	15-19.9	25	3.13	3.40	3.26	3.10 <sup>C</sup>
	20-24.9	26	3.09	3.32	3.24	3.01
	25-29.9	46	3.20	3.29	2.95	3.13 <sup>b</sup>
	30-34.9	31	3.14	3.19	3.03	3.02
	35-39.9	13	3.13	3.03	3.00	2.73 <sup>a</sup>
	>40	15	2.98	3.04	3.07	2.57 <sup>ABCb</sup>

Mean values of traits within the examined factors followed by the same letters differ significantly: capital letters – at  $P \leq 0.01$ ; small letters – at  $P \leq 0.05$

mer, autumn and winter the highest body condition scores were recorded for cows in the drying off period, at 3.43, 3.40 and 3.22 points, while in the spring – in the final lactation period, i.e. in the 10th and later months (3.27). According to Markusfeld et al. [13], body condition of cows towards the end of lactation should be maintained at 3.5 points until drying off. In that period cows with lower milk yields tend to fatten, which was not found in this study. The lowest body condition scores were recorded in cows during the winter feeding period, as confirmed by the data given in Table 1. Differences in BCS values at individual phases of the production cycle were confirmed statistically. The lowest body condition scores at the beginning of lactation were also reported by Adamski and Onyszko [1], Januś [10], Januś and Borkowska [11] and Jankowska and Sawa [8]. A study by Markusfeld et al. [13] showed that body condition at parturition and loss of body condition at early lactation were related with health, fertility and milk yield.

The longest calving interval and interpregnancy period were shown in individual seasons, except for winter. in cows with the highest BCS, assessed at 4.00-4.25 points.

In the winter no animals had excessive fat reserves, while the longest calving interval and interpregnancy period were recorded for cows with BCS of 3.00-3.25 (Table 3). The

**Table 2**

Effect of successive month after calving on cow's body condition according to season

Month after calving	Season							
	III-V		VI-VIII		IX-XI		XII-II	
	n	LSM	n	LSM	n	LSM	n	LSM
1	18	3.20	30	3.18	8	3.25	4	2.81
2-3	45	2.98 <sup>AB</sup>	41	3.07	40	3.05 <sup>A</sup>	19	2.72 <sup>AB</sup>
4-9	70	3.12	112	3.12 <sup>A</sup>	133	3.01 <sup>B</sup>	112	2.94 <sup>C</sup>
10 and further	44	3.27 <sup>A</sup>	26	3.36	37	3.15	57	3.10 <sup>A</sup>
Drying off	38	3.22 <sup>B</sup>	47	3.43 <sup>A</sup>	48	3.40 <sup>AB</sup>	76	3.22 <sup>BC</sup>

n – number of cows

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calving interval below 400 days was found in the spring in cows with BCS of 3.00-3.75, in the summer for those with BCS of 2.50-2.75 and 3.50-3.75, while in the autumn it was for BCS of 2.00-2.25 and 3.00-3.75. In the winter, irrespective of body condition, calving intervals were minimum 400 days. Apart from the spring feeding period, insemination success in terms of the number of services per conception deteriorated with an increase in fat reserves. In cows with greater energy reserves the reproductive rest period was shorter. Similarly, Markusfeld et al. [13] reported that cows with a high BCS at calving showed signs of oestrus faster. In this study a statistically significant effect of body condition on reproduction was found only in the winter for calving interval, interpregnancy period and reproductive rest period, showing that the greater the fat reserves of a cow, the longer these periods were. Veerkamp et al. [15] were of an opinion that energy reserves may be used as an indicator to evaluate fertility and may facilitate identification of these cows, which increase their milk yields with no depletion of their energy reserves or deterioration of their fertility indexes. Those authors calculated genetic correlations between the BCS values and fertility at  $-0.4$  to  $-0.6$  for calving interval and for calving to the first service interval.

Summing up it may be stated that body condition of cows kept in different management systems was comparable, with a trend towards slightly higher values in the stall barn system compared to loose housing. First calvers and cows in their 2nd-3rd lactation had the highest BCS in the summer, cows in their 4th-5th lactation – in the spring, while cows in >5th lactation – in the autumn; however, the differences were not confirmed statistically. Cows with the highest milk yields (>11 000 kg milk in the 305-day lactation and >40 kg in test day milking), irrespective of the season of the year, had lower BCS compared to cows from the other milk yield groups. The successive month of lactation had a significant effect on body condition of cows. Regardless of the season of the year cows suffered losses in

**Table 3**  
Indicators of fertility according to cow's body condition in different seasons

Season	Body condition (pts)	Number of cows	Indicators of fertility					
			calving interval (days)	calving-to-conception period (days)	reproductive rest period (days)	service period (days)	services per conception	
			LSM	LSM	LSM	LSM	LSM	LSM
III-V	2.50-2.75	34	415	155	77	63	1.67	
	3.00-3.25	42	394	120	96	23	1.45	
	3.50-3.75	18	381	132	79	49	2.11	
	4.00-4.25	2	432	150	72	39	1.50	
VI-VIII	2.50-2.75	30	397	135	78	54	1.90	
	3.00-3.25	40	425	138	80	45	1.95	
	3.50-3.75	31	394	112	68	30	1.67	
	4.00-4.25	2	481	202	63	134	2.50	
IX-XI	2.00-2.25	3	399	153	78	52	2.66	
	2.50-2.75	33	449	159	88	61	1.81	
	3.00-3.25	44	398	118	76	28	1.59	
	3.50-3.75	19	389	108	73	46	2.05	
XII-II	4.00-4.25	4	547	267	63	84	3.00	
	2.00-2.25	11	404 <sup>a</sup>	129 <sup>a</sup>	73 <sup>A</sup>	55	2.00	
	2.50-2.75	26	443	151	74 <sup>B</sup>	72	2.53	
	3.00-3.25	7	520 <sup>a</sup>	239 <sup>a</sup>	198 <sup>ABa</sup>	73	2.14	
	3.50-3.75	2	441	164	52 <sup>a</sup>	112	2.50	

Mean values of traits within the examined factors followed by the same letters differ significantly: capital letters – at  $P \leq 0.01$ ; small letters – at  $P \leq 0.05$

body condition from the onset of lactation, while starting from the 4th month BCS of cows was increasing. No significant effect of the season of the year or body condition on fertility indexes of cows was observed, although in the group of cows with the highest BCS (4.00-4.25) the longest calving interval and interpregnancy period, as well as lower success rates of the 1st service were recorded, while the reproductive rest period was shorter.

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