TOX/2015/38

COMMITTEE ON TOXICITY OF CHEMICALS IN FOOD, CONSUMER PRODUCTS AND THE ENVIRONMENT

Review of potential risks from aluminium in the diet of 1 to 5 year old children and updated exposures for infants aged 0 to 12 months

Background

1. The Scientific Advisory Committee on Nutrition (SACN) is undertaking a review of scientific evidence that will influence the Government's dietary recommendations for infants and young children. SACN is examining the nutritional basis of the advice. The Committee on Toxicity in Food, Consumer Products and the Environment (COT) was asked to review the risks of toxicity from chemicals in the diet of infants, most of which has been completed, and young children. The reviews will identify new evidence that has emerged since the Government's recommendations were formulated, and will appraise that evidence to determine whether the advice should be revised. The recommendations cover diet from birth to age five years, but are being considered in two stages, focussing first on infants aged 0 to 12 months, and now on advice for children aged 1 to 5 years.

2. There are currently no Government dietary recommendations for infants and young children which relate to aluminium.

3. Aluminium is the most commonly occurring metallic element, comprising eight percent of the earth's crust. The total aluminium content of food includes aluminium that is naturally present, aluminium as a contaminant, aluminium in food additives, and aluminium from food contact materials (FCM) (food containers such as cans, cookware, utensils and food wrappings). Additional exposure can come from drinking water used in food preparation, including reconstitution of infant formula, as well as water that is directly consumed.

4. The 2013 COT statement on potential risks from aluminium in the infant diet is included in Annex A[1]. This discussion paper provides estimated aluminium exposures for children in the UK aged 1 to 5 years and also provides an updated exposure assessment for infants because new data have become available since the COT statement.

[1] http://cot.food.gov.uk/cotstatements/cotstatementsyrs/cotstatements2013/aluminium

5. The risks associated with exposure to aluminium are assessed in this discussion paper using the PTWI of 2000 µg/kg bw established by the Joint FAO/WHO Expert Committee on Food Additives (JECFA) in line with the approach taken by COT in 2013.

6. There are no new reviews on aluminium from international bodies to consider updating or revising the toxicology section from the infant statement. When considering the risk assessment for the updated exposures the toxicology section and human health based guidance value explained in the 2013 COT statement are used.

Aluminium exposures in infants aged 0 to 12 months and young children aged 1 to 5 years

New data on sources of aluminium exposure

Human breast milk

7. A literature search identified no new data for levels of aluminium in breast milk in the UK since those in the 2013 COT statement on the potential risks of aluminium in the infant diet. Therefore the mean and maximum measured values of 27 and 79 µg/L, identified from the Baxter study (Baxter *et al.*, 1991), were used for exposure estimates of aluminium in children aged 6 to 18 months.

Infant formulae and foods

8. Levels of aluminium have recently been measured in an FSA survey of metals in infant formulae and food, and in the composite food samples of the 2014 Total Diet Study TDS).

Drinking water

9. The Drinking Water Inspectorate publishes 1st and 99th percentile data from the water companies, which undertake water testing in England and Wales. The range of 99th percentiles across England and Wales in 2014 was < 5 to 96 µg/L.

Environmental

10. Aluminium concentrations were measured in soil in 5,670 topsoil[2] samples collected between 1978 and 1982 in England and Wales, avoiding large urban areas. Samples were analysed 30 years later. (Rawlings *et al.*, 2012). The median and 90th percentile concentrations were 5.8 and 8 %. No data were identified specifically relating to dust.

[2] From a depth of 0 to 15 cm

Exposure

11. Consumption data from the Diet and Nutrition Survey in Infants and Young Children (DNSIYC) (DH, 2013) and recent data from the National Diet and Nutrition Survey Rolling Programme years 1-4 (NDNS) (Bates *et al.*, 2014) have been used for the estimation of dietary exposure. Bodyweight data used in the estimation of aluminium exposures were average bodyweights of 5.9, 7.8, 8.7 and 9.6 kg for infants aged 0 to 4.0, >4.0 to 6.0, >6.0 to 9.0 and >9.0 to 12.0 months old, respectively (COT, 2013). Average bodyweights of 9.2, 10.6, 11.2, 12 and 16.1 kg were used for infants and young children aged 6.0 to <12.0, 12.0 to <15.0, 15 to <18, 18 to 24 and 24 to 60 months, respectively (DH, 2013; Bates *et al.*, 2014).

Infants

Breast milk

12. Since no new data were available on breastmilk, the estimated exposures of exclusively breastfed infants, aged 0-6 months are as in the 2013 COT statement. Data on breast milk consumption have now become available from DNSIYC and NDNS and these were used in estimating exposure from breastmilk in the 6-18 months age groups based on the mean and maximum aluminium levels of 27 and 79 µg/L, respectively (Table 1). There were too few records of breast milk consumption for children older than 18 months in NDNS to allow a reliable exposure assessment, and breast milk is expected to contribute minimally in this age group.

Table 1. Aluminium exposure from breastfeeding estimated for mean and 97.5th percentile level consumption of breast milk

Age group (months)	Number of consumers	Exposure from 27 µg/L (µg/kg bw/day)		Exposure from 79 µg/L (µg/kg bw/day)	
		Mean	97.5th percentile	Mean	97.5th percentile
>6 to 9	140	1.8	4.3	2.1	12.6
>9 to 12	124	1.0	3.1	3.0	9.1
12 to 15	66	0.8	2.0	2.3	5.9
15 to 18	32	0.7	1.4	2.0	4.1

Infant formulae and complementary food

13. Exposure estimates were derived using occurrence data from the FSA's survey of metals in infant formulae and food consumption data from DNSIYC.

14. Possible aluminium exposure levels from infant formulae were calculated for infants up to 4 months of age assuming exclusive feeding on formula (Table 2). 0 to 3.99 months is not recorded in DNSIYC. Exposure estimates were derived using the occurrence data for First Milk Infant Formula with default values for mean (800mL) and high level (1200mL) consumption, assuming exclusive feeding on infant formula,

Table 2: Estimated aluminium exposures (µg/kg bw/day) from exclusive first-milk infant formula for 0 to 3.99 months

Infant Formula	Al – LB-UB Range **(µg/kg bw/d)**	
	800 mL	1200 mL
Ready to Feed	2.44-4.61	3.66-6.92
Dry Powder[a]	7.89-9.93	11.8-11.9

[a] Exposure does not include the contribution from water

15. Exposure of infants and children aged 4.0 to <12.0 months, from infant formulae, commercial infant foods and other foods commonly consumed by this age group, was estimated using DNSIYC consumption data. Mean exposures for 4.0 to <12 months from infant formula ranged from 0.85-2.49 µg/kg bw/day and 97.5th percentile exposures ranged from 1.83-4.81 µg/kg bw/day, respectively (Table 3). The overall possible mean and 97.5th percentile aluminium exposures ranged from 18.5-37.3 and 55.9-80.0 µg/kg bw/day, respectively.

Table 3: Estimated aluminium exposures (µg/kg bw/day) from infant formulae, commercial infant foods and other foods (excluding water) in infants aged 4 to 12 months

Food	**Al - LB-UB Range (µg/kg bw/d)**					
	4 -5.99 Months (n=116)		**6-8.99 Months (n=606)**		**9-11.99 Months (n=686)**	
	Mean	**97.5th**	**Mean**	**97.5th**	**Mean**	**97.5th**
Infant Formula	1.45-2.49	2.55-4.81	1.09-1.92	2.48-4.14	0.85-1.47	1.83-3.28
Commercial Infant Foods	11.6-11.7	45.2-45.4	11.0-17.1	65.0-65.2	16.1-16.2	62.5-62.6
Complementary Foods	3.77-3.95	18.8-19.1	11.4-11.8	36.7-37.9	18.3-18.9	50.5-51.4
Total (excluding water)	18.5-19.8	55.9-57.4	36.1-37.3	78.2-79.9	30.4-31.7	78.7-80.0

16. Exposure from soya formula was considered separately because it is known to have high aluminium levels. There were only 8 respondents who reported consumption of soy based infant formula across the 4-12 month age range. As these were divided across the 3 age bands, a reliable exposure estimate could not be established. Al was reported in soya formula at a level of 2550 µg/kg. Using the consumption values of regular infant formula from the 4 to 6 month age group, exposure estimates for aluminium in soya formula would be 145 and 358 µg/kg bw/d for the mean and 97.5th percentile, respectively, i.e. two orders of magnitude higher than for non-soya formula.

Children aged 12 to 18 months

17. Exposure estimates for these age groups were derived using occurrence data from the infant metals survey and the 2014 TDS; the basis for each survey is explained in Annex B. In brief, the exposure data derived from the infant survey allow estimation of aluminium exposure in infant formula and foods as sold, whereas the results for the TDS are based on analysis of food that is prepared as for consumption. In addition, the infant metal survey included analysis of infant formulae and commercial infant foods which are not included in the TDS. Consumption data from DNSIYC were used for the estimation of exposure for each study.

Infant Metals Survey

18. The ranges of total mean and 97.5th percentile exposures from infant formula, commercial infant foods and other foods were 31.6 - 34.2 and 61.2 - 72.0 µg/kg bw/day, respectively (Table 4).

Table 4. Estimated aluminium exposures from infant formulae, commercial infant foods and other foods in infants aged 12 to 18 months using data from the FSA infant foods survey

Food	**Al - LB-UB Range (µg/kg bw/d)**			
	12-14.99 Months (n=670)		**15-17.99 Months (n=605)**	
	Mean	**97.5th**	**Mean**	**97.5th**
Infant Formula	0.29-0.52	1.15-2.22	0.16-0.28	0.79-1.63
Commercial Infant Foods	8.98-9.01	46.0-46.0	4.97-4.99	27.8-27.8
Complementary Foods	23.5-24.4	51.7-52.6	26.3-27.2	51.5-52.9
Total (excluding water use in reconstitution)	33.0-34.2	70.7-72.0	31.6-32.7	61.2-62.3

Exposure estimates based on the TDS

19. Table 5 shows the possible aluminium exposures that were calculated using the 27 and 25 Group TDS data for children aged 12 to 18 months. A more detailed breakdown of individual food groups for the 27 and 25 TDS can be found in Annex B. This approach was taken in order to allow the potential impact of aluminium levels in water to be assessed. The exposure data derived from the TDS are higher than those estimated from the infant metal survey. This is due to the inclusion of a larger number of foods in the exposure estimate for the TDS relative to the infant metal survey

20. In the 27 Group TDS (which includes tap water and bottled water), total mean and 97.5th percentile aluminium exposures from a combination of all food groups ranged from 79.2 - 93.1 and 176 - 189, respectively. In the 25 Group TDS (excluding tap water and bottled water), total mean and 97.5th percentile aluminium exposures from a combination of all food groups ranged from 79.2 - 92.9 and 176 - 188 µg/kg bw/day, respectively. Thus in the TDS samples, the concentration of aluminium in drinking water (<20 µg/L) had a negligible impact on total dietary exposure. The upper end of the range of high-level exposure to aluminium from drinking water (4.44 µg/kg bw/day from Table 7 below) is considerably lower than the upper bound mean and high-level exposure to aluminium from the 25 group TDS and would make a negligible difference if added to dietary levels. The combined estimate for exposure to aluminium from the 25 group TDS in addition to drinking water does not take account of the contribution from water used by the research laboratory (which was below the LOD of 3 µg/l) for the cooking of food samples.

21. The food groups with the highest contribution to aluminium exposure were: miscellaneous cereals, non-alcoholic beverages, bread, other vegetables and dessert food groups (see Annex B).

Table 5. Estimated aluminium exposures from the total diet for the 27 and 25 group TDS in infants aged 12 to 18 months

Food Group	**Aluminium - LB - UB Range (µg/kg bw/day)**			
	12 to 14.99 Months (n=670)		**15 to 17.99 Months** (n=605)	
	Mean	**97.5th**	**Mean**	**97.5th**
27 Groups	79.2-80.8	176-179	91.5-93.1	187-189
25 Groups	79.2-80.6	176-178	91.5-92.9	187-188

Children aged 18 months to 5 years

22. Exposure estimates for these age groups were derived using occurrence data from the 2014 TDS and consumption data from the NDNS.

23. Table 6, shows the possible aluminium exposures that were calculated using the 27 and 25 group TDS data for children aged 18 months to 5 years. A more detailed breakdown of individual food groups for the 27 and 25 TDS can be found in Annex C.

24. In the 27 Group TDS, total mean and 97.5th percentile aluminium exposures from a combination of all food groups ranged from 101-108 and 172-178 µg/kg bw/day, respectively. In the 25 Group TDS, total mean and 97.5th percentile aluminium exposures from a combination of all food groups ranged from 101-108 and 172-177 µg/kg bw/day, respectively. Thus again, the concentration of aluminium in drinking water in the TDS samples (<20 µg/L) had a negligible impact on total dietary exposure. The upper end of the range of high-level exposure to aluminium from drinking water (6.06 µg/kg bw/day from Table 7 below) is considerably lower than the upper bound mean and high-level exposure to aluminium from the 25 group TDS and would make a negligible difference if added to dietary levels. The combined estimate for exposure to aluminium from the 25 group TDS in addition to drinking water does not take account of the contribution from water used by the research laboratory (which was below the LOD of 3 µg/l) for the cooking of food samples.

25. As for the 12-18 month age group, the food groups with the highest contribution to aluminium exposure were: miscellaneous cereals, non-alcoholic beverages, bread, other vegetables and dessert food groups (see Annex C).

Table 6. Estimated aluminium exposures from the total diet for the 27 and 25 group TDS in infants aged 18 months to 5 years

Food Group	Aluminium - LB - UB Range (µg/kg bw/day)			
	18 to 24 Months (n=70)		24 to 60 Months (n=429)	
	Mean	97.5th	Mean	97.5th
27 Groups	106-108	172-173	101-102	175-177
25 Groups	106-108	172-173	101-102	175-177

Drinking water

26. Aluminium exposures from drinking water and water used in preparation of beverages for infants aged 0 to 12 months and young children aged 1 to 5 years (Table 7) have been calculated using the range of 99th percentile value of < 5 to 96 µg/L (paragraph 8). The consumption data for infants aged 4 to 12 months were consumer only data from DNSIYC. The estimated exposures to aluminium from drinking water are considerably lower than dietary levels. The highest value of the ranges of exposure from drinking

water (Table 7) is <4% of the upper value of the 97.5th percentile ranges reported in Tables 5 and 6 for the TDS.

Table 7. Possible aluminium exposures from drinking water in children aged 4 months to 5 years

Age group (months)	Number of consumers	Exposure range (µg/kg bw/day)	
		Mean	97.5th percentile range
4 to 6	77	<0.02-0.44	<0.07-1.43
6 to 9	490	<0.05-0.91	<0.17-3.24
9 to 12	597	<0.06-1.16	<0.20-3.91
12 to 15	558	<0.06-1.24	<0.21-4.06
15 to 18	503	<0.07-1.39	<0.23-4.44
18 to 24	198	<0.08-1.51	<0.32-6.06
24 to 60	364	<0.07-0.48	<0.23-4.33

27. Water used to reconstitute dry formula provides another source of aluminium exposure from drinking water. Consumption estimates of this source of drinking water (used to reconstitute dry formula) were derived using a reconstitution factor of 6.67; with 85 percent of the reconstituted formula being water. Exposure to aluminium from this source has been estimated in table 8 below. Since DNSIYC does not cover infants aged 0 to 4 months, a scenario was assumed in which infants are exclusively fed on infant formula, consisting of 85 per cent water, at the default values for milk consumption used by EFSA (2012): 800 mL (mean) and 1200 mL (high level). This approach is consistent with that used by COT in its 2013 statement. There is likely to be double counting of the values in tables 5 and 6, and therefore the total exposure from these sources should not be summed. The highest of the values is used in the risk characterisation in this discussion paper.

Table 8: Possible aluminium exposures from drinking water used to make up dry infant formula by infants and children aged 0 to 5 years

Age group (months)	Number of consumers	Exposure range (µg/kg bw/day)	
		Mean	97.5th percentile
0 to 4	N/A	<0.58-11.06 *	<0.86-16.60 *
4 to 6	3	<0.05-0.95	<0.05-1.05
6 to 9	18	<0.13-2.44	<0.40-7.75
9 to 12	35	<0.08-1.55	<0.25-4.88
12 to 15	8	<0.07-1.40	<0.21-4.02
15 to 18	2	<0.18-3.37	<0.20-3.79

18 to 24	6	<0.06-1.23	<0.09-1.80
24 to 60	4	<0.13-2.50	<0.23-4.37

* Assumed average and high level consumption of 800 and 1200 mL from which a consumption value for water used for reconstitution was derived by applying a factor of 0.85.

Soil/dust

28. Potential exposures of UK infants aged >9 to 12 months and young children aged 1 to 5 years to aluminium in soil and/or dust were calculated assuming ingestion of 100 mg/day (US EPA, 2008; WHO, 2007) and median and 97.5th percentile aluminium concentrations of 58,000 and 80,000 mg/kg reported for soil (EA, 2007) (Table 8). Data specific to dust were not available. Children of these age groups are likely to consume more soil and dust than younger infants who are less able to move around and come into contact with soil and dust.

Table 8. Possible aluminium exposures (µg/kg bw/day) from soil and/or dust in infants and young children aged > 9 months to 5 years

Aluminium concentration (mg/kg)	Ages (months)				
	>9 to 12	12 to 15	15 to 18	18 to 24	24 to 60
58,000 (median)	604	547	518	483	360
80,000 (97.5th percentile)	833	755	714	667	497

29. Exposure from air is not considered in this discussion paper as it is likely to be a minor source compared with diet.

Risk Characterisation

30. Potential risks from infants' exposures to aluminium were characterised by comparison with the PTWI of 2000 µg/kg bw, which is equivalent to 286 µg/kg bw per day. Use of the TDS data, which involves preparation of food as for consumption, will allow for migration of aluminium from food contact materials, although there could be some additional exposure from this route in the home, depending on food preparation and storage. Drinking water seems to be a minor source of aluminium exposure compared to food.

31. The estimates of dietary exposure to aluminium are below the PTWI and do not indicate a toxicological concern. An exception to this would be infants fed on soya-based formula, who could have much higher dietary exposures. However, current UK government advice is that infants should not be fed soya formula unless it has been prescribed or recommended by a medical practitioner. Although foods based on soya were included in TDS

samples, these are composited with other similar (non-soya) foods prior to analysis. Thus, the specific contribution of soya-based foods to exposure assessments to aluminium in older children (12 months-5 years) cannot be determined from TDS data without developing scenario-based approaches.

Table 9 Estimated dietary exposures to aluminium and comparison to the PTWI

Food	Age (months)	Estimated dietary exposures (µg/kg bw/day)		% PTWI	
		Average consumers	High level consumers	Average consumers	High level consumers
Exclusive breast milk	0 to 4	10.7	16	3.7	5.5
Exclusive infant formula	0 to 4	9.93	11.9	3.5	4.2
Total diet (excluding water)	4 to 12	31.7	80.0	11	28
	12 to 18	93.1	189	33	66
	18 to 24	108	173	38	60
	24 to 60	102	177	36	62

32. Because toxicity will depend on total exposure to aluminium from all sources, it is important to consider combined exposures from food, water, and also non-dietary sources. Drinking water seems to be a minor source of aluminium exposure compared to food. Exposure to aluminium present in soil/dust has the potential to exceed the PTWI (table 10). However, it should be noted that all measurements of aluminium do not distinguish between specific aluminium compounds, and the relative bioavailability of the species naturally present in soil or dust is unknown.

Table 10. Range of estimated exposures to aluminium from ingested soil/dust and comparison to the PTWI

Age (months)	Estimated exposures (µg/kg bw/day)		% PTWI	
	Median concentration	High level concentration	Median concentration	High level concentration
9 to 12	604	833	211	291

12 to 15	547	755	191	264
15 to 18	518	714	181	250
18 to 24	483	667	169	233
24 to 60	360	497	126	174

33. Overall, the estimated exposures of infants and young children to aluminium from the dietary sources that have been considered do not indicate toxicological concerns or a need for modified Government advice. However this needs to be confirmed for young children who are high consumers of soya-based foods such as soya milk.

Questions on which the views of the Committee are sought

34. Members are invited to comment on the exposure calculations and to answer the following questions.

i. Do Members agree with the approach to exposure assessment?

ii. Do Members agree that exposure scenarios should be included for soya-based foods?

iii. Should the aluminium content of water be further taken into account in the exposure calculations?

iv. Should the new information be formulated as an addendum to the 2013 statement or would members prefer a complete statement?

v. Should additional information, for example on concentrations of aluminium in food, be included?

vi. Do Members agree with the provisional conclusion in paragraph 34.

Secretariat
November 2015

References

Bates B, Lennox A, Prentice A, Bates C, Page P, Nicholson S, Swan G (2014). National Diet and Nutrition Survey Results from Years 1, 2, 3 and 4 (combined) of the Rolling Programme (2008/2009 – 2011/2012): https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/310995/NDNS_Y1_to_4_UK_report.pdf

Defra (Department for Environment, Food and rural affairs). (2015). Air pollution in the UK 2014. Available at: http://uk-air.defra.gov.uk/library/annualreport/viewonline?year=2014_issue_1

DH (Department of Health) (2013). Diet and Nutrition Survey of Infants and Young Children (DNSIYC), 2011. Available at: http://transparency.dh.gov.uk/2013/03/13/dnsiyc-2011/

Rawlins, B G, McGrath, S P, Scheib, A J, Breward, N, Cave, M, Lister, T R, Ingham, M, Gowing, C and Carter, S. 2012. The Advanced Soil Geochemical Atlas of England and Wales. Available at: http://resources.bgs.ac.uk/ebooks/AdvancedSoilGeochemicalAtlasEbook/index.html#/1/

TOX/2015/38 ANNEX A

COMMITTEE ON TOXICITY OF CHEMICALS IN FOOD, CONSUMER PRODUCTS AND THE ENVIRONMENT

Review of potential risks from aluminium in the diet of 1 to 5 year old children and updated exposures for infants aged 0 to 12 months

Statement on the potential risks from aluminium in the infant diet

http://cot.food.gov.uk/cotstatements/cotstatementsyrs/cotstatements2013/aluminium

Secretariat
November 2015

COMMITTEE ON TOXICITY OF CHEMICALS IN FOOD, CONSUMER PRODUCTS AND THE ENVIRONMENT

Review of potential risks from aluminium in the diet of 1 to 5 year old children and updated exposures for infants aged 0 to 12 months

Possible aluminium exposure from dietary sources in children aged 12 to 18 months

Two surveys were conducted during 2014 to measure the concentrations of elements in food consumed by infants and young children. The first survey was a total diet study (TDS) which focused on sampling foods eaten by young children (18 months and older) and the other was a survey on types of foods eaten by infants younger than 18 months (referred to as the Infant Survey).

The TDS consist of: (i) selecting foods based on food consumption data, to represent as best as possible a typical diet; (ii) their preparation to food as consumed and (iii) the subsequent pooling of related foods before analysing the composite samples for elements.

The Infant Survey on the other hand measured the concentrations of metals and other elements in food 'as sold', in the following categories: , infant formula commercial infant foods and groups of food comprising the top 50 most commonly consumed varieties of foods not specifically marketed for infants (see tables B1-B3).

Table B1. Infant formula

Infant Formula	
Dry Powder	**Made Up Formula**
First and Hungrier Milk	First Milk and Hungrier Milk
Follow On Milk	Follow On milk
Growing Up Milk	Growing up Milk
Soy Milk	
Goat Milk	
Organic Milk	
Comfort Milk	

Table B2. Commercial infant foods

Commercial Infant Foods
Cereal Based Foods and Dishes
Dairy Based Foods and Dishes
Fruit Based Foods and Dishes
Meat and Fish Based Foods and Dishes
Snacks (Sweet and Savoury)
Other Savoury Based Foods and Dishes (excluding Meat)
Drinks

Table B3. Other foods commonly eaten by infants.

Other Foods	
Beverages	Fruit Products
Bread	Green Vegetables
Canned Vegetables	Meat Products
Cereals	Milk
Dairy Products	Other Vegetables
Eggs	Potatoes
Fish	Poultry/Chicken
Fresh Fruit	

Exposure Assessments

Tables B4 and B5 summarise lower- and upper-bound total dietary exposures to aluminium using the 27 groups of the 2014 TDS for ages 12 to 18 months. The data for each food category is reported separately so that the contribution to exposure from each class could be assessed more transparently for the most relevant infant age group. In addition the total exposure from the total diet has been provided.

Table B4. Estimated aluminium exposures from foods eaten by infants aged 12 to 18 months using data from 27 TDS Groups

Food Groups	Al - LB-UB Range (µg/kg bw/d)			
	12-14.99 Months (n=670)		15-17.99 Months (n=605)	
	Mean	97.5th	Mean	97.5th
Alcoholic drinks	0	0.01	0	0
Bottled water	0.00-0.01	0.00-0.09	0.00-0.01	0.00-0.21
Bread	10.16	27.71	11.4	30.63
Canned veg	2.57	13.16	2.51	11.62
Carcase meat	0.47	2.42	0.59	2.92
Condiments	1.87	11.11	2.1	10.84
Dairy products	3.2	17.1	2.71	11.91
Desserts	4.03	34.71	5.51	40.35
Eggs	0.07	0.39	0.08	0.4
Fats and oils	0.00-0.01	0.00-0.05	0.00-0.02	0.00-0.06
Fish	1.33	6.15	1.24	6.3
Fresh fruit	2.1	7.19	2.58	7.4
Fruit products	1.44	10.37	1.65	10.93
Green veg	1.31	5.79	1.43	5.37
Meat products	1.88	9.94	2.32	10.67
Meat substitutes	0.05	0	0.14	1.73
Milk	0.00-1.31	0.00-3.74	0.00-1.31	0.00-3.19
Miscellaneous Cereals	20.62	64.75	24.94	73.49
Non-alcoholic beverages	15.81	74.53	19.12	89.79
Nuts	0.18	0.76	0.08	0.74
Offal	0	0	0.01	0
Other veg	5.75	20.95	5.84	19.14
Potatoes	3.48	12.76	3.22	10.53
Poultry	0.98	4.31	1.1	4.74
Snacks	0.59	4.07	0.92	6.4
Sugars	1.35	8.21	2.03	10.13
Tap water	0.00-0.20	0.00-0.75	0.00-0.22	0.00-0.90
Total	79.24-80.77	176.33-178.66	91.52-93.09	186.86-188.50

Possible aluminium exposures from foods other than infant foods

The food groups “bottled water” and “tap water” (drinking water) were removed from the 27-group TDS in order to create a 25-group TDS. The exposures from drinking water were estimated separately and discussed in the main body of the paper. This was to account for the variability in occurrence levels of aluminium found in various location across the UK.

Table B5. Estimated aluminium exposures from foods eaten by children aged 12 to 18 months using data from 25 TDS Groups.

Food Groups	Al - LB-UB Range (µg/kg bw/d)			
	12-14.99 Months (n=670)		15-17.99 Months (n=605)	
	Mean	97.5th	Mean	97.5th
Alcoholic drinks	0	0.01	0	0
Bread	10.16	27.71	11.4	30.63
Canned veg	2.57	13.16	2.51	11.62
Carcase meat	0.47	2.42	0.59	2.92
Condiments	1.87	11.11	2.1	10.84
Dairy products	3.2	17.1	2.71	11.91
Desserts	4.03	34.71	5.51	40.35
Eggs	0.07	0.39	0.08	0.4
Fats and oils	0.00-0.01	0.00-0.05	0.00-0.02	0.00-0.06
Fish	1.33	6.15	1.24	6.3
Fresh fruit	2.1	7.19	2.58	7.4
Fruit products	1.44	10.37	1.65	10.93
Green veg	1.31	5.79	1.43	5.37
Meat products	1.88	9.94	2.32	10.67
Meat substitutes	0.05	0	0.14	1.73
Milk	0.00-1.31	0.00-3.74	0.00-1.31	0.00-3.19
Miscellaneous Cereals	20.62	64.75	24.94	73.49
Non-alcoholic beverages	15.81	74.53	19.12	89.79
Nuts	0.18	0.76	0.08	0.74
Offal	0	0	0.01	0
Other veg	5.75	20.95	5.84	19.14
Potatoes	3.48	12.76	3.22	10.53
Poultry	0.98	4.31	1.1	4.74
Snacks	0.59	4.07	0.92	6.4
Sugars	1.35	8.21	2.03	10.13
Total	79.24-80.56	176.33-177.69	91.52-92.86	186.86-188.44

Secretariat
November 2015

COMMITTEE ON TOXICITY OF CHEMICALS IN FOOD, CONSUMER PRODUCTS AND THE ENVIRONMENT

Review of potential risks from aluminium in the diet of 1 to 5 year old children and updated exposures for infants aged 0 to 12 months

Possible aluminium exposure from dietary sources in young children aged 18 to 60 months

TDS

The concentrations of 26 elements, including metals were measured in the 2014 UK TDS. Composite samples for 27 TDS food groups (Table 1) were collected from 24 UK towns and analysed for their levels of aluminium. Where appropriate, tap water was used in the preparation and cooking of food samples. The results from this survey were used together with food consumption data from the Diet and Nutrition Survey for Infants and Young Children (DNSIYC) (DH, 2013) for ages 12 to 18 months and the National Diet and Nutrition Survey Rolling Programme years 1-4 (NDNS) (Bates *et al.,* 2014) for age 18 months to 5 years, to estimate dietary exposures.

Table C1. Food groups used for analysis of elements in the 2014 TDS

TDS Food Groups*	
Bread	Fresh Fruit
Miscellaneous Cereals	Fruit Products
Carcase Meat	Non Alcoholic Beverages
Offal	Milk
Meat Products	Dairy Products
Poultry	Nuts
Fish	Alcoholic Drinks
Fats and Oils	Meat Substitutes
Eggs	Snacks
Sugars	Desserts
Green Vegetables	Condiments
Potatoes	Tap Water
Other Vegetables	Bottled Water
Canned Vegetables	

*Food samples representative of the UK diet are purchased throughout the year in 24 towns covering the UK and 137 categories of foods are combined into 27 groups of similar foods for analysis

Exposure Assessment

Tables C2 and C3 summarise lower- and upper-bound total dietary exposures to aluminium using the 27 groups of the 2014 TDS for ages 18 months to 5 years. The data for each food category is reported separately so that the contribution to exposure from each class could be assessed more transparently for the most relevant infant age group. In addition the total exposure from the total diet has been provided.

Table C2. Estimated aluminium exposures from foods eaten by children aged 18 to 60 months using data from 27 groups of the 2014 Total Diet Study

Food Groups	Al - LB-UB Range (µg/kg bw/d)			
	18-24 Months (n=70)		2-5 years (n=429)	
	Mean	97.5th	Mean	97.5th
Alcoholic drinks	0	0	0	0
Bottled water	0.00-0.01	0.00-0.07	0.00-0.02	0.00-0.19
Bread	12.04	27.07	13.71	31.87
Canned veg	4.28	16.42	2.64	10.19
Carcase meat	0.65	3.33	0.39	2.09
Condiments	1.48	7.3	2.29	12.07
Dairy products	2.93	13.94	1.64	6.54
Desserts	8.36	45.84	9.32	44.65
Eggs	0.06	0.32	0.06	0.34
Fats and oils	0.00-0.02	0.00-0.07	0.00-0.02	0.00-0.06
Fish	1.64	6.57	1.26	4.83
Fresh fruit	3.14	8.24	2.27	5.99
Fruit products	3.7	14.28	3.37	16.22
Green veg	1.22	7.32	1.26	5.11
Meat products	2.76	12.77	3.36	11.18
Meat substitutes	0.04	0.63	0.16	2.43
Milk	0.00-1.23	0.00-3.87	0.00-0.87	0.00-2.51
Miscellaneous Cereals	26.65	55.83	21.78	55.09
Non-alcoholic beverages	25.8	106.61	24.87	72.13
Nuts	0.04	0.06	0.13	1.84
Offal	0	0	0	0
Other veg	3.53	11.79	3.68	13.14
Potatoes	3.3	6.96	3	8.78
Poultry	1.28	3.63	1.08	4.66
Snacks	1.08	6.55	1.25	6.62
Sugars	2.39	11.33	3.44	14.49
Tap water	0.00-0.22	0.00-1.17	0.00-0.20	0.00-0.76
Total	106.38-107.86	172.03-173.42	100.96-102.06	175.33-177.09

Possible aluminium exposures from other foods

The food groups “bottled water” and “tap water” (drinking water) were removed from the 27-group TDS in order to create a 25-group TDS. The exposures from drinking water were estimated separately and discussed in the main body of the paper. This was to account for the variability in occurrence levels of aluminium found in various location across the UK.

Table C3. Estimated aluminium exposures from foods eaten by children aged 18 to 60 months using data from 25 TDS Groups

Food Groups	Al - LB-UB Range (µg/kg bw/d)			
	18-24 Months (n=70)		2-5 years (n=429)	
	Mean	97.5th	Mean	97.5th
Alcoholic drinks	0	0	0	0
Bread	12.04	27.07	13.71	31.87
Canned veg	4.28	16.42	2.64	10.19
Carcase meat	0.65	3.33	0.39	2.09
Condiments	1.48	7.3	2.29	12.07
Dairy products	2.93	13.94	1.64	6.54
Desserts	8.36	45.84	9.32	44.65
Eggs	0.06	0.32	0.06	0.34
Fats and oils	0.00-0.02	0.00-0.07	0.00-0.02	0.00-0.06
Fish	1.64	6.57	1.26	4.83
Fresh fruit	3.14	8.24	2.27	5.99
Fruit products	3.7	14.28	3.37	16.22
Green veg	1.22	7.32	1.26	5.11
Meat products	2.76	12.77	3.36	11.18
Meat substitutes	0.04	0.63	0.16	2.43
Milk	0.00-1.23	0.00-3.87	0.00-0.87	0.00-2.51
Miscellaneous Cereals	26.65	55.83	21.78	55.09
Non-alcoholic beverages	25.8	106.61	24.87	72.13
Nuts	0.04	0.06	0.13	1.84
Offal	0	0	0	0
Other veg	3.53	11.79	3.68	13.14
Potaoes	3.3	6.96	3	8.78
Poultry	1.28	3.63	1.08	4.66
Snacks	1.08	6.55	1.25	6.62
Sugars	2.39	11.33	3.44	14.49
Total	106.38-107.63	172.03-173.42	100.96-101.84	175.33-176.83

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