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SWINE DYSENTERY: PRACTICAL OBSERVATIONS, CONTROL AND DIAGNOSTICS

Prodanov-Radulović J. [*]*, Došen R., Stojanov I., Polaček V., Milanov D., Pušić I., Marčić D.*

Scientific Veterinary Institute „Novi Sad", Rumenački put 20, 21000 Novi Sad
[*]Corresponding author: jasna.prodanov@gmail.com

Abstract

Swine dysentery is a severe mucohemorrhagic enteric disease of pigs which has a large impact on pig production, with important losses caused by mortality and suboptimal performance. The causative agent is *Brachyspirahyodysenteriae*. The aim of the paper was to evaluate all the available data on *B. hyodysenteriae* presence on swine farms in Vojvodina region. The material for this research included five swine farms, where certain disorders and health problems in weaned, grower and fattening pigs were detected. Depending on the specificity of each evaluated case and available material, the applied research methods included: anamnestical and clinical evaluation, gross pathological examination, standard bacteriological testing for detection of the presence of aerobic and anaerobic bacteria in the tissue samples derived from diseased and/or died pigs. Besides this, in some cases the molecular diagnostic method (RT-PCR) was included. Swine dysentery is a common and important endemic problem in many swine farms in Vojvodina. On endemically infected swine farms transmission mainly occurs by ingestion of infected faeces. All the observed factors affecting disease persistence and transmission on the farm are thoroughly analysed and discussed. Finally, current prophylactic and therapeutic approaches to fight against disease are described.

Key words: *control, diagnostics, swine dysentery*

Introduction

Swine Dysentery (SD) is a severe mucohemorrhagic enteric disease of pigs which has a large impact on pig production, with important losses caused by mortality and suboptimal performance (Alvarez-Ordóňez et al., 2013). The causative agent is *Brachyspirahyodysenteriae,* a gram negative, motile, anaerobic bacterium which belongs to the *Brachyspiraceae* family, phylum *Spirochaetes* (Hampson, 2012) and naturally infects pigs (including feral pigs) and occasionally some other species (Jacobson et al., 2004). On infected farms it has been isolated from mice, rats, dogs and feral birds (Alvarez-Ordóňez et al., 2013). The disease primarily affects pigs during the growth and finishing periods, but it may also occur in adults and occasionally in suckling pigs (Hampson, 2012). Clinical signs may vary in range, from mild mucous diarrhea with unaltered general condition to severe hemorhagic diarrhea with a mortality rate of 50-60% (Alvarez-Ordóňez et al., 2013). The disease is primarily transmitted by ingestion of faecal material either from clinically affected pigs or from clinically normal pigs that carry *B. hyodysenteriae* (Novotna and Škardova, 2002).

Swine dysentery is a relatively common endemic problem in many countries in the European Union, South America and Southeast Asia (Hampson, 2012).The incidence varies in different countries and regions and changes with time. Variations in prevalence can be due to the use of different diagnostic methods or to differences among countries in housing management and feeding regimens (Novotna and Škardova, 2002). In many countries the prevalence may be concealed by the use of antimicrobials as feed additives, in others the ban of antibiotics as growth promoters may have resulted in an increase in SD prevalence (Alvarez-Ordóňez et al., 2013; Pringle et al., 2012).

The aim of the paper is to summarize the available data on *B. hyodysenteriae* presence on swine farms in Vojvodina region. The factors affecting disease transmission are thoroughly discussed (husbandry factors - production system, production stage, farm management). Finally, current prophylactic and therapeutic approaches to fight this disease are described.

Materials and methods

The material for this research derived from five swine farms, where certain disorders and health problems in different swine categories (weaners, growers and fattening pigs) were detected. Depending on the specificity of each evaluated case and available material, the applied research methods included: anamnestical and clinical evaluation, gross pathological examination, standard bacteriological testing to detect the presence of aerobic and anaerobic bacteria in the organs and tissue samples (spleen, liver, kidney, lung, mesenterial and mediastinal lympho nodes) derived from diseased and/or died pigs. In one case, the microbiological feed testing, in order to examine the presence of fungi and mycotoxins by the method of thin layer chromatography, was included. Besides this, the molecular diagnostic methods, real time reverse transcriptase-polymerase chain reaction (RT-PCR) for detection of *Mycoplasma hyopneumoniae* (Strait et al., 2008) and a multiplex RT-PCR for detection of *Brachyspira hyodysenteriae* (DNA extracted from faeces) (La et al., 2006) were applied.

Results and discussion

In the first examined farm, by anamnestical evaluation, health problems in weaners and finishers were discovered: loss of weight, insufficient weight gain and dehydration. Clinically, at the end of the weaning period, the bloody diarrhoea in most of weaned piglets was detected. In some cases, the diarrhoea was greyish black, with blood and mucus flecks. Perineal staining was also present. Analysing the existing data on the farm, the high incidence of morbidity and mortality in weaners was noticed. Therapeutic treatment of piglets only temporarily improved health problems. In addition, a reappearance of SD often occurs after removal of antimicrobials from the water or feed. Clinically, in the finishers, the prominent signs of bronchopneumonia (dyspnea, cough and purulent nasal discharge, fever) and intermittently bloody diarrhoea have been registrated lately. By applying gross pathological examination on dead weaners and finishers, the prominent changes on the digestive tract (*Gastroenteritis haemorrhagica, Typhlocolitis haemorrhagica, Ulcus oesophagogastricum*) and respiratory tract (*Pleuritis adhaesiva diffusa, Pneumonia fibriosa in statu hepatisationis rubrae et griseae*) were detected. By bacteriological testing from the tissue samples derived from the dead fatteners, *Escherichia coli haemolytica* and *Actinobacillus suis* were isolated. By applying RT-PCR method on the faecal samples derived from weaners and finishers, *B. Hyodysenteriae* was detected. By applying real time RT-PCR method on the lung tissue derived from dead finishers, *M. hyopneumoniae* was detected.

Swine dysentery occurs mainly in grower and finisher pigs, and less frequently in weaners. It is often seen a few weeks after animals are moved from the nursery, coinciding with a dietary change and removal of antimicrobials used to control respiratory and enteric diseases (Alvarez-Ordóňez et al., 2013). The first evidence of SD is usually soft, yellow to gray faeces. A few days after infection, large amounts of mucus and often flecks of blood are found in the faeces. This progresses to watery stools containing blood, mucus, and shreds of white mucofibrinous exudate (Hampson, 2012). Where antibiotic medication is routine, any cause of loss of appetite (such as pneumonia) stops the intake of antibiotics and the animal may then succumb to SD (Novotna and Škardova, 2002). Outbreaks of SD are often associated with stressful conditions such as crowding, transportation or dietary changes and composition of the diet (Hampson, 2012).The pig diet has been proposed as one of the most important factors that can influence spirochaete colonization and the occurrence of mucohemorrhagic diarrhea (Jacobson et al., 2004). The intestinal tract of pigs is densely populated with bacteria and the intestinal microbiota has important influence on animal health and growth performance (Hampson, 2012). Leser et al. (2000) indicated that the pig intestinal microbial ecosystem responds fast and dynamically to perturbations such as dietary changes or infection with intestinal pathogens.

In the second evaluated swine farm, the feed from a different source was introduced in weaners-growers production stage. After that, the problem of high morbidity and mortality in weaned pigs was detected. Clinically, in the weaners and growers, a weaker food intake and bloody diarrhea associated with pronounced apathy and decumbency was observed. By applying gross pathological examination of dead weaners and growers the prominent changes on the digestive tract (*Gastroenteritis haemorrhagica, Enteritis colibacillosa, Typhlocolitis haemorrhagica)* were detected. Pigs with clinical dysentery had gross lesions, compatible with SD in the large intestine (Jacobson et al., 2004). A predominant gross change in most pigs was moderately to markedly increased mucous secretion and superficial necrotic foci with pseudo membranes. By bacteriological testing from the tissue samples deriving from dead pigs the following bacteria were isolated: *Escherichia coli haemolytica, Clostridium perfringens*. By applying RT-PCR method on the faecal samples derived from weaners and growers, *B. Hyodysenteriae* was detected.

The clinical and gross pathology findings suggested the possibility that change in the feed components influences the health condition of examined swine farms. It is well known that on endemically infected swine farms, clinical signs often occur after change in feed composition (Hampson, 2012).The influence of diet composition on the appearance of SD might be mainly related to the digestibility of their ingredients, which, in turn may have effect on the composition and equilibrium of the large intestine microbiota (Jacobson et al., 2004). The composition of the microbiota is relevant because *B. hyodysenteriae* executes its pathogenic action in association with other anaerobic members of the large intestinal microbiota (Alvarez-Ordóňez et al., 2013).

On the third examined swine farm, the health problems in finishers were connected with the recent purchasing of breeding animals from 3 different sources. Clinically, the bloody diarrhoea was continually present in finishers, especially in the first 10-15 days in fattening phase. Diarrhea was also detected after moving to new pens and mixing with different animals. At the same time, breeding animals (sows, boars) were only occasionaly affected. Therapeutic treatment of finishers by oral and parenteral antibiotics application only temporarily improved health condition. Applying gross pathological examination on the dead finishers, typical changes SD were found: swollen colonic mucosa, with loss of typical rugose appearance, covered by mucus and fibrin, with flecks of blood. In some animals lesions become more chronic i.e. mucosal surface was covered by a thin, dense, fibrinous exudate. However, lesions were found also in clinically healthy pigs as reddened areas of the colonic mucosa, covered with mucus, but with normal colonic contents. By applying RT-PCR method on the faecal samples derived from breeding animals and finishers, *B. Hyodysenteriae* was detected.

Biosecurity aspects are important for the prevention of infective disease transmission. New outbreaks of SD usually occur following introduction of asymptomatic carrier pigs that are not quarantined and/or treated prophylactically (Alvarez-Ordóňez et al., 2013). Introduction of new stock is the greatest risk, so a reliable history of the source herd is essential. Purchased animals should be quarantined for at least 3 weeks, and treated to eliminate *B. hyodysenteriae* (Hampson, 2012). Oubreaks of SD can also occur in herds following introduction of contaminated feed, tracks, or by visitors who have had contact with infected pigs. Asymptomatic pigs may develop diarrhea following stressful management procedures, such as moving to new pens, mixture of animals from different origin, inadequate stocking densities or changes in feed (Alvarez-Ordóňez et al., 2013).

On the fourth examined swine farm, the health problems in fattening stage in the last 7 days were noticed. Clinically, pigs became depressed, manifested clinical signs of apathy and inappetence. Also, decreased interest for food was recorded with the signs of respiratory disease (cough) and bloody diarrhoea. The clinical signs were noticed after some changes in feed components, i.e. the new source of corn and barley was introduced. By applying gross pathological examination on dead fatteners the prominent changes on the digestive tract indicative for SD (diffuse mucohemorrhagic typhlocolitis) were observed. With an aim to exclude alimentary intoxication, the laboratory feed testing was applied. The presence of mycotoxin (Ochratoxin A) in sunflower pellets (0.1mg/kg) and in the barley (0.02mg/kg) was discovered.

It may be supposed that as a consequence of immunosuppresive action of mycotoxins (Kabak et al., 2006), clinical and gross pathological lesions that correspond to SD occurred on the examined farm. The gastrointestinal tract represents the first barrier against ingested food contaminants and natural toxins. Stability of the intestinal flora appears to be an important factor for animal health. Thus an impaired balance of the intestinal microbiome could have many adverse effects on the health of the host. However, data on the influence of toxins on the intestinal microflora are still limited (Greinier et al., 2013). The biggest challenge with mycotoxicoses is the non-specific nature of symptoms in the affected animals (Kabak et al., 2006). Consequently, the health disorders due to mycotoxins in the feed are difficult to diagnose (Prodanov-Radulović et al, 2011).

On the last examined swine farm, certain irregularities in the implementation of all-in/all-out system were found. Analysing the existing data on the farm, it was concluded that the basic health problem and the high mortality in growers and fatteners is a consequence of respiratory diseases and SD. Clinically, mucohemorrhagic diarrhoea occurs dominantly in the growers and sporadically in fattening pigs. Despite the fact that the growers and fatteners were therapeutically treated, there was no evident response to applied medication. Besides this, in the fatteners the canibalism and signs of respiratory disease were detected. The main problem on the farm is the existing production technology: at the same time there are always 5 different age groups of pigs situated in the same object. Despite separated pigs with the clinical signs of SD, the animals faeces can be easily carried out by workers boots through the corridors and stables. By applying gross pathological examination on the dead fatteners the prominent changes on the digestive tract

(*Gastroenteritis haemorrhagica, Typhlocolitis haemorrhagica*) and respiratory tract (*Pleuropneumonia, Pneumonia fibriosa in statu hepatisationis rubrae et griseae, Pericarditis fibrinosa*) were detected. By applying RT-PCR method on the fecal samples derived from weaners and finishers, *B. Hyodysenteriae* was detected. By applying real time RT-PCR method on the lung tissue derived from dead finishers, *M. hyopneumoniae* was detected.

Brachyspira hyodysenteriae is shed in faeces for variable periods of time. On endemically infected swine farms transmission mainly occurs by ingestion of infected faeces (Jacobson et al., 2004). Transmission between pens may occur in housing systems where there are open channels between pens (Hampson, 2012). All-in/all-out management with cleaning and desinfection between batches reduces the risk of reinfection of medicated pigs and limits spread of SD infection (Alvarez-Ordóňez et al., 2013). Ideally, affected batches of pigs should be moved to clean buildings after medication to break the cycle of infection. Careful disposal of infected bedding, the use of boot scrubbers and desinfectant foothbaths, cleaning and desinfection of equipment used in infected areas, and changing of protective clothing are vital measures (Hampson, 2012). To a great extent, the production system is a decisive factor in the control and prevention of SD. In farrow-to-finish herds, the pathogen can persist in endemic infected sows, which have overcome the infection and developed protective immunity but still shed the pathogen in their faeces. The proximity of facilities and continuous flow of animals in this sort of production system will facilitate the transmission of infection to non-infected animals. Depending on the herd immune status and measures taken to control the disease, animals will be more or less severely affected and the disease will affect principally pigs at the growing or finishing period when the medication used to control respiratory infections is removed, favoring the expression of SD (Alvarez-Ordóňez et al., 2013).

The treatment and control of SD are based mainly on the use of antimicrobials, as no commercial vaccine against *B. hyodysenteriae* is available (Hidalgo et al., 2011). Antimicrobial agents such as pleuromutilins, macrolides and lincosamides are used in the control of SD (Novotna and Škardova, 2002). However, decreased susceptibility to tiamulin among *B. hyodysenteriae* isolates has been reported in several countries. Such isolates have been detected in many pig-producing countries, for example in Spain and Czech Republic, and they represent a serious threat to the pig industry (Hidalgo et al., 2011). Continuous treatment with antibiotics in herds with SD over extended periods of time is the probable explanation to the situation of resistance reported (Pringle et al., 2010).

In Serbia, many herds are preventively or curatively treated against SD. When started with treatment, it is advised to treat the whole group in the stable. Parenteral injection of, for example, tiamulin, tylosin and lincomycin can be used. Besides this, water/feed medication is given for in-contacts (e.g. tiamulin or valnemulin). However, development of resistance to antimicrobial agents is an increasing threat to the treatment options (Novotna and Škardova, 2002). Depending on the herd structure, the production system, and economical considerations, SD eradication can be performed in several ways. These vary from intensive medication of all pigs for a short period to introduction of medicated early weaning and multisite production, through an ongoing program performed by emptying and desinfection of each herd unit in a cycle, and introducing medicated animals to cleaned and disinfected units (Hampson, 2012).

The recommendation for biosecurity plan includes some basic principles for the prevention and control of SD, such as maintaining a closed herd with no contact with outside animals. In the case of new introductions, the farmer should isolate, test and treat incoming animals for SD. The measures should also include control of visitors and vehicles, and prevention of direct and indirect contact with other domestic species and wildlife. The producer should ensure that swine feed and water are free of contamination.When introducing new animals to the herd, attemps should be made to establish the following: the disease status of the resident herd and the farm of origin, the available diagnostic tests, prophylactic treatments and their efficacy. All principles mentioned above apply equally to intra-farm biosecurity. External security of building; all-in/all-out policies, cleaning and desinfection between houses, and treatment prior moving or mixing may be important in controlling the spread of SD between different ages, groups and houses where pigs are kept. Especially important is the existence of strategically placed, well-maintained effective disinfectant foot baths and cleaning equipment; washing facilities and separation of clean and dirty areas; separated way for carcass removal and appropriate facilities and protocols for slurry or manure collection and disposal.

Conclusion

In order to control SD in endemically infected swine herd, improved basic hygiene measures and use of strategic medication are necessary. Eradication by depopulation is the preffered method of control if practically and economically possible. Accordingly, the antimicrobial susceptibility testing of clinical isolates of *B. hyodysenteriae* has become essential in selecting SD treatment strategies. Moreover, a monitoring program may help to detect new resistance trends and to evaluate the usefulness of the available antimicrobials on a national level. Nowadays, a natural solution for prevention and treatment of SD could be the use of plant extracts. These include a natural product added to swine feed (it is not a medication) and can be used freely (no waiting period) in all production phases.

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