Hygiene and Microbial Contamination along the Pork Value Chain in Vietnam

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Introduction
Introduction


• Funded ACIAR and lead by ILRI and collaborate with HSPH and VNUA
**Pig value chains in Vietnam**

- Pork accounts for 75% of total meat consumed daily at households.
- 80% of pork on market from small business and slaughterhouses

![Diagram of Pig Value Chain](image)

**Figure 1.** Pig value chain in Vietnam

- Pork may contain high levels of microbial contamination such as *Salmonella* and *Escherichia coli* which might cause harm to consumers.

(Source: adapted from Vo T.T 2011)
Objective

To assess hygiene and microbial contamination status along the pork value chain in Vietnam
Materials and methods
Study locations

Figure 2. Study locations

Provinces
- Hung Yen
- Nghe An

Districts
- Khoai Chau
- Van Giang
- Tien Lu
- Do Luong
- Dien Chau
- Hung Nguyen

Communes
- Nhue Dung
- Dai Hung
- Binh Kieu
- Nghi Tru
- Tan Dien
- Thang Loci
- Duc Thang
- Minh Phuong
- Thu Sy
- Thuyong Son
- Da Son
- Lam Son
- Dien Lan
- Dien Nguyen
- Dien Kim
- Hung Dao
- Hung Phuc
- Hung Thong

R: Rural
P: Peri – urban
U: Urban
Sample collection and analyses

Table 1. Location and collected samples

<table>
<thead>
<tr>
<th>Location</th>
<th>Farm</th>
<th>Slaughterhouse</th>
<th>Market</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khoai Chau – Hung Yen</td>
<td>36</td>
<td>88</td>
<td>90</td>
<td>214</td>
</tr>
<tr>
<td>Tien Lu - Hung Yen</td>
<td>36</td>
<td>73</td>
<td>83</td>
<td>192</td>
</tr>
<tr>
<td>Van Giang - Hung Yen</td>
<td>36</td>
<td>105</td>
<td>99</td>
<td>240</td>
</tr>
<tr>
<td>Dien Chau - Nghe An</td>
<td>36</td>
<td>88</td>
<td>75</td>
<td>199</td>
</tr>
<tr>
<td>Do Luong - Nghe An</td>
<td>36</td>
<td>100</td>
<td>80</td>
<td>216</td>
</tr>
<tr>
<td>Hung Nguyen - Nghe An</td>
<td>36</td>
<td>91</td>
<td>87</td>
<td>214</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>216</strong></td>
<td><strong>545</strong></td>
<td><strong>514</strong></td>
<td><strong>1275</strong></td>
</tr>
</tbody>
</table>

Figure 3. Types of collected samples
## Sample collection and analyses

### Table 2. Samples analyses

<table>
<thead>
<tr>
<th>Biological</th>
<th>Measurement/Unit</th>
<th>Number analysed</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Salmonella</em> qualitative</td>
<td>Pos/Neg</td>
<td>1275</td>
<td>ISO 6579:2002</td>
</tr>
<tr>
<td><em>Salmonella</em> quantitative</td>
<td>MPN/g</td>
<td>297</td>
<td>ISO 6579:2002</td>
</tr>
<tr>
<td><em>E. coli</em></td>
<td>CFU/g (ml, cm²)</td>
<td>1256</td>
<td>Plate count</td>
</tr>
</tbody>
</table>

*a* All type of samples  
*b* Cut and ground pork
Results and discussion
Salmonella contamination along the pig value chains

At pig farms

Overall Salmonella prevalence in drink water, floor swab and waste water were 19.5%, 36.1% and 38.9%, respectively.

Fig 4. Salmonella contamination at pig farms by sample types and province
Salmonella contamination along the pig value chains

At pig slaughterhouses

Fig 5. Salmonella contamination at pig slaughterhouse by sample types and province

Overall Salmonella prevalence at slaughterhouses: in carcass swab (38.9), feces (33.6), mesenteric lymph node (35.6), floor swab (22.4) and rinsing water (20.4)
**Salmonella** contamination along the pig value chains

At pork markets

![Bar chart showing Salmonella contamination at pork market by sample types and province.](chart)

**Fig 6.** *Salmonella* contamination at pork market by sample types and province

*Salmonella* prevalence at market: cut pork (44.7), ground pork (41.3) and cutting boards (25.3%)
**Salmonella** contamination along the pig value chains

**Table 3.** *Salmonella* concentration (MPN/g) in pork at market in by province

<table>
<thead>
<tr>
<th>Province</th>
<th>Sample type</th>
<th>n</th>
<th>Mean</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hung Yen</td>
<td>Pork</td>
<td>108</td>
<td>7.4</td>
<td>&lt; 0.3</td>
<td>&gt; 110</td>
</tr>
<tr>
<td></td>
<td>Ground pork</td>
<td>56</td>
<td>17.4</td>
<td>&lt; 0.3</td>
<td>100</td>
</tr>
<tr>
<td>Nghe An</td>
<td>Pork</td>
<td>109</td>
<td>10.6</td>
<td>&lt; 0.3</td>
<td>&gt; 110</td>
</tr>
<tr>
<td></td>
<td>Ground pork</td>
<td>24</td>
<td>18.4</td>
<td>&lt; 0.3</td>
<td>&gt; 110</td>
</tr>
<tr>
<td>Overall</td>
<td>Pork</td>
<td>217</td>
<td>8.8</td>
<td>&lt; 0.3</td>
<td>&gt; 110</td>
</tr>
<tr>
<td></td>
<td>Ground pork</td>
<td>80</td>
<td>17.7</td>
<td>&lt; 0.3</td>
<td>&gt; 110</td>
</tr>
</tbody>
</table>

- 19 MPN/g in pork sausages, 21.16 (0.03 -110) MPN/g in cut pork in *Italy* (*Bonardi* et al., 2008)

In pork:
- Below 10 MPN/g, *Germany* (*Sinell* et al., 1990)
- Between <0.03 - 2.10 MPN/g, *Ireland* (*Prendergast*, 2009)
- From: -2.64 ± 1.76 log CFU/g, *Belgium* (*Delhalle* et al., 2009)
E. coli contamination along the pig value chains

At pig farms

Fig 7. E. coli contamination at pig farms
**E. coli contamination** along the pig value chains

At pig slaughterhouses

![Graph showing E. coli contamination at pig slaughterhouses](image)

**Fig 8.** *E. coli* contamination at pig slaughterhouses
**E. coli contamination** along the pig value chains

At pork markets

![Graph showing E. coli contamination at pork markets](image)

**Fig 9.** *E. coli* contamination at pork markets
Conclusions and recommendation

✓ Demonstrated high levels of *Salmonella* in the final product (pork at market 44.7%) induces the potential health risks for the consumers.

✓ Detected values for *E. coli* indicates general poor hygiene along the chain.

✓ Appropriate hygiene practices and management are required to achieve better pork quality and reduce the risk for the consumer.

✓ These data will serve as inputs for health risk assessments related to pork consumption which will used for bet best intervention of the project.
Acknowledgements

✓ Australian Centre for International Agricultural Research (ACIAR)

✓ Project titled PigRISK: “Reducing disease risks and improving food safety in smallholder pig value chains in Vietnam”

✓ ILRI/A4NH, CENPHER/HSPH and VNUA

✓ Farmers, slaughterhouses, sellers and local authorities
Thank you for your attention!