QUALITATIVE RISK ASSESSMENT OF ANIMAL MEAL
APPLIED TO SWINE PRODUCTION

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Abstract

There are gaps in the pig production chain, particularly as regards the possible destinations of dead animals on farms. The production of animal meal presents itself as an alternative for the recycling of biological waste. The objective of this study was realize a qualitative microbiological risk assessment on animal meal in order to provide subsidies to indicate possible hazards and risks associated with the use of meal produced from dead pigs on farms. The microorganism Salmonella was the main hazard reported. The scenario tree presented 15 scenarios for contamination and recontamination of animal meal. For the first scenario was defined release and exposure risk levels as moderate, was obtained as the risk level of the occurrence moderate. The risk level of the consequence determined as low together with the level of occurrence obtained previously resulted in the final risk level low. For the second scenario defined release risk level as high and the exposure risk level as moderate, we obtained as moderate risk level of occurrence. The risk level of the consequence determined as high related to the level of occurrence previously obtained resulted in the final risk level high. From the information and scenarios considered, it was not possible to indicate the production of animal meal as a probable destination for dead animals on pig farms.

Introduction

The necessity for food in the world and the rapid growth of the human population has generated greater demand in the national and international markets. Brazil ranks fourth in exports and third in pork production, registering 3.643 million tons of pork in 2015 (ABPA, 2016). There are gaps in the pig production chain, particularly as regards the possible destinations of dead animals on farms. Production of animal meal presents as an alternative for the recycling of biological waste. The lack of technical and scientific information about animal meal produced from dead animals compromises decision making it necessary to analyze the processes to identify risks associated with the presence of hazards and consequences that could arise from the adoption of the process. The aim of this study was realize a qualitative microbiological risk assessment on animal meal in order to provide subsidies to indicate possible hazards and risks associated with the use of meal produced from dead pigs on farms.

Material and methods

In order to identify the biological hazards, it was firstly pointed out that relevant microorganisms to swine farming could survive in the animal meal production process, according to methodology by OIE (2010). From this information, a systematic review protocol was initiated according to Bucher et al. (2012) considering the animal meal contamination. Different studies attributed the higher microbiological risk to the stage
following the end of industrialization process (mainly regarding the risk of recontamination). From this information, a systematic review was conducted to determine which microorganisms could be recontaminated from animal meal after cooling.

The effectiveness of animal meal production in preparation of a microbiologically acceptable end product was considered in the risk assessment. Thereby, the risk of contamination and recontamination would be subsequent to industrialization. The risk assessment was structured considering the following steps: I) Release assessment, where the stages responsible for contamination of the animal meal were indicated; II) Exposure assessment, analyzing presence of microorganisms in the animal meal from the recontamination (considering factors that contribute to spread hazard such as inactivation, survival, prevalence and incidence in the Brazilian herd; III) Consequence assessment, checking presence of hazard in animal meal may generate health and economic problems for both public health and animal health (represented by the percentage of associated mortality, zoonotic potential of the disease and level of economic impact generated by the occurrence in the country); IV) Risk estimation, considering the risk levels from previous evaluations (stages I and II) to determine risk levels of the possible scenarios using the risk and maturity matrices, since for each of the two scenarios evaluated were level of risk (insignificant, very low, low, moderate and high).

A scenario tree was constructed with aim of identifying critical points of contamination and animal meal contamination. From the scenarios found, we chose to evaluate the worst and the intermediate scenarios to verify the risk involved in steps considered.

**Results and discussion**

The microorganism *Salmonella* was considered the main contaminant of both raw materials and products and by-products used in animal feed, followed by mycotoxins (Ochratoxin, Fumonisin and Aflatoxin) present in grains and cereals used as a basis for diets (Kosicki et al., 2016). Other microorganisms mentioned in the studies were *Clostridium* and *Listeria*, capable of contaminating grains and environment because they are ubiquitous (Maciorowski et al., 2007). *Salmonella* was the only microorganism with records in scientific articles that evaluated animal meal therefore it was considered the main microbiological hazard.

The possibility of introduction was reported from absence of this microorganism in industrialization process (up to the digester). In the following steps such as handling, packaging, storage and transport of animal meal at room temperature, there were risks of contamination and recontamination by microorganisms that were distributed in the industry environment. It is important to consider that these studies were carried out in greases that used as raw material by-products generated from slaughtering under inspection of animal products (federal, state or municipal) (Larsen et al., 2014; Maciorowski et al., 2007; Melo et al., 2011; Moura et al., 2014; Pellegrini et al., 2015). In the European Union, Larsen et al. (2014) reported a decrease in the presence of *Salmonella* from 0.7% to 0.5% in the diet and from 2.9% to 0.6% in meat and bone meal between 2002 and 2010. Albuquerque et al. (1999) when evaluating raw materials, grease surfaces and final product found eight positive samples in bone meal (61.53%), three in meat meal (50%) and one in blood meal (33.33%), demonstrating the importance of *Salmonella* in the animal meal production cycle and its capacity to
contaminate and recontaminate products. According to the systematic review, the process of animal meal production performed adequately presents a low risk of contamination and recontamination by *Salmonella*. However, recontamination may generate several scenarios for introducing the microorganism into animal meal, since this bacterium may be present in any equipment, especially in the subsequent stages to digester (silos and transporters) due to dust and presence of biofilms (Vestby et al., 2009).

The scenario tree presented 15 possible scenarios of contamination and recontamination of animal meal, so, it was decided to analyze two scenarios. The first scenario (intermediary) considered to use as raw material the by-products from the slaughter destined to production of animal meal, being contamination by *Salmonella* spp. from transport vehicle due to lack of cleaning and hygiene. The final product would be used as fertilizer (Figure 1). Defining release and exposure risk levels as moderate, we obtained as the risk level of the occurrence moderate. The risk level of the consequence determined as low together with the level of occurrence obtained previously resulted in the final risk level low.

![Figure 1. The first scenario (intermediary) of contamination and recontamination of animal meal.](image)

Second scenario (worst) considered to use as raw material the by-products from the slaughter destined to the production of animal meal, being the recontamination by *Salmonella* spp. would occur by biofilms presence in silos due to the high contamination of industry environment and lack of adequate cleaning. *Salmonella* would spread by the property with low prevalence from use of animal meal in animal feed (Figure 2). Defining release risk level as high and the exposure risk level as moderate, we obtained as moderate risk level of occurrence. The risk level of the consequence determined as high related to the level of occurrence previously obtained resulted in the final risk level high.

![Figure 2. The second scenario (worst) of contamination and recontamination of animal meal.](image)
Conclusion

Salmonella was the main hazard reported. The scenario tree presented 15 scenarios for contamination and recontamination of the animal meal. If the industrialization process were adequate, considering time/temperature, the risk of contamination would be insignificant. The presence of contamination in equipment due to presence of dust and biofilms may contribute to the recontamination of the sterilized meal. The storage place and poor hygiene of the vehicles also contribute. The first scenario (intermediary) considered to use as raw material the by-products from the slaughter destined to production of animal meal, being contamination by Salmonella spp. from transport vehicle due to lack of cleaning and hygiene. The final product would be used as fertilizer. When setting the release and exposure risk levels both as moderate and the risk level of the consequence as low, the final risk level is obtained as low.

The second scenario (worst) considered to use as raw material the by-products from the slaughter destined to the production of animal meal, Salmonella spp. recontamination in industry environment (by biofilms presence and dust) and the use of animal meal in animal feed. Defining release risk level as high and exposure as moderate, the level of the occurrence was moderate. This level allied to the high consequence risk level resulted in the high end risk level. From the information and scenarios considered, it was not possible to indicate the production of animal meal as a probable destination for dead animals on pig farms.

References


