

Joint International Symposium
Global Past, Present and Future Challenges in Risk Assessment –
Strengthening Consumer Health Protection

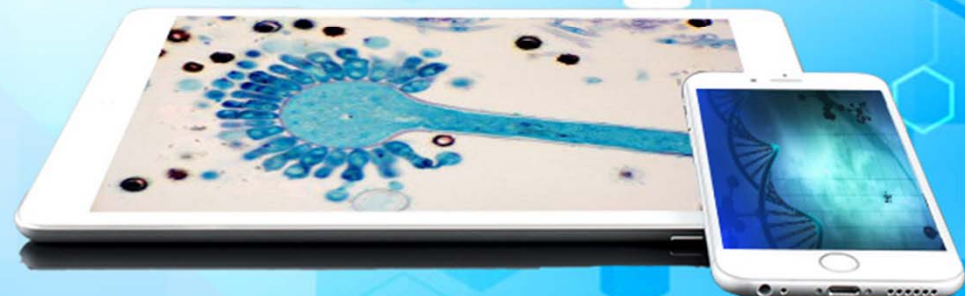
Risk Assessment of Aflatoxins

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MINISTRY OF FOOD AND DRUG SAFETY
National Institute
of Food and Drug Safety Evaluation



Outline of Presentation

Contents

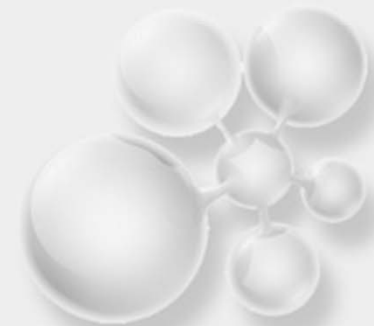
I How important is aflatoxin

II Food standard for aflatoxin

III Risk Assessment

IV Risk Management

V Recommendation



Aflatoxins in food: an unavoidable problem

Aflatoxins



Many aflatoxin alerts in RASFF portal

Out of the 2993 original notifications counted in RASFF in 2016, many concerned pathogenic micro-organisms, heavy metals and mycotoxins.

This is according to figures from the RASFF preliminary annual report 2016. RASFF notifications shown in the RASFF portal are so-called 'original notifications', representing a new case reported on a health risk detected in one or more consignments of a food or feed.



Aflatoxin, a Silent Threat to Africa's Food Supply

Food supply issues aren't uncommon in Africa. Famines caused by drought, flood, or conflict are frequent. But there is another constant threat to the continent's food security that receives little public attention: aflatoxins.

Produced by fungus in the same way that penicillin is, aflatoxins can cause disease and are linked to liver cancer. That's pretty alarming since they largely affect food staples like corn and groundnuts. But in addition...

The toxins are relatively occurring and exist at high levels in much of Africa's food supply. Some scientists estimate that up to one-third of Africa's food supply is infected with aflatoxins at levels higher than the safe. The [Partnership for Aflatoxin Control in Africa \(PACA\)](#) is working to assess the extent of the infection.

Aflatoxins help affect many people in Africa from common diseases like malaria and tuberculosis. But because aflatoxins' effects are so diverse and incremental, it's not always easy to figure them out. The toxins include neurotoxicity, liver necrosis, cancer, and failure of the liver. And they are blamed for [liver cancer outbreaks in Asia](#).

"It's pretty scary because you can't smell or taste the toxin," says [Lizbeth Simons](#), the project director of PACA and senior partner at the [Toxinology Institute](#), which helps companies and governments develop products that can't rely on sight, smell, or taste. "The only green flag you have is a dead giveaway that the toxin is present."


Aflatoxin has been around for a long time, but it wasn't until a major outbreak in the 1960s that scientists first identified the threat. Over the course of a few months, [100,000 commercial fish in Lake Erie](#) died. "Turkey X disease," scientists figured that reported loss from Brazil was the common link among the perished birds.

The culprit? A fungus carried on the feed.

Since then, governments around the globe have worked to limit the amount of aflatoxins that find their way into the food supply.

원장에서 아플라톡신 검출 뉴스

기사 공유하기 100% 당첨경품까지



<http://news.naver.com/main/read.nhn?mode=LSD&mid=sec&aid=1102&aid=003&aid=0000529023>

지난 4월 입안예고인 '식품의 기준 및 규격중 개정안'과 살명자료에 따르면 최근 장류의 곰팡이독소에 대한 모니터링 결과 발효식품인 원장 및 고추장에서 아플라톡신이 검출됐고, 수입 고춧가루에서도 다량의 아플라톡신 B1이 약 80ppb(μg/kg)까지 나타났다.

식약청의 위해식품정보에 따르면 수입 칠리파우더(4건), 인도네시아산 라면(2건), 국산 편장(1건) 등에서 기준치(10ppb)를 훌쩍 넘긴 32.1ppm까지 아플라톡신 B1이 검출됐다.

한국식품연구원 전통식품연구단 최신영 박사는 "장류식품을 잘 관리한다면 곰팡이독소가 저절로 없어질 것"이라며 "가능한 한 저장과정에서 곰팡이 성장을 최소화하도록 0℃ ~ 10℃ 사이로 온도를 유지해야 한다"고 충고했다.

한마디로 제조할때도 잘못하면 아플라톡신이 발생하고,

리콜정보

위해정보 신고 자동차량등록

추천내외

- 위해정보 처리내역
- 알기쉬운 안전이야기
- 안전조사보고서
- 안전통상
- 보도자료
- 리콜정보
- 국내안전정보
- 해외안전정보
- 국내안전법령/규정
- 해외안전법령/규정

사건내용

제명	'아플라톡신' 기준 초과 검출 제주제품 회수 조치		
종목	식용유/기름	소면부처	식용의약품안전처
리콜개시일	2014-02-18	계시일	2014-03-25
회수수량	2292		
사건내용	식용의약품안전처가 1월 29일 식품안전처에 '해당식품(경상북도 영주시 소재)이 제조된 '연미준백밀떡' 중에서 기준치를 초과한 '아플라톡신' 검출량이 해당 제품을 판매 금지 및 회수 조치한다고 밝혔다. 회수 대상은 유통기한이 2015.01.12.까지인 제품으로, 검사결과 '총 아플라톡신'이 기준치(5μg/kg 이하)를 초과하여 검출(792.8μg/kg)된 것이다. 이 '연미준백밀떡'의 제조업체는 곡류 다량성 폐 반식류인 곰팡이(Aspergillus flavus) 등에게 의해 생성되는 특소로서 간혹성 발암물질(국제암연구소)		

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EU: Food body warns of aflatoxin outbreak

14 August 2006 | Source: Keith Nuthall

European Union (EU) food safety consumer alert service RASFF has warned of a series of aflatoxin contaminations in a variety of imported and EU-produced foodstuffs.

FOOD&DRINK
europe.com

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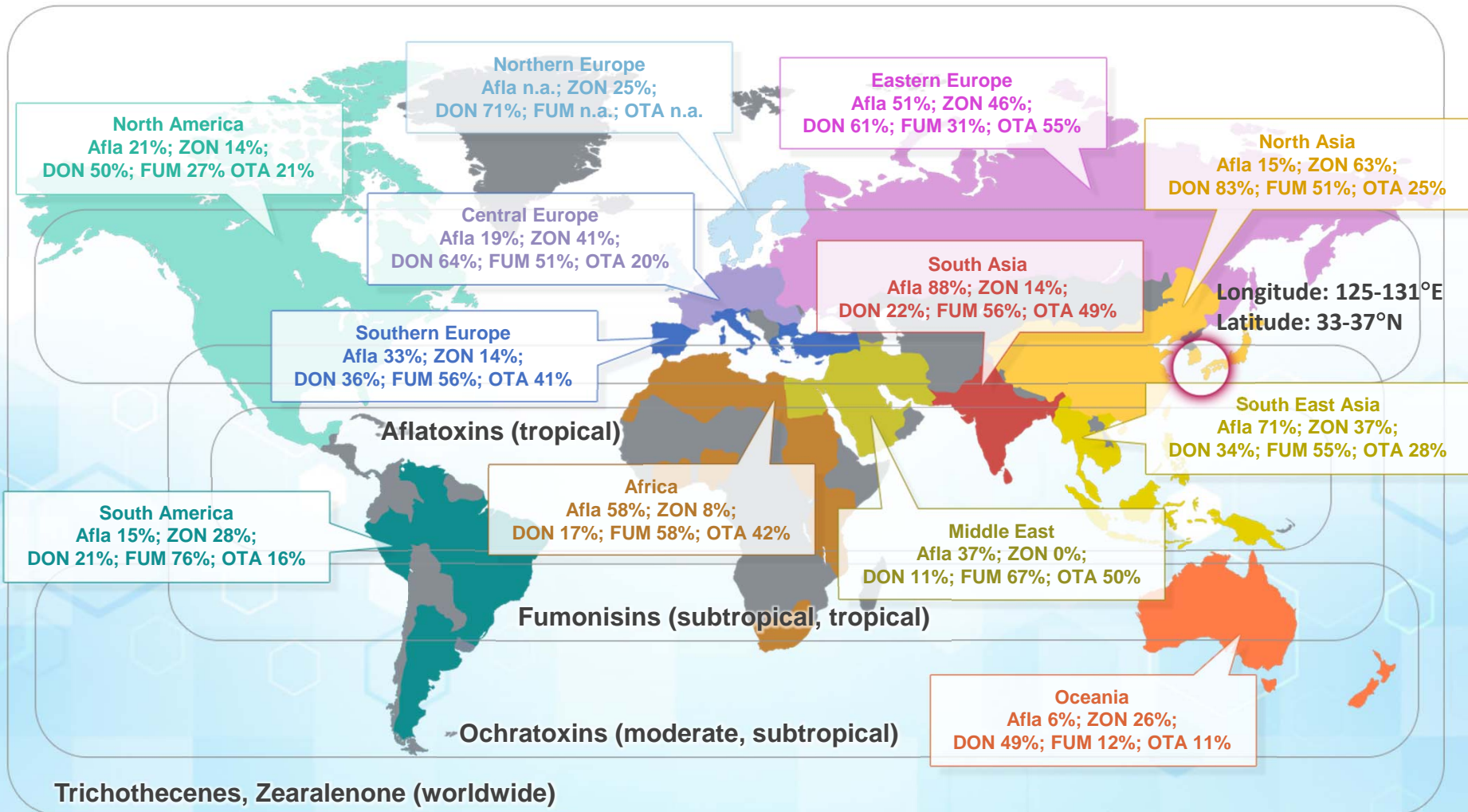
News Headlines

28/04/2005 - Food pathogens and harmful toxins dominate the EU's food risk alert system this week, detected in a range of products from fish and cheese to pinotches and chilli powder, reports [Lindsay Partos](#).

In place since 1979 RASFF provides national authorities with a tool to swap information on national measures taken to ensure food safety, and communicate (a legal obligation) on foods withdrawn from the food chain.



Geography and Mycotoxins: South Korea



Aflatoxins?

✓ Difuranocoumarin derivatives produced by the fungi *Aspergillus flavus* and *Aspergillus parasiticus*

- Aflatoxins are secondary fungal metabolites.
- Aflatoxin types include B1, B2, G1, G2.
- B1 is most prevalent and toxic aflatoxin.

✓ Aflatoxin has received considerable attention due to their significance in agricultural loss and human health.

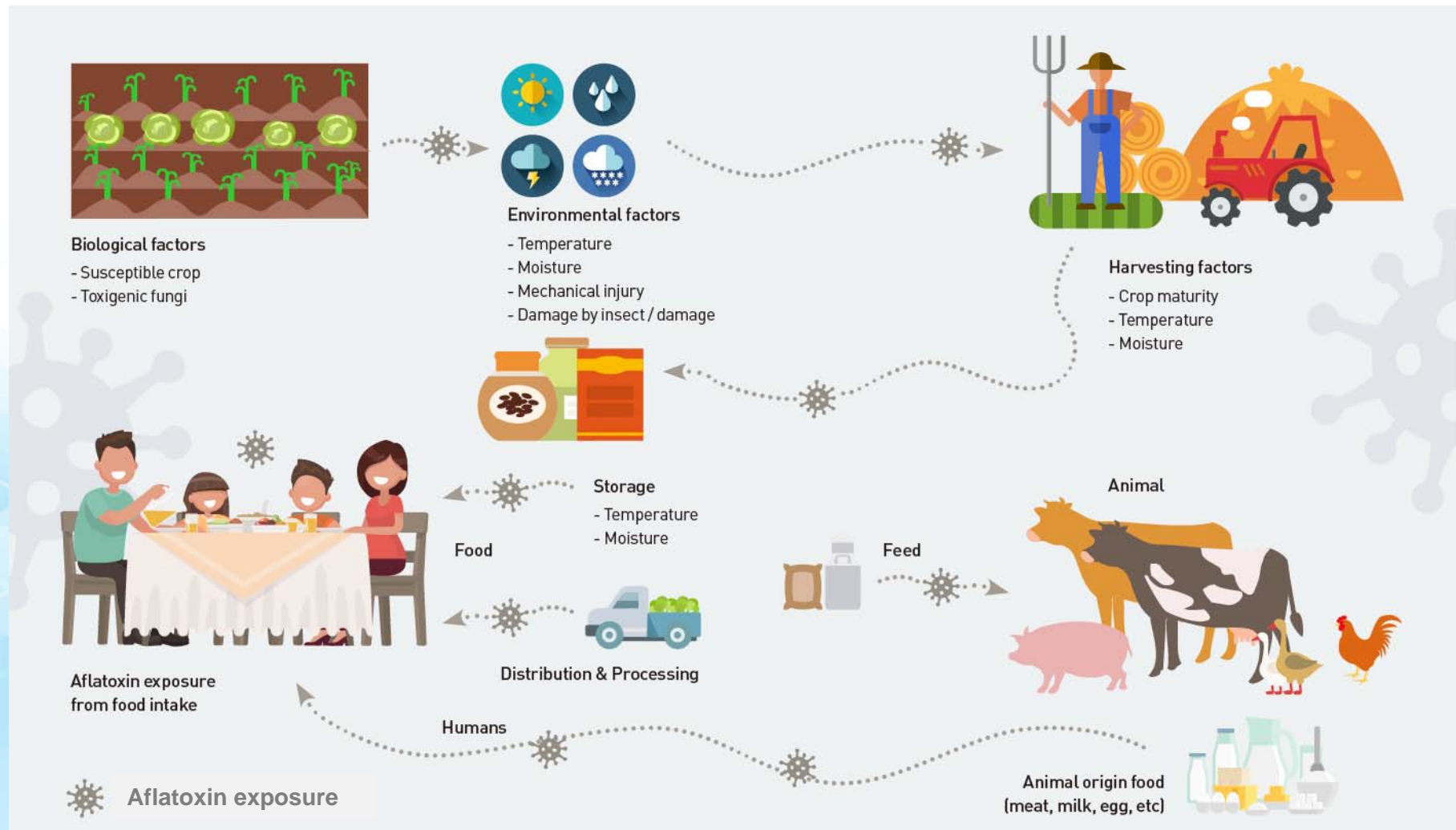
✓ Aflatoxin is epidemiologically implicated as carcinogen in humans and an environmental contaminant which is widespread in nature, therefore chronic toxicity is of greater concern than acute toxicity.

✓ Major source of exposure: cereals, peanuts/nuts, spices etc.

✓ How to control aflatoxins?

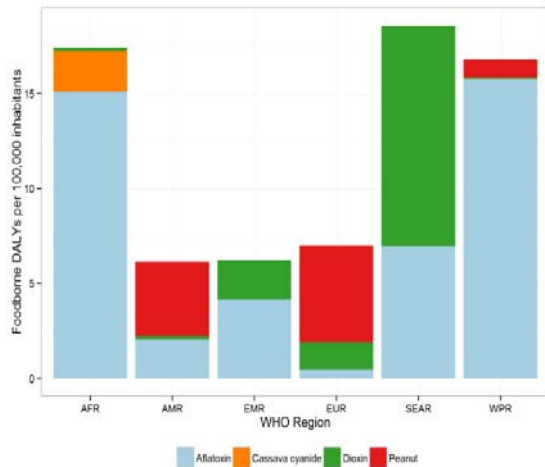
Aflatoxins?

Aflatoxin exposure throughout the food chain



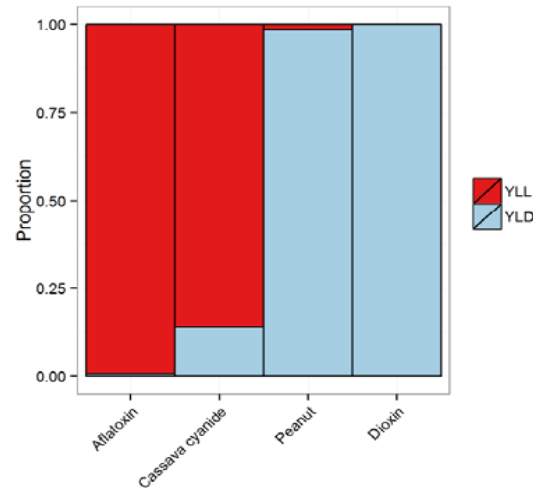
How important is aflatoxins?

Relative contribution to the DALY incidence



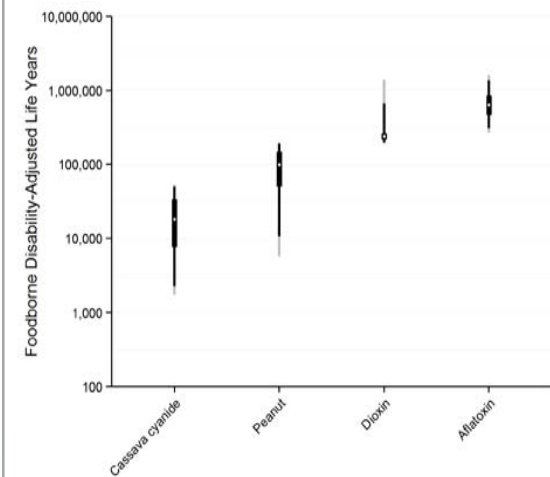
- Deaths and disability adjusted life years (DALYs)
- African Region (AFR)
- Southeast Asia Region (SEAR)
- Western Pacific Region (WPR)
- Eastern Mediterranean Region (EMR)
- Europe (EUR)
- Americas Region (AMR)

Relative contributions from YLLs and YLDs



- Years lived with disability (YLD),
- Years of life lost (YLL)

DALY of four chemicals From contaminated food



- DALY for each of four chemicals from contaminated food ranked from lowest to highest with 95% UI (The dot in the middle of each box represents the median, the box the 50% UI, the dark bar the 95% UI, and the light bar the 95% UI).

WHO report on global burden of foodborne diseases, aflatoxin is one of the main issues.

Gibb et. al. (2016).

Regulatory limits for aflatoxins-1

- ✓ Permitted maximum levels of aflatoxins vary greatly, depending on whether the country imports or exports the affected commodities.
- ✓ Very strict regulation can be costly.

Target food	Classification	Comparison target country or organization (µg/kg)				
		Korea	Codex	EU	USA	Japan
Cereals, legumes, peanuts, nuts and their simple processed products (grinding, cutting, etc.)	B1+B2+G1+G2	15.0	15(Groundnuts, almonds, hazelnuts, Brazil nuts and pistachio)	4.0 (All cereals and all products derived from cereals) 10.0 (Maize and rice) 15.0 (Groundnuts,) 15.0 (Almonds, pistachios and apricot kernels) 15.0 (Hazelnuts and Brazil nuts) 10.0 (Other tree nuts)	20 (All food) ^{c)} 15 (Brazil nuts, groundnuts and processed products,, pistachio)c)	10 (All food) ^{c)}
	B1	10.0	-	2.0 (All cereals and all products derived from cereals) 5.0 (Maize and rice) 8.0 (Groundnuts)a), 12.0 (Almonds, pistachios and apricot kernels) 8.0 (Hazelnuts and Brazil nuts) 5.0 (Other tree nuts)		
Cereal products and legume products	B1+B2+G1+G2	15.0	-	4 (All cereals and all products derived from cereals, including processed cereal products)		
	B1	10.0	-	2 (All cereals and all products derived from cereals, including processed cereal products)		
Groundnuts (peanuts) and other oilseeds and processed products	B1+B2+G1+G2	15.0	-	4 (Groundnuts and processed products)b)		
	B1	10.0	-	2 (Groundnuts and processed products) b)		

Regulatory limits for aflatoxins-2

Target food	Classification	Comparison target country or organization (µg/kg)				
		Korea	Codex	EU	USA	Japan
Soy sauces/pastes, red pepper powder and curry powder	B1+B2+G1+G2	15	-	-	20 (All food) ^{c)} 15 (Brazil nuts, groundnuts and processed products,, pistachio) ^{c)}	10 (All food) ^{c)}
	B1	10	-	-		
Nutmeg, turmeric, dried pepper, dried paprika and natural species	B1+B2+G1+G2	15	-	10.0 (Capsicum spp., Piper spp, nutmeg, ginger, turmeric)		
containing these	B1	10	-	5.0 (Capsicum spp., Piper spp, nutmeg, ginger, turmeric)		
Wheat flour	B1+B2+G1+G2	15	-	-		
	B1	10	-	-		
Dried fruits	B1+B2+G1+G2	15	-	10		
				4.0 (Products intended for direct human consumption)		
	B1	10	-	5 2.0 (Products intended for direct human consumption)		
Infant foods, follow-up foods, cereal foods for infants and young children, other foods for infants and young children	B1	0.1	-	0.10 (Including Dietary foods for special medical purposes intended specifically for infants)		

a) Exception of Ground nuts(peanuts) and other oilseeds for crushing for refined vegetable oil production

b) Exception of Crude vegetable oils destined for refining and refined vegetable oils

c) Sum of B₁, B₂, G₁ and G₂

Risk Assessment

Hazard Identification
(toxicology,
epidemiology)

**Hazard
Characterization**
(toxicology, epidemiology)

**Exposure
Assessment**

**Risk
Characterization**

Establishing Standards

appropriate protection level (food contaminants et al.)

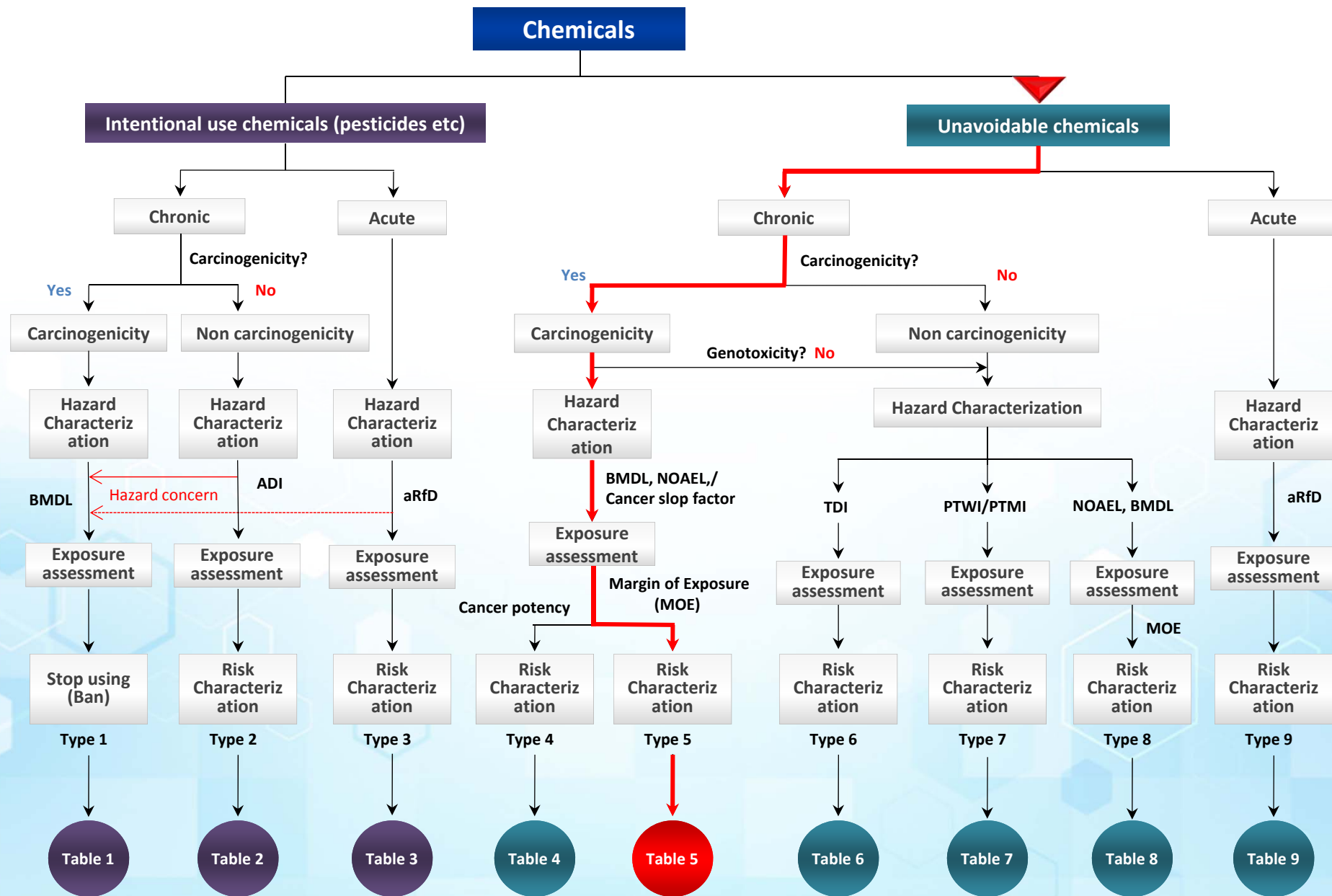
Priority setting

Implementing policies and providing management plans.

Reducing risk

perception differences through risk communication

Flowchart of Risk Assessment in NiFDS



Hazard Identification

One of most potent mutagenic and carcinogenic substances known

Liver cancer in most species

Some evidence humans are at lower risk than other species

B1 (AFB1) most common, most studied, most toxic

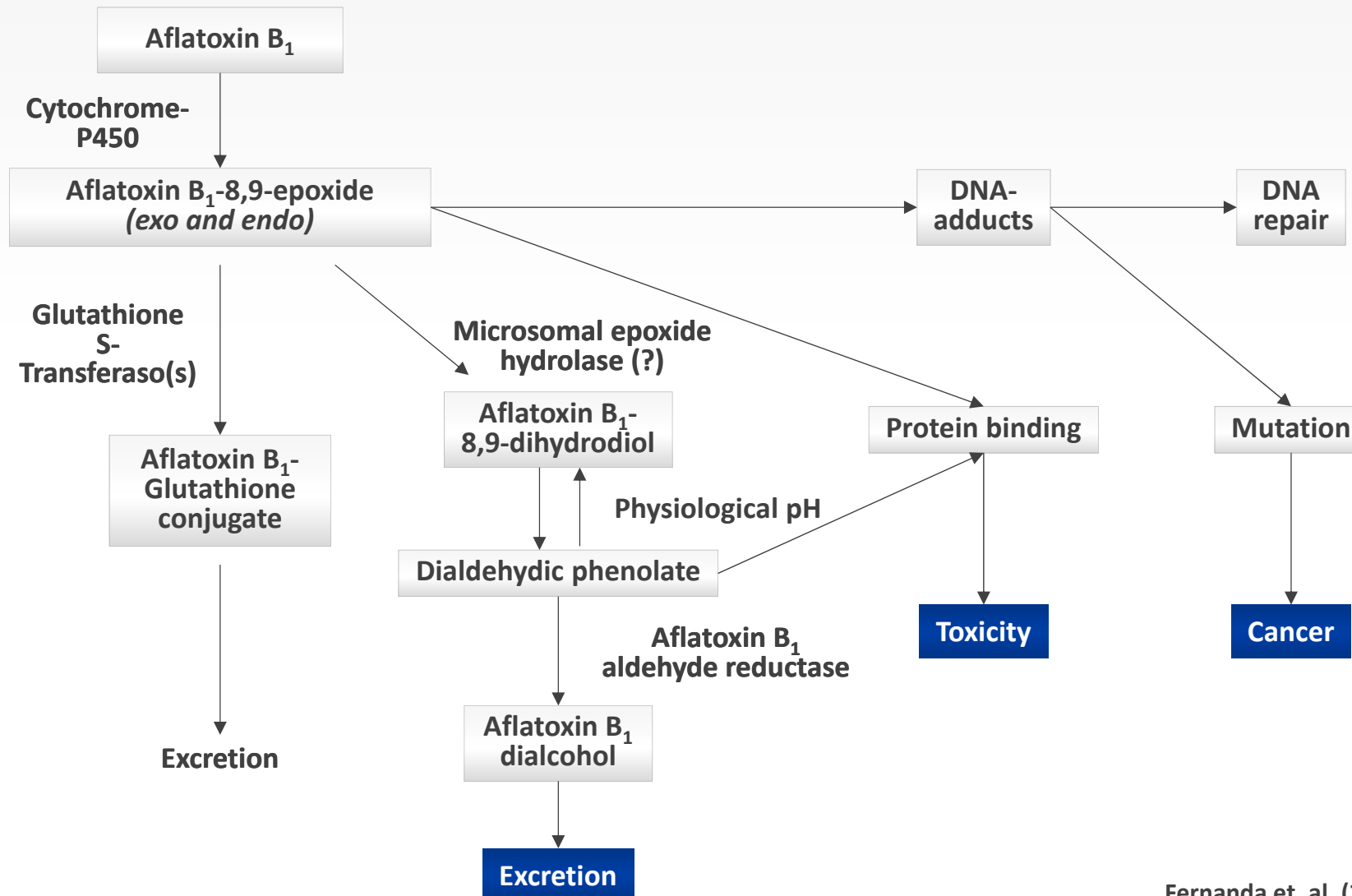
Toxicity varies by species

- LD50 0.5 mg/kg for duckling
- LD50 60 mg/kg for mouse
- Binds to nucleic acids in some species
- Difficult to assess for humans

Death usually from liver damage

Hazard Identification

Major metabolic processes of aflatoxin B₁



Fernanda et. al. (2016).

Hazard Identification

✓ Epidemiological studies for aflatoxin B1 and liver cancer

Country	Region	AFB1 intake (ng/kg b.w./day)	Liver cancer rate/year ^a	Liver cancer rate/60 years ^a
Kenya ^b	Highland	4.2	14	840
	Midland	6.8	43	2,580
	Lowland	12.4	58	3,480
Swaziland ^c	High veldt	14.3	35	2,100
	Middle veldt	40.0	85	5,100
	Lebombo	32.9	89	5,340
	Low veldt	127.1	184	11,040
Transkei ^d	Four districts	16.5	91	5,460
Mozambique ^e	Manhica-Mangud	20.3	121	7,260
	Massinga	38.6	93	5,580
	Inhambane	77.7	218	13,080
	Inharrime	86.9	178	10,680
	Morrumbene	87.7	291	17,460
	Homoine-Maxixe	131.4	479	28,740
	Zavala	183.7	288	17,280
China ^e	Guangxi B	11.7	1,754	105,240
	Guangxi B	90.0	1,822	109,320
	Guangxi C	704.5	2,855	171,300
	Guangxi D	2,027.4	6,135	368,100

^a Age-adjusted annual incidence of liver cancer for men per one million individuals. The age distributions of the population groups studied did not deviate significantly from each other. In the study from China, the incidence of HBsAg + carriers was 23% of all members of the cohort and in the study from Swaziland and (presumably) Kenya it was 21–28%, whereas no information was found for Mozambique. The calculation of the lifetime liver cancer rate (last column) assumed a lifespan of 60 years.

^b Peers et al. (1976) as corrected by Carlborg (1979).

^c Peers and Linsell (1977).

^d Van Rensburg et al. (1985).

^e Yeh et al. (1989).

EFSA Journal (2007).

Hazard Characterization

✓ BMD10 and BMDL10 on the development of liver cancer in rats by exposure to AF B1*

Model	Log (likelihood)	AIC	Accept	BMD10 (µg/kg b.w./day)	BMDL10 (µg/kg b.w./day)
BMDS					
Gamma		75.52	Yes	0.47	0.23
Logistic		73.54	Yes	0.45	0.34
Log-logistic		75.52	Yes	0.48	0.26
Log-probit		75.50	Yes	0.48	0.28
Multistage		75.61	Yes	0.44	0.17
Multistage-Cancer		73.64	Yes	0.42	0.17
Probit		73.52	Yes	0.41	0.31
Weibull		75.56	Yes	0.46	0.21
Quantal-Linear		78.24	No	0.14	0.10
PROAST					
Gamma	-34.76		Yes	0.47	0.23
Logistic	-34.77		Yes	0.45	0.34
Log-logistic	-34.76		Yes	0.48	0.26
Log-probit	-34.75		Yes	0.48	0.28
Two-stage	-34.82		Yes	0.42	0.34
Weibull	-34.78		Yes	0.46	0.21
LVM: E2	-34.76		Yes	0.41	0.31
LVM: H2	-37.04		No	0.20	-

* Wogan et al., 1974

Hazard Characterization

✓ Toxicity information for major mycotoxins

Mycotoxin	Units	TDI	TDI***	IARC
Aflatoxin B1	NOT ESTABLISHED		BMDL ₁₀ = 170 ng/kg bw/day	GROUP 1
Aflatoxin M1				GROUP 2B
Ochratoxin A	PTWI*	1.0	0.11 µg/kg bw./week	GROUP 2B
Fumonisin	TDI**	2.0	1.65 µg/kg bw/day	GROUP 2B
Patulin		0.4	0.4 µg/kg bw/day	GROUP 3
Deoxynivalenol		1.0	1 µg/kg bw/day	GROUP 3
Zearalenone		0.5	0.4 µg/kg b.w./day	GROUP 3

* PTWI: Provisional tolerable weekly intake (ng/kg bw/week)

** TDI: Tolerable daily intake (ng/kg bw/day)

*** As designated by the National Institute of Food Drug Safety Evaluation

Dietary Exposure Assessment

✓ Aflatoxin contamination

- 10,443 samples from 300 products during 2012-2015
- analyzed by HPLC and LC-MS/MS

✓ Food consumption

- the Korea National Health and Nutrition Examination Survey (KNHANES, 2011–13)
- the mean and extreme intake (P95) by age

✓ Body weight

- calculated using the MIMS/MAP 3.0 & Oracle 10g programs

**Aflatoxin contamination
in food ($\mu\text{g/g}$)**

×

**Food consumption
(g/day)**

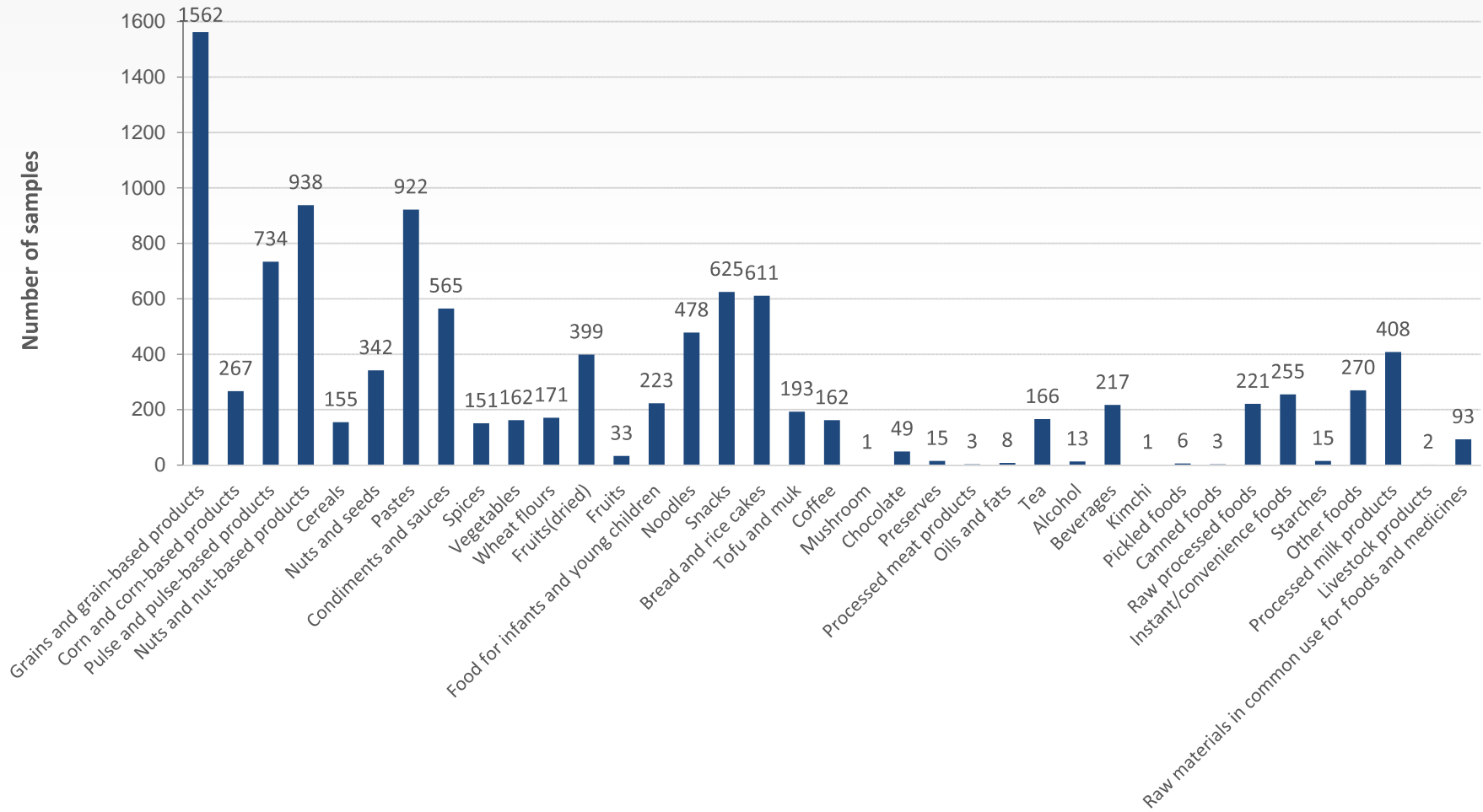
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**Aflatoxins exposure
(ng/kg bw/day)**

**Body weight
(Kg)**

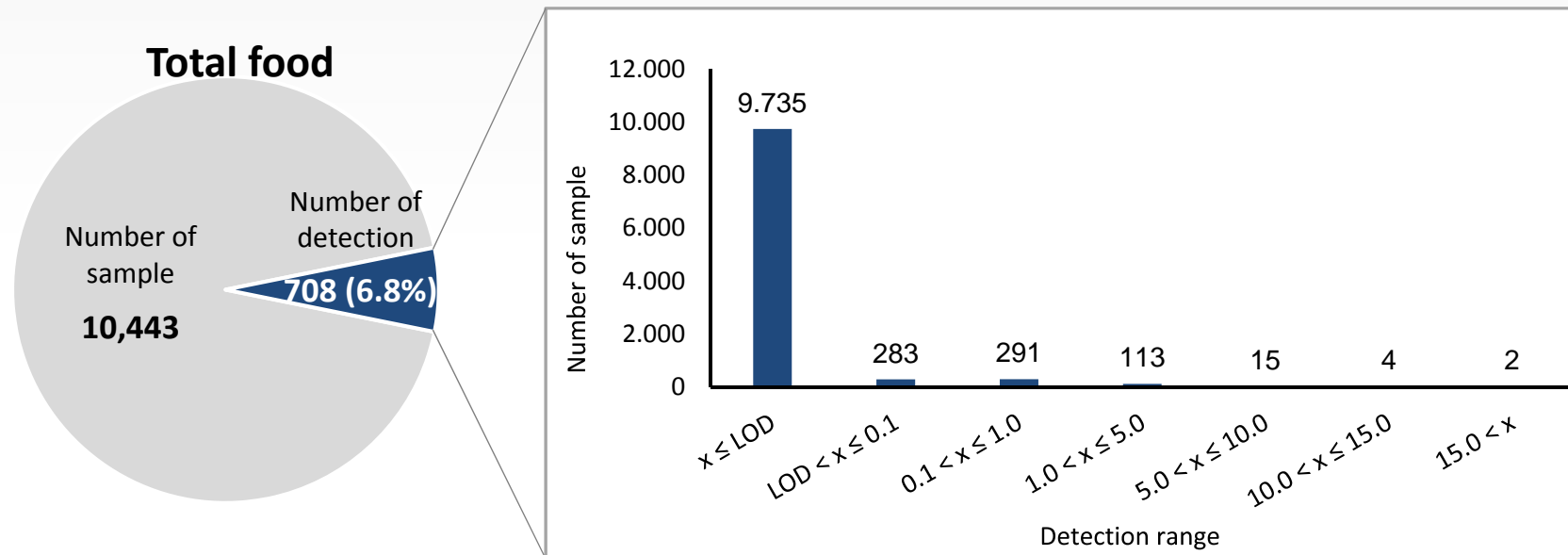
Dietary Exposure Assessment

Number of food samples tested for aflatoxins



Dietary Exposure Assessment

Total aflatoxins detection range in food



Samples were analyzed using high-performance liquid chromatography (HPLC) and mass spectrometry (MS), according to the CODEX HPLC or HPLC/MS/MS method, while “nondetects” were evaluated using ND (0) and ND (limit of detection, LOD).

Dietary Exposure Assessment

Data Management System in NiFDS

MIMS KFDA
유해물질 모니터링 정보관리시스템

Monitoring Information Management System
Complete, consistent and deducted D/B Acquisition Environment!
WHO GEMS/food protocol compatible!
Role-based WUI(web user interface) applied!

실험실계 결과입력
현황조회 코드분류

Member 로그인

아이디 비밀번호 로그인

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KFDA MAP 2.0 Monitoring database and Assessment Program (II)

FANTASY Food And coNtaminant daTA System
FINDS Food Intake by Individuals Database
DREAMS Dietary Exposure Assessment System

식품 중의 유해물질 모니터링 D/B

FANTASY
Food And coNtaminant daTA System

식품 중의 유해물질에 대한 정의와 함께, 유해물질 모니터링 과정을 통하여 수집한 농도, 가공식품의 원료배합비율, 조리음식의 레시피, 성분변화를 등의 농도(함량)데이터베이스이다.

식품 중 유해물질 모니터링 D/B 구축현황

유해물질 데이터 베이스 구축 실적

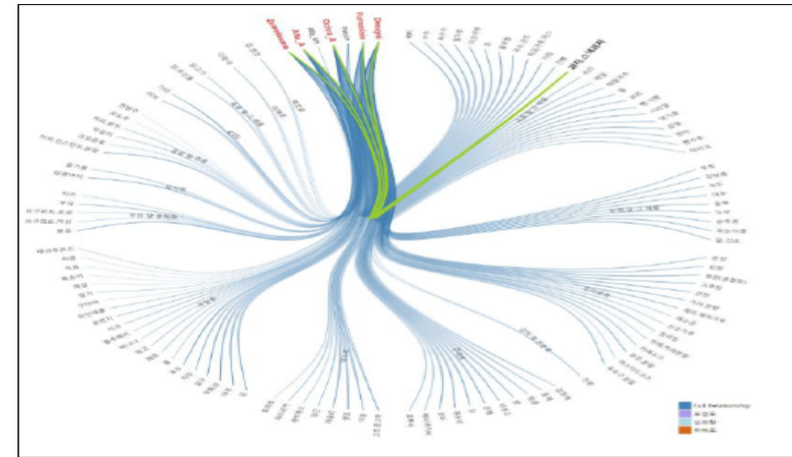
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국립수산물품질관리원	24,106
농촌진흥청	22,293
농업기술연구원	7,293
농촌진흥청 국립식량과학원	5,324
농촌진흥청 국립축산과학원	303
농촌진흥청 국립수목원	294
농촌진흥청 국립원예특작과학원	87
농촌진흥청 국립과채HORTICULTURE시험장	70

구분	건수
국립농업과학원	25,609
국립수산물품질관리원	5,318
농촌진흥청	2,368
농업기술연구원	1,957
농촌진흥청 국립식량과학원	2,050
농촌진흥청 국립축산과학원	303
농촌진흥청 국립수목원	278
농촌진흥청 국립원예특작과학원	87
농촌진흥청 국립과채HORTICULTURE시험장	70

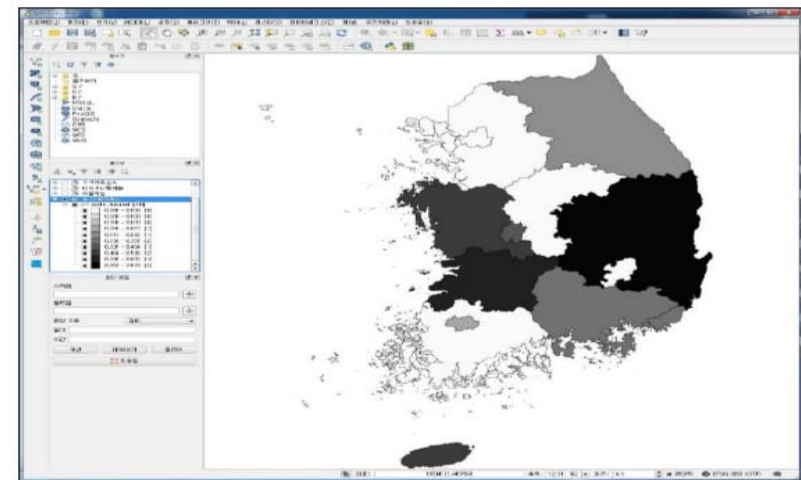
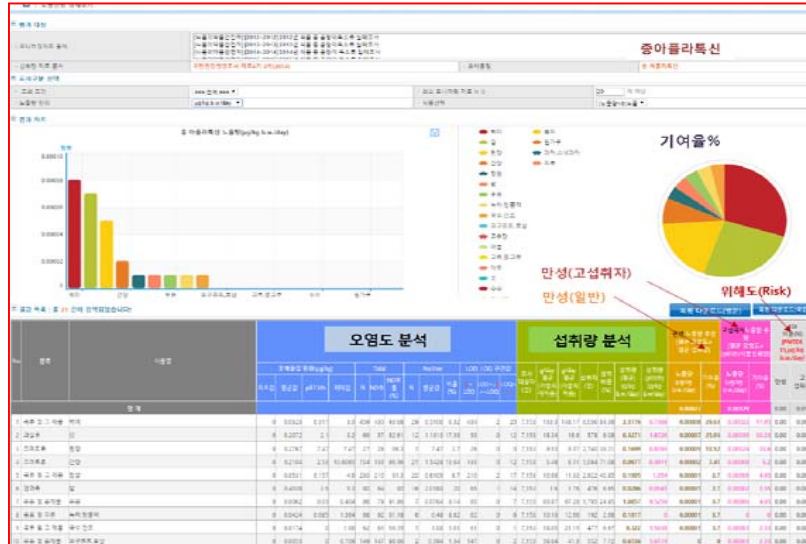
Collection program
of hazardous substances monitoring DB &
(MIMS, Monitoring Information Management System)
(MAP, Monitoring database and Assessment Program)

Dietary Exposure Assessment

Data Management System in NiFDS



SNA: Food-Hazard network analysis



GIS: Contamination Map(eg, Total Afl.)

Dietary Exposure Assessment

✓ Concentrations of aflatoxin in food

Category	No. of samples	LC %	Concentration range(LB / UB) (µg/kg)			
			Mean	Median	Minimum	Maximum
Grains and grain-based products	1562	92	0.09 / 0.23	0 / 0.04	0 / 0	74.86 / 74.86
Corn and corn-based products	267	91	0.10 / 0.21	0 / 0.08	0 / 0	4.55 / 4.55
Pulse and pulse-based products	734	96	0.02 / 0.09	0 / 0.02	0 / 0	7.25 / 7.25
Nuts and nut-based products	938	93	0.10 / 0.18	0 / 0.03	0 / 0	12.20 / 12.20
Cereals	155	86	0.03 / 0.22	0 / 0.05	0 / 0	1.26 / 1.26
Nuts and seeds	342	93	0.04 / 0.15	0 / 0.02	0 / 0	6.62 / 6.62
Pastes	922	88	0.10 / 0.23	0 / 0.03	0 / 0	10.61 / 10.61
Condiments and sauces	565	86	0.04 / 0.17	0 / 0.06	0 / 0	6.85 / 6.85
Spices	151	88	0.34 / 0.66	0 / 0.23	0 / 0	9.51 / 9.51
Vegetables	162	98	0.01 / 0.14	0 / 0.07	0 / 0	1.44 / 1.44
Wheat flours	171	96	0.02 / 0.13	0 / 0.02	0 / 0	1.20 / 1.20
Fruits(dried)	399	94	0.02 / 0.18	0 / 0.07	0 / 0	3.20 / 3.20
Fruits	33	100	-(a)	-	-	-
Food for infants and young children	223	98	0 / 0.07	0 / 0.07	0 / 0	0.14 / 0.16
Noodles	478	98	0.01 / 0.13	0 / 0.02	0 / 0	1.08 / 2.18
Snacks	625	97	0.01 / 0.17	0 / 0.04	0 / 0	2.12 / 2.18
Bread and rice cakes	611	98	0 / 0.05	0 / 0.02	0 / 0	2.16 / 2.18
Tofu and muk	193	95	0.05 / 0.10	0 / 0.0	0 / 0	1.16 / 1.16
Coffee	162	96	0.03 / 0.06	0 / 0.03	0 / 0	3.27 / 3.27
Mushroom	1	100	-	-	-	-
Chocolate	49	98	0 / 0.17	0 / 0.02	0 / 0	0.06 / 2.18
Preserves	15	100	-	-	-	-
Processed meat products	3	100	-	-	-	-
Oils and fats	8	100	-	-	-	-
Tea	166	93	0.04 / 0.14	0 / 0.02	0 / 0	1.36 / 2.18
Alcohol	3	100	-	-	-	-
Beverages	217	98	0 / 0.05	0 / 0.02	0 / 0	0.7 / 0.7
Kimchi	1	100	-	-	-	-
Pickled foods	6	100	-	-	-	-
Canned foods	3	100	-	-	-	-
Raw processed foods	221	82	0.02 / 0.07	0 / 0.02	0 / 0	1.67 / 1.67
Instant/convenience foods	255	95	0.01 / 0.10	0 / 0.03	0 / 0	1.46 / 2.18
Starches	15	87	0.06 / 0.21	0 / 0.03	0 / 0	0.68 / 0.96
Other foods	270	87	0.04 / 0.12	0 / 0.04	0 / 0	4.65 / 4.65
Processed milk products	408	98	0 / 0.06	0 / 0.01	0 / 0	0.71 / 0.71
Livestock products	2	100	-	-	-	-
Raw materials in common use for foods and medicines	93	94	1.07 / 1.14	0 / 0.03	0 / 0.01	93.44 / 93.44

LC: left-censored data(values below the limit of detection)

(a): not calculated where all data were left-censored or the number of data was very limit

Dietary Exposure Assessment

✓ The average and high consumer exposure to aflatoxin by age class

Population groups	Estimates exposure for average consumer ^a (ng/kg b.w./day)		Estimates exposure for high consumer ^b (ng/kg b.w./day)	
	LB	UB	LB	UB
All population	0.263	1.105	0.777	3.596
Adults ^c	0.255	1.056	0.729	3.347
1~2 years	0.614	3.049	1.912	10.393
3~6 years	0.537	2.502	1.650	7.636
7~12 years	0.375	1.657	1.181	5.595
13~19 years	0.242	1.060	0.773	3.815
20~64 years	0.252	1.052	0.721	3.335
65 <	0.273	1.085	0.783	3.485

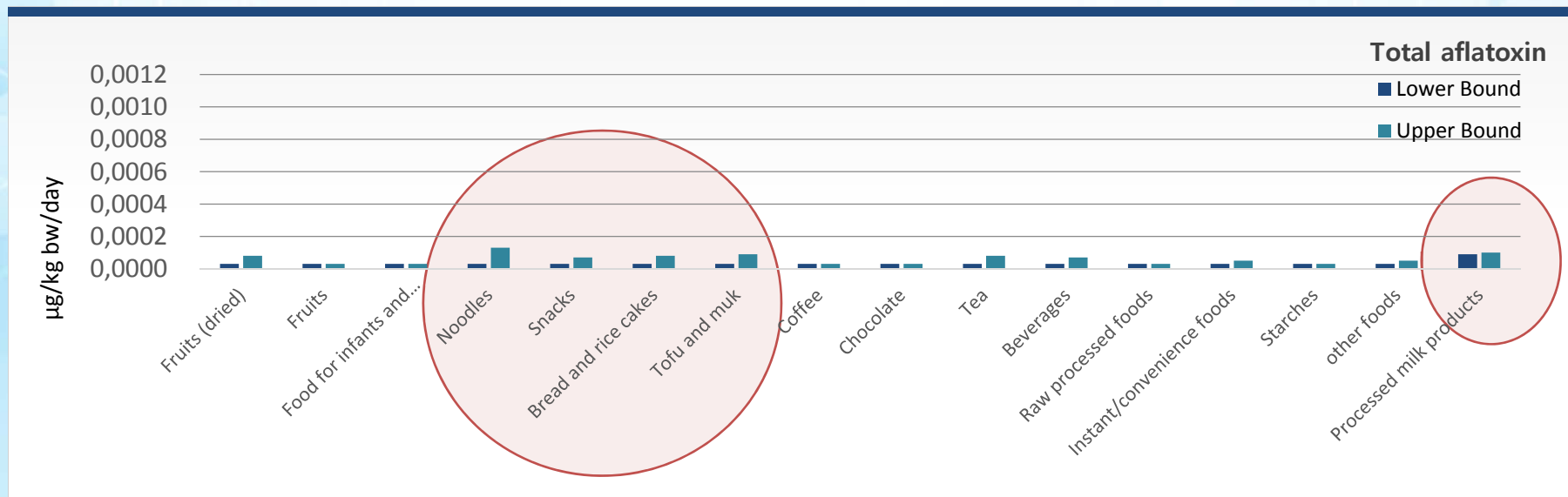
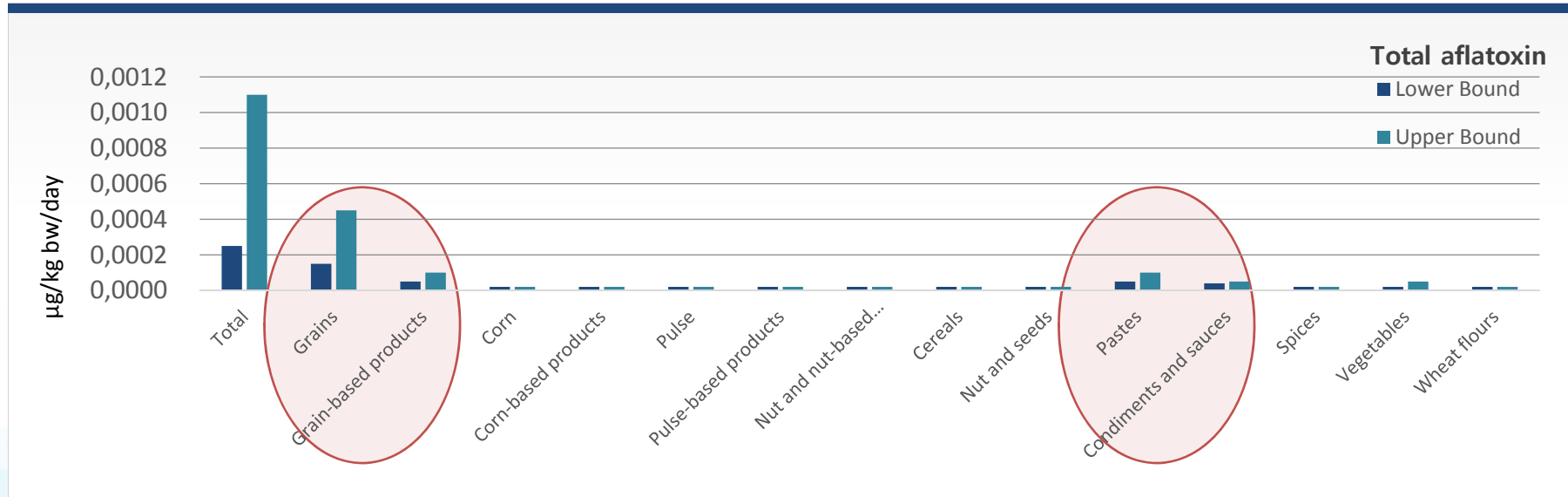
^a Average intake is based on average occurrence and average consumption.

^b High consumer is based on average occurrence and 95th percentile consumption.

^c 20 < group

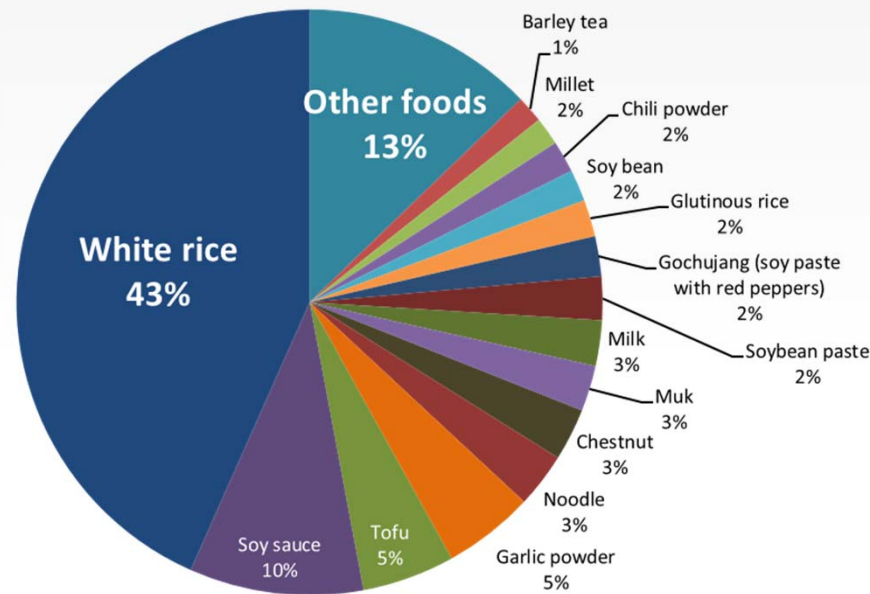
Dietary Exposure Assessment

✓ Daily aflatoxin exposure in **each food group**

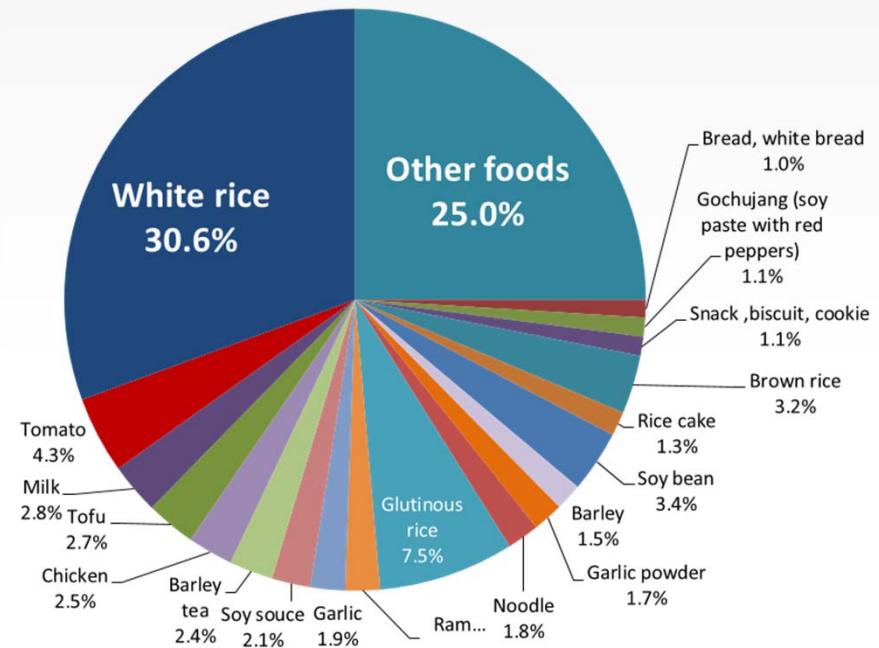


Dietary Exposure Assessment

✓ Contribution of **each food** to dietary exposure of aflatoxins



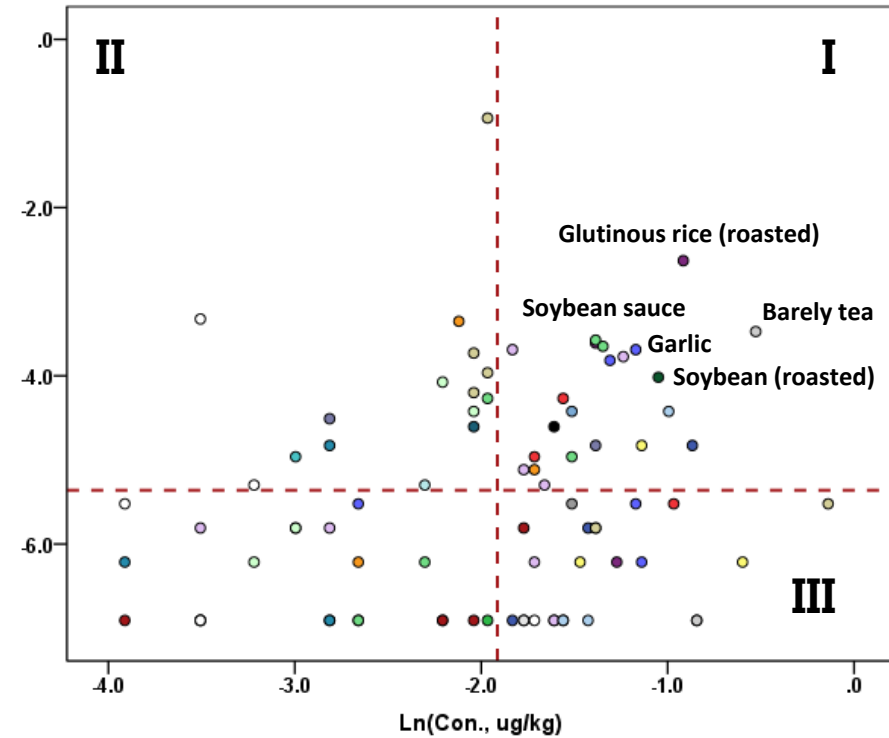
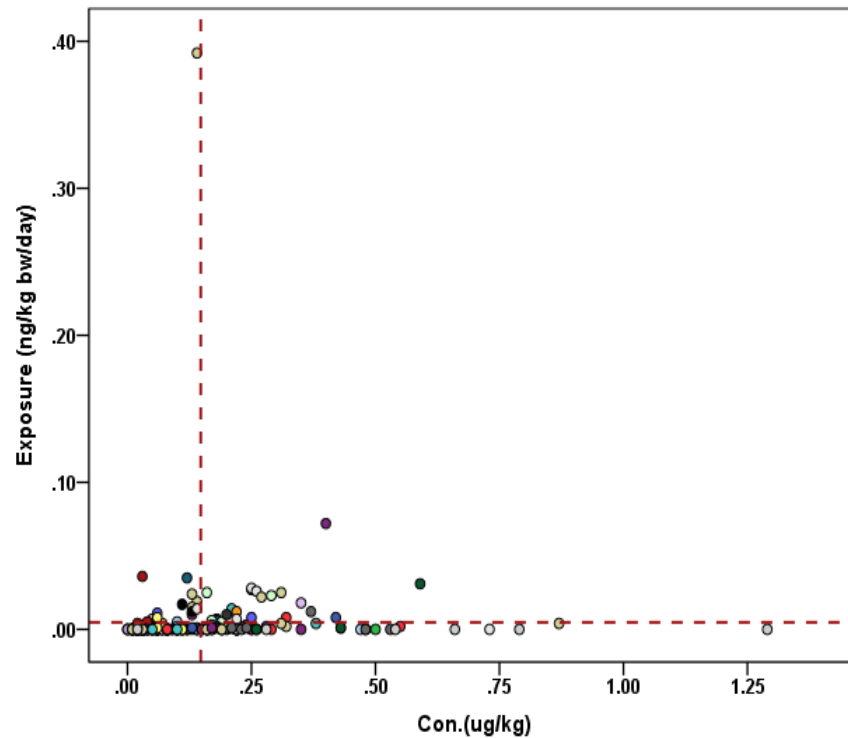
Contribution to aflatoxin exposure using LB concentration in all population



Contribution to aflatoxin exposure using UB concentration in all population

Dietary Exposure Assessment

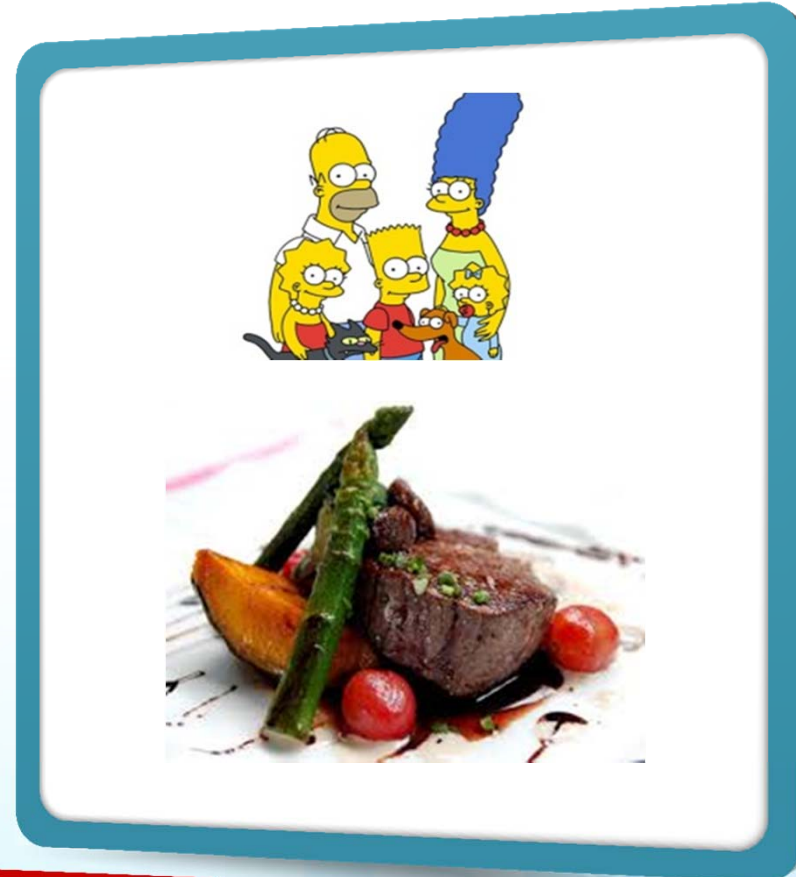
Foods with high contamination & exposure level (Group I)



- | | | | | | |
|-------------------------------|------------------------|---------------------------|--------------------------------|-----------------------------|-------------------------|
| ● Nuts and nut-based products | ● Other foods | ● Wheat flours | ● Corn and corn-based products | ● Seasoned foods | ● Coffee |
| ● Nuts and seeds | ● Kimchi | ● Mushrooms | ● Corn | ● Alcohol | ● Canned foods |
| ● Grains | ● Tea | ● Bread and rice cakes | ● Processed milk products | ● Instant/convenience foods | ● Special purpose foods |
| ● Grain-based products | ● Pulse | ● Raw processed foods | ● Beverages | ● Preserves | ● Condiments |
| ● Fruits (dried) | ● Pulse-based products | ● Cereals | ● Sauces | ● Vegetables | |
| ● Fruits | ● Tofu and <i>muk</i> | ● Oils and fats | ● Starches | ● Chocolate | |
| ● Snacks | ● Noodles | ● Processed meat products | ● Pickled foods | | |

Diet Style of Korean

“ Korean Diet is different from Western-style Diet ”



Grain (Rice etc) consumption
= 300g/day

Risk Characterization

Low possibility of hazardous effects related to aflatoxin exposure through food intake

The aflatoxin risk from food intake: the margin of exposure (MOE) method

$$\text{MOE} = \frac{\text{BMDL}_{10} (\mu\text{g}/\text{kg bw}/\text{day})}{\text{Daily exposure } (\mu\text{g}/\text{kg bw}/\text{day})}$$

The mean daily exposure for total aflatoxin: 0.0011 $\mu\text{g}/\text{kg bw}/\text{day}$

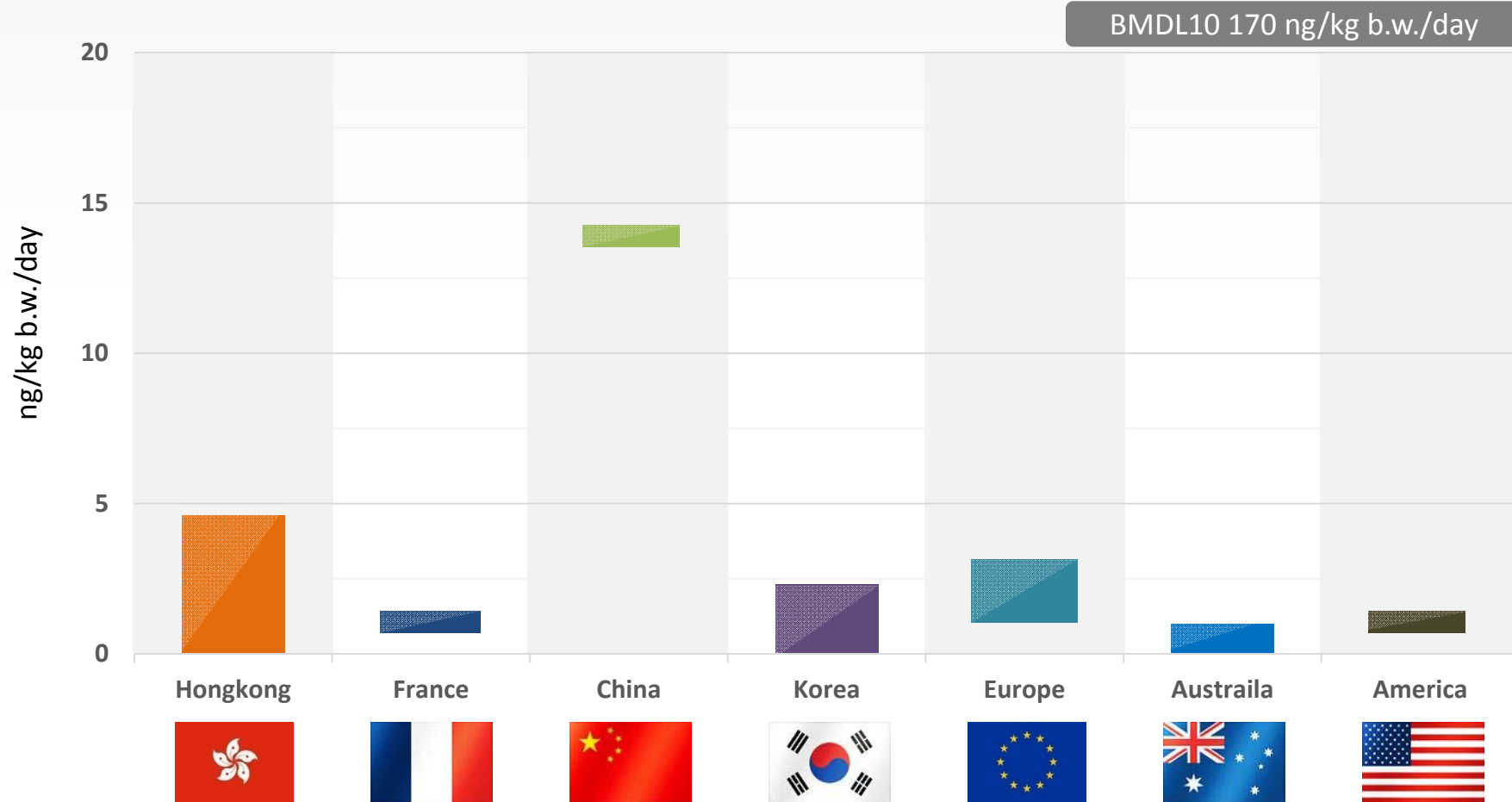
BMDL₁₀ for aflatoxin: 0.170 $\mu\text{g}/\text{kg bw}/\text{day}$

Koreans maintaining an average diet were assessed to have a low possibility of hazardous effects related to aflatoxin exposure.

Nevertheless, because aflatoxins are carcinogenic and genotoxic, their levels in food should be continuously monitored and minimized following the **ALARA principle**.


Risk Characterization

Comparison of Exposure Levels with Foreign Countries

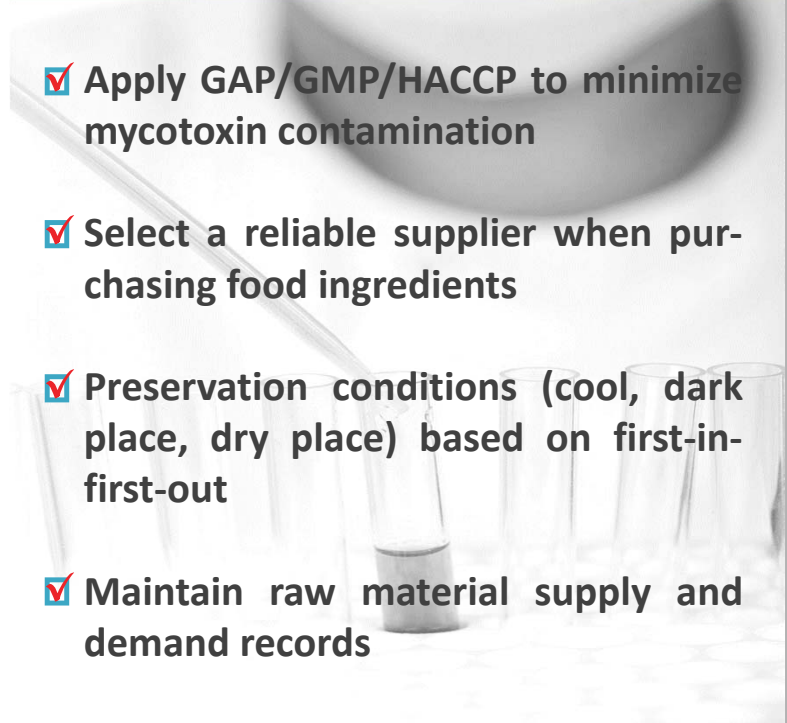


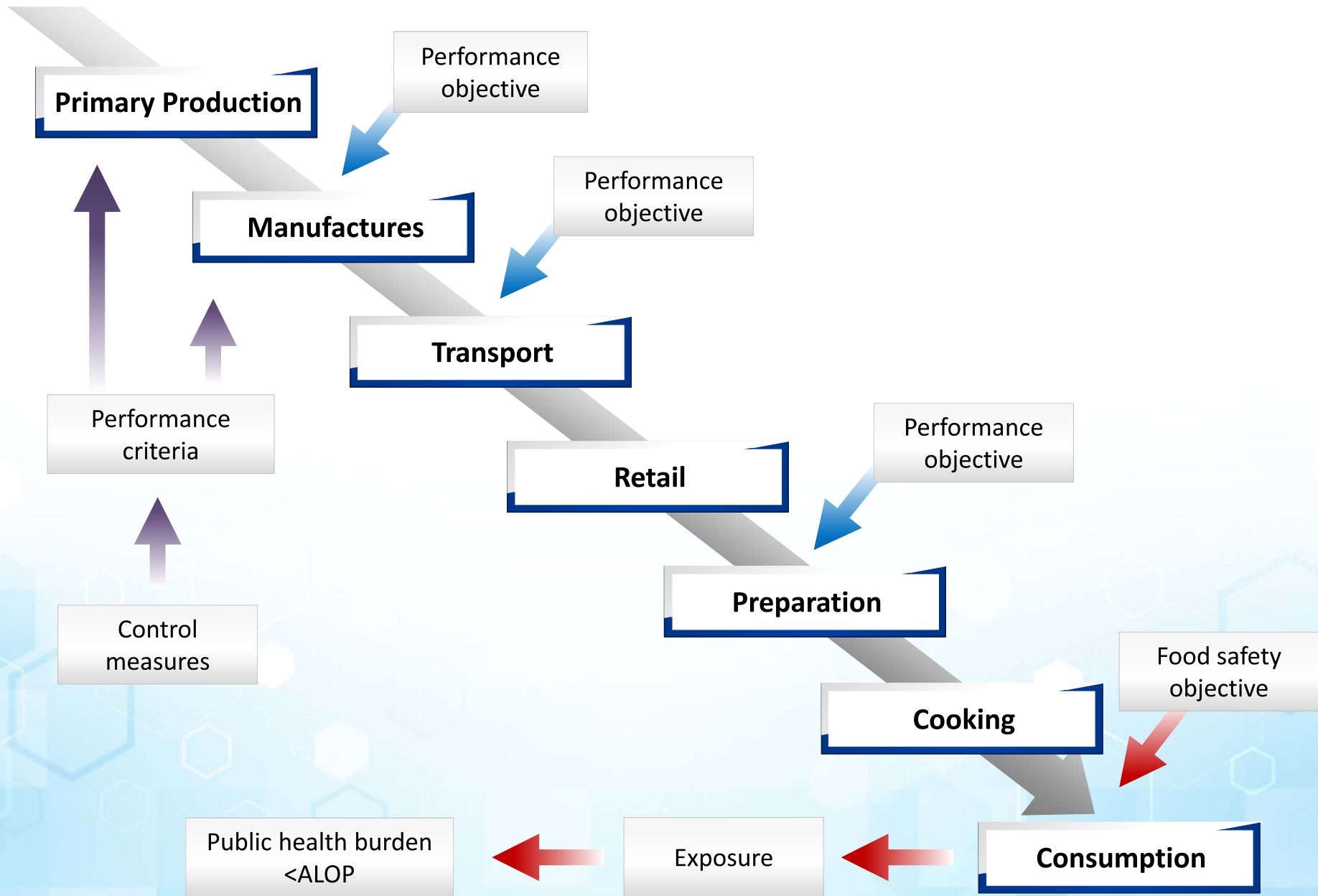
Reduction strategy

Home

- 
- ✓ Keep cereals and processed products in cool dark place
 - ✓ Maintain a balanced diet
 - ✓ Check the expiration date and discard the moldy food
 - ✓ Be careful when storing nuts
 - ✓ Purchase from trusted retailers

Industry

- 
- ✓ Apply GAP/GMP/HACCP to minimize mycotoxin contamination
 - ✓ Select a reliable supplier when purchasing food ingredients
 - ✓ Preservation conditions (cool, dark place, dry place) based on first-in-first-out
 - ✓ Maintain raw material supply and demand records



Food safety practices throughout the food chain



불량식품 연구사업단 성과발표회 및 국제심포지엄



MINISTRY OF FOOD AND DRUG SAFETY
National Institute
of Food and Drug Safety Evaluation



**Thank you
for your attention**



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of Food and Drug Safety Evaluation

