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Physico-chemical aspects and sedimentcopy of urine of pregnant sows produced in an intensive system

Aspectos físico-químicos e sedimentoscopia da urina de matrizes suínas na fase de gestação criadas em sistema intensivo

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ABSTRACT: The impact of pig farming on the worldwide economy causes production to be directed at an industrial scale, requiring the control of diseases that affect economic performance. Urinary infection (UI), for example, has a high prevalence in current production systems, causing economic losses due to the predisposition to reproductive failures, leading to an increase in disposal of sows and replacement rates. In this context, the objective of this work was to evaluate the prevalence of urinary tract infection (UTI) and possible changes in the urine sediment examination of pregnant sows to survey changes compatible with inflammation of the lower urinary tract. The samples were collected, randomly, from 43 sows of commercial genetic lineage, in different stages of gestation, and that belonged to a pig farm located in Guapimirim-RJ. The pig farm's herd consisted of 200 sows, 90 of which were in the gestation phase. The samples were collected by spontaneous urination, using the first morning urine, before feeding, which happened around 7 am. The presence of UTI was identified in 12 of the 43 sows analyzed, with 21.5% of the herd being evaluated. A prevalence of 27.9% was observed with animals showing compatible UTI changes. This data was considered severe. The urine sediment examination is the best way to diagnose UTI with sedimentcopy being the most conclusive part. Despite this, it is necessary to relate the laboratory data with the zootechnical management used, as well as the environmental conditions.

KEYWORDS: EAS; Swine; Urinary infection.

RESUMO: O impacto da suinocultura na economia mundial, faz com que a produção seja dirigida para a escala industrial, exigindo o controle de doenças que afetam o rendimento econômico. A infecção urinária (IU), por exemplo, apresenta alta prevalência nos sistemas atuais de produção, causando perdas econômicas em função da predisposição para falhas reprodutivas, levando a um aumento dos descartes de matrizes e das taxas de reposição. Neste contexto, o objetivo desse trabalho foi avaliar a prevalência de IU e possíveis alterações no EAS de porcas gestantes, para levantamento de alterações compatíveis com inflamação de trato urinário inferior. Foram analisadas 43 amostras de urina de porcas de linhagem genética comercial, em fases distintas de gestação, colhidas de forma aleatória, em uma granja localizada no município de Guapimirim-RJ. O plantel da granja era constituído por 200 matrizes, sendo 90 delas na fase de gestação. As amostras foram coletadas por micção espontânea, sendo utilizadas as primeiras urinas da manhã, antes do arraçoamento, que acontecia por volta das 7 horas. A presença de infecção urinária foi identificada em 12 das 43 porcas analisadas, sendo avaliados 21,5% do rebanho. Observou-se uma prevalência de 27,9%, com os animais apresentando alterações compatíveis de IU, constatando-se que este nível foi considerado grave. O EAS é a melhor forma de diagnosticar IU, sendo a sedimentoscopia a parte mais conclusiva, apesar disto, é necessário relacionar os dados laboratoriais com o manejo zootécnico utilizado, bem como as condições ambientais.

PALAVRAS-CHAVE: EAS; Infecção urinária; Suíno.

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INTRODUCTION

According to Merlini; Merlini (2011), the impact of pig farming on the world economy requires production to be directed to industrial scale, requiring the control of diseases that affect economic output, including urinary infection (UI). It is highly prevalent in the current production systems, causing economic losses due to predisposition to reproductive failure, leading to an increase in the elimination of reproductive females and in the replacement rates (MAZUTTI et al., 2013a; RITTERBUSCH et al., 2014; MOURA et al., 2018). Because of this, many authors have studied the influence of periparturient diseases in the reproductive performance of sows (PORTO et al., 2004; RUEDA LÓPEZ, 2008; BORDIN; GOMES; BUENO, 2012; BELLINO et al., 2013; VENANCIO et al., 2017).

Mayrink (2005) observed that when we identify a sow with cystitis, it means that at least two to four more sows present the condition. Little et al. (2006) observed that because there is a constant perineal contamination and because they have a relatively short urethra, domestic females present a predisposition to urinary infections, a fact that even makes the porcine species a model for the study of urinary tract infections (UTI) (NIELSEN et al., 2019).

The intensification and the confinement have generated problems related to the health of the herd (COSTA, 2008). In the current systems, one of the main objectives is to optimize the biological efficiency of animals according to the growth and the reproduction. Among the factors that hinder this objective is the loss of the health. Thus, the knowledge of the affections that affect the swine is paramount in modern production systems. (PELLIZA et al., 2007). The several predisposing factors for the appearance of these affections are poor hygiene conditions in the facilities, locomotor apparatus problems, quality and quantity of water ingested, and age of the female (SOBESTIANSKY, 2007; DROLET, 2019).

Alberton; Mazutti; Donin (2011) pointed out that the great challenge of the sector, besides adopting prophylactic measures against urinary infections, will be the use of diagnostic practices that enable the identification and early treatment of females with dysfunctions. Ritterbusch et al. (2014) reinforced the need of an efficient monitoring program to control the problem in the farms in order to avoid unnecessary losses and replacements.

In this context, the objective of this work was to evaluate the prevalence of urinary infection and possible alterations in the urinalysis test in pregnant sows, in order to identify changes compatible with lower urinary tract inflammation, since inflammatory conditions are frequent and result in economic losses.

MATERIAL AND METHODS

In this work, 43 urine samples from sows of a commercial genetic lineage, in different stages of pregnancy, randomly sampled in a farm located in the municipality of Guapimirim-RJ, were analyzed. The paper was approved by the Ethics Committee on the Use of Animals at the Unigranrio University, CEUA protocol 030/2020.

The herd of the pig farm consisted of 200 female breeders, 90 of them in the gestation phase, and with an intensive breeding system, in which the animals were confined in barns. The type of production was farrow to finish operation with the final product being the finished pig with an average of 100 kg of live weight.

The urine samples were collected by spontaneous urination and, following the recommendation of Polo et al. (2013), the first urine of the morning was used, before feeding, which happened approximately at 7 A.M. All the sows had their vulvae cleaned and, in all collections, the first spurts of urine were discarded (MAZZUTI et al., 2013b; MOURA et al., 2018).

In prevalence studies carried out in Brazil, Sobestiansky et al. (2013) found that when entering the facility for urine collection, usually a group of females stands up immediately and after a few seconds starts urinating. A second group takes longer to rise. Females with bladder weakness are usually part of the latter group. Therefore, samples from both groups were identified and collected to have a reliable result: 16 sows from the first group and 27 from the second group.

To avoid the collection of the same animal, colored tapes tied at the back of the cages were used, making identification easier.

According Garcia-Navarro (2005), immediately after collecting, the samples were stored in a Styrofoam thermal container with ice and protected from light until the moment of transport to the Clinical Pathology Laboratory of School Hospital Alan Kardec da Silveira of Unigranrio, at Duque de Caxias-RJ. The samples were packed in plastic tubes, identified according to the numbering of the animals. The maximum time between collection and arrival at the laboratory for processing was 80 minutes. To avoid damage to the quality of the samples, a maximum number of up to ten animals per collection was stipulated, thus five visits were made to the pig farm.

The urinalysis test was performed at the laboratory and the physical examination analyzed the color, odor, appearance, and specific density of the samples. Regarding color, the samples were classified as colorless, light yellow, dark yellow, and brownish. and ammoniacal. With regard to appearance, they were divided in limpid and cloudy. The density was measured with the aid of a refractometer (Refractometer A 300 CL, Tokyo, Japan). In the chemical test, reactive tapes (Uriquest – Labtest Diagnóstica S. A. Lagoa Santa, M.G. Brazil) were used for urinalysis of pH, nitrite, protein, glucose, ketone, urobilinogen, bilirubin, and blood. According to Alberton; Sobestiansky; Donin, (2012), physical examination and reactive strips enable the UTI to be diagnosed with excellent specificity and good sensitivity.

After the physical and chemical tests, 10ml of urine was centrifuged at 1500rpm, for five minutes, with the supernatant neglected. For sedimentoscopy, an aliquot of 20µL of the urinary sediment was used, placed between the coverslip and glass slide and observed under optical microscopy with 400X magnification, with the changes being recorded on a sheet for later analysis.

The values found for UI and the number of animals evaluated were used calculate the prevalence. This result was reached by dividing the number of positive animals for UI by the total number of evaluated animals, multiplied by 100.

RESULTS AND DISCUSSION

The presence of UI was identified in 12 of the 43 analyzed sows, four (25%) belonging to the 1st group and eight (29.6%) to the 2nd group, according to Sobestiansky et al., (2005) who reported that females with urinary infection usually take longer to stand up.

Agreeing with Alberton; Sobestiansky; Donin, (2012), in this study, the association of the various parameters of the urinalysis exam showed to be suggestive of UI, some of which are more important (sedimentoscopy, nitrite, protein, blood, density and pH). These authors note that, in most cases, only the reactive strips can be used for diagnosis. According to Grahofer; Bjorkman; Peltoniemi (2020), this test is cheap and easy to perform on pig farms. Mazutti et al. (2013b) underline to the importance of the results of these diagnoses on the routine practices, since prophylactic or curative procedures can be performed according to the prevalence obtained. According to Drolet (2019), there is much greater importance for asymptomatic animals, as in this case, they are only discovered if examined.

We have evaluated 21.5% of the herd, observing a prevalence of 27.9%, with the animals presenting alterations compatible with UI. According to Sobestiansky (2007), values of UI higher than 25% indicate the existence of chronic and serious problems on the farm. This value is close to the results found in the epidemiological studies conducted by Brazilian researchers which indicated in Brazil a prevalence of UI of approximately 33% in female breeders from commercial farms. Piassa et al. (2015) reported a prevalence of 58% in a certificated swine reproduction farm in Paraná, Moura et al. (2018) reported a prevalence of 41.1% in a farm in Mato Grosso do Sul, while Alberton; Sobestiansky; Donin (2012) reported 10 to 60%, with average 29,0% for southern Brazil.

The results for the physical parameters of the urine are shown in table 1.

According to Grahofer; Bjorkman; Peltoniemi (2020), the color of the urine varies according to its concentration and should not be red or brown as it would indicate hematuria or myoglobinuria. Among the 12 (27.9%) sows with UTI, nine (75%) presented a dark yellow urine, in one (8.3%) the urine was brownish due to the presence of bilirubin and blood, and in two (16.6%) light yellow. Porto et al. (2003), who reported that urine from sows with UTI tends to be dark yellow, obtained similar results. Merlini et al. (2013) found a predominance of light yellow staining and associated urine color with other physicochemical variables, thus showing that this parameter can be affected by a number of factors and therefore should not be used alone to estimate the presence of UTI in sows. Moura et al. (2018) reported that of 60% of the samples that had a dark yellow color, 96.7% presented an ammoniacal odor. In contrast, Menin et al. (2008), reported that 70.7% of the samples UI exhibited a light yellow color.

The scent of urine, although a very subjective proof, can be used as an indicative of UTI (ALBERTON et al., 2000), since around 60% of the time there is this relationship (ALBERTON; SOBESTIANSKY; DONIN, 2012). This work found six (13.95%) samples with ammoniacal odor, all of which presented UTI alterations. Menin et al. (2008) reported that from 66.04% of the samples with ammoniacal odor, 73.18% were positive for UI. Porto et al. (2003), reported a lower percentage with ammoniacal odor (28.6%), 43.8% of which were positive for UI.

Regarding the aspect, 17 (39.53%) urine samples were classified as clear, of which 16 (94.12%) did not present alterations for UI and one (5.88%) did so. Porto et al. (2003), in their studies, reported 37.1% of the samples classified as clear, similar to the result found in this study, but only 42.1% did not present UI, a value lower than the one found in this study. Twenty-six (60.46%) samples were considered cloudy, 14 (53.85%) with no changes for UI, and 12 (46.15%) with changes related to this infection. Of the samples with UI, 94.12% presented a cloudy aspect due to the increase amount of sediments, a picture compatible with UI. Garcia-Navarro (2005) reported that the urine of any animal species can become cloudy by precipitation of salts eventually present on it. Alberton et al. (2000) observed that clouding might

Table 1. Parameters of the physical examination of urine with the respective number of animals (parentheses) of 43 pregnant sows from the municipality of Guapimirim-RJ

Odor	*Suis generis* (37)	Ammoniacal (6)		
Aspect	Clear (16)	Cloudy (27)		
Density	Up to 1008 (17)	1008 -1012 (7)	Above 1012 (19)	
Color	Brownish (1)	Light yellow (26)	Dark yellow (14)	Colorless (2)

be affected by leaving the sample in the refrigerator or when the room temperature is low.

No relationship was observed between urinary density and UTI, the same result found by Merlini et al. (2013). In general, the average density was 1014, not differing between sows with or without infection. There is a relationship between daily water intake and urine density of the first morning urination. The sows that ingest more water produce more urine, thus decreasing the density (ALBERTON; SOBESTIANSKY; DONIN, 2012).

The results regarding the chemical parameters of urine are found in Table 2.

Regarding the pH of the 43 examined urine samples there was no relation with the presence of UI, in accordance with the findings of Merlini et al. (2013). In this work the pH ranged from 5.0 to 9.0 whereas Menin et al. (2008) reported in their studies a range of 5.5 to 7.5 and Piassa et al. (2015) an average pH of 6.37.

In 66.6% of the animals with UI, the urinary pH was neutral to alkaline. It was observed that 33.3% of animals with UTI presented an acid pH, indicating that the urine pH may vary regardless of UTI. When compared to animals that did not present changes for the UI, 38.7% presented a pH neutral to alkaline and 61.3% an acid pH. Although the urine may be alkaline in UI, several studies in Brazil have not detected a difference in the pH of sows with or without UI (ALBERTON; SOBESTIANSKY; DONIN, 2012)

No animal presented alterations regarding the glucose, ketone, and urobilinogen levels, likewise in the study of Merlini et al. (2013).

Three (7%) animals presented nitrituria, all of them with UI. Other three (7%) animals exhibited blood in the sample and all of them had an increase of red blood cells in the sediment. Merlini et al. (2013) recorded in their studies with pregnant sows a positive correlation between the presence of blood and nitrite in the urine.

Of the animals with UI, five (41.66%) showed proteinuria, which can be explained by the increase in the number scaling cells and pyocytes in the urine and by the inflammatory process, characterizing a post-renal proteinuria. Alberton; Sobestiansky; Donin (2012) report that the animals with proteinuria should be considered suspicious since there is a close relationship with UI.

The results regarding the sedimentoscopy parameters of urine are found in Table 3.

Table 2. Biochemical parameters with the respective number of animals (parentheses) of 43 pregnant sows from the municipality of Guapimirim-RJ

Glucose	Neg (43)						
ketone	Neg (43)						
Urobilinogen	Neg (43)						
Bilirubin	+ (1)	Neg (42)					
Nitrite	+ (2)	+++ (1)	Neg (40)				
Protein	+ (4)	Neg (36)	Traces (3)				
Blood	+ (1)	++ (1)	Neg (40)	Traces (1)			
pH	5.0 (5)	5.5 (1)	6.0 (16)	6.5 (1)	7.0 (15)	8.0(4)	9.0 (1)

Neg=Negative

Table 3. Parameters of urine sedimentoscopy of 43 pregnant sows with the respective number of animals (parentheses), from the municipality of Guapimirim-RJ, results per field of 400 times

Cylinders	Mucous filament	Red blood cell	Crystals	Epithelial Cells	Pyocytes
Absent (41)	Absent (33)	Rare (16)	Absent (19)	Rare (9)	Rare (5)
Hyaline (2)	Present (10)	0 a 2 (5)	CO e AU (6)	Countless (1)	Absent (1)
		2 a 4 (10)	CO, AU e TP (2)	0 a 2 (5)	0 a 2 (6)
		4 a 6 (8)	CO (8)	2 a 4 (14)	2 a 4 (12)
		6 a 8 (2)	TP (3)	4 a 6 (5)	4 a 6 (5)
		8 a 10 (1)	AP (1)	6 a 8 (4)	6 a 8 (7)
		10 a 12 (1)	AU (4)	> de 8 (3)	8 a 10 (1)
				10 a 12 (2)	> de 10 (6)

calcium oxalate (CO), amorphous urates (AU), amorphous phosphates (AP), triple phosphate (TP)

Among the 43 samples, 19 (44.18%) presented crystalluria, and 10 (32.26%) did not present UI changes, so this condition can be present both in females with UI or without any alterations. Of the 12 animals with UI, nine (75%) presented crystalluria, of which 44.44% with calcium oxalate crystals or triple phosphate, 33.33% with amorphous urates, and 11.11% with amorphous phosphates. The types of crystals found were similar to those reported by Lorenzett et al. (2019) in a case of urolithiasis in breeders.

Of the 20 (46.5%) animals that presented pH between 7.0 and 9.0 and of the 23 (53.5%) with a pH between 5.0 and 6.0, 65% and 47.8%, respectively, presented crystalluria. Similarly, Perestrelo; Perestrelo (1988), observed a higher frequency of crystals in alkaline urines. However, in this work no relationship was observed between the presence of crystals and UI. Bellino et al. (2013) reported in their studies that there is not always an association between crystalluria and tissue lesions, making it not decisive in the detection of urinary infection.

It was observed that 23.25% of the samples presented a mucous filament, and 50% of them were from animals with UI. Moura et al. (2018) reported that 70% of the sows that had vulvar discharge presented urinary infection. The presence of this filament may be due to an inflammatory condition, not only of the urinary tract but also of the genital tract. According to Bordin et al. (2012), vulvar discharge is one of the most evident symptoms, being directly related to urinary infections.

CONCLUSION

The level of prevalence of urinary infection was considered severe. The urinalysis is the best way to diagnose UI, with sedimentoscopy being the most conclusive part. Despite this, it is necessary to relate the laboratory data to the zootechnic management used, as well as environmental conditions.

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