Feed Evaluation and Feed Intake

Ruurd T. Zijlstra[1] and Tom A. Scott[2]

[1]Prairie Swine Centre Inc., P.O. Box 21057, 2105 8th Street East, Saskatoon, SK S7H 5N9
[2]Pacific Agri-Food Research Centre, P.O. Box 1000, Agassiz, BC V0M 1A0
E-mail: ruurd@sask.usask.ca / scottta@EM.AGR.CA

▪ Introduction

Voluntary feed intake of pigs determines nutrient intake levels and thus has a great impact on efficiency of pork production. Adequate feed intake is hard to maintain on many farms and is then an important factor limiting productivity. Stressors, e.g. hot temperature, increased stocking density and reduced health status, together with genotype influence feed intake and thus growth. Furthermore, dietary factors, including energy density, deficiencies or excesses of nutrients, antibiotics, flavours, feed processing, and availability of water influence feed intake (NRC, 1998). In contrast to poultry, differences in intake of pigs fed different batches of ingredients have rarely been described.

The spectrum of factors that affect voluntary feed intake is very broad. The purpose of this paper is to highlight some of these factors, while in the workshop their importance in formulating diets for grower-finisher pigs will be addressed by using calculations for specific examples.

▪ Voluntary Feed Intake and Stressors

Various stressors influence voluntary feed intake in swine. Stressors can be grouped into environmental (temperature, humidity, air circulation, etc), social (space allocation, group size, re-grouping, etc.), and immunological (disease, pathogen concentration, etc.) factors.

The impact of ambient temperature on feed intake has been studied broadly. Cold temperatures increase feed intake, while hot temperatures reduce feed intake when compared to temperatures in the zone of thermal comfort (Revell and Williams, 1993). Effects of other environmental factors on feed intake are not as well defined, and are usually explained within the context of zone of

thermal comfort. Regarding social factors, space restriction reduces feed intake, although the response varies across studies. Mixing unfamiliar pigs reduces feed intake, whereas increased group size does not reduce feed intake consistently. Immunological stress or activation of the immune system results in reduced feed intake of grower-finisher pigs. The reduced feed intake of pigs exposed to space restriction or pathogens could not be overcome by increasing dietary lysine content (Brumm and Miller, 1996; Williams et al., 1997), indicating that the lysine requirement of socially- or immunologically-stressed pigs was lower because of a reduced protein deposition rate.

▪ Voluntary Feed Intake and Feed Evaluation

The current assumption is that dietary energy content mainly determines voluntary feed intake of grower-finisher pigs from 15 to 110 kg (NRC, 1998). Thus, as dietary DE content is reduced, pigs attempt to maintain energy intake by increasing intake of dry matter. However, even during 1960s when pigs were less lean and this assumption was developed, grower pigs had greater difficulty dealing with a reduced dietary energy content than finisher pigs (Owen and Ridgman, 1968), likely because gut-size is a limiting factor for grower but not finisher pigs. The emphasis on selection criteria for increased leanness or reduced backfat has reduced voluntary feed intake of some lines of pigs (Revell and Williams, 1993). Thus, some present-day grower pigs may have less ability to deal with feed of a lower than desired energy content. Within the overall management of voluntary feed intake, a correct prediction of dietary energy content is thus essential. The energy content of complete diets can be predicted reasonably accurately from chemical characteristics (Noblet and Perez, 1993). Apart from energy, controlling balances for specific nutrient groups (carbohydrates, fat, and protein) might influence voluntary feed intake as well (Revell and Williams, 1993). Finally, a few specific dietary nutrients, e.g., content of tryptophan relative to large neutral amino acids, are known to impact brain functions directly and thereby affect voluntary feed intake.

▪ Voluntary Feed Intake and Ingredient Evaluation

For pigs, information is limited about variation in voluntary feed intake among batches of ingredients. A palatability study with sorghum indicated that pigs preferred specific sorghum hybrids (Williams et al., 1993); however, relationships between preference and ingredient characteristics were not studied. Because dietary energy content affects feed intake, attention should be paid to the variation in DE content of ingredients. The DE content ranged by 16% for barley, 9% for wheat, and 18% for field peas (Fairbairn et al., 1999; Zijlstra et al., 1998 & 1999a). The range in DE content of barley could be predicted accurately with chemical characteristics or near infrared reflectance

spectroscopy (NIRS), but not with physical characteristics or available metabolisable energy (AME) content for poultry (Zijlstra et al., 1999b). Using the measured DE content of 11 field pea samples to re-formulate diets to an equal DE content resulted in similar voluntary feed intake of grower pigs for 10 out of 11 samples (Zijlstra and Patience, 1998). For wheat, inclusion of selected samples into diets for weaned pigs resulted in large differences in voluntary feed intake (R.G. Campbell, personal communication). Ingredient factors other than DE content might influence voluntary feed intake, for example increased water-holding capacity was linked to reduced feed intake (Kyriazakis and Emmans, 1995).

For poultry, a wealth of information is available describing differences in voluntary feed intake among batches of cereal grains. In the standard test to measure DE content in pigs, feed allowance is maintained at 2.5 to 3 times DE intake for maintenance. In contrast, a broiler chick bioassay was developed to measure voluntary feed intake together with AME content of ingredient samples (Scott et al., 1998a). Subsequently, differences in voluntary feed intake of up to 20% for wheat and up to 30% for barley have been described in diets fed to broiler chickens (Scott et al., 1998b). The observed differences in feed intake among ingredient samples were not related strongly to measured AME values. Moreover, voluntary feed intake was a better predictor for performance than AME content of ingredient samples, indicating that factors other than AME content determine voluntary feed intake of broiler chicks. Finally, the AME content of wheat and barley, voluntary feed intake and subsequent performance among ingredient batches could not be predicted accurately by chemical characteristics (Classen et al., 1995), but were highly predictable by NIRS (Swift et al., 1998ab). The factors that determine voluntary feed intake of broiler chicks might play an important role in swine nutrition as well, and should be considered to enable equivalent performance of grower-finisher pigs.

▪ Summary

Environmental, social, and immunological stressors affect voluntary intake of pigs. The DE content of feed appears to determine feed intake of grower-finisher pigs within limits. In poultry, factors other than dietary energy content predict feed intake and subsequent performance better.

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