

The Research on Improving the Quality of Jinhua Pork Ham

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SUMMARY:

For the meat scientists and technologists of the world to understand Jinhua Pork Ham—the famous traditional meat product of China, we write this article, and hope that it will attract the readers.

The article briefly expounds Jinhua Pork Ham's historical course of development, survey of production and market, technological process etc. It also emphatically explains how scientific and technical researchers and managerial personnel have carried out a series of works to improve the quality of the product, since the foundation of P. R. China, on the basis of traditional technology analysis, i.e. have formulated united quality standards of products and operating technology rules, have trained processing technicians, have improved fresh keeping and edible methods of finished products and so on. Because these underway scientific researches and technical innovations have gained good effects, the product quality is enhanced further. Thus it wins fame all round the world, and is welcomed by both domestic and foreign consumers.

INTRODUCTION:

Jinhua Pork Ham is famous for its bright colour, fragrant smell, delicious flavour and beautiful appearance in the world. Since the Southern Song Dynasty (1127-1279), it has been confirmed as a precious tribute to emperors in past feudal dynasties, so it gains the name of TRIBUTE HAM. Jinhua Pork Ham has got gold medal prizes in many domestic and international commodity fairs. Besides being sold in many domestic regions, it has also been exported to Hongkong, Macao, Singapore and the Philippines, as well as some European and American countries.

Brief developmental history of the production of Jinhua Pork Ham: Zhejiang Province lies in Southeast China with a temperate climate and plentiful products, and is flourishing in raising pigs. The people began making the Ham in Song Dynasty (960-1279). It was confirmed as a collected product by local authorities in Ming Dynasty (1368-1644). It was recorded in many local chronicles of Jinhua's subordinate counties. The 1885 revised Compendium of Materia says: "Jinhua, the popular name of ham, is finely made in Jinhua, the salted hams are divided into winter ham and spring ham. It is also differently made from front leg or hind leg. Winter ham is made from hind leg, its meat is delicate and thick, and it can be kept without deterioration for long time,.....".

Early at the end of 17th century, Jinhua Pork Ham was exported. At the beginning of 20th century, it was displayed at many domestic and international commodity fairs, and it won gold medal prizes at Southeast Asia Quanyao Fair in 1910, Chinese Goods Exhibition in 1915 and Panama International Fair. It gained Special Quality Prize for Commodities at Westlake International Fair in 1929. According to historical data of industry and commerce in 20th century, the production of the ham was distributed over every subordinate county of Jinhua Prefecture. There were hundreds of ham workshops which could produce 960,000 hams at most a year. Besides ham workshops, the peasants raising pigs in the counties made hams by themselves. Because of a series of wars, lack of funds and bad management, the ham industry gradually declined. The ham production touched bottom in 1949, the capacity of which was only 86,000 hams a year.

After the foundation of P. R. China, Jinhua Pork hams are unitedly managed by state-operated commerce. The ham capacity is stable at some 800,000 a year in 1980s after several rises and falls. Besides state-operated enterprises, still some rural enterprises produce hams, the capacity of which varies considerably and accounts for about 10 percent of the total capacity.

The situation of production and market: Jinhua Pork Hams were transported from producing areas to Hangzhou, and then to other cities in the Country. After the railway is open to traffic, Shanghai became a hub of transportation and market. Now Jinhua Pork Hams are sold in many cities such as Beijing, Tianjin, Guangzhou, Amoy. After the Opium War (Britain's invasion of China, 1840-1842), Jinhua Pork Hams were directly exported. After P. R. China was founded in 1949, the

exportation of Jinhua Pork Hams was unitedly managed by Shanghai Food Import & Export Corporation. By 1986, totally 3,540,000 Jinhua Pork Hams had been exported. They were mainly marketed to Hong Kong.

Process technology

There is a complete set of strict and scientific technological processes in making Jinhua Pork Hams. The flowchart is shown as figure 1.

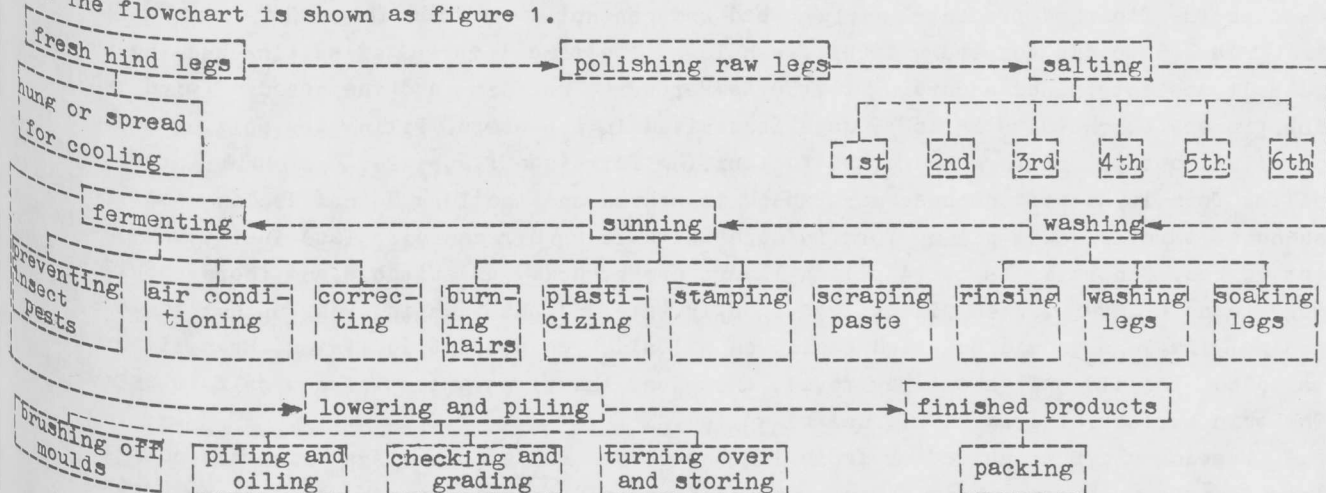


Figure 1 Jinhua Pork Ham processing flowchart

Operating rules in processing Jinhua Pork Hams

1. picking raw materials (requirements in choosing hind legs of pigs)
 - a. Choose raw materials (requirements in choosing hind legs of pigs) before and after slaughtering as raw materials.
 - b. Male and female, sick and injured, yellow fat pigs and those which catch dermatosis are not allowed as raw materials.
 - c. Do not blow air when slaughtering pigs, the hairs and blood should be cleaned, no damage and erythema are allowed.
 - d. Fresh legs must be spread out or hung one by one to cool and keep fresh without being polluted.

Weight: The suitable net weight of each fresh leg is between 4.5--8 kg.

Skin layer: The suitable skin thickness of fresh legs is less than 35mm, the thinner, the better. Fresh legs with rough skin and big foot are not suitable for raw materials.

Fat: The fat thickness of the roots of legs which is set up as a standard should be less than 3cm, the thinner, the better.

Colour: Muscle is bright red, fat is pure white, skin colour is white or light yellow and dry without softening and adhering signs.

Appearance: The centres of legs are full, the feet are very small, the shape of legs is complete.

2. Polishing raw legs: Polish fresh legs with a knife into bright and clean ones. Remove aitch bones, leg bones, sacral vertebrae, lumber vertebrae and caudal vertebrae to make a neat appearance, then cut the edge of legs into semilunar shape, finally squeeze out extravasated blood to prevent bacteria and deterioration.

3. Salting: Salting hams is considerably influenced by temperature and humidity. The temperature should be between 0°C and 15°C, relative humidity be 70 % and 90 %. So the best time for salting the hams is between the Beginning of Winter (19th solar term) and the Beginning of Spring (1st solar term) each year in Jinhua region.

Salting operations have much concerns with the quality of the products. The quantity and time of applying salt must be strictly controlled according to the size of legs, thickness of leg centre, meat quality, fresh degree, temperature and humidity.(see table 1) If too much salt is used, the activation of enzymes is restrained and the finished products are fragranceless. If the quantity of salt is not enough, the growing and breeding of harmful microbes can not be checked,so the finished products easily go bad and can not be stored long. The quantity of salt generally is 3.5 to 4kg for every 100kg fresh legs. The time interval of salting and the quantity of salt are determined according to the temperature, humidity and the speed of wind. Whole salting process which lasts 25 to 35 days is divided into 6 steps. Piling dry salting method has parallel feet piling form and cross feet piling form (see figure 2). In middle winter, cross feet piling form is adopted because more space is spared and the legs do not decline easily. In other seasons, parallel feet piling form is more suitable as air can circulate easily, and the legs do not go bad. Generally 12 to 14 piling layers are regarded as suitable, and there should be no more than 16 layers. When piling legs, gently take and put them in order as not to drop the salt grains. The legs should be piled tidily on all sides to prevent declining. Each time when salt is added, the old salt should be moved, then just the right amount of new salt is spread evenly. The skin surface of legs should not be salted.

4. Washing and Sunning: after fresh legs have been salted, the legs which are called salted legs contain much water, and there are much dirt and impurities adherent to the surface. So the legs should be washed and sunned in time, dehydrated and kept clean to prevent moisture absorption and create conditions for late ferment. The washing and sunning course contains following processes:

Soaking legs: The salted legs are soaked in fresh water pond. Water quality should meet health demands. Salted legs are soaked layer upon layer in fresh water pond, with skin surface up, and the top layer does not go out of water. The soaking time is determined by climate, the size of legs, the quantity of salt and water temperature. In winters (water temperature below 10°C),

Table 1 Salting order, interval and quantity

salting order	salting interval (day)	salting quantity for every 5kg fresh legs (g)	notes
1st time	1 (1st day)	about 75 g	all the data are adopted under 5° to 10°C ambient temperature
2nd time	1 (2nd day)	about 150 g	
3rd time	5 (7th day)	about 75 g	
4th time	6 (13th day)	about 50 g	
5th time	7 (20th day)	about 25 g	
6th time	7 (27th day)	reduce according to the situation	

soaking time generally is 15 to 18 hours. In spring (water temperature above 10°C), soaking time is 6 to 8 hours. Soft and soaked surface is aimed at. Washing legs: scrub the soaked salted legs one by one with bamboo brooms or washers, then soak

them again in the pond for 2 to 3 hours, and scrub them for the second time till they are completely clean.

Sunning legs: two clean salted legs are tied at bends with a string. They are sunned in pairs on the shelf without contact, one above another with the faces towards the sun for even distance, full sunshine and good circulation. At night, the leg shelves should be covered with canvas to keep legs dry and prevent dew or rain.

Scraping legs: after the washed legs are hung on the shelves, the remnant hairs, greasy dirt and left water should be eliminated with a knife. Press out remnant blood and water at the three sticking points. When the surface is a bit dry, stamping and plasticizing begin.

Stamping: when leg surface is soft and a bit dry in about two-hour sunning period, trade marks of Jinhua Pork Ham are printed, which should be regular and clear.

Plasticizing: In the sunning course, the legs must be plasticized timely. When the leg surface is basically dry, the legs are laid on the plasticizing bench and gently beaten with a wooden mallet on hock joint to make foot bones neat. Then the paw is pressed against the bench edge to form a 45° angle. The legs are pressed by both hands against the bench to make full centres. Finally the skin surfaces are rubbed and tapped to make them smooth. By plasticity, the legs are

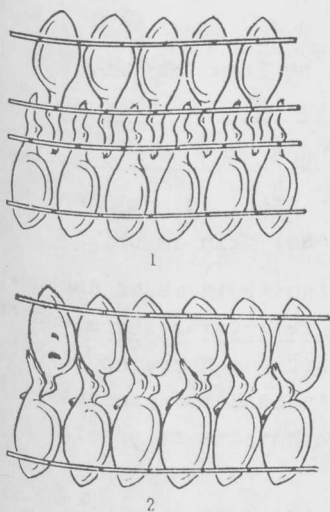


Figure 2 salting piling method
1. parallel feet piling form
2. cross feet piling form

to keep indoor temperature and regular fermentation. In fermenting rooms, the optimum temperature is 25°C to 37°C, the optimum humidity is 60 % to 70 %. After a certain time of fermentation every kind of tissues of the leg shrink differently and form a uneven surface. Polish the hams for the last time to make them appear more beautiful. Hang the polished hams in turn on the shelves and continue fermenting until they give out aroma in dog days.

At the early fermenting stage, apparatus must be fixed to contain the dropping oil for cleaning hams or other uses in case oil pollutes the surroundings.

6. Lowering and piling: In dog days, the hams begin giving out aroma. Lower them in turn from the shelves and brush off the moulds. Clean the hams with oil and pile them to encourage later ripening and softening. Then grade and pile the hams according to their quality. Now Jinhua Pork Hams are finished.

Strengthening Technological Management and Improving the Quality of the Products

After the foundation of P. R. China, researchers and managing personnel have done the following works to improve the quality of Jinhua Pork Hams:

1. Formulating united quality standards of the products.

Jinhua Pork Hams used to be made mainly in dispersive workshops. Now they are processed and managed by united state-operated food incorporations. United quality standards are formulated to improve the quality of products and facilitate the management. They are as follows:

(1) Sensory targets

Table 2		Sensory targets
colour	The skin is bright yellow, muscle section is dark rose or pink. Fat section is white or light red with lustre	
shape	Ham shape is standard, the foot bend and leg end are in alignment; the distance between the middle of leg bone-end and the middle of hip bone is basically equal to the width between hip bone-end and the belly; the distance between the middle of leg bone-end and the middle of hip bone is 1 to 2 cm longer than that between the middle of hip bone and leg end; meat can not be seen from skin surface, skin can not be seen from meat surface; the ham takes the shape of a bamboo leaf, the paw is bent to form a acute angle without cracks, and the stamp is clear.	
tissue state	The meat is compact and solid, the section is neat.	
odour	The meat has a special aroma of Jinhua Pork Ham.	
Impurity	Hairless.	

shaped like bamboo leaves.

Burning hairs: When the legs are sunned dry and skin shrinks , the remnant hairs appear, which must be burned off with a petrol blowtorch. Perform the operation quickly and evenly, and do not char the skin.

Sunning time: 5 to 6 days in winters, 4 to 5 days in springs , the skin is sunned firmly and yellow.

5. Fermenting: The sunned legs are fermented to give out aroma and be kept for long storage. Fermenting should be carried out in buildings which have leg shelves and are flyproof , dampproof, heat insulated, ventilated, dry and clean. The whole fermenting period lasts about 6 months. The hams must be separately hung in order on the shelves according to the sizes . There is certain distance among them for good ventilation. Windows are opened on fine days and shut on rainy days. They are shut on days and opened at nights in megathermal climate

(2) Physical and Chemical norms

Nitrite content in Jinhua Pork Ham (mg/kg, shown as "NaNO₂") should be less than 20.

Table 3 Quality standards of Jinhua Pork Ham

Grade	Aroma	Meat Quality	Weight	Shape
Special grade	It smells fragrant after three sticking	Lean meat is more than fat. Ham centre is full	2.5 kg to 5 kg	Skin is fine and foot is small and straight. Fat is less. Skin is bright yellow without hairs and erythema. No damage, moth-eating or rat-biting signs and cracks
first grade	It smells fragrant after two sticking no peculiar smell in the left sticking	Lean meat is more than fat. Ham centre is full	More than 2.25 kg	No scars for exported hams, no big erythema for domestic marketed hams. other requirements are the same as special grade hams.
second grade	It smells fragrant in one sticking, no peculiar smell in the other two sticking	Ham centre is a little thin, but leg bone joint is not exposed. The root meat is a bit salty	More than 2 kg	Foot is straight but a bit thick. No moth-eating or rat-biting signs. Knife traces are fine. No hairs.
third grade	There are peculiar smell in one of the three sticking but no stink	The root meat is a bit salty	More than 2 kg	No rat-biting signs, but knife traces are rough.

Notes: aroma separately insert bamboo stick in three fixed muscle positions, smell it soon after the stick is pulled out; Sticking depth is 1/3 to 1/2 of ham thickness (vertically); Sticking positions--the first sticking is at the seam between leg bone and tibia, the second sticking is at the back between leg bone and ilium, the third sticking is at the hollow place between sacral vertebra and ilium.

2. Formulating technological and operating norms.

Jinhua Pork Ham processing techniques used to be imparted to apprentices by master workers before state-operated food companies were founded, and there were not united technological and operating norms. After Food Company of Zhejiang was established in 1954, it made many investigations on the production of Jinhua Pork Ham, Jiang Ham and Smoked Bamboo-leaf Ham, and started formulating operating norms. In 1956 and 1957, it three times invited well-known technicians in producing areas for conversation, systematically complied their skills, and formulated operating norms which are now issued and carried out. The main points are : slaughtered pigs must be bloodless and hairless; the meat must be fresh; the climate change should be well-known in time ; The fermentation of semi-finished products must be well managed. After the united operating norms are formulated, the quality of products is ensured.

3. Training technicians and evaluating titles.

In old days the famous ham technicians kept the technique a secret. So the quality of hams differs greatly. After the foundation of P. R. China, the government has paid great attention to the special processing technique of Jinhua Pork Hams. Old technicians continue to play roles, meantime new technicians are trained. A Jinhua Pork Ham middle school has been set up to train qualified personnel. Some young workers are trained by appointed technicians, and now they have become technical backbones in ham factories.

Since 1979, Jinhua regional companies have written ham teaching materials, run short-term training

ining class three times, and trained hundreds of technicians, Now ham processing speciality is set up in the commercial colleges. In 1988, technical personnel in ham factories were evaluated titles, issued certificates, and promoted on salaries. They are activated and keep their minds on the work.

4. Storing Jinhua Pork Hams.

a. Storing hams in commercial warehouses.

The warehouses for storing hams should be built at a ventilated, cool, dry and clean place, which are dampproof, heatproof, insectproof, ratproof, dustproof and fireproof. Before hams are stored in the warehouses, the warehouses and apparatus must be cleaned and fully disinfected to prevent harmful bacteria and worm eggs from breeding. The hams are checked one by one. Those without peculiar smells or insect eggs are allowed to be stored in the warehouses. Then they are separately piled according to their grades. Producing area, grades, quantity and entering time are recorded on the tags. To raise the utilization ratio of the warehouses, firm rectangular shelves may be set up which have 3 to 4 storeys and 80 to 90 cm storey distance. 5 to 10 layers of hams are usually parallel-feet piled on the bamboo curtain bottoms. Each layer has 10 hams, hams on bottoms face up and the other face down. In the storage period, hams should be turned over in time, usually one time for every 5 to 7 days after dog days; about 10 days after the Autumnal Equinox (16th solar term); some 20 days after Slight Snow (20th solar term). The interval time should not be too long in case the close hams go mouldy.

Inverse arrange method may be adopted to prevent hams from losing oil and shrinking in summers. As hams do not lose oil in winters, they still are parallel-feet piled.

b. Storage of Jinhua Pork Hams in retail shops.

The warehouses of retail departments are usually small, so the capacity may not be very large, and hams should be quickly stocked and sold in half a month at most. The hams are stored in bamboo boxes or baskets with division shelves. 10 to 20 hams are stored in a box and should not be piled too long. Hams must be turned over in time to find problems and to take preventive measures.

Small warehouses should also be ventilated, cool, dry and clean to prevent hams from insect and rat pests or going mouldy.

c. Storage of Jinhua Pork Hams for consumers.

After you have bought one entire Jinhua Pork Ham, you should immediately remove the airtight package, and hang it at a ventilated, dry place to prevent sunshine, rains and pollutions. If the requirements are met, the ham can be stored without deterioration for 3 to 4 years or longer. Except that surface fat oxide layer increases and muscle shrinks a little, the aroma and fresh taste remain unchanged. If the

oil, one entire ham must be thoroughly coated), then it should be stuck a tier of edible polythene films or clean oilpaper. By these means, the hams can be protected from losing oil or shrinking and oxidation which causes rancid taste.

d. Preventing Jinhua Pork Hams from insect pests.

Insects often encroach on the hams, so insect pests must be controlled to ensure the quality of hams. The insects are often cheese flies, ham moths, green bottle flies, house flies, mites, red shell worms, soft worms, oil worms, and gold flies etc. These insects damage the nutritive value of Jinhua Pork Hams and their fine appearances, and sometimes make the persons ill, so hygiene and disinfection of the processing sites, warehouses and surroundings must be emphasized to protect the hams from insect pests.

e. Edible methods: predecessors have summed up pentiful edible and cooking methods about Jinhua Pork Hams, they are briefly introduced as follows:

Eating raw hams is a simple and scientific edible method. People are accustomed to sipping

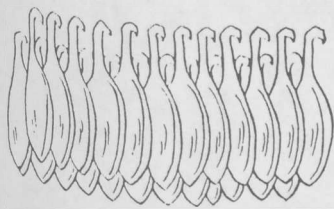


Figure 3 Inverse arrange method

ham is bought for many meals, the sections must be coated with vegetable oil (the best is rape oil, one entire ham must be thoroughly coated), then it should be stuck a tier of edible polythene films or clean oilpaper. By these means, the hams can be protected from losing oil or shrinking and oxidation which causes rancid taste.

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tea or drinking with raw ham slices. One German meat specialist once encouraged people to eat raw hams, But most Chinese people prefer to eating cooked hams.

Eating stewed hams: Jinhua Pork Hams can be stewed alone or with other things. Stew the hams alone in clay pots with slow fire, then cut them into slices, eat them while they are hot. The taste is delicious, palatable, fragrant and ungreasy; Stew the hams with fresh pork, beef, chicken, duck meat, seafood and vegetables etc. in clay pots with slow fire, the meat and soup are both delicious, it is a better edible method.

Eating steamed hams: remove the hams off skin and bones, cut them into slices, place them in bowls and cook them in food steamer, this is one edible method; Cook them with fish, shrimps, seafood and vegetables etc. and a little millet wine, onion, ginger and salt in food steamer.

Sweet-eating method: soak a big loaf of Jinhua Pork Ham in warm boiled water, Stew it alone or with candied fruit, lotus seed, cherry etc. and a little rock candy or white sugar with slow fire. When the ham skin is soft, eating may begin.

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