

Study on Wild Pork and Pigs in Thai Nguyen, Vietnam - and Pork Meat Export Criteria to Europe

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Abstract

Feeding wild pigs and managing wild pork meat quality is meaningful in Vietnam, esp. In Thai Nguyen province as pork products can offer variety of tastes due to food processing and suitable for Vietnamese tastes and can export to the world widely.

At present, most pig breeds are selected and raised in accordance with local conditions, especially wild boar and hybrids are very popular with people, the demand for products is increasing day by day. But raising pigs is also facing many obstacles, because wild boars are wild, domesticated more difficult than foreign pigs, and require a large area of land and a rich source of green food. Wild boars have good characteristics of adaptability, tolerance to harsh conditions in mountainous areas, taking advantage of natural food sources and low technical requirements.

Authors use statistical data and qualitative analysis to draw conclusion. The study find out that Softness, the amount and structure of collagen Then The cut of the meat is dry, the meat is slightly hiss, the muscle is a bit tight; And Fresh color - Healthy pork is usually light pink to crimson in color. This parameter is an important food quality standard.

Key-words: Protein, Nutrition, Wild Pork and Pigs, Vietnam, Thai Nguyen.

1. Introduction

In order to raise pure wild boar and wild boar effectively, it is necessary to balance the nutritional composition of the feed in terms of metabolic energy and the level of crude protein in the diet suitable for this pig breed based on natural food sources. necessary. With appropriate nutrition, it will be a favorable condition for wild boars and crossbreeds to promote genetic potential and good

characteristics of breeding products, easy to raise in concentrated and semi-wild ways to improve people's income. local. Currently, animal feed accounts for 70-75% of the total cost, but the unit price of protein-rich feedstuffs of animal and plant origin has increased, increasing input costs for pig production, which has motivated people to Animal husbandry and feed manufacturers seek to reduce feed costs, calculate appropriate diets to reduce feed costs and improve economic efficiency of farmers. There have been many studies on the appropriate balance of energy and crude protein in the diets of foreign and crossbred pigs, but the study on the appropriate diet balance for wild boar and wild boar has not been studied systematically.

We organized our study with introduction, methodology, main results, discussion and conclusion.

2. Literature Review

Wild pig with scientific name is *Sus scrofa*, also known as Loi pig, Kun Bui. Wild boars are present all over the world. It is the ancestor of the domestic pig breeds, which have 21 subspecies that live in a very wide range including parts of Europe and northern Asia, as well as southern and northern Africa. In Vietnam, wild pig is found in most of the forest areas of the provinces, especially in the northern mountainous areas and along the Truong Son mountain range. Taming and raising them to become a pet is completely new in Vietnam.

According to Dao Le Hang (2008) [7]: Wild boar, the whole body is covered with short hairs, similar to bamboo roots, usually dark brown in color. The head and body length of an adult pig is about 90 - 180 cm, the tail length is about 30 cm, the height of the shoulder is about 55 - 110 cm. Herds of wild boar can travel together on long journeys to new settlements, but do not migrate. Wild boars are more active at night, at dusk and at dawn. When the pig matures it will leave the herd and live independently around 50-350 kg, with some domesticated pigs up to 450 kg. Males are usually larger than females. Wild pigs have 4 pairs of fangs and 6 pairs of breasts.

Feeding conditions, not only affect the amount of digestive juices secreted, but also change the activity of digestive enzymes markedly. V.A. Teletnep (1966) [Excerpt from Ton That Son et al. (2006) [21], when studying the digestive enzyme secreting activity of pancreatic juice, it was found that the protease activity depends on the intensity of secretion of the pancreas and its composition. Ration. With diets that are well balanced in nutritional composition relative to the body weight and age of the pig, there is little variation in trypsin intake.

According to the authors: Hoang Toan Thang, Cao Van (2006), when studying the effect of the same level of protein on the nitrogen digestion in the small intestine of pigs, it was found that, in the diet, there are different types of feeds. different diets, the content of nitrogen forms in the intestinal chyme is different. This directly affects the ability to absorb and use nitrogen in the digestive tract. Therefore, it requires the study of different protein levels, on the basis of stabilizing the content of some essential amino acids as well as the change in the ratio and content of amino acids on the same protein level. were established on the same type of diet, to eliminate errors caused by differences in diets.

In the world, the authors have focused a lot on research in the field: Determining the protein and energy needs of pigs to promote growth, complete development, reduce costs and increase livestock efficiency. The balance between protein/ME in pigs is an important requirement for growth, meat quality, and lean percentage at the growing stage of pigs.

Survey results on 77 wild boar breeding facilities across the country by the National Institute of Livestock Production showed that 61.1% of the establishments raised pure Thai wild boar, 38.9% raised many types, including wild boar. Thailand, Vietnam, native pigs and hybrids. There are 6 establishments that also raise pure Vietnamese wild boar. The Thai wild boar is imported from Thailand. However, in the South, there are also Malaysian wild boars, which Mr. Chau Xuan Vu (Phu Quoi commune, Long Ho, Vinh Long) imported dozens of pigs from Malaysia in 2006.

Lat but not least, Huy,.D.T.N et al (2015) mentioned important roles of banks in financing economic activities including agriculture.

3. Methodology

Authors also use statistic and data to make analysis an propose solutions. Experiences in Vietnam food processing also mentioned. Beside, Authors mainly use combination of quantitative methods and qualitative methods including synthesis, inductive and explanatory methods.

4. Main Results

4.1. Overview

Wild boar is distributed mainly in the world in the regions of North Africa; Europe, Southern Russia, China, Middle East, India, Sri Lanka, Indonesia (Sumatin, Java, Sumbawa), Corsica, Sardiaigue, remote areas of Egypt and Sudan. According to some other documents, wild boar is also

found a lot in western India, the United States (California, Texas, Florida, Virginia, Hawai...) Australia, New Zealand and islands in the South Pacific.

A. Some Characteristics of Appearance, Reproduction and Behavior

***Appearance Characteristics**

According to Dao Le Hang (2008): Wild boar, the whole body is covered with short hairs, similar to bamboo roots, usually dark brown in color. The head and body length of an adult pig is about 90 - 180 cm, the tail length is about 30 cm, the height of the shoulder is about 55 - 110 cm. Herds of wild boar can travel together on long journeys to new settlements, but do not migrate. Wild boars are more active at night, at dusk and at dawn. When the boar matures it will leave the herd and live independently around 50-350 kg, with some domesticated pigs up to 450 kg. Males are usually larger than females. Wild boars have 4 pairs of fangs and 6 pairs of breasts.

***Reproductive Habits**

Dao Le Hang (2008) also said that: In the wild, female wild boars give birth several times a year and the mating season varies depending on geographical areas and living environment. The number of children per birth is from 1 to 12, an average of 4 -8 children / time. The gestation period is 110 - 120 days, the average is 115 days, the lactation period is 3 - 4 months. The average time for piglets to mature is 7 months.

The age considered sexually mature for mating in females is 8 – 10 months, with a mean of 9 months. In sexually mature males, mating is 8-10 months, with an average of 9 months. Usually, female wild boars give birth in spring and mating occurs throughout the year but is concentrated in the wet season, usually 4 to 8 pigs. Females mature after 8 – 10 months, but usually do not mate until 12 months of age and males usually do not like to handle sows under 1 year of age.

The female wild boar gives birth in a grass nest, the piglets will stay in the nest for a few days. Piglets are usually healthy. Contrary to their initial healthy appearance, only about half of wild boars live to adulthood, some die from disease or are eaten by other animals. Young wild boars are nursed by their mothers for 3-4 months and gradually become independent.

In the wild wild boar can live up to 10 years, sometimes they can live up to 27 years.

*** Habits of Life**

Wild boar are often found in large areas, they live in herds, the number can be up to 100 animals, these herds are the offspring and juveniles.

Herds of wild boar can travel together on long journeys to new settlements, but do not migrate. Wild boars are more active at night, at dusk and at dawn. When the boar matures, it will leave the herd and live independently.

***Eating Habit**

Wild boars are omnivores and sometimes eat indiscriminately. Daily food is mushrooms, tubers, rice, rice, fruits, eggs, carrots, vertebrates. Thanks to the ability to eat a variety of foods, wild boar survives in many different environments, from desert to mountainous areas.

Animal foods are birds, mammals, amphibians, reptiles, carrion, insects, terrestrial arthropods, mollusks.

Plant foods are roots, tubers, bark, grass, rice, and fruits. Other foods are feces, carnivores, mushrooms.

Wild boars are active and become reckless if they feel threatened, they will use all their strength, fangs and body to chase and injure the enemy.

B. Growth and Sexual Characteristics of Wild Boars and Hybrids

***Growth Characteristics**

Wild boars grow slowly and reach their maximum size depending on breed, environment and age. The European wild boar is usually much larger in stature than the Asian wild boar. While the Asian wild boar can only be 65 - 70 cm tall, 120 - 140 cm long, 70 - 150 kg in weight, the European wild boar can be up to 90 - 100 cm tall, 150 - 160 cm long, and weigh up to 200 - 350 kg. Males are usually 20-30 kg larger than females. Newborn pigs are very small, weighing 0.5 - 0.7 kg, 15 - 25 cm long. Weaning age 55 - 60 days; The weight of piglets at weaning is 4-5 kg/head. The age of slaughter can be calculated from 8 to 10 months old. The weight of slaughter usually ranges from 25-35 kg depending on the needs of the market.

Table 1 - The Growth Rate of Wild Boar

Month of age	Weight (kg)	Growth rate (g/day)
0 – 2	0,5 – 5	8,33 - 83,33
2 – 4	10 – 12	166,66 - 200,00
4 – 6	15 – 25	250,00 - 416,66
6 – 8	25 – 35	300,00 - 583,33
8 – 10	40 – 50	666,66 - 833,33

Source: Đào Lê Hằng (2008)

The growth rate (for wild boars that have been raised in Thailand and Vietnam) is slow (average is only about 0.15 - 0.3 kg/day). Physiological life span of wild boar lasts from 15 to 25 years.

Table 2 - Characteristics of the Reproductive Ability of Wild Boar

No	Content	Performance Indicators
1	Age of first heat	6 - 7 month old
2	First estrous weight	18 - 20 kg
3	Mating age	7 - 8 month old
4	Weight at mixing	30 - 35 kg
5	Pregnancy period	110 - 130 days
6	estrus time	2 - 3 days (nái tơ)
		3 - 4 days (nái rạ)
7	estrus cycle	20 - 22 days
8	Birth coefficient	1,2 - 1,3 litters/year
9	No of pigs born each time	4 - 8 pigs

(Source: Đào Lê Hằng, 2008 [7])

*Weight Gain of Wild Boar by Month of Age

Research results show that the weight of hybrid wild boar from birth to 10 months of age, following the general growth laws of cattle, body weight increases gradually with age. The birth weight of the hybrid wild boar is 0.5 - 0.7 kg, weaning at 2 months of age is 3.7 - 4.0 kg and at 10 months of age is 26.52 - 26.96 kg.

* Weight Gain of Wild Boar in Different Stages

The rate of weight gain/day is one of the indicators contributing to the assessment of the production ability of a pig breed. The results showed that the average weight gain of wild boars increased gradually from the 2nd to the 10th month. The average weight gain of wild boar from birth

to 10 months of age was 80.0 g/head. /day, the lower growth rate was in the period of 2 - 4 months old, reaching 70.0 g/head/day and the highest was in the period of 8 -10 months old, reaching 80.0 g/head/day.

C. Diet and Food Standards of Wild Boar and Wild Boar F2

a. For Wild Boar

Table 3 - Self-mixed Mixed Feed Ration

Ingredients	Ratio (%)	Ingredients in 10 kg mixed food
Food pellets	75	7,5
Rice bran grade 1	24	2,4
Bone meal	0,5	0,05
Premix mineral	0,5	0,05
Total	100	10 kg food
Energy (Kcal/kg)	3000	
Protein raw (%)	14	

(Source: Võ Văn Sự, 2009)

* Feeding level: 1 kg/head/day, divided into 0.5 kg/meal at 7 am and 16 pm

- Green vegetables, fruit and vegetable foods are allowed to be fed freely, ensuring 1 - 1.2 kg of green food or more.
- In the days of mating, supplement the sow with 2 eggs, bean sprouts or germinated rice 0.5 kg/head.
- The distance between 2 times of fine mining must be suitable. During the first 3 months, you can exploit 1-2 times/week, after that, you can exploit 2-3 times/week.

Table 4 - Self-mixed Mixed Feed Ration

Ingredients	Ratio (%)	Ingredients in 10 kg mixed food
Food pellets	20	2,0
Rice bran grade 1	79	7,9
Bone meal	0,5	0,05
Premix mineral	0,5	0,05
Total	100	10 kg mixed food
Energy (Kcal/kg)	2700	
Protein raw (%)	12-13	

(Source: Võ Văn Sự, 2009)

* Hygiene of disease prevention:

- Deworming for pigs at the beginning of the period when pigs reach 7-10 kg and before breeding.
- Vaccinate all kinds of vaccines according to regulations to prevent diseases for pigs.
- Periodically disinfect and disinfect livestock cages and tools.
- Regularly clean the feeding and drinking troughs.
- In winter, cover to keep pigs warm, in summer to cool the barn.

Food and feeding method:

- Food is full of nutrients, not rancid, moldy.
- The daily intake of pregnant sows depends on the sow's condition. Skinny sows must increase feed, too fat sows must reduce mixed feed but must increase forage.
- In winter, when the temperature in the barn is $< 15^{\circ}\text{C}$, sows need to eat more (0.2 - 0.3 kg/day) to compensate for the energy lost due to cold resistance.

C. Basic Characteristics of the Digestive Physiology of Pigs

Pigs are omnivores with a single stomach. The gastric environment contains gastric juice secreted by the gastric glands. The gastric juice has a low pH environment suitable for pepsin activity to break down proteins into albumin, peptone products and a small amount of amino acids (Nguyen Xuan Tinh (1996)). The pig's small intestine is very long and has many digestive secretions such as: pancreatic juice, intestinal juice and bile, in which only pancreatic juice and intestinal juice contain enough enzymes to thoroughly digest nutrients in feed.

Therefore, the small intestine is a digestive part full of enzymes that break down nutrients in food into the simplest nutrients, helping the body absorb directly through the intestinal wall into the bloodstream. Bile juice does not contain digestive enzymes, but it aids in digestive activities, especially fat digestion. The small intestine environment is alkaline and has a special structure, highly adapted to digestion and absorption of food. Along the intestinal mucosa, there are developed intestinal glands that secrete intestinal secretions in a full-secretory fashion, that is, the glandular cells filled with enzymes fall directly into the intestinal cavity, creating an endogenous nitrogen source up to 30 g/day. This is a feature that affects the accuracy of the digestibility test results in pigs, which cannot be ruled out. In the large intestine of pigs, there is a symbiotic intestinal microflora in the cecum and colon that is capable of breaking down fibers. The large intestine does not secrete enzymes, but only continues to break down food by enzymes in the small intestine. This digestion

rate is high or low depending on the retention time in the large intestine (12 - 16 hours) (Excerpt from Tran Van Phung et al., 2004).

Digestion fiber 14%, digest protein 12%, have 9% carbohydrates and 3% lipids of the remaining nutrients digested by the large intestine. The main activity of the large intestine is the fermentation of fiber due to the action of the microflora in the cecum and colon and the decomposition of excess protein in food by rotten bacteria to form Crezon toxins. Fenol, Idol, Scatol. These toxins are absorbed into the bloodstream and detoxified in the liver. If these substances are too much, they will cause liver toxicity and are excreted through feces, causing unpleasant stench, polluting the environment, and also causing diarrhea in pigs (Tch Hoang Toan Thang et al. 2006).

D. Digestion of Protein in the Pig's Body

Protein is the basis of life, it contributes to many important functions in the pig's body. Protein in muscle tissue accounts for half of total body protein, the rest is in organs, internal organs, blood and hair; It is also present in small amounts in enzymes and other body secretions. In the pig's body, protein is always in a dynamic state, that is, there is always a new protein synthesized for growth, to accumulate lean meat and to compensate for the loss due to proteolysis. However, in practice it is difficult to formulate an ideal protein diet.

4.2. Vietnam Experiences in Feeding Wild Pigs

4.2.1. The Role of Feed-exchange Energy in Pig Survival

All living, developing and reproductive activities of pigs are associated with the process of using and exchanging energy. Energy in food is stored in the physical forms of food such as fat, sugar, protein, and carbohydrates. Pigs receive food energy from the outside, through digestion, absorption in the digestive tract into the body and synthesized into fat, glucose, and pure protein of the pig's body.

The pig's body wants to function like walking, breathing, circulating, digesting, excreting... All must use the energy stored in the body's fat, sugar, and protein to convert it into heat. Heat energy turns into function and acts on the body's organs to function in a rhythmic manner, through the control of nerves, hormones, and enzymes.

Energy participates in the construction of nerve cells, nerve sheaths, forming important compounds such as lipoprotein, glucoprotein found in nerve cell membrane tissue, in exocrine glands.

Fat both stores energy and acts as a cushion under the skin, surrounding the digestive tract, circulation, and respiration to resist mechanical impact, heat and cold for the body. Pigs need more energy than other cattle because the genetic makeup of pigs accumulates fat about 45-50% (Le Hong Man et al., 2003).

5. Discussion

+ Methods for sensory evaluation of meat quality:

Muscle tissue (flesh) must go through some transformation and is a result of the slaughter process. This affects the quality of ingredients in food processing and post-processing. Meat quality characteristics include:

Hydrophilicity is a factor that affects the production process. This is the ability to absorb and hold water. Myofibrillar protein between an important role, has specific physical and chemical properties and a 3D structure. It makes up 55 - 60% of all protein in muscle and is the main component of fibre. Higher hydrophilicity results in lower costs in meat production and meat processing. Hydrophilicity is especially important for widely used lợnpork thịt in meat processing. Hydrophilicity is very low in beef and is not a major factor.

Softness – this property is influenced by the amount and structure of collagen. Collagen is determined by the factors of existence. This property is also determined by the structure of the myofibrils or part of the related muscle fibers.

The meat is firm, not mushy, good elasticity, not leaking, viscous. Use your fingers to press into the flesh to make an indentation but leave no mark when you lift your finger. The fibers are even.

The cut of the meat is dry, the meat is slightly hiss, the muscle is a bit tight; The dermis is soft, the fat is white to slightly ivory. It does not have a strong oily smell when smelled.

Appetite - a sensory property of meat including its effect on sensation, taste and smell. It depends on factors such as: species, age, breeding conditions, nutrition and sex

Fresh color - it is a function of many important factors, especially during post-slaughter and processing. Healthy pork is usually light pink to crimson in color. Color is the viewer's observable perception, which is controlled by the two physical phenomena of light diffusion and absorption. The colors of the meat are lighter if strong light is diffused and darker when light is high. This parameter is an important food quality standard. Changing colors are the first signs of decomposition.

Table 5 - Sensory Parameters of Meat

Factor	Demand
<i>Fresh meat</i>	
<i>State</i>	Surface is dry, clean, free from hairs and dirty matter Smooth cutting surface Having elasticity, pressing your finger into the meat does not leave an imprint on the surface of the meat when you remove it; Pulp adherent to the root canal wall (if present)
<i>Color</i>	Features of the product
<i>Odor</i>	Characteristic of the product without any strange smell
<i>After boiling</i>	
<i>Odor</i>	After boiling Fragrance, characteristic of the product, no strange smell
<i>Taste</i>	Sweet taste, characteristic of the product, no strange smell
eat broth	Maromatic, clear, large fat scum, when reacting with copper sulphate (CuSO ₄) gives a slightly cloudy color.

* Source: TCVN 7046:2009

+ Determination of the pH of meat: The pH in meat is an important indicator to assess the quality of meat after slaughter. The pH right after slaughter is about 6.8 - 7.0. Over time, the pH of meat is approximately 5.7 - 6.0, at this time the meat contains the highest water content. The decrease in pH below 5.7 brings it closer to the protein isoelectric point (pH 5.2 - 5.4). Thus, the meat has a lower water holding capacity. An increase in pH in the range of 7.0 is also detrimental because autolytic processes are spontaneously present in meat. pH is a key parameter for assessing deviations from normal post-mortem glycolysis which can cause a wide range of complications.

+ Determine the content of Colesterol and Triglyceride: We took the blood of experimental pigs at the end of the experiment into test tubes with anticoagulant and tested on modern equipment of the University Hospital of Medicine and Pharmacy, Thai Nguyen university. Each batch of experiments was repeated 3 times to determine the content of Colesterol and triglycerides.

- The method of determining the quality of feed, the quality of experimental pork is calculated on the equipment system of the Institute of Life Sciences - Thai Nguyen University based on the following Vietnamese standards:

Sampling method of feed ingredients is carried out according to Vietnamese standard TCVN 4325:2007 (ISO 6497:2002) on animal feed.

The determination of dry matter of animal feed was carried out according to Vietnam standard (TCVN) 4326: 2001 (ISO 6496: 1999).

The protein content of the feed was conducted according to Vietnam standard 4328-1: 2007 (ISO 5983-1:2005) by the Kjeldahl method on the German Gerhardt analytical system.

The lipid content in the feed was conducted according to Vietnamese standards (TCVN 4331: 2001) (ISO 6492: 1999).

Total mineral content was conducted according to Vietnamese standards (TCVN 4327:2007) (ISO 5984: 2002).

Total fiber content was conducted according to Vietnamese standards (TCVN 4329: 2007) (ISO 6865: 2000).

Phosphorus content according to Vietnamese standard TCVN 1525: 2001 (ISO 6491:1998)

- Raw energy determined on the analysis system CALORIMETER CAL2K of South Africa at the laboratory - Institute of Life Sciences.
- Metabolic energy (ME) (Kcal/kg): determined energy of raw materials and calculated based on documents of La Van Kinh (2003).
- Measurement of pH was carried out according to Vietnamese standards (TCVN 4835; 2002) (ISO 2917: 1999).

6. Conclusion

As we analyzed, high quality wild pork meat have to follow criteria of Vietnam standards on state, odor, tastes, color.

Second, The lipid content in the feed was conducted according to Vietnamese standards and The protein content of the feed was conducted according to Vietnam standard 4328-1: 2007 (ISO 5983-1:2005).

Third, Softness, the amount and structure of collagen Then The cut of the meat is dry, the meat is slightly hiss, the muscle is a bit tight; And Fresh color - Healthy pork is usually light pink to crimson in color. This parameter is an important food quality standard.

Bui Thi Thom, Dinh Tran Ngoc Huy, Tran Van Phung (2021) also stated that Wild boar hybrids meat has a rich and higher nutrient content than domestic pork, helping us to compensate for vitamins that vegetables and fruits do not have or have very little, such as vitamins B1, B2, B6, B12, A and D. And Huy, D.T.N. (2015) also stated management standards in order to help better management of enterprises including agriculture filed.

Wild Pork Meat export to Europe and even US and others

Vietnam can try to adapt to pork meat criteria with high quality from European markets in order to export wild pork to Europe in future during EVFTA. The door to the EU has opened wide when tariff barriers are removed according to the schedule. However, to be able to stand firmly in this market, Vietnamese goods still have to overcome a series of challenges such as: Rules of origin, requirements on traceability, technical standards, dynamic hygiene and safety, etc. opened wide when tariff barriers were removed according to the schedule. The EU is one of Vietnam's largest export markets. However, our market share in this area is still very small, because the competitiveness of Vietnamese goods (especially price competitiveness) is still limited. Therefore, the EVFTA Agreement can increase the price competitiveness of Vietnamese goods when imported to this important market.

Figure 1- Taking Care Wild Pigs



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