Risk assessment in the pork meat chain in Nagaland, India

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Abstract
The approach to a risk assessment study in the pork meat value chain in Nagaland, North-East India, is introduced. It contains
a) Assessment of pathological hazards in different chains and conditions of pork meat marketing in selected district
b) Awareness and practices of the actors of these chains

Background
Nagaland is one of the north-eastern states of India. Pork occupies an important place in the diet of the mainly (90%) Christian population. Consequently, there is a great local demand for pork meat; imported pigs are expensive and a market is growing fast for the local black and cross-bred pigs, giving the poor a marketing opportunity to sustainably increase their household incomes. ILRI aims to support poor people to seize this market gap through collaboration with national partners. The presented work is part of a research program set up to improve the production and marketing of pigs in the Northeast of India.

Introduction
A previous study by ILRI[1] indicates that "in Nagaland, as elsewhere in the North Eastern Region, there is little or no formal infrastructure for slaughter of pigs or display of pork, which raises concerns about public health issues related to food safety".

➤ Lack of public awareness for human and livestock health risks
➤ To assess these risks, implementation of a disease risk assessment strategy in the pig/pork meat value chain
➤ Local collaboration with the Government of Nagaland and NEPED (Nagaland Empowerment of People through Economic development)

Material and methods
➤ Pathway approach → from stable to table
➤ Identification of two basic chain structures of the pig market (see fig.1) in the district of Kohima, Nagalands capital which represents about 1/6 of Nagaland's population
➤ Risk Assessment using different tools:
 ▪ Check lists and questionnaires
 ▪ Participatory methods (Participatory risk assessment, PRA)
 ▪ Rapid diagnostic tests for several pathogens
  (Total aerobic bacteria, Enterobacteriaceae, *Staphylococcus aureus*, *Listeria spp*, *Brucella suis*, Cysticercus, intestinal parasites, antibiotic residues) in
a) Faecal and blood samples taken at slaughter level (n=93)
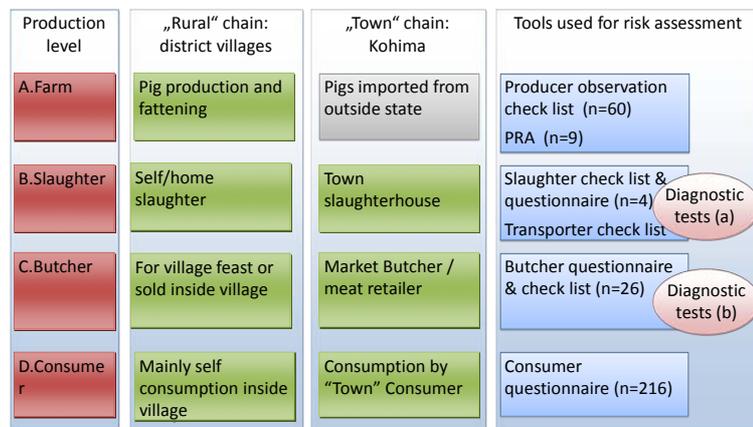b) Meat samples taken at butcher level (n=91)

Production level	„Rural" chain: district villages	„Town" chain: Kohima	Tools used for risk assessment
A. Farm	Pig production and fattening	Pigs imported from outside state	Producer observation check list (n=60); PRA (n=9)
B. Slaughter	Self/home slaughter	Town slaughterhouse	Slaughter check list & questionnaire (n=4); Transporter check list — Diagnostic tests (a)
C. Butcher	For village feast or sold inside village	Market Butcher / meat retailer	Butcher questionnaire & check list (n=26) — Diagnostic tests (b)
D. Consumer	Mainly self consumption inside village	Consumption by "Town" Consumer	Consumer questionnaire (n=216)

Figure 1: Levels and pathways of two pork meat production chains, and tools used for the risk assessment study.

Results

A. Farm level
➤ All participatory discussion resulted in a list with pig diseases seen in the respective village, including acute febrile disease with high mortality
➤ In none of the 9 villages visited farmers had access to veterinary drugs
➤ Only 6% out of 70 participating farmers kept more than 3 pigs with a maximum of 6 pigs

B. Slaughter level
➤ All town and village slaughter is open-air (town slaughter places open with a kind of roof)
➤ Before opening, carcasses are commonly flame treated
➤ Only 1 slaughter place with running water and partly fixed (concrete) floor
➤ 100% no refridgeration of carcasses/meat
➤ 6% pigs tested positive for *Brucella suis* (all town butchered, imported pigs)
➤ 7.5% pigs tested positive for Cysticercosis (all town butchered, imported pigs)
➤ 4% meat samples with antibiotic residues (comprising village and town pigs)

C. Butcher level
➤ Total aerobic bacteria counts: 46% of samples highly (> 10 000 CFU/g) and 19,8% unacceptably contaminated (> 100 000 CFU/g); town > village
➤ *Enterobacteriaceae* present in 83,5% of meat samples and >1000 CFU/g in 75%; town > village
➤ *Listeria spp* present in 32% of samples; town > village
➤ Purchase time has an influence on bacterial cell counts: meat sampled early (7-9.30 am) significantly less contaminated than meat sampled later during the day ($p<0.01$)

D. Consumer level
➤ High incidence of self-reported gastro intestinal illness:
➤ 83% report illness in the last 6 months
➤ 32% report illness last month
➤ Consumption of pork does not predict illness
➤ 99% boil meat >60 min
➤ 96% eat cold leftovers, most without re-heating, most after >12 hours
➤ Evidence of possible cross-contamination when preparing food
➤ 90% do not own a fridgerator

Conclusions
➤ Hazards and most probably risks associated to pig production and pork meat marketing in Nagaland are present for human and animal health
➤ Village slaughter pigs and village pork meat show fewer hazards than imported slaughter pigs and their meat sold by market retailers in town
➤ Great potential for farmers to optimize and increase the local pig production

Outlook
➤ Detailed data analysis of selected aspects to identify risks and possible intervention realms
➤ Capacity building of concerned actors to mitigate the risks
➤ Provide data to stakeholders and decision makers to promote animal health and market strategies leading to pig-promoting policy

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[1] Deka, R. and Thorpe, W. 2008. Nagaland's pig sub sector – current status, constraints and opportunities