The report of surveillance results for chemical hazards in foods and feeds (2015~2016)

MAFF

Ministry of Agriculture,
Forestry and Fisheries

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This report is an abridged translation of the original version (https://www.maff.go.jp/j/syouan/seisaku/risk_analysis/survei/pdf/chem_27-28.pdf) in Japanese and is provided for reference purposes only. If there are any discrepancies between this book and the original version, the original prevails.

This document includes summary and other information of surveillance and monitoring. The data is available on the website of MAFF (https://www.maff.go.jp/e/policies/food_safety/Health_of_Consumers/occurrence_data.html).

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List of acronyms

3-Ac-DON	3-acetyl-deoxynivalenol
15-Ac-DON	15-acetyl-deoxynivalenol
4-Ac-NIV	4-acetyl-nivalenol
Co-PCB	coplanar-PCB; dioxin-like PCBs
DON	deoxynivalenol
EPN	*O*-ethyl *O*-4-nitrophenyl phenylphosphonothioate
FAO	Food and Agriculture Organization of the United Nations
FID	flame ionization detector
GC	gas chromatograph
GC-MS	gas chromatograph mass spectrometer
GEMS/Food	Global Environmental Monitoring System/ Food Contamination Monitoring and Assessment Programme
HPLC	high performance liquid chromatograph
ICP	inductively coupled plasma
ICP-MS	inductively coupled plasma mass spectrometry
LB	lower bound
LC	liquid chromatograph
LC-MS	liquid chromatograph mass spectrometer
LC-MS/MS	liquid chromatograph tandem mass spectrometer
LOD	limit of detection
LOQ	limit of quantification
3-MCPD	3-chloropropane-1,2-diol
MS	mass spectrometer
NIV	nivalenol
PAH	polycyclic aromatic hydrocarbon

PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-*p*-dioxin
PCDF	polychlorinated dibenzofuran
TEQ	toxic equivalency
UB	upper bound
WHO	World Health Organization

1. Introduction

The major tasks of the Food Safety and Consumer Affairs Bureau of the Ministry of Agriculture, Forestry and Fisheries of Japan (MAFF) include development and implementation of policies and measures for improving the safety of domestically produced foods and feeds according to the Act for Establishment of the Ministry of Agriculture, Forestry and Fisheries (1999) and the Food Safety Basic Law (2002). Food safety activities follow the principles and procedures stipulated in the *Standard Operating Procedure (SOP) for Food Safety Risk Management by the MAFF and the Ministry of Health, Labour and Welfare (MHLW)* developed by the MAFF in 2006. The principles in the SOP coincide with the internationally agreed principles and concept as contained in the *Codex Working Principles for Risk Analysis for Food Safety for Application by Governments* adopted by the Codex Alimentarius Commission in 2007.

In order to know if any measures are necessary to improve food safety, science- and risk-based surveillance of hazards in foods and feeds and statistical analysis of the results shall be conducted to determine the levels of safety. If found necessary, measures shall be developed taking into consideration the methods of primary production, food processing and distribution, and consumption of foods and feeds. The surveillance results are also critical for verifying the effectiveness of the measures taken.

The occurrence data of hazards in foods so obtained from surveillance as well as consumption of these foods are essential for dietary exposure assessment. Estimated dietary exposure will be compared with the respective health-based guidance value estimated on a basis of toxicological data to determine the safety of foods.

MAFF has conducted surveillance for chemical and microbiological hazards in foods and feeds. The results of surveillance on chemical hazards conducted through FY2014 have been uploaded on the MAFF website[1]. This report contains the results of surveillance conducted in FY2015 and 2016.

[1] https://www.maff.go.jp/e/policies/food_safety/attach/pdf/ensuring-2.pdf

2. Executive summary

This report is a compilation of results of the surveillance on chemical hazards in foods and feeds conducted in FY2015 and 2016 by the Food Safety and Consumer Affairs Bureau, Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan.

The surveillance on chemical hazards in foods and feeds was conducted following the “Mid-term Surveillance/Monitoring Programme” and “Annual Surveillance/Monitoring Programme”. The monitoring of pesticide residues in agricultural produce was also conducted to check the compliance of pesticide uses with the approved Good Agricultural Practice (GAP) for the use of pesticides as determined by the MAFF.

The following table indicates the number of analytical results.

	Chemical hazards in raw commodities			Chemical hazards formed in transportation and/or food processing	Pesticide residues	**Total**
	Metals	Mycotoxins	Dioxins			
Agricultural produce	838	6,896	-	-	3,763	**11,497**
Fish and crustaceans	-	-	170	-	-	**170**
Processed foods	552	48	-	4,252	-	**4,852**
Feeds	813	1,038	-	-	-	**1,851**
Total	**2,203**	**7,982**	**170**	**4,252**	**3,763**	**18,370**

Note: The numbers shown are not the number of samples. When two chemical hazards were analyzed in one test sample, it was counted as “2”.

2.1 Results and overview

2.1.1 Agricultural produce, fish and crustaceans

(1) Lead

Lead was analyzed in domestically produced vegetables (asparagus, celery, cucumber, spinach, sweet pepper and taro; total 478 samples) in FY2015. Lead concentrations in spinach and taro (with peel) were similar to the results in FY 2010. Those in most of samples of other vegetables were lower than the respective limits of quantification.

(2) Mycotoxins

Deoxynivalenol (DON) and nivalenol (NIV) are formed by the genus *Fusarium*, causative mold of *Fusarium* head blight of wheat and barley. These mycotoxins and their modified forms can be formed at high concentrations in wheat and barley grains depending on climatic conditions. MAFF has encouraged farmers to implement good agricultural practices as contained in the “Guidelines for Reduction of Deoxynivalenol and Nivalenol Contamination in Wheat and Barley” (December 2008).

Domestically produced wheat (292 samples) and barley (208 samples) grains were analyzed for nationwide occurrence and annual variation of concentrations of DON and NIV. MAFF used the results to verify the implementation of the measures contained in

the guidelines and their effectiveness in the fields. The mean concentrations of DON and NIV in wheat and barley grains harvested in FY2015 and 2016 were the lowest among the results obtained since FY2002. No samples contained DON higher than the provisional maximum level of 1.1 mg/kg established by the MHLW for DON in wheat.

(3) Dioxins

The concentration of dioxins concentrations were analyzed in fish and crustaceans (170 samples) provided by fisheries cooperative associations as instructed by the “Basic Guidelines for Promotion of Measures against Dioxins” (adopted by the Meeting of Ministers concerning Measures against Dioxins in March 30, 1999).

After the statistical analysis of the analytical results from the previous years: (1) the concentrations of dioxins in the wild Japanese amberjack were found to be significantly lower; (2) those in the atka mackerel and red snow crab were significantly higher; and (3) those in other species were not significantly different. For each of the species tested, the dioxin concentration ranges are similar among all the years. On the other hand, for each species, a large variability was observed within the results obtained in the same year.

(4) Pesticide residues

A total of 706 samples of 10 domestically grown agricultural produce were analyzed for pesticide residues to check the compliance with GAP for pesticide uses. A total of 3,763 analytical results were obtained. Except for two Chinese chive samples, all other samples were found to contain residues at or below the respective maximum residue limits established under the Food Sanitation Act. Concerning the two Chinese chive samples, MAFF: (1) instructed the farmers to prevent drift of the pesticides; (2) requested the pesticide industries to include a new text on the labels of their formulation products about prevention of drifts. Ingesting these Chinese chives at a normal consumption amount continuously, even every day for whole life, would not cause any adverse health effect.

2.1.2 Processed foods

(1) Lead

A total of 228 samples of canned fruits, pickled vegetables and some other processed foods available in the market in Japan were analyzed for lead. After the statistical analysis, lead concentration in canned fruits were significantly lower than the surveillance results in FY2013. It indicates that the mitigation measures taken by the manufacturers for food cans are effective for reduction of lead concentrations in canned foods. For other foods, some of samples contained lead at relatively high concentrations.

(2) Mycotoxins

Aflatoxins in 12 samples of soft brown sugar products imported and sold in Japan were analyzed (48 analytical results). All the samples analyzed contained lower aflatoxins than the maximum level established under the Food Sanitation Act.

(3) Acrylamide

MAFF has encouraged food business operators to reduce acrylamide in processed foods by implementing mitigation measures as contained in the "Guidelines for Reduction of Acrylamide in Foods" (November 2013). MAFF also issued a leaflet "What we can do at home to reduce acrylamide in foods" [2] (October in 2015) and has promoted the mitigation in home cooking.

A total of 1,353 samples of processed foods (12 different foods that significantly contribute to the intake of acrylamide in Japan) were analyzed. After the statistical analysis and comparison with the results of previous surveillance, acrylamide concentrations in breads and rolls remained low and those in French fried potato and potato snack were significantly lower. Mitigation measures taken by food business operators have been effective.

[2] https://www.maff.go.jp/e/policies/food_safety/attach/pdf/acrylamide_booklet.pdf

(4) Polycyclic Aromatic Hydrocarbons (PAHs)

A total of 120 samples of domestically produced shaved “katsuobushi” (produced through boiling, fermentation with mold, smoking and drying bonito) were analyzed for PAHs (2,040 analytical results). Some of samples contained PAHs at relatively high levels.

(5) 3-MCPD fatty acid esters and Glycidyl fatty acid esters

MAFF contributed significantly to the elaboration of a “Code of Practice for the Reduction of 3-MCPD esters and Glycidyl esters in Refined Oils and Food Products Made with Refined Oils” (CXC79-2019) and has encouraged the food industries to reduce these compounds in their products.

Thirty samples of rice bran oil were analyzed for 3-MCPD fatty acid esters and glycidyl fatty acid esters (as free 3-MCPD or glycidol, 60 analytical results) in FY2016. The concentrations of 3-MCPD fatty acid esters and glycidyl fatty acid esters in rice bran oils tended to be lower than the results obtained in FY2012 and 2013. No statistical comparison between the results of FY2016 and those of FY2012-2013 was performed because the sampling methods were different in these surveys.

(6) Trans fatty acids

In FY2005–2007, MAFF estimated an average dietary intake of trans fatty acids (TFA) in Japan to be 0.44-0.47% of total energy intake. It was about half of the WHO recommendation, which is less than 1% of total energy intake.

A total of 389 samples of fats, oils and processed foods, which may significantly contribute to the dietary intake of TFA in Japan, were analyzed in FY2015. The concentrations of TFA in foods tended to be lower than the results of the previous surveys, indicating that efforts by the food manufactures in mitigating TFA have been effective. No statistical comparison between the results from FY2015 and those from FY2005-2007 was performed due to differences in sampling and analytical methods.

Deep-fried foods and frozen processed foods (180 samples) were also analyzed in FY2016. About 70% of the deep-fried foods and 90% of the frozen processed foods contained less than 0.3 g of TFA per 100 g. According to the “Guidelines on trans fatty acid labelling” (February in 2011) by the Consumer Affairs Agency of Japan, the content of TFA in those foods can be expressed as “0 g” on the labels.

For people eating the normal diet, the risk arising from the intake of TFA remained low. MAFF emphasized the importance of having a

balanced diet as well as not taking too much fats including saturated fatty acids.

(7) Histamine

Appropriate hygienic and temperature control is necessary to suppress histamine formation in foods. Pickled vegetables (230 samples) sold in the Japanese market were collected and analyzed for histamine. The concentrations of histamine were low in most of samples, but some contained histamine at high level.

2.1.3 Feeds

MAFF establishes maximum levels (MLs) for contaminants in feeds under the Act on Safety Assurance and Quality Improvement of Feeds and instructs the feed industries to comply with the MLs. MAFF follows the principles described in the Codex General Standard for Contaminants and Toxins in Food and Feed (CXS 193-1995): e.g., conducting surveillance and application of the ALARA principle. MAFF also monitors contaminants in feeds on the market to check the compliance with the MLs and, if necessary, revises the MLs on the basis of the latest occurrence data.

Composite feeds, fish meal and maize grain were analyzed for metals (cadmium, lead and total mercury), total arsenic and mycotoxins (aflatoxin B_1, deoxynivalenol and zearalenone) in FY 2015 and 2016. A total of 1,851 of analytical results were obtained.

No samples contained contaminants above the MLs. The obtained data on metals (cadmium, lead and total mercury), total arsenic and mycotoxins (deoxynivalenol and zearalenone) in composite feeds served as the basis for the revision of the MLs in FY2019.

2.2 Conclusions

Surveillance conducted in FY2015 and 2016 revealed that the concentrations of chemical hazards in foods were as low as or lower than the surveillance results of previous years. This indicates that the efforts to mitigate these hazards in foods by food business operators have been effective.

MAFF will continue to investigate the occurrence of chemical hazards in foods and feeds and verify the effectiveness of measures to reduce contamination. MAFF will also estimate the dietary intake of chemical hazards using the occurrence data obtained from the surveillance and food consumption data. When the dietary exposure assessment indicates a public health concern, MAFF will develop measures to improve food safety.

3. Design of surveillance and monitoring

This chapter describes objectives of the surveillance/monitoring, criteria for selection of target chemical hazards and foods, and requirements for analytical laboratories.

3.1 Surveillance on chemical hazards

3.1.1 Objectives of the surveillance

MAFF obtains the occurrence data of chemical hazards in foods by surveillance. The data are essential for estimation of the dietary exposure to chemical hazards. It will be compared with the respective health-based guidance value to determine the safety of foods. If it is found to be necessary to reduce risk, measures to improve food safety should be developed and implemented.

3.1.2 Selection of target chemical hazards and foods

MAFF has developed a "List of Chemical Hazards in Foods and Feeds of High Priority for Risk Management by MAFF" (priority list; 2006) and reviewed and updated it periodically (2010 and 2016)[3]. In the course of it, MAFF considers a wide range of information including: (1) mitigation measures studied and implemented by other countries or recommended by international organizations; and (2) concerns/interests expressed by stakeholders such as consumers, farmers, food manufacturers, retailers and restaurant

[3] https://www.maff.go.jp/j/syouan/seisaku/risk_analysis/priority/chemical_h27.html

industry.

For the chemical hazards of priority, MAFF develops the medium term (5 years) plan [4] of surveillance to be conducted on the chemical hazards listed in the Priority List. In developing the medium term plan, MAFF selects the foods and feeds subject to surveillance on a basis of the consumption data, the past surveillance results, and the availability of validated analytical methods. Based on the medium term plan, MAFF develops a detailed annual plan [5] that includes information on statistically based sampling methods (e.g., number of samples and sample size).

3.2 Monitoring on pesticide residues

3.2.1 Objectives of the monitoring

Pesticide residues in agricultural produce reflect the pesticide uses by farmers. MAFF conducts monitoring of pesticide residues to check the compliance with GAP and Maximum Residue Limits (MRLs) to determine if additional risk management measures are necessary.

3.2.2 Selection of target foods and pesticides

Agricultural produce are selected among those with large

[4] https://www.maff.go.jp/j/syouan/seisaku/risk_analysis/survei/middle_chem_h28.html
[5] https://www.maff.go.jp/j/syouan/seisaku/risk_manage/index.html#survey_year

production volume on a basis of the past monitoring results.

Pesticides are selected from the list of pesticides that are used on the agricultural produce selected above. There shall be validated analytical methods of the pesticides (compounds in the residue definition) to be selected.

3.3 Requirements for analytical laboratories

The data obtained from surveillance and monitoring are used to estimate the dietary exposure and to verify the effectiveness of measures taken to improve food safety. They may also be uploaded to the GEMS/Food database[6]. The relevant data contained in the GEMS/Food database are used by the Codex Committee on Contaminants in Foods when developing Codex maximum levels and codes of practice, which will be adopted by the Codex Alimentarius Commission as international standards. For reflecting the situations in Japan in the Codex recommendations, it is important to objectively indicate that the data are scientifically reliable and obtained in those laboratories that have implemented quality assurance systems. For uploading onto the GEMS/Food database, various kinds of data are necessary in addition to the analytical data.

When requesting chemical analyses, MAFF requires the laboratories to demonstrate that they have implemented quality assurance

[6] https://extranet.who.int/gemsfood/

systems, such as regular conduct of internal quality control and participation in the external quality control.

Validated analytical methods are also essential for obtaining scientifically reliable analytical results. MAFF requires the laboratories to use validated and robust analytical methods to ensure that similar results can be obtained wherever and whenever the analysis is conducted and whoever analyzes the same sample.

Appropriateness of analytical methods depending on the range of concentrations to be measured, which requires different limits of quantification (LOQ) and limits of detection (LOD). If an insensitive method is used, the analytical results of <LOD may not warrant that it is safe to eat that food. On the other hand, if a hyper-sensitive method is used, it may cost a lot unnecessarily and may take longer than appropriate analytical method.

For the reasons above, MAFF specifies the requirement for the LOQ and LOD, and the laboratories shall report recoveries and any other necessary information related to quality assurance of analytical results.

4. Analytical results (available online)

The results of the surveillance for chemical hazards in foods and feeds conducted in FY2015 and 2016 are available at the following URL.

https://www.maff.go.jp/e/policies/food_safety/occurrence_data.html

4.1 Descriptions of the data of chemical hazards

Minimum

The minimum is the lowest concentration among the analytical results of multiple samples. Minimum is not indicated when all analytical results are below the limit of quantification (LOQ).

Maximum

The maximum is the highest concentration among the analytical results of multiple samples. Maximum is not indicated when all analytical results are below the LOQ.

Mean

The mean is the arithmetic average of the analytical results of multiple samples. When there are analytical results below the LOQ, both upper bound (UB; results below the LOQ are regarded to be at the LOQ) and lower bound (LB; results below the LOQ were regarded to be at zero) means are calculated.

Median

The median is the middle value in a series of analytical results arranged in a rank order. When the number of analytical results is even, the median is the average of the two values at the center of series. The median is generally regarded to be more robust statistically than the mean as the median is less influenced by extreme value(s).

4.1.1 Concentrations of dioxins

The term “dioxins” includes a number of similar chemicals with different potencies of toxicity. The total of “dioxins” is expressed in the total toxicity, “total toxicity equivalency (TEQ).” calculated by summing up the product of concentration and toxicity conversion factor (toxic equivalent factor; TEF) of each of dioxins, assuming that the toxicity of 2,3,7,8-TCDD, the most potent dioxin species, to be 1. The TEFs proposed by WHO in 2005 were used for calculation. When calculating TEQ, all analytical results below the LOQ are regarded to be at zero.

Analytes and LOQs are shown in the table below.

Analyte		**LOQ (pg/g wet weight)**
PCDD (polychlorinated dibenzo-p-dioxins)	2,3,7,8-TCDD	0.01
	1,2,3,7,8-PeCDD	0.01
	1,2,3,4,7,8-HxCDD	0.02
	1,2,3,6,7,8-HxCDD	
	1,2,3,7,8,9-HxCDD	
	1,2,3,4,6,7,8-HpCDD	0.02

Analyte		LOQ (pg/g wet weight)
	OCDD	0.05
PCDF (polychlorinated dibenzofran)	2,3,7,8-TCDF	0.01
	1,2,3,7,8-PeCDF	0.01
	2,3,4,7,8-PeCDF	
	1,2,3,4,7,8-HxCDF	0.02
	1,2,3,6,7,8-HxCDF	
	1,2,3,7,8,9-HxCDF	
	2,3,4,6,7,8-HxCDF	
	1,2,3,4,6,7,8-HpCDF	0.02
	1,2,3,4,7,8,9-HpCDF	
	OCDF	0.05
Co-PCB (coplanar polychlorinated biphenyl; dioxin-like PCBs)	3,3',4,4'-TCB	0.1
	3,4,4',5-TCB	
	3,3',4,4',5-PeCB	
	3,3',4,4',5,5'-HxCB	
	2,3,3',4,4'-PeCB	1
	2,3,4,4',5-PeCB	
	2,3',4,4',5-PeCB	
	2',3,4,4',5-PeCB	
	2,3,3',4,4',5-HxCB	
	2,3,3',4,4',5'-HxCB	
	2,3',4,4',5,5'-HxCB	
	2,3,3',4,4',5,5'-HpCB	

4.1.2 Concentrations of trans fatty acids and saturated fatty acids

There are fatty acids with the different number of carbons, and number and positions of double bonds. For analysis, MAFF used analytical methods validated internationally and the trans fatty acids (TFA) and saturated fatty acids (SFA) described in Section 5.7 were analyzed.

For calculating the total TFA and SFA, how analytical results below the LOQ and/or LOD were handled is shown in the table below.

	analytical results	**calculation of total TFA/SFA**
i	all < LOD	Results < LOD are regarded to be at zero.
ii	> 60% below LOQ (except for the above i)	Results <LOD are regarded to be at half of the LOD. Results ≥LOD and <LOQ are regarded to be at half of the LOQ.
iii	≤ 60% below LOQ, of which ≥ 50% below LOD	
iv	≤ 60% below LOQ, of which < 50% below LOD	Results <LOQ are regarded to be at half of the LOQ.

The groups of foods analyzed are explained below.

A	breads and rolls, hardtack, popcorn (popped and pre-popped) and rice cracker
B	deep fried chicken (including chicken nugget and “kara-age”), French-fried potato and frozen processed foods (“kara-age”, dumpling, “croquette”, meatball, meat cutlet, springroll and “tempura”)
C	dairy cream and cream substitute, lard containing fat other than pork fat as ingredients, mix for hot coffee, tea and cocoa beverages, roux and soup mix

D	coffee whitener, ice milk, ice cream-like product and salad dressing
E	vegetable oil
F	biscuit, cookie, cracker, puff pie, semiperishable (half-dry) cake and snack
G	apple pie/meat pie, chocolate, cream puff, custard pudding, Danish pastry, doughnut and Japanese style short cake
H	frozen processed foods (Chinese steamed bun, fried rice, hotcake, “okonomi-yaki”, pancake, pilaf, pizza and “tako-yaki”)
I	deep-fried foods (“croquette”, loin cutlet, minced meat cutlet, deep fried fish and “tempura”) and frozen processed foods (deep fried fish)

Descriptions of Japanese foods:

- “Croquette” is a casual food like the French croquette, consisting of breaded, deep fried patties, typically filled with mashed potatoes or cream sauce.
- “Kara-age” is a Japanese style deep fried chicken most often soy source-flavored.
- “Okonomi-yaki” is a Japanese-style savory pancake containing sliced cabbage and other ingredients.
- “Tako-yaki” is a Japanese savory snack in the shape of little round ball containing pieces of octopus.
- “Tempura” is a Japanese dish consisting of pieces of vegetables or fish that have been coated with batter and deep fried.

Analytes and limit of quantifications of trans fatty acids

Analyte (trans fatty acid)		LOQ (g/100 g sample) for different food groups								
		A	B	C	D	E	F	G	H	I
14:1 (9t)	myristeraidic acid (trans-9-tetradecenoic acid)	0.01	0.008	0.03	0.02	0.05	0.03	0.02	0.004	0.01
16:1 (9t)	palmiteraidic acid (trans-9-hexadecenoic acid)	0.01	0.01	0.04	0.03	0.06	0.04	0.03	0.01	0.02
18:1 (6t) 18:1 (7t) 18:1 (8t)	petroselaidic acid (trans-6-octadecenoic acid) (trans-7-octadecenoic acid) (trans-8-octadecenoic acid)	0.01	0.02	0.03	0.05	0.08	0.02	0.02	0.01	0.03
18:1 (9t)	elaidic acid (trans-9-octadecenoic acid)	0.01	0.02	0.05	0.05	0.07	0.03	0.02	0.01	0.03
18:1 (10t)	trans-10-octadecenoic acid	0.01	0.02	0.05	0.05	0.07	0.03	0.02	0.01	0.03
18:1 (11t)	trans-vaccenic acid (trans-11-octadecenoic acid)	0.01	0.02	0.03	0.05	0.09	0.02	0.02	0.01	0.03
18:2 (9t,12t)	linoelaidic acid (trans-9,12-Octadecadienoic acid)	0.01	0.02	0.06	0.05	0.08	0.06	0.04	0.01	0.03
18:2 (9t,12c)	trans-12-linoelaidic acid (cis-9,trans-12-octadecadienoic acid)	0.02	0.02	0.05	0.06	0.1	0.03	0.03	0.01	0.03
18:2 (9c,12t)	trans-9-linoelaidic acid (trans-9,cis-12-octadecadienoic acid)	0.01	0.02	0.05	0.06	0.09	0.03	0.03	0.01	0.03
18:3 (9t,12t,15t)	trans-9, trans-12, trans-15-octadecatrienoic acid	0.02	0.02	0.09	0.07	0.1	0.09	0.05	0.01	0.02
18:3 (9t,12t,15t)	trans-9, trans-12, trans-15-octadecatrienoic acid	0.03	0.03	0.1	0.2	0.1	0.1	0.08	0.02	0.05
18:3 (9t,12c,15t)	trans-9, trans-12, trans-15-octadecatrienoic acid					0.1				
18:3 (9c,12t,15t) 18:3 (9c,12c,15t)	cis-9, trans-12, trans-15-octadecatrienoic acid cis-9, cis-12, trans-15-octadecatrienoic acid	0.01	0.03	0.07	0.1	0.1	0.04	0.03	0.01	0.05
18:3 (9t,12c,15c)	cis-9, trans-12, cis-15-octadecatrienoic acid	0.01	0.03	0.05	0.1	0.1	0.1	0.06	0.02	0.05
18:3 (9c,12t,15c)	trans-9, cis-12, cis-15-octadecatrienoic acid	0.02	0.03	0.1	0.1	0.1	0.04	0.03	0.02	0.05
20:1 (11t)	trans-11-eicosenoic acid	0.02	0.03	0.05	0.08	0.1	0.1	0.06	0.01	0.04
22:1 (13t)	trans-13-docosenoic acid	0.01	0.01	0.05	0.04	0.2	0.05	0.03	0.01	0.02

Analytes and limit of quantifications of saturated fatty acids

Analyte (saturated fatty acid)		LOQ (g/100 g sample) for different food groups								
		A	B	C	D	E	F	G	H	I
4:0	butyric acid (butanoic acid)	0.01	0.007	0.01	0.01	0.05	0.02	0.01	0.003	0.01
6:0	caproic acid (hexanoic acid)	0.01	0.005	0.01	0.01	0.05	0.01	0.01	0.003	0.008
7:0	enanthic acid (heptanoic acid)	-	0.005	-	-	-	-	-	0.003	0.008
8:0	caprylic acid (octanoic acid)	0.01	0.005	0.01	0.01	0.04	0.01	0.01	0.002	0.008
10:0	capric acid (decanoic acid)	0.01	0.005	0.01	0.01	0.04	0.01	0.01	0.003	0.008
12:0	lauric acid (dodecanoic acid)	0.01	0.006	0.02	0.01	0.04	0.01	0.01	0.003	0.009
13:0	tridecylic acid (tridecanoic acid)	-	0.006	-	-	-	-	-	0.003	0.01
14:0	myristic acid (tetradecanoic acid)	0.01	0.007	0.02	0.01	0.05	0.01	0.01	0.003	0.01
15:0	pentadecylic acid (pentadecanoic acid)	0.01	0.008	0.02	0.02	0.05	0.02	0.01	0.004	0.01
16:0	palmitic acid (hexadecanoic acid)	0.01	0.009	0.03	0.02	0.05	0.02	0.01	0.005	0.01
17:0	margaric acid (heptadecanoic acid)	0.01	0.01	0.03	0.02	0.07	0.02	0.02	0.01	0.02
18:0	stearic acid (octadecanoic acid)	0.01	0.01	0.04	0.03	0.07	0.03	0.02	0.01	0.02
20:0	arachidic acid (eicosanoic acid)	0.01	0.02	0.06	0.04	0.1	0.04	0.03	0.01	0.03
22:0	behenic acid (docosanoic acid)	0.01	0.01	0.04	0.03	0.2	0.03	0.02	0.01	0.02
24:0	lignoceric acid (tetraicosanoic acid)	0.01	0.01	0.04	0.03	0.3	0.03	0.02	0.01	0.02

4.2 Descriptions of the analytical results of monitoring of pesticide residues in agricultural produce and contaminants in feeds

Number of samples

It equals to the number of agricultural produce analyzed. More than one pesticide may be analyzed in one sample.

Limit of quantification (LOQ)

Where there were different LOQs reported for different analytical methods, only the highest LOQ is indicated in the table.

The description, "The number of samples containing the analyte below the LOQ" means the number of samples containing the analyte at lower concentration than the highest LOQ.

Maximum Residue Limits (MRLs)/Maximum Levels (MLs)

The effective MRLs/MLs in the last year of the surveillance are indicated in the table, which may not be the same as the currently valid MRLs/MLs.

The number of samples below the MRL/ML

The total number of samples containing the residues at or below the respective MRL/ML at the time of each monitoring.

Appendix　Sampling and methods of analysis

Chemical hazards		Food	Sampling	Method of analysis	
				Principle	Reference/Notes
Metals	Arsenic (total) Cadmium Lead Mercury (total)	Asparagus Celery Cucumber Pepper, sweet Spinach Taro	Purchased from retailers	ICP-MS	-
		Canned or retort pouch soybean Fruits jam Grape juice Pickled cucumber			
	Lead	Canned fruits			
Mycotoxins	DON 3-Ac-DON 15-Ac-DON NIV 4-Ac-NIV	Barley Wheat	Collected from warehouses (e.g. country elevators))	(2015) GC-MS	“Method of simultaneous analysis of trichothecene mycotoxins (Type B) by GC-MS[7]
				(2016) LC-MS/MS	Nakagawa, et al. 2014.[8]

[7] http://www.famic.go.jp/technical_information/food_contaminants_analysis/index.html

[8] Harmonized collaborative validation of a simultaneous and multiple determination method for nivalenol, deoxynivalenol, T-2 toxin, HT-2 toxin, and zearalenone in wheat and barley by liquid chromatography coupled to tandem mass spectrometry （LC-MS/MS）.

Chemical hazards		Food	Sampling	Method of analysis	
				Principle	Reference/Notes
Mycotoxins	DON-3-Glu Diacetoxyscirpenol T-2 toxin HT-2 toxin Zearalenone	Barley Wheat	Collected from warehouses (e.g. country elevators))	LC-MS/MS	-
	DON NIV	Adzuki bean (dry) Common bean (dry)	Purchased from retailers	LC-MS/MS	Nakagawa, et al. 2014.[2]
	Aflatoxins	Barley	Collected from warehouses (e.g. country elevators))	HPLC-FL	"Test methods related to total aflatoxin", Director notice (Syoku-An No. 0816, dated August 16th, 2011) by the Ministry of Health, Labour and Welfare
	Ochratoxin A			HPLC-FL	AOAC 2000.03
	Sterigmatocystin			LC-MS/MS	-
	Aflatoxins	Soft brown sugar	Purchased from retailers	HPLC-FL	-
Dioxins		Fish and crustaceans	Collected from fishery cooperatives	GC-MS	"The interim guidelines of method of analysis for dioxins in foods" in February 2008 by the Ministry of Health, Labour and Welfare.

Chemical hazards	Food	Sampling	Method of analysis	
			Principle	Reference/Notes
Acrylamide	French-fried potatoes	Purchased from retailers and restaurants	LC-MS/MS	-
	Rice cracker	Purchased from manufacturers		
	Bakery wares Confectionaries Others	Purchased from retailers		
PAH	Shaved dried bonito (katsuobushi)	Purchased from retailers	GC-MS	-
3-MCPD fatty acid esters Glycidyl fatty acid esters	Rice bran oil	Purchased from retailers	GC-MS	DGF Standard Methods Section C Fats C-VI 18 (10) (AOAC Official Method Cd29c-13)
Trans fatty acids Saturated fatty acids	Vegetable oils	Purchased from retailers	GC-FID	AOCS Official Method Ce 2b-11 AOCS Official Method Ce 1h-05
	Bakery wares Confectionaries Dairy products and analogues Deep fried foods Frozen foods Others			AOCS Official Method Ce 2c-11 AOCS Official Method Ce 1j-07

Chemical hazards	Food	Sampling	Method of analysis	
			Principle	Reference/Notes
Histamine	Pickled vegetables	Purchased from retailers	LC-MS/MS	-
Pesticide residues	Agricultural produce	Collected from farmers	Methods indicated in Annex of the Director Notice (Syoku-An No.0124001, dated January 24th, 2005) with some modifications.	
Arsenic (total) Cadmium Lead Mercury (total) Aflatoxin B1 DON Zearalenone	Composite feeds Fish meal Maize grain	Collected from markets	Methods indicated in Annex of the Director Notice (19 Syou-An No.14729, dated April 1st, 2008) .	