CULLING AND FERTILITY OF COWS WITH ENERGY METABOLIC DISTURBANCES IN THE EARLY POSTPARTURIENT PERIOD

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Abstract

The aim of the study was to evaluate the incidence of the abnormal blood values of nonestrified fatty acids (NEFA), glucose, and aspartate aminotransferase (AspAT) in cows after parturition, as well as a retrospective analysis of the culling and fertility in groups of cows characterised by increased values of NEFA and/or AspAT. The study involved 164 dairy cows (primiparas and multiparas) with a milk yield of 6,800 to 8,804 kg/305 days of lactation. The control group included cows with an NEFA concentration <500 µEq/L and AspAT activity <106 IU/L. Group A only consisted of cows with NEFA ≥500, group B of cows with AspAT activity ≥106 IU/L, and group C of animals with higher values in both these indices. The greatest number of cows subject to early culling came from the groups B and C (84% in total). The group B had the highest index of culling due to infertility (50%), as well as general culling (72%). The most unfavourable prognosis concerned the cows, which demonstrated an increase in the AspAT concentration without any apparent intensification of lipolysis.

Key words: cows, nonestrified fatty acids, AspAT, glucose, culling, fertility.

The lower feed intake after parturition, and the fast-growing demand for energy resulting from increased milk production, are the main causes of metabolism disturbances in cows, especially with a high milk yield (15, 18). The negative energy balance in the organism leads to the intensification of catabolic changes. The mobilisation of the energy reserve stored in the form of additional fat may be the cause of liver function and hepatocytes structure impairment, as a result of excessive lipolysis and triglycerides accumulation (24). It has been suggested that there is a connection between a fatty liver and a tendency to postparturient strokes, retained placenta, abomasum displacement, ketosis, mastitis, and metritis (3, 13, 14, 33). In cows with increased lipomobilisation after parturition, the reproductive indices are lower, which may be due to, among other things, a higher endometritis incidence, delayed post-parturient activity of the ovaries, ovulation disturbances, or the early death of embryos (3, 36). Even many weeks after the detection of the decreased value of triglycerides in the liver, the impairment of reproductive functions can be observed (4, 35).

Among the biochemical blood indices reflecting the risk and result of the negative energy balance in cows during early lactation, both in metaphylactic and single case diagnosis, it is recommended that the concentration of free fatty acids (NEFA), glucose, as well as the aspartate aminotransferase (AspAT) in the blood (11, 22, 23) be determined. An increase in the NEFA concentration in the blood makes it possible to come to conclusions about the size of the lipolysis, whereas the glucose concentration suggests that there is a bodily balance between the gluconeogenesis, the demand for glucose and the resistance to insulin (24). The interpretation of the changes in the AspAT activity in blood after parturition is not clear (19). A large rise in the activity of this enzyme of cows with increased lipolysis is attributed to hepatocyte damage (24). Changes in the enzyme activity after parturition also depend on the concentration of 3-methylhistidine, which is an indication of the degree of muscle protein degradation (8, 25, 29). Apart from the fat tissue, about 25% of the bodily proteins make up an additional endogenous source of energy. An increase in the AspAT activity in the blood may also be the result of the greater involvement of this enzyme in changing feed amino acids in the liver cells, including their catabolism and use in gluconeogenesis (18, 38).
The aim of this study was to evaluate the incidence of the abnormal values of the NEFA and glucose concentrations, and AspAT activity in cows’ blood after parturition, as well as the retrospective analysis of the culling and fertility in groups of cows characterised by increased values of NEFA and/or AspAT.

Material and Methods

The study was carried out between October and April at five farms with herds of 160-300 cows. The average milk yield was 6,800 to 8,804 kg of milk/305 d of lactation. In total, the study involved 164 dairy cows, including 19 primiparas and 145 multiparas. The cows were kept in free stalls (two farms) and tie stalls (three farms), where the animals were fed twice a day (7:00–8:00 and 14:00–15:00) a total mixed ratio (TMR) or a semi mixed ratio (SMR) with a separate complement of concentrate. During 10 d before parturition and 14 d after parturition, liquid or granulated supplements containing propylene glycol were used. Because of a high percentage of ground grain, the rations were supplemented with 120-240 g of NaHCO₃/cow/d.

Blood samples were twice collected from the jugular vein (Vacuette system) between 6:00 and 7:00 (before feeding). The first blood test was performed between the first and thirteenth day after parturition, and the second test was performed fourteen days later. The serum, after centrifugation at 3,000 g, was frozen and stored (at -20°C) until the assay (about seven days). The serum, after centrifugation at 3,000 g, was frozen and stored (at -20°C) until the assay (about seven days). The biochemical examination of the samples included glucose and AspAT determinations, using a standard set (Alpha-Diagnostics, Poland), as well as NEFA using the chemical method (10).

The culling and fertility were determined in the groups of cows characterised by raised values of NEFA and AspAT after parturition, assuming the range quoted in literature (12). The control group included cows with an NEFA concentration <500 µEq/L and AspAT concentration <106 IU/L. Group A only included cows with NEFAG≥500, group B cows with AspAT activity ≥106 IU/L, and group C animals with increased values in both indices. The decision as to which group the cow should be assigned to depended on the higher of the two values of a given index, which was used to calculate the means and standard deviation. During the analysis of the glucose concentration, the lower of the two values was used in the study, assuming a reference range 2.2–4.5 mM/L (37). Observations on the cows’ fertility were carried out until pregnancy was confirmed by per rectum examination about 45 d after insemination, but not longer than up to 305 d after parturition. The cows were analysed for early culling, conception rate, repeat breeding rate, days to conception, service per conception rate, and infertility culling index. The statistical study included an analysis of variance and a division of means into homogenous groups with LSD test. All the analyses were performed using STATISTICA software by StatSoft® Poland.

Results

In the studied population of 164 cows, an increase in the NEFA concentration was found in 32.2% of cases, and an increased AspAT activity was noted in 30.5% of animals, including 15.2% of cows with elevated values in both of these indices. The first blood tests were performed on average on 5.75 ±3.80 d, whereas the second on 19.63 ±3.90 d after parturition. No significant differences were found between the date of the first and second blood test in the control group and all experimental groups. An increased NEFA concentration was found mostly during the first 13 d after parturition (90.6% of cows), and only in three cases between days 14 and 30 (5.7%). In six cows, elevated values were noted in both the examinations (11.3%). Increased AspAT activity was also usually observed in the first two weeks after parturition (70.0% of cows), and in only ten cases (20.0%) after this time. In 18 (36.0%) cows, an increased activity in this enzyme was found in both examinations. A decreased concentration in glucose (below <2.2 mM/L) was noted in all groups of the cows. The smallest number of cows with hypoglycaemia was found in the control group (8.1%). In the other groups, the percentage of cows was much higher and equalled 17.9%, 20.0%, and 52.0% in the Groups A, B, and C, respectively. In these groups, a decreased glucose concentration in both tests was found in two (7.1%), one (4.0%), and three (12.0%) cows, respectively. In the control group, a decreased glucose concentration was always observed in only one out of two blood samples.

The animals in the first and second lactation were the biggest group among the control cows (59.3%) (Table 1). In the group of primiparas, there was one case of increased NEFA concentration and AspAT activity. The greatest number of cases with an elevated value of NEFA was found among the cows in the second lactation (50.0%), whereas AspAT activity was greater in the second and third lactations (56.0%). The high values of both indices were observed mostly in the third and fourth lactation (56.0%).

The results presented in Table 2 demonstrate that cows culled due to infertility in the groups A and C were characterised by a higher than average number of calvings - 3.87 ±2.17 and 3.50 ±0.71. The lowest average number of calvings (2.33 ±2.16) was characteristic for cows culled from the control group. However, the differences observed were statistically insignificant. No differences were found between the mean NEFA concentration in the cows culled due to infertility and in calving. The mean AspAT activity in the cows culled from the groups B and C was higher than in the cows in calving. A statistically significant difference was confirmed in the group B (P<0.05). Only in the group C, the mean glucose concentration in calving and infertile cows was lower than those observed in the control group (P<0.05). The highest mean glucose concentration after parturition was found in the calving cows from the group B. It was higher (P<0.05) in comparison with the mean glucose concentration in the culled cows from this group, and
did not differ from the mean values obtained in the control group. Apart from the control cows, the mean glucose concentrations in the blood of the cows culled due to infertility in all experimental groups were lower than in the calving cows. However, a statistically significant difference was only demonstrated in cows from the group B (P<0.05).

The longest average interval between conception was found in the cows from the group C, and the shortest one was in the control cows (P<0.05) (Table 3). The first service to conception rate was the lowest in the cows from the groups B and C. The percentage of cows repeating oestrus was the highest in the groups A and C. When comparing the average interval between conceptions, it was noted that the longest period was in the group C, and the shortest one in the control group (P<0.05). In the remaining groups of cows, the interval between conceptions was also longer; however, the mean values were not statistically different. The average number of inseminations (excluding re-inseminations) in the calving cows was the highest in the groups B and C, but the differences were statistically insignificant.

Among the 164 cows undergoing blood tests, 66 animals were culled (40.2%) (Table 4). Most cows subjected to early culling came from the groups B and C (84% of all the culled cows). The most common reason for early culling was a lack of appetite, a sudden decrease in condition and milk yield, and in some cases an increase in the number of somatic cells, and also a low milk yield or a lack of milk after mastitis. Thirty-three cows were culled due to infertility (20.1% of all cows subjected to blood tests) and the highest culling rate (50.0%) was found in the group B. In the same group, the general culling rate was the highest, and came to 72.0%.

The culled animals, which demonstrated increased concentrations of NEFA and AspAT postpartum, were mostly older cows (50%), i.e. after four or more calvings (Table 5). In the group with only an elevated AspAT concentration, the high value of the early culling rate was found both among older cows (≥five calvings), as well as those after second calving. In the cows from this group, there was also a high culling rate due to infertility (50.0% of cows qualified for reproduction), with a large percentage of cows in second lactation.

### Table 1
The percentage of cows with normal and elevated values of NEFA and/or AspAT depending on the number of calvings

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of cows</th>
<th>Number of calvings</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>&gt;5</th>
</tr>
</thead>
<tbody>
<tr>
<td>control</td>
<td>86</td>
<td>19.8%</td>
<td>39.5%</td>
<td>11.6%</td>
<td>10.5%</td>
<td>5.8%</td>
<td>12.8%</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>28</td>
<td>3.6%</td>
<td>50.0%</td>
<td>7.1%</td>
<td>25.0%</td>
<td>3.6%</td>
<td>10.7%</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>25</td>
<td>4.0%</td>
<td>36.0%</td>
<td>20.0%</td>
<td>12.0%</td>
<td>12.0%</td>
<td>16.0%</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>25</td>
<td>-</td>
<td>16.0%</td>
<td>24.0%</td>
<td>32.0%</td>
<td>12.0%</td>
<td>16.0%</td>
<td></td>
</tr>
</tbody>
</table>

### Table 2
The value of blood indices in pregnant cows and cows culled due to infertility

<table>
<thead>
<tr>
<th>Group</th>
<th>Fertility</th>
<th>N</th>
<th>Number of calvings</th>
<th>NEFA µEq/L</th>
<th>AspAT IU/L</th>
<th>Glucose Mm/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>control</td>
<td>culled</td>
<td>15</td>
<td>2.33±2.16</td>
<td>328±103&lt;sup&gt;a&lt;/sup&gt;</td>
<td>86±35&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.88±0.40&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>pregnant</td>
<td>60</td>
<td>2.83±1.91</td>
<td>302±122&lt;sup&gt;a&lt;/sup&gt;</td>
<td>70±11&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.86±0.48&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td>A</td>
<td>culled</td>
<td>8</td>
<td>3.87±2.17</td>
<td>693±141&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>80±10&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.46±0.54&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>pregnant</td>
<td>19</td>
<td>2.89±1.49</td>
<td>686±166&lt;sup&gt;a&lt;/sup&gt;</td>
<td>79±14&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.64±0.60&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>B</td>
<td>culled</td>
<td>7</td>
<td>2.80±0.84</td>
<td>395±143&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>163±57&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.46±0.33&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>pregnant</td>
<td>7</td>
<td>2.86±1.68</td>
<td>353±87&lt;sup&gt;a&lt;/sup&gt;</td>
<td>133±10&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.12±0.55&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>C</td>
<td>culled</td>
<td>3</td>
<td>3.50±0.71</td>
<td>536±6&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>206±99&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.00±0.48&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>pregnant</td>
<td>12</td>
<td>3.31±1.11</td>
<td>666±148&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>161±68&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.41±0.52&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>abc</sup> mean values marked with different letters differ statistically at P<0.05.
Table 3
An index of cows’ fertility in groups differentiated by elevated values of NEFA and/or AspAT in the blood after parturition

<table>
<thead>
<tr>
<th>Group</th>
<th>Control</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cows (n=131)</td>
<td>75</td>
<td>27</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>Number of calvings</td>
<td>2.93±1.95</td>
<td>3.19±1.74</td>
<td>2.83±1.34</td>
<td>3.33±1.05</td>
</tr>
<tr>
<td>Days to first insemination</td>
<td>82±25&lt;sup&gt;a&lt;/sup&gt;</td>
<td>91±26&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>93±34&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>107±35&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>¹Service to conception rate</td>
<td>32.0% (40.0%)</td>
<td>33.3% (47.4%)</td>
<td>28.6% (57.1%)</td>
<td>26.7% (33.3%)</td>
</tr>
<tr>
<td>²Percentage of cows repeating heat</td>
<td>18.3% (14.7%)</td>
<td>52.6% (37.0%)</td>
<td>28.6% (14.3%)</td>
<td>41.7% (33.3%)</td>
</tr>
<tr>
<td>Days to conception</td>
<td>118±51&lt;sup&gt;a&lt;/sup&gt;</td>
<td>137±67&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>131±49&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>167±82&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>³Service per conception rate</td>
<td>2.32±1.59 (1.90±1.02)</td>
<td>2.85±1.93 (2.50±1.95)</td>
<td>3.08±2.02 (2.00±1.53)</td>
<td>3.50±2.98 (2.58±1.78)</td>
</tr>
</tbody>
</table>

<sup>ab</sup> mean values marked with different letters differ statistically at p<0.05; ¹,² (no brackets) – values for all cows in the group, (in brackets) – values for pregnant cows; ³ re-insemination not included.

Table 4
Culling in groups differentiated by elevated values of NEFA and/or AspAT in the blood after parturition

<table>
<thead>
<tr>
<th>Group</th>
<th>Control</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early cull n=33</td>
<td>12.8%</td>
<td>3.6%</td>
<td>44.0%</td>
<td>40.0%</td>
<td>20.1%</td>
</tr>
<tr>
<td>Late cull (infertility) n=33</td>
<td>17.4%</td>
<td>28.6%</td>
<td>28.0%</td>
<td>12.0%</td>
<td>20.1%</td>
</tr>
<tr>
<td>Total</td>
<td>30.2%</td>
<td>32.2%</td>
<td>72.0%</td>
<td>52.0%</td>
<td>40.2%</td>
</tr>
</tbody>
</table>

<sup>1</sup> 14 cows – loss of appetite, loss of condition, low milk yield with/without increase in somatic cells in milk; 7 cows – low milk yield or lack of milk after mastitis; 5 cows – inflammatory states of hoof and joints, posture defects due to current or past inflammatory states of joints, abscess of soft tissue of legs and rump; 4 cows – recurring prolapse of the vagina; 2 cows – died (unknown cause); 1 cow – spine injury; <sup>2</sup> no brackets – percentage of culled cows in relation to all studied cows; data in brackets – percentage of culled cows in relation to cows qualified for reproduction.

Table 5
Culling of cows depending on the number of calvings in groups differentiated by elevated values of NEFA and/or AspAT in the blood after parturition

<table>
<thead>
<tr>
<th>Group</th>
<th>Cull</th>
<th>N</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>≥5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control&lt;br&gt;early infertility&lt;br&gt;n=11&lt;br&gt;infertility&lt;br&gt;n=15</td>
<td>18.2%</td>
<td>18.2%</td>
<td>27.3%</td>
<td>18.2%</td>
<td>18.2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A&lt;br&gt;early infertility&lt;br&gt;n=1&lt;br&gt;infertility&lt;br&gt;n=8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100.0%</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B&lt;br&gt;early infertility&lt;br&gt;n=11&lt;br&gt;infertility&lt;br&gt;n=7</td>
<td>36.4%</td>
<td>18.2%</td>
<td>-</td>
<td>-</td>
<td>45.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C&lt;br&gt;early infertility&lt;br&gt;n=10&lt;br&gt;infertility&lt;br&gt;n=3</td>
<td>10.0%</td>
<td>20.0%</td>
<td>30.0%</td>
<td>40.0%</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup> cows removed from reproduction.
Discussion

In the energy metabolism disturbances in cows after parturition, changes in many biochemical blood indices can be observed (3, 24, 31). The most serious risk factor for the health and fertility of cows is the excessive energy deposit in the form of fat tissue before parturition (3). The intensification of the lipolysis in cows with an excessive condition leads to a sudden increase in the NEFA concentration in the blood, and the maximum value of this index can be observed up to 72 h after parturition (8, 16, 30, 34). This can explain, as found in our own studies, the high percentage of samples with an elevated NEFA concentration in the first blood test after parturition. Single cases of cows with increased values of the NEFA concentration in both tests suggest that the level of fatty liver might have been significant. It has been suggested that the changes in the NEFA concentration also depend on the rate of the milk yield increase determining the balance between the demand for energy and its supply from the feed ratio (16, 17, 32). Thus, few cases of cows with elevated values of this index were found after the second blood test. When selecting cows for the study, the rule was to make the first blood test the earliest possible after parturition. However, the time from parturition to the first blood sample collection in many cows was over three days, which might have had a significant influence on the value of the NEFA concentrations, which were lower than those found in the literature (8, 16, 17, 30, 34).

The study also shows that the elevated AspAT concentration is found most frequently in the first days after parturition, although the percentage of cases is lower in relation to those with a high NEFA concentration. In some cows it lasts for quite a long time after parturition, and in a few cases an increase can be observed only some time after parturition. In 80.0% of cows, higher concentrations of NEFA and AspAT were found at the same time, and in 68.0% of cases when the blood test was performed between the days 1 and 13 after parturition.

An increase in the AspAT concentration in the blood of cows with intensified post-parturient lipolysis is attributed to hepatocytes damage, as a result of the excessive accumulation of triacylglycerols (24). The degree of fatty liver depends on the length of the exposure to the elevated NEFA concentration and the amount of glucoplastic complexes, and the NEFA concentration in the blood is proportional to the fat deposit and energy deficit (17). The conclusions drawn from the study suggest a diagnostic usefulness of the AspAT assay (6, 23, 24, 27). It appears that an increase in the concentration of this enzyme in the blood is closely related to the degree of fatty liver and changes of other biochemical blood indices observed in cows with excessive fat mobilisation syndrome. Other authors have obtained different results, suggesting a limited usefulness of the determination of this enzyme (5, 26).

Liver steatosis is most often observed in multiparas, which is connected, among other things, with a higher milk yield and the amount of fat tissue built up in the periparturient period (20, 21). In our studies, an increase in the percentage of cows with intensified lipolysis after the third and fourth parturition coincided with an increase in the AspAT concentration in the blood. In the analysed population of cows there were also cases, which only showed an increase in NEFA or AspAT (groups A and B). Among the animals with only an increased NEFA concentration, the majority of cows were after two calvings (Table 1). This points to their overcondition before parturition, and emphasises the problem of energy oversupply in primiparas during lactation and the dry period.

A separate group involved cows in which the AspAT concentration increase was only observed after parturition. More than half (56%) of these are animals in their second and third lactation. The assumption that the seemingly primary increase in the AspAT concentration without any noticeable lipolysis (an increase in the NEFA concentration) resulted from different time of the blood tests was not confirmed. The time from parturition to the blood sample collection, which showed the increased values of AspAT, NEFA or of both these indices in the first, or only in the second test, did not differ between groups A, B, and C. The percentage of samples with elevated values of the studied indices in the first and second study was also comparable. This demonstrates that the increase in the AspAT concentration did not depend on lipolysis, which is confirmed by the lack of differences between the mean values of the NEFA concentrations in the cows from the group B and the controls. A significant increase in the AspAT serum activity in comparison with the histological evaluation of the degree of liver steatosis in the cows concerns about 83% of the serious cases of lipidosis; however, in 63% of cases, the increased activity of this enzyme can be found in mild forms of steatosis (6). One has to remember that, in the present study, the size of the lipolysis was determined on the basis of unambiguous criterion, i.e. a NEFA concentration ≥ 500 µEq/L.

Post-parturient cows demonstrated a lowered feed intake, a decreased rumen pool of propionic acid, and an increased demand for glucose (9). One of the physiological signs of metabolic adaptation during this period is an intensification of the paths of changes making it possible to use alternative sources of substrates for gluconeogenesis (1, 7). The estimate studies show that 10%-30% of glucose can be synthesised de novo from amino acids (28). Lower glucose concentrations in the groups of culled cows with elevated values of the studied indices after parturition suggest an intensification of catabolic processes and decreased gluconeogenesis. The cases of the elevated AspAT concentrations without any apparent lipolysis suggest an increased use of amino acids for gluconeogenesis (18). An increase in AspAT activity can be observed, among others, in the hunger, diabetes, hypothermic stress, or after the administration of glucocorticoids and glucagon (38).

The most unfavourable prognosis concerns the cows, which demonstrated an increase in the AspAT
concentration in the blood in the early post-parturient period without any apparent intensification of lipolysis. The main reason for the poor breeding prognosis is a very high culling index and infertility, despite better fertility indices in calving cows in relation to the other groups (A and C, Table 3). This shows that, in these groups, the consequences of the metabolic disturbances most radically select animals, and a high culling index due to infertility suggests a very long recovery period after parturition.

The analysis of the biochemical examinations of the blood demonstrated that only in the group B, a statistically higher mean AspAT and lower glucose concentrations were confirmed in cows culled due to infertility in comparison with the calving cows. It is difficult to point out the mechanism explaining the extremely poor prognosis in relation to the health and fertility of the cows with an elevated AspAT concentration without a significant increase in lipolysis. Despite a higher percentage of such cases in cows in the second and third lactation, the cull is high both for young and older cows (Table 5). In all groups of cows with metabolic disturbances after parturition, worse fertility indices were noted in relation to the control group.

The total size of the cull in the groups suggests that an increase in AspAT activity in the early post-parturient period results in more serious health consequences if it does not occur with lipolysis.

References


