POLICY BRIEF

A FOOD SAFETY MOVE TO ELIMINATE IN-FEED ANTIBIOTICS INCREASES PIGLETS' SULFUR AMINO ACIDS REQUIREMENT

Key message.

- Use of sub-therapeutic levels of antibiotics as antimicrobial growth promoters in piglets feed can lead to drug resistance in human beings.
- Alternatives to use antibiotics as growth promoters include biofortification. Some of the nutrients that can be used are amino acids that serve both in promoting immunity and the growth of the piglets.
- The sulfur amino acids are used by pigs for growth and maintaining intestinal health. Their demand increases in times of an immune challenge.
- There is little research on amino acids requirement of piglets, specifically the sulfur amino acids, when fed with diets free of antibiotics.

Policy recommendations.

Increase the dietary sulfur amino acids content by at least 9% for piglets that are fed antimicrobial growth promoter free diets.

Farmers should be made aware in the importance of sulfur amino acids as an alternative to antimicrobial growth promoter.

The need for sulfur amino acid

Amino acids (**AA**) are organic compounds that have amine and carboxylic group. Amino Acids are also the simplest form after a protein digestion, therefore, what is absorbed by the body. Currently, the pig's AA requirements for body maintenance or production function such as, growth, milk production or gestation have been determined and are given [(1)]. Twenty amino acids are required to synthesize a protein and of these 20, methionine is the second limiting in cereal-based diets fed to pigs. Cystine is non-essential but would become a conditional essential in some situations like an immune challenge. Methionine and cystine contain sulfur in their structure, therefore, forming the dietary sulfur amino acids (**SAA**). The SAA requirements are often given as a ratio to lysine which is the first limiting amino acid.

Piglets fed diets containing antimicrobial growth promoters (AGP) have less intestinal bacterial mass, thinner intestinal wall and less mucin production compared to those without in-feed AGP.[(2)]

These AGP are subtherapeutic doses of antibiotic such as chlortetracycline and ionophores that are included in piglets' diet so as to reduce the chances of post weaning diarrhea and to boost their growth. However, long-term use of AGP has been linked to the potential problem of increasing transferable resistance of bacteria to antimicrobial drugs. Within the last decade, Europe has had pork production without use of dietary AGP and North America is facing voluntary withdrawals.

The dietary SAA is equally partitioned for growth and as a source of energy as well as use in synthesis body protective barrier against harmful bacteria. Feeding pigs AGP-free diets will increase need for intestinal protective barrier consequently more SAA would be allocated towards this purpose. Thus, to maintain similar growth to AGP-fed counterpart the pig would either increase feed intake or require increased dietary SAA content. The current SAA ratio to lysine for weaned piglets ranges between 54 to 57% [(Figure 1)]. These values were obtained from piglets that had AGP in their diets.

Figure: 1 The SAA: Lys % requirement for piglets fed AGP-fortified diets

REFERENCE	SAA: Lys%
National Research Council, 1998	57
Dean et al., 2007	54
Moehn et al., 2008	55
National Research Council, 2012	55

This policy shows how through nutritional intervention one can promote use of antibiotic free diets. A potentially important way is to increase the dietary SAA to levels exceeding recommendations that have been established.

A ban in use of antimicrobial growth promoters

The ban in the use of AGP in livestock started from Sweden in 1986 and was adopted by the European Union since January 2006. It has been noted that incidences of diseases like the post weaning diarrhea has been on the rise since the AGP ban[6].The PWD has been implicated with decreased performance that has a negative effect on time to market, consequently production cost.

A potentially important means to minimize the negative impact of immune system stimulation, due to disease, is the fortification of piglets` diets with nutrients at levels exceeding recommendations that have been established in pigs fed AGP. Thus, the requirement SAA that is needed for piglets health and production is likely to increase. Also, raising piglets commercially without AGP-fortified diets could increase exposure to incidences of immunological challenge and hence the need for more SAA.

Currently, the SAA requirements given by NRC[1] are from a collection of studies that included AGP in their diets. It is possible that the AA requirement for piglets under AGP-free feeding regime to be different from current recommendations.

Figure 2: Piglets eating

Sulfur Amino Acids for AGP-Free diets

Although dietary SAA of 55% is enough for AGP fed piglets, this content was not enough to promote similar growth under the AGP-free feeding[7].

Thus an increase to 60% was necessary, hence a 9% increase in SAA (Figure 4 and 5). The response was similar when intestinal morphology was used as a response criterion. The ratio of villus height to crypt depth improved with increasing dietary SAA (Figure 6).

This confirms that either for growth or support of intestinal health, the SAA requirement was higher for piglets on AGP-free diets. However, if the dietary sources of SAA are not sufficient to support body requirement, there will be increased muscle wasting leading to weight loss and health deterioration (Figure 3a).

Figure 3: Emaciated piglets versus healthy piglets

a) Emaciated piglets

b) Healthy piglets

Figure 4: Increasing SAA levels on growth

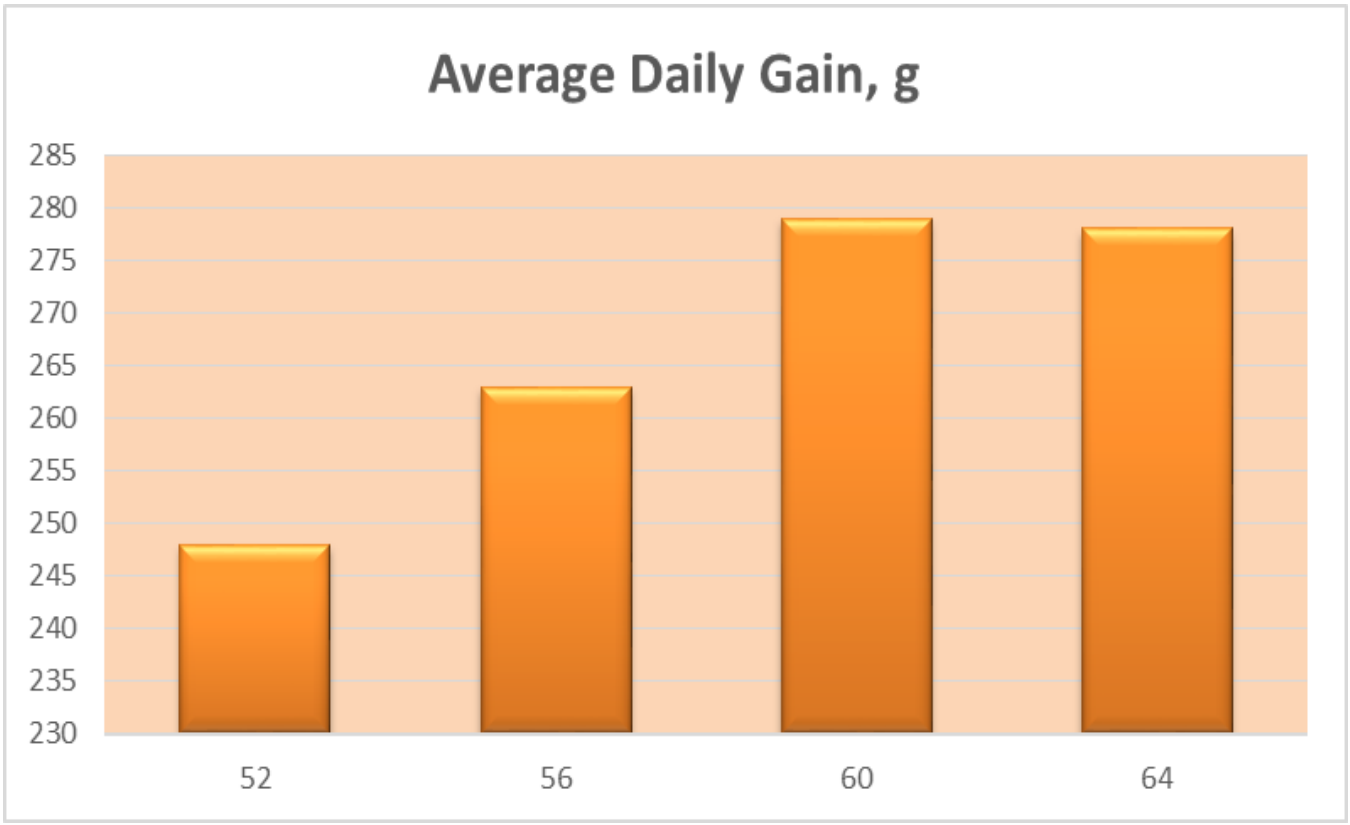


Figure 5: Increasing SAA levels on feed intake

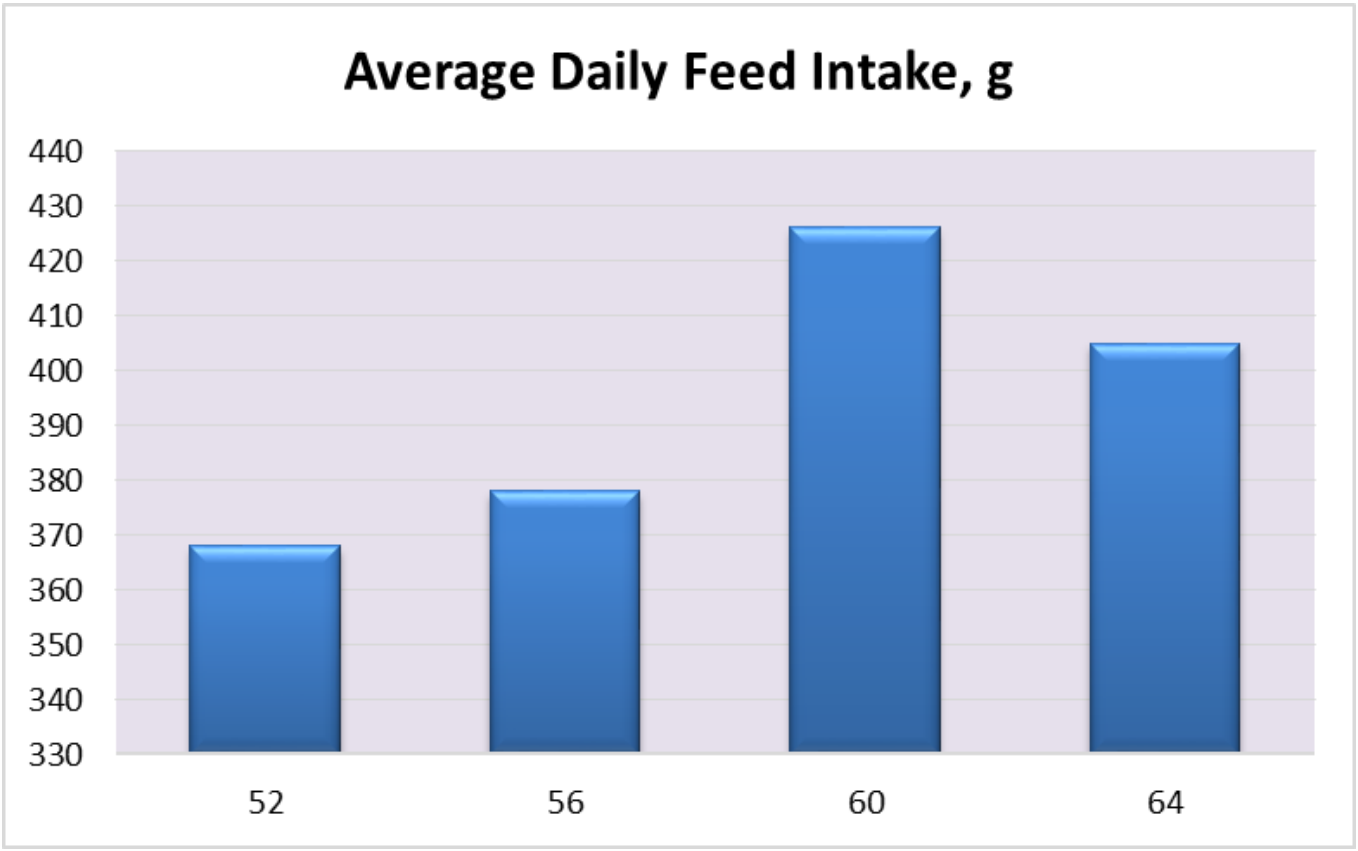
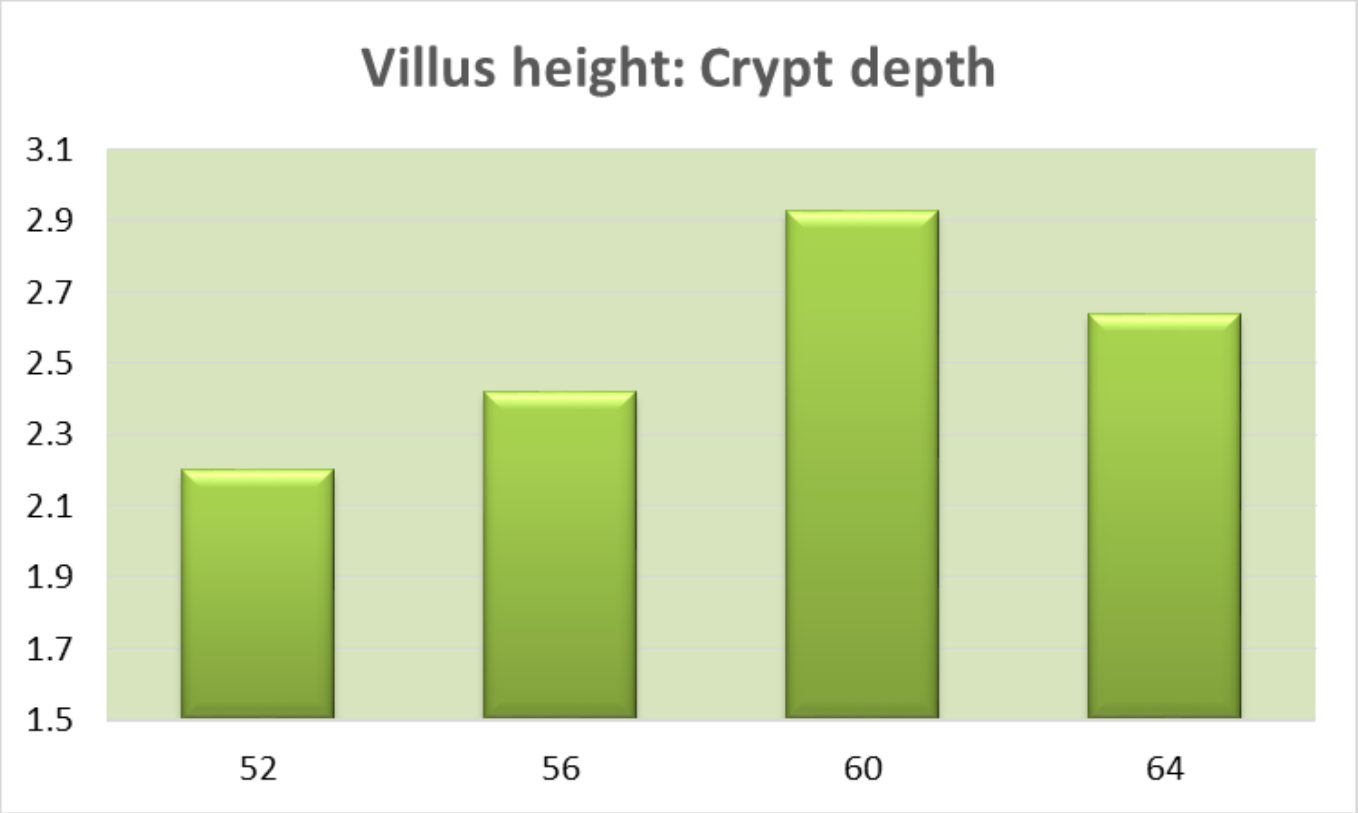


Figure 6: Increasing SAA levels on intestinal morphology



What are the consequences of low dietary sulfur amino acids?

1. Compromised gut health leading to diarrhea
2. Compromised immunity of piglets leading to increased cost due to treatment
3. Nutrient deficiency which causes growth retardation leading to increased time to market

Outcome of increased dietary sulfur amino acids

1. Attained growth rate similar to those fed AGP.
2. Minimize antibiotic resistance in pigs caused by use of sub-therapeutic or low levels of antibiotics in the diet.
3. No incidence of diarrhea or illness.
4. Reduced cost of production due to less feed cost and less time to market.

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