

QUALITY ASSURANCE STEPS IN HYGIENIC MEAT PRODUCTION

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India with the world's largest depository of cattle wealth produces only 2.13% of the 221.5 MT of meat at world level. Nevertheless, unlike in the developed occident, we lack a meat breed. The rising demand for protein with the richest biological value is met solely from spent animals at the end of their productive life. Meat production estimated as 4.73mMT (FAO, 2001) with an annual growth rate of 4.1% from 1.4mMT beef, 1.43mMT buffalo beef, 0.23mMT mutton, 0.47 mMT chevon and 0.60 mMT pork and chicken has been achieved during the last one decade from slaughterhouses, authorized by local bodies and on a considerable number of animals slaughtered in unauthorized places. The slaughter and dressing practices in many slaughterhouses is far from satisfactory on hygienic grounds. Apart from the overcrowding operations in rather feasible facilities, the heedless unscientific practices caters to unsafe meat production ensuing meat borne infections and intoxications, deterioration of keeping quality, pollution and many untoward public health issues. The Codex Alimentarius Commission under the GATT mandates the implementation of HACCP, the food control quality management system, in all steps of food chain. Hence it is imperative on the part of meat inspection authorities to lock in hygiene in all steps from 'farm to fork'. Exclusively either upgrading the existing slaughterhouses with capacity to accommodate higher daily kill or establishing new ones with modern infrastructural facilities, for a safe and wholesome meat production in the country, complements this fact.

The infrastructure

The first step in planning an abattoir is to ascertain the maximum daily kill of each class of animal and proposed disposal and treatment of edible and inedible byproducts. The obligatory amenities for hygienic meat production include the availability of clean, healthy stock, proficient pre slaughter care and transportation, facilities for overhead rail dressing, lairage facilities for rest of slaughter animals, provision of adept veterinary inspection with well equipped laboratory, availability of potable water which may be made available via an overhead storage tank chlorinated with bleaching powder (3g in 1000L with 35% available Cl₂) of water, electricity, equipments for cleaning and sanitation, maintenance of personnel hygiene, cold storage facilities, rooms for storing hide, head, offals, entrails etc. and a suitable ecofriendly waste collection, treatment and disposal system.

HUMANE SLAUGHTER

The humane slaughter and dressing technique encompasses a

sequence of steps which are depicted in flowchart :

The stock

Apparently healthy animals may harbor many pathogens, which along with the microflora in slaughter hall environment contaminate meat and meat products. Hence to assure safety, the availability of a clean and healthy stock is crucial. Either excessively filthy or those without health certification should never be permitted to the abattoir. Animals arriving dead must be suspected for cases like anthrax. In such a case, provisions should be made available to rule out the same (by staining a blood smear from ear vein with polychrome methylene blue test). Confirmed cases should be dry rendered.

Lairaging

Lairage should simulate conditions in stables. For pigs, watersprays may be used. Animals are rested for 12-24h, fasted but given ad libitum water before slaughter. Ample quantity of potable water, ventilation, lighting, manger, water trough, dung channel, drainage facilities etc. are essential. All these reduce the stress on animals, which eventually improves the eating quality, keeping quality and economic value of meat and its products.

Stunning

This process involves rendering the animal unconscious. Apart from humanitarian grounds, this step entails an overall superior quality meat. There are mainly three methods of stunning:

- 1) Mechanical: By means of captive bolt pistol - cattle, buffalo. Cattle are stunned by means of penetrative type of captive bolt pistol (Temple Cox or Cash Magnum Knockout make, Ordnance factory, Pune) by firing at the point of intersection of two imaginary lines drawn from base of horns to inner canthus of opposite eye. 0.22-rim fire blank cartridge (red) is used for the purpose.
- 2) Electrical: Sheep, Goat, Pigs, Poultry
- 3) Gaseous: Pigs, Poultry

In religious slaughter (Jewish and Muslim methods) stunning is prohibited.

Exsanguination

Within 30s of stunning, animal must be bled. Effectively stunned animal is hoisted to a bleeding rail (4.3m high). Bleeding continues for 5-6 min. About 40-60% of total blood volume is lost with 3-5% remaining in muscle and rest in viscera. Blood, which forms 2% of live body weight in cattle and 3.5%

of live body weight in pigs, may either be hygienically collected for commercial purposes or rendered to produce blood meal.

Sticking sites:

- Cattle, sheep and goat - Bilateral severance of jugular vein and carotid arteries by incision across the throat.
- Pigs - Severance of anterior venacava by inserting knife in the midline of neck at the depression in front of sternum and pushed forward.
- Poultry - Severing the right or left jugular vein at the base of skull.

Veterinary Inspection

- Ante mortem Inspection (AMI): Animals awaiting slaughter should be inspected before slaughter in the lairage. Any signs of diseases, distress, injury etc should be noted and appropriate action be taken.
- Post mortem Inspection (PMI): After slaughter head, carcass, viscera and their associated lymph nodes are inspected for any anomalies and arbitrated accordingly. Laboratory tests shall prop up the results.

Slaughter line

- Cattle, sheep and goat : After complete bleeding is effected, dehiding is done on a flaying cradle followed by hoisting the animal on dressing the rails of height 3.4m.. Rest of the online operations include decapitation in which head is removed by severing at occipitoatlantal junction, feet removal and evisceration. The dressed body of the animal at this stage is termed 'carcass'. Carcasses are then subjected to electrical stimulation in order to hasten the onset of rigor and hence preventing cold shortening and for improving the tenderness of muscle.
- Pigs : Pig skin (rind) being edible, deskinning is not done. Hence it has to undergo various depilation process prior to decapitation and evisceration, which include the following :

Scalding : The completely bled pigs are conveyed on the rails into an immersion type scalding tank, where they are kept moving inside at 61-64°C for 4-6 min. The time- temperature combination is decided upon the pulling off hairs and prevention of overcooking too.

Dehairing: Pigs are mechanically lifted from the tank and transferred to the dehairing machine fitted with metal scrapers, which depilates the hair as pigs revolve.

Singeing: Any remaining hairs are burnt off by means of a blowlamp.

Scraping and washing

Washing

Carcasses are thoroughly washed with potable water using a

high-pressure jet cleaner to remove blood and other contaminants.

Hot deboning

Carcasses are split into fore and hind quarters at the level of last intercostals space and muscles are seamed out of bones.

Packing and storing

Meat is weighed and packed in high density polyethylene pouches and hot sealed. Sealed pouches are blast frozen at -200°C.

Waste disposal

Manure and paunch wastes are disposed off in manure bays. Bones, hooves etc are dry rendered.

Slaughter and dressing of poultry

Holding: After unloading from crates, birds are held in the receiving dock or held for about 8h by providing water or immediately after unloading they are hung upside down by the feet on shackles suspended from a continuous moving conveyor line. AMI is done in the holding area and on the line during which any bruises, fracture or diseases are checked for.

Shackling: A quieting time of not more than 3 min and 6 min for domestic fowl and turkey respectively, is allowed before stunning to avoid struggling.

Stunning: Birds are electrically stunned by passing current, 70-100V, through head in an electrically charged waterbath.

Bleeding: Within 30s after effective stunning birds are bled by cutting jugular vein and carotid artery at the base of skull. The bleeding time allowed is 3 min for turkey and 1.5 min for chicken.

Scalding: Birds are immersed in hot water at either 53°C (soft scald) or 63°C (hard scald) for loosening of feathers.

Defeathering: Feathers are rubbed free of follicles in a defeathering machine equipped with rotating rubber fingers that beat the body surface.

Singeing: Finer filoplumes are burned off by a blow lamp. In ducks waxing may be done for this by immersing the carcass in a molten wax tank of 90°C and then to a water tank. Fine feathers are removed along with the scrapping of wax.

Washing: Done in a stream of water to remove any dirt or soil.

Neck slitting, feet removal and evisceration: A vertical incision is made on the dorsal surface of neck to assist in the removal of crop, oesophagus and trachea. The vent is cut around after squeezing out the faecal matter. Care must be taken to avoid carcass contamination with faeces. The whole of viscera including the edible offal and lungs are drawn out using an evisceration fork but leaving it hanging from carcass ready for inspection. Feet are removed by means of an automatic cutter. Edible offals or giblets (heart, liver and gizzard) are removed for further

Phosphate injection: 0.5% solution of sodium tripolyphosphate (maximum of 5% of body weight is permitted) is injected into breast or leg muscle which will enhance the water holding capacity of the carcass.

Chilling: Carcasses are dropped into tank containing chilled water for 30-60 min .This is to reduce the internal temperature to 40C.

After draining any surplus water, carcasses are weighed and packed in high density polyethylene pouches and hot sealed. Sealed pouches are blast frozen at -200 C.

The chief sources of contamination on meat and its products are the animal itself, operatives and the slaughterhouse environment. Contaminants derived mainly from soil gain entry into meat during flaying from hide, fleece or skin, knives and other equipments, operatives' hands, legs and arms. In addition to, other sources include the gastrointestinal tract due to faulty gut spill, vermin, residues of sanitizers and so on. In pigs, scalding tank is a significant source of cross contamination.

A modern abattoir is essential for hygienic meat production. Only clean and healthy animals with health certification must be admitted to the abattoir. Prior to slaughter, the animal should be presented in clean and dry condition. Operatives should be provided with easily cleanable headgears, footwear, gloves and hand washing facilities. Education and training them imparting an awareness on wholesome meat production and distribution, pros and cons of faulty meat handling resulting in meat borne hazards and instilling a sense of responsibility is inexorable. All

equipments including knives and steel that come into contact with meat and its products must be properly washed and sanitized regularly. Water at 82°C may be provided for this. On the rail system of dressing stands unique with respect to safety, wholesomeness and superior workmanship giving way to the traditional on the floor system of dressing. Accidental gut spill can be prevented by ligating the esophagus (rodding) and rectum (bunding) and removing the tract intact during evisceration. Sufficient space (3.4m) must be provided between carcasses on the rail to avoid cross contamination by contact or water splashing while power hosing. Pre and post slaughter decontamination of abattoir plays the major part of the game of hygiene. The correct sequence of general routine cleaning includes gross cleaning, pre rinsing, application of food grade detergents, post rinsing, disinfection and terminal rinsing.

Meat industry in India is not well organized due to the lack of clear vision and sound policy. Most of the slaughterhouses in the country are ill managed, unhygienic, overcrowded and lack the essential infrastructure and inspection services and the meat business leans upon untrained class of butchers and handlers. The country lacks a uniform rational slaughter policy. These critical aspects along with the meat borne diseases have turned up meat food safety a challenging issue. The only panacea in addressing the concern is to ensure the hygienic status of the animals during production, transportation and slaughter, operatives, equipments and environment, implementation of stringent AMI and PMI procedures, appropriate modernization of slaughterhouses, proper education of meat handlers, maintaining cold chain and enforcing a uniform updated and pragmatic legislation based on quality management strategies like HACCP, throughout the country.

Slaughter and dressing procedure of cattle and pigs.

