Myanmar Pig Partnership
EVIDENCE BRIEF

Pig meat and food safety in Myanmar: evidence to support practice

Research findings reveal that disease-causing bacteria, including *Salmonella*, are widespread on pig farms of all sizes in Yangon Region, Myanmar, as well as in pig meat sold to consumers in the city and rural areas. This evidence provides a snapshot of how intensification in pig production can affect food safety – and points to potential responses.

BACKGROUND

Foodborne disease (FBD), in particular gastro-intestinal (GI) disease, places a heavy burden on the most vulnerable people in poorer countries. According to the World Health Organization, in 2010 in southeast Asia, FBD accounted for 150 million illnesses, 175,000 deaths and the loss of 12 million years due to ill health (DALY, Disability Adjusted Life Years).

Myanmar's agriculture development strategy for 2019-2023 acknowledges food safety management as below international standards. The UN Food and Agriculture Organization's Myanmar programming framework 2017-2022 prioritiseses capacity strengthening for formulating food safety policy and implementation.

The bacteria *Salmonella enterica* and *Streptoccus suis (Strep.suis)*, both associated with pigs, pass to people through food and work exposure. *Salmonella* causes GI disease in people, occasionally life-threatening. *Strep. suis* causes severe illness, including meningitis. Both are reported to be significant among pigs and people in southeast Asia, but little is known of the FBD burden in Myanmar specifically, or of the contribution from pig meat – the second greatest source of animal protein in Myanmar.

Research implications

- **Improving food safety will require training retailers, slaughter workers and traders in aspects of food contamination not detectable by sight alone.**
- **Investment in stricter hygiene controls in pig processing, and related review of legislative controls, should be prioritised.**
- **The supermarket sector needs extra focus to ensure it is not left behind in implementing internal food safety management systems and practices.**
- **Food safety awareness initiatives aimed at consumers are justified given the high level of contamination of retail meat. These could catalyse positive change for rural/shorter pig-supply chains through social sanctioning.**

Image: Naomi Marks

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APPROACH

The project studied the prevalence of *Salmonella* and *Strep. suis* in pig meat production in Yangon Region. Sampling took place at different scales of intensification at retail, processing and farm levels.

Retail sampling included 15 supermarkets in Yangon City, 15 retailers at an urban wet market in a peri-urban township (A) and 15 retailers at wet markets in two rural townships (B and C). Slaughter sampling included a large slaughterhouse taking pigs from a wide area including all scales of production, and eight smaller, low-throughput slaughterhouses sourcing pigs from farms in rural townships B and C.

Farm sampling took place in two time windows (2016-17 and 2019-20) and at three scales of production, including two intensive farms (>700 pigs) in the government-designated livestock intensive zone of rural township C; 10 smaller, semi-intensive farms (10-70 pigs) in rural townships B and C; and seven backyard farms (<10 pigs) in peri-urban township A in the first time window, and five in the second. Farms were sampled on three season-based occasions in each time window (winter, summer and rainy).

The study gathered information on working practices though questionnaires and interviews and evaluated the sampling data alongside this.

The project's efforts to gather key data on the infectious and zoonotic causes of human diarrhoea in Yangon Region were curtailed following government changes in early 2021.

FINDINGS

1. Supermarket-sold pig meat has high *Salmonella* contamination.

Prevalence of *Salmonella* positive samples (n[1]= 45 per site) was greatest among supermarkets (88.9%), despite this being the only retail type in which meat was displayed chilled. This prevalence was significantly greater than for rural wet markets (53%), but not significantly different from the urban wet markets (71%, n=45).

Analysis of risk factors revealed an association between *Salmonella* detection and the time taken to transport meat from supplier to retailer. Also, supermarket and urban wet market sellers tended to obtain their meat from large slaughterhouses where pigs were supplied from a wide area with longer supply chains than rural markets. Here, longer journey times, mixing of pigs with associated stress and poor hygiene practices in transport vehicles likely increased the opportunities for pre-slaughter contamination. Rural wet market sellers obtained their meat from close-by, low-throughput, small slaughterhouses mainly supplied by local, semi-intensive farms. Other observations included a very high prevalence of *Salmonella* among meat samples that were minced or pre-packed by the retailers in our study (89%, n=35), mainly the supermarkets. This highlights the importance of routine, in-process cleaning practices to minimise cross-contamination.

2. Carcase contamination is common at slaughterhouses.

Over half the carcases sampled carried *Salmonella* (52%, n=91) – a significantly greater proportion than for gut content of the same pigs (29%). The disparity was more marked for the large slaughterhouse (carcase prevalence 64%, n=45) than for the small slaughterhouses (39%, n=46).

In both large and small slaughterhouses a lack of chilling facilities was described, which is likely to enhance bacterial growth. A number of factors likely to increase cross-contamination before and after slaughter were identified in both groups: inconsistent cleaning and disinfection of pig-transport vehicles, animal resting areas (lairage) and slaughter equipment and also inconsistent rinsing of carcases (a practice which may anyway enhance cross-contamination); and finally handling, dressing and butchering of carcases on flat surfaces (rather than from a rail). The high risk practice of gathering pigs into a single lairage from many collection points was unique to the large slaughterhouse and likely compounded these other risks.

3. *Salmonella* is widespread and increasing on all pig farms.

Salmonella was found on every farm, with the overall sample prevalence nearly doubling between sampling windows (22%, n=328 in the first, to 42%, n=172 in the second). There were consistent differences in prevalence for the different scales of farm intensification. In the first sampling window, the prevalence on semi-intensive farms (13%, n=180) was significantly lower than both intensive (28%, n=40) and backyard farms (38%, n=108). Whereas in the second sampling window, the prevalence for semi-intensive farms (31%, n=107), although still lowest, was only significantly lower than backyard farms (72%, n=29). Prevalence on intensive farms had risen to 50% (n=36).

The relative prevalence of different *Salmonella* strains (serotypes) may reflect practices at different levels of intensification. *S.* Kentucky, associated with poultry and human disease, was prevalent on backyard farms where commercial pig diets were commonly supplemented with kitchen waste. *S.* Rissen and *S.* Stanley, commonly described

1 n=sample size

in Thailand's pigs, were widespread in intensive and semi-intensive farms – where improved, rather than indigenous, pig breeds were widely used. *S.* Weltevreden, associated with commercial pig feeds containing fishmeal was also prevalent. Commercial diets, as a source of many serotypes of *Salmonella*, may explain the general increase in prevalence over time across all scales of farm studied.

4. Zoonotic strains of *Strep. suis* are infrequent but may be emerging.

The prevalence of *Strep. suis* on tonsil samples of live pigs was similar across farm intensities and in line with reports from other countries. Whole genome sequencing confirmed the striking absence of disease-associated subgroups, otherwise found worldwide and in neighbouring countries, from the entire collection. Only a single tonsil isolate collected from an intensive farm in the second sampling period was a disease-associated type.

5. Poorer farmers face significant challenges in improving biosecurity.

Biosecurity practices were largely absent on backyard farms, only partially implemented on semi-intensive farms, but moderately well implemented on intensive farms. Backyard farms routinely used kitchen or catering waste food to supplement commercial feed and surface water for drinking, likely increasing exposure of pigs to foodborne pathogens.

Backyard farmers struggled with low household incomes and a lack of access to low-interest loans. As a result, they could afford little investment in farming, including in biosecurity and hygiene measures. These farmers were also found to have insufficient land for housing pigs and were less likely to access expert veterinary services. Backyard farmers largely viewed pig-keeping as a source of ready cash, rather than a route to commercial growth. The semi-intensive farmers showed a greater inclination to invest in commercial feeds and hygiene measures. Productivity gains related to disease reduction were an incentive. However, information access to effective biosecurity measures was generally limited. Some semi-intensive farmers collaborated to reduce disease spread between properties. However, because the supply chains did not differentiate meat from healthy pigs, slaughterers and traders did not offer farmers a higher price for healthy pigs. Lack of awareness by traders meant that farmers' collective action to improve farm-level hygiene had little effect on food safety.

6. Social sanctioning incentivises.

The study's interviews showed that tight social relationships between rural retailers and consumers can create a mechanism for informal accountability through the possibility of social sanctioning (boycotting) of retailers perceived to have unhygienic practices. This incentivised the rural retailers to maintain good food safety practices. Such sanctioning did not exist for urban markets because retailers and others in the urban supply chain have limited direct relationships with consumers.

DISCUSSION

Sample sizes were time- and resource-limited, which restricts statistical analysis. Nevertheless, the findings provide strong evidence that food safety in the pig-meat sector needs better awareness and greater investment. They confirm that Myanmar's food safety policy in this sector should be reviewed and existing regulations enforced.

Pig production investment. The market-led pig supply chain presents a major challenge to changing established risky practices and implementing

8. Popular 'pork sticks' are often unsafe.

Pork sticks are a popular street food in Yangon, comprised of pieces of freshly cooked tongue, liver, kidney, intestine and uterus. Six out of 10 samples were found to have bacterial contamination above internationally-acceptable levels.

Image: Naomi Marks

evidence-based food safety regulations. Farmers will improve farm biosecurity only when the wider challenges they face, such as access to credit, are addressed. Investment in stricter hygiene controls in pig production and processing should be prioritised.

Training along the supply chain. The data show that the whole pig supply chain needs a tailored awareness programme. The high percentage of *Salmonella*-positive samples in Yangon slaughterhouses shows these facilities need better hygiene practices to reduce carcase cross-contamination. Once this is in place, there is scope to incentivise traders to improve pre-slaughter hygiene. Then there will be potential to reward farmers who produce pigs with a lower prevalence of *Salmonella*. Improving food safety this way requires training for farmers, traders, slaughter workers and retailers in those aspects of food safety that are not detectable by eye alone. This study showed that in the absence of low-interest loans and accessible veterinary expertise or preventative herd health investments, poorer farmers will not be incentivised to adopt new practices through training efforts alone.

Consumer awareness. Given the high level of bacterial contamination on meat at retail, food safety awareness initiatives aimed at consumers are justified. Effective communication about invisible aspects of food safety could catalyse positive change for rural/shorter pig-supply chains through consumer choice. For the longer supply chains that serve urban centres, where the 'social sanctioning' in rural retail outlets is absent, communication messages can educate consumers in safer meat preparation. This is critical to incentivise investments in hygiene management along the supply chain.

Supermarket focus. The high prevalence of *Salmonella* found on retail pig meat is in line with similar findings elsewhere in southeast Asia. Other regional surveys typically identified a relatively low prevalence among supermarket samples compared to wet markets. However, this was not the case in this study. Myanmar's supermarket sector may need extra focus to ensure effective, internal food safety management systems and practices.

Legislation and regulations. Not all significant risks associated with pig meat are detectable by sight alone, as shown by our data. Stricter hygiene controls during processing may be an effective route to control the introduction of contaminants, including measures to exclude all diseased animals and prevent cross-contamination in slaughterhouses. This could be combined with mechanisms to monitor food safety at markets and appropriate investment in infrastructure, including chilling. The data support targeted amendments to, and enforcement of, existing food safety legislation.

About the research

'An integrated management approach for surveillance and control of zoonoses in emerging livestock systems: Myanmar Pig Partnership' was a five-year (2016-2021) interdisciplinary project exploring disease risk accompanying changing pig production patterns in Yangon Region, Myanmar. The project investigated intensification in the production and supply of pig meat and how related factors, including socioeconomic conditions for farmers and people's understandings and practices, may be impacting the risks for human and animal health. The focus was on zoonotic bacterial infections, dynamics of antibiotic resistance, uptake of preventive health practices and, ultimately, achievement of better livelihoods. Fieldwork was conducted before 2021.

Find out more at myanmarpigpartnership.org

The project was a collaboration between the University of Cambridge (leading), Myanmar Livestock Breeding and Veterinary Department, Oxford University Clinical Research Unit, Vietnam, and Institute of Development Studies, UK. It was funded by UK Research and Innovation, the UK Foreign, Commonwealth and Development Office, and UK Defence Science and Technology Laboratory under the Zoonoses and Emerging Livestock Systems (ZELS) programme.

Further reading

This research briefing is best read in conjunction with other research briefings from the Myanmar Pig Partnership:

- Taking Myanmar's AMR National Action Plan forward
- Training paths to improve health and livelihoods for Myanmar pig farmers

Also, the following papers:

- Why behaviours do not change: structural constraints that influence household decisions to control pig diseases in Myanmar. A. Ebata *et al*
- Social embeddedness of pig value chains in Myanmar and its implications for food and nutrition security. A. Ebata.
- Value chain governance, power and negative externalities: what influences efforts to control pig diseases in Myanmar. A. Ebata *et.al.*

The following are in production (and titles provisional):

- Prevalence, antimicrobial resistance and genomic comparison of non-typhoidal Salmonella isolated from pig farms and pig slaughterhouses in Yangon, Myanmar.
- Bacterial contamination of pork collected from markets and supermarkets in Yangon, Myanmar.
- Characteristics of pig farming practices in different farm scales in Myanmar.

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