STUDY ON PRODUCTION OF SAFE PIG MEAT WITH HIGH QUALITY

1. Introduction

Antibiotic growth promoters have played a potent role in animal production in the past decades that enhanced feed efficiency, improved reproduction and reduced mortality and stunted rate. Long term use of in-feed antibiotics, however, resulted in the residual of antibiotics in animal products as led to develop drug resistance strains of pathogens. Therefore, several countries like EU, USA, Japan, Australia have banned several antibiotics use as growth promoters in animal feed. In Vietnam, on the other hand, antibiotics have been used widely at both therapeutic and sub-therapeutic doses and hence, drug residues and drug resistant bacteria become popular. As a result, antibiotic residues in animal products were found tens to thousands times higher the international standard (CODEX). In addition, common pathogens such as *E. coli, Salmonella, Staphylococcus, Streptococcus* have resisted to most common antibiotics such as penicillin, erythromycin, ampicillin, tetracycline, streptomycin. Furthermore, microbial contamination in carcass from slaughters and retailers was high. This is the cause of acute food poisoning. According to Hanh *et al* (1999), Thu *et al* (2000) and many others, 50% - 100% pig meat samples at slaughters and retailers did not meet Vietnam standard for micro-organism. At the moment, however, most investigators paid their attention only to take the picture of food contamination. The entire solution for producing safe meat form raising, slaughtering, distributing and processing is still neglected. The current study would cover these issues to produce safe food for consumers and improve public health.

2. Methodology

The study was conducted from January 2004 to February 2007 at animal feed and pig production enterprises, abattoirs, pig meat wholesalers and retailers in Hanoi and Ho chi Minh cities; Ha Tay, Bac Ninh, Hai Duong, Binh Duong, Dong Nai, Tay Ninh and Tien Giang provinces.

Feed, meat, digesta, and respiratory fluid samples were collected following Vietnamese standard. Antibiotic residues were analyzed using HPLC, hormone was determined by quick test (qualitative) and ELISA (quantitative). Microbial tests followed Vietnamese standard and AOAC.

CRD and RCBD were used in experimental designs. Data were analyzed for ANOVA using MINITAB, STAT GRAPHIC PLUS.

3. Results

3.1 Survey on production, slaughtering and distribution

The survey from 20 feed mills and 60 pig farms around Hanoi and Ho chi Minh cities showed that antibiotics were included in feed for disease prevention or treatment without basing on any regulation. Thus, drug resistance of pathogens and drug residues become more seriously. Antibiotic sensitivity test of samples from pig farms in Ho chi Minh city, Dong Nai and Binh Duong provinces showed that 50-100% of common pathogens resisted to common antibiotics such as chlotetracyclin, norfloxacin, gentamycin, streptomycin; and from 20 abattoirs, 10 wholesalers and 15 retailers from Hanoi and Ho chi Minh cities showed that microbial contamination levels rose from slaughterhouse to retailer and were much higher than Vietnamese standard, especially *E. coli* and *Salmonella*.

3.2 Solutions for producing safe pig meat

3.2.1 Before slaughter

a) Nutrition interventions

A series of six experiments were conducted with several interventions in nutrition for reducing the possibility of antibiotic residual in meat.

❶ Use of most common antibiotics (chlotetracycline, tiamulin, avilamycin) in pig feed and its residual in meat:

- Inclusion of chlotetracycline, tiamulin and avilamycin improved weight gain, and chlotetracycline and avilamycin improved feed efficiency compared to the control. This result coincided with those reported by Gustafson (1986), Ziv (1986), Langlois *et al* (1986) and Cromwell (1991).
- Tiamulin and avilamycin were found no residual regardless withdrawal time, while chlotetracyclin was found no residual after 5 days of withdrawal.

❷ Use of formic acids to replace antibiotic growth promoters in pig feed:

- Total aerobic bacteria tested in feed 3 and 7 days after inclusion of formic acid declined significantly compared to the control.
- Inclusion of 0.21% formic acid improved significantly weight gain, feed efficiency and days of diarrhoea compared to the control, which was similar to chlotetracyclin treatment. This result was slightly lower than that reported by Kirchgenner *et al*. (1997) and Paulicks *et al*. (1996).

❸ The efficiency of probiotic supplementation in pig ration:

- *E. coli* and *Salmonella* levels in faeces 1 and 7 days post-feeding experimental diets declined dramatically, while the level increased in the control. This result coincided with those reported by Fuller (1992), Kinh (1998), Saarela *et al*. (2000).
- Supplementation of probiotic 0.03-0.04% and chlotetracyclin 0.12% improved 1.82-3.03% gain, 2.13-2,14% feed efficiency, and reduced 0.88-1.91% feed cost per kg gained, 40.6-57.5% days of diarrhoea compared to the control. Similar results were reported by Kyriakis *et al*. (1999), Pho and Thuy (2003).

❹ Use of toxin binders for eliminating the effect of mycotoxin in pig feeds:

- Aflatoxin levels in feed 7 days post-adding mycosorb, mycofix and bentonite reduced by 37%, 35% and 23% as compared to the control, respectively.
- Weight gain in mycosorb and mycofix treatments improved by 1.63% as compared to the control, while showed no clear effect in bentonite supplementation.
- Days of diarrhoea in mycosorb, mycofix and bentonite treatments reduced by 24.3%, 30.4% and 25.6% as compared to the control, respectively. Viet *et al*. (2005) reported that bentonite and zeonite inclusion improved digestibility, while current study found no evidence of digestibility enhancement.

❺ Prevention of diarrhoea and respiratory diseases in pigs by using herbs:

Two preparations have been prepared from 17 herbs for prevention of diarrhoea (FR) and respiratory diseases (FH). FR had strong effect on *E. coli, Shigella dysenteriae, Vibrio cholerae, Salmonella,* while FH showed effect on bacterial respiratory diseases: *Staphylococcus aureus, Streptococcus* spp. The main active elements in FH are BMB5 (6-C-β-D-glucopyranosylapigenin) and BMB52 (7-(tetrahydro-3,4,5-trihydroxy-6-(hydroxymethyl)-2H-pyran-2-yl)-6-hydroxy-2-(4-hydroxyphenyl)-4H-chromen-4-one) which have strong effect on *E. coli*, *Streptococcus* and *Staphylococcus aureus.*

❻ Impact of herbal preparations in preventing diarrhoea and respiratory diseases in pigs:

- Supplementation of 0.2-0.4% FR in feed improved 3.3-4.2% weight gain, 3.2% feed efficiency and reduced 4.2% feed cost/kg gained.
- Supplementation of 0.5% FH and 0.2% tiamulin improved 1.66% and 1.96% gain, 4.1% and 5.1% feed efficiency, 2.1% and 3.1% feed cost/gain compared to the control, respectively.
- Combination of 0.3% FR and 0.5% FH improved 1.96% weight gain, reduced 21.4% days of diarrhoea compared to the control.

- Phyto-antibiotic residual study showed that no residue was found in meat, liver and kidney samples at 3, 5 and 7 days after withdrawal.

b. Environmental interventions

- The effect of stock density on performance was observed on 84 three ways crossed pigs with the initial weight of 26 kg. The result found that stock density for exotic crossed breed was 0.8 m^2/pig and 1.0m^2/pig for grower and finisher periods, respectively.
- The effect of modifying house to reduce ambient temperature on performance was conducted on 180 three and four way cross exotic pigs. Result showed that using isolation roof or fan improved gain by 5.87% and 3.46%, respectively.

3.2.2 Slaughtering and distribution intervention

- Manufacturing small scale slaughtering machine with capacity of 15-30 pigs/hour reduced the risk of micro-organism contamination.
- Using inox box for motorbike, pedicab and van during transportation of meat significantly reduced aerobic bacteria, *E. coli* and *Coliforms*. Furthermore, bacterial contamination levels reduced further when using ice underneath the box during transportation.

3.3 Developing pig husbandry and slaughtering to meet the requirement of safe meat production and conducting on-farm demonstration

The procedures include: safe feed production, bio-security husbandry, safe husbandry and slaughtering. The results then would be conducted on-farm demonstration which brought about good results in producing safe meat.

A total of 18 demonstration farms with different scales from 30 to 350 finished pigs/batch in Hanoi and Ho chi Minh city areas in 2005 and 2006 were conducted. A series of techniques was applied for producing safe pig meat and samples were collected for residual analysis. Pig performance was maintained or improved and no residue was found.

4. Conclusions

- A series of interventions in bio-security, nutrition, breeding and husbandry techniques should be applied in order to produce safe finished pigs prior to slaughter. It is possible for totally eliminating of antibiotic growth promoters, hormones in feed by replacement of organic acids, probiotics, enzymes, herb preparations that brought about good results of performance and production efficiency.

- Hanging frame, ceramic floor with sanitation, sterilisation of equipment, surface and water sanitation standard are necessary conditions to prevent microbial contamination during slaughter

- Using specialised chilling vehicles is the need to reduce microbial contamination during transportation. In case of using three-wheeled vehicle and van, the surface should be enclosed by inox, chilling with ice. In case of using pedicab and motorbike, inox box with lid and ice at bottom should be used.

- Meat should be preserved in inox box (chilling), table should be covered by inox sheet with smooth surface and easy to sanitation to assure carcass free from microbial contamination during distribution.

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