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Survey of Existing Pork Processing and Marketing Systems in Assam

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ABSTRACT

A scientific approach has been applied to document the existing pork processing and marketing systems, and the study was conducted in Kamrup District, Assam. Different quality characteristics (carcass measurements, physico-chemical and microbiological) of pork marketed in this area were evaluated. The hygienic status of meat personnel/butchers and meat shops (which handle pork) were also assessed. Further, the work involved a survey to understand the requirements of pork consumers in the district. A total of 43 pork shops and 62 pork carcasses were assessed in the five different blocks under study. In this study 51 meat handlers and 300 pork consumers were evaluated. No pakka retail pork shops exist in any of the places under survey, irrespective of rural or urban areas. The microbiological characteristics of the pork carcasses, hands of meat personnel and the common facilities available in the pork shops viz. wooden cutting board, cutting knives etc. evaluated during the survey indicated that the counts for all the organisms considered were well above the prescribed limits for clean/hygienic pork.

Key words: *Pork processing, consumer evaluation, hygienic pork, clean pork.*

INTRODUCTION

Pork production in India is supported by a large number of indigenous breeds of pigs, crossbreds (constituting about 17% of total pigs) and exotic breeds including Yorkshire, Landrace, Duroc and Hampshire. Pork production is estimated to comprising about 11 % of total meat production (6.4 MT) in the country (FAO 2008). Pig production remained largely a nomadic (scavenging) activity in North Eastern regions, with very little or no input primarily an activity of weaker section people. Pig is an important source of meat for the consumers of this region, where 28% of the country's pig population is available and plays an important role in socio-economic growth. Documented reports indicate that more than 90 % people in this region consume pork (Kumaresan *et al.* 2008). The pig slaughtering system is still traditional except in a very few modern slaughter houses. Also, the people involved in slaughter activities have little knowledge of clean and hygienic pork production. Pork used to be sold in open environment without taking care of any hygienic practices. At room temperature, deteriorative changes of meat are very fast unless specific measures are taken to retard the contamination and growth of microorganisms.

Availability of quality pork is a scarce item for most of the consumers and the available literature indicates that no systematic study was conducted in the past to evaluate the existing hygienic status of pork processing sector in India. Also, a systematic consumer survey is very much essential to find out the quality awareness and requirements of pork consumers. Therefore, this work has been undertaken, as a beginning step for a large survey, to document the existing production processing and marketing systems of pork.

MATERIALS AND METHODS

The experiment was designed to evaluate and document the existing pork processing system in Kamrup district, Assam. In the project, five blocks (Greater Guwahati region/Kamrup Metro, Rani Development Block, Boko Development Block,

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Chaygaon Development Block and Goreswar Development Block) were selected for the study. The samples were collected from both city/town and rural/village areas (five each from urban and rural areas) from each block. Even though, evaluation of at least ten retail pork shops from each selected blocks were proposed, a total of only 43 shops could be covered in the survey due to the existence of less number of shops in the village areas. The survey in each block took about 7-10 days for completion and the following activities were undertaken. Screening the locality and identification of key informants and rapport building, consumer survey, documentation of carcass quality measurements and collection of samples for microbiological analysis.

Different quality characteristics (carcass measurements, physico-chemical and microbiological) of pork marketed in this area were evaluated. The hygienic status of meat personnel/ butchers and meat shops (which handle pork) were also assessed. The project also involved a survey to understand the quality awareness and requirements of pork consumers in the district. The samples were collected from both city/town and rural/village areas (five each from urban and rural areas) from each block. A total of 62 pork carcasses were assessed in the five different blocks under study. The pH of the meat samples were measured using a digital pH meter (Elico, Model LI 127, India) in the shop itself. Different carcass characteristics viz. skin colour, loin eye area, visual carcass marbling score and back fat thickness were measured (Briskey and Kauffman, 1971). Moistened swab method was followed for microbial enumeration (ICMSF, 1996) of microbes from surface of pig carcasses. The data collected from five different blocks were pooled and analyzed in Microsoft Excel.

RESULTS AND DISCUSSION

Existing pig slaughter practices: Adequate slaughter facilities are not available to produce pork under sanitary conditions in any of the five blocks under the survey. In village areas, pig slaughter mostly take place in unauthorized places, that too only one or two animals are slaughtered once in a week or on special occasions, making it difficult to ensure effective meat inspection practices. In fact, it was observed that, the meat inspection practices are not followed efficiently in any of these areas. Overcrowded slaughter in unaesthetic places was also common, especially during festive seasons. In all of these places, floor slaughter was practiced with poor hygiene.

It was noticed during the survey that the slaughter operations in urban/town areas starts much earlier (4.30 am to 6.00 am) compared to that in village areas (6.30 am to 8.30 am). Further, the number of pigs slaughtered per day per butcher varies from 1-2 in villages and 1-5 in urban areas. There exist some common places meant only for pig slaughtering in two blocks, where about 20-45 pigs were killed during market days and distributed to different nearby places. In village areas slaughter operations are restricted mostly to the market days (twice per week in most of the villages) while in town/urban areas pork is available at least 4-5 days per week. In most of the places, mechanical stunning with a pole axe or similar hard structures is in practice. Bleeding is rarely practiced during the slaughter operations and even if bleeding is done, the blood is painted over the skin surface. In all cases, hot water was kept ready well before slaughtering the pigs. This water, with a temperature of well above 90^{o}C, was used for scalding purpose, however, there was no time frame and water was applied over the skin until almost all the long bristles/hairs are removed. It was found that majority of the butchers were using steel glasses with sharp edges for removing the hair/bristles (as scraper) after the hot water application. The technique followed for singeing was quite interesting. Small pieces of bamboo were tied together in the form of a bundle (about 5-7 inch diameter and 2-2.5ft length) and one such bundle will be used for singeing one pig. Washing of pigs after singeing was followed in many cases but with very limited amount of water. A report on pig meat marketing management and inspection system in Kathmandu Valley, Nepal (Rana *et al.* 2006) indicates that there is no fixed system for marketing exists; however, there is a regular live animal and pork haat bazaar system developed in

different municipalities and a few highway roadside bazaars to which farmers bring their live animals for sale to local traders.

General appearance of pork shops: There exist no pakka retail pork shops in any of the places under survey, irrespective of rural or urban areas. While the so called pork shops available in the rural/village areas have no covered building facilities, some of the shops in the urban/town areas have some sort of buildings with roof for selling the pork. Out of 20 pork shops surveyed in villages, 9 were just roadside shops, whose position changes from time to time. The remaining 11 pork shops in the village areas had either a thatched roof or bamboo roof. Seven of these shops have walls made of bamboo too. The floor area of most of these shops ranges from 4-7 . The facilities available in these shops are very much limited and it include a) a structure similar to a small table made of low quality wooden planks, b) a wooden cutting board for fabrication of pork, c) 2-3 knives of different sizes (one for cutting large pieces and another one or two for cutting small pieces), d) a hand held knife sharpener e) a balance (mostly hand held) for weighing the pork and f) a piece of cloth for cleaning the knives and hands of butchers occasionally. The packaging material used in all the shops was black coloured plastic carry bags.

All the 23 pork shops surveyed in urban/town areas had some sort of building with walls and roof. Cemented floors were there for 13 shops, however only 5 of them had proper walls made of bricks with cement plastering. Other 18 shops had temporary walls made of bamboo sheets, which are either hanged from the roof or fixed by few numbers of bamboo poles on the sides. There exists tin roofing for 15 numbers of shops while others had thatched or bamboo sheet roofing. Overhead carcass hanging facilities (a long wooden/bamboo pole or metal pipe of about 2" diameter etc.) were present in 13 shops, while in other shops the fabrication operations were done at floor level itself. Most of these shops had a floor area in the range of 10-17 m^2. Only 8 shops had two persons for various operations (one butcher and one assistant), while a single person (butcher) manages all the operations in other shops. However, it was noticed that they used to get the required help from either family members or friends during the slaughter and evisceration operations. The selling procedure used to complete by noon time in most of the shops, in fact, the entire meat was sold out by that time.

General carcass characteristics: It was observed during the survey that local pig breeds, either pure or crossbreds, constitute majority of the slaughter stock. Due to indiscriminate mating practices existing in these areas coupled with the low economic and literacy rate of the people associated with the slaughter operation, it was very difficult to assess whether the pigs belong to purebred or cross bred. Even though, few numbers of crossbred pigs belonging to Desi x Tamworth (5 nos.) and Desi x Hampshire (7 nos.) were noticed during the survey, the percentage of exotic inheritance could not be found out. According to the butchers version, it was found that majority (58% i.e. 36 nos.) of the pigs slaughtered belong to an age group of 1-1.5 years. Also, 21% (i.e. 13 nos.) of the pigs belonged to the 0.5-1 year age group, while the remaining pigs were of more than 1.5 years of age. An interesting feature observed during the survey is that, the skin colour of almost all the pigs slaughtered was black. Different carcass characteristics that could measure during the survey are depicted in Table 1. The loin eye area (i.e. the area of cross section of longissimus dorsi muscle between 10^{th} and 11^{th} ribs) and back fat thickness (i.e. thickness of subcutaneous fat at the level of 10^{th} rib, which include the skin thickness too) were far below the standards recommended by the European and USDA classification for pork carcasses. However, there exist practical difficulties in direct application of the standards recommended by these International agencies to our indigenous and cross bred pigs.

Microbiological characteristics of pork carcasses: The microbiological characteristics of the 62 pork carcasses evaluated during the survey (Table 2) indicated that the counts for all the

Table 1: Selected pork carcass characteristics assessed during the survey

Parameter	Age group		
	0.5-1.0 year n=6	1.0-1.5 year n= 21	More than 1.5 year n=11
Loin eye area (Av.)	1.9 sq. inch	3.7 sq. inch	4.2 sq. inch
Back fat thickness (Av.)	0.42 inch	0.68 inch	0.76 inch
Visual carcass marbling score (1-5 scale) (Av.)	1.15	1.74	2.09

organisms considered were well above the prescribed limits for clean/hygienic pork by International (USDA 2001, Codex Alimetarius Commission 2005) and the .national (Food Safety Standards Act, 2006) standards. The higher numbers of total coliform (indicator of post processing/fecal contamination) and the *Staph. aureus* (indicator of personnel hygiene) counts present in the pork samples suggests the possible contamination of wash water with fecal material and improper personnel hygiene maintained by the people involved in the slaughter and processing operations (Malik 2003). Major sources of contamination of dressed pork are likely the incoming pigs, contact with work surface, equipments, hands etc (Castillo *et al.* 2002). Use of single knife to cut head, legs and opening of viscera also leads to extended contamination of carcasses. Some of the samples were contaminated even by *Salmonella* sp. whose prescribed limit in all forms of pork is NIL by all the regulatory standards (Todd 2003). This higher contamination rate indicates a higher risk to the public from the mishandled and cross-contaminated pork.

Table 2: Microbiological characteristics of the pork carcasses assessed during the survey

Parameter	Average count (log cfu/cm^2) n=62	Range (cfu/plate)
Total plate count/Aerobic count	2.14×10^6	68-261
Coliform count	1.76×10^3	36-75
Staphylococcus aureus count	1.97×10^3	62-109
Salmonella sp. count	1.71×10^1	0-84
Lactobaccillus count	2.01×10^4	76-126
Yeast and mold count	2.14×10^2	78-169

Hygienic status of personnel: A total of 51 meat personnel belonging to a wide range of age group (11years to 68years) from 42 pork shops were evaluated during the survey. A good majority (35 nos.) of them has come to the pork trade as a family business practice, but others were new entrepreneurs in this field. Even though, all of them could communicate well in Hindi as well as in Assameese, 21% (11 nos.) of them have not gone to school, 45% (23nos.) and 29% (15 nos.) studied up to 5th and 10th standards, respectively, while other two persons had an educational qualification of 10+2. The following observations were made during the evaluation of meat personnel viz. a) none of them had obtained a prior training on scientific slaughter and processing operations, b) all of them were unaware of standard cuts of pork and pork fabrication techniques, c) all of them had knowledge about some sort of diseases (mainly worm related) transmitted through unhygienic pork, but none of them were clear about what the diseases are and what are its impacts on consumers and their own health and d) practically there was no by-products remaining after slaughter except the stomach and intestinal contents i.e. all portions including the ear, tail, tongue, feet and all visceral organs (except gall bladder) were sold out or utilized for own preparations at home. It was also observed that the retailers have extraordinary skills to convert a visibly contaminated carcass into a most attractive material through scrupulous removal of dirt and fascia, meticulous spreading of fat and neat display of musculature. Therefore, it was only a "camouflage hygiene" existed in most of these pork shops, especially in rural areas but it served well to attract the customers.

Hygienic status of in pork shops: The results of enumeration of microbial counts on the hands of 51 meat personnel and that on the most common facilities available in the pork shops viz. wooden

Table 3: Microbiological counts in the hands of meat personnel

Parameter	Average count (cfu/100cm^2) n=51	Range (cfu/100cm^2)
Total plate count	654	456-844
Coliform count	211	72-272
Staphylococcus aureus count	392	140-552
Salmonella sp. count	31	18-60
Lactobaccillus count	116	56-192
Yeast and mold count	184	112-296

cutting board, cutting knives (43 numbers each) and that on the slaughter floor (samples were taken only from 13 urban/town pork shops which had cemented floors) are depicted in Table 3 and Table 4, respectively. The test results clearly indicate that the counts of different organisms present were far more than the values for microbial monitoring for manufacture of hygienic products under EU GMP guide (1997). These findings calls for the need of a proper training for the personnel involved in the pork trade on importance of maintenance of hygienic practices during various slaughter and processing operations.

Quality awareness of pork consumers: Out of 300 consumers evaluated during the survey, 218 were assessed at the shop itself while they come for purchase of pork and the remaining persons were assessed at their homes. Eighty nine percent (194 nos.) of the consumers came for purchase of pork were males and majority of them (82%) were in the age group of 20-50 years. However, the percentage of females participated in the survey at homes was more (73%) compared to their male counterparts. The following observations were made during the evaluation of pork consumers viz. a) majority of them (65%) had a purchase frequency of pork per month in the range of 2 to 3 times, b) most of them (78%) used to purchase small quantity of pork at a time i.e. 1 -2 kg, c) 89% of the consumers expressed more liking for pork from black coloured pigs while the rest had no reservations for pork colour, d) 74% of the consumers were not satisfied with the existing hygienic conditions as far as slaughtering, processing and packaging are concerned, but none of them ever raised their voices for improvement, e) 43% of the consumers were ready to pay more for good quality pork, if make available and f) 86% of them used to make only curry or fry, out of the fresh pork they purchase.

Table 4: Microbiological counts on different facilities available in the pork shops

Parameter	Wooden cutting board (cfu/100cm^2)n=43	Cutting Knife (cfu/100cm^2)n=43	Slaughter Floor (cfu/100cm^2)n=13
Total plate /Aerobic count	863 (668-1008)	734 (688-780)	574 (384-740)
Coliform count	218 (88-344)	409 (236-512)	247 (64-504)
Staphylococcus aureus count	499 (328-836)	288 (20-544)	236 (80-712)
Salmonella sp. count	132 (44-244)	82 (48-116)	85 (12-212)
Lactobaccillus count	117 (64-208)	179 (136-240)	42 (20-80)
Yeast and mold count	272 (32-448)	292 (228-336)	238 (76-432)

· Values in the parenthesis indicate the range

CONCLUSION

The results of this study clearly indicate that the hygienic status of the pork marketed and the facilities existing in the pork shops needs a lot of improvement, in order to ensure clean pork to the consumers. The authors feel that the documented finding of this study could act as a base for developing the future action plans for the improvement of pork processing sector, not only in Assam but for the entire nation.

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REFERENCES

Briskey EJ and Kauffman RG (1971) Quality characteristics of muscle as a food. In: The Science of Meat and Meat Products. 2nd ed. J.F. Price and B.S. Schweigert (eds.), W.H. Freeman and Co., San Francisco.

Castillo A, Hardin MD and Dickson JS (2002) Reduction of microbial contamination on carcasses. Control of food borne microorganisms. Juneja VK, Sofos JN, Dekker M (ed). Chapman & Hall Inc, New York, pp 361-369.

Codex Alimentarius Commission (2005) MRLs for veterinary drugs in foods. Updated as at 26th session of the Codex Alimentarious Commission. Giant report Internet, Assess on 24th March. Website: http://www.codexalimetarius.net/indexen.stm.

EU GMP Guide (1997) http://ec.europa.eu/transparency/docs/guide_citoyen/en.pdf

FAO (2008). Year Book production, 51 Statistics Series, No. 142, FAO, Rome, pp 204-209.

ICMSF (1996) Microorganisms in Foods. 5. Characteristics of microbial pathogens. Springer Science and Business Media, London, U.K, pp 45-328.

Jay JM (1996) Modern Food Microbiology. 4th edn. Chapman & Hall, Inc, New York, pp 88-126

Kumaresan A, Bujarbaruah KM, Venkatasubramanian V and Pourouchottamane R (2008) Technology inventory for livestock and poultry production in north-eastern region. Zonal coordinating unit-III, ICAR, Umiam, pp 53-55.

Malik SVS (2003) Public health and safety aspects of livestock products. In: National workshop on identification of technologies and equipments for meat and milk products, 2003, September 5-6, IVRI, Izatnagar, India, pp 51-53.

Rana S, Joshi DD, Joshi PR and Sharma M (2006) Pig meat marketing management and inspection system in Kathmandu Valley. NZFHRC, Kathmandu, Nepal, pp 123 131.

Steenkamp JB (1997) Dynamics in consumer behavior with respect to agricultural and food products. Agricultural marketing and changing world. B. Wierenga, A. VanTilburg, K. Steenkamp and JBM Wedel (ed). Kluwer Academic Publishers, pp 144-188.

Thomas R, Anjaneyulu ASR and Kondaiah N (2006) Quality and shelf life evaluation of emulsion and restructured buffalo meat nuggets at cold storage. Meat Sci., 72: 373379.

Todd ECD (2003) Microbiological safety standards and public health goals to reduce food borne disease. Meat Sci., 66:33-43.

USDA (2001) United States Department of Agriculture, Food Safety and Inspection Service. Performance Standards for the production of processed meat and poultry products, proposed rule. Federal Reg 66: 12589-12636.