UDC 636.082.455:591.526:618.179:502.175 https://doi.org/10.15407/animbiol21.02.042

SURVEY ON THE COURSE OF PUERPERIUM AND ON FERTILITY AFTER IMPLEMENTATION OF THE *IVET*® BIRTH MONITORING SYSTEM IN HEIFERS

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The aim of this study was to investigate the influence of the birth monitoring system iVET® on the puerperium, milk yield and fertility of the dam in the subsequent lactation.

On a large dairy farm in Saxony-Anhalt, the visual birth monitoring of the heifers was complemented by the automated iVET® birth monitoring system. The iVET® consists of two components: a transmitter, which is inserted into the vagina of the animals to be monitored and a receiver which must be installed above the calving pen. During the birth process, the transmitter is forced out of the vagina and sends a signal to the receiver which then triggers an SMS or phone call to the person in charge. In the control group (n=192), birth monitoring was performed by farm personnel in the same way as before the start of the study. In the iVET® group (n=167), a distinction was made between the animals in which the transmitter remained longer (24h+group, n=88) or shorter than 24 hours (24h-group, n=79). The experimental phase started with the recording of the calving process and ended at day 200 p.p. To assess the heifer's fertility, the onset of ovarian activity was determined by ultrasound examination of the ovaries. The following fertility measures were calculated: first service conception rate (FCR), overall pregnancy rate (PR), mean pregnancy index (PI), conception rate (CR), mean interval from calving to first insemination (CFI), mean days open (DO), mean interval from first insemination to conception (FIC), mean calving interval (CI).

In the iVET® group, significantly fewer animals calved without assistance and there were significantly more calvings with extreme difficulty especially in the 24h+group. The iVET® group had a significantly higher number of injuries, the injuries were more severe, the healing progressed more slowly and these animals developed an endometritis significantly more frequently than the control group. In the control group, significantly more animals had active ovaries when they were first examined on Day 10 p.p. than in the iVET® group. The iVET® group had a signifianty longer CFI, but a significantly shorter FIC than the control group. Concerning the other fertility measures, there were no significant differences. In the 24h+group, the milk yield of the first 100 days p.p. was significantly lower than in the 24h-group, but there was no significant difference between the 100-d-yield of the iVET® group and the control group. The number of animals which had to be culled before Day 200 p.p. was significantly higher in the iVET® group than in the control group.

Birth monitoring by means of the iVET® system impaired the course of labour and in consequence the puerperium. The evaluation of calving ease and the examinations during puerperium showed that a retention time of transmitters in heifers of more than 24 hours cannot be recommended. This limitation makes the use of the birth monitoring system problematic; under real-life conditions it is hardly possible to predict the beginning of birth with sufficient accuracy with an acceptable amount of effort.

Keywords: CATTLE, HEIFERS, BIRTH, MONITORING, PUERPERIUM, FERTILITY, MILK YIELD

The objective of successful management of the cow at calving time is to ensure delivery of a viable calf and smooth transition of the cow from the dry to the milking string without complications. The two major problems encountered at calving time are dystocia and perinatal mortality [6]. The adverse effects of poor calving management are numerous and well documented. Dams with dys-

tocia often show retained fetal membranes and metritis and in consequence poor fertility measures and impaired milk yield in the following lactation [1–4]. A close calving monitoring, particulary in heifers, therefore is an integral part of successful calving management. The objective of this study was to investigate the influence of the birth monitoring system *iVET*® on the puerperium as well as on the milk yield and on the fertility of the dam in the subsequent lactation.

Materials and methods

The study was conducted from July 2013 to July 2014 on a large dairy farm in Saxony-Anhalt in Germany (877 lactating and 123 dry German Holstein cows, 941 replacement heifers and 227 calves <6month of age).The visual birth monitoring of the heifers was complemented by the automated *iVET*® birth monitoring system. The *iVET*® birth monitoring system consists of two components: of a transmitter (fig. 1), which is inserted into the vagina of the animals to be monitored and of a receiver (fig. 2) that must be installed above the calving pen.

During the birth process, the transmitter is forced out of the vagina and sends a signal to the receiver which then triggers an SMS or phone call to the person in charge. Pregnant heifers were examined clinically 3 to 2 weeks before the calculated calving date, and only clinically healthy heifers were used. Those heifers were housed in a free stall barn with straw bedding and fed a total mixed ration. The median age of the heifers at calving during the study period was 782 d. A total of 359 heifers were allocated randomly to two groups. 192 heifers were assigned to the control group in which birth monitoring was performed by farm personnel in the same way as before the start of the study. 167 heifers were assigned to the *iVET*® group (study group) in which the *iVET*® system was used. In the *iVET*® group a distinction was made after calving between the animals in which the transmitter remained longer or shorter than 24 h. The experimental phase started with the recording of the calving process and ended at day 200 p.p. Labor was assessed in terms of calving ease. Animals were clinically examined 4 times *post-partum* (day 1, day 10, day 21, day 42).

Fig. 1. Transmitter of the *iVET*® birth monitoring system

Fig. 2. Receiver unit of the *iVET*® birth monitoring system

Injuries of the vulva and the vagina due to calving and the healing process were scored. To assess the heifer's fertility, the onset of ovarian activity was determined by ultrasound examination of the ovaries. The following fertility measures were calculated: first service conception rate (FCR), overall pregnancy rate (PR), mean pregnancy index (PI), conception rate (CR), mean interval from calving to first insemination (CFI), mean days open (DO), mean interval from first insemination to conception (FIC), mean calving interval (CI). Additionally, body condition score (BCS), occurrence of peripartal diseases, culling data and the 100d-milk-yield we reevaluated.

Results and discussion

The interval from insertion of the *iVET*®-transmitterto first birth alarm averaged 74.6±89.2 h. In the *iVET*® group, significantly fewer animals

calved without assistance (P≤0.05). Also, there were significantly more calvings with extreme difficulty (table 1).

The heifers of the *iVET*® group suffered from a higher number of injuries, the injuries were more severe (table 2), and the healing progressed more slowly. Furthermore, these animals developed an endometritis significantly more frequently (47.4 % vs. 33.1 %, P≤0.05), and it lasted significantly more often until the end of puerperium on day 42 p.p. (31.5 % vs. 19.6 %, P≤0.05). The experimental arrangement did not reveal any influence on the frequency of retained placenta, on the occurrence of metritis, and on the trend of BCS. Within the *iVET*® group, animals in which the transmitter remained longer than 24 h significantly more often had extreme calving difficulties, and they significantly less often calved without as-

Table 1

Calving ease in study groups (n = number of animals)

% (n)	control	*iVET*®	<24 h°	≥24 h
Score 1*	44.8a (86)	27.0b (45)	44.3c (35)	11.4d (10)
Score 2	12.0 (23)	17.4 (29)	22.8 (18)	12.5 (11)
Score 3	15.6 (30)	17.4 (29)	15.2 (12)	19.3 (17)
Score 4	23.4 (45)	28.1 (47)	16.5c (13)	38.6d (34)
Score 5	4.2a (8)	10.2b (17)	1.3c (1)	18.2d (16)
Total	100 (192)	100 (167)	100 (79)	100 (88)

Note: within a row: a vs. b; c vs. d — P≤0.05. º <24 h — *iVET*® remained shorter than 24 h; ≥24 h — *iVET*® remained 24 h or longer. *Score 1 — spontaneous calving, no assistance needed; Score 2 — very easy extraction, 1 person, max. 1 min; Score 3 — easy extraction: 1–2 persons, extraction force without effort, quickly (within 5 min); Score 4 — moderately severe extraction: 2 persons, moderate extraction force, duration 5–15 min, stretching of soft birth canal necessary; Score 5 — severe extraction: 2 persons, maximal extraction force, duration 15–25 min, stretching of soft birth canal necessary, only very slow progress (<1 cm per expulsive strain).

Table 2

Injuries of the *vestibulum vaginae* and the vagina 1 p.p. (n = number of animals)

% (n)		Control	*iVET*®	<24 hº	≥24 h
Injuries of the *vestibulum vaginae*#	degree 1	34.6a (66)	19.8b (32)	22.8 (18)	16.9 (14)
	degree 2	59.2 (113)	69.1 (112)	74.7 (59)	63.9 (53)
	degree 3	6.3 (12)	11.1 (18)	2.5c (2)	19.3d (16)
Injuries of the vagina*	no injury	54.7a (41)	37.7b (61)	55.7c (44)	20.5d (17)
	degree 1	28.0a (21)	16.7b (27)	16.5 (13)	16.9 (14)
	degree 2	17.3a (13)	45.7b (74)	27.9c (22)	62.7d (52)

Note: within a row: a vs. b; c vs. d — P≤0.05. # Injuries of the *vestibulum vaginae*: degree 1 — noor mild injuries; degree 2 — marked injuries <2 cm deep; degree 3 — severe injuries ≥2 cm deep. * Injuries of the vagina: degree 1 — lesion <2 cm deep and up to 10 cm long; degree 2 — lesion ≥2 cm deep and/or ≥10 cm long. º <24 h — *iVET*® remained shorter than 24 h; ≥24 h — *iVET*® remained 24 h or longer.

Table 3

Fertility measures (n = number of animals)

		Control	*iVET*®	<24 hº	≥24 h
CFI	d, mean ± standard deviation (n)	87.7a±21.1 (138)	100.7b±25.4 (108)	98.1±23.9 (64)	104.5±27.4 (44)
DO		112.9±38.5 (94)	111.9±35.8 (70)	108.2±35.6 (42)	117.5±35.9 (28)
FIC		27.2a±33.1 (94)	16.8b±25.5 (70)	14.9±23.7 (42)	19.7±28.2 (28)
CI		392.9±38.5 (94)	391.9±35.8 (70)	388.2±35.6 (42)	397.5±35.9 (28)
PI		1.8±0.9 (94)	1.5±0.7 (70)	1.5±0.8 (42)	1.5±0.6 (28)
PR	% (n)	68.1 (94)	64.8 (70)	65.6 (42)	63.6 (28)
FCR		31.9 (44)	38.0 (41)	40.6 (26)	34.1 (15)
CR		31.3 (94)	35.4 (70)	35.3 (42)	35.4 (28)

Note: within a row: a vs. b — P<0.05. º <24 h — *iVET*® remained shorter than 24 h; ≥24 h — *iVET*® remained 24 h or longer. FCR — first service conception rate; PR — overall pregnancy rate; PI — mean pregnancy index; CR — conception rate; CFI — mean interval from calving to first insemination; DO — mean days open; FIC — mean interval from first insemination to conception; CI — mean calving interval.

sistance than the animals in which the transmitter remained for less than 24 h (table 1).

Additionally, they showed a poorer performance in some examinations during the puerperium. In the control group, significantly more animals had active ovaries when they were examined on day 10 p.p. (81.9 % vs. 63.7 %, P≤0.05) and on day 42 p.p. (97.9 % vs. 91.2 %, P≤0.05). The fertility measures are presented in table 3. Animals of the *iVET*® group took a longer time to first insemination than animals of the control group, but became pregnant more quickly (P≤0.05). Thus, DO and the expected calving interval were almost equal in both groups. Concerning the other measures of fertility, there were no significant differences. Comparisons of some fertility analyses showed that the animals of the *iVET*® group with a longer retention time of the transmitter did not perform as well as those with a shorter retention time.

However, these differences were not significant. In the group of heifers with the longer retention time, the milk yield of the first 100 days p.p. was significantly lower than in the group with the shorter retention time (2910.4±454.2 kg vs. 2723.8±483.6 kg, P≤0.05). The yield of the control group (2770.9±526.4 kg) was between the yields of the other two groups. In the *iVET*® group significantly more heifers were culled than in the control group (22.2 % vs. 10.9 %, P≤0.05). The number of animals that had to be culled was three times higher in the group with the longer retention time than in the group with the shorter retention time (33.0 % vs. 10.1 %, P≤0.05). In contrast to [5], who tested the birth monitoring device C6, the *iVET*® system was not well tolerated by all heifers and caused irritation and discomfort to the heifer which may lead to neuro-hormonal alterations of the birth process. This could be one reason for the high percentage of dystocia and injuries. An obvious problem was that the *iVET*® seemed too large for heifers. As a result of the current investigation, the *iVET*® birth monitoring system has already been modified and a smaller version for heifers or smaller cows has been developed.

Conclusions

Birth monitoring by means of the *iVET*® system did not improve the course of the puerperium or the fertility of the heifers. The evaluation of calving ease and the examinations during puerperium showed that a retention time of transmitters in heifers of more than 24 hours cannot be recommended. This limitation makes the use of the birth monitoring system problematic; under real-life conditions it is hardly possible to predict the beginning of birth with sufficient accuracy with an acceptable amount of effort. Therefore, this device was lacking in several aspects and should be improved and evaluated further before its use in primiparous cattle can be recommended. Further controlled experiments were needed to eliminate major drawbacks.

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