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# The role of feed and feed processing in development of gastric ulcers

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Stomach lesions were proposed as a concern in commercial production of swine when Bullard (1951) documented esophagogastric ulcers as the cause of death in an adult boar. In the past 5 to 7 years, with the widespread use of European genotypes and modern grain processing techniques, stomach ulcers have emerged as a major health concern in U. S. swine operations.

Our experiences at Kansas State University indicate that, for each 100 micron decrease in average particle size of corn in swine diets, there is approximately a 1.3% increase in gain efficiency. However, the incidence of keratinization and/or ulceration also tend to increase in nursery pigs (Healy et al., 1994), growing-finishing pigs (Cabrera et al., 1994; Wondra et al., 1999b,c), and lactating sows (Wondra et al., 1995d,e) as particle size of the diet is reduced. Reimann et al. (1968), Maxwell et al. (1970, 1972), and Regina et al. (1999) reported that smaller particle sizes of cereal grain increased fluidity of stomach contents. Those authors hypothesized that the increased fluidity allowed more mixing of stomach contents; thus, pepsin and digestive acids were continuously in contact with the ulcer-prone mucosa of the esophageal region of the stomach. So, in the decision of how finely to grind cereals for use in diets for pigs, the economic benefits from increased growth efficiency versus the potential for increased incidence and/or severity of stomach lesions will be major considerations.

As for other feed processing technologies, in our lab we have generated a considerable volume of data to suggest that good quality pellets increase gain efficiency by about 6% compared to feeding the same diets in meal form. However, we also have noticed that pelleting tends to increase scores for keratinization and/or ulceration in pigs (Wondra et al., 1995b,c; Amornthewaphat et al., 1999). Thus, as with the decision of how finely to grind cereals in diets for pigs, the potential for greater incidence and/or severity of stomach lesions when pigs are fed pelleted diets will be an important consideration.

However, before we place all of the blame for development of stomach lesions in pigs on advanced feed manufacturing processes, it should be noted that the incidence and/or severity of lesions probably are affected by grain type and stressful housing/shipping conditions (Ricker et al., 1967; Pickett et al., 1969; Lawrence et al., 1998). Also,

the most significant factor in development of stomach ulcers was, perhaps, suggested by Berruecos and Robison (1972), when the heritability estimate for gastric lesions in pigs was estimated to be .52 (i.e., as highly heritable as many carcass characteristics). Yet, major changes in genetics and management practices to avoid difficulties with stomach lesions are at the least very expensive and cumbersome. So swine producers are constantly seeking alternative strategies that address this issue.

Ayles et al. (1996) suggested that occasionally to change (e.g., when pigs are moved or sorted) from fine-ground to coarse-ground and then back to fine-ground diets could be an effective measure to prevent ulcers in pigs while capturing most of the benefits in growth efficiency when fine grinding. Alternatively, Maxwell et al. (1970) observed that decreased pH in the stomach was associated with increased ulceration and Patience et al. (1986) reported that pH of the gastrointestinal tract was increased by adding buffers to the diet. Thus, it seems possible that alkaline salts (buffers) could help neutralize acidity in the stomach and improve morphology of the gastric mucosa. To investigate this possibility, we (Wondra et al., 1995a) fed pigs corn-soybean meal-based diets with 1% NaHCO<sub>3</sub> or 1% KHCO<sub>3</sub> and observed a mild reduction in scores for stomach lesions. Similar results were reported by Sorrell et al. (1996) where 1% NaHCO<sub>3</sub> in diets for finishing pigs decreased scores for stomach lesions in at least some groups of pigs. However, more research is needed to verify these results and to evaluate other anti-ulcer feed additives that might be more economical or more effective for use in the swine industry.

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