

THE INFLUENCE OF THE VULVAR-VAGINAL TRACT DISEASES ON BOVINE REPRODUCTIVE ACTIVITY

INFLUENȚA AFECȚIUNILOR TRACTULUI COPULATOR ASUPRA ACTIVITĂȚII DE REPRODUCȚIE LA BOVINE

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ABSTRACT | REZUMAT

Over the decades, most of the research in the field of dairy cow breeding has focused mainly on the impact of uterine and ovarian diseases on infecundity status within this species. As a result, the present paper aims to highlight the negative influence of vulvar, vestibular, and vaginal injuries on the reproductive performance of the cattle harnessed for postpartum milk production. In this research, carried out between 2014 and 2017, 1772 cows of Romanian Black Spotted, Holstein, and Montbéliard breeds, belonging to three commercial farms from the southern part of Romania were included. Females were supervised during the calving and postpartum period until the new pregnancy was declared. Our results show that out of the 1772 monitored parturitions, 141 (7.95%) involved injuries in at least one segment of the reproductive tract. Moreover, the longest service period was obtained in the Romanian Black Spotted cows, which required 123.71 days to regain pregnancy after parturition.

Keywords: vulvar-vaginal tract, conception rate, service-period, bovines, assisted calving

De-a lungul deceniilor, majoritatea cercetărilor în domeniul reproducției vacilor de lapte s-a axat în principal pe impactul afecțiunilor uterine și ovariene asupra stării de infecunditate la această specie. Ca urmare a acestui fapt, studiul de față își propune să scoată în evidență influența negativă a injuriilor localizate la nivel vulvar, vestibular și vaginal asupra activității de reproducție la vacile axate pentru producția de lapte după perioada post-partum. În cadrul acestui studiu, realizat în perioada 2014-2017, au fost incluse 1772 de vaci din rasele Bălțată cu Negru Românească, Holstein Friză și Montbéliard, din trei ferme comerciale din zona de sud a României. Femelele au fost monitorizate predominant în timpul parturirii și post-partum, până la momentul în care au fost declarate gestante. Dintre concluziile cercetării, se poate desprinde faptul că din cele 1772 de parturiri monitorizate, 141 (7.95%) s-au soldat cu injurii a cel puțin unei porțiuni din segmentul tractului copulator. De asemenea, cel mai lung service period a fost înregistrat în cadrul rasei Bălțată cu Negru Românească, unde a fost nevoie de 123,71 de zile pentru ca femelele să rămână gestante după parturire.

Cuvinte cheie: segment vulvo-vestibulo-vaginal, rată de concepție, service-period, bovine, asistență la fătare

Regardless of the productive traits of the cows, for both dairy and beef cattle, the breeding activity is essential in order to fulfil the goal of obtaining 1 calf/cow/year (5). To reach this achievement, females require well-balanced nutrition this way avoiding a negative energy balance after parturition. Moreover, to obtain the stated objective, the reproductive tract needs to recover properly during the puerperium.

Regarding the restoration of the genital tract after the injuries suffered during birth, it should be high-

lighted that the uterus is not the only segment benefiting from a period of involution. The posterior segments of the female genital tract require the same type of processes to take place. Frequently, the vulva, vestibule and vagina suffer during parturition, resulting in injuries that can lead to the extension of the voluntary waiting period. Regarding the acquired pathologies of the vestibule and vagina, granular, purulent, and necrotic vestibular-vaginitis (3, 14, 19, 22), with acute or chronic evolution can be outlined (23).

Rizk and Mosbah (2016) described the rectovaginal fistula as part of the vulvar-vaginal (VV) tract pathologies. Major causes stated were dystocia by foot nape position, perineal and peri-vaginal abscesses, and certain congenital anomalies. Given the mutual role of the

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lower reproductive tract segments in cows, it is considered that they can be independently or collectively involved. In most cases, due to the existing injuries, different bacterial species can attend during parturition, such as *Escherichia coli*, *Staphylococcus* spp., *Streptococcus* spp., *Proteus* spp., *Klebsiella* spp. (23), *Ureaplasma diversum* (10, 19), *Mycoplasma bovis*, *Mycoplasma canadense* (17), *Prevotella* spp., *Porphyromonas levii* (3, 4, 7, 12, 22). Viral species such as Pseudocowpox virus (2), Bovine Herpesvirus-1 (8), Bovine Herpesvirus-4 (6) and fungal species: *Aspergillus* spp., *Mucor* spp., *Penicillium* spp. (1) can also exploit the conditions created within the calving.

Although the dominant pathologies of the female genital tract in dairy cows are metritis and endometritis, often detectable by purulent vaginal discharge, there is a lack of information regarding the correlation between VV lacerations and uterine disorders, in the context of impaired reproductive parameters. Thus, it is easy to understand that labour dystocia can be related to these types of lesions, which subsequently affect feed intake and can exacerbate the negative energy balance during the postpartum period (20). At the same time, Mammi et al. (2021) reported that dystocia affects rumination and can alter the inflammatory profile of the cows. The weakened physical barriers of the genitalia, along with the induced immunosuppression, will constitute the background for the pathogenic germs' proliferation (24).

The main purpose of this paper focuses on underlining the negative impact of VV tract diseases in cattle on the resumption of reproductive activity after the postpartum period. Simultaneously, various causes leading to dystocia and issues related to calving assistance were followed.

MATERIALS AND METHODS

Animals, housing, and nutrition

The study was conducted over a period of four years, on 1772 multiparous bovines (155 Romanian Black Spotted, 1184 Holstein-Friesian, and 433 Montbéliarde), from three farms located in South-Eastern Romania. The breeding conditions, feeding, microclimate, and animal welfare from each farm will be described below.

Within the first farm, Romanian Black Spotted cows are reared in traditional barns that have windows, low ceilings, but no natural or artificial ventilation. The animals benefit from poor nutrition and manure management. Milking is achieved using automated machines and the achieved product is stored in stainless steel canisters. The cows are moved in the maternity one week before parturition, the diet being suited to the close-up period.

Within the second farm, Montbéliarde cows, a mi-

xed milk-meat breed, are reared in a free-stall housing system, in barns with natural ventilation through doors and windows. The animals are fed using the feed mixer wagon and the manure is evacuated automatically. Two weeks before calving, the cows are moved to the paddock that is specially designed for this category.

The third farm is the most modern one by far. Here, the Holstein cows are reared free in paddocks. The barns have both natural and artificial ventilation, the manure is removed automatically, and the animals are fed using the feed mixer wagon.

Working protocol

All the females, whether the parturition was assisted or not, were clinically evaluated by the same staff every 12 hours for five days in milk (DIM). Besides the general state of the doe and the offspring, the mammary gland, the external genital apparatus (through transrectal palpation), and the VV tract (through inspection, palpation, and examination with a vaginal speculum) were carefully examined.

The following indicators were taken into consideration for the study of VV tract pathology: i) calvings per year, ii) females with oedema and infiltration of the VV tract, iii) females with lesions (superficial or profound lacerations), iv) females with necrotic vaginitis, v) females with recto-vaginal fistula, vi) females with one or more pathologies of VV tract, vii) females with granulomatous vestibular vaginitis.

The following contributory factors that can influence the VV tract pathology were taken into consideration: i) calving assistance, ii) nulliparous or multiparous parturition, iii) offspring gender.

Once all the injuries of the reproductive tract were identified and treated in the puerperal period, the females start to get ready for future reproductive activity. After 55 DIM, the breeding protocol consists of transrectal ultrasound evaluation and application of different hormonal treatments for heat induction. After this, the cows were artificial inseminated (AI), the gestation diagnosis was achieved by ultrasound examination at least 30 days after AI.

The length of the service period and the conception rate were followed in order to evaluate the breeding activity of each female correlated with the identified pathology. The females that have other upper genital tract pathologies were excluded from this study.

The study was carried out in accordance with the current legislation of the European Union (Directive 2010/63/EU of the European Parliament and Council of 22nd of September 2010 on animal protection used for scientific purposes as Furnaris et al., (2016) already described. Animals were familiarized gradually with the staff involved and there were not brutally handled in order to prevent stress.



Fig. 1. Clinical aspects of cows' vulvar-vaginal tract pathologies. **A** - Profound linear lesion that starts from the superior vulvar commissure to the superior part of the vestibulum; **B** - Multiple superficial lesions from the vestibular mucosa; **C** - Profound reactivated lesion followed the removal of a vicious scar from the right vulvar labia; **D** - Granular vulvar-vestibulitis with inflammation of the mucosa's lymphoid follicles. **E** - Edema and infiltration of the vulva; **F** - Dehiscence chronic lesion that causes the incomplete restrained of the vulvar labia and narrowing of the vulvar opening; **G** - Necrotic vestibule-vaginitis identified through vaginoscopy

All the data obtained from this study were analysed and interpreted using Office Excel 2016, where values such as mean average, correlation, and Student test were calculated for the breeding parameters previously listed.

RESULTS AND DISCUSSIONS

It is well known that parturition in any animal species is not always eutocic. However, there are situations in which even eutocic calvings involved injuries within the VV tract (Fig. 1), which subsequently affects the resumption of reproductive activity in this species. In the present study, different pathologies of the vulvar-vaginal tract that could interfere with the reproductive activity in cows were pursued.

During the four years included in the study, the results from the farm I indicated 38.75 calvings and 8.25% VV tract pathologies per year. Within the identified pathologies in this farm (Fig. 2), granular vulvar-vestibulitis (24.34%) represented the most common one, followed by granulomatous vestibular vaginitis (with an annual average of 5.5%), oedema and VV infiltration (with an average of 5.25% per year); at the opposite pole being the rectovaginal fistula (with an average of 0.25% per year). Only one case of the

rectovaginal fistula was identified in farm I. The percentage of cows that were monitored during calving was 53.55%.

Farm II recorded 108.25 calvings per year and the annual average of pathologies of the VV segment was 11.75% (Fig. 3). Although in this farm there are Montbéliard cows, mixed milk-meat breed, with a more pronounced skeleton than those of the dairy breeds, no case of rectovaginal fistula has been identified. Due to the import of heifers in order to replace the reformed females, the annual average diagnosis of granular vulvar-vestibulitis was 25.

Two cases of necrotic vestibular-vaginitis were reported on farm I and three cases on farm II. Of the total pathologies related to the inferior vulvar-vaginal tract, only the oedema and the infiltration had a higher incidence in multiparous cows, the necrotic vaginitis appearing exclusively at primiparous, and the VV lacerations being evenly distributed (14 cases for each primiparous and multiparous). Assistance during parturition was provided in a proportion of 67.15%.

The calvings' mean value per year was 296 in farm III, and the annual average of VV segment pathologies is 15.25%, most of the diseases being granular vulvar-vestibulitis (55 cases), edema, vulvar-vaginal infiltration (37 cases), and lacerations of these compo-

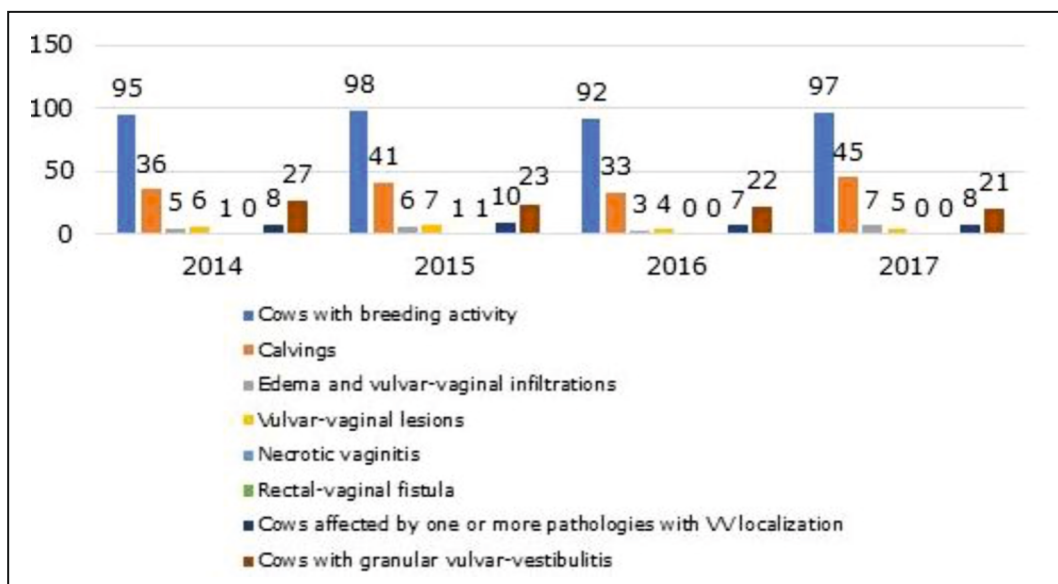


Fig. 2. Vulvar-vaginal segment lesions in relation to the number of calvings and the number of breeding cows in farm I

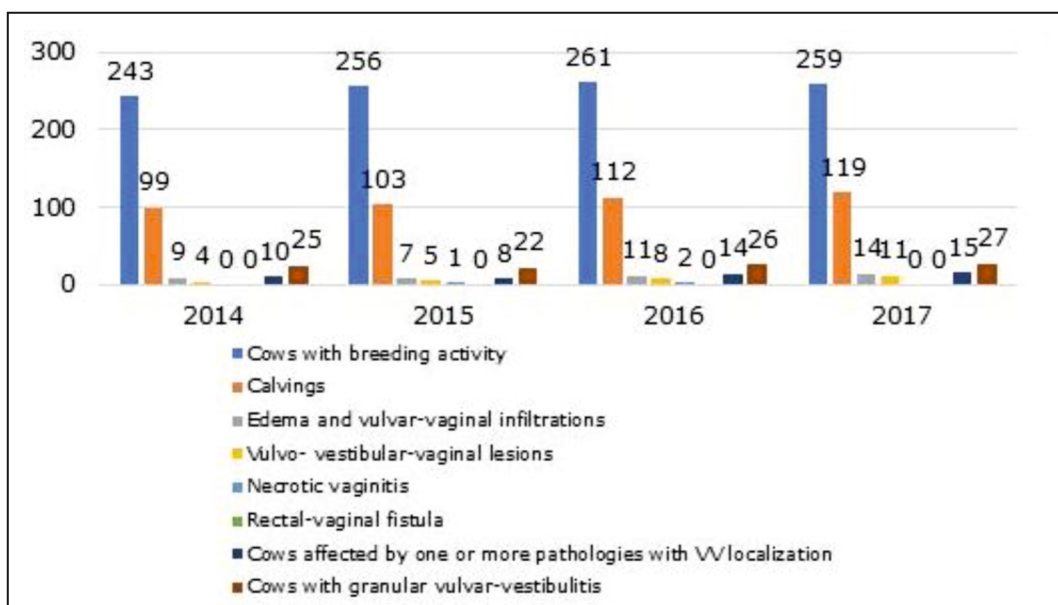


Fig. 3. Vulvar-vaginal segment lesions in relation to the number of calvings and the number of breeding cows in farm II

nents (27 cases). The only case of twin calving registered in this farm caused a rectovaginal fistula, the parturition not being assisted. Only 51.34% of the animals were assisted in calving within farm III.

As a consequence of the statistical analysis between the variable represented by the lesions of the VV segment and the variable represented by the calving assistance, a weak negative correlation resulted between the two (-0.27). Therefore, calving assistance is not relevant for the involvement of the vulvar-vaginal tract, but according to Giuliadori et. al (2013), it cannot be claimed the same statement regarding the

appearance of metritis and endometritis. Not surprisingly was the remark of Vieira-Neto et al. (2016) who found that there is a significant positive correlation between dystocia and vulvar-vaginal discharge. Moreover, the same study highlights an increase in the incidence of uterine diseases in cows with vulvar-vaginal discharge as a result of the imbalance of the host defence mechanism, disruption of physical barriers and decreasing of activation, recruitment and functioning of phagocytic cells.

Along the four years, 9 moderate extended necrotic vestibular-vaginitis were identified at 3 days postpar-

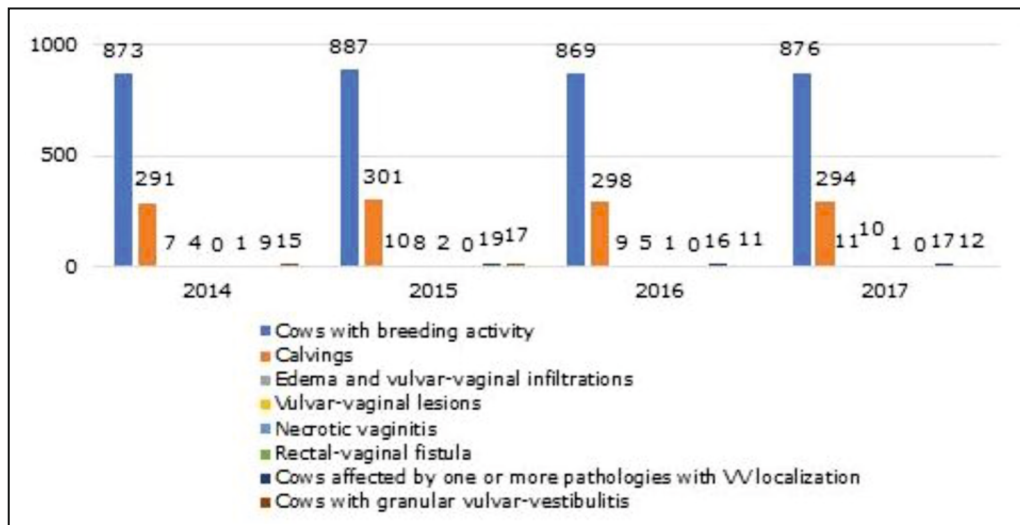


Fig. 4. Vulvar-vaginal segment lesions in relation to the number of calvings and the number of breeding cows in farm III

tum, within all farms, the incidence being at 0.5% of the total of 1772 supervised cases.

In a study by Goshen et al. (2012), where 908 Holstein breed animals were included, the incidence of reduced necrotic vestibular-vaginitis was 47% and the incidence of moderate necrotic vestibular-vaginitis was 22.2%. This significant difference between the results of the present study and those of the study accomplished by Goshen's team can be attributed to the monitoring of a single cows' breed and based on the farming system of Israeli farms.

If in our study the incidence of granular vestibular-vaginitis vasculitis was 14.55%, Nascimento-Rocha et al. (2017) obtained a prevalence of 61.6% without involving the bacterium *Ureaplasma diversum*.

Within farm I, more than half of the VV pathologies resulted from the birth of male foetuses, a fact which can be improved by choosing the semen from bulls with a good calvings' index.

The breeding parameters monitored for the farm I indicated that the onset of reproductive activity after calving in healthy females is earlier with 0.42 days (Table 1).

Table 1

Breeding parameters in cows within farm I

<i>Farm I</i>	<i>Service period length (days)</i>	<i>Conception rate</i>
Cows with VV injuries	123.71	20.49 %
Healthy cows	123.29	21.04 %

The conception rate is significantly higher in healthy cows, compared to those that have suffered from

pathologies of the VV tract (Table 1).

In the case of farm II, the sex of the offspring was unevenly distributed in the causality of the VV diseases, so that oedema and VV infiltration were provoked in a higher percentage by male foetuses and the other disorders by female foetuses.

The influence of VV pathology on reproductive function is highlighted in Table 2, where the service-period is longer with 1.51 days in affected cows than in healthy ones. The conception rate is much closer between the two categories (30.15% in the affected group, respectively 30.22% in the healthy one), but this is a percentage that does not satisfy the international requirements for the Montbéliard breed (15).

In farm III, the pathologies of the VV segment were caused in the same proportion by both sexes.

Table 2

Breeding parameters in cows within farm II

<i>Farm II</i>	<i>Service period length (days)</i>	<i>Conception rate</i>
Cows with VV disorders	111.55	30.15 %
Healthy cows	110.04	30.22 %

In Table 3, there are indicated the reproductive aspects concerning the females from farm III. Therefore, healthy females have a longer service-period (0.26 days) than those with VV disorders, and the conception rate was 0.86% lower (Table 3).

In 2019, Kiser et al. suggest a conception rate of at least 35% in the Holstein breed. This is contrary to the results obtained in the farm III.

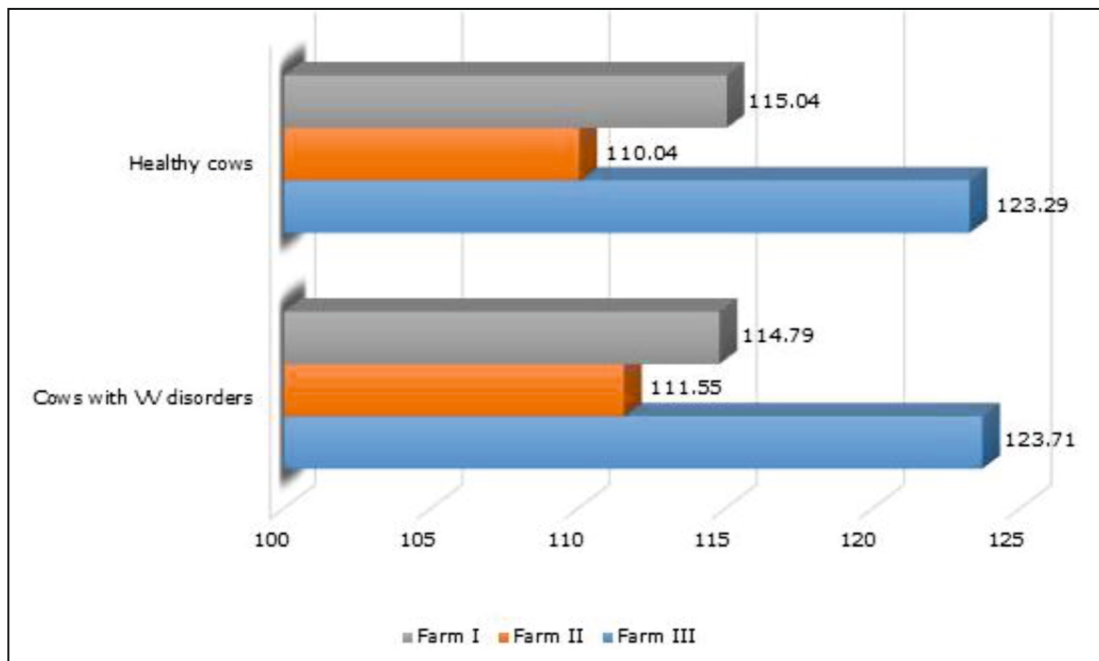


Fig. 5. Service-period length (days) in three farms, between 2014 and 2017

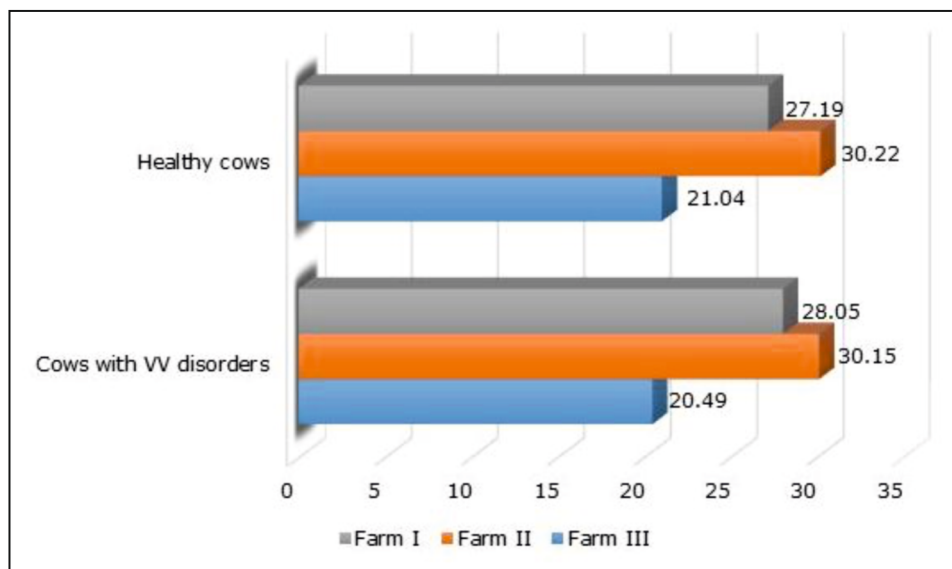


Fig. 6. Conception rate (%) in the 3 farms during the four-year study

Table 3
Breeding parameters in cows within farm III

<i>Farm III</i>	<i>Service period length (days)</i>	<i>Conception rate</i>
Cows with VV disorders	114.79	28.05 %
Healthy cows	115.04	27.19 %

Out of the 1772 calvings that had been monitored, 141 resulted in one or more pathologies associated with the VV segment (7.95%).

In Fig. 5 can be seen that the longest service-period was recorded in farm III, even though the breeding management is superior in this farm compared to the other two. This could be a consequence of the higher milk yield in the last farm.

From Fig. 6, we can state that the highest conception rate percentage is recorded in the group of healthy Montbéliard cows, that being the minimum agreed percentage for the Holstein breed (15).

Regarding the pathology of the lower reproductive tract found in cows from all 3 farms, there are significant differences in terms of statistics between single and multiple diseases in the VV duct ($p \leq 0.05$) (Table 4).

Table 4
Highlighting the Student test value
between the single and multiple conditions
of each farm over the 4 years

Farm	Student test value
I	0.0001
II	0.0082
III	0.0079

Over the decades, pathologies associated with the VV tract have been neglected in terms of their impact on the reproductive activity, the greatest attention being focused on the ovarian and uterine disorders. Due to the tracking of a large number of fresh cows, it turned out that these pathologies, regardless of their severity, do not significantly interfere with the breeding activity. This may be largely attributed to the fact that some of the pathologies identified do not blatantly disturb the immunological status of females, and to a lesser extent, to the restoration of the ailments during the voluntary waiting period. Nonetheless, those animals which at the first visit, showed unhealed necrotic vestibular-vaginitis were inseminated with a gun protected by a single-use plastic sheath to reduce the risk of contamination.

CONCLUSIONS

Out of 1772 cows included in the study, only 7.97% suffered from one or more pathologies of the VV tract, the highest incidence being identified at farm III (21.29%). In terms of breeding parameters, the longest service-period was recorded in the affected cows belonging to farm I (123.71 days), and the highest rate of conception was in farm II (30.15%).

Diseases of the VV tract were not a decisive factor in the resumption of breeding activity in cattle. However, the severity of disorders must be monitored in order to interfere neither with the interconnected immune defence mechanisms nor with the reproductive function.

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