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ENDOMETRITIS THERAPY IN SOWS BY INTRA UTERINE INSTILLATION OF YEAST CELL WALL SOLUTION

LAZAREVIĆ M*, MILOVANOVIĆ A**, BARNA T**, MILJAS N*** and MILANOV DUBRAVKA**

**University of Belgrade, Faculty of Veterinary Medicine, Serbia*
***Veterinary Scientific Institute, Novi Sad, Serbia*
****Veterinary Station "Srna", Trebinje, Republic of Srpska*

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On the basis of our investigations it was possible to conclude that intrauterine treatment of sows with puerperal uterine infections with sterile YCW (Yeast Cell Wall) resulted in significant clinical improvement. The percent of recidivism was the lowest (10%) in groups of sows treated with 10 and 20 g of YCW.

The degree of bacterial CFU (Colony Forming Units) reduction in samples of sows uterine flushings following instillation of YCW (5, 10 and 20 g) was wery high and ranged from 1361 to 1444 times, while in sows treated with Lotagen 2% solution (100 mL) this parametar was only 32.

At the moment of weaning, piglets from sows treated with 10 and 20 g of YCW were heavier when compared to the control and Lotagen group and their DBWG (Daily Body Weight Gain) was higher when compared to the Lotagen and control group.

Treatment of sows by IU instillation of YCW did not influence the number of piglets in the next breeding cycle.

Key words: agalctia, metritis, sows, yeast cell wall

INTRODUCTION

The postpartum dysgalactia syndrome (PPDS) represents one of the most important diseases in sows. Following partitution uterine infections in sows are very common on some farms and may cause serious economical losses. These infections are always followed by hypogalactia, thus influencing piglet's growth and health. Postpartum lactation problems in sow are now more adequately described as postpartum dysgalactia syndrome over the more traditionally used MMA syndrome (Mastitis-Metritis-Agalactia). These three symptoms are not always present in the case of early lactation problems (Klopfenstien *et al*., 2006). Lactation failure in the postpartum sow, but still is recognized as a serious health problem in all counties with intensive swine production. Backstom *et al*. (1984) reported that prevalence of PPDS was 13% in pluriparous and 4.2% in primiparous sows. In affected sows the number of piglets surviving at 1 week of age was significantly smaller and total piglet mortality up to weaning was higher. Noblet *et al*. (1997) reviewed the importance of sufficient colostrum and milk intake needed for the maintenance of homeothermic balance. As piglets are born with very limited energy reserves they must consume adequate amounts of colostrum and milk shortly after birth. PPDS is a primary cause of neonatal problems (eg, diarrhea, crushing, runting, inanition, poor growth) and affects usually 15-20% of the sows (Merck, 2011).

Puerperal hypogalactia may also be of endocrine and nutritional origin and it was postulated that blood glucose level plays an important role (Šamanc *et al*., 1989). In this study authors were able to demonstrate significantly lower levels of blood glucose in primiparous sows that developed agalactia following partitution. However, this phenomenon was not observed in multiparous sows. In another study, Šamanc *et al*. (1992), showed that concentrations of cortisol, tri-iodothyronine, thyroxine and glucose were lower in first litter sows with hypo or agalactia. Nitovski (1993) determined concentrations of the lactogenic hormone prolactin, progesterone, cortisol, insulin, tri-iodothyronine, thyroxine, as well as serum concentrations of glucose, Ca and P in 47 healthy gilts and 17 gilts suffering from hypo or agalactia after partitution. In this study blood samples were collected before mating, in the first third of pregnancy, 10 day before partitution, 1 and 7 days after partitution. The serum concentrations of estimated hormone varied similarly in both experimental groups except for cortisol. In agalactic gilts serum cortisol was significantly lower before and after partitution. This was accompanied with lower serum glucose concentration.

It is reported that uterine resistance to infection is highest in estrus when plasma levels of estrogen are high and progesterone levels are low, and in contrast, susceptibility to infections is high during the luteal phase, i.e. when progesterone levels are high and estradiol is low (Dalin *et al*., 2004). Wulster-Radclife *et al*. (2002) also showed that endogenous and exogenous progesterone reduces in gilts the ability of the uterus to resist infections.

The genetic background of PPDS has been investigated and the estimated heretabilty averaged 0.0879 with a 95% confidence interval. This emphasizes the importance of considering the genetic predisposition and additional factors including hygiene and management conditions (Preissler, 2011). Šamanc (2011) points out that nutritional factors may contribute to sows predisposition for PPDS and that special attention must be given to balanced feed mixtures containing a sufficient quantity of crude fibers.

In a clinical examination of 78 gilts Bostedt *et al*. (1998) documented that duration of partus and frequency of obstetrical interventions are important factors leading to puerperal illness. Signs of clinical interest were increased body temperature, cardiac rate and respiratory frequency. Approximately 75% of diseased animals had anorexia, 66% abnormal faecal consistency but only 24.4% showed exclusively signs of mastitis. Predominantly *E. coli*, *Staphylococcus spp*. and *Streptococcus spp*. were isolated from the genital tract. Some bacterial species were isolated in milk specimens originating from sows that developed clear signs of mastitis (Kemper and Gerjets, 2009). On the basis of answers obtained by questionnaires sent to 110 herdsman in Belgium Papadopulos *et al*.

(2010) quoted that 37 of them reported occurrences of PPDS whereas 73 reported no cases of PPDS. The same authors enlisted four main risk factors: (1) moving pregnant sows to the farrowing unit 4 days or less before expected farrowing (2) farrowing induction (3) feeding sows *ad libidum* during lactation and (4) frequent farrowing supervision. They concluded that control measures should include optimizing management and feeding practices in order to lower the number of modern pig herds suffering from problems associated with PPDS.

Interesting findings were reported by Van Gelder and Bilkei (2005) who found that mean serum alpha 1-acid glycoprotein (AGP) and serum haptoglobin (HPT) concentrations were significantly higher in sows suffering from PPDS. AGP and serum cortisol concentrations were negatively correlated with litter weight indicating that activation of the cellular immune response in sows negatively affects the growth rate of suckling piglets.

Among other causative agents of hypo and agalactia in sows it is worth mentioning that products of sorghum ergot (*Claviceps Africana*) and rye ergot (*Claviceps purpurea*), if present in feed mixtures, may reduce milk production and feed intake resulting in death of piglets. Symptoms may significantly vary depending on the degree of intoxication and it is documented that ergot derivatives suppress prolactine release (Blaney *et al*., 2000; Kopinski *et al*., 2007).

Mannan-oligosaharides are gut active carbohydrates (GAC) derived from the cell wall of yeasts (YCW) and they can adsorb pathogens expressing type-1-fimbrae, reducing their ability to colonize the gastrointestinal tract (Spring et al., 2000). Many trials documented that GAC may bound to and eliminate pathogenic bacteria like *Salmonella spp*. and *E. coli* in broilers (Spring *et al*., 2000) and *Clostridia perfringens* in turkeys and broilers (Sims *et al*., 2004). This mode of action resulted in consistent improvements in piglet, sow, broiler and turkey performance (Miguel *et al*., 2002; Hooge *et al*., 2003; Sims *et al*., 2004; Hooge 2004a; 2004b; Rozeboom *et al*., 2005). One of the important GAC effects, if they are orally administered during the first 24 hours of life, is a positive influence on Ig G absorption in neonatal piglets and calves (Lazarevic, 2005; Lazarevic *et al*., 2010) and piglets (Hengartner *et al*., 2005).

In this study we focused our attention to sows with clinically manifested puerperal endometritis and purulent vaginal discharge. Affected animals were treated by intrauterine installation of different doses of sterile Yeast Cell Wall (YCW) Alltech® suspensions, in sterile saline, or 2 % Lotagen solution in order to reduce bacterial count and improve health status of sows without the use of antibiotics.

MATERIAL AND METHODS

Animals

The study was carried out on a pig farm with 600 sows, in the near vicinity of Novi Sad. A total of 59 sows were included in the trial from the beginning, but first litter and older sows were excluded from statistical analyses. All sows in the trial were from second to sixth parity and mainly Swedish Landrace (SL) and crossbreds of SL and Great Yorkshire. Their health status was monitored daily and after delivery. Sows with clinical signs of postpartum uterine infections, were treated as described below.

Finally, 50 sows were taken into consideration. Forty of them had clinically expressed signs of postpartum endometritis 2-3 days following partitution and ten of them were healthy. These animals were divided in 4 groups (10 each) and treated as follows only once:

Group YCW I – IU instillation of 5 g YCW in 100 ml of sterile saline
Group YCW II – IU instillation of 10 g YCW in 100 ml of sterile saline
Group YCW III – IU instillation of 20 g YCW in 100 ml of sterile saline
Group L – IU instillation of 100 ml 2 % Lotagen solution
Group C – Untreated animals

Group C consisted of 10 healthy animals and no therapy or uterine content sampling for microbial analyses was performed. Only piglets BW was estimated at the same time intervals as for other groups.

Before treatment, samples of uterine flushing were collected by means of an especially designed catheter for sows (Figure 1) which enables sampling and minimizes the risk of uterine wall perforation (General Medic, Beograd, Srbija). Bacterial count, types of bacteria, bacterial, neutrophyle and eosinophyle presence on the stained smears (May Grünwald-Giemsa method) were determined. Samples were collected again from the same animals two to five days after therapy and the same laboratory tests were repeated.

Figure 1. A set for uterine content sampling and YCW or Lotagen application

Body temperature (BT) of the sows was followed daily with laser thermometer (ThermoFlash® PRO-IR ZH-36, France) and when BT was higher than 39.5°C antibiotics were introduced by parenteral route (PenStrep, Avilamycine) in a dose prescribed by the manufacturer. This was performed only in six sows.

A clinical estimation was performed using the originally developed scale as follows:

a. mucopurulent voluminous discharge, reduced appetite, high BT 4
b. mucopurulent voluminous discharge, reduced appetite, normal BT 3
c. discharge in small amount, slightly reduced appetite, normal BT 2
d. no discharge, normalized appetite, normal BT 1

On the first day of therapy and 2-5 days later, body weights of piglets were recorded in order to calculate average BW and daily weight gains. Their BW was also estimated at the moment of weaning. From this data, we calculated daily body weight gains from therapy to second sampling (2-5 days later), and from therapy to weaning.

Since this therapeutic approach has not been described earlier, we have also recorded the number of piglets in treated sows in the next breeding cycle, in order to investigate a possible negative consequence of the applied method.

Housing and feeding

Sows were housed in commercial crates measuring 2.2 m x 1.5 m, with standard creep access for piglets, allowing *ad libitum* suckling. They were kept under air conditioned environment, 23-24°C and day - light regime 14+10 hrs. Sows were fed corn wheat based diets meeting commercial nutrient specifications (Table 1) according to AEC tables (1993).

Table 1. Composition of sow gestation and lactation diets

Formulated dietary component	Gestation diet (dry matter basis, g/kg)	Lactation diet (dry matter basis, g/kg)
Metabolisable energy MJ/kg	13.14	13.63
Crude protein	136.8	168.4
Crude fiber	51.5	46.7
Crude fat	34.9	38.7
NFE	656.8	628.7
Ash	5.02	5.42
Lysine	6.1	9.8
Calcium	7.4	9.5
Phosphorous	6.3	6.6

YCW and Lotagen preparation and application

We have used YCW (Batch No 6.9.175, Alltech, Fermin, Senta) as provided by the company. Amounts of 5, 10 and 20 g were measured and placed in plastic flasks for artificial insemination which were closed tightly with plastic caps. Flasks and their content were sterilized by ^{60}Co radiation over 72 hrs. The total absorbed radiation dose was 25 kGy. Prior to application, 100 mL of pre warmed (37°C) sterile saline was added to each flask and well shaken to form a suspension. Application was performed with sterile catheter, as described above, suitable both for intra uterine sampling and medicament application. In the fourth group of sows, a 100 mL of 2% Lotagen (Byk Gulden, Germany) solution was applied in the same manner. Instillation was performed only once.

Uterine content sampling and bacteriological examination

Samples of the uterine content were collected by syringe aspiration after delivery on days 1 - 3 when clinical signs of infection were evident. This was performed with a sterile catheter that enables safe sampling. Second sampling was performed in the same manner 2 – 5 days following therapy. Samples were placed in labeled sterile plastic tubes and transported to the laboratory. Microbiological analyses of uterine flashings were performed in order to estimate the presence of both aerobic and anaerobic bacteria and their total count (colony forming units – CFU).

All samples were inoculated on Columbia agar (CM331, Oxoid, Basingstoke, UK) containing 5% sheep blood and Mac Conkey agar (CM115, Oxoid, UK). Following inoculation, the plates were incubated aerobically at 37^{o}C for 24 - 48h. The cultures were purified by sub culturing on the nutrient agar (CM3, Oxoid, UK). Each isolate was identified on the basis of colonial morphology, microscopic appearance and biochemical test (Quin *et al*., 1998).

Total bacterial count (CFU/mL) was determined using the standard plate count method from a series of ten-fold dilutions. Dilutions (10^1-10^5) were prepared in buffered peptone water (CM 1049, Oxoid, Basingstoke, UK) and inoculated in the amount of 0.5 mL in Petri dishes containing 5% sheep blood in Tryptone soya agar (CM131, Oxoid). Plates were incubated during 48h at 37^{o}C under aerobic conditions.

Cytology

This was performed after drying of smears on microscope slides and standard May Grunwald Giemsa staining. We used Olympus BH-2 direct light microscope with total magnification of 1000 x and an immersion objective. Photomicrographs were taken by digital Olympus BX-40 (Japan) camera. The presence of neutrophiles and eosinophyles, epithelial cells and bacteria in uterine flushing was estimated.

RESULTS

Clinical findings

Using the above described scale, we were able to judge the improvement in the sow's health status following IU instillation of the YCW or Lotagen solution. The data are presented in Table 2.

In all groups of sows, at the beginning of the trial the average clinical score values ranged from 2.8 to 3.4 and did not differ significantly. Therapy by IU instillation of YCW or Lotagen in all groups resulted in significant improvement 2-5 days after therapy ($p<0.001$). The best results were achieved with IU instillation of

10 and 20 g of YCW and what is even more important, the percent of recidivism (sows that still had signs of infection 5 days following therapy) was only 10% in these two groups.

Table 2. Clinical improvement in the sow's health status following IU instillation of YCW (5, 10 and 20 g) and Lotagen 2% solution

	Average clinical score	Average clinical score 2-5 d after therapy	Clinical improvement, %	Recidivism %
YCW I 5 g	2.8 ± 0.42	1.3 ± 0.48	53.4	30
YCW II 10 g	3.2 ± 0.63	1.1 ± 0.32	65.7	10
YCW III 20 g	3.4 ± 0.48	1.2 ± 0.32	64.7	10
LOTAGEN	3.4 ± 0.52	1.5 ± 0.53	55.9	50

Bacterial count

In 40 uterine flushing samples, at the beginning of investigation, we were able to isolate 8 different bacterial species. In 8 sows, we isolated only one dominant bacteria (20%) in three of them (7.5%) three different bacterial species and in remaining 72.5% of animals infection was caused by two bacteria. In eight samples (20%) one bacterial species dominating on the agar plate together with sparse non-specific mixed culture (*Staphylococcus coagulase – and Bacillus sp.*) was isolated. In two samples we isolated only nonspecific bacteria (*Staphylococcus coagulase – and Bacillus sp.*). Bacterial species and their abundance are presented in Table 3.

Table 3. Bacterial species isolated from sows uterus and their relative abundance

Species	No. of isolates	%
E. coli	29	39.83
Streptococcus a haemolyticus	5	6.85
Staphylococcus (coagulase -)	9	12.33
Staphylococcus aureus	8	10.96
Str. dysgalactiae subsp. equisimilis	14	19.18
Arcanobacterium pyogenes	7	9.59
Bacillus sp	1	1.37
Staphylococcus hyicus	1	1.37
Total	73	100

It is evident that the most frequently isolated bacterial species were *E. coli, Streptococcus dysgalactiae subspecies equisimilis, Arcanobacterium pyogenes, Staphylococcus aureus, Staphylococcus (*coagulase -) and *Streptococcus* α *haemolyticus.* The first two species had the most abundant growth on plates.

Following IU instillation of YCW we were able to demonstrate a significant reduction in the bacterial count (CFU – colony forming unite) and these data are presented in Table 4. It may be concluded that YCW when applied in the uterus of infected sows significantly reduces the number of CFU. The same effect was observed for Lotagen solution, but to a lesser extent.

Table 4. The degree of bacterial number reduction (CFU) in samples of sows' uterine flushings following instillation of YCW (5, 10 and 20 g) and Lotagen 2% sol. (100 mL)

No	YCW I 5 g		YCW II 10 g		YCW III 20 g		Lotagen 100 mL 2 %	
	Ear mark	Degree of CFU reduction	Ear mark	Degree of CFU reduction	Ear mark	Degree of CFU reduction	Ear mark	Degree of CFU reduction
1	5871	233.3	7949	9.5	5106	1500	8294	0
2	5190	8702.1	5206	3.3	6634	35	7628	0
3	8017	20.0	8542	2861.1	6897	168.1	6256	0.002*
4	5572	5.0	5491	1008.0	7798	2.87	6079	91.8
5	6502	1.5	6891	6935.5	5519	8.0	5896	45.1
6	7032	3125	8600	12.7	7999	1356.6	5566	0.01*
7	5606	25.0	7457	3566.6	7811	2.83	5407	13.5
8	5679	1500.0	2481	2.35	2492	1.45	5860	3.9
9	8401	1.5	6971	44.9	5767	22.85	6934	8.0
10	5462	4.3	5612	3011.55	5527	10 750	6596	0.165*
S	13 617.7		14 443.95		13 847.1		162.3	
X RD	1361.7		1444.4		1384.7		32.46	

* values lower than 1 represent elevations of the CFU number, RD – reduction degree

The degree of CFU number reduction was nearly the same in all groups of sows treated with intra uterine instillation of YCW (5, 10 and 20 g). No dose dependent effect was noted and it was evident that the degree of CFU number reduction varied greatly within all groups of sows. Treatment with Lotagen solution, also resulted in clinical improvement, but was not that efficient (degree of CFU reduction was only 32.6) and 50% of sows still had a purulent discharge after 2-5 days (Table 2).

Smears

Examination of the stained smears from the uterus content generally revealed numerous bacteria and neutrophyles in the first samples (at the day of therapy). The number of PMN cells was 30 - 400 per all visual fields. The cells were in different stages starting from clear non damaged membrane and segmented nuclei do degeneration like karyopycnosis, karyiolysis or lipid degeneration. Such a finding indicates acute inflammation. Lymhocytes, monocytes and uterine epithelial cells were rare. In 30 % of samples we were able to demonstrate chains of *Streptococcae* and *Cocobacilli.*

On the stained smears obtained 2-5 days following therapy, in general, cells were rare and we noticed 1 – 5 epithelial cells and 1 – 10 PMN per visual field accompanied with few lymphocytes. Bacteria were present in one of 15 samples. This phenomenon was observed for all treatments but sows that still had vaginal discharge (Lotagen group) had much more bacteria in the second samples.

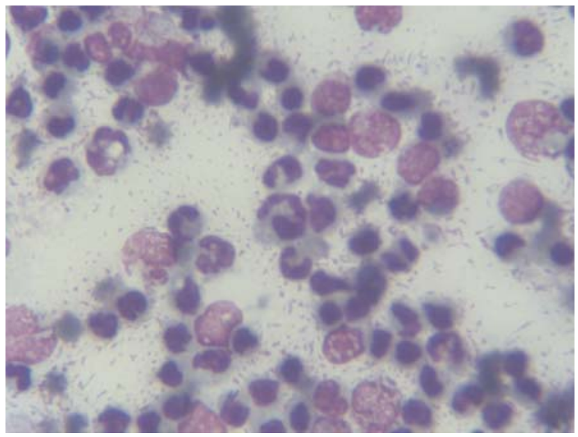

Figure 2a. A typical stained smear of vaginal content from sows with clinical signs of puerperal infection. Note the presence of numerous bacteria and neutrophyles

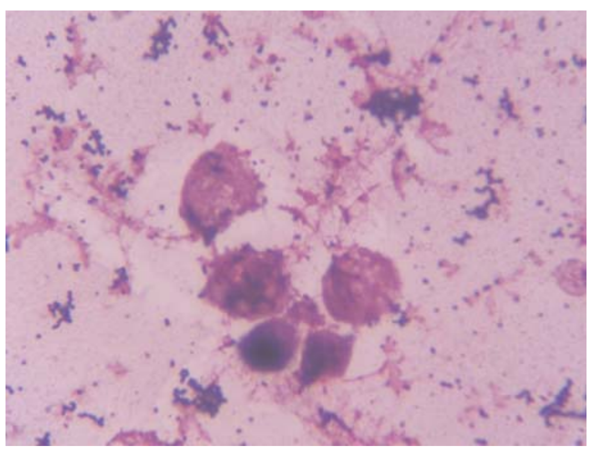

Figure 2b. A typical stained smear of vaginal content from sows that were treated with IU instillation of YCW 2-5 days after therapy. Note the presence of 2 epithelial cells and one lymphocyte

Piglets number and body weights

On the day of therapy, the average number of piglets was lower in the YCW II group when compared to groups YCW I, L and C ($p<0.05$). After treatment the number of piglets was higher in the control group when compared to groups YCW I and YCW II ($p<0.05$). The average number of piglets weaned, was highest in the control group (non infected sows) and lowest in the Lotagen treated group. These differences were only numeric. Total piglets loss was highest in the Lotagen treated group (Table 5).

Table 5. Average number of piglets during the trial

	Number of piglets at the day of therapy	Number of piglets 2 – 5 days after therapy	Number of piglets weaned	Total loss %
YCW I 5 g	10. 8 ± 0.63	10.5 ± 0.85	9.9 ± 1.14	9.16
YCW II 10 g	9.9 ± 0.99	9.8 ± 1.03	9.5 ± 1.18	4.20
YCW III 20 g	10.9 ± 1.37	10.3 ± 0.67	9.5 ± 1.35	14.70
Lotagen	10.9 ± 0.99	10.6 ± 1.07	9.2 ± 1.40	18.40
Control	10.9 ± 0.57	10.9 ± 0.57	10.2 ± 1.40	6.80

In Table 6, the average values and standard deviations for piglets body weights during the trial are presented, while results of statistical analyses are shown in Tables 6.1, 6.2. and 6.3.

Table 6. Body weights (g) of piglets ($\overline{X}$ ± SD) at the moment of therapy of sows, 2-5 days after and at weaning

	BW - therapy	BW - therapy + 2-5 D	BW at weaning
YCW I 5 g	1942.8 ± 239.51	2666.3 ± 315.25	7119.1 ± 997.59
YCW II 10 g	1858.8 ± 144.83	2459.4 ± 224.31	7695.4 ± 568.54
YCW III 20 g	1843.1 ± 212.45	2541.1 ± 427.31	7695.4 ± 717.29
Lotagen	1956.3 ± 267.75	2492.5 ± 377.65	6936.9 ± 893.42
Control	1981.8 ± 201.85	2582.0 ± 253.86	6623.9 ± 793.16

Table 6.1. Statistical analyses of differences in piglets BW at the moment of therapy of sows

	YCW I	YCW II	YCW III	Lotagen	Control
YCW I	*	NS	NS	NS	NS
YCW II	*	*	NS	NS	NS
YCW III	*	*	*	NS	NS
Lotagen	*	*	*	*	NS

NS – non significant

Table 6.2. Statistical analyses of differences in piglets BW 2 – 5 days after therapy of sows

	YCW I	YCW II	YCW III	Lotagen	Control
YCW I	*	NS	NS	NS	NS
YCW II	*	*	NS	NS	NS
YCW III	*	*	*	NS	NS
Lotagen	*	*	*	*	NS

NS – non significant

Table 6.3. Statistical analyses of differences in piglets BW at weaning

	YCW I	YCW II	YCW III	Lotagen	Control
YCW I	*	NS	NS	NS	NS
YCW II	*	*	NS	$p<0.05$	$p<0.01$
YCW III	*	*	*	$p<0.05$	$p<0.01$
Lotagen	*	*	*	*	NS

NS – non significant

Statistical differences were not evident for body weights of piglets at the moment of therapy or 2-5 days later (moment of second sampling). However, when we analyzed body weights at the moment of weaning, we were able to conclude that in groups YCW II and YCW III piglets were significantly heavier when compared to piglets in the Lotagen and Control group. Other differences were only numeric. We must stress out that these results are not completely reliable because not all piglets were weaned at the same day of life. Therefore, a more precise parameter was daily body weight gain and these data are presented in Table 5 while results of statistical analyses are shown in Tables 7.1. and 7.2.

Table 7. Daily body weight gain (g) of piglets from the moment of therapy of sows 2-5 days after and during the whole period of observation (x ± SD)

	DBWG - therapy – 2-5 days	DBWG up to weaning
YCW I	206.4 ± 42.55	221.1 ± 27.85
YCW II	192.1 ± 42.22	230.2 ± 31.93
YCW III	204.5 ± 52.70	241.2 ± 30.91
Lotagen	162.7 ± 31.17	205.7 ± 39.61
Control	199.0 ± 82.26	210.1 ± 38.72

Statistical analyses of piglets DBWG from the moment of sows therapy to 2-5 days after, indicated significant differences ($p<0.05$) only when groups YCW I and III and Lotagen were compared.

Table 7.1. Statistical analyses of differences in piglets DBWG from the moment of sows therapy to 2-5 days after

	YCW I	YCW II	YCW III	Lotagen	Control
YCW I	*	NS	NS	p<0.02	NS
YCW II	*	*	NS	NS	NS
YCW III	*	*	*	p<0.05	NS
Lotagen	*	*	*	*	NS

NS – non significant

Table 7.2. Statistical analyses of differences in piglets DBWG from the moment of sows therapy to weaning

	YCW I	YCW II	YCW III	Lotagen	Control
YCW I	*	NS	NS	NS	NS
YCW II	*	*	NS	NS	NS
YCW III	*	*	*	p 0.05	p 0.05
Lotagen	*	*	*	*	NS

NS – non significant

At the end, statistical analyses of piglets DBWG from the moment of sows therapy to weaning revealed significant differences when YCW III group was compared to the Lotagen and control groups ($p<0.05$).

In order to estimate if the applied treatment had influence on the sow's reproductive performances we have followed the number of piglets born in the next breeding cycle of the same sows. These results are presented in Table 8.

Table 8. Reproductive success of sows, included in the study, in the next reproductive cycle (average values, $\overline{X} \pm SD$)

	Total born	Born alive	Total loss %
YCW I 5 g, n = 8*	11.90 ± 2.47	10.75 ± 1.67	9.49
YCW II 10 g, n = 9*	12.30 ± 2.69	10.89 ± 1.96	11.78
YCW III 20 g, n = 8*	12.10 ± 2.47	10.40 ± 1.60	14.46
Lotagen, n = 9*	11.78 ± 2.91	10.30 ± 2.18	12.22
Control*, n = 9	13.44 ± 1.59	11.44 ± 0.88	21.50

*From the total of 50 sows 2 died, in the following six months and 5 of them were sold

Generally it might be concluded that treatment of sows by IU instillation of YCW or Lotagen did not influence the number of piglets born in the next breeding cycle. However, the percent of total piglet loss was highest in the control group

DISCUSSION

Sufficient colostrum and milk intake is extremely important for piglets and numerous attempts were performed in order to improve milk production in sows. Addition of iodinated casein to sows' diet resulted in higher body weight of piglets at the moment of weaning and also in higher thyroid gland hormone concentrations in the sera of sows (Djurdjevic *et al*., 1980).

Our results regarding the number and type of bacterial isolates from uterine flushings are in accordance to those reported by Radovic (1997). Treatment of endometritis with antimicrobial agents and antibiotics has various degrees of success and the cost of treatment is high. In cows, milk has to be disposed and there is a possibility for developing microbial resistance along with reduced phagocytic activity of leukocytes. For that reason alternative ways of therapy were investigated by using natural substances as means of activation of natural defense mechanisms in the uterus. One of them was garlic extract (*Alium sativum*). In this trial administration of PGF 2α served as a positive control (Sarkar *et al*., 2006). Authors were able to demonstrate lowering of the cervical mucus pH value accompanied with a significant reduction of bacterial load similar to our findings The total number of isolates was 65, comprising mostly of facultative anaerobic bacteria. Following treatment an elevation of thyroid hormone levels in the plasma from both groups of treated animals was noted, as well as a decline in cortisol levels. It is well known that circulatory levels of thyroxine and tri-iodothyrinine play an important role in correlating the persistent infection, as well as subclinical condition of infection (David *et al*., 1998). A decrease in their concentration occurred due to constant caloric deprivation or to enhanced endogenous cortisol production (Peterson and Ferguson, 1989).

Another attempt to investigate alternative way of therapy was by using three lactic bacteria strains: *Lactobacillus acidophilus, Enterococcus faecalis* and *Enterococcus cecorum* (Xuefeng *et al*., 2011). All tested bacteria exerted a high level of adhesion to immortalized endometrial epithelial cells *in vitro* and *L. acidophilus* was the most efficient. In coculture assays these bacteria significantly reduced adhesion of pathogens *E. coli* and *S. aureus*. Authors concluded that the ability of LAB tested for inhibition of adhesion of endometritis-associated pathogens is highly specific and depends on both probiotic and pathogen strains. As prebiotics also prevent bacterial adhesion to epithelial cells in the digestive tract (Spring *et al.*, 2000) we may postulate that mannan oligosaccharides were also able to exert the same effect in the lumen of infected sows uterus. Our results clearly show a significant degree of reduction in bacterial count following intrauterine instillation of YCW. Clinical improvement in sows was also evident in our study, as well as piglets higher body weight gains.

De Winter *et al*. (1995) suggested that in the uterine mucose infiltration of neutrophils in proestrus and estus should not be interpreted as acute endometitis unless their numbers are significantly increased (>20 neutrophils/field area 400 x magnification). In our study we were able to see numerous neutrophils on the stained uterine content smears and also reduction of these cells following therapy (Figs 1 and 2).

Various relatively new medicaments were tested in the therapy of PDA which is usually based on administration of antibiotics and oxytocin. Among them, meloxicam and flunixine were efficient in improving clinical score (Hirsch *et al*., 2003). However meloxicame lowered the mortality rate in piglets by 50% in comparison to reference control group reaching statistical significance ($p<0.05$)

Waller *et al*. (2002) reported results of the study conducted in 19 Hungarian pig herds over a 4 year period. Authors evaluated the relationship between the duration of vulval discharge and subsequent fertility and litter size. They concluded that both parity 1 and parity 2-8 sows having vulvar discharge in excess of 6 days had significantly lower fertility compared with sows of similar parity where the duration of vulval discharge was less than 6 days. A duration of vulval discharge in 1 parity sows in excess of 6 days significantly reduced litter size (total born and live born) in subsequent farrowings, but not in parity 2-8 sows. Our results confirmed that in treated sows subsequent fertility was not affected and the percent of loss of piglets was highest in the control group.

Address for correspondence:
Dr Miodrag Lazarević, professor
Faculty of Veterinary Medicine
Department of Physiology and Biochemistry
Bul. oslobodjenja 18
11 000 Belgrade
E mail: lazarevicm@vet.bg.ac.rs

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TERAPIJA ENDOMETRITISA KRMAČA INTRAUTERINOM INSTILACIJOM PREPARATA NA BAZI ZIDA KVASCA

LAZAREVIĆ M, MILOVANOVIĆ A, BARNA T, MILJAS N, MILANOV DUBRAVKA

SADRŽAJ

Na osnovu rezultata naših istraživanja bilo je moguće zaključiti da tretman krmača obolelih od puerperalnih infekcija materice, sterilnim preparatom dobijenim iz zida kvasca (YCW), ima za posledicu značajan klinički napredak. Procenat krmača sa recidivom je bio najniži (10%) u grupi tretiranoj sa 10 i 20g YCW.

Stepen redukcije broja bakterijskih kolonija (CFU) u uzorcima dobijenih iz materice krmača posle tretmana YCW preparatom je bio veoma visok i kretao se u opsegu od 1361 do 1444 puta. Kod obolelih krmača, tretiranih rastvorom Lotagena (2%), vrednost ovog parametra je bila svega 32.

U momentu zalučenja, prasad krmača tretiranih YCW preparatom u količini od 10 i 20 g bila su teža u poređenju sa prasadima krmača grupe tretirane Lotagenom i prasadima kontrolnih (neteretiranih) krmača. Osim toga i njihovi prosečni dnevni prirasti su bili veći. Tretman krmača intrauterinom instilacijom preparata na bazi YCW nije negativno uticao na broj prasadi u sledećem reproduktivnom ciklusu.