Food Safety Issues in South East Asia

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Indonesian Society of Microbiology, the International Commission on Food Mycology (ICFM) and the International Committee on Food Microbiology and Hygiene (ICFHM)

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Outlines

• Food Safety Definition
• SEA Countries
• Issues with Foodborne Diseases Data in SEA
• Food Safety Microbiology Status in:
  - Brunei, Singapore
  - Indonesia, Malaysia, The Philippines, Thailand
  - Cambodia, Lao PDR, Myanmar, Vietnam
• Common Pathogens, Foods and Conditions
Food Safety

A condition and or effort such that foods do not contain biological, chemical or physical hazards at levels that can cause adverse effects on human’s health
## SEA countries

<table>
<thead>
<tr>
<th>No</th>
<th>Country</th>
<th>GDP per capita* (USD)</th>
<th>HDI*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Singapore</td>
<td>43,117</td>
<td>0.846</td>
</tr>
<tr>
<td>2</td>
<td>Brunei</td>
<td>31,239</td>
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<td>3</td>
<td>Malaysia</td>
<td>8,423</td>
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<td>Thailand</td>
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<td>5</td>
<td>Indonesia</td>
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<td>Philippines</td>
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<td>8</td>
<td>Laos</td>
<td>984</td>
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<td>9</td>
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<td>Myanmar</td>
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*2010
Foodborne Diseases

World wide (WHO, 2004)
- 1.8-3.1 billions cases of foodborne diarrhea
- 52.7-124 million cases of foodborne salmonellosis
- 2.16 million cases of typhoid fever
- 216,000 death due to typhoid fever

US
- 1988-1992: 90% of outbreaks due to bacterial pathogens (Bean et al., 1997)
- 2000+: Noroviruses accounted for 50% of outbreaks
Issues with Foodborne Disease Data in SEA

• Lack of a coherent and consistent surveillance programs in countries
  - information scarce and patchy
  - may not always represent to the true picture
  - increase in number due to increased awareness

• Data on microbial illnesses are available, mostly from stool isolates, not equal to those foodborne

• Reports on food intoxications/poisoning due to bacterial toxin is fewer

• Other food safety problems also occur: chemical agents or `biotoxins, abuse of chemicals/adulteration
Brunei

- Cholera was no longer reported since 1982 (WHO report, 1999)
- Largest cholera outbreak in 1965; 24 cases in 1970, 72 confirmed and 1999 outbreak involving 29 suspect cases happened in school
- Sporadic outbreaks, possibly not related to hygienic condition but improper food handling, e.g. outbreak due to rice-chicken, no pathogen identified (2000)
- High GDP, best health services
Singapore

- Cholera cases have been declining from 17 cases in 1992 to 7 cases a year in 2007.
- During 1992-2007: 210 cholera cases due to *V. cholerae* O1 biotype El Tor and serotype Ogawa (83.8%) (Wong, 2010).
- Food associated with outbreaks:
  - partially cooked green mussel (1993)
  - iced banana flavored drink (contaminated crushed ice (1999)
  - imported seafood items (2004)
- 24% of cholera cases: imported foods.
Singapore

- Salmonellae continues to cause foodborne illnesses
- Serotypes found in 2000:
  - S. Enteritidis
  - S. Stanley
  - S. Weltervreden
  - S. Typhimurium
- S. Typhimurium DT104L resistant to multiple antibiotic
- In 2007
  S. Enteritidis: the most important foodborne pathogen responsible for 62.2% of non-typhoid salmonellosis, including a cream cake outbreak (Solhan et al., 2011)
## Indonesia

### Reported Foodborne Disease in Indonesia 2001-2009*

<table>
<thead>
<tr>
<th>Year</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
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<tbody>
<tr>
<td>Number of outbreaks</td>
<td>26</td>
<td>43</td>
<td>34</td>
<td>164</td>
<td>184</td>
<td>159</td>
<td>179</td>
<td>197</td>
<td>109</td>
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<tr>
<td>Number of cases</td>
<td>1955</td>
<td>3635</td>
<td>1843</td>
<td>7366</td>
<td>8949</td>
<td>8733</td>
<td>7471</td>
<td>8943</td>
<td>3050</td>
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</tbody>
</table>

*BPOM, 2009  
**incomplete
Indonesia

Foodborne Diseases in Indonesia
2009

- Microbiology: 36.7%
- Chemical: 21.1%
- Expired: 13.8%
- Not known: 4.4%
- Not identified: 20.2%
- No sample: 2.8%

n = 119

*Suratmono, 2010*
Foodborne Diseases in Indonesia 2009

- Home made: 42.14%
- Street Food: 13.21%
- Industry: 15.72%
- Food service industry: 26.67%
- Others: 1.26%

n = 119
Indonesia

• Four most frequently isolated pathogens from diarrheal patients (Oyofo et al., 2002; Tjaniadi et al., 2005):
  - *V. cholerae* O1 (37.1%)
  - *Shigella flexneri* (27.3%)
  - *Salmonella* (17.7%)
  - ETEC (18%)

• Others *V. parahaemolyticus* (7.3%), *S. Typhi* (3.9%), *C. jejuni* (3.6%), *V. cholerae* non O1 (2.4%), EHEC 1%, *Clostridium difficile* 1%, *S. Paratyphi* (0.7%)

• Protozoa and parasites: *Blastocystis hominis* 5.7%, *Trichuris trichuria* 2.1%, *Ascaris lumbricoides* 1.5%, *Giardia lamblia* 0.8% and *Endolimax nana*. 
Indonesia

- Some of *V. cholerae*, *S. flexneri*, *Salmonella* : resistant to various antibiotic
  - 75-95% of *Shigella* resistant to ampicillin, trimethoprim-sulfamethoxazole, chloramphenicol, tetracyclin, but sensitive to nalidixic acid, ciprofloxacin and ceftriaxone.
  - *S. Typhi*, *S. Paratyphi* : sensitive to all antibiotic

- *E. coli* resistant to ampicillin, gentamicin, cefotaxine, ciprofloxacin and trimethoprim-sulfamethoxazole was isolated from carriers in hospital and community
Indonesia

• Street food vendor is more likely to cause infection from S. Paratyphi based on 2 separate studies conducted in Semarang and Jakarta (Gasem et al., 2001; Vollaard et al., 2004a)

• Street food vendors were characterized by poor hand washing practices/facility, direct contact with hand, male worker and low education (Vollaard et al., 2004b).

• Typhoid fever was less associated with food, and related to: other case in the home, no washing prior to eating and recent consumption of ice cubes
• Consistent with studies in clinical isolates, *Salmonella* is often isolated in food, especially from seafood for export (Dewanti-Hariyadi, 2005, USDA, RASFF)

• *Staphylococcus aureus* are commonly isolated from ready-eat-food, sometimes at low concentration (<10⁵ CFU/g); improper handling (temperature, time) are likely to support the growth and toxin production

• Prior to 2008, emerging pathogens such as *E. coli O157:H7* and or EHEC, *Enterobacter sakazakii* (*Cronobacter* spp) have been reported from ground beef, slaughterhouse and dry food, respectively
Malaysia

• Four bacterial pathogen species most commonly isolated from stool samples examination (Lee, 2002)
  - non typhoid *Salmonella* 57%
  - enteropathogenic *E. coli* 14%
  - *Shigella* 11%
  - *Campylobacter* 5%
  - *Aeromonas* 5%
  - Also Protozoa: *Cryptosporidium* and *Giardia*
Malaysia

- S. Typhi was found to be resistant to ampicillin and chloramphenicol
- All *Shigella flexneri* were resistant to ampicillin and cotrimoxazole, while 80% was resistant to chloramphenicol
- 61.2% of *E. coli* strains was resistant to kanamycin, tetracycline, chloramphenicol, gentamicin, ampicillin, nalidixic acid, sulfamethoxazole-trimethoprim, cefetoxin, norfloxacin, and to ciprofloxacin.
### Salmonella Serotype Isolates in Malaysia

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Enteritidis</td>
<td>233</td>
<td>26.7</td>
<td>206</td>
<td>25.0</td>
<td>155</td>
<td>28.1</td>
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<tr>
<td>Weltervreden</td>
<td>200</td>
<td>21.9</td>
<td>165</td>
<td>20.0</td>
<td>142</td>
<td>25.7</td>
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<tr>
<td>Corvallis</td>
<td>115</td>
<td>12.6</td>
<td>117</td>
<td>14.2</td>
<td>57</td>
<td>10.3</td>
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<tr>
<td>Typhimurium</td>
<td>49</td>
<td>5.4</td>
<td>43</td>
<td>5.2</td>
<td>37</td>
<td>6.7</td>
</tr>
<tr>
<td>Stanley</td>
<td>32</td>
<td>3.2</td>
<td>37</td>
<td>4.5</td>
<td>9</td>
<td>3.3</td>
</tr>
<tr>
<td>Tshongwe</td>
<td>29</td>
<td>3.2</td>
<td>18</td>
<td>2.2</td>
<td>8</td>
<td>1.4</td>
</tr>
<tr>
<td>Biegdam</td>
<td>19</td>
<td>2.1</td>
<td>15</td>
<td>1.8</td>
<td>7</td>
<td>1.3</td>
</tr>
<tr>
<td>Albany</td>
<td>17</td>
<td>1.9</td>
<td>15</td>
<td>1.8</td>
<td>5</td>
<td>0.9</td>
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<tr>
<td>Braenderup</td>
<td>12</td>
<td>1.3</td>
<td>11</td>
<td>1.3</td>
<td>5</td>
<td>0.9</td>
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<tr>
<td>Newport</td>
<td>10</td>
<td>1.1</td>
<td>10</td>
<td>1.2</td>
<td>5</td>
<td>0.9</td>
</tr>
</tbody>
</table>

*Thong, 2006*
Several studies on foodborne pathogens in specific foods have been reported

- *E. coli* O157:H7 was isolated from 36% of beef samples (Son et al., 1998)
- *Listeria monocytogenes* from 74% of imported beef, 43.5% of local beef and 56% of fermented fish (Hassan et al., 2001)
- *Campylobacter* in 3-18.8% of fresh vegetables (Chai et al., 2009)
- *V. cholerae* is carried by shellfish which has been implicated in the cholera outbreaks.
Philippines

- Stool samples of diarrheal patients (Adkins et al., 1987):
  - 58.4% had one or more enteric pathogen
  - rotavirus: the most frequently isolated (30.6%)
  - bacterial pathogens: *Shigella* (11.6%), *Salmonella* (9.2%) and enterotoxigenic *E. coli* (7.8%).
  - 30% had multiple pathogens.
  - *Salmonella*, ETEC, *C. jejuni* isolated from healthy people
- Foodborne nematodes:
  73.3% contained parasites; 32% with one parasite, and 41% with more than one parasite (Belizario et al., 2010).
Thailand

- 1,493 cases of diarrhea per 100,000 /year during 1990 -1995 (Pitisuttithum (2003) )
- 110 cases of foodborne intoxication, 140 cases of dysentery, 20 cases of enteric fever, 26 cases of hepatitis
- Number of acute diarrhea started to decrease in 2003
- *V. cholerae*, *Shigella flexneri* or *S. dysenteriae* and *Salmonella*
- Reasons for outbreaks: unsafe drinking water, lack of personal hygiene and consumption behavior (e.g. eating raw or underprocessed food product)
## Thailand

<table>
<thead>
<tr>
<th>Foodborne diseases</th>
<th>No of cases</th>
<th>Death</th>
<th>Morbidity rate</th>
<th>Mortality rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute diarrhea</td>
<td>956313</td>
<td>146</td>
<td>541.26</td>
<td>0.05</td>
</tr>
<tr>
<td>Dysentery</td>
<td>23113</td>
<td>3</td>
<td>12.44</td>
<td>0</td>
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<tr>
<td>Foodborne intoxications</td>
<td>12685</td>
<td>11</td>
<td>67.79</td>
<td>0</td>
</tr>
<tr>
<td>Enteric fever</td>
<td>9633</td>
<td>3</td>
<td>3.57</td>
<td>0</td>
</tr>
</tbody>
</table>
Thailand

*Salmonella* serotype most commonly isolated in Thailand

<table>
<thead>
<tr>
<th>Source</th>
<th><em>Salmonella</em> serotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pig</td>
<td>Rissen, Derby</td>
</tr>
<tr>
<td>Pork</td>
<td>Weltervreden, Rissen, Anatum, Emek</td>
</tr>
<tr>
<td>Chicken</td>
<td>Emek, Rissen, Enteritidis</td>
</tr>
<tr>
<td>Chicken meat</td>
<td>Weltervreden, Emek, Hadar</td>
</tr>
<tr>
<td>Human</td>
<td>Weltervreden, Rissen, Stanley, Enteritidis, Anatum</td>
</tr>
</tbody>
</table>
Thailand

• A large foodborne disease outbreaks linked to school meals in 2005: 1,598 cases associated with mixed chicken-rice dish, attack rate 37% *Shigella sonnei* as well as *Salmonella* group C were etiologically linked to the outbreak (Chanachai et al., 2008)

• A very rare outbreak of botulism was reported in Thailand in 2006: 91 victims, 42 needed mechanical ventilator due to respiratory failure, no fatality. Improperly home-canned bamboo shoots was the source of the intoxication (Witoonpanich et al., 2010).
Cambodia

- Diarrhea: leading cause for morbidity and mortality
- Inadequate water and sanitation program
  - Access to drinking water in rural (29%) and urban community (69.55%)
  - Access to hygienic facilities 8.6% (rural), 49% (urban)
- The number of diarrhea & dysentery cases
  - 0-4 years 17.5%
  - 5-14 years 4%
  - >15 years 8.3%
- S. Typhi 0.9% the samples of diarrheal patients
  - 56% resistant to ampicillin, 56% to chloramphenicol, 81% to trimethoprim-sulfamethoxazole
- 2001 school related outbreak and outbreak of toxic fish.
Lao PDR

• Diarrhea:
  very important health problem, 16% of death in children
• Studies in 1996 and 1997
  *Shigella* 16.8%
  Diarrhegenic *E. coli* 17.1%
  Rotavirus 6.1%
  *C. jejuni* for 4.4%
• Almost all *Shigella* & diarhegenic *E. coli* were resistant to ampicillin, tetracyclin and erythromycin.
• January-August of 2007: 7 diarrheal cases/100,000
Lao PDR

• During cholera epidemic:
  - 58.6% of stool samples were positive for *V. cholerae* O1 Ogawa (Lenglet, 2010)
  - Water was the vehicle of the outbreak.
• A human trichinellosis outbreak due to *Trichinella* species was reported in 2004
  - Pork meals, i.e. uncooked minced pork with mint and fermented pork were the implicated vehicles for of the nematodes (Sayasone et al., 2006)
Myanmar

- 70 percent of diarrheal diseases was due to food contamination
- Most frequent illnesses: diarrheal diseases, foodborne intoxication, typhoid & paratyphoid
- In 2000 typhoid fever outbreak: drinking unboiled river water, contact with other patients before illness and failing to wash hands with soap after defecation (Aye and Siriaryapon, 2004).
- Food survey on *mohinga*:
  - noodle: 100% coliform, 80% fecal coliform, 2% EPEC/S. Typhi
  - soup: 20% coliform, no fecal coliform or pathogen
  - contamination: mixing noodles with warm soup and addition of fresh ingredients (Aung et al., 2004).
Vietnam

- Study on 587 diarrheal children & 249 age-matched healthy controls: 60% had pathogenic bacteria
  - Children <2 years old:
    - group A Rotavirus (46.7%)
    - diarrhegenic E. coli (22.5%)
  - In children >2 years old
    - enterotoxigenic Bacteroides fragilis 7.3%
    - Shigella 4.7%, respectively

- E. coli and Shigella resistant to ampicillin, chloramphenicol and trimethoprim-sulfamethoxazole.

- Children with diarrhea: poor families, lack potable water & latrines, mothers not washing hands, low education and or little information on hygienic habits (Vu Nguyen, 2006).
Vietnam

• Diarrhegenic *E. coli* (Hien et al., 2008)
  - Attaching and effacing *E. coli* (AEEC) (9.2%)
  - Enteroaggregative *E. coli* (EAggEC) 8.8%
  - Enterotoxigenic *E. coli* (4%)
  - Enteropathogenic *E. coli* (2.8%)
  - Enteroinvasive *E. coli* (0.8%).

• Typhoid fever 24.2/100,000 population (Ochiai, 2008).

• Infection due to flukes linked to consumption of raw fresh water fish or crabs, and aquatic plants (Thanh et al., 2009).
Common Foodborne Infections and Intoxications

• Bacterial pathogens most commonly reported to cause food infection: *Shigella flexneri*, typhoid and non-typhoid *Salmonella*, *Vibrio cholerae* O1
• Strains resistant to multiple resistant antibiotic are common for nontyphoid *Salmonella*, *Shigella*, *E.coli*
• Rotavirus is the viruses commonly associated with diarrhea
• Helminthic parasites are also reported
• Sporadic foodborne intoxication reported are *Staphylococcus aureus*, *Clostridium botulinum*, cassava poisoning (cyanide), toad and fish poisoning
Foods and Conditions associated with Foodborne Infections and Intoxications

• Several conditions shared in (mostly) developing countries within SEA are contributors to food safety status
  - Unsafe water
  - Unhygienic practices (e.g. open defecation or use of night soil for fertilization of fish ponds)
• Raw or undercooked food associated with outbreaks
  - freshwater and brackish water fish, snails
  - amphibians, terrestrial snake, aquatic insects/plants
• When hygienic handling is the reason, RTE foods involved are non specific
• Street food vendors and schools are common setting
Thank You
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