Effects of a feeding strategy to increase intramuscular fat content of pork under the conditions of organic farming

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Abstract

In an ongoing study, the effect of the implementation of a specific feeding strategy using a high portion of home-grown grain legumes on the intramuscular fat (IMF) content of pork, is assessed under different conditions on organic farms in Germany and Austria. Preliminary results indicate that variation in the IMF content seems to be higher between farms than between treatments within each farm.

Introduction

Considering the various aspects, the issue of intrinsic and extrinsic pork quality is a very complex and multifactorial concept. It encompasses both objective carcass and organoleptic measures and subjective perceptions about the product and the production methods (Edwards and Casabianca 1997). Beside the various factors influencing the different quality traits and their potentially synergistic or antagonistic impacts, the variability within the traits aggravates reasonable and valid conclusions from the previous data available. It is commonly acknowledged that meat quality is a difficult characteristic to assess as many different aspects, both objective and subjective, make up the overall trait (Hofmann 1994). All the various characteristics of pork quality can not be assessed directly in each carcass because those measurements and assessments would be too expensive. Therefore, the previous scientific access for quality assessment of meat is primarily an indirect approach based on a few numbers of easily detectable quantitative traits and on the prescription of minimal standards in relation to the product in terms of size or composition and in relation to the production process. Specifications and exclusion criteria vary between countries or between label programs.

Consumers are interested in many aspects related to meat quality, such as appearance, freshness, taste, nutritional value and food safety. According to Andersen (2000), appearance often has become the customer`s single factor to evaluate the quality of pork. However, the IMF content is the prominent criterion for eating quality of pork. It has been defined among others as flavour carrier (Affentranger et al. 1996). The fat finely distributed in the muscle and recognizable in higher contents as marbling, makes it possible to differentiate between differently treated animals in relation to eating quality. Previous studies showed that the texture and the taste of pork was improved with an increased IMF level (Affentranger et al. 1996) while low-fat meat has shown to be almost taste-neutral. The authors concluded that the positive

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effect of increased IMF holds true as long as it is not associated with an increase in the level of visible intramuscular fat.

An increase in IMF level is associated with an increase in visual perception of fat and a corresponding decrease in the willingness of consumers to purchase the meat (Fernandez et al. 1999). Consumers also show a huge variability in their eating preference to non-visible IMF. In a hedonic test panel, nearly one third of the consumers behaved indifferently while the majority preferred the pork with the highest IMF (Sundrum and Acosta Aragon 2005).

The non-consideration of this trait and the unidirectional selection for lean meat resulted in IMF-contents in *M. longissimus dorsi (M.l.d.)* which on average are clearly below the desirable content of more than 2 % (Fernandez et al. 1999). Modern slaughter pigs currently show an average IMF content of only 1% (Köhler et al. 1999). Nutritional effects on intramuscular fat characteristics and IMF content are clearly greater than genetic effects (Sundrum and Acosta Aragon 2005, Cameron et al. 2000). Feeding is an important tool as many dietary components are readily transferred from the feed to the fat tissue. The fatty acid (Wood and Enser 1997) and vitamin composition (e.g. Vitamin E) in the diet (Buckley et al. 1995) have a direct influence on the quality of the meat. Pig producers primarily try to approach maximal rates of lean tissue deposition and carcass index values by means of providing diets formulated to meet the requirements in relation to the limiting amino acids. In the growing period, protein accretion increases as the supply of the limiting amino acid increases (Heger et al. 2002).

While in general farmers are striving to increase the IMF by breeding methods, investigations of Sundrum et al. (2000) showed that it is possible to achieve an IMF content higher than 2.5 % by feeding rations enriched with grain legumes such as lupines and faba beans.

Materials and methods

On farm research

In this study, a total number of 12 organic pork producers in Germany and Austria are involved. Following the concept of phase feeding, two dietary treatments, a control diet and an experimental diet are used simultaneously in the fattening period. On each farm separate pens are used in the same time period for the control and the experimental diet. On each farm one replicate is conducted.

Animals

Genotypes vary between the farms, but belong to those genotypes which are also used in conventional pig production.

Feeding strategy

In Germany all pigs in the experimental groups on the different farms receive the same diet. The single components for the experimental diet are stored and mixed immediately before the transfer to the farms. The feedstuff is packed into bags (20 kg) and is transported to the farms. Counting the bags enables to estimate the amount of feed used and thereby the feed conversion ratio. Each formulated mixture is analyzed by Near Infrared Spectroscopy (NIRS) and controlled regarding its crude protein and metabolizable energy content. The amino acid supply is separately determined by HPLC method.

The experimental diet, which is formulated in order to obtain a high IMF content in the pork, contains a high portion (> 40 %) of grain legumes (lupines and faba beans) in Germany, in Austria the rations contain 36 % of a mixture of peas and faba beans. The diet supplies restricted amounts of essential amino acids while at the same time increasing the supply with non-essential amino acids to values clearly above the requirement. The control diet represents the feeding strategy followed on the individual farm. The recording of growth performance data starts at the beginning of the finishing phase with about 70-80 kg and ends before slaughtering with about 115-120 kg live weight. Carcass parameters such as carcass weight (kg), carcass classification, lean meat content (%), fat and meat area (mm) and pH-content are assessed at the abattoir. Individual samples of *M.l.d.* of 10 pigs per treatment are taken from between the 13th and 14th rib and frozen at -20 °C before analysis. Afterwards the samples are analyzed for IMF content by NIRS. Furthermore feed intake and net feed conversion ratios are assessed.

Preliminary Results

The preliminary results show a huge variation in the IMF content of the *M.l.d.* of carcass between the farms. The variation seems to be higher between farms than between treatments within each farm. Source of variation is expected to be due to different live weights in the feeding groups, different feed intake and different feeding strategies such as *ad libitum* feeding or restricted feeding.

Furthermore feed intake of the experimental diet in groups fed *ad libitum* tended to be higher than in groups fed the control diet. The data pool of several farms is not yet completed and samples of *M.l.d.* are not tested in total until now.

Conclusions

A number of factors can affect pork quality. Particularly live weight at the beginning of the fattening period and the duration of intake of the relevant feedstuff have to be considered. In the ongoing study results are expected that provide answers in relation to the suitability of feed rations in order to increase the IMF content of pork under practical farm conditions. Based on the results, recommendations for the farmers will be elaborated on how to optimize pork quality in dependence of different farm conditions.

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