Journal of Veterinary Science and Public Health

J. Vet. Sc. Public Health, v. 9, n. 1, p. 032-043, 2022

OCCURRENCE OF INTESTINAL PROTOZOAN IN SOWS AND THEIR LITTER IN AN INTENSIVE FARM

OCORRÊNCIA DE PROTOZOÁRIO INTESTINAL EM PORCAS E LEITÕES EM UMA GRANJA INTENSIVA

Ricardo Babinski Bregonde[1], Vinicius Dahm[1], Ana Paula Monlinari Candeias[1], Laura Zanella de Souza[1], Camila Aparecida Luiz[1], Nelson Luis Mello Fernandes[1], Sílvia Cristina Osaki[1*]

1. Universidade Federal do Paraná
*Corresponding author: silvia_cristinao@yahoo.com.br
DOI: 10.4025/revcivet.v9i1.57052

RESUMO

Distúrbios gastrointestinais em suínos são um dos maiores problemas enfrentados pelos suinocultores modernos. A produção intensiva aliada ao uso indevido de agentes antiparasitários e a limpeza e desinfecção incorreta das instalações favorecem a infecção dos animais. Diversos patógenos podem ser responsáveis por causar distúrbios gastrointestinais em suínos, sendo os coccídios em especial os responsáveis pelo desenvolvimento da diarreia em leitões, o que compromete diretamente o seu desenvolvimento e gera custos adicionais à cadeia produtiva. No entanto, poucas pesquisas sobre a prevalência desses parasitas em suinoculturas intensivas foram realizadas. Portanto, neste estudo, objetivou-se avaliar a ocorrência de parasitoses intestinais em porcas e leitões em uma granja intensiva de suínos no município de Palotina no Paraná, Brasil. No total, 94 amostras de fezes (41 porcas e 53 filhotes) foram coletadas em três maternidades e analisadas pelas técnicas coproparasitológicas de Willis-Mollay e Sheather. De todas as amostras analisadas, 10,64% foram positivas para pelo menos um protozoário (10/94), assim distribuídos: 10% (2/10) identificados como *Cystoisospora suis* (oocistos com dois esporocistos e quatro esporozoítos), 1% (1 /10) identificados como cistos de *Giardia* spp., e os 70% restantes (7/10) identificados como protozoários (oocistos não esporulados). Os resultados permitiram verificar que os parasitas intestinais ainda estavam presentes nas maternidades das pocilgas intensivas. Portanto, a vigilância constante da eficácia dos tratamentos antiparasitários aplicados aos animais deve ser realizada para evitar gastos desnecessários decorrentes do manejo ineficiente dos animais.

Palavras-Chave: Enteroparasitas; Produção animal; Suinocultura

ABSTRACT

Gastrointestinal disorders in pigs are one of the biggest problems faced by modern pig farmers. Intensive production together with the misuse of antiparasitic agents and the incorrect cleaning and disinfection of facilities favor the infection of animals. Several pathogens can be responsible for causing gastrointestinal disorders in pigs, with coccidia in particular being responsible for the development of diarrhea in piglets, which directly compromises their development and generates additional costs to the production chain. However, not much research on the prevalence of these parasites in intensive piggeries has been carried out. Therefore, in this study, we aimed to evaluate the occurrence of intestinal parasites in sows and piglets in an intensive pig farm in the municipality of Palotina in Paraná, Brazil. In total, 94 stool samples (41 sow and 53 litter samples) were collected in three maternity rooms and analyzed using the coproparasitological techniques of Willis-Mollay and Sheather. Of all the samples analyzed, 10.64% were positive for at least one protozoan (10/94), distributed as follows: 10% (2/10) identified as *Cystoisospora suis* (oocysts with two sporocysts and four sporozoites), 1% (1/10) identified as cysts of *Giardia* spp., and the remainder 70% (7/10) identified as protozoa (non-sporulated oocysts). The results allowed us to verify that intestinal parasites were still present in the maternity facilities of intensive piggeries. Therefore, constant surveillance of the effectiveness of the antiparasitic treatments applied to the animals must be carried out to avoid unnecessary expenses resulting from inefficient animal handling.
Key words: Enteroparasites; Animal production; Pig farming

INTRODUCTION

Brazil is the fourth largest producer of pork in the world, with 3,983 million tons produced in 2019 according to a report by the Brazilian Association of Animal Protein (2020). Moreover, it is one of the countries with the highest numbers of pig herds and farming and slaughter facilities (NISHI et al., 2000), many of which are concentrated in the southern regions, especially in the states of Santa Catarina, Paraná, and Rio Grande do Sul. The state of Paraná was responsible for approximately 19.85% of all slaughterhouse outputs in Brazil, being second only to the state of Santa Catarina (ABPA, 2020).

Gastrointestinal disorders in pigs result in the greatest economic losses in the swine production chain, with numerous infectious pathogens being responsible for the triggering of these disorders (BLV, 2016; ZIMMERMAN et al., 2012). In this context, disorders of a parasitic origin are of great importance. However, this research area is often neglected and lacks recent study findings, especially with respect to the prevalence and epidemiology of intestinal parasites in livestock in Brazil (d'ALENCAR et al., 2006),

with few studies carried out, such as the one performed by de Oliveira et al. (2019), who analyzed 43 producing units of piglets and found 8.27% of samples positive for coccidia. Therefore, we aimed in this study to determine the occurrence of intestinal protozoan in sows and their litter reared at the maternity facilities of an intensive pig farm in the municipality of Palotina, Paraná, Brazil.

METHODS

Ethical Statement

This study was approved by the Ethics Committee on the Use of Animals at the Universidade Federal do Paraná (Protocol number: CEUA-Palotina 25/2017).

Study Location

The municipality of Palotina (24° 17′ 0″ S, 53° 50′ 0″ W), which is located in the western region of the state of Paraná, had an estimated population of 31,846 inhabitants in 2019, as estimated by the Brazilian Institute of Geography and Statistics. The Köppen climate classification for Palotina is Cfa, meaning that it has no defined dry season but a humid subtropical climate with hot and rainy summers (IAT, 2020).

The farm from which the study samples were collected is located in the rural region of the municipality (Figure 1). Because it carries out intensive farming of pigs intended for breeding and meat production, it has the facilities for sow insemination and individual gestation of the animals (i.e., cages and maternity rooms) and a nursery for the weaned piglets.

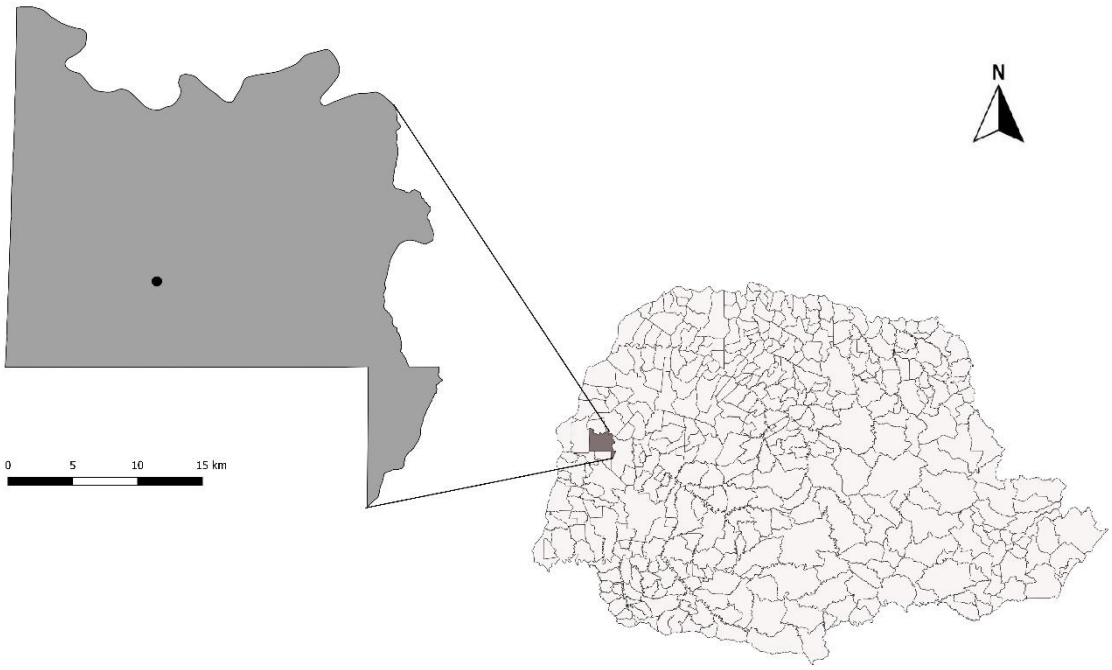

Figure 1: State of Paraná showing the municipality of Palotina. The black dot indicates the location of the pig farm. Source: Research data. Geoprocessing performed with QGIS versions 2.14 and 3.18.

For sample collection, three maternity rooms were chosen, each containing 20 cages. The mothers were housed in the rooms for approximately three to five days before the piglets were born and remained in the cages until the piglets were weaned, which usually occurred 21 days after farrowing. The animals were handled with an "all-in/all-out" system. After weaning, the rooms were disinfected and sanitized by using a water jet to spray a 1:40 mix of the Noval® X Car product in cold water and the Farmasept® Plus disinfectant over the surfaces. The antiparasitic management of the females with ivermectin was carried out twice a year, lasting one week each time.

In the maternity rooms, the animals were held in cast iron installations with floors of the iron grid/plastic grid type. The cages were suspended from the ground, with a ditch below for waste deposition and disposal. Each cage had a feeder and a drinker for the sows, which were also shared by their litter. Environmental acclimatization was achieved through the use of fans and a water dripping system applied through ducts positioned above the sows. The ceiling was covered with plastic canvas, and the side walls had movable curtains that allowed natural ventilation.

The animals were kept in confinement and fed three times a day with bran (a corn and soy bran mix) supplemented with minerals and vitamins. To conceal the animals during the farrowing and weaning periods, wooden walls and floors were attached to the

cages, with openings on the side and top for removal of the piglets when necessary. Heating was provided from clear halogen lamps.

Sample Collection and Processing

The sows of this study were of DanBred breed. Sample collection took place in September 2018. Fecal samples were collected directly from the rectal ampulla of 41 randomly distributed sows in the three maternity rooms chosen for the study. Additionally, 53 fecal samples from the weaning litter were collected from the floor of the cages. The litter feces were characterized according to the following criteria: small, whitish, or yellowish feces of firm, pasty, or diarrheal consistencies, deposited in the corners of the cages. If there was more than one piglet sample per cage, all of the samples were collected and pooled for study. Of the 41 sows chosen for sample collection, 37 had samples taken from their respective litters.

All samples were stored in screw-cap bottles, identified, packed, and refrigerated until the time of analysis, which occurred within 48 hours after collection. The samples were analyzed for the presence of coccoidia using the coproparasitological techniques of Willis-Mollay (WILLIS, 1921) and Sheather (SHEATHER, 1923).

Statistical Analysis

The study results and data from the epidemiological questionnaire were analyzed using the EpiInfo program (version 7.2.0.1). The chi-square test for a 2 × 2 contingency table and Yates correction were performed to assess the main risk factors related to protozoan in swine.

RESULTS

Of the 94 (41 sow and 53 litter) samples analyzed, 10 (10.64%) were positive for at least one protozoan, seven of which were identified with the Willis-Mollay technique (7/10 or 70%) and three with the Sheather technique. None of the evaluated samples tested positive through more than one technique. Of these 10 samples, three were from sows, corresponding to 7.32% (3/41) of the total number of sows evaluated, and seven were from piglets, corresponding to 13.21% (7/53) of the total number of litter samples analyzed.

The parasites found in the 10 positive samples were coccidium oocysts, with two (2/10 or 20%) identified as *Cystoisospora suis* (oocysts with two sporocysts and four

trophozoites) and one cyst identified as *Giardia* spp. (1/10 or 10%). The remaining seven samples could not be species identified, but they were identified as protozoan. Of these results, there was only one case of which both the sow and her litter were positive for coccidium oocysts.

To determine whether there was a correlation between the stool consistency and presence of the parasite, chi-square tests were carried using a 2 × 2 contingency table. The results showed there was a statistically significant difference between the protozoan-positive and -negative samples in terms of stools with a diarrheal consistency ($p = 0.013$). By contrast, there were no statistically significant differences between the coccidium-positive and -negative samples in terms of stools with a pasty or firm consistency.

In the statistical analysis, stool samples with a diarrheal consistency showed a statistically significant difference ($p = 0.013$). However, feces with a pasty or firm consistency showed no statistically significant differences.

DISCUSSION

The results of this study allowed us to infer the efficacy of antiparasitic management as well as the hygiene and sanitation of the environment at local pig farms. However efficient such management may be, it was still possible to verify the persistence of parasitic infection in some animals.

The findings in the present study do not corroborate those of Nishi et al. (2000), who studied intestinal parasites in pigs from 14 properties located in the states of São Paulo and Minas Gerais and found a higher prevalence of coccidia (22.8%) in the analyzed samples. This difference may be related to the location of the study, since the studies were carried out in different regions, and may have particularities, such as different climates. In addition, Nishi et al. (2000) determined the presence of *Ascaris suum* and eggs of the superfamily Strongyloidea, not found in the present study, demonstrating once again the difference between the locations where the studies were conducted. Antiparasitic management was probably not related to the difference in relation to helminths, since the properties in both studies used ivermectin for the management of parasitic infestations.

The absence of helminth eggs in the swine feces analyzed by the present study may be due to the antiparasitic management performed with Ivermectin, which has shown good results for the control of gastrointestinal nematodes in swine (IDIKA et al., 2017). Although the study by Nishi et al. (2000) find these parasites even with the use of

ivermectin, the occurrence found by them is low, and the presence can be explained due to the presence of resistance to the antiparasitic in the properties studied by them. Ivermectin, which was developed in the 1980s, belongs to the macrocyclic lactone group of antiparasitics and has the ability to act on both ectoparasites and endoparasites of adult, immature, and larval forms. The drugs of the macrocyclic lactone group act by opening the glutamate-gated chlorine channels in nerve and muscle cells, which blocks the transmission of neuronal signals, leading to various consequences, such as deleterious paralysis, the suppression of reproductive behaviors, and death from starvation (MELO, 2001; COELHO, 2009).

Ivermectin, however, has no negative effect on the population of gastrointestinal coccidia (NORTHOVER et al., 2017), which can be observed in the present study by the presence, although low, of oocysts in the analyzed stools.

Cystoisospora suis is responsible for causing yellowish to grayish, fetid, pasty diarrhea, mainly in piglets in the weaning phase (LINDSAY et al., 1985; MEYER et al., 1999; SOBESTIANSKY et al., 1998). Sows do not seem to be the main source of infection to their piglets, as they eliminate oocysts in the feces only rarely and even then in small quantities only (LINHARES et al., 2012; SOTIRAKI et al., 2008). This was corroborated in the present study, where none of the sows tested had eliminated oocysts of *C. suis*. Piglet infection usually occurs through infective oocyst-containing feces from previous litters that had persisted in the environment after the hygiene and disinfection processes (SOBESTIANSKY et al., 1998).

In a study of the prevalence of endoparasites in Swiss pigs, Schubnell et al. (2016) found an 8.8% (11/125) prevalence of *C. suis*, 68% of which were confirmed with gastrointestinal disorders. Their results also do not corroborate those found in the present study. The difference may be related mainly to the health status of the animals; that is, their pigs mostly had gastroenteric disorders, which may have favored the diagnosis of the protozoan in question, whereas our study used animals with and without gastroenteric disorders.

With regard to the zoonotic profile, only the genus *Giardia* has the capacity to infect humans, with *Giardia duodenalis* (synonymous with *Giardia lamblia* and *Giardia intestinalis*) being the most important. This protozoan, which is usually transmitted through contaminated water, leads to self-limited disease, weight loss, malabsorption syndrome, and diarrhea in humans. In developing countries, infected patients are usually asymptomatic (HELLARD et al., 2000; THOMPSON, 2000).

G. duodenalis has been classified through molecular biology into eight assemblages (A-H). Studies indicate that probably only A and B can affect humans and animals (HEYWORTH, 2016). Both assemblages with zoonotic potential have already been reported in swine (ARMSON et al., 2009; FARZAN et al., 2011). Although the present study did not carry out the molecular identification of these assemblies, the risk of contamination between animals and humans may exist.

Liu et al. (2019) studied the prevalence of *Giardia duodenalis* in pigs in Shanghai, China, finding a rate of 26.88%. Their much higher rate is likely due to the diagnostic methodology employed; namely, nested PCR, which is the most sensitive technique for the diagnosis of *Giardia* spp. infections. Other factors for the difference in prevalence between our and their studies may be the location and differences in the means of pig production. In Brazil, in a study by Barbosa et al. (2015), the presence of *Giardia* spp cysts was observed only in pigs raised in a semi-intensive system, demonstrating that the property of the present study requires improvements in sanitary management, as it may be possible to control this parasitosis in a intensive swine breeding system.

CONCLUSION

The animals had a low rate of protozoan infection. Piglets were more affected than sows.

There was a statistically significant difference between the protozoan-positive and -negative samples in terms of stools with a diarrheal consistency.

There were no statistically significant differences between the coccidium-positive and -negative samples in terms of stools with a pasty or firm consistency.

Ethical approval: This study is following the Ethical Principles of Animal Experimentation and was approved by the Ethics Committee on the Use of Animals at the Federal University of Paraná-Setor Palotina, with protocol number 25/2017.

Funding Information:
Federal University of Paraná for scientific initiation scholarships

REFERENCES

ABPA, **Associação Brasileira de Proteína Animal. Relatório Anual**

2020 – Carne Suína. Disponível em: http://abpa-br.org/wp-content/uploads/2020/05/abpa_relatorio_anual_2020_portugues_web.pdf. Acesso em 14 jul. 2020.

ARMSON, A.; YANG, R.; THOMPSON, J.; JOHNSON, J.; REID, S.; RYAN, U.M. *Giardia* genotypes in pigs in Western Australia: Prevalence and association with diarrhea. **Experimental Parasitology**. v.121, p.381–383, 2009. <DOI: 10.1016/j.exppara.2009.01.008>.

BARBOSA, A.S.; BASTOS, O.M.P.; DIB, L. V.; DE SIQUEIRA, M.P.; CARDOZO, M.L.; FERREIRA, L.C.; CHAVES, W.T.; FONSECA, A.B.M.; UCHOA, C.M.A.; AMENDOEIRA, M.R.R. Gastrointestinal parasites of swine raised in different management systems in the State of Rio de Janeiro, Brazil. **Pesquisa Veterinária Brasileira**. v.35, p.941–946, 2015. <DOI: 10.1590/s0100-736x2015001200001>.

BLV, **Projekt PathoPig**. 2016 https://www.blv.admin.ch/blv/de/home/tiere/tiergesundheit/frueherkennung/pathopig.html.

COELHO, A.C.W. **Anthelmintic resistance in goats in Mossoró-RN**. 2009. 57 f. Dissertação (Mestrado em Sanidade e Produção Animal) - Universidade Federal Rural do Semi-Árido, Mossoró.

d'ALENCAR, A.S.; FAUSTINO, M.A.G.; SOUSA, D.P.; de LIMA, M.M; ALVES, L.C. Infecção por helmintos e coccídios em criação de suínos de sistema confinado localizada no município de Camaragibe-PE. **Ciência Veterinária nos Trópicos**, v.9, p.79-86, 2006.

FARZAN, A.; PARRINGTON, L.; COKLIN, T.; COOK, A.; PINTAR, K.; POLLARI, F.; FRIENDSHIP, R.; FARBER, J.; DIXON, B. Detection and characterization of *Giardia duodenalis* and *Cryptosporidium* spp. on swine farms in Ontario, Canada. **Foodborne Pathogens and Disease**. v.8, p.1207–1213, 2011. <DOI: 10.1089/fpd.2011.0907>.

HELLARD, M.E.; SINCLAIR, M.I.; HOGG, G.G.; FAIRLEY, C.K. Prevalence of enteric pathogens among community based asymptomatic individuals. **Journal of Gastroenterology and Hepatology**, v.15, p.290–293, 2000. <DOI: 10.1046/j.1440-1746.2000.02089.x>.

HEYWORTH, M.F. *Giardia duodenalis* genetic assemblages and hosts. **Parasite** v.23. p.1-5, 2016. <DOI: 10.1051/parasite/2016013>.

IDIKA, I.K.; NWAUZOIJE, H.C.; UJU, C.N.; UGWUOKE, C.;

EZEOKONKWO, R.C. Efficacy of ivermectin against gastrointestinal nematodes of pig in Nsukka area of Enugu State, Nigeria. **Veterinary Parasitology: Regional Studies and Reports,** v. 10, p.39–42, 2017. <DOI: 10.1016/j.vprsr.2017.07.006>.

Instituto Água e Terra (IAT). Plano de Manejo - Parque Estadual de São Camilo - Análise da Região da Unidade de Conservação [Online]. 2006 [citado 2020 Nov 01]. Available from: http://www.iat.pr.gov.br/Pagina/Plano-de-Manejo-Parque-Estadual-de-Sao-Camilo#

LINDSAY, D.S.; CURRENTM W.L.; TAYLOR, J.R. Effects of experimentally induced *Isospora suis* infection on morbidity, mortality, and weight gains in nursing pigs. **American Journal of Veterinary Research**, v.46, p.1511–1512, 1985.

LINHARES, G.F.C.; SOBESTIANSKY, J.; LINHARES, D.; BARCELLOS, D.;

MORENO, A.M.; MATOS, M.P.C. Endoparasitoses. In: SOBESTIANSKY, J; BARCELLOS, D. **Doenças dos Suínos**. 2.ed. Goiânia: Cânone Editorial, 2012. Cap.6, p.433-466.

LIU, H.; XU, N.; YIN, J.; YUAN, Z.; SHEN, Y.; CAO, J. Prevalence and multilocus genotyping of potentially zoonotic *Giardia duodenalis* in pigs in Shangai, China. **Parasitology**, v.146, p.1199-1205, 2019. <DOI: 10.1017/S0031182019000349>.

MELO, C.F.L.A. **Resistência a anti-helmínticos em nematódeos gastrintestinais de ovinos e caprinos na região do baixo e médio Jaguaribe**. 54f. 2001. Dissertação (Mestrado em Ciências Veterinárias) – Departamento de Ciências Animais, Universidade Estadual do Ceará, Fortaleza.

MEYER, C.; JOACHIM, A.; DAUGSCHIES, A. Occurrence of *Isospora suis* in larger piglet production units and on specialized piglet rearing farms. **Veterinary Parasitology**, v.82, p.277–284, 1999. <DOI: 10.1016/S0304-4017(99)00027-8>.

NISHI, S.M.; GENNARI, S.M.; LISBOA, M.N.T.S.; SILVESTRIM, A.; CAPROANI Jr, L.; UMEHARA, O. Parasitas Intestinais em Suínos Confinados nos Estados de São Paulo e Minas Gerais. **Arquivos do Instituto Biológico**, v.67, p.199-203, 2000.

NORTHOVER, A.S.; GODFREY, S.S.; LYMBERY, A.J.; MORRIS, K.; WAYNE, A.F.; THOMPSON, R.C.A. Evaluating the Effects of Ivermectin Treatment on Commu-nities of Gastrointestinal Parasites in Translocated Woylies (*Bettongia*

penicillata). **EcoHealth**, v.14, p. 117-127, 2017. <DOI: 10.1007/s10393-015-1088-2>.

de OLIVEIRA, N.T.E.; CARVALHO, P.L.O.; GENOVA, J.L.; SILVEIRA, F.H.R.; OGAWA, L.; CRISTOFORI, E.C.; CAXIAS JUNIOR, O.A.; SANTANA, A.L.A. Effect of endoparasites occurrence in sows from intensive production system. **Rev. Bras. Parasitol. Vet,** v. 28 (4). Oct-dec 2019, <DOI: 10.1590/S1984-29612019091>

SCHUBNELL, F.; VON AH, S.; GRAAGE, R.; SYDLER, T.; SIDLER, X.; HADORN, D.; BASSO, W. Occurrence, clinical involvement and zoonotic potential of endoparasites infecting Swiss pigs. **Parasitology International**, v.65, p.618-624, 2016. <DOI: 10.1016/j.parint.2016.09.005>.

SHEATHER, A.L. The detection of intestinal protozoa and mange parasites by a floatation technique. **Journal of Comparative Pathology and Therapeutics**, v.36, p.266-275, 1923. <DOI: 10.1016/S0368-1742(23)80052-2>.

SOBESTIANSKY, J.; WENTZ, I.; SILVEIRA, P.R.S.; SESTI, L.A.C. **Suinocultura intensiva: produção, manejo e saúde do rebanho**. 1.ed. Brasília**:** EMBRAPA-SPI, 1998. 388p.

SOTIRAKI, S.; ROEPSTORFF, A.; NIELSEN, J.P.; MADDOX-HYTTEL, C.; ENOE C.; BOES, J.; MURRELL, K.D.; THAMSBORG, S.M. Population dynamics and intra-litter transmission patterns of Isospora suis in suckling under on-farm conditions. **Parasitology**, v.135, p.395-405, 2008. <DOI: 10.1017/S0031182007003952>.

THOMPSON, R.C. Giardiasis as a re-emerging infectious disease and its zoonotic potential. **International Journal for Parasitology**, v.30, p.1259–1267, 2000. <DOI: 10.1016/s0020-7519(00)00127-2>.

WILLIS, H.H. A simple levitation method for the detection of hookworm ova. **Medical Journal of Austrália**, v.8, p.375-376, 1921. <DOI: 10.5694/j.1326-5377.1921.tb60654.x>.

ZIMMERMAN, J.F.; KARRIKER, L.A.; RAMIREZ, A.; SCHWARTZ, K.J.; STEVENSON, G.W. **Diseases of Swine**. 10.ed. West Sussex: Wiley-Blackwell, 2012. 1012p.