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Pigs to Pork

NUTRITION

Cooperative Extension Service PURDUE UNIVERSITY Lafayette, Indiana

Stomach Ulcers in Swine

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Summary

The incidence of gastric ulcers in swine appears to have increased from almost nothing to a suspected high of 20 per cent within the past 5 to 7 years. Three years of research at Purdue University has given the following results concerning swine ulcers.

(1) The use of gelatinized corn increases the incidence of ulcers.

(2) Apparently, it is the starch portion of the corn kernel which, when it is gelatinized and fed to hogs, results in swine gastric ulcers.

(3) Grinding the feed for hogs too finely is a predisposing factor responsible for starting gastric ulcers and related lesions.

(4) Gelatinization of milo has an effect similar to that for gelatinizing corn. However, the effect is much less for barley and wheat.

(5) The incorporation of as little as 30 per cent oats into the ration appears to offer some protection against the ulcer lesions. It appears that a material contained in the hull of the oat is the part of the oat grain which protects against the ulcerous effect.

(6) No tested feed additive has given protection against the onset of swine gastric ulcers. Some 20 additives including antibiotics, tranquilizers, vitamins and amino acids have been tested.

(7) An interesting observation has been made about the stomach contents of swine which have ulcers. The contents are greatly diluted with water, but the pH or acid base balance is not altered.

(8) The condition is observed more often in barrows than in gilts. Also, the condition appears to be heritable, to a certain degree, because it has occurred more often in some lines than in others.

(9) Heat stress increases the incidence of gastric ulcers.

Introduction

Ulcers of the digestive tract have been found to occur in many species of animals. Some of these occur in the small intestine while others occur in the stomach. When an ulcer occurs, it is presumed the body has failed in some unknown aspect to protect the intestine or stomach linings against the corrosive nature of the digestive juices which it secretes.

In swine there are 2 types of stomach ulcers: one which attacks the glandular area of the stomach and is called a peptic ulcer and one which attacks the non-glandular esophageal area of stomach and is called esophagogastric ulcer, or gastric ulcer.

The gastric ulcer is the more commonly found type in pigs today. Prior to 1951, the gastric type ulcer had not been reported, but today it has been estimated that over 20 per cent of all finishing pigs are affected.
The Significance of Gastric Ulcers

The scientific literature classifies gastric ulcers of swine into 3 degrees of severity. They are as follows: (1) the bleeding type ulcer which usually results in death within a few days, (2) a less severe type of ulcer which may persist throughout the life of the pig and result in generally poor performance, (3) the least severe type of ulcer which may actually heal and thus no outward symptoms can be seen. In the case of the two least severe types of ulcers, it might be hypothesized they create no real problem. This assumption is quite true in any current group of pigs. However, research with large numbers of pigs has shown a greater incidence of ulcers within certain lines of pigs, indicating heredity may be involved.

Purdue Research Facts

Gelatinized corn produces ulcers. Quite by accident, it was found that gelatinizing corn caused a marked increase in the number of gastric ulcers. Research was being conducted with gelatinized corn in creep rations for young pigs in an attempt to increase palatability, or acceptability of the ration. In less than one week after the start of the research, blood appeared in the droppings of several of the pigs and several died shortly thereafter. Postmortem examination of the stomachs of all pigs fed the gelatinized corn showed an incidence of over 50 per cent of ulcers. Since that time, some 25 feeding experiments have demonstrated that the use of gelatinized corn in the diet of pigs somehow predisposed the incidence of gastric ulcers.

Gelatinized corn is the result of heating corn under high pressure steam and then releasing the pressure rapidly. This results in an expansion and gelatinization of the corn.

Gelatinized starch portion of the corn is responsible. In order to identify the portion of the corn kernel which, when gelatinized, is responsible for the greatly increased incidence of gastric ulcers in pigs, corn was separated mechanically into starch, bran and germ portions. Each of these portions which had been gelatinized was re-combined with the other 2 portions in their raw form. For example, gelatinized bran was recombined with raw corn starch portion and with the raw germ portion. Similarly, gelatinized starch was recombined with raw bran and raw germ, and so forth. Each time the gelatinized starch portion of the corn kernel was included a marked increase in the incidence of gastric ulcers occurred. It is difficult to conceive why gelatinization of the starch portion would result in increased gastric ulcers in pigs, when it is fed to them.

Fine grinding increases gastric ulcers. One of the most important results that has come from the Purdue research is that the finer the ration is ground, the greater will be the incidence of gastric ulcers. This, too, is difficult to explain. In fact, there have been research results which indicated the grinding of swine rations extremely fine resulted in improved efficiency of feed conversion.

Gelatinized milo produces ulcers also. The effect of gelatinization of several grains on the incidence of gastric ulcers, when fed to swine, was studied. In addition to corn, barley, milo and wheat were compared in the raw and gelatinized forms in swine rations. The process of gelatinization tended to increase the predisposition of all tested grains compared to produce ulcers. However, the effect from gelatinization was much greater in the case of milo and corn than was true for the gelatinization of barley or wheat.

Oats in the ration offer protection. The incorporation of either 30 per cent or 70 per cent oats into a swine ration containing gelatinized corn resulted in very marked protection against the incidence of gastric ulcers and associated lesions. As it would be expected, the inclusion of 70 per cent oats resulted in a slight depression in rate of gain. No growth depression was observed by incorporating 30 per cent oats. In fact, pigs fed 30 per cent oats along with gelatinized corn gained more rapidly than those fed only gelatinized corn. Since the inclusion of oats decreased the ulcer lesions, it is logical to assume such pigs would gain
more rapidly than those fed only gelatinized corn which had more ulcer lesions.

Subsequent research demonstrated it was a small portion of the hull fraction of oats which was responsible for the protection against the ulcerous lesions associated with the feeding of gelatinized corn.

The feeding of either 30 per cent or 70 per cent raw wheat with gelatinized corn afforded no protection against the ulcers.

Several additives offered no protection. In the early stages of the research, several feed additives and accessory nutrients were studied to learn whether they might offer protection against ulcers for pigs fed gelatinized corn. None of the tested additives gave any protection. The additives studied included 20 grams of terramycin per ton of feed; 100 ppm of copper; 2000 I. U. of vitamin A per pound of ration; 20 I. U. of vitamin E (d, l, alpha tocopherol or tocopherol acetate) per pound; 0.5 milligrams menadione (vitamin K) per pound; 5000 I. U. of vitamin A per pound; 0.3 per cent added methionine; 10 per cent dried skim milk; 10 per cent solka-floc (cellulose); 6 times the National Research Council requirements for the B-vitamins, orally or injected daily; 100 milligrams vitamin C per pound; 100 milligrams vitamin C injected daily; 1.5 milligrams vitamin B-1 per pound; 50 micrograms of vitamin B-12 per pound; 0.5 per cent added lysine and 10 per cent fish meal.

Stomach contents are more fluid. Almost without exception, the stomach contents of pigs with ulcer lesions contained much more water and thus the contents were much more liquefied. Actually, no significance has been attached to this observation, but perhaps later research findings will attach logical significance to the condition. There was no measurable difference in pH (acid-base relationship) of the stomach contents between pigs with healthy stomachs and those with gastric ulcers.

Sex related and perhaps heritable. When barrows and gilts were fed together, there was a much higher incidence of gastric ulcers among barrows. Furthermore, where past history of the pigs was known, there seemed to be a degree of heritability since certain blood lines showed a larger number of pigs with gastric ulcers, consistently. Several breeds were compared and several sources of commercial pigs were utilized.

In a stress study, increasing the environmental temperature resulted in increased incidence of gastric ulcers. This work was conducted in environmental chambers where the temperature could be controlled.

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