Ensuring Food Safety and Fair Trade in ASEAN: Case Study of Risk-Based Aflatoxin Standard

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Outline

- ASEAN food safety standard harmonization
- Food safety standard: Aflatoxin case study
- Aflatoxin risk assessment
- Aflatoxin risk management
- Risk-based standard: Aflatoxin in Thai peanuts
- Conclusion
ASEAN COMMUNITY

POLITICAL-SECURITY Blueprint
- Rules based, shared norms and values
- Cohesive, peaceful, stable, resilient with shared responsibility
- Dynamic and outward looking

ECONOMIC Blueprint
- Single Market and production base
- Competitive economic region
- Equitable Economic development
- Integration into global economy

SOCIO-CULTURAL Blueprint
- Human Development
- Social Welfare and Protection
- Social justice and rights
- Environmental Sustainability
- ASEAN Identity

- Free flow of goods
- Intra- & Inter-regional trade facilitation
- Standard harmonization

ASEAN Food Safety Standard Harmonization Approach

Risk Analysis

Risk assessment policy
- Risk evaluation
- Option assessment
- Implementation
- Monitoring/review

Risk Assessor
- scientific based result
- uncertainties

Risk Manager
- consumer benefits
- impacts on economy and society
- stakeholder input

- hazard ID
- hazard characterization
- exposure assessment
- risk characterization

* Risk communication at all steps

Aflatoxin Standard

- hazard ID
- hazard characterization
- exposure assessment
- risk characterization

- scientific based result
- uncertainties

Risk Manager
- consumer benefits
- impacts on economy and society
- stakeholder input

* Risk communication at all steps
Questions from risk management

- Is there any significant risks from mycotoxin in food commodities? How high the risk? What mycotoxin? What food commodities involve?

- Which risk management needed to reduce consumer risk from aflatoxin? Is standard/regulation needed?

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**Codex Committee on Contaminants in Food**

- **CODEX STAN 193-1995: General Standard for Contaminants and Toxins in Food and Feed**

<table>
<thead>
<tr>
<th>Mycotoxin</th>
<th>Product</th>
<th>Level (µg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aflatoxin, Total</td>
<td>Peanut intended for further processing</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Almonds, Brazil nuts, Hazelnuts, Pistachios</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Moderate processing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Almonds, Brazil nuts, Hazelnuts, Pistachios</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>“ready-to-eat”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dried figs “ready-to-eat”</td>
<td>10</td>
</tr>
<tr>
<td>Aflatoxin M1</td>
<td>Milk</td>
<td>0.5</td>
</tr>
<tr>
<td>Ochratoxin A</td>
<td>Raw wheat, Barley, Rye</td>
<td>5</td>
</tr>
<tr>
<td>Fumonisins (B1 + B2)</td>
<td>Raw maize grain</td>
<td>4,000</td>
</tr>
<tr>
<td></td>
<td>Maize flour and maize meal</td>
<td>2,000</td>
</tr>
<tr>
<td>Patulin</td>
<td>Apple juice</td>
<td>50</td>
</tr>
</tbody>
</table>

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**Rapid Alert System for Food and Feed (RASFF) - 2013**

**Mycotoxin**

<table>
<thead>
<tr>
<th>Year</th>
<th>Aflatoxins</th>
<th>Deoxynivalenol</th>
<th>Fumonisins</th>
<th>Ochratoxin A</th>
<th>Patulin</th>
<th>Zearalenone</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>839</td>
<td>14</td>
<td>14</td>
<td>27</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>2005</td>
<td>946</td>
<td>10</td>
<td>2</td>
<td>42</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>2006</td>
<td>801</td>
<td>3</td>
<td>9</td>
<td>54</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>2007</td>
<td>705</td>
<td>4</td>
<td>2</td>
<td>30</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>2008</td>
<td>902</td>
<td>3</td>
<td>1</td>
<td>20</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2009</td>
<td>638</td>
<td>2</td>
<td>1</td>
<td>27</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2010</td>
<td>649</td>
<td>2</td>
<td>1</td>
<td>34</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2011</td>
<td>585</td>
<td>3</td>
<td>1</td>
<td>35</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2012</td>
<td>484</td>
<td>4</td>
<td>1</td>
<td>32</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2013</td>
<td>341</td>
<td>8</td>
<td>7</td>
<td>54</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

**Monitoring of Aflatoxin M1 Contamination in Milk - 2007**

<table>
<thead>
<tr>
<th>Type of Milk</th>
<th>No. of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>UHT milk</td>
<td>75</td>
</tr>
<tr>
<td>Pasteurized milk</td>
<td>125</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
</tr>
</tbody>
</table>
Monitoring of Aflatoxin (B1 & Total) in 2011

<table>
<thead>
<tr>
<th>Foods/Feeds</th>
<th>No. of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw/roasted peanut</td>
<td>216</td>
</tr>
<tr>
<td>Ground roasted peanut</td>
<td>104</td>
</tr>
<tr>
<td>Fried peanut &amp; other products</td>
<td>38</td>
</tr>
<tr>
<td>Maize</td>
<td>40</td>
</tr>
<tr>
<td>White/Brown rice</td>
<td>50</td>
</tr>
<tr>
<td>Dried chili</td>
<td>40</td>
</tr>
<tr>
<td>Jobs tear</td>
<td>40</td>
</tr>
<tr>
<td>Cashew nut</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>548</strong></td>
</tr>
</tbody>
</table>

% of Milk Sample detected Aflatoxin M1 at specified ranges (μg/kg)

Aflatoxin in Peanuts

Average aflatoxin contaminated in various foods in 2011

Aflatoxin B1 (μg/kg)
- Mouldy kernel
- Good kernel
- Thai ML 20
- Codex ML 15
- Total aflatoxin (μg/kg)
**Hazard Identification - Aflatoxin B1**

Human epidemiological studies:
- Correlation between human liver cancer and aflatoxin exposure (synergism with hepatitis B)
- IARC - Group 1 – Carcinogenic to humans

Animal studies:
- LD50 in male rat: 7200 µg/kg (oral)
- Hepatotoxicity
- Hepatocarcinogenicity

**Exposure Assessment of Aflatoxin**

**Dietary Exposure**

\[ = \sum \text{Aflatoxin level in a Food} \times \text{Consumption of a Food} \]

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**Hazard Characterization (JECFA, 1998)**

- Quantitative assessment of genotoxic carcinogen (JECFA, 1998)
- No threshold level \( \rightarrow \) no NOEL
- Risk affected by presence of hepatitis B surface antigen
- Potency estimates from epidemiological data:
  - HBsAg+: 0.3 cancers/year per 100 000 population per ng AFB, kg b.w. per day
  - HBsAg-: 0.01 cancers/year per 100 000 population per ng AFB, kg b.w. per day

**http://consumption.acfs.go.th/index.php**

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(http://consumption.acfs.go.th/index.php)
Comparison of total intake between average peanuts consumption and high peanuts consumption of Thai population in 2011

<table>
<thead>
<tr>
<th>Consumption Level</th>
<th>Aflatoxin B1 Intake (ng/person/day)</th>
<th>Total Aflatoxin Intake (ng/person/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>47</td>
<td>56.8</td>
</tr>
<tr>
<td>High</td>
<td>184.8</td>
<td>216.9</td>
</tr>
</tbody>
</table>

65.7% of aflatoxin intake comes from peanuts

Ratio of Aflatoxin B1 (%) intake from various foods for average peanut consumption consumers

- Raw peanut: 14.70%
- Ground peanut: 10.10%
- Fried peanut: 27.40%
- Rice: 7.40%
- Dried chili: 5.10%
- Egg: 2.60%
- Viscera: 4.50%
- Others: 28.10%

65.7% of aflatoxin intake comes from peanuts

Ratio of Aflatoxin B1 (%) intake from various foods for high peanut (raw) consumption consumers

- Raw peanut: 81.70%
- Roasted peanut: 2.60%
- Fried peanuts: 3.70%
- Rice: 7.00%
- Dried chili: 1.90%
- Egg: 1.10%
- Viscera: 1.30%
- Others: 3.00%

91.3% of aflatoxin intake comes from peanuts

Estimated risk of liver cancer in Thai consumers from Aflatoxin B1

- Estimated potency of liver cancer using JECFA model (1997)

Potency (cancer/year/100,000 people)

- For population without Hepatitis B surface antigen:
  \[ \text{Potency} = 0.01 \times \text{Aflatoxin B1 intake (ng/kgbw/day)} \]
- For population with Hepatitis B surface antigen:
  \[ \text{Potency} = 0.30 \times \text{Aflatoxin B1 intake (ng/kgbw/day)} \]
Estimated Potency of Liver Cancer in 2011 (cancer/year/100,000 people)

- Average consumption: 0.034
- High peanut consumption: 0.135

Estimated Potency of Liver Cancer caused by Aflatoxin B1 (cancer/year/Thai population)

- 2011 Cancer risk: 22

How to manage risk from aflatoxin in peanuts?

- Establish standards for the whole food chain
- Promote standards to farmers, shellers, manufacturers, etc.
- Certify producers
- Certify products
- Educate consumers
- Anything else???

Establishment of standards for entire food chain

1. Farm
2. Peanut shelling plant
3. Raw peanuts
4. Processing plant
5. Peanut products

Import peanuts

- 20-30%
- 70-80%
Main regulations on contaminants

- Notification under MOPH (No. 98) B.E. 2529 (1986) entitled Contaminants in Foods
  - Tin, Zinc, Copper, Lead, Arsenic, Mercury, Aflatoxin
  - ML of aflatoxins in food in general is 20 µg/kg
- Notification under MOAC B.E. 2537 (1994) entitled Property of deteriorated feed
  - ML of aflatoxin in feed (30-200 µg/kg) and feed raw material (50-500 µg/kg)

Setting up standards on peanut (cont.)

- Thai Agricultural Standard on Good Manufacturing Practices for Peanut Shelling Plant covers all steps affecting the contamination of aflatoxin in the shelling plant e.g. raw material storage, shelling, sorting, etc.
- Thai Agricultural Standard on Dried Peanut (TAS4700-2011) covers minimum requirements/quality criteria including specification of moisture content and total aflatoxin, sampling and analysis of aflatoxin, etc.
Setting up standards on peanut (cont.)

2. Development of mandatory standard (Regulation) on Peanut kernel: Aflatoxin requirement

- ML = [15 or 20] µg/kg (ppb)
- focusing on peanut shelling plant, peanut distributor, importer & exporter

Estimated Potency of Liver Cancer (cancer/year/Thai population)

Comparison between present situation and removal from market 50% peanut contaminated with Aflatoxin (total) at level higher than 15 and 20 ppb

Estimated Potency of Liver Cancer (cancer/year/Thai population)

Comparison between present situation and removal from market 90% peanut contaminated with Aflatoxin (total) at level higher than 15 and 20 ppb

PEANUT KERNEL : MAXIMUM LEVEL OF AFLATOXIN (TAS 4702 – 2014)

To be effective on January 2017 for peanut kernels sold/imported into Thailand
Maximum level of total aflatoxins in peanut kernel shall **not exceed 20 ppb** (microgram/kilogram)

Control measures for peanut kernel producers (shelling plant, collector, packer, and warehouse operator)
- Sorting
- Testing for aflatoxins before selling

Control measures for importer and exporter
- Mouldy kernel, broken kernel, damaged kernel and foreign matters shall be sorted out before distribution and record be kept
- Such defective kernel shall be separated in clearly labelled container, and shall not be marketed for human consumption or processed into food products.

Control of moisture content/Sorting of peanuts & aflatoxin testing

Implement at producer level
**Control measures for peanut kernel producer**

- To ensure that peanut kernel is in compliance with the specified maximum level:
  - A shelling manufacturer shall be required to test aflatoxin level of each lot of peanut kernel prior to distribution.
  - A collector, packer, or warehouse operator shall be randomly tested aflatoxin level during storage.
  - Test result shall be kept for inspection by competent authority or certification body.

**Exporter**

- Peanut kernel exporter shall have
  - Evidence showing that exported peanut kernel is produced by the licensed and certified peanut kernel producer in accordance with this standard.
  - Test result by recognized competent authority or private laboratory showing that aflatoxin level does not exceed the maximum level or limit as required by trading-partner countries.

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**Study of Aflatoxin reduction by sorting**

Aflatoxin level in peanut kernel passing normal/routine sorting at 16 – 81 µg/kg

- Re-sorting
- Aflatoxin reduced to 0-50 µg/kg
- 17-100% reduction: Average 82%
**Importer**

- Peanut kernel importer shall have
  - Evidence showing that imported peanut kernel is produced from peanut kernel producer who has control measure in place
  - Test result issued by the recognized competent authority or private laboratory showing that aflatoxin level does not exceed the maximum level specified.

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**Risk Communication**

- Risk manager vs Risk assessor
- Risk manager vs Policy maker
- Risk manager vs Stakeholders
  - Peanut kernel producers, importers/exporters
  - Peanut farmers
  - Peanut processors
  - Certification bodies, Laboratories
  - Consumers, Public

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**Importation of peanut into Thailand**

- Implement of Std. by producer & exporter
  - Information/training
  - Testing by lab / Use of Test kit

- Register & certify producer/exporter by CA/CB
  - Audit/certify producer/exporter
  - List of approved producer/exporter prepared & submit to ACFS
  - Recognition of CA/CB by ACFS

- Export of peanut kernel to Thailand
  - Recognised Lab with Std. methods
  - CoA for Aflatoxin each shipment
  - Information provided to importer
  - Border control by Thai MOAC

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**Summary**

- Risk-based standards can be achieved by the application of risk analysis principles including risk assessment, risk management & risk communication
- Adequate data and knowledge are needed in conducting risk assessment
- Farm-to-Table risk management to ensure consumer safety
- Standard harmonization taking into account international standards and risk analysis principles is a key success in ensuring food safety and fair trade in ASEAN
Thank you
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