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Original article

Effect of an integrated veterinary herd health program on fertility performance and incidence of reproductive disorders in five dairy herds

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Abstract

The study was carried out in 5 dairy herds of Polish Holstein-Friesian cows. The average milk yield was about 9000 kg per year. For each herd, the following fertility parameters were calculated at the start of the program and 4 years later: first- service conception rate, services per conception, length of inter-calving period and culling rate due to infertility. The incidence of silent heat, ovarian cysts, ovarian afunction, retained placenta and clinical endometritis was also recorded. Four years after implementation of the program, the average first-service conception rate increased from 43.2% to 51.2%. In three herds the differences were statistically significant ($p<0.05$). There was also a decrease in the number of services per pregnancy and in the culling rate due to infertility. Fertility performance was maintained in two herds. The average incidence of silent heat decreased from 38.1% to 29.7% and the difference was statistically significant ($p<0.05$) in three herds. There was no significant reduction in incidence of other reproductive disorders during the 4 years except for clinical endometritis in one herd. The average milk yield increased from 9300 kg to 9530 kg milk per cow per year. In conclusion, the results indicate that the implementation of the integrated veterinary herd health program improved or maintained fertility performance despite an increase in milk yield.

Key words: integrated herd health program, high yield, cows, fertility performance

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Introduction

In recent years, there have been significant changes in cattle breeding in Poland. The number of cows decreased, and at the same time the milk yield increased significantly (PFHBiPM 2020). Along with the increase in milk yield, a decrease in the fertility of cows in Poland (Morek-Kopec and Zarnecki 2009, Borkowska et al. 2012, Janus and Borkowska 2012) and other countries (Dobson et al. 2007, Lucy 2007, Walsh et al. 2011) was observed. The first-service conception rate has declined over the last 30 years from 60-70% to 30-40% concurrent with the rapid increase in yields (Royal et al. 2000, Butler 2003, Dobson et al. 2008, Norman et al. 2009). The classical role of the veterinarian, which consists of intervening at the owner's request to treat individual cows with health problems, is becoming insufficient in modern high-yielding dairy herds (Mee 2010). One of the methods of improving the profitability of dairy cattle breeding is the implementation of herd management programs, enabling the checking of the cows' health and their productivity (Noordhuizen and Wentink 2001, de Kruif and Opsomer 2004, Derks et al. 2013). An integrated veterinary health herd program adjusted to Polish conditions has been developed at the Department of Animal Reproduction with Clinic in Olsztyn. The program includes monitoring of herd records, regular herd visits to check reproduction, nutrition, milk production, udder health, lameness and calf management. Criteria for assessing herd health are defined and herd-specific goals, e.g. increasing the conception rate or decreasing the milk somatic cell count are set.

The aim of this study was to evaluate the effect of an integrated veterinary herd health program on fertility performance and incidence of reproductive disorders in 5 dairy herds.

Materials and Methods

The study was carried out in 5 dairy herds of Polish Holstein-Friesian cows in the years 2017-2020. The average number of cows in the herds ranged from 77 to 300. The cows were housed in loose-type barns with cubicles and fed a total mixed ration based on grass silage, maize silage, concentrate and vitamin and mineral supplements. The average milk yield was 9200 kg per year. All cows were inseminated artificially by an experienced AI-technician. The animals were inseminated at the first estrus occurring after 60 days post-partum (p.p.). The farm staff were instructed for accurate estrus detection**.** In cows diagnosed as subestrous the estrus synchronisation was performed.

In all herds, one of the goals of the program was to improve fertility. The other aims of the program were improvement of the health status of the mammary gland (decrease in clinical and subclinical mastitis cases), increase in milk production and decrease in the number of metabolic disorders by correction of the feed ration. The reasons and prevalence of lameness as well as the health problems of the calves during the entire rearing period were also analysed. The herds were visited at 3-week intervals. During every herd visit the following cows were examined gynecologically: 14-27 days p.p. for puerperal control, cows without estrus > 60 days p.p., for pregnancy diagnosis 30-42 days after AI and cows with reproductive disorders (abortion, dystocia, retained fetal membranes, vaginal discharge, anestrus, irregular estrus cycles, repeat breeding). The examination procedure included inspection of the vulva, tail and perineum, vaginoscopy, transrectal palpation, and ultrasonography of the uterus and ovaries using a Honda 1500 portable ultrasound scanner equipped with a 5 MHz linear-array transducer.

The incidence of reproductive disorders was recorded. For each herd, the following fertility parameters were calculated at the start of the program and after 4 years: first-service conception rate, services per conception, length of inter-calving period and culling rate due to infertility. First-service conception rate was defined as the percentage of animals pregnant after first insemination and services per conception as the number of inseminations per conception. The inter-calving period is the interval from parturition to parturition. The culling rate because of infertility was defined as the percentage of cows removed from the herd due to infertility.

The statistical analysis of data was performed by Chi-square test using GraphPad Prism version 9.00 (GraphPad Software, San Diego, CA, USA). The levels of significance was considered as $p<0.05$.

Results

Fertility performance is presented in Table 1.

At the start of the program the first conception rate in the most herds was 40.0% with the exception of herd A, where it was 48.6%. After 4 years of program implementation the average first conception rate increased from 43.2% to 51.2% ($p<0.05$). In herds B, C and D the differences were statistically significant ($p<0.05$). At the start of the program the average number of services per conception was 2.2 (range from 2.0 to 2.4), after 4 years it was 2.0 (1.9 to 2.1). The differences among herds were not statistically significant ($p>0.05$). The average inter-calving interval was 405,3 days

Table 1. Fertility performance in five dairy herds at the start of the program (2017) and after four years (2020).

Variables	Year	Herd					
		A n=140; 2020 n=190	B n=260	C n=300	D n=115	E n=77	Total
First-service conception rate (n, %)	2017	68 48.6	108 41.5[a]	129 43.0[a]	48 41.7[a]	32 41.6	385 43.2[a]
	2020	93 48.9	128 49.2[b]	156 52.0[b]	64 55.7[b]	41 53.3	482 51.2[b]
Inter-calving interval (days, mean ±SD)	2017	396.9±48.8	399.4±46.7	419.2±60.5	398.8±55.4	412.3±70.2	405.3±56.3
	2020	411.8±53.1	403.1±47.3	416.1±55.3	406.4±59. 3	410.4±58.3	409.6±54.7
Services per conception	2017	2.0	2.3	2.4	2.3	2.0	2.2
	2020	2.0	2.0	2.1	1.9	1.9	2.0
Culling rate (n, %)	2017	21 15.0	35 13.5	6 15.3	13 11.3	7 9.1	122 13.7
	2020	26 13.7	30 11.5	38 12.7	10 8.7	5 6.5	109 11.6

Values with different letters differ significantly at $p<0.05$

Table 2. Milk yield and incidence of reproductive disorders in five dairy herds at the start of the program (2017) and after four years (2020).

Variables	Year	Herd					
		A n=140; 2020 n=190	B n=260	C n=300	D n=115	E n=77	Total
Milk yield (kg per cow per year)	2017	9 800	8 900	9 000	9 200	9 100	9 200
	2020	9 850	9 400	9 300	9 500	9 600	9530
Silent heat (n, %)	2017	55 39,3	60 23.7[a]	145 48.3[a]	55 47.8[a]	25 32.5	340 38.1[a]
	2020	60 31.6	41 15.8[b]	120 40.0[b]	39 33.9[b]	20 26.0	280 29.7[b]
Ovarian cysts (n, %)	2017	15 10.7	19 7.3	40 13.3	15 13.0	10 13.0	99 11.1
	2020	16 8.4	18 6.9	36 12.0	14 12.2	8 10.4	92 9.8
Ovarian afunction (n, %)	2017	5 3.6	7 2.8	15 5.0	4 3.5	3 3.9	34 3.8
	2020	5 2.6	5 1.9	14 4.6	3 2.6	1 1.3	28 3.0
Retained placenta	2017	6 4.3	12 4.6	21 7.0	8 6.9	2 2.6	49 5.5
	2020	10 5.3	11 4.2	19 6.3	8 6.9	2 2.6	50 5.3
Clinical endometritis	2017	21 15.0	13 5.0	57 19.0	22 19.1[a]	10 13.0	123 13.8
	2020	23 12.1	12 4.6	51 17.0	10 8.7[b]	9 11.7	105 11.2

Values with different letters differ significantly at $p<0.05$

(range from 396.9 days to 419.2 days) at the start of the program, 4 years later 409.6 days (403.1 days to 416.1 days). The differences among herds were not statistically significant ($p>0.05$). The average culling rate for infertility was 13.7% (range from 9.1% to 15.3%) at the start of the program, and at the end

of the study the average percentage of cows culled due to infertility was 11.6% (6.5% to 13.7%.) The differences among herds were not statistically significant ($p>0.05$).

The milk yield and the incidence of reproductive disorders in the herds are presented in Table 2.

The average milk yield reached 9200 kg milk per cow per year (range from 8900 to 9800 kg) at the start of the program and increased during 4 years to 9530 kg (9300 to 9850 kg). At the beginning the average incidence of silent heat was 38.1% (range from 23.7% to 48.3%), 4 years later decreased to 29.7% (15.8% to 40.0%) ($p<0.05$). In herds B, C and D the differences were statistically significant ($p<0.05$). Ovarian cysts occurred in average in 11.1% of cows (range from 7.3% to 13.3%) at the start of the program. After 4 years the average incidence of ovarian cysts was 9.8% (6.9% to 12.2%). Ovarian afunction was diagnosed on average in 3.8 % of cows (range from 2.8 to 5.0%) at the start of the program and in 3.0% (1.3% to 4.6%) of cows after 4 years. The difference was not statistically significant ($p>0.05$). The average incidence of retained placenta was 5.5% (range from 2.6% to 6.9%) at the start of the program and 5.3% (2.6% to 6.0%) at the end of the study. The difference was not statistically significant ($p>0.05$). Clinical endometritis was diagnosed on average in 13.8% of cows (range from 5.0% to 19.1%) at the start of the program and in 11.2% of cows (4.6% to 17.0%) after 4 years and a significant difference was observed only in herd D ($p<0.05$).

Discussion

The results of the study showed that the implementation of this health program contributed to fertility improvements. The conception rate increased significantly in 3 out of 5 participating herds. There was also a reduction in the number of services per pregnancy and in the culling rate due to infertility. In 3 herds the incidence of silent heat decreased statistically significantly ($p<0.05$). This was the result of improved heat detection, the use of hormonal heat induction, and improved cow nutrition. The farm staff were instructed for more accurate estrus detection. In cows diagnosed as subestrous estrus synchronisation was performed. Dependent on the presence of corpus luteum, cows were treated with prostaglandin $F_2\alpha$ or with Ovsynch and its modification protocols. Feeding rations were checked and improved as far as possible. Good cooperation with the farmers should be indicated here.

Detection of estrus is one of the most important factors impacting the reproductive performance in dairy cows. In high yielding cows the expression of oestrus is poor and the incidence of silent heat is high (Lopez et al. 2004, Zduńczyk et al. 2005, Dobson et al. 2008). High producing dairy cows have lower oestradiol level compared to lower producing dairy cows (Lopez et al. 2004). High milk producing dairy cows experience a substantial increase in energy requirements post-partum. Feed intake is limited and this requirement is being met by mobilisation of body fat. As a result, cows enter a state of negative energy balance (NEB) and lose body condition. Inadequate nutrition during the post-partum period can lead to more severe NEB (Butler 2003). The consequences of severe NEB are an increased risk of metabolic diseases and a reduction in follicular growth and estrus expression (Roche 2003). Thus, checking and correction of nutrition are very crucial components of the herd health program.

On the other hand, elevated feed intake in high yielding cows increases liver blood flow and the metabolism of oestradiol (Sangsritavong et al. 2002, Wiltbank et al. 2006).

The incidence of silent heat and ovarian cysts was higher than reported previously for dairy herds with a lower milk yield (Barański et al. 2008).

There was no significant reduction in the incidence of ovarian cysts, ovarian afunction, retained placenta or clinical endometritis during the 4 years except for clinical endometritis in herd D. However, the early identification and therapy of these reproductive disorders contributes to improving fertility.

The implementation of a herd health program helps to improve reproductive outcomes (de Kruif and Opsomer 2004, de Kruif et al. 2008, Mee 2010).

Despite the increase in first-service conception rate the length of the inter-calving interval was not shortened, and even slightly extended. However, this was caused by its extension by the farmers due to the high yield of cows. This is a common practice in high yielding dairy herds (Dymnicki et al. 2003, Bogucki et al. 2007, Janus and Borkowska 2012). According to the Polish Federation of Cattle Breeders and Dairy Farmers, in 2019 the average length of inter-calving period was 433 days (PFHBiPM 2020).

In herd A the fertility performance was good at the start of the program and was maintained despite the increase in the number of cows and the productivity. In herd E the first-service conception rate increased from 41.6% to 53.2%, but the difference was not statistically significant due to the relatively low number of cows in this herd.

In conclusion, the results indicate that the implementation of the integrated veterinary herd health program led to an improvement in fertility performance or its maintenance, depending on the circumstances in the herd, despite an increase in milk yield.

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