Reproductive problems and welfare of dairy cows

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Abstract: High milk yield characteristics with insufficient emphasis on traits relating to health in dairy cows increases the risk of suffering from reproductive problems, which represent one of the welfare indicators. This paper considers the most common problems of reproduction in large capacity dairy farms in Serbia in the light of their effects on the welfare of cows. Data on reproduction parameters, prepertal and postpartal reproductive disorders in total 3865 Holstein-Friesian cows held in tied system were collected. Rearing conditions in all farms were similar regarding housing and nutrition, and differences existed in some management procedures. Results pointed on prolonged intercalving period, interval from calving to the first artificial insemination, and extended service period (average values: 15.6 month, 98.46 days and 180.94 days, respectively), and increased insemination index (2.65). The most frequent reproductive disorders were ovarian hypofunction, insufficiencia corpora lutea and endometritis (31.18%, 17.54% and 14.31%, respectively). Due to reproductive disorders 7.6% of cows were culled. Condition on the farms in respect to the reproduction is commonly related to the intensive production and tied system. Risk related to the occurrence of reproductive problems is multifactorial, and associated with the housing conditions, nutrition, management and selection. Even in the tied system, improvement is possible by implementation of measures for enhancement of cows’ health and welfare in general, i.e. by introduction of certain changes in the rearing technology.

Key words: dairy cows, reproduction, welfare

INTRODUCTION

Failures in reproduction, mastitis, laminitis and metabolic disorders represent the major health problems of highly productive dairy cows. All of these follow the high demands in intensive milk production systems. Their occurrence is often correlated: frequently, cows suffering from mastitis and laminitis have some of reproductive problems as well (Fleicher et al., 2001). These disorders often have a mutual cause and the same consequences, and the same goes for interrelation of reproductive disorders. In general, the risk related to the occurrence of reproductive problems on farms with intensive breeding system is regularly associated with the housing conditions, nutrition, management and selection (EFSA, 2009); these factors are also important for the occurrence of technopathies (Rauw, 1998) mentioned above.

Problems in reproduction affect reproductive efficiency of dairy herd - an important contributor of production effectiveness which permanently declines during the last decades (Dobson et al., 2007). Presence of the reproductive problems has consequences usually emphasized through an economic aspect, i.e. reduced farm profitability caused by lesser number of calves born, decreased milk yield per lactation as well as overall lifetime production, and increased costs due to veterinary services and earlier culling of cows. The component traits in breeding indices are weighted by their relative financial contribution to overall profitability, rather than their contribution to welfare (FAWC, 2009). Beside lower production results, the presence of reproductive problems in a herd can be indicated by health
and behavioral disorders. In assessing cows’ welfare, they can be “seen” as infertility and difficult calvings i.e. dystocia (Welfare Quality, 2009). They can reflect prolonged or short-term poor welfare, such as lack of oestrus, embryonic loss or early abortion, and can also cause poor welfare directly, particularly dystocia and genital infections associated with pain or inflammatory reactions (EFSA, 2009). Undoubtedly, the incidence of any problem in reproduction suggests that organism of the animal fails to comply with the environment.

Animals’ compliance with their environment is the essence of the welfare concept, and welfare problems are generally the consequence of negative animal-environment interactions (Anon., 2001). Especially in intensive rearing systems production’ goals interferes with welfare of dairy cows. It is known that reproductive and other health problems rarely occur in less intensive and pasture growing conditions. Many studies indicated the existence of a direct link between the decline of reproductive efficiency in dairy cows and various stress factors resulting from housing in confined space. However, the risk of suffering reproductive disorders is independent of the housing system (EFSA, 2009).

In Serbia, intensive and semi-intensive cattle production system are prevalent at large capacity farms. Although breeders in Serbia gradually opting for the free system (with or without use of pasture), regardless of the farm capacity, large number of dairy cows still spend most of their life tied. In this paper, fresh data on problems of reproduction in large capacity dairy farms in Serbia were presented, in the light of their linkage to the rearing system and management effects on the welfare of dairy cows.

MATERIALS AND METHODS

In the period of the first six month of 2013 total 3865 Holstein-Friesian cows at three farms were monitored. The average milk yield was 8000 liters in the standard lactation of 305 days, with about 3.5% fat, and about 3% of the proteins. Rearing conditions in all of the farms were similar regarding housing and nutrition. The farms have stalls for lactating cows with 120 places and medium long beds in two rows, and “Grabner” chain binding system. Straw has been used as a bedding material above concrete floor. Diet is based on complete meals from the mixer-trailer, and feeding groups are formed by production level.

The common practice at all of the farms is 55 to 60 days long dry period, and average age at the first calving is 24 months. Differences between these farms existed in some management procedures, i.e. in accuracy and time of certain technological procedures performance, depending on the organization of work and ability of responsible person. To determine reproductive efficiency of the herd data on following parameters were collected: calving interval, service period, interval from calving to the occurrence of the first estrus after calving, and insemination index. Percent of cows culled due to reproductive disorders was noticed. As reproductive disorders the presence of follicular cysts (cista ovarii), ovarian hypofunction (hypofunctio ovarii), corpus luteal insufficiency (insuficiencia corpora lutea) and the occurrence of abortions were determinated. Difficult calving (dystocia), and postcalving disorders (uterine prolapse - prolapsus uteri, retained placenta - retention secundinarum, and endometritis) were also monitored.

RESULTS AND DISCUSSION

As in many other counties, in our dairy herds problems of reproduction are evident, which directly have an effect on reduced reproductive performance of cows and therefore the milk production is significantly lower than cows' genetic predisposition (Vuković et al.,
That is manifested as prolonged postpartal anoestrus, increase number of cows in silent estrus with irregular estrous cycle duration, decline in the first insemination conception rate, increase number of inseminations needed for successful conception, increase number of cows with abnormal early embryonic development and various forms of uterine diseases, and increasing embryonic and fetal mortality rate (Gvozdić et al., 2011).

Values of the farms’ reproductive parameters are presented in the table 1.

Table 1

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Optimal* Values</th>
<th>Unfavorable* Values</th>
<th>Determined Values</th>
</tr>
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<tbody>
<tr>
<td>Average calving period (months)</td>
<td>12.5 to 14</td>
<td>&gt; 14</td>
<td>15.36</td>
</tr>
<tr>
<td>Average service period (days)</td>
<td>85 to 110</td>
<td>&gt; 140</td>
<td>180.94</td>
</tr>
<tr>
<td>Average number of inseminations per successful conception, insemination index</td>
<td>&lt; 1.7</td>
<td>&gt; 2.5</td>
<td>2.65</td>
</tr>
<tr>
<td>Culling due to reproductive disorders</td>
<td>&lt; 10%</td>
<td>&gt; 10</td>
<td>7.6</td>
</tr>
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</table>

*Walker (1997)

According to table 1, data from studied farms are not in accordance with recommended values. This is consistent with the results of Gvozdić et al. (2011) and Vuković et al. (2013). In our study, the average calving period was 15.6 month, three month longer than technological and economical acceptable value for herds with intensive milk production.

In economic sense, long calving intervals mean fewer calves born during the productive lifetime of the cow, which leads to the less number of calves, loss of replacement heifers, and therefore loss of potential income. Maximal milk and calves production is enabled by 12-13 months calving interval (Walker, 1997).

However, more recent research shows that a reproductive management strategy with extended calving intervals of 15 months or more seems to offer significant advantages for the welfare of high yielding dairy cows, without reducing overall milk production (EFSA, 2009). Cows with high genetic merit for milk production have a greater predisposition for losing body condition to support milk production. This leads to a greater negative energy balance in early lactation, with more rapid loss and a slower recovery of body condition that, in turn, affects her ability to conceive. It is suggested by EFSA that extending calving intervals for high yielding cows from 12 to 15 or 18 months may improve welfare by giving time for the cow to recover condition. Such strategies, along with breeding cows for health and fertility, would be economic since cows would have longer productive lives.

Calving interval is determined by gestation duration and service period duration (interval between calving and successful conception). Since gestation duration is biologically constant, the calving interval is influenced by the factors determining service period duration (Stančić and Košarčić, 2007). Prolonged calving interval in our study was the direct effect of prolonged service period influenced by large number of failed conceptions.

According to Walker (1997), in well managed dairy herds average service period is optimally between 85-110 days, with no more than 10% of cows having service period longer than 120 days. In the case that it is above 140 days, or number of cows with service period longer than 120 days is more than 15% there are serious reproduction issues on that dairy farm. Lucy (2007) reported that 20 years ago approximately 1.75 inseminations were needed for successful conception while in the last few years it has increased to more than 3. In our study, the average number of inseminations was increased (2.6), as well in the study by
Vuković et al. (2013) and Gvozdić et al. (2011) (3 and 3.5, respectively). Vuković et al. (2013) found that only in 15% of cows less than three inseminations were needed for conception, and it was 24% of cows with service period longer than 120 days. This could be consequence of the fact that first estrus within 60 days postpartum has been recorded in small number of cows. In good managed dairy herds the first postpartal estrus should be detected within 60 days after calving in 90% of dairy cows (Walker, 1997).

Prolonged anestrus postpartum may be influenced by genetic, as well as many paragenetic factors (Stancic and Košarčić, 2007): high milk production in the current lactation, age, parity of calving, and reproductive disorders after calving (dystocia, retention of placenta and infection of the uterus). However, it is often result of incorrect estrus detection. In our dairy farms, estrus detection procedure is based on checking of external and behavioral estrus manifestation in cows, twice a day (during morning and evening milking time).

External signs of estrus in high-productive dairy cows often have short duration and/or they are weakly expressed. First postpartal estrus is without manifest clinical signs in about 70% of dairy cows, declining to 50% during second postpartal estrous cycle (Crowe, 2008). Observation method is not adequate for estrus detection in animals in “the silent heat”, where estrus is not followed with manifest of external signs of sexual receptivity (Vuković et al., 2013). One of the potential factors that may contribute to timely detection of estrus may be lack of attention or experience of person responsible to visually detect estrus. In large herds, time needed for appropriate monitoring of all animals should also be considered as an additional factor.

Animals with reproductive problems are potential candidates for reducing fertility in the herd (Dobson et al., 2008). It is manifested by low conception and pregnancy rates.

Infertility is also influenced by concurrent disease, such as lameness and mastitis. Inappropriate phenotype for the system, poor management, inadequate feeding, breeding immature heifers and using inappropriate bulls that exacerbate dystocia contribute to its occurrence. More detailed, according to EFSA (2009; 2012), in a tie system reduced fertility can be one of the adverse effects of the following hazards: too low ventilation, insufficient light level (for both, cows and stockperson), too short light duration, inadequate hygiene, composition and quantity of bedding, lack of space for movement and resting, poor calving conditions and management, underfeeding (including inadequate nutrient supply in relation to genotype and energy output), inadequate transition feeding (inadequate feeding strategy, energy and fiber supply), overfeeding (excess of nutrient supply in relation to genotype and energy output at the end of lactation and dry period), inadequate feeding schedule (frequency and regularity of supplying feed), improper operational pain management (e.g. caesarean section, obstetric interventions), improper obstetric interventions (pregnancy diagnostic, treatment of metritis, retained placenta, etc.).

Infertility is a main reason for premature, involuntary culling of dairy cattle. It is not, in itself, a welfare problem but can be an indirect indicator of poor welfare. Particularly use of the hormones in reduction of infertility and control of reproduction result in poor welfare as it deprives the animals of a coping mechanism, to delay the onset of the reproductive process postpartum, and to cope with metabolic stress caused by high production. Deficits in nutrition, housing, handling and management leading to poor fertility in dairy cattle cannot be compensated by hormonal treatments (EFSA, 2009). Beside infertility, culling can be also a consequence of difficult calving, or post-calving complications, which may result in on-farm death of cow. High rates of mortality are almost always associated with a poor quality of life for the animals (Keyserlingk et al., 2009). Maher et al. (2008) found the peaks in the number of on-farm deaths within one month and 9-12 months following the last recorded calving (24.5% and 17.1% of all cows that die on-farm, respectively). Sol et al. (1984) also found a
culling peak shortly after calving attributed to calving difficulties, mastitis, teat injuries and other health problems. In our study, culling rate due to infertility or problems during and after calving reached 7.6%, while in the study of Vuković et al. (2013) it was 8.7% and Stojić et al. (2011) reported 15% culling rate due to reproductive disorders. First two values are within an acceptable range according to Walker (2007). Crosse et al. (1999) found infertility/reproduction as more frequent reasons for culling than in our farms (i.e. 23.5%).

Good health is central to good welfare. The immune resistance of high yielding cows in negative energy balance during early lactation is weak, raising susceptibility to some diseases. In table 2 data on the reproductive disorders recorded in our study are presented.

### Occurrence of reproductive disorders

<table>
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<tr>
<th>Parameter</th>
<th>Number of cows</th>
<th>Frequency of the occurrence (%)</th>
</tr>
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<tbody>
<tr>
<td>Cista ovarii</td>
<td>151</td>
<td>3.90</td>
</tr>
<tr>
<td>Hypofuntio ovarii</td>
<td>1205</td>
<td>31.18</td>
</tr>
<tr>
<td>Insuficiencia corpora lutea</td>
<td>678</td>
<td>17.54</td>
</tr>
<tr>
<td>Abortus</td>
<td>22</td>
<td>0.57</td>
</tr>
<tr>
<td>Partus gravis (dystocia)</td>
<td>62</td>
<td>1.60</td>
</tr>
<tr>
<td>Prolapsus uteri</td>
<td>14</td>
<td>0.36</td>
</tr>
<tr>
<td>Retentio secundina</td>
<td>420</td>
<td>10.87</td>
</tr>
<tr>
<td>Endometritis</td>
<td>553</td>
<td>14.31</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>3105</strong></td>
<td><strong>80.34</strong></td>
</tr>
</tbody>
</table>

According the results, the most frequent reproductive disorders were ovarian hypofunction, insuficiencia corpora lutea and endometritis (31.18%, 17.54 and 14.31% respectively). First three diagnoses in the table may be considered as reproductive problems related to infertility problems previously discussed. In the paper by Rosenberg (2010) ovarian cysts i.e. cystic ovarian disease (COD) is classified as the most common endocrine pathology in dairy cows, especially in Holsteins as the most susceptible to develop a cystic condition compared to other breeds, with incidence from 1 to 30% (in our study 3.90%).

Presence of ovarian cysts negatively affects estrous cyclicity, conception, and prolongs calving interval. Occasionally, a persistent presence of follicular cysts can lead to increased testosterone levels, causing some cows to exhibit masculine aggressive and sexual behavior (Ball and Peters, 2004). Factor associated with appearance of ovarian cysts are numerous, such as genetics, body condition, stress and environmental factors including feeding management and housing type (Nelson et al., 2010). Determining the type of cyst is important as the proper treatment for follicular and luteal cysts differs. The use of ultrasound is the best tool for achieving this. Hanzen et al., (2000) reported values of follicular and luteal cysts diagnosed by manual rectal palpation as 66%, compared to 75% and 85%, respectively, when diagnosis is made with the aid of transrectal ultrasonography. Recent practice in our studied farms is the use of this method, which proved to be particularly useful in detection of the conditions of ovaries, such as ovarian hypofunction, and insuficiencia corpora lutea. Unfortunately, application of this method is currently limited by a small number of trained staff and available equipment.

Table 2 shows presence of some problems related to reproductive tract in about 80% of cows in this study. Similarly, Gvozdić et al. (2011) detected more than 70% of cows with calving and postcalving reproductive disorders. The most frequent disorders in their study...
were endometritis (64%) and dystocia (62%), while Stojić et al. (2011) founded certain reproductive diseases in 10.2% of cows, abortus in 2.8%, and dystocia in 2% of total 8721 Holstein-Friesian cows in large capacity Serbian farms.

Dystocia occurs when there is a failure in one or more of the three main components of calving: expulsive forces, birth canal adequacy and fetal size and position. Mee (2012) reported that dystocia rates appear to have increased in countries with development cattle production: at the cow level, in dairy industries with confinement systems (e.g. USA, The Netherlands, Canada) with similar genotypes (Holstein-Friesian) tend to be high (>5%). Despite the relatively frequent occurrence in US (22.6% of heifers and 13.7% of cows - data from paper by Mee, 2012), Garry (2004) stated that in the US dairy industry the welfare aspect of dystocia was almost ignored. We believe that similar is at some of the farms in our country.

In Welfare quality protocol for cattle welfare assessment (2009) a warning threshold for the occurrence of dystocia is 2.75% and alarm threshold is 5.5%. Results from our study are under warning threshold value (1.60%). It may be connected with appropriate age and condition of heifers in the time of the first insemination. Gustaffson (2003) and Mee (2004) state that the prevalence of dystocia can be increased by the lack of exercise. Body condition of pregnant heifers can be positively affected by time which they spent untied; at one of the studied farms the practice is to tie heifers first time shortly before calving. To reduce risk of dystocia particularly at first calving, EFSA (2009) recommended that heifers should be inseminated after they reach the mature weight for the breed and only sires known to have low incidence of dystocia should be used to breed heifers. Countries with functional selection indices which include dystocia, have a lower prevalence (Mee, 2012).

In our studied farms, heifers are inseminated after they reach appropriate body mass (350 kg) and not before 15 month of age. Selection of bulls’ semen on high yielding dairy farms is carried out by the principle of avoidance of inbreeding, and to preserve standard dimensions of cows. However, dairy animals are not rigorously selected for calving ease and management is not directed at reducing dystocia risk. Dystocia can be also one of the adverse effects of poor calving conditions (pen design), poor calving management, overfeeding, inadequate preventive medicine, herd-health management including health recording neglect, and lack of knowledge or lack of time (EFSA, 2009; 2012). In the paper by Ostojić-Andrić et al. (2011), incidence of dystocia points to significant gaps in farm management. Vasseur et al. (2010) emphasized it is not just the management system but the management of the system is also critical to calving success. According to Mee (2012), in intensive management systems the pain, distress and injuries associated with dystocia in individual animals may receive less attention. This lack of attention to individual cows has been occurring with the ‘lost in the herd’ and ‘loser cow’ syndromes in intensive large dairy units.

The same author cited that dystocia in confinement systems impacts production (41% of costs), fertility (34%) and cow and calf morbidity and mortality (25%), excluding costs associated with increased culling, veterinary costs and other management costs. It has the greatest effect on future cow fertility, through increased risk of retained placenta and metritis in addition to the effects on cow culling and on stillbirth. Dystocia also increases the likelihood of calf respiratory and digestive disorders and subsequent heifer milk yield. Cows which experienced dystocia are more likely to have it again at a subsequent calving. Then, when the costs associated with the interrelated consequences of dystocia are included, the total cost of dystocia is four-times greater than treatment costs alone.

As is mentioned above, dystocia itself can be a hazard for the occurrence of uterine infection. Uterus infections and reproductive failure can be the adverse effects of inadequate conveying of biosecurity measures at the farm (inadequate cleaning, introducing
Infections/diseased cattle, and/or inadequate control of vectors and pests) (EFSA, 2009; 2012). Frequent occurrence of endometritis at our farms may be also caused by these factors. Importance of biosecurity measures in the prevention of disease and protection of dairy cows welfare of is considered in the papers by Relić et al. (2006) and Hristov et al. (2008).

In the publications of authors from our country is often mentioned that there are failures in the farm management that contribute to reproductive disorders, and generally treat welfare and biosecurity in our dairy farm, for what is the key a human factor. Stojić et al. (2011) consider the results achieved in reproduction were at lower level than those provided for in the plan. In their opinion, as for the other production indicators significantly better results can be accomplished primarily by reducing the impact of subjectivity in dairy operations. Reproductive disorders presented in this paper are indirect indicators of adverse conditions in which the animals live. As in all farm with tied system and closed stalls, it is difficult to compensate negative effect of the confinement and poor microclimate. Improving reproductive performance of the herd, as well as achieving producer’ goals, is best if it goes to the expense of prolonging productive life of animals; otherwise the positive effect is short-term. Better welfare status, with contribution to the reduction of reproductive problems, would be enabled by managing cows more in accordance with their needs and with respect to the physiological limits of the organism, such as keeping as much as possible free and outdoor (e.g. during dry period), and provision of quality food and maximal comfort during all daily activities.

CONCLUSIONS

Reproductive disorders of dairy cows are very complex. They endangering the welfare of cows in many aspects, especially in terms of the quality of their life and shortening of the life span. In high productive herds, particularly in tie-system, it is very difficult to avoid the occurrence of problems in reproduction. Situation about presence of certain reproductive disorders at the farms studied in this paper is somewhat better or similar than in other large capacity farms in Serbia, and common for high productive herds.

According to the failures observed, the following changes may contribute to the improvement of the reproductive efficiency and the welfare of cows: improving methods for detection of estrus and reproductive problems in aim to provide the timely insemination or treatment, upgrading of action plan and provision of sufficient number of skilled workers for monitoring and care of the animals, and planned work on the prevention of difficult calvings. In addition, improvement certainly can be achieved by planning and implementation of biosecurity measures and measures for cattle welfare protection, as well as by enhancement of the housing conditions in general.

REFERENCES


