Risk Assessment Studies
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Chemical Hazard Evaluation

Phthalates in Food

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EXECUTIVE SUMMARY

Phthalates is a large group of chemicals that are commonly used to soften plastics polymers (otherwise known as "plasticisers"). They are used in a wide range of consumer products including but not limited to plastic containers, personal care products and toys. They are ubiquitous in the environment and low levels of phthalates in food is not unexpected.

2. So far, Health-Based Guidance Values (HBGVs) and laboratory reference materials are only available for the seven phthalates studied in this piece of research work.

3. This study serves to (1) determine the actual levels of seven phthalates (i.e. DEP, DBP, BBP, DEHP, DNOP, DINP and DIDP) in selected foods that are commonly consumed in Hong Kong as well as foods that were reported to be adulterated with phthalates before; (2) to estimate the dietary exposure to phthalates of the Hong Kong adult populations at territory-wide scale; and (3) to assess the health risk associated with the exposure, if any.

Results

4. A total of 317 samples in 16 food groups were tested for seven phthalates. Vast majority of them (310 samples or 98%) have at least one phthalate detected at quantifiable levels and only 7 samples (2.2%) were found free from the seven phthalates tested. The results tally with similar overseas studies that phthalates are widespread in food.

5. Among the seven phthalates examined, DEHP was the most commonly

detected phthalate compound, followed by DINP, BBP, DBP, DIDP, DEP and DNOP. The maximum detected levels ranged from 23 μg/kg for DNOP to 7 900 μg/kg for DINP.

6. Four (1.26%) samples were found to have phthalates at levels exceeding the Centre's action levels*, including a peanut oil sample with 3 500 μg/kg DEHP, an olive pomace oil sample with 3 300 μg/kg DEHP and two Chinese white wine samples with DBP at levels of 560 and 470 μg/kg. Risk assessment confirmed that all these samples would not cause adverse health problem from phthalates alone upon usual consumption.

7. Regarding the dietary exposure assessment, the exposure to both average and high consumers (95th percentile, or "P95") of the adult populations were well within the corresponding HBGVs for individual phthalate (maximum 13%). Furthermore, no age-sex population sub-group exceeded their respective HBGVs. The food group "cereal and cereal products" was the major contributor for DBP, BBP, DEHP, DNOP and DINP dietary exposure, while non-alcoholic drinks and poultry were the major contributors for DEP's and DIDP's, respectively.

Conclusions and Recommendations

8. This study estimated that the dietary exposures to seven phthalates analysed in the average adult consumer population ranged from a low of 0.011 /0.098 μg/kg bw/day for DNOP (lower bound / upper bound) to a high of 4.8 μg/kg

* The action levels involved are as follows: DBP : 300 μg/kg (0.3 mg/kg); DEHP: 1 500 μg/kg (1.5 mg/kg) in food; 5 000 μg/kg (5 mg/kg) in distilled spirits.

bw/day[†] in the case of DINP. As the maximum dietary exposure contributed to only about 13% of HBGV even for high consumers in one of the phthalates, the result indicates health risk from tested phthalates to local adult population is quite remote from public health point of view.

9. Overall, the findings of the present study did not provide sufficient justifications to warrant changes to the basic dietary advice on healthy eating. The public is advised to maintain a balanced and varied diet which includes a wide variety of fruit and vegetables so as to avoid excessive exposure to any contaminants from a small range of food items.

[†] Same lower bound (LB) and upper bound (UB) figures in 2 significant figures.

Risk Assessment Studies –

Phthalates in Food

OBJECTIVES

This study aims to (1) determine the amount of seven phthalates, namely DEP, DBP, BBP, DEHP, DNOP, DINP and DIDP, in selected food items that are commonly consumed in Hong Kong as well as foods that were reported to be adulterated with phthalates before and to (2) estimate their dietary exposure of the Hong Kong adult population and to (3) assess the associated health risks, if any.

BACKGROUND

2. Phthalate esters, or simply known as phthalates, are chemically known as benzenedicarboxylic diesters. They differ in the length of their side chains indicated as R in Figure 1 and they are named based on the number of carbon atoms and arrangement of side chains (Table 1).

Figure 1. General structure of phthalate compounds

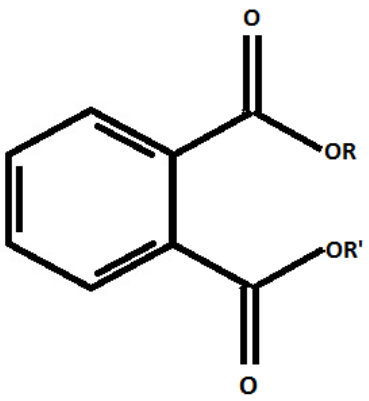


Table 1. Backbone carbon length of seven phthalates (NICNAS 2008)

Phthalate		Length of backbone carbon
DEP	Diethyl phthalate	C2
DBP	Dibutyl phthalate	C4
BBP	Butylbenzyl phthalate	C4, C5
DEHP	Diethylhexyl phthalate	C6
DNOP	Di-n-octyl phthalate	C8
DINP	Diisononyl phthalate	C8, C9
DIDP	Diisodecyl phthalate	C9, C10

3. So far, health-based guidance values (HBGVs) are only available to the seven more commonly used phthalates compounds as listed in Table 1 above, which were all developed by overseas authorities. As HBGVs are the basis of quantitative risk assessment, this report is meant to be a study of these seven specific phthalates in food.

Sources of Phthalates

4. Nowadays, phthalates are found in many consumer products because these chemicals, especially those with longer side chains (e.g. C4 to C10), can impart flexibility to many types of otherwise rigid plastics products. One of the most common example is products made with polymers of polyvinyl chloride (PVC). Phthalates compounds do so by embedding themselves between long plastic polymer chains, thus increases the spacing between polymers and renders them with increased physical flexibility. In contrast, phthalates with shorter side chains (e.g. C1, C2, C4) are usually used as solvents and are detectable in plastics, cosmetics and personal care products (UBA, 2011). For these reasons, phthalates can be recovered from a wide variety of consumer products, including but not limited to cling film, plastic sheets, containers, adhesives, detergents, lubricating

oils, vinyl floorings, pharmaceuticals, personal care products, hoses, and inflatable and flexible toys. With such extensive uses, human exposures to phthalates are common (NRC, 2008).

5. Concerning their use as plasticisers in plastic manufacturing, it is important to note that phthalates are indeed not irreversibly bonded to the plastics polymers and therefore would gradually be released to the surroundings upon use. As a result, phthalates could contaminate food and indoor air environment and has been quoted as one of the ubiquitous environmental contaminants (Wormuth et al. 2006).

Sources of Exposure

6. Dated back to 2011 when Hong Kong was at the height of the "Plasticisers in Food" incident, it was discovered that certain food ingredient manufacturers in Taiwan had illegally used phthalate plasticisers as a food additive (clouding agent), resulting in unusually high levels of certain phthalates being detected in some food. By September 2011, about 50 out of a thousand food samples collected locally since May 2011 were found to have DEHP, DINP or DBP exceeded action levels established for emergency control at that time. Implicated food included sports drinks, jelly snack, drink premixes, Taiwan style cup drinks, biscuits, instant noodles, condiments. Regular surveillance of targeted food for phthalates had been set up by Centre for Food Safety since then.

7. Indeed, owing to the versatile nature of phthalates, their extensive use in plastics products and their ubiquitous presence in the environment, human could be exposed to phthalates through various means including ingestion, direct skin contact (e.g. personal care products, vinyl flooring, toys) and inhalation (e.g. indoor air, house dust). However, food remains as a main source of adult exposure to phthalates. It is believed that most of these exposures a result of phthalates leached out from food contact materials used in packaging materials, food processing machineries, contaminated food and drinking water. (CICAD52, 2003) (Wormuth et al., 2006) (CDC, 2009)

8. Using figures available in 2008, DEHP is considered as one the most commonly used phthalates in terms of worldwide production figure, totaled to 2.5 million tonnes and represented about half of the phthalates produced in 2008. (UBA, 2011).

Toxicity

Kinetics and metabolism

9. Generally, phthalates are hydrolyzed quickly to monoesters after entering the body and are excreted via urine and faeces after further metabolisms. They do not accumulate in the body. (NICNAS 2005) (Wormuth et al. 2006)

Acute toxicity

10. Available data shows that oral acute toxicity of the seven phthalates is generally low. The oral LD_{50} (oral lethal dose 50%) of the seven phthalates studied range from 2 330 – 20 400 mg/kg bw in rats for BBP, to >30 600 - >40 000 mg/kg bw in rats for DEHP (Please see Table 2) (NICNAS, 2005). The information suggests that the general public is unlikely to experience acute toxicity of the phthalates from food.

Table 2. Acute oral toxicity of seven phthalates

Phthalate	Oral LD_{50} (mg/kgbw)	Animal	Reference
DEP	>5600 – 31000	Rat	NICNAS, 2008
DBP	6300 – 8000	Rat	NICNAS, 2008
BBP	2330 - 20400	Rat	NICNAS, 2008
DEHP	8600	Mouse	CICAD52, WHO, 2003
	9200 - 9500	Rat	CICAD52, WHO, 2003
	30600 - >40000	Rat	NICNAS, 2008
DNOP	53700	Rat	NICNAS, 2008
DINP	>10000 (CAS 68515-48-0) >40000 (CAS 28553-12-0)	Rat	NICNAS, 2008
DIDP	>29100	Rat	NICNAS, 2008

Carcinogenicity and genotoxicity

11. For genotoxicity, the phthalates varies in available information. It is noted that DBP, BBP, DEHP, DNOP, DINP, and DIDP are non-genotoxic while the data so far is insufficient to conclude that DEP is genotoxic. (Please see Table 3) (NICNAS 2008 and CICAD52, 2003)

Table 3. Genotoxicity of seven phthalates

Phthalate	Overall conclusion on genotoxicity	Reference
DEP	Insufficient Data	NICNAS, 2008
DBP	Non-genotoxic	NICNAS, 2008
BBP	Non-genotoxic	NICNAS, 2008
DEHP	Non-genotoxic	NICNAS, 2008
	Not classified as genotoxic	EFSA, 2005c
	The results of *in vitro* mutagenicity tests in microbial assays are equivocal.	CICAD52, WHO, 2003
DNOP	Non-genotoxic	NICNAS, 2008
DINP	Non-genotoxic	NICNAS, 2008
	Not genotoxic	EFSA, 2005d
DIDP	Non-genotoxic	NICNAS, 2008
	DIDP is a non-genotoxic agent.	EFSA, 2005e

12. For carcinogenicity, the International Agency for Research on Cancer (IARC) classified DEHP as "possibly carcinogenic to humans" (group 2B) and BBP as "not classifiable as to its carcinogenicity to humans" (group 3). No other evaluations had been performed on the remaining five phthalates by IARC. Appendix I includes a summary of other evaluations on carcinogenicity in phthalates.

Reproductive toxicity

13. Currently, CFS is aware that DEHP has been reported to have testicular and fertility effects in animal studies, and DINP was reported to affect birth weight

in animal studies. Data was not available for DEP, DBP, BBP and DNOP. More details are available in Appendix II.

Health-Based Guidance Values (HBGVs)

14. Availability of HBGVs is a key element in quantitative dietary exposure and CFS has reviewed information from international and overseas authorities. It is concluded that HBGVs are clearly established on seven phthalates compound as shown in Table 4 below. When multiple HBGVs are available for the same phthalates, CFS would accord priority to international standards over regional standards and/or the more updated standard for this risk assessment study.

Table 4. Health-Based Guidance Values (HBGVs) of phthalates

Phthalate		Health-based Guidance Value (TDI, µg/kg bw)	Endpoints in Animal Studies	Source
DEP	Diehtyl phthalate	5000	Developmental effects in rats	CICAD52, WHO (2003)‡
		800 (oral RfD)	Decreased growth rate, food consumption and altered organ weights	US EPA (1987*)§
DBP	Dibutyl phthalate	10	Developmental effects in rats	EFSA (2005a)**
		100 (oral RfD)	Increased mortality	US EPA (1987*)††
BBP	Butylbenzyl phthalate	500	Testicular toxicity and reduced anogenital distance in rats	EFSA (2005b)‡‡

‡ CICAD52 . WHO, 2003.
§ US EPA. Diethyl phthalate. Integrated Risk Information System (IRIS). 1987.
** EFSA 2005a. Opinion of the Scientific Panel on Food Additives, Flavourings, Processing Aids and Material in Contact with Food (AFC) on a request from the Commission related to Di-Butylphthalate (DBP) for use in food contact materials.
†† US EPA. Dibutyl phthalate. Intergrated Risk Information System (IRIS). 1987.
‡‡ EFSA 2005b. Opinion of the Scientific Panel on Food Additives, Flavourings, Processing Aids and Materials in Contact with Food (AFC) on a request from the Commission related to Butylbenzylphthalate (BBP) for use in food contact materials.

Phthalate		Health-based Guidance Value (TDI, μg/kg bw)	Endpoints in Animal Studies	Source
		200 (oral RfD)	Significantly increased liver-to-body weight and liver-to-brain weight ratios	US EPA (1989*)[§§]
DEHP	Diethylhexyl phthalate	25	Peroxisomal proliferation in the liver in rats	WHO (2011)[***]
		50	Testicular toxicity in rats	EFSA (2005c)[†††]
		20	Increased relative liver weight	US EPA (1987)[‡‡‡]
DNOP	Di-n-octyl phthalate	400 (Minimal risk level (MRL)(Intermediate duration)[§§§])	Effect on liver	US ATSDR (1997)[****]
DINP	Diisononyl phthalate	150	Liver and kidney effects in rats	EFSA (2005d)[††††]
DIDP	Diisodecyl phthalate	150	Liver effects in dogs	EFSA (2005e)[‡‡‡‡]

- Listed in order of increasing side-chain length.

Local Regulatory Control

15. In Hong Kong, while there are no direct regulatory levels for phthalates, there are general provisions that all food must be fit for human consumption. For the purpose of risk management of food incidents involving abuses of phthalates in food, CFS has established action levels on a number of phthalates in stages since 2011, which include: 300 μg/kg for DBP in food; 5 000 μg/kg for DEHP in distilled spirits[§§§§] and 1 500 μg/kg for DEHP in other foods; and 9000 μg/kg for

[§§] US EPA. Butyl benzyl phthalate. Integrated Risk Information System (IRIS). 1989.
[***] WHO 2011. Guidelines for drinking-water quality, fourth edition.
[†††] EFSA 2005c. Opinion of the Scientific Panel on Food Additives, Flavourings, Processing Aids and Materials in Contact with Food (AFC) on a request from the Commission related to Bis(2-ethylhexyl)phthalate (DEHP) for use in food contact materials. The EFSA Journal (2005) 243, 1-20. http://www.efsa.europa.eu/en/efsajournal/doc/243.pdf
[‡‡‡] US EPA. Di(2-ethylhexyl)phthalate (DEHP). Integrated Risk Information System (IRIS). 1987.
[§§§] Minimal Risk Level (MRL) is used by ATSDR health assessors and other responders to identify contaminants and potential health effects that may be of concern at hazardous waste sites. An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure. Intermediate refers to the duration of 15-365 days.
[****] Agency for Toxic Substances and Disease Registry (ATSDR). DNOP in Minimal Risk Levels (MRLs) for Hazardous Substances.
[††††] EFSA 2005d. Opinion of the Scientific Panel on Food Additives, Flavourings, Processing Aids and Materials in Contact with Food (AFC) on a request from the Commission related to Di-isononylphthalate (DINP) for use in food contact materials.
[‡‡‡‡] EFSA 2005e. Opinion of the Scientific Panel on Food Additives, Flavourings, Processing Aids and Materials in Contact with Food (AFC) on a request from the Commission related to Di-isodecylphthalate (DIDP) for use in food contact materials.
[§§§§] This action level was adopted in 2013.

the sum of DINP and DIDP in food. Phthalates were included in the regular food surveillance programme after the 2011 incident. Essentially all samples taken were satisfactory except a few isolated samples were found to exceed these action levels.[*****]

Overseas Regulatory Control

16. The Codex Alimentarius Commission (Codex) has yet to establish any standard for phthalates in food or in food contact materials (FCMs).

17. In Mainland China, the use of chemical additives in FCMs (including phthalates) is regulated by the "Standards for uses of additives in food contact materials and articles" (GB 9685-2016). It is a revised version where enforcement commenced on 19th October 2017. Various maximum levels, including various combinations of maximum levels / maximum residual levels / specific migration limits, are set for phthalates like DBP, DEHP and DINP in FCMs. No Mainland standards are available on phthalates in food.

18. In the European Union (EU), substances used in the manufacture of plastics FCMs are regulated by "Plastic materials and articles intended to come into contact with food" (EU Regulation No. 10/2011). Specific Migration Limits (SMLs)[†††††] and other use restrictions are set for phthalates like DBP, DEHP, DINP and DIDP in FCMs.

[*****] Three samples in 2012 and one sample of in 2016.

[†††††] Specific migration limit (SML) means the maximum permitted amount of a given substance released from a material or article into food or food simulants, as stated in the EU regulation.

19. In the USA, the Food and Drugs Administration (US FDA) specified that a number of phthalates (e.g. DBP, BBP, DEHP and DINP) can be used as a component of FCMs (e.g. adhesives, paper and paperboard components, polymers, adjuvants like plasticisers) as indirect additives in its regulations (21CFR175 to 178) . CFS is not aware of regulatory levels for phthalates applicable to for food.

20. In Taiwan, the "Sanitation Standard for Food Utensils, Containers and Packages" specified, among other things, requirements on various phthalates (e.g. DMP, DEP, DBP, BBP, DEHP, DNOP, DINP, DIDP) in plastic FCMs. The standard includes maximum amount of phthalates that can be used in FCMs and maximum migration limits, but not as a maximum level in food. (Taiwan 2012)

SCOPE OF STUDY

21. Despite overseas studies demonstrated phthalates as contaminants generally pose low health risk to the public, there has been confusion and ongoing concern from public in relationship to its possible developmental effect on male reproductive system in animal studies (NRC, 2008). Therefore, the CFS has embarked on this study with an aim to (1) determine the levels of seven phthalates (i.e. DEP, DBP, BBP, DEHP, DNOP, DINP and DIDP) in selected foods that have been commonly consumed in Hong Kong, and foods that are reported to contain phthalates through overseas studies or local data so as to provide baseline situation; (2) to estimate the dietary exposure to phthalates of the Hong Kong adult populations; and (3) to assess the health risk associated with the exposure, if any.

METHODOLOGY AND LABORATORY ANALYSIS

Methodology

22. A total of 317 food samples were collected from retailers and wholesalers between November 2016 and April 2017 in Hong Kong. The samples included beverages, dairy products, seafood, fruits and vegetables, cereals, beef, pork, poultry, oils and fats. In order to provide risk assessment in worst case scenario, food that are more likely to have higher phthalate content (e.g. food with higher fat contents or history of phthalates abuse) or commonly consumed would be selected for testing (see Table 5). A more detailed list of the types of food samples collected could be found in Appendix III.

Table 5. Food groups analysed

Food group (including their products)	**Number of samples**
Non-alcoholic beverages (e.g. carbonated drinks, juice drinks, coffee, tea drinks, soya drinks, sports drinks)	32
Alcoholic beverages (e.g. beer, red wines and spirits)	11
Dairy products (e.g. milk, milk products, cheese, milk powder)	27
Fish (e.g. fresh and sea water fish)	33
Crustaceans (e.g. shrimps, crabs)	9
Beef (e.g. minced beef, beef frank, pre-packaged steak, beef balls)	12
Pork (e.g. ham, mince pork, pork sausages)	21
Poultry (e.g. chicken steak, turkey, chicken sausages)	21
Fruits (e.g. apples, oranges, bananas)	18
Vegetables (e.g. Chinese flowering cabbage, Chinese kale, hairy gourd)	24
Cereals (e.g. bread, biscuits, cakes, breakfast cereals, rice)	46
Oils and fats (e.g. butter, cream, vegetable fat spread, and liquid cooking oil)	33
Condiments and sauces (e.g. XO sauce, chilli oil)	6
Snacks (e.g. chocolate, konjac snack)	6
Mixed dishes (e.g. microwave lunch boxes, pizzas, hamburgers)	9
Infant food* (e.g. infant formula, RTE infant juice drink, RTE infant food)	9
Total	**317**

* Risk assessment on phthalates to infants are conducted separately by back calculation.

Laboratory Analysis

23. Laboratory analysis of phthalates was conducted by the Food Research Laboratory (FRL) of CFS. In this project, edible portion of 317 samples were all subjected to testing of DEP, DBP, BBP, DEHP, DNOP, DINP and DIDP. The collected samples were analysed as consumed. Certain samples were prepared by steaming, boiling, dissolving or peeling, while some other samples like prepackaged drinks, biscuits, hamburger and pizza were analysed as purchased and without further cooking.

24. The phthalate levels in food samples were analysed by gas chromatography – tandem mass spectroscopy (GC-MS/MS) except for DINP and DIDP by ultra-performance liquid chromatography - tandem mass spectroscopy (UPLC-MS/MS). Stable isotope labelled analogs of the seven phthalates were spiked quantitatively into a measured amount of sample, which was then extracted by ultra-sonication and orbital shaking with acetonitrile or acetone/hexane mixture. The sample extract was purified by frozen and dispersive solid phase extraction. After sample cleanup, the sample solution was concentrated to dryness and the residue was reconstituted into acetonitrile for instrument analysis. Identification was confirmed by comparing the relative retention time and the ion ratios with those of the standards. The limits of detection (LODs) and the limits of quantification (LOQs) of the seven phthalates were 5 and 15 μg/kg respectively.

Treatment of Analytical Values Below the LOD

25. In this study, data were treated with the lower bound (LB) and upper bound (UB) approach. That is, at the LB, results below the LOD were replaced

by zero whilst at the UB, results below the LOD were replaced by the value reported as the LOD. This approach compares the two extreme scenarios, based on the consideration that the true value for results less than LOD may actually be any value between zero and the achieved LOD. The LB scenario assumes that the chemical is absent; therefore, to results reported as <LOD a value of zero is assigned. The UB scenario assumes that the chemical is present at the level of the LOD; thus, to results reported as <LOD a value of the corresponding LOD is assigned.

RESULTS AND DISCUSSION

Phthalates in Different Foods

26. Vast majority (98%) of the 317 samples analysed had at least one phthalate detected at quantified levels and only seven samples (2.2%) were free from the seven phthalates analysed. These seven samples included one konjac snack sample, three ready-to-eat (RTE) infant juice drink samples, one lemon tea sample, one juice drink sample and one soda drink sample. The results tally with similar overseas studies that phthalates are widespread in food. (See figure 2)

Figure 2. Detection rate of phthalates in food samples

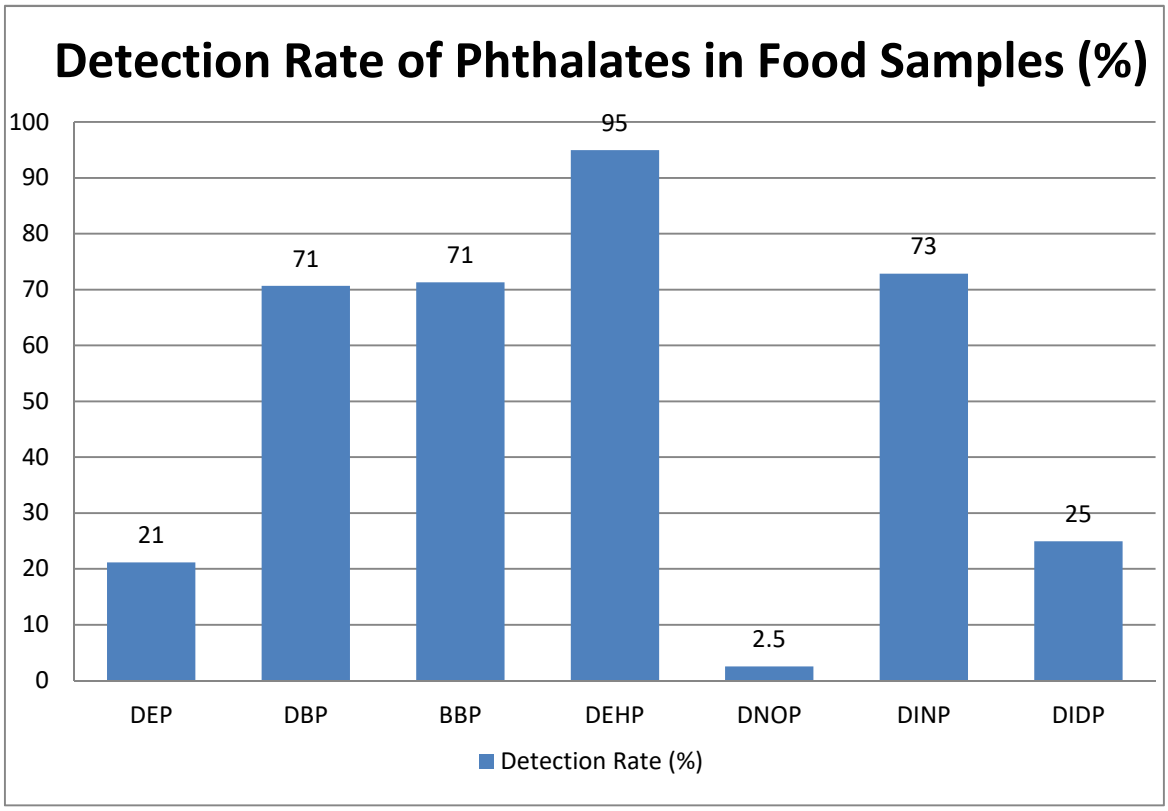


Table 6. Average, minimum and maximum levels of phthalates in samples

	DEP	DBP	BBP	DEHP	DNOP	DINP	DIDP
Average (LB)	2.1	21	14	100	0.33	130	34
Average (UB)	6.0	23	15	100	5.2	130	37
Min	ND	ND	ND	ND	ND	ND	ND
Max	43	560	93	3 500	23	7 900	3 800

*LOD = 5 µg/kg, LOQ = 15 µg/kg

27. DEHP was the most commonly found phthalate in this study and was recovered from about 95% of the samples. This finding was in line with the US study (Schecter et al. 2013). In contrast, DNOP was only detected in about 2.5%

of samples tested. The detection rate of the other five phthalates varied between around 20% and 70%. (Table 6 and Figure 2)

28. The maximum levels for the seven phthalates studied also varied widely from a low of 23 µg/kg for DNOP to a high of 7 900 µg/kg for DINP. (Table 6)

29. Out of the 317 samples tested, only four samples (1.3% of the samples) were found to have phthalates at levels exceeding the Centre's action levels.[‡‡‡‡‡] They included one peanut oil sample with 3 500 µg/kg DEHP, one olive pomace oil sample with 3 300 µg/kg DEHP and two Chinese white wine samples with DBP at levels of 560 and 470 µg/kg. Risk assessment confirmed that all these samples would not cause adverse health problem from phthalates upon usual consumption. For details of the phthalate levels in food samples, please refer to Appendix III.

30. Generally, the average levels of DINP and DEHP in food were found to be much higher than the other phthalates (see Table 6). The differences were even more pronounced for certain food groups like pork, oil and fats, and mixed dishes (see figure 3 and 4). To certain extent, these elevated mean levels were explainable by individual samples or sub-groups of samples with high phthalates levels (e.g. 7 900 µg/kg DINP in one minced pork sample, 3500 and 900 µg/kg DEHP and 1100 and 1500 µg/kg DINP in two olive pomace oil samples, and 3500 µg/kg DEHP and 1500 µg/kg DINP in one peanut oil sample). (See Appendix III for levels of phthalates among samples). Nonetheless, risk assessment confirmed

[‡‡‡‡‡] The action levels are as follows: DBP : 300 µg/kg (0.3 mg/kg); DEHP: 1500 µg/kg (1.5 mg/kg) in food other than distilled spirits; 5000 µg/kg (5 mg/kg) in distilled spirits; and sum of DINP and DIDP: 9000 µg/kg (9 mg/kg).

that all these samples would not cause adverse health problem from phthalates upon usual consumption.

Figure 3. Average levels of phthalates by food groups (LB)

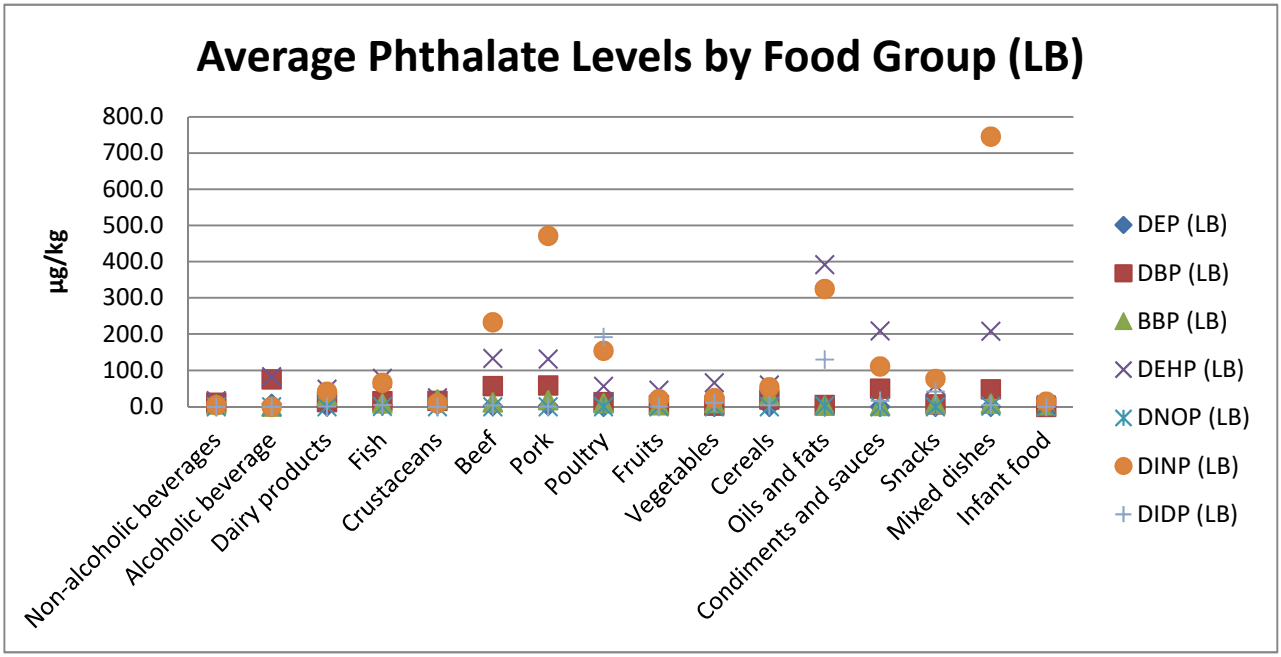
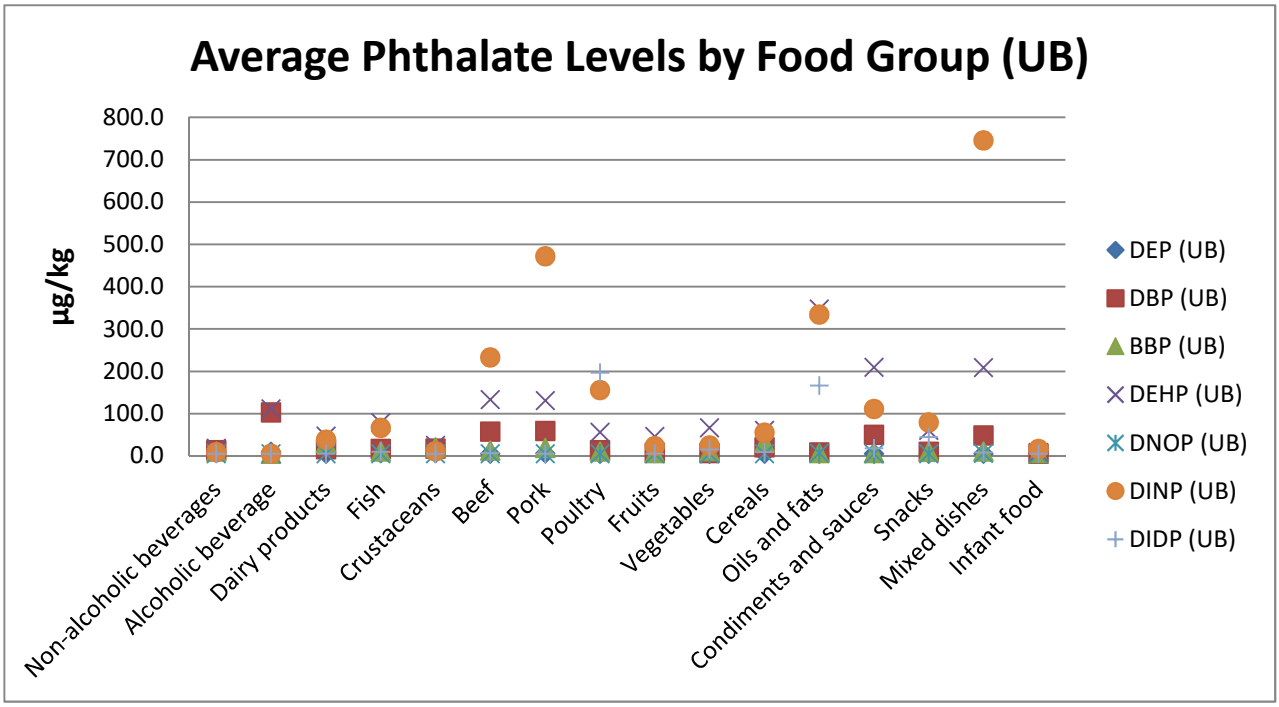


Figure 4. Average levels of phthalates by food groups (UB)



31. The top three food groups detected with higher sum of average levels (LB) of seven phthalates were "mixed dishes" (1 000 μg/kg, which were mainly contributed by DINP and DEHP), "oil and fats" (860 μg/kg, which were mainly contributed by DEHP, DINP and DIDP) and "pork and pork products" (680 μg/kg, which were mainly contributed by DINP and DEHP).

Infant Foods

32. A small number of infant foods were sampled in order to provide a snapshot of the levels of the phthalates in these group of food. For infant formula (prepared as RTE form), the highest levels of phthalates detected were 9.5, 7.4 and 13 μg/kg for BBP, DEHP and DINP respectively. No other type of phthalates was detected in the infant formula.

33. For RTE infant food, the highest levels of phthalates detected are 10, 16 and 53 μg/kg for BBP, DEHP and DINP respectively and the other phthalates were not detected.

34. For RTE infant juice drink, no samples were tested positive for the seven phthalates analysed.

Dietary Exposure to Phthalates

35. Overall, the dietary exposures to the seven phthalates tested in average local adult consumer population were estimated from a low of 0.011 / 0.098 μg/kg bw/day for DNOP (LB/UB) to a high of 4.8 μg/kg bw/day for DINP[§§§§§] (see Table 7). As the maximum dietary exposure contributed only 13% of HBGV even for high consumers (P95), the result indicates health risk from phthalates to local adult population is quite remote from public health point of view.

Table 7. The exposure to the seven phthalates for mean and high consumers

Phtha-lates	HBGV (μg/kg bw/day)	Average Exposure		High Consumer (P95) Exposure	
		Exposure (LB - UB) (μg/kg bw/day)	%HBGV (LB - UB)	Exposure (LB - UB) (μg/kg bw/day)	%HBGV (LB - UB)
DEP	5000	0.034 - 0.11	0.00068 - 0.0021	0.088 - 0.19	0.0018 - 0.0039
DBP	10	0.37 - 0.39	3.7 - 3.9	0.73 - 0.75	7.3 - 7.5
BBP	500	0.27 - 0.29	0.054 - 0.058	0.48 - 0.52	0.096 - 0.10
DEHP	25	1.7 - 1.7	6.6 - 6.6	3.3 - 3.3	13 - 13
DNOP	400	0.011 - 0.098	0.0027 - 0.024	0.025 - 0.17	0.0062 - 0.043
DINP	150	4.8 - 4.8	3.2 - 3.2	11 - 11	7.2 - 7.2
DIDP	150	0.096 - 0.18	0.064 - 0.12	0.49 - 0.57	0.33 - 0.38

36. Actually, similar findings were seen for the dietary exposure to individual age-sex population sub-groups for both average and high consumers, meaning that there is no evidence of particular higher health risk to any age / sex subgroup of adult population from dietary exposure to phthalate (see Appendix IV).

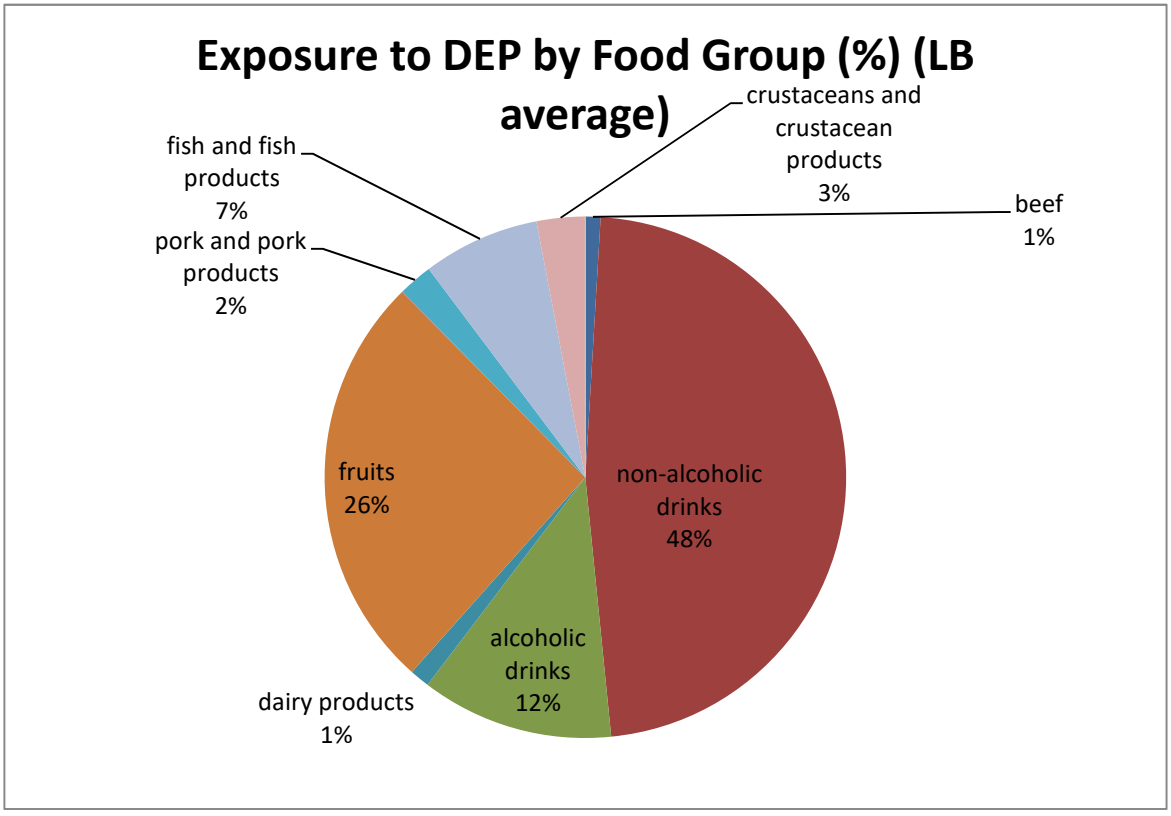
[§§§§§] Same LB and UB figures in 2 significant figures

Major Food Group Contributors

37. The relative contribution of each food group to overall LB phthalates exposure would be discussed in this section. LB figures would be used as they are considered a better reflection of the actual contribution to overall exposures, especially for those with a large percentage of samples below detectable levels.

38. For DEP, the largest contributor in terms of food groups to average consumers is non-alcoholic drinks (0.0160 µg/kg bw/day (LB), 48% of the DEP exposure), followed by fruits (0.0088 µg/kg bw/day (LB), 26% of the DEP exposure), alcoholic drinks (0.0040 µg/kg bw/day (LB), 12% of the DEP exposure) and fish (0.0025 µg/kg bw/day (LB), 7.3% of the DEP exposure). (See Figure 5)

Figure 5. Relative contribution of each food group to overall lower bound (LB) DEP exposure of average consumers in local adult population.



39. For DBP, BBP, DEHP, DNOP and DINP, the largest contributor in terms of food groups for average consumers is cereal and cereal products, which accounts for about 73 to 97% of the dietary exposure to the five phthalates. After cereal and cereal products, food groups like fruits, vegetables, pork and pork products were among the more prevalence contributors in terms of food groups among the five phthalates (See figure 6 – 10) .

Figure 6. Relative contribution of each food group to overall lower bound DBP exposure of average consumers in local adult population.

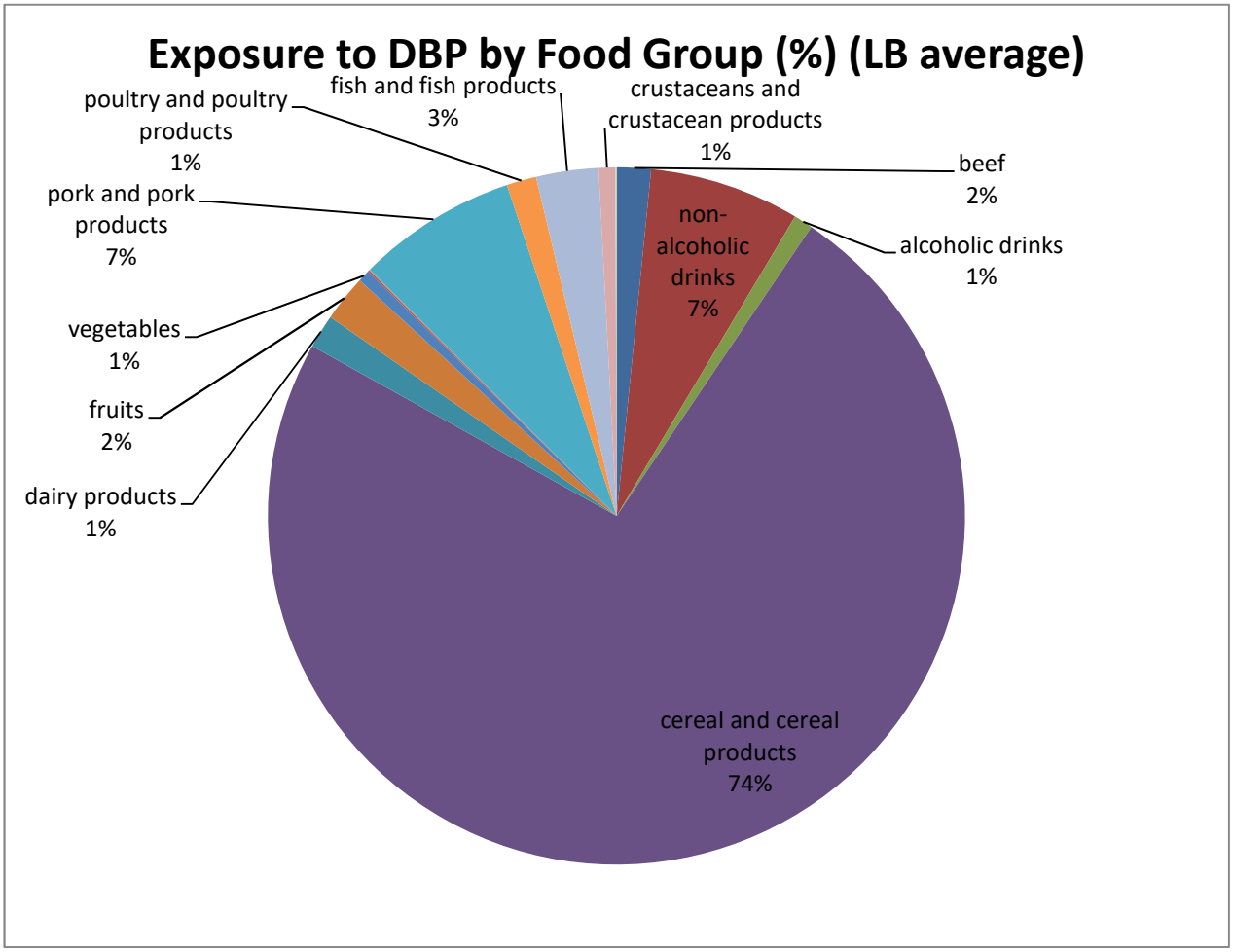


Figure 7. Relative contribution of each food group to overall lower bound BBP exposure of average consumers in local adult population.

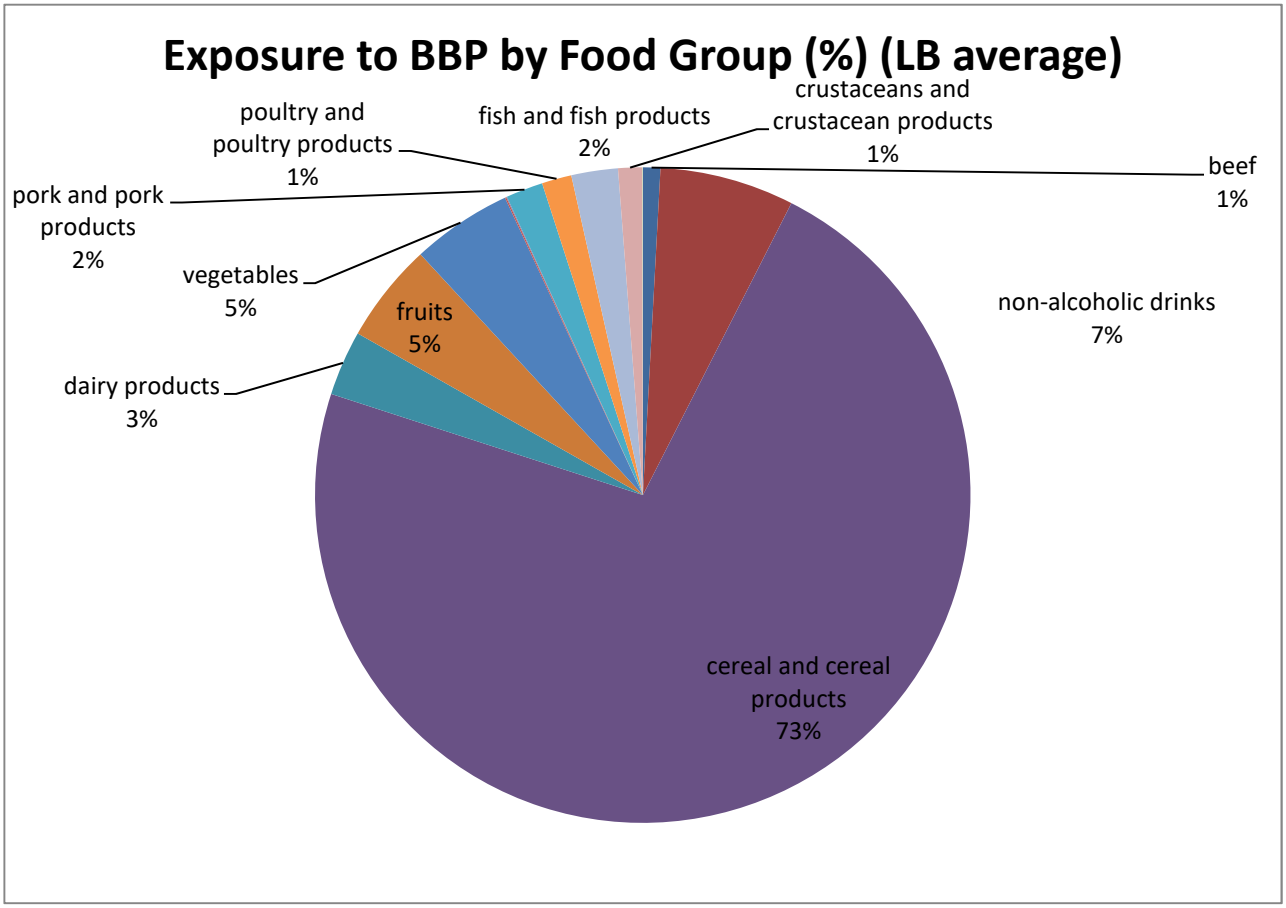


Figure 8. Relative contribution of each food group to overall lower bound DEHP exposure of average consumers in local adult population.

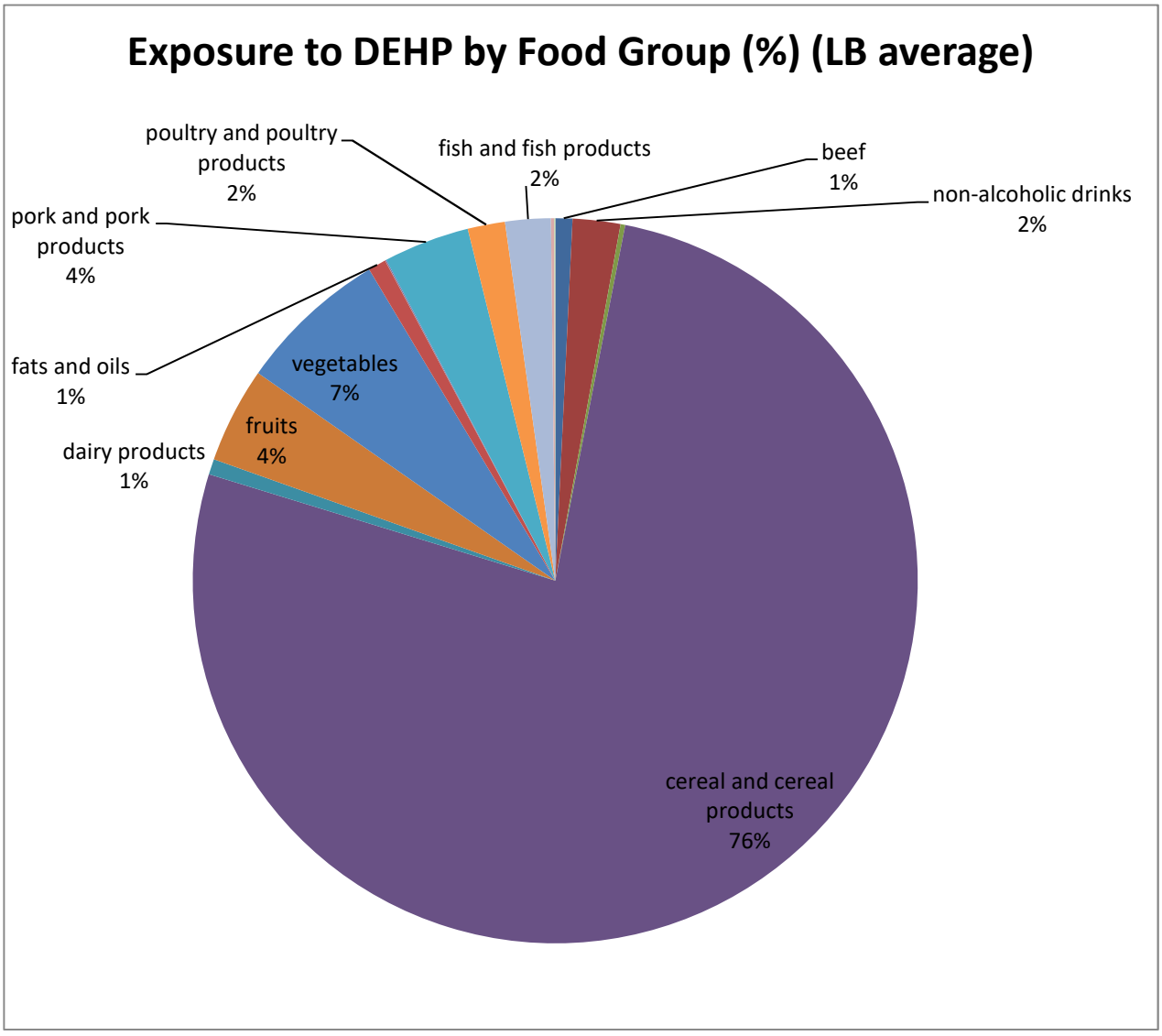


Figure 9. Relative contribution of each food group to overall lower bound DNOP exposure of average consumers in local adult population.

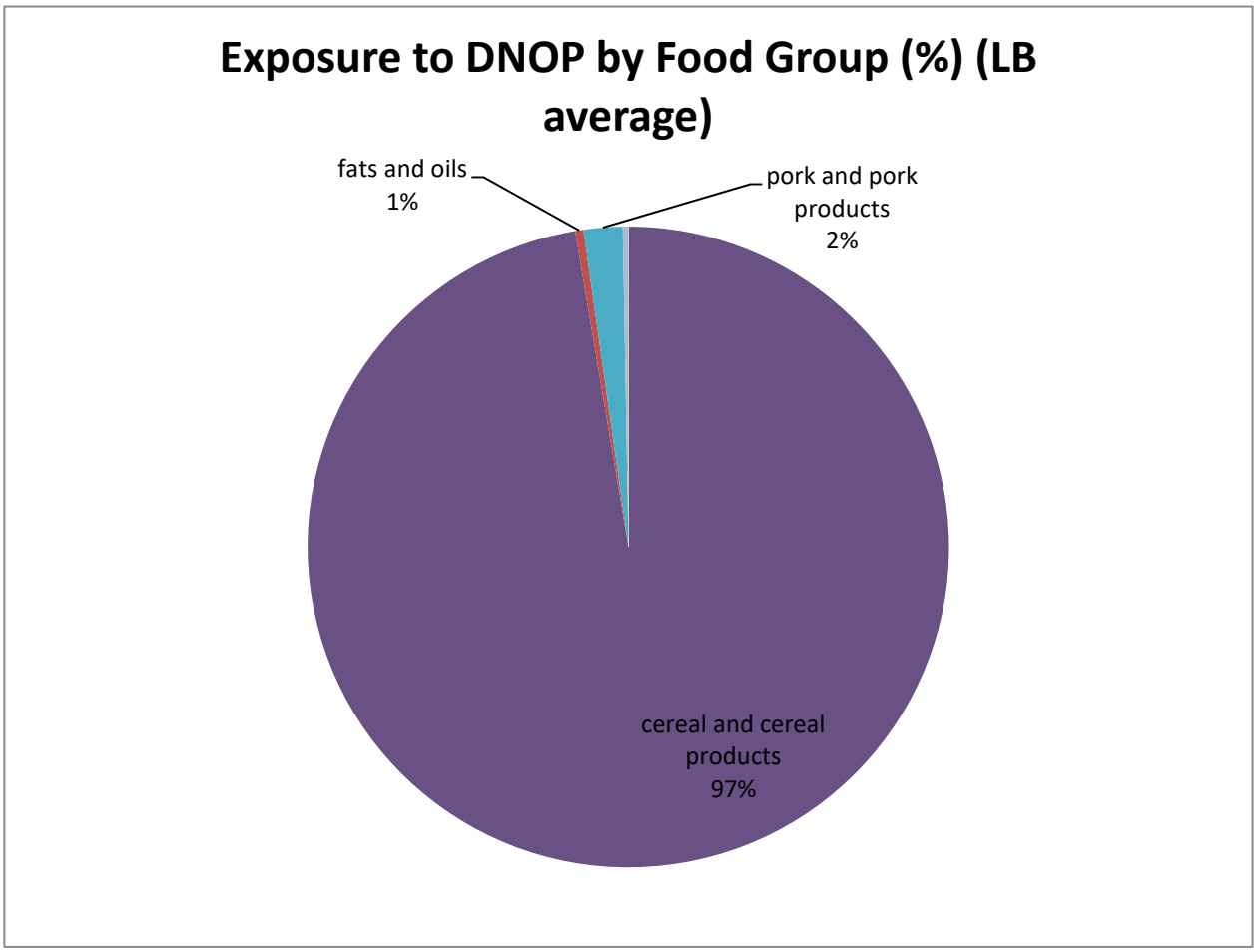
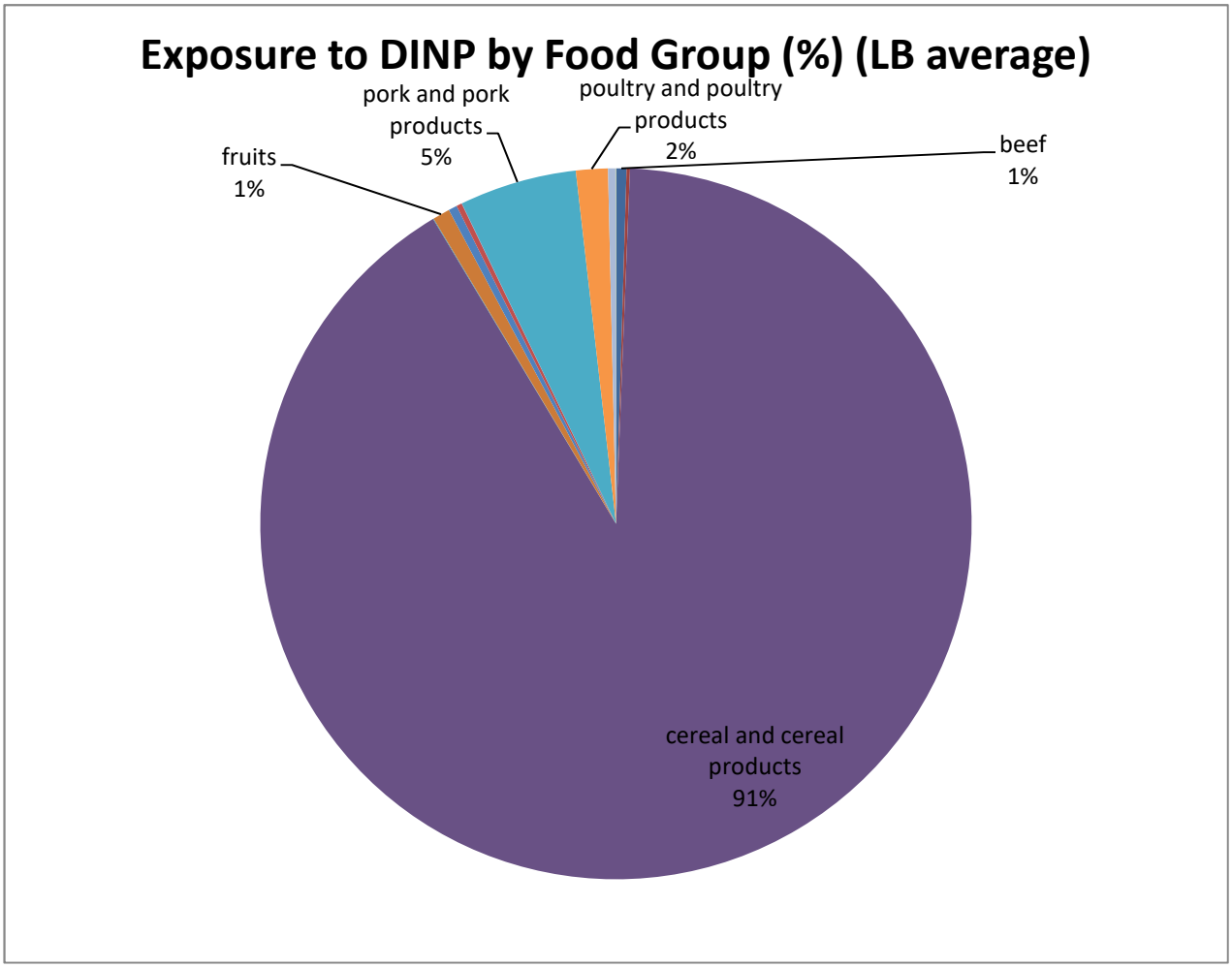
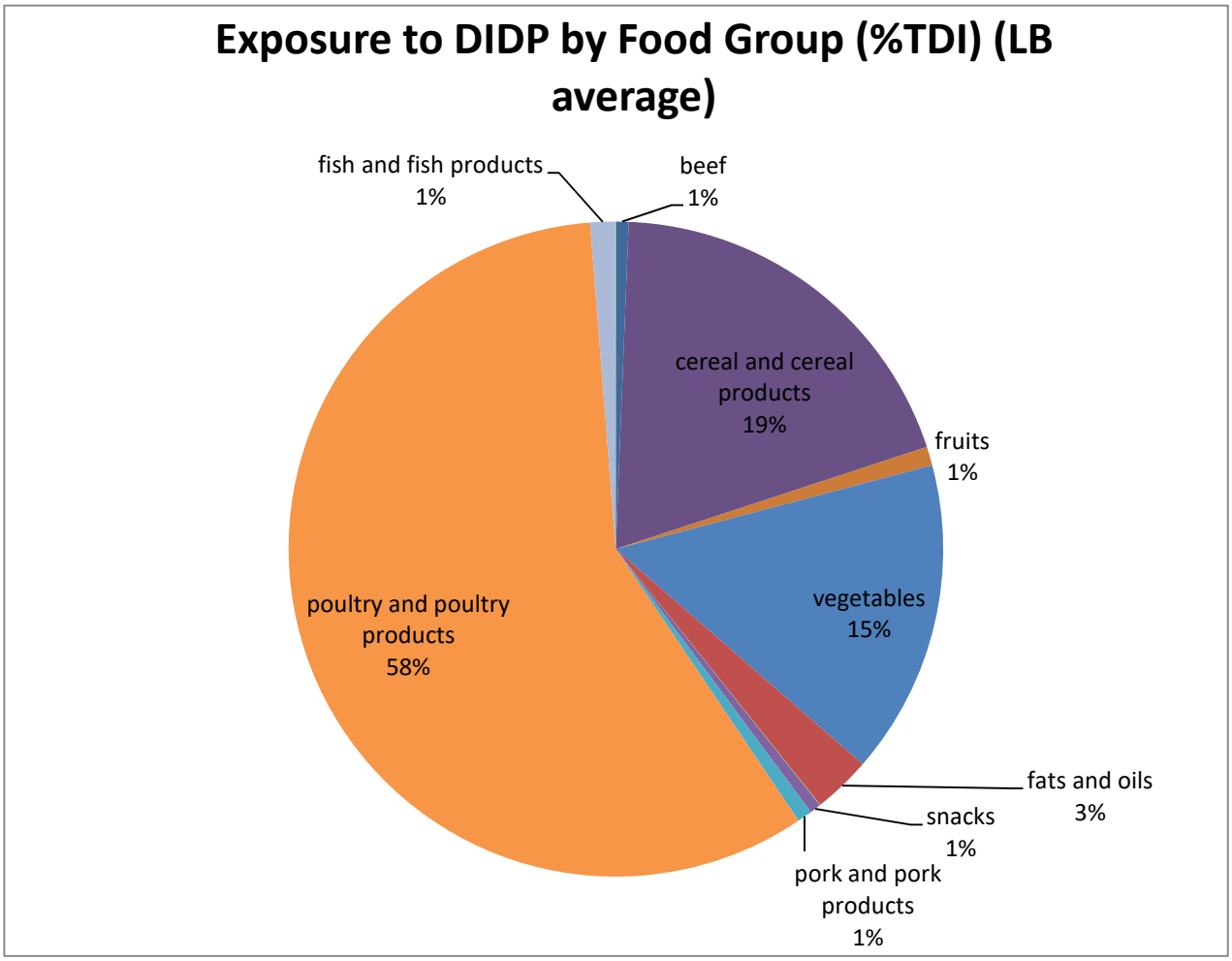


Figure 10. Relative contribution of each food group to overall lower bound DINP exposure of average consumers in local adult population.



40. In contrast, the largest contributor to DIDP dietary exposure in terms of food groups to average consumers was poultry and poultry products (58%). The contribution from cereal and cereal products was shrunk to 19%, followed by vegetables (15%).

Figure 11. Relative contribution of each food group to overall lower bound DIDP exposure of average consumers in local adult population.



Risk assessment for Infants Foods

41. As consumption data were not available for infant age groups, risk assessment was made possible by back calculation in order to provide a rough estimation on the corresponding exposure.

42. For infant formula (prepared as RTE form), back calculation were made using the 50th percentile (P50) body weight of local newborn baby girls (about 3.5

kg)[******]. For samples with 9.5, 7.4 and 13 μg/kg for BBP, DEHP and DINP respectively, it is shown that a newborn girl would need to consume about 180 kg, 12 kg and 40 kg of the infant formula tested per day to reach the relevant HBGVs for BBP, DEHP and DINP respectively. This is impossible in real life situation.

43. Regarding other RTE infant food, back calculations were made using the 50th percentile body weight of local six months old girls (about 7 kg)[††††††]. For RTE infant food samples with 10, 16 and 53 μg/kg for BBP, DEHP and DINP respectively, it was shown that a six-month old girl would need to consume about 350 kg, 11 kg and 20 kg of the infant food samples per day to reach the relevant HBGVs for BBP, DEHP and DINP respectively, which is again an impossible situation.

44. As phthalate was not detected in all three samples of RTE infant juice drink analysed, it is just unlikely that the HBGVs would be reached.

45. With the above results, it was estimated that infant food with the detected levels of phthalates reported will not cause adverse health issues.

[******] It is more conservative to use the body weight of baby girls as they weights less than the corresponding baby boys with the same age.

[††††††] WHO recommends that infant should be exclusively breastfed for the first six months of life.

Discussion

46. For the seven phthalates analysed, the overall dietary exposures for both average and high consumers were low for the adult populations in Hong Kong. This conclusion applied to all sub-populations of different ages and sexes of local adult population. At current levels of phthalate detection, the local adult populations would not experience adverse health outcome due to exposure to the seven phthalates analysed. In our assessment, the target users of infant food would also not be experiencing adverse health outcome due to phthalates analysed through consumption of the infant foods tested.

47. Although the food group "cereal and cereal products" was a major contributor to many of the phthalates in the adult population, this can be explained by their relatively high consumption amount by local adults. Since the overall dietary exposure was way below corresponding HBGVs, the finding does not carry the inference that consumption of "cereal and cereal products" is hazardous. To be more exact, the Centre's assessment confirmed that there is no need to modify the dietary habit as the overall exposure to the seven phthalates are well below the relevant HBGVs.

48. We also noticed that relatively high phthalates levels were detected in a number of samples, citing the situation of mixed dishes, pork products and edible oil below. For mixed dishes comprising primarily of hamburgers, pizza and prepackaged lunchbox, higher levels of DINP (2 100 and 3 800 μg/kg in two different samples) and DEHP (990 μg/kg) were more commonly found among prepackaged lunch boxes in microwavable packing. In contrast, these phthalates were much lower in pizza and hamburgers in alternative forms of product packing.

In the case of pork samples, the higher mean DINP level was mainly contributed by a minced pork sample with a particularly high DINP level of 7 900 μg/kg, where the other pork samples have much lower levels of DINP which range from 7.4 to 870 μg/kg DINP. Among all speculations, the use of PVC-based packaging films is suspected as the most possible contributing factor. Regarding different types of edible oil sampled, higher levels of phthalates were found in samples of some peanut oil (DINP in three peanut oil ranged from 630 to 1 500 μg/kg and one of them has a DEHP level of 3 500 μg/kg) and samples of olive oil (DINP ranges from 350 to 1 300 μg/kg, and one olive oil sample has 1 200 μg/kg of DIDP.)

49. While the levels in these samples will not cause health issues, it was believed that exposure to those phthalates chemicals can be further reduced by modification in the process of products manufacture and packaging for some products.

50. By similar reasoning, there is no cause for undue alarm even four samples as mentioned in para 29 above. The existing action levels were established to screen out food that had been intentionally adulterated with phthalates. As both edible oil and ethanol (spirits) are lipophilic in nature and extract phthalates readily from the plastic polymers upon direct physical contact, these results were not of surprise and do not point to intentional adulteration as in the 2011 Taiwan Plasticiser Incident. Risk assessment also confirmed that all these samples would not cause adverse health problem from phthalates upon usual consumption.,

Comparison of Exposure Levels with Other Countries

51. Overseas data on phthalate exposure were retrieved for comparison. Despite that sample coverage, methodology and analytical methods differ, the average adult exposure data in our study are considered at comparable levels (see Table 8 below).

Table 8. Comparision of adult dietary exposure to seven phthalates in various countries (μg/kg bw/day)

Phthalate	This study‡‡‡‡‡‡	Denmark	UK	Europe§§§§§§	Australia*******	USA†††††††	China‡‡‡‡‡‡‡
DEP	0.034 - 0.11	-	-	1.15	50	0.033	0.14 – 1.33
DBP	0.37 - 0.39	1.8 – 4.1§§§§§§§	0.2********	3.61	20	0.184	5.62 – 6.30 1.21†††††††††
BBP	0.27 - 0.29	0.3 – 0.4‡‡‡‡‡‡‡‡	0.1§§§§§§§§	0.31	-	0.085	0.44 – 1.67
DEHP	1.7 - 1.7	2.7 – 4.3*********	2.5††††††††††	2.85	200	0.673	6.03 – 6.38 2.07‡‡‡‡‡‡‡‡‡
DNOP	0.011 - 0.098	-	-	-	-	0.021	0.00 – 1.27
DINP	4.8 - 4.8	5§§§§§§§§§	<0.17**********	-	1 380	-	4.39††††††††††

‡‡‡‡‡‡ Average exposure, LB - UB.
§§§§§§ Wormuth et al. 2006. Male adults, P50 – P95 exposure estimate. ***Includes non-food oral exposures***.
******* 24th Australian TDS, phase 2. FSASZ, 2016. Theoretical maximum daily exposure.
††††††† Schecter et al., 2013. Mean level.
‡‡‡‡‡‡‡ The exposure data for China is from Yang, X., et al. (2017) except otherwise stated. The values are average estimated daily intake (LB – UB).
§§§§§§§ UK 1993 TDS. LOD 0.01 mg/kg. EFSA 2005a.
******** Total exposure from food for adults, 2000. EFSA 2005a.
††††††††† Wang et al., 2016. Exposure from food only.
‡‡‡‡‡‡‡‡ Mean exposure for adults. EFSA 2005b.
§§§§§§§§ UK 1993 TDS. EFSA 2005b.
********* Mean exposure for adults. EFSA 2005c.
†††††††††† UK 1993 TDS. LOD 0.01 mg/kg. EFSA 2005c.
‡‡‡‡‡‡‡‡‡ Sui et al., 2015. Exposure from food only.

Phthalate	This study‡‡‡‡‡‡	Denmark	UK	Europe§§§§§§	Australia*******	USA†††††††	China‡‡‡‡‡‡‡
DIDP	0.096 - 0.18	3‡‡‡‡‡‡‡‡‡‡	<0.17§§§§§§§§§	-	-	-	-

Uncertainties and Limitations

52. Although more accuracy and precision in exposure estimation could be achieved with more samples analysed, compromises had to be made in relation to the use of finite laboratory resources. In this study, only food items that had been reported to contain phthalates or commonly consumed locally were sampled and analysed. Furthermore, as the overall numbers of samples were limited to some 310 in this study, the results of this study represented only a snapshot of the phthalate levels in the selected locally available foods. This is especially true for infant foods, where only three types of products with a total of nine samples were analysed.

53. In the Hong Kong Population-based Food Consumption Survey (2005-2007), a set of two non-consecutive days of 24-hour dietary intake questionnaires was used to obtain food consumption information (e.g. the types and amounts of food consumed) among individuals aged 18 or above in Hong Kong. Back calculations were used instead in the rough estimation of phthalate exposure from infant foods for reasons above.

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§§§§§§§§§ Total oral exposure from food for adults. EFSA 2005d.
********** UK 1993 TDS as derived from the LOD of 0.01 mg/kg food. EFSA 2005d.
†††††††††† Mao et al., 2015. Exposure from food only.
‡‡‡‡‡‡‡‡‡‡ Total exposure from food for adults, 2003. EFSA 2005e.
§§§§§§§§§§ UK 1993 TDS. LOD of 0.01 mg/kg food. EFSA 2005e.

54. As this study serves to "determine the amount of seven types of phthalates, namely DEP, DBP, BBP, DEHP, DNOP, DINP and DIDP, in selected food items and to estimate their dietary exposure of the Hong Kong adult population and to assess the associated health risks", it only covers seven types of phthalates that have both health-based guidance values (HBGVs) and commercially available laboratory reference materials and leaves out other phthalates that have been reported in some other studies. Having said that, the seven phthalates covered in this study are the commonly used and more thoroughly studied phthalates and therefore the results can provide a useful reference of the exposure to the phthalates by the local population in general.

CONCLUSIONS AND RECOMMENDATIONS

55. Regarding the dietary exposure assessment, the exposure to both average and high consumers (95th percentile, or "P95") of the adult populations are well within the corresponding HBGVs (maximum 13% HBGV) for individual phthalate. Furthermore, no age-sex population sub-group had exceeded the HBGVs. The food group "cereal and cereal products" is the major contributor for DBP, BBP, DEHP, DNOP and DINP dietary exposure, while non-alcoholic drinks and poultry were the major contributors for DEP and DIDP dietary exposure, respectively.

56. The findings of the dietary exposure to seven phthalates in the adult population in the present study did not provide sufficient justifications to warrant changes to the basic dietary advice on healthy eating. The public is advised to maintain a balanced and varied diet which includes a wide variety of fruit and

vegetables so as to avoid excessive exposure to any contaminants from a small range of food items.

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Appendix I

Carcinogenicity of Seven Phthalates

Phthalate	Carcinogenicity	Reference
DEP	F344/N rat 2 year dermal study: no treatment-related carcinogenicity; reduction in fibroadenomas of the mammary glands (female). B6C3F1 mouse 2 year dermal study: increase in hepatocellular adenomas or carcinomas combined (dose-related in males only from 280 mg/kg bw/d). Negative in Swiss CD-1 mouse (male) initiation/promotion study.	NICNAS, 2008
DBP	Negative in in vitro cell transformation assays. No in vivo carcinogenicity studies are available.	NICNAS, 2008
BBP	F344 rat 2 year dietary study: increase in MCL (female only, not subsequently corroborated); Increase in pancreatic tumours (not with diet restriction). LOAEL = 720 mg/kg bw/d. NOAEL = 360 mg/kg bw/d. F344/N rat 2 year dietary study: increase in pancreatic cell adenoma and adenoma/carcinoma (combined). LOAEL = 500 mg/kg bw/d. NOAEL = 240 mg/kg bw/d. B6C3F1 mouse 2 year dietary study: no carcinogenic effects. Positive in 1 of 3 in vitro cell transformation assays.	NICNAS, 2008
DEHP	The human relevance of the molecular events leading to DEHP induced cancer in several target tissues (e.g., liver and testis) in rats or mice could not be ruled out.	IARC, 2013
	F344 rat 2 year dietary study: LOAEL = 146.6 mg/kg bw/d: increase in hepatocellular adenomas and carcinomas and increase in MCL. NOAEL = 28.9 mg/kg bw/d. Sprague-Dawley rat (male) lifetime (about 3 year) dietary study: increase in hepatocellular adenomas and carcinomas; increase in benign Leydig cell tumors. B6C3F1 mouse 2 year dietary study: LOAEL = 292 mg/kg bw/d : increase in hepatocellular adenomas and carcinomas. NOAEL = 98 mg/kg bw/d. Syrian golden hamster 23 month inhalation study: no significant	NICNAS, 2008

Phthalate	Carcinogenicity	Reference
	increase in tumour incidence	
	DEHP and its major metabolites are considered to be non-mutagenic substances after taken together both negative and positive results in animal studies.	EFSA, 2005c
	Inadequate or equivocal evidences from different animal studies.	CICAD52, WHO, 2003
DNOP	Rat (species not identified) 15 month dietary study: "numerous" liver nodules – no additional information. Sprague-Dawley rats: 26 week dietary study: increase in gamma-glutamyltransferase-positive foci in liver.	NICNAS, 2008
DINP	F344 rat 2 year dietary study: LOAEL = 358-442 mg/kg bw/d (male-female) increase in MCL. NOAEL = 88-108 mg/kg bw/d (male-female) B6C3F1 mouse 2 year dietary study: LOAEL = 335 mg/kg bw/d (female) and 742 mg/kg bw/d (male) increase in hepatocellular adenomas and carcinomas combined. NOAEL = 112 mg/kg bw/d (female) and 275 mg/kg bw/d (male) Positive in 1 of 7 in vitro cell transformation assays.	NICNAS, 2008
	NOAEL 88 mg/kg bw/day derived from a chronic/carcinogenicity rat study.	EFSA, 2005d
DIDP	No in vivo carcinogenicity studies are available. Positive in 1 of 2 in vitro cell transformation assays.	NICNAS, 2008
	There is no concern in regard with carcinogenicity.	EFSA, 2005e

Appendix II

Reproductive Toxicity of Seven Phthalates

Phthalate	Reproductive Toxicity	Reference
DEP	Not Available	-
DBP	Not Available	-
BBP	Not Available	-
DEHP	Lowest identified NOAEL for testicular effects in the diet corresponding to 3.7 mg/kg bw/day in rats, is based on a high incidence Sertoli cell vacuolation at the next higher dose level in a 13-week guideline study. The NOAEL for reproductive performance and fertility was 340 mg/kg bw/day and for developmental toxicity 113 mg/kg bw/day, respectively based on a 2-generation reproduction study of DEHP in rats. The NOAEL for testicular toxicity was 100 mg/kg (equivalent to approx. 8 mg DEHP/kg bw/day in F0 animals and approx. 5 mg DEHP/kg bw/day in the F1 and F2 Sprague-Dawley rats.) ….. A NOAEL of 5 mg/kg bw/day for testicular toxicity and developmental toxicity can be derived from this study.	EFSA, 2005c
	In terms of fertility, the LOAEL in a continuous-breeding study with Swiss CD-1 mice is 3640 mg/kg bw/day.	CICAD52, WHO, 2003
DNOP	Not Available	
DINP	NOAEL of 622 mg/kg bw/day was established for decreases in live birth and survival indices in a one-generation range-finding study in rats. In the two-generation study involving dietary administration at 0.2, 0.4 and 0.8%, parental toxicity was limited to lower mean body weight and hepatic changes with a LOAEL of 114 mg/kg bw/day. A decrease of mean offspring body weight was observed following parental administration of DINP in the 1- and 2-generation studies with an estimated LOAEL of 0.2% in diet (159 mg/kg bw/day).	EFSA, 2005d
DIDP	No effects were seen on fertility in animal study.	EFSA, 2005e

Appendix III

Levels of the Seven Phthalates in Food Samples Collected**********

(A) DEP

Sample description	No. of samples	Minimum level	Maximum level	Average DEP level (LB, ND = 0) (μg/kg)	Average DEP level (UB, ND = LOD) (μg/kg)
Non-alcoholic beverages 非酒精飲品					
Soda drinks 汽水	3	ND	16	5.3	8.7
Juice drinks 果汁飲品	3	ND	8.9	3.0	6.3
Lemon tea 檸檬茶	3	ND	11	6.3	7.9
Soya bean drink 大豆飲品	3	ND	19	8.1	9.8
Milk tea drink 奶茶飲品	5	ND	7.8	2.7	5.7
Coffee drink 咖啡飲品	5	ND	11	3.4	6.4
Sports drinks 運動飲品	5	ND	10	3.2	6.2
Taiwan style bubble milk tea drinks 臺式珍珠奶茶飲品	5	ND	43	14	15
Alcoholic beverage 酒精飲品					
Chinese white wine (distilled spirits) 中式白酒（蒸餾酒）	5	ND	31	12	14
Beer 啤酒	3	7.9	11	9.0	9.0
Red wine 紅酒	3	ND	5.6	1.9	5.2
Dairy products 乳製品					
Full cream milk 全脂奶	6	ND	5.4	1.8	5.1
Evaporated milk 淡奶	3	ND	ND	0	5
Condensed milk 煉奶	3	ND	ND	0	5
Milk powder (Non-infant formula) 奶粉（非嬰兒配方奶粉）	3	ND	6.3	2.1	5.4
Processed cheese 加工芝士	3	ND	ND	0	5
Cream 忌廉	3	ND	5.3	1.8	5.1
Yoghurts 乳酪	3	ND	ND	0	5
Yoghurt drinks 乳酪飲品	3	ND	6.6	2.2	5.5
Fish 魚類					
Grass carp 鯇魚	3	ND	ND	0	5
Golden thread 紅衫	3	ND	11	5.6	7.3

********** All levels reported are in ready-to-eat forms.

Sample description	No. of samples	Minimum level	Maximum level	Average DEP level (LB, ND = 0) (µg/kg)	Average DEP level (UB, ND = LOD) (µg/kg)
Fish ball / fish cake 魚蛋/魚片	3	7.5	18	13	13
fish fillet 魚柳	3	5.5	8.9	7.0	7.0
Fish meat paste / Minced dace 魚滑/絞鯪魚肉	3	ND	14	7.0	8.7
Pomfret 鯧魚	3	ND	6.9	2.3	5.6
Yellow croaker 黃花魚	3	ND	ND	0	5
Grey mullet 烏頭	3	ND	7.4	2.5	5.8
Smoked salmon 煙三文魚	3	ND	5.8	3.6	5.3
Canned sardine 罐頭沙甸魚	3	ND	ND	0	5
Canned tuna (in oil) 罐頭吞拿魚	3	ND	5.1	1.7	5.0
Crustaceans 甲殼類					
Freshwater or seawater shrimp/prawn 淡水或鹹水蝦	3	7.0	20	11	11
Freshwater or seawater crab 淡水或鹹水蟹	3	ND	7.4	2.5	5.8
Seawater lobster or freshwater crawfish/ crayfish 鹹水龍蝦或淡水螯蝦/小龍蝦	3	ND	6.8	4.5	6.2
Beef 牛肉					
Minced beef 免治牛肉	3	ND	8.7	2.9	6.2
Beef flank 牛腩	3	ND	ND	0	5
Beef steak 牛扒	3	ND	5.7	1.9	5.2
Beef ball 牛肉丸	3	ND	ND	0	5
Pork 豬肉					
Minced pork 免治豬肉	3	ND	13	8.7	10
Ham 火腿	3	ND	9.4	3.1	6.5
“Barbeque” pork 叉燒	3	ND	ND	0	5
Pork chop 豬扒	3	ND	ND	0	5
Chinese sausage 臘腸	3	ND	6.8	2.3	5.6
Pork sausage 豬肉腸	3	ND	ND	0	5
Luncheon meat 午餐肉	3	ND	ND	0	5
Poultry 家禽					
Chicken egg (whole) 全隻雞蛋	3	ND	ND	0	5
Chicken nugget 炸雞塊	3	ND	ND	0	5
Plain chicken 白切雞	3	ND	ND	0	5
Chicken steak 雞扒	3	ND	ND	0	5
Roasted duck 燒鴨	3	ND	ND	0	5
Turkey ham 火雞肉火腿	3	ND	ND	0	5

Sample description	No. of samples	Minimum level	Maximum level	Average DEP level (LB, ND = 0) (μg/kg)	Average DEP level (UB, ND = LOD) (μg/kg)
Chicken franks 雞肉腸	3	ND	ND	0	5
Fruits 水果					
Orange 橙	3	ND	5.6	1.9	5.2
Apple 蘋果	3	14	16	15	15
Peanut butter 花生醬	3	ND	ND	0	5
Banana 香蕉	3	ND	ND	0	5
Pear 梨	3	6.9	16	11	11
Grape 葡萄/提子	3	ND	7.5	4.4	6.1
Vegetables 蔬菜					
Chinese flowering cabbage 菜心	3	ND	ND	0	5
Pak-choi / White cabbage 小白菜	3	ND	ND	0	5
Chinese lettuce (loose leaf) 唐生菜	3	ND	ND	0	5
Chinese kale/ Chinese broccoli 芥蘭	3	ND	ND	0	5
Pe-tsai / Chinese cabbage /Tienntsin cabbage 大白菜/紹菜/黃芽白	3	ND	ND	0	5
Hairy gourd 節瓜	3	ND	ND	0	5
Fried Potato 炸薯	3	ND	ND	0	5
Potato chips 薯片	3	ND	ND	0	5
Cereals 穀類					
White rice 白飯	3	ND	ND	0	5
White bread 白麵包	3	ND	ND	0	5
Rice noodles/Rice vermicelli 米粉/米線	3	ND	ND	0	5
Oatmeal, instant 即食麥皮/燕麥片	3	ND	ND	0	5
Instant noodles 即食麵	3	ND	ND	0	5
Egg noodles 全蛋麵	3	ND	ND	0	5
Macaroni 通心粉	3	ND	ND	0	5
Cake 蛋糕/西餅	4	ND	ND	0	5
"Pineapple" bun 菠蘿包	3	ND	ND	0	5
Saline crackers 梳打餅	3	ND	ND	0	5
Cookies 曲奇餅	3	ND	ND	0	5
Spaghetti 意大利粉	3	ND	ND	0	5
Udon 烏冬	3	ND	ND	0	5
Breakfast cereal 早餐麥片	3	ND	ND	0	5
Egg roll 蛋卷	3	ND	ND	0	5
Oils and fats 油和脂肪					

Sample description	No. of samples	Minimum level	Maximum level	Average DEP level (LB, ND = 0) (μg/kg)	Average DEP level (UB, ND = LOD) (μg/kg)
Butter 牛油	3	ND	ND	0	5
Lard 豬油	2	5.2	12	8.6	8.6
Mayonnaise 蛋黃醬／白汁沙律醬	3	ND	ND	0	5
Peanut oil 花生油	3	ND	ND	0	5
Olive oil 橄欖油	5	ND	5.5	1.1	5.1
Margarine 人造牛油	3	ND	ND	0	5
Vinegar and oil salad dressing 醋和油沙律醬	3	ND	ND	0	5
Corn oil 粟米油	3	ND	ND	0	5
Canola/vegetable seed oil 菜籽油	3	ND	ND	0	5
Soybean oil 大豆油	3	ND	ND	0	5
Olive pomace oil 橄欖渣油	2	ND	ND	0	5
Condiments and sauces 調味料和醬汁					
XO Sauce XO 醬	3	ND	ND	0	5
Chilli oil 辣椒油	3	ND	ND	0	5
Snacks 零食					
Chocolate 朱古力	3	ND	ND	0	5
Konjac snacks 蒟蒻小食	3	ND	ND	0	5
Mixed dishes 混合材料菜式					
Hamburgers (no cheese) 漢堡包（無芝士）	3	ND	ND	0	5
Pizza, cheese and meat/sausage 芝士和肉/香腸薄餅	3	ND	ND	0	5
Microwave lunch box (Pork chop with rice) 微波爐飯盒（豬扒飯）	3	ND	ND	0	5
Infant food 嬰兒食品					
RTE infant food 即食嬰兒食品	3	ND	ND	0	5
RTE infant juice drinks 即食嬰兒果汁飲品	3	ND	ND	0	5
Infant formula (milk-based) 嬰兒配方（奶類製品）	3	ND	ND	0	5

(B) DBP

Sample description	No. of samples	Minimum level	Maximum level	Average DBP level (LB, ND = 0) (μg/kg)	Average DBP level (UB, ND = LOD) (μg/kg)
Non-alcoholic beverages 非酒精飲品					
Soda drinks 汽水	3	ND	9.7	3.2	6.6
Juice drinks 果汁飲品	3	ND	21	7.0	10
Lemon tea 檸檬茶	3	ND	6.4	4.2	5.8
Soya bean drink 大豆飲品	3	5.1	61	27	27
Milk tea drink 奶茶飲品	5	ND	19	8.2	9.2
Coffee drink 咖啡飲品	5	ND	9.5	3.2	6.2
Sports drinks 運動飲品	5	ND	24	11	13
Taiwan style bubble milk tea drinks 臺式珍珠奶茶飲品	5	ND	92	25	26
Alcoholic beverage 酒精飲品					
Chinese white wine (distilled spirits) 中式白酒（蒸餾酒）	5	15	560	220	220
Beer 啤酒	3	5.6	10	7.3	7.3
Red wine 紅酒	3	ND	6.0	2.0	5.3
Dairy products 乳製品					
Full cream milk 全脂奶	6	12	89	30	30
Evaporated milk 淡奶	3	12	17	15	15
Condensed milk 煉奶	3	ND	ND	0	5
Milk powder (Non-infant formula) 奶粉（非嬰兒配方奶粉）	3	ND	9.1	5.2	6.9
Processed cheese 加工芝士	3	15	19	18	18
Cream 忌廉	3	16	22	20	20
Yoghurts 乳酪	3	6.1	14	10	10
Yoghurt drinks 乳酪飲品	3	ND	11	3.7	7.0
Fish 魚類					
Grass carp 鯇魚	3	8.3	110	50	50
Golden thread 紅衫	3	ND	10	6.7	8.3
Fish ball / fish cake 魚蛋/魚片	3	5.6	33	23	23
Fish fillet 魚柳	3	7.7	15	12	12
Fish meat paste / Minced dace 魚滑/絞鯪魚肉	3	8.1	78	39	39
Pomfret 鯧魚	3	8.5	11	9.8	9.8
Yellow croaker 黃花魚	3	ND	17	10	12
Grey mullet 烏頭	3	ND	15	5.0	8.3

Sample description	No. of samples	Minimum level	Maximum level	Average DBP level (LB, ND = 0) (μg/kg)	Average DBP level (UB, ND = LOD) (μg/kg)
Smoked salmon 煙三文魚	3	8.2	9.2	8.6	8.6
Canned sardine 罐頭沙甸魚	3	ND	9.3	5.2	6.9
Canned tuna (in oil) 罐頭吞拿魚	3	ND	5.5	3.5	5.2
Crustaceans 甲殼類					
Freshwater or seawater shrimp/prawn 淡水或鹹水蝦	3	21	50	31	31
Freshwater or seawater crab 淡水或鹹水蟹	3	5.9	21	11	11
Seawater lobster or freshwater crawfish/ crayfish 鹹水龍蝦或淡水螯蝦/小龍蝦	3	ND	12	7.7	9.3
Beef 牛肉					
Minced beef 免治牛肉	3	9.0	13	10	10
Beef flank 牛腩	3	24	41	34	34
Beef steak 牛扒	3	7.7	11	8.8	8.8
Beef ball 牛肉丸	3	27	290	180	180
Pork 豬肉					
Minced pork 免治豬肉	3	13	240	92	92
Ham 火腿	3	25	38	33	33
“Barbeque” pork 叉燒	3	18	250	130	130
Pork chop 豬扒	3	9.0	110	43	43
Chinese sausage 臘腸	3	33	100	57	57
Pork sausage 豬肉腸	3	28	49	39	39
Luncheon meat 午餐肉	3	5.7	36	21	21
Poultry 家禽					
Chicken egg (whole) 全隻雞蛋	3	ND	ND	0	5
Chicken nugget 炸雞塊	3	17	27	21	21
Plain chicken 白切雞	3	10	19	13	13
Chicken steak 雞扒	3	7.6	9.7	8.7	8.7
Roasted duck 燒鴨	3	9.7	32	20	20
Turkey ham 火雞肉火腿	3	5.2	9.4	7.3	7.3
Chicken franks 雞肉腸	3	7.8	24	18	18
Fruits 水果					
Orange 橙	3	ND	8.3	2.8	6.1
Apple 蘋果	3	11	17	13	13
Peanut butter 花生醬	3	ND	25	10	12
Banana 香蕉	3	ND	ND	0	5

Sample description	No. of samples	Minimum level	Maximum level	Average DBP level (LB, ND = 0) (µg/kg)	Average DBP level (UB, ND = LOD) (µg/kg)
Pear 梨	3	ND	7.5	4.4	6.1
Grape 葡萄/提子	3	ND	ND	0	5
Vegetables 蔬菜					
Chinese flowering cabbage 菜心	3	ND	5.6	1.9	5.2
Pak-choi / White cabbage 小白菜	3	ND	ND	0	5
Chinese lettuce (loose leaf) 唐生菜	3	ND	ND	0	5
Chinese kale/ Chinese broccoli 芥蘭	3	ND	5.2	1.7	5.1
Pe-tsai / Chinese cabbage /Tienntsin cabbage 大白菜/紹菜/黃芽白	3	ND	ND	0	5
Hairy gourd 節瓜	3	ND	ND	0	5
Fried Potato 炸薯	3	8.2	11	9.2	9.2
Potato chips 薯片	3	11	20	17	17
Cereals 穀類					
White rice 白飯	3	7.8	15	11	11
White bread 白麵包	3	18	25	21	21
Rice noodles/Rice vermicelli 米粉/米線	3	6.1	16	12	12
Oatmeal, instant 即食麥皮/燕麥片	3	9.7	15	12	12
Instant noodles 即食麵	3	16	25	20	20
Egg noodles 全蛋麵	3	ND	7.2	4.7	6.4
Macaroni 通心粉	3	ND	9.7	5.8	7.5
Cake 蛋糕/西餅	4	21	28	24	24
"Pineapple" bun 菠蘿包	3	21	49	35	35
Saline crackers 梳打餅	3	25	130	64	64
Cookies 曲奇餅	3	16	31	22	22
Spaghetti 意大利粉	3	5.8	7.6	6.9	6.9
Udon 烏冬	3	ND	6.9	2.3	5.6
Breakfast cereal 早餐麥片	3	16	36	25	25
Egg roll 蛋卷	3	26	40	35	35
Oils and fats 油和脂肪					
Butter 牛油	3	ND	11	5.9	7.6
Lard 豬油	2	5.5	11	8.3	8.3
Mayonnaise 蛋黃醬／白汁沙律醬	3	ND	5.1	1.7	5.0
Peanut oil 花生油	3	10	51	27	27
Olive oil 橄欖油	5	ND	21	7.2	9.2
Margarine 人造牛油	3	ND	ND	0	5

Sample description	No. of samples	Minimum level	Maximum level	Average DBP level (LB, ND = 0) (μg/kg)	Average DBP level (UB, ND = LOD) (μg/kg)
Vinegar and oil salad dressing 醋和油沙律醬	3	ND	7.0	2.3	5.7
Corn oil 粟米油	3	ND	ND	0	5
Canola/vegetable seed oil 菜籽油	3	ND	ND	0	5
Soybean oil 大豆油	3	ND	ND	0	5
Olive pomace oil 橄欖渣油	2	ND	ND	0	5
Condiments and sauces 調味料和醬汁					
XO Sauce XO 醬	3	7.3	120	74	74
Chilli oil 辣椒油	3	10	41	26	26
Snacks 零食					
Chocolate 朱古力	3	7.1	26	14	14
Konjac snacks 蒟蒻小食	3	ND	ND	0	5
Mixed dishes 混合材料菜式					
Hamburgers (no cheese) 漢堡包（無芝士）	3	11	51	25	25
Pizza, cheese and meat/sausage 芝士和肉/香腸薄餅	3	11	33	26	26
Microwave lunch box (Pork chop with rice) 微波爐飯盒（豬扒飯）	3	15	230	94	94
Infant food 嬰兒食品					
RTE infant food 即食嬰兒食品	3	ND	ND	0	5
RTE infant juice drinks 即食嬰兒果汁飲品	3	ND	ND	0	5
Infant formula (milk-based) 嬰兒配方（奶類製品）	3	ND	ND	0	5

(C) BBP

Sample description	No. of samples	Minimum level	Maximum level	Average BBP level (LB, ND = 0) (μg/kg)	Average BBP level (UB, ND = LOD) (μg/kg)
Non-alcoholic beverages 非酒精飲品					
Soda drinks 汽水	3	ND	ND	0	5
Juice drinks 果汁飲品	3	ND	ND	0	5
Lemon tea 檸檬茶	3	ND	ND	0	5
Soya bean drink 大豆飲品	3	ND	93	31	34
Milk tea drink 奶茶飲品	5	ND	21	5.5	8.5
Coffee drink 咖啡飲品	5	ND	10	3.3	6.3
Sports drinks 運動飲品	5	ND	ND	0	5
Taiwan style bubble milk tea drinks 臺式珍珠奶茶飲品	5	5.0	55	18	18
Alcoholic beverage 酒精飲品					
Chinese white wine (distilled spirits) 中式白酒（蒸餾酒）	5	ND	8.7	3.1	6.1
Beer 啤酒	3	ND	ND	0	5
Red wine 紅酒	3	ND	ND	0	5
Dairy products 乳製品					
Full cream milk 全脂奶	6	28	40	36	36
Evaporated milk 淡奶	3	20	40	27	27
Condensed milk 煉奶	3	14	50	26	26
Milk powder (Non-infant formula) 奶粉（非嬰兒配方奶粉）	3	25	27	26	26
Processed cheese 加工芝士	3	31	35	33	33
Cream 忌廉	3	33	39	35	35
Yoghurts 乳酪	3	28	39	34	34
Yoghurt drinks 乳酪飲品	3	20	41	27	27
Fish 魚類					
Grass carp 鯇魚	3	ND	47	18	19
Golden thread 紅衫	3	ND	8.6	4.9	6.6
Fish ball / fish cake 魚蛋/魚片	3	6.3	29	17	17
Fish fillet 魚柳	3	11	21	14	14
Fish meat paste / Minced dace 魚滑/絞鯪魚肉	3	5.8	15	9.2	9.2
Pomfret 鯧魚	3	8.2	45	21	21
Yellow croaker 黃花魚	3	ND	6.9	2.3	5.6
Grey mullet 烏頭	3	ND	8.5	5.4	7.0

Sample description	No. of samples	Minimum level	Maximum level	Average BBP level (LB, ND = 0) (μg/kg)	Average BBP level (UB, ND = LOD) (μg/kg)
Smoked salmon 煙三文魚	3	6.3	10	8.4	8.4
Canned sardine 罐頭沙甸魚	3	ND	9.2	3.1	6.4
Canned tuna (in oil) 罐頭吞拿魚	3	ND	ND	0	5
Crustaceans 甲殼類					
Freshwater or seawater shrimp/prawn 淡水或鹹水蝦	3	24	42	33	33
Freshwater or seawater crab 淡水或鹹水蟹	3	5.5	34	17	17
Seawater lobster or freshwater crawfish/ crayfish 鹹水龍蝦或淡水螯蝦/小龍蝦	3	ND	21	10	12
Beef 牛肉					
Minced beef 免治牛肉	3	ND	5.2	1.7	5.1
Beef flank 牛腩	3	ND	6.6	4.3	6.0
Beef steak 牛扒	3	6.3	13	10	10
Beef ball 牛肉丸	3	11	44	31	31
Pork 豬肉					
Minced pork 免治豬肉	3	8.5	13	10	10
Ham 火腿	3	6.3	47	32	32
“Barbeque” pork 叉燒	3	5.4	9.0	6.6	6.6
Pork chop 豬扒	3	7.3	7.7	7.5	7.5
Chinese sausage 臘腸	3	ND	49	28	30
Pork sausage 豬肉腸	3	ND	51	28	30
Luncheon meat 午餐肉	3	ND	26	15	16
Poultry 家禽					
Chicken egg (whole) 全隻雞蛋	3	5.4	10	7.6	7.6
Chicken nugget 炸雞塊	3	7.9	9.6	8.7	8.7
Plain chicken 白切雞	3	ND	8.5	5.3	6.9
Chicken steak 雞扒	3	ND	7.3	4.8	6.5
Roasted duck 燒鴨	3	ND	10	3.3	6.7
Turkey ham 火雞肉火腿	3	ND	35	14	16
Chicken franks 雞肉腸	3	6.8	32	23	23
Fruits 水果					
Orange 橙	3	5.4	14	8.8	8.8
Apple 蘋果	3	5.7	10	7.4	7.4
Peanut butter 花生醬	3	ND	ND	0	5
Banana 香蕉	3	ND	6.7	3.9	5.6

Sample description	No. of samples	Minimum level	Maximum level	Average BBP level (LB, ND = 0) (μg/kg)	Average BBP level (UB, ND = LOD) (μg/kg)
Pear 梨	3	5.1	6.5	6.0	6.0
Grape 葡萄/提子	3	5.2	7.4	6.3	6.3
Vegetables 蔬菜					
Chinese flowering cabbage 菜心	3	6.9	8.9	8.2	8.2
Pak-choi / White cabbage 小白菜	3	7.7	11	9.0	9.0
Chinese lettuce (loose leaf) 唐生菜	3	5.5	10	7.5	7.5
Chinese kale/ Chinese broccoli 芥蘭	3	6.8	12	9.6	9.6
Pe-tsai / Chinese cabbage /Tienntsin cabbage 大白菜/紹菜/黃芽白	3	6.5	7.8	7.1	7.1
Hairy gourd 節瓜	3	ND	6.2	3.9	5.5
Fried Potato 炸薯	3	9.4	20	16	16
Potato chips 薯片	3	17	30	25	25
Cereals 穀類					
White rice 白飯	3	24	35	30	30
White bread 白麵包	3	25	31	27	27
Rice noodles/Rice vermicelli 米粉/米線	3	8.2	21	15	15
Oatmeal, instant 即食麥皮/燕麥片	3	17	25	22	22
Instant noodles 即食麵	3	20	42	34	34
Egg noodles 全蛋麵	3	33	43	37	37
Macaroni 通心粉	3	18	38	26	26
Cake 蛋糕/西餅	4	29	48	38	38
"Pineapple" bun 菠蘿包	3	23	40	32	32
Saline crackers 梳打餅	3	16	86	41	41
Cookies 曲奇餅	3	25	49	39	39
Spaghetti 意大利粉	3	25	37	31	31
Udon 烏冬	3	32	43	39	39
Breakfast cereal 早餐麥片	3	21	32	26	26
Egg roll 蛋卷	3	32	37	35	35
Oils and fats 油和脂肪					
Butter 牛油	3	ND	12	7.1	8.7
Lard 豬油	2	ND	ND	0	5
Mayonnaise 蛋黃醬／白汁沙律醬	3	ND	9.1	5.8	7.5
Peanut oil 花生油	3	ND	ND	0	5
Olive oil 橄欖油	5	7.2	16	10	10
Margarine 人造牛油	3	ND	ND	0	5

Sample description	No. of samples	Minimum level	Maximum level	Average BBP level (LB, ND = 0) (μg/kg)	Average BBP level (UB, ND = LOD) (μg/kg)
Vinegar and oil salad dressing 醋和油沙律醬	3	ND	5.7	1.9	5.2
Corn oil 粟米油	3	ND	ND	0	5
Canola/vegetable seed oil 菜籽油	3	ND	ND	0	5
Soybean oil 大豆油	3	ND	ND	0	5
Olive pomace oil 橄欖渣油	2	13	14	14	14
Condiments and sauces 調味料和醬汁					
XO Sauce XO 醬	3	ND	ND	0	5
Chilli oil 辣椒油	3	ND	15	5.0	8.3
Snacks 零食					
Chocolate 朱古力	3	12	15	14	14
Konjac snacks 蒟蒻小食	3	ND	5.9	3.9	5.6
Mixed dishes 混合材料菜式					
Hamburgers (no cheese) 漢堡包（無芝士）	3	ND	17	11	12
Pizza, cheese and meat/sausage 芝士和肉/香腸薄餅	3	8.2	17	13	13
Microwave lunch box (Pork chop with rice) 微波爐飯盒（豬扒飯）	3	ND	6.2	3.7	5.4
Infant food 嬰兒食品					
RTE infant food 即食嬰兒食品	3	6.0	10	7.9	7.9
RTE infant juice drinks 即食嬰兒果汁飲品	3	ND	ND	0	5
Infant formula (milk-based) 嬰兒配方（奶類製品）	3	ND	9.5	5.2	6.9

(D) DEHP

Sample description	No. of samples	Minimum level	Maximum level	Average DEHP level (LB, ND = 0) (μg/kg)	Average DEHP level (UB, ND = LOD) (μg/kg)
Non-alcoholic beverages 非酒精飲品					
Soda drinks 汽水	3	ND	10	6.4	8.1
Juice drinks 果汁飲品	3	ND	8.2	4.9	6.5
Lemon tea 檸檬茶	3	ND	6.4	4.2	5.8
Soya bean drink 大豆飲品	3	7.9	63	29	29
Milk tea drink 奶茶飲品	5	6.5	22	12	12
Coffee drink 咖啡飲品	5	5.4	11	8.4	8.4
Sports drinks 運動飲品	5	5.8	24	11	11
Taiwan style bubble milk tea drinks 臺式珍珠奶茶飲品	5	16	120	56	56
Alcoholic beverage 酒精飲品					
Chinese white wine (distilled spirits) 中式白酒（蒸餾酒）	5	ND	1100	230	240
Beer 啤酒	3	6.2	7.9	7.2	7.2
Red wine 紅酒	3	5.4	8.1	6.5	6.5
Dairy products 乳製品					
Full cream milk 全脂奶	6	16	82	39	39
Evaporated milk 淡奶	3	10	50	27	27
Condensed milk 煉奶	3	9.6	31	17	17
Milk powder (Non-infant formula) 奶粉（非嬰兒配方奶粉）	3	11	16	13	13
Processed cheese 加工芝士	3	34	220	100	100
Cream 忌廉	3	27	71	47	47
Yoghurts 乳酪	3	21	140	80	80
Yoghurt drinks 乳酪飲品	3	14	97	60	60
Fish 魚類					
Grass carp 鯇魚	3	13	73	41	41
Golden thread 紅衫	3	68	87	79	79
Fish ball / fish cake 魚蛋/魚片	3	8.0	91	56	56
fish fillet 魚柳	3	27	160	75	75
Fish meat paste / Minced dace 魚滑/絞鯪魚肉	3	34	58	45	45
Pomfret 鯧魚	3	30	110	73	73
Yellow croaker 黃花魚	3	39	220	110	110
Grey mullet 烏頭	3	13	39	26	26

Sample description	No. of samples	Minimum level	Maximum level	Average DEHP level (LB, ND = 0) (μg/kg)	Average DEHP level (UB, ND = LOD) (μg/kg)
Smoked salmon 煙三文魚	3	62	330	180	180
Canned sardine 罐頭沙甸魚	3	34	160	98	98
Canned tuna 罐頭吞拿魚	3	72	97	82	82
Crustaceans 甲殼類					
Freshwater or seawater shrimp/prawn 淡水或鹹水蝦	3	17	22	20	20
Freshwater or seawater crab 淡水或鹹水蟹	3	13	33	23	23
Seawater lobster or freshwater crawfish/ crayfish 鹹水龍蝦或淡水螯蝦/小龍蝦	3	ND	68	31	32
Beef 牛肉					
Minced beef 免治牛肉	3	60	140	100	100
Beef flank 牛腩	3	17	82	50	50
Beef steak 牛扒	3	13	33	20	20
Beef ball 牛肉丸	3	180	470	360	360
Pork 豬肉					
Minced pork 免治豬肉	3	43	330	140	140
Ham 火腿	3	97	130	112	112
“Barbeque” pork 叉燒	3	37	370	160	160
Pork chop 豬扒	3	22	120	80	80
Chinese sausage 臘腸	3	74	190	118	118
Pork sausage 豬肉腸	3	45	110	78	78
Luncheon meat 午餐肉	3	11	640	229	229
Poultry 家禽					
Chicken egg (whole) 全隻雞蛋	3	26	64	40	40
Chicken nugget 炸雞塊	3	71	200	130	130
Plain chicken 白切雞	3	23	77	44	44
Chicken steak 雞扒	3	30	50	37	37
Roasted duck 燒鴨	3	35	97	65	65
Turkey ham 火雞肉火腿	3	9.9	97	41	41
Chicken franks 雞肉腸	3	17	49	34	34
Fruits 水果					
Orange 橙	3	17	37	25	25
Apple 蘋果	3	84	120	100	100
Peanut butter 花生醬	3	10	140	79	79
Banana 香蕉	3	7.2	19	13	13

Sample description	No. of samples	Minimum level	Maximum level	Average DEHP level (LB, ND = 0) (µg/kg)	Average DEHP level (UB, ND = LOD) (µg/kg)
Pear 梨	3	28	62	40	40
Grape 葡萄/提子	3	9.3	23	17	17
Vegetables 蔬菜					
Chinese flowering cabbage 菜心	3	43	120	78	78
Pak-choi / White cabbage 小白菜	3	44	91	64	64
Chinese lettuce (loose leaf) 唐生菜	3	16	100	72	72
Chinese kale/ Chinese broccoli 芥蘭	3	70	130	92	92
Pe-tsai / Chinese cabbage /Tienntsin cabbage 大白菜/紹菜/黃芽白	3	16	52	29	29
Hairy gourd 節瓜	3	7.9	76	34	34
Fried Potato 炸薯	3	30	50	43	43
Potato chips 薯片	3	32	290	120	120
Cereals 穀類					
White rice 白飯	3	60	86	70	70
White bread 白麵包	3	18	42	28	28
Rice noodles/Rice vermicelli 米粉/米線	3	ND	21	10	11
Oatmeal, instant 即食麥皮/燕麥片	3	12	45	26	26
Instant noodles 即食麵	3	69	83	74	74
Egg noodles 全蛋麵	3	51	130	79	79
Macaroni 通心粉	3	6.6	54	36	36
Cake 蛋糕/西餅	4	43	89	66	66
"Pineapple" bun 菠蘿包	3	29	71	51	51
Saline crackers 梳打餅	3	73	130	100	100
Cookies 曲奇餅	3	57	200	120	120
Spaghetti 意大利粉	3	18	73	43	43
Udon 烏冬	3	40	52	47	47
Breakfast cereal 早餐麥片	3	31	130	65	65
Egg roll 蛋卷	3	49	110	80	80
Oils and fats 油和脂肪					
Butter 牛油	3	35	62	46	46
Lard 豬油	2	10	14	12	12
Mayonnaise 蛋黃醬／白汁沙律醬	3	ND	21	13	14
Peanut oil 花生油	3	350	3500	1400	1400
Olive oil 橄欖油	5	44	570	300	300
Margarine 人造牛油	3	11	100	52	52
Vinegar and oil salad dressing 醋和油沙	3	ND	14	7.6	9.3

Sample description	No. of samples	Minimum level	Maximum level	Average DEHP level (LB, ND = 0) (μg/kg)	Average DEHP level (UB, ND = LOD) (μg/kg)
律醬					
Corn oil 粟米油	3	110	560	280	280
Canola/vegetable seed oil 菜籽油	3	16	44	32	32
Soybean oil 大豆油	3	53	74	65	65
Olive pomace oil 橄欖渣油	2	900	3300	2100	2100
Condiments and sauces 調味料和醬汁					
XO Sauce XO 醬	3	140	560	310	310
Chilli oil 辣椒油	3	57	150	110	110
Snacks 零食					
Chocolate 朱古力	3	79	160	120	120
Konjac snacks 蒟蒻小食	3	ND	5.0	1.7	5.0
Mixed dishes 混合材料菜式					
Hamburgers (no cheese) 漢堡包（無芝士）	3	78	130	110	110
Pizza, cheese and meat/sausage 芝士和肉/香腸薄餅	3	62	140	97	97
Microwave lunch box (Pork chop with rice) 微波爐飯盒（豬扒飯）	3	78	990	420	420
Infant food 嬰兒食品					
RTE infant food 即食嬰兒食品	3	10	16	13	13
RTE infant juice drinks 即食嬰兒果汁飲品	3	ND	ND	0	5
Infant formula (milk-based) 嬰兒配方（奶類製品）	3	ND	7.4	2.5	5.8

(E) DNOP

Sample description	No. of samples	Minimum level	Maximum level	Average DNOP level (LB, ND = 0) (μg/kg)	Average DNOP level (UB, ND = LOD) (μg/kg)
Non-alcoholic beverages 非酒精飲品					
Soda drinks 汽水	3	ND	ND	0	5
Juice drinks 果汁飲品	3	ND	ND	0	5
Lemon tea 檸檬茶	3	ND	ND	0	5
Soya bean drink 大豆飲品	3	ND	ND	0	5
Milk tea drink 奶茶飲品	5	ND	ND	0	5
Coffee drink 咖啡飲品	5	ND	ND	0	5
Sports drinks 運動飲品	5	ND	ND	0	5
Taiwan style bubble milk tea drinks 臺式珍珠奶茶飲品	5	ND	ND	0	5
Alcoholic beverage 酒精飲品					
Chinese white wine (distilled spirits) 中式白酒（蒸餾酒）	5	ND	ND	0	5
Beer 啤酒	3	ND	ND	0	5
Red wine 紅酒	3	ND	ND	0	5
Dairy products 乳製品					
Full cream milk 全脂奶	6	ND	ND	0	5
Evaporated milk 淡奶	3	ND	ND	0	5
Condensed milk 煉奶	3	ND	ND	0	5
Milk powder (Non-infant formula) 奶粉（非嬰兒配方奶粉）	3	ND	ND	0	5
Processed cheese 加工芝士	3	ND	ND	0	5
Cream 忌廉	3	ND	ND	0	5
Yoghurts 乳酪	3	ND	ND	0	5
Yoghurt drinks 乳酪飲品	3	ND	ND	0	5
Fish 魚類					
Grass carp 鯇魚	3	ND	ND	0	5
Golden thread 紅衫	3	ND	ND	0	5
Fish ball / fish cake 魚蛋/魚片	3	ND	ND	0	5
fish fillet 魚柳	3	ND	ND	0	5
Fish meat paste / Minced dace 魚滑/絞鯪魚肉	3	ND	ND	0	5
Pomfret 鯧魚	3	ND	ND	0	5
Yellow croaker 黃花魚	3	ND	ND	0	5
Grey mullet 烏頭	3	ND	ND	0	5

Sample description	No. of samples	Minimum level	Maximum level	Average DNOP level (LB, ND = 0) (μg/kg)	Average DNOP level (UB, ND = LOD) (μg/kg)
Smoked salmon 煙三文魚	3	ND	ND	0	5
Canned sardine 罐頭沙甸魚	3	ND	ND	0	5
Canned tuna (in oil) 罐頭吞拿魚	3	ND	15	5.0	8.3
Crustaceans 甲殼類					
Freshwater or seawater shrimp/prawn 淡水或鹹水蝦	3	ND	ND	0	5
Freshwater or seawater crab 淡水或鹹水蟹	3	ND	ND	0	5
Seawater lobster or freshwater crawfish/ crayfish 鹹水龍蝦或淡水螯蝦/小龍蝦	3	ND	ND	0	5
Beef 牛肉					
Minced beef 免治牛肉	3	ND	ND	0	5
Beef flank 牛腩	3	ND	ND	0	5
Beef steak 牛扒	3	ND	ND	0	5
Beef ball 牛肉丸	3	ND	ND	0	5
Pork 豬肉					
Minced pork 免治豬肉	3	ND	ND	0	5
Ham 火腿	3	ND	ND	0	5
“Barbeque” pork 叉燒	3	ND	ND	0	5
Pork chop 豬扒	3	ND	ND	0	5
Chinese sausage 臘腸	3	ND	ND	0	5
Pork sausage 豬肉腸	3	ND	ND	0	5
Luncheon meat 午餐肉	3	ND	ND	0	5
Poultry 家禽					
Chicken egg (whole) 全隻雞蛋	3	ND	ND	0	5
Chicken nugget 炸雞塊	3	ND	ND	0	5
Plain chicken 白切雞	3	ND	ND	0	5
Chicken steak 雞扒	3	ND	ND	0	5
Roasted duck 燒鴨	3	ND	ND	0	5
Turkey ham 火雞肉火腿	3	ND	ND	0	5
Chicken franks 雞肉腸	3	ND	ND	0	5
Fruits 水果					
Orange 橙	3	ND	ND	0	5
Apple 蘋果	3	ND	ND	0	5
Peanut butter 花生醬	3	ND	ND	0	5
Banana 香蕉	3	ND	ND	0	5

Sample description	No. of samples	Minimum level	Maximum level	Average DNOP level (LB, ND = 0) (μg/kg)	Average DNOP level (UB, ND = LOD) (μg/kg)
Pear 梨	3	ND	ND	0	5
Grape 葡萄/提子	3	ND	ND	0	5
Vegetables 蔬菜					
Chinese flowering cabbage 菜心	3	ND	ND	0	5
Pak-choi / White cabbage 小白菜	3	ND	ND	0	5
Chinese lettuce (loose leaf) 唐生菜	3	ND	ND	0	5
Chinese kale/ Chinese broccoli 芥蘭	3	ND	ND	0	5
Pe-tsai / Chinese cabbage /Tienntsin cabbage 大白菜/紹菜/黃芽白	3	ND	ND	0	5
Hairy gourd 節瓜	3	ND	ND	0	5
Fried Potato 炸薯	3	ND	ND	0	5
Potato chips 薯片	3	ND	ND	0	5
Cereals 穀類					
White rice 白飯	3	ND	ND	0	5
White bread 白麵包	3	ND	ND	0	5
Rice noodles/Rice vermicelli 米粉/米線	3	ND	ND	0	5
Oatmeal, instant 即食麥皮/燕麥片	3	ND	ND	0	5
Instant noodles 即食麵	3	ND	ND	0	5
Egg noodles 全蛋麵	3	ND	ND	0	5
Macaroni 通心粉	3	ND	ND	0	5
Cake 蛋糕/西餅	4	ND	ND	0	5
"Pineapple" bun 菠蘿包	3	ND	ND	0	5
Saline crackers 梳打餅	3	ND	ND	0	5
Cookies 曲奇餅	3	ND	ND	0	5
Spaghetti 意大利粉	3	ND	ND	0	5
Udon 烏冬	3	ND	ND	0	5
Breakfast cereal 早餐麥片	3	ND	ND	0	5
Egg roll 蛋卷	3	ND	ND	0	5
Oils and fats 油和脂肪					
Butter 牛油	3	ND	ND	0	5
Lard 豬油	2	ND	ND	0	5
Mayonnaise 蛋黃醬／白汁沙律醬	3	ND	ND	0	5
Peanut oil 花生油	3	ND	11	3.7	7.0
Olive oil 橄欖油	5	ND	12	5.4	7.4
Margarine 人造牛油	3	ND	ND	0	5

Sample description	No. of samples	Minimum level	Maximum level	Average DNOP level (LB, ND = 0) (μg/kg)	Average DNOP level (UB, ND = LOD) (μg/kg)
Vinegar and oil salad dressing 醋和油沙律醬	3	ND	ND	0	5
Corn oil 粟米油	3	ND	ND	0	5
Canola/vegetable seed oil 菜籽油	3	ND	ND	0	5
Soybean oil 大豆油	3	ND	ND	0	5
Olive pomace oil 橄欖渣油	2	15	23	19	19
Condiments and sauces 調味料和醬汁					
XO Sauce XO 醬	3	ND	ND	0	5
Chilli oil 辣椒油	3	ND	ND	0	5
Snacks 零食					
Chocolate 朱古力	3	ND	ND	0	5
Konjac snacks 蒟蒻小食	3	ND	ND	0	5
Mixed dishes 混合材料菜式					
Hamburgers (no cheese) 漢堡包（無芝士）	3	ND	ND	0	5
Pizza, cheese and meat/sausage 芝士和肉/香腸薄餅	3	ND	ND	0	5
Microwave lunch box (Pork chop with rice) 微波爐飯盒（豬扒飯）	3	ND	15	5.0	8.3
Infant food 嬰兒食品					
RTE infant food 即食嬰兒食品	3	ND	ND	0	5
RTE infant juice drinks 即食嬰兒果汁飲品	3	ND	ND	0	5
Infant formula (milk-based) 嬰兒配方（奶類製品）	3	ND	ND	0	5

(F) DINP

Sample description	No. of samples	Minimum level	Maximum level	Average DINP level (LB, ND = 0) (μg/kg)	Average DINP level (UB, ND = LOD) (μg/kg)
Non-alcoholic beverages 非酒精飲品					
Soda drinks 汽水	3	ND	ND	0	5
Juice drinks 果汁飲品	3	ND	ND	0	5
Lemon tea 檸檬茶	3	ND	ND	0	5
Soya bean drink 大豆飲品	3	ND	11	3.7	7.0
Milk tea drink 奶茶飲品	5	ND	14	4.7	7.7
Coffee drink 咖啡飲品	5	ND	8.2	1.6	5.6
Sports drinks 運動飲品	5	ND	12	2.4	6.4
Taiwan style bubble milk tea drinks 臺式珍珠奶茶飲品	5	ND	63	23	24
Alcoholic beverage 酒精飲品					
Chinese white wine (distilled spirits) 中式白酒（蒸餾酒）	5	ND	ND	0	5
Beer 啤酒	3	ND	ND	0	5
Red wine 紅酒	3	ND	ND	0	5
Dairy products 乳製品					
Full cream milk 全脂奶	6	ND	20	4.2	7.6
Evaporated milk 淡奶	3	ND	27	16	18
Condensed milk 煉奶	3	ND	13	6.2	7.9
Milk powder, fortified. (Non-infant formula) 強化奶粉（非嬰兒配方奶粉）	3	ND	5.5	1.8	5.2
Processed cheese 加工芝士	3	71	640	260	260
Cream 忌廉	3	5.6	54	28	28
Yoghurts 乳酪	3	5.6	6.1	5.9	5.9
Yoghurt drinks 乳酪飲品	3	ND	6.5	2.2	5.5
Fish 魚類					
Grass carp 鯇魚	3	ND	24	13	14
Golden thread 紅衫	3	5.4	38	23	23
Fish ball / fish cake 魚蛋/魚片	3	7.7	24	15	15
fish fillet 魚柳	3	ND	50	17	20
Fish meat paste / Minced dace 魚滑/絞鯪魚肉	3	19	210	110	110
Pomfret 鯧魚	3	ND	32	19	21
Yellow croaker 黃花魚	3	ND	15	9.3	11
Grey mullet 烏頭	3	ND	10	6.6	8.3

Sample description	No. of samples	Minimum level	Maximum level	Average DINP level (LB, ND = 0) (μg/kg)	Average DINP level (UB, ND = LOD) (μg/kg)
Smoked salmon 煙三文魚	3	7.0	860	310	310
Canned sardine 罐頭沙甸魚	3	8.9	150	68	68
Canned tuna (in oil) 罐頭吞拿魚	3	31	250	130	130
Crustaceans 甲殼類					
Freshwater or seawater shrimp/prawn 淡水或鹹水蝦	3	ND	5.0	1.7	5.0
Freshwater or seawater crab 淡水或鹹水蟹	3	ND	22	10	12
Seawater lobster or freshwater crawfish/ crayfish 鹹水龍蝦或淡水螯蝦/小龍蝦	3	8.3	21	16	16
Beef 牛肉					
Minced beef 免治牛肉	3	31	130	65	65
Beef flank 牛腩	3	5.9	690	240	240
Beef steak 牛扒	3	8.5	14	11	11
Beef ball 牛肉丸	3	400	990	620	620
Pork 豬肉					
Minced pork 免治豬肉	3	34	7900	2700	2700
Ham 火腿	3	14	18	16	16
“Barbeque” pork 叉燒	3	30	140	84	84
Pork chop 豬扒	3	7.4	55	25	25
Chinese sausage 臘腸	3	44	81	60	60
Pork sausage 豬肉腸	3	18	870	340	340
Luncheon meat 午餐肉	3	14	200	110	110
Poultry 家禽					
Chicken egg (whole) 全隻雞蛋	3	ND	6.4	3.9	5.5
Chicken nugget 炸雞塊	3	22	110	81	81
Plain chicken 白切雞	3	17	180	79	79
Chicken steak 雞扒	3	ND	310	110	110
Roasted duck 燒鴨	3	7.8	2300	780	780
Turkey ham 火雞肉火腿	3	ND	47	16	19
Chicken franks 雞肉腸	3	11	23	17	17
Fruits 水果					
Orange 橙	3	ND	12	6.1	7.8
Apple 蘋果	3	19	160	85	85
Peanut butter 花生醬	3	7.0	46	30	30
Banana 香蕉	3	ND	ND	0	5

Sample description	No. of samples	Minimum level	Maximum level	Average DINP level (LB, ND = 0) (µg/kg)	Average DINP level (UB, ND = LOD) (µg/kg)
Pear 梨	3	ND	14	4.7	8.0
Grape 葡萄/提子	3	ND	ND	0	5
Vegetables 蔬菜					
Chinese flowering cabbage 菜心	3	9.2	18	14	14
Pak-choi / White cabbage 小白菜	3	6.7	9.5	7.8	7.8
Chinese lettuce (loose leaf) 唐生菜	3	ND	8.5	5.0	6.7
Chinese kale/ Chinese broccoli 芥蘭	3	6.7	22	16	16
Pe-tsai / Chinese cabbage /Tienntsin cabbage 大白菜/紹菜/黃芽白	3	ND	ND	0	5
Hairy gourd 節瓜	3	ND	ND	0	5
Fried Potato 炸薯	3	51	110	85	85
Potato chips 薯片	3	28	92	62	62
Cereals 穀類					
White rice 白飯	3	ND	48	24	25
White bread 白麵包	3	30	320	140	140
Rice noodles/Rice vermicelli 米粉/米線	3	ND	10	5.6	7.3
Oatmeal, instant 即食麥皮/燕麥片	3	ND	33	13	15
Instant noodles 即食麵	3	13	20	17	17
Egg noodles 全蛋麵	3	6.4	130	57	57
Macaroni 通心粉	3	ND	12	5.8	7.5
Cake 蛋糕/西餅	4	83	150	110	110
"Pineapple" bun 菠蘿包	3	48	130	77	77
Saline crackers 梳打餅	3	34	90	60	60
Cookies 曲奇餅	3	60	100	79	79
Spaghetti 意大利粉	3	6.8	11	9.0	9.0
Udon 烏冬	3	ND	5.7	3.7	5.4
Breakfast cereal 早餐麥片	3	59	270	180	180
Egg roll 蛋卷	3	7.2	62	27	27
Oils and fats 油和脂肪					
Butter 牛油	3	23	35	30	30
Lard 豬油	2	10	13	12	12
Mayonnaise 蛋黃醬／白汁沙律醬	3	27	96	57	57
Peanut oil 花生油	3	630	1500	1000	1000
Olive oil 橄欖油	5	350	1300	810	810
Margarine 人造牛油	3	14	20	18	18

Sample description	No. of samples	Minimum level	Maximum level	Average DINP level (LB, ND = 0) (μg/kg)	Average DINP level (UB, ND = LOD) (μg/kg)
Vinegar and oil salad dressing 醋和油沙律醬	3	5.4	81	54	54
Corn oil 粟米油	3	73	160	100	100
Canola/vegetable seed oil 菜籽油	3	28	42	37	37
Soybean oil 大豆油	3	75	170	120	120
Olive pomace oil 橄欖渣油	2	1100	1500	1300	1300
Condiments and sauces 調味料和醬汁					
XO Sauce XO 醬	3	67	140	110	110
Chilli oil 辣椒油	3	39	190	120	120
Snacks 零食					
Chocolate 朱古力	3	99	240	150	150
Konjac snacks 蒟蒻小食	3	ND	ND	0	5
Mixed dishes 混合材料菜式					
Hamburgers (no cheese) 漢堡包（無芝士）	3	67	270	140	140
Pizza, cheese and meat/sausage 芝士和肉/香腸薄餅	3	48	150	110	110
Microwave lunch box (Pork chop with rice) 微波爐飯盒（豬扒飯）	3	53	3800	2000	2000
Infant food 嬰兒食品					
RTE infant food 即食嬰兒食品	3	19	53	37	37
RTE infant juice drinks 即食嬰兒果汁飲品	3	ND	ND	0	5
Infant formula (milk-based) 嬰兒配方（奶類製品）	3	ND	13	4.3	7.7

(G) DIDP

Sample description	No. of samples	Minimum level	Maximum level	Average DIDP level (LB, ND = 0) (μg/kg)	Average DIDP level (UB, ND = LOD) (μg/kg)
Non-alcoholic beverages 非酒精飲品					
Soda drinks 汽水	3	ND	ND	0	5
Juice drinks 果汁飲品	3	ND	ND	0	5
Lemon tea 檸檬茶	3	ND	ND	0	5
Soya bean drink 大豆飲品	3	ND	ND	0	5
Milk tea drink 奶茶飲品	5	ND	ND	0	5
Coffee drink 咖啡飲品	5	ND	ND	0	5
Sports drinks 運動飲品	5	ND	ND	0	5
Taiwan style bubble milk tea drinks 臺式珍珠奶茶飲品	5	ND	ND	0	5
Alcoholic beverage 酒精飲品					
Chinese white wine (distilled spirits) 中式白酒（蒸餾酒）	5	ND	ND	0	5
Beer 啤酒	3	ND	ND	0	5
Red wine 紅酒	3	ND	ND	0	5
Dairy products 乳製品					
Full cream milk 全脂奶	6	ND	ND	0	5
Evaporated milk 淡奶	3	ND	ND	0	5
Condensed milk 煉奶	3	ND	ND	0	5
Milk powder (Non-infant formula) 奶粉（非嬰兒配方奶粉）	3	ND	ND	0	5
Processed cheese 加工芝士	3	ND	7.9	5.0	6.7
Cream 忌廉	3	ND	ND	0	5
Yoghurts 乳酪	3	ND	ND	0	5
Yoghurt drinks 乳酪飲品	3	ND	ND	0	5
Fish 魚類					
Grass carp 鯇魚	3	ND	ND	0	5
Golden thread 紅衫	3	ND	6.0	2.0	5.3
Fish ball / fish cake 魚蛋/魚片	3	ND	ND	0	5
fish fillet 魚柳	3	ND	ND	0	5
Fish meat paste / Minced dace 魚滑/絞鯪魚肉	3	ND	ND	0	5
Pomfret 鯧魚	3	ND	33	11	14
Yellow croaker 黃花魚	3	ND	15	5.0	8.3
Grey mullet 烏頭	3	ND	ND	0	5

Sample description	No. of samples	Minimum level	Maximum level	Average DIDP level (LB, ND = 0) (μg/kg)	Average DIDP level (UB, ND = LOD) (μg/kg)
Smoked salmon 煙三文魚	3	ND	24	8.0	11
Canned sardine 罐頭沙甸魚	3	ND	67	26	27
Canned tuna (in oil) 罐頭吞拿魚	3	ND	26	8.7	12
Crustaceans 甲殼類					
Freshwater or seawater shrimp/prawn 淡水或鹹水蝦	3	ND	ND	0	5
Freshwater or seawater crab 淡水或鹹水蟹	3	ND	ND	0	5
Seawater lobster or freshwater crawfish/ crayfish 鹹水龍蝦或淡水螯蝦/小龍蝦	3	ND	ND	0	5
Beef 牛肉					
Minced beef 免治牛肉	3	ND	23	7.7	11
Beef flank 牛腩	3	ND	8.6	4.7	6.4
Beef steak 牛扒	3	ND	6.2	2.1	5.4
Beef ball 牛肉丸	3	ND	5.8	1.9	5.3
Pork 豬肉					
Minced pork 免治豬肉	3	ND	9.5	3.2	6.5
Ham 火腿	3	ND	7.3	2.4	5.8
“Barbeque” pork 叉燒	3	ND	6.1	2.0	5.4
Pork chop 豬扒	3	ND	ND	0	5
Chinese sausage 臘腸	3	ND	ND	0	5
Pork sausage 豬肉腸	3	ND	ND	0	5
Luncheon meat 午餐肉	3	ND	ND	0	5
Poultry 家禽					
Chicken egg (whole) 全隻雞蛋	3	ND	ND	0	5
Chicken nugget 炸雞塊	3	6.3	16	12	12
Plain chicken 白切雞	3	ND	ND	0	5
Chicken steak 雞扒	3	ND	ND	0	5
Roasted duck 燒鴨	3	ND	3800	1300	1300
Turkey ham 火雞肉火腿	3	ND	71	24	27
Chicken franks 雞肉腸	3	ND	140	47	50
Fruits 水果					
Orange 橙	3	ND	ND	0	5
Apple 蘋果	3	ND	7.2	2.4	5.7
Peanut butter 花生醬	3	ND	ND	0	5
Banana 香蕉	3	ND	ND	0	5

Sample description	No. of samples	Minimum level	Maximum level	Average DIDP level (LB, ND = 0) (µg/kg)	Average DIDP level (UB, ND = LOD) (µg/kg)
Pear 梨	3	ND	ND	0	5
Grape 葡萄/提子	3	ND	ND	0	5
Vegetables 蔬菜					
Chinese flowering cabbage 菜心	3	ND	23	7.7	11
Pak-choi / White cabbage 小白菜	3	ND	130	43	47
Chinese lettuce (loose leaf) 唐生菜	3	ND	ND	0	5
Chinese kale/ Chinese broccoli 芥蘭	3	ND	11	3.7	7.0
Pe-tsai / Chinese cabbage /Tienntsin cabbage 大白菜/紹菜/黃芽白	3	ND	ND	0	5
Hairy gourd 節瓜	3	ND	ND	0	5
Fried Potato 炸薯	3	ND	50	22	23
Potato chips 薯片	3	ND	30	13	15
Cereals 穀類					
White rice 白飯	3	ND	ND	0	5
White bread 白麵包	3	ND	11	3.7	7.0
Rice noodles/Rice vermicelli 米粉/米線	3	ND	ND	0	5
Oatmeal, instant 即食麥皮/燕麥片	3	ND	ND	0	5
Instant noodles 即食麵	3	ND	ND	0	5
Egg noodles 全蛋麵	3	ND	33	19	21
Macaroni 通心粉	3	ND	ND	0	5
Cake 蛋糕/西餅	4	ND	77	24	26
"Pineapple" bun 菠蘿包	3	ND	5.3	1.8	5.1
Saline crackers 梳打餅	3	ND	25	8.3	12
Cookies 曲奇餅	3	ND	16	8.2	9.9
Spaghetti 意大利粉	3	ND	ND	0	5
Udon 烏冬	3	ND	ND	0	5
Breakfast cereal 早餐麥片	3	ND	7.7	2.6	5.9
Egg roll 蛋卷	3	ND	ND	0	5
Oils and fats 油和脂肪					
Butter 牛油	3	5.6	7.4	6.5	6.5
Lard 豬油	2	ND	ND	0	5
Mayonnaise 蛋黃醬／白汁沙律醬	3	ND	10	3.3	6.7
Peanut oil 花生油	3	36	60	48	48
Olive oil 橄欖油	5	120	1200	480	480
Margarine 人造牛油	3	ND	13	6.6	8.2

Sample description	No. of samples	Minimum level	Maximum level	Average DIDP level (LB, ND = 0) (μg/kg)	Average DIDP level (UB, ND = LOD) (μg/kg)
Vinegar and oil salad dressing 醋和油沙律醬	3	ND	16	7.8	9.5
Corn oil 粟米油	3	66	110	82	82
Canola/vegetable seed oil 菜籽油	3	23	35	30	30
Soybean oil 大豆油	3	36	59	48	48
Olive pomace oil 橄欖渣油	2	360	2000	1200	1200
Condiments and sauces 調味料和醬汁					
XO Sauce XO 醬	3	ND	44	18	20
Chilli oil 辣椒油	3	ND	31	14	16
Snacks 零食					
Chocolate 朱古力	3	14	220	84	84
Konjac snacks 蒟蒻小食	3	ND	ND	0	5
Mixed dishes 混合材料菜式					
Hamburgers (no cheese) 漢堡包（無芝士）	3	ND	12	4.0	7.3
Pizza, cheese and meat/sausage 芝士和肉/香腸薄餅	3	ND	19	6.3	9.7
Microwave lunch box (Pork chop with rice) 微波爐飯盒（豬扒飯）	3	ND	15	5.0	8.3
Infant food 嬰兒食品					
RTE infant food 即食嬰兒食品	3	ND	ND	0	5
RTE infant juice drinks 即食嬰兒果汁飲品	3	ND	ND	0	5
Infant formula (milk-based) 嬰兒配方（奶類製品）	3	ND	ND	0	5

Appendix IV

Average Phthalate Levels by Food Groups

(a) LB

Food Group	Average DEP (LB) (µg/kg)	Average DBP (LB) (µg/kg)	Average BBP (LB) (µg/kg)	Average DEHP (LB) (µg/kg)	Average DNOP (LB) (µg/kg)	Average DINP (LB) (µg/kg)	Average DIDP (LB) (µg/kg)
Non-alcoholic beverages	5.8	11	7.0	18	0.0	5.3	0.0
Alcoholic beverage	8.2	100	1.4	110	0.0	0.0	0.0
Dairy products	1.1	15	31	47	0.0	37	0.56
Fish	3.8	16	9.4	78	0.45	66	5.5
Crustaceans	6.1	17	20	25	0.0	9.3	0.0
Beef	1.2	57	12	130	0.0	230	4.1
Pork	2.0	59	18	130	0.0	470	1.1
Poultry	0.0	13	9.5	56	0.0	150	190
Fruits	5.3	5.0	5.4	46	0.0	21	0.40
Vegetables	0.0	3.7	11	66	0.0	24	11
Cereals	0.0	20	32	60	0.0	55	5.0
Oils and fats	0.69	4.9	3.7	350	2.3	330	170
Condiments and sauces	0.0	50	2.5	210	0.0	110	16
Snacks	0.0	6.9	9.0	59	0.0	77	42
Mixed dishes	0.0	48	9.0	210	1.7	750	5.1
Infant food	0.0	0.0	4.4	5.2	0.0	14	0.0

(b) UB

Food Group	Average DEP (UB) (μg/kg)	Average DBP (UB) (μg/kg)	Average BBP (UB) (μg/kg)	Average DEHP (UB) (μg/kg)	Average DNOP (UB) (μg/kg)	Average DINP (UB) (μg/kg)	Average DIDP (UB) (μg/kg)
Non-alcoholic beverages	8.3	13	10	18	5.0	8.9	5.0
Alcoholic beverage	10	100	5.5	110	5.0	5.0	5.0
Dairy products	5.1	16	31	47	5.0	39	5.2
Fish	6.6	17	11	78	5.3	67	9.4
Crustaceans	7.8	17	21	25	5.0	11	5.0
Beef	5.4	57	13	130	5.0	230	7.0
Pork	6.1	59	19	130	5.0	470	5.4
Poultry	5.0	13	11	56	5.0	160	200
Fruits	7.8	7.8	6.5	46	5.0	23	5.1
Vegetables	5.0	7.0	11	66	5.0	25	15
Cereals	5.0	21	32	60	5.0	55	8.8
Oils and fats	5.2	8.1	6.9	350	6.4	330	170
Condiments and sauces	5.0	50	6.7	210	5.0	110	18
Snacks	5.0	9.4	9.8	61	5.0	79	45
Mixed dishes	5.0	48	10	210	6.1	750	8.4
Infant food	5.0	5.0	6.6	7.9	5.0	17	5.0

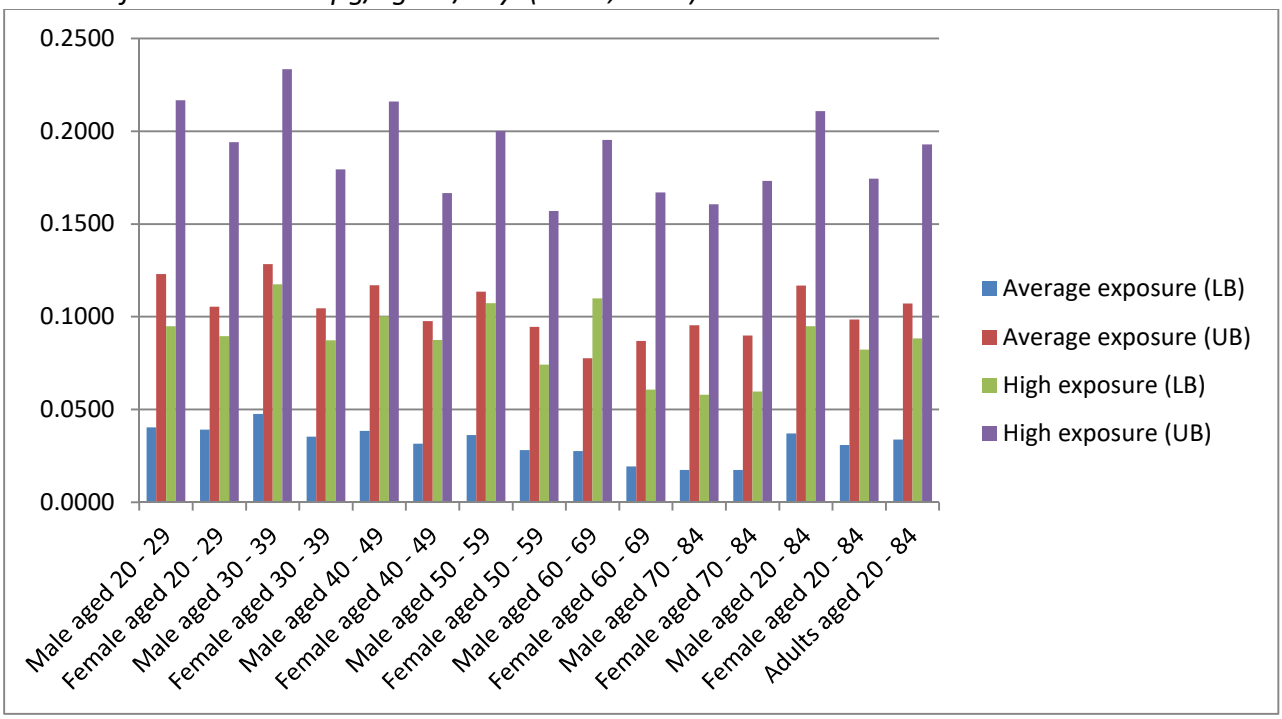
Appendix V

Dietary Exposure to Seven Phthalates in Hong Kong Adults by Various Age-gender Groups

(A) DEP

Age-gender Groups	Dietary Exposure to DEP (µg/kg bw/day)	
	Average (LB-UB)	High Consumer (P95) (LB-UB)
Male aged 20 - 29	0.0404 - 0.1230	0.0949 - 0.2166
Female aged 20 - 29	0.0391 - 0.1055	0.0895 - 0.1940
Male aged 30 - 39	0.0477 - 0.1283	0.1175 - 0.2334
Female aged 30 - 39	0.0353 - 0.1045	0.0873 - 0.1794
Male aged 40 - 49	0.0385 - 0.1170	0.1002 - 0.2161
Female aged 40 - 49	0.0316 - 0.0976	0.0874 - 0.1666
Male aged 50 - 59	0.0363 - 0.1136	0.1073 - 0.2002
Female aged 50 - 59	0.0280 - 0.0944	0.0741 - 0.1570
Male aged 60 - 69	0.0276 - 0.0776	0.1099 - 0.1952
Female aged 60 - 69	0.0193 - 0.0870	0.0607 - 0.1671
Male aged 70 - 84	0.0175 - 0.0953	0.0580 - 0.1606
Female aged 70 - 84	0.0174 - 0.0899	0.0597 - 0.1733
Male aged 20 - 84	0.0371 - 0.1168	0.0949 - 0.2108
Female aged 20 - 84	0.0308 - 0.0984	0.0823 - 0.1744
Adults aged 20 - 84	0.0338 - 0.1071	0.0883 - 0.1929

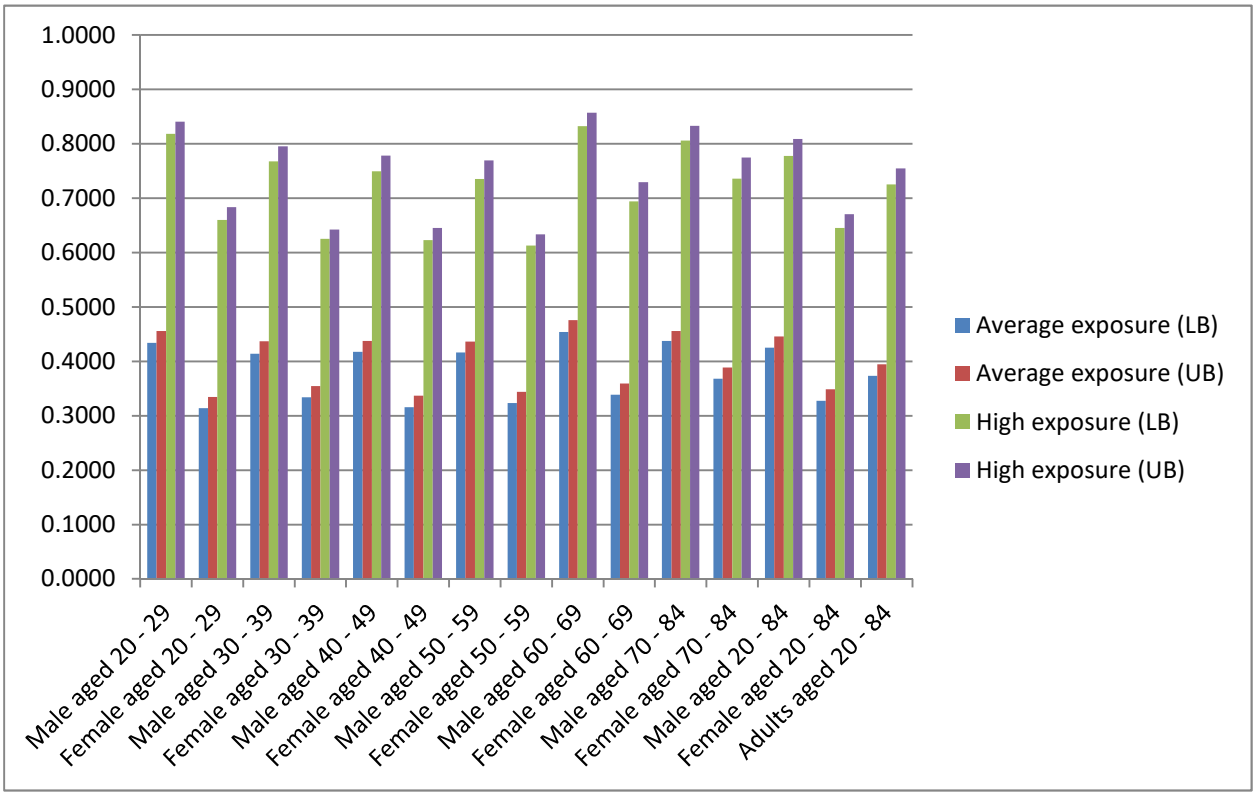
The TDI for DEP is 5 000 µg/kg bw/day. (WHO, 2003)



(B) DBP

Age-gender Groups	Dietary Exposure to DBP (µg/kg bw/day)	
	Average (LB-UB)	High Consumer (P95) (LB-UB)
Male aged 20 - 29	0.4343 - 0.4560	0.8186 - 0.8407
Female aged 20 - 29	0.3137 - 0.3344	0.6603 - 0.6838
Male aged 30 - 39	0.4141 - 0.4369	0.7680 - 0.7956
Female aged 30 - 39	0.3337 - 0.3547	0.6250 - 0.6427
Male aged 40 - 49	0.4174 - 0.4375	0.7496 - 0.7781
Female aged 40 - 49	0.3158 - 0.3367	0.6229 - 0.6456
Male aged 50 - 59	0.4163 - 0.4364	0.7352 - 0.7698
Female aged 50 - 59	0.3231 - 0.3441	0.6128 - 0.6337
Male aged 60 - 69	0.4541 - 0.4756	0.8325 - 0.8574
Female aged 60 - 69	0.3385 - 0.3592	0.6944 - 0.7298
Male aged 70 - 84	0.4374 - 0.4561	0.8060 - 0.8333
Female aged 70 - 84	0.3682 - 0.3890	0.7362 - 0.7750
Male aged 20 - 84	0.4251 - 0.4460	0.7777 - 0.8090
Female aged 20 - 84	0.3277 - 0.3485	0.6453 - 0.6709
Adults aged 20 - 84	0.3735 - 0.3944	0.7254 - 0.7549

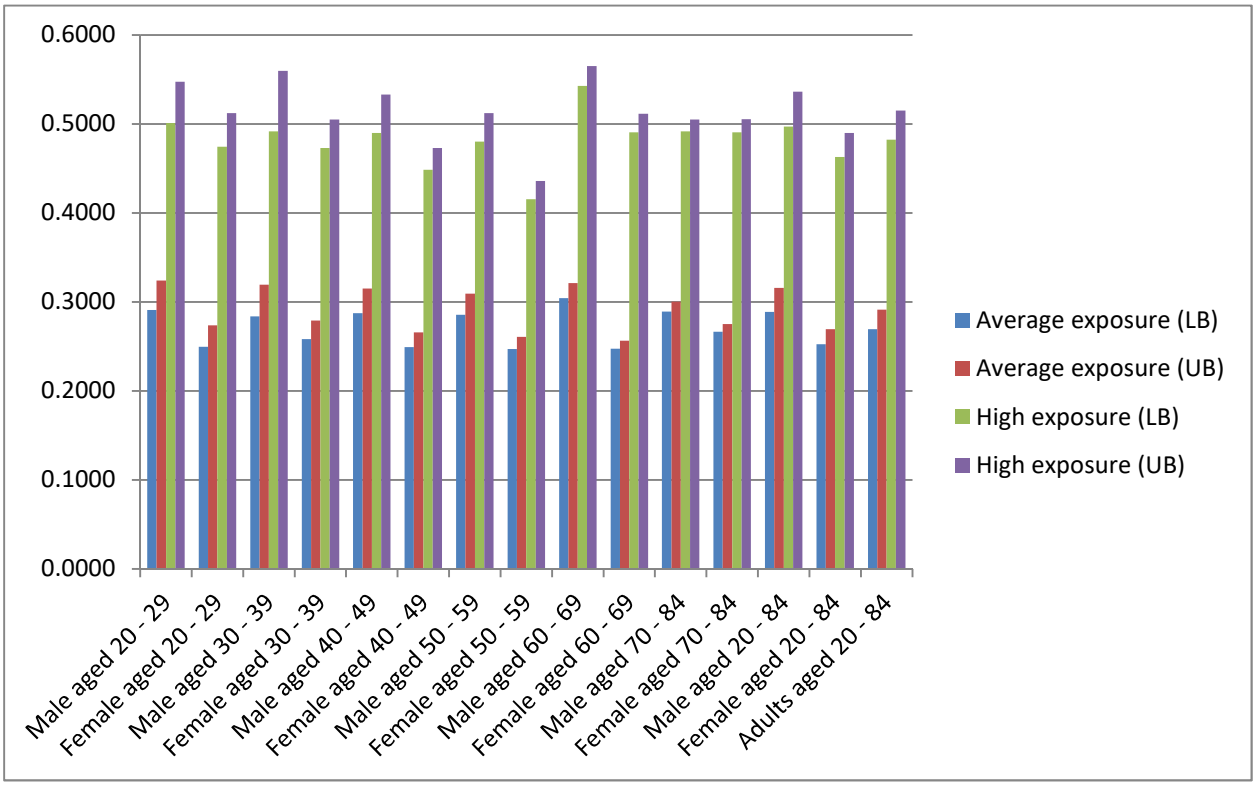
The TDI for DBP is 10 µg/kg bw/day. (EFSA, 2005a)



(C) BBP

Age-gender Groups	Dietary Exposure to BBP (µg/kg bw/day)	
	Average (LB-UB)	High Consumer (P95) (LB-UB)
Male aged 20 - 29	0.2910 - 0.3241	0.5010 - 0.5475
Female aged 20 - 29	0.2494 - 0.2735	0.4743 - 0.5122
Male aged 30 - 39	0.2835 - 0.3193	0.4918 - 0.5598
Female aged 30 - 39	0.2580 - 0.2789	0.4729 - 0.5049
Male aged 40 - 49	0.2874 - 0.3151	0.4899 - 0.5330
Female aged 40 - 49	0.2491 - 0.2658	0.4485 - 0.4729
Male aged 50 - 59	0.2853 - 0.3094	0.4802 - 0.5122
Female aged 50 - 59	0.2470 - 0.2608	0.4154 - 0.4360
Male aged 60 - 69	0.3043 - 0.3210	0.5427 - 0.5649
Female aged 60 - 69	0.2472 - 0.2564	0.4906 - 0.5114
Male aged 70 - 84	0.2890 - 0.3002	0.4916 - 0.5050
Female aged 70 - 84	0.2665 - 0.2751	0.4905 - 0.5053
Male aged 20 - 84	0.2887 - 0.3156	0.4969 - 0.5363
Female aged 20 - 84	0.2524 - 0.2695	0.4628 - 0.4898
Adults aged 20 - 84	0.2695 - 0.2912	0.4822 - 0.5152

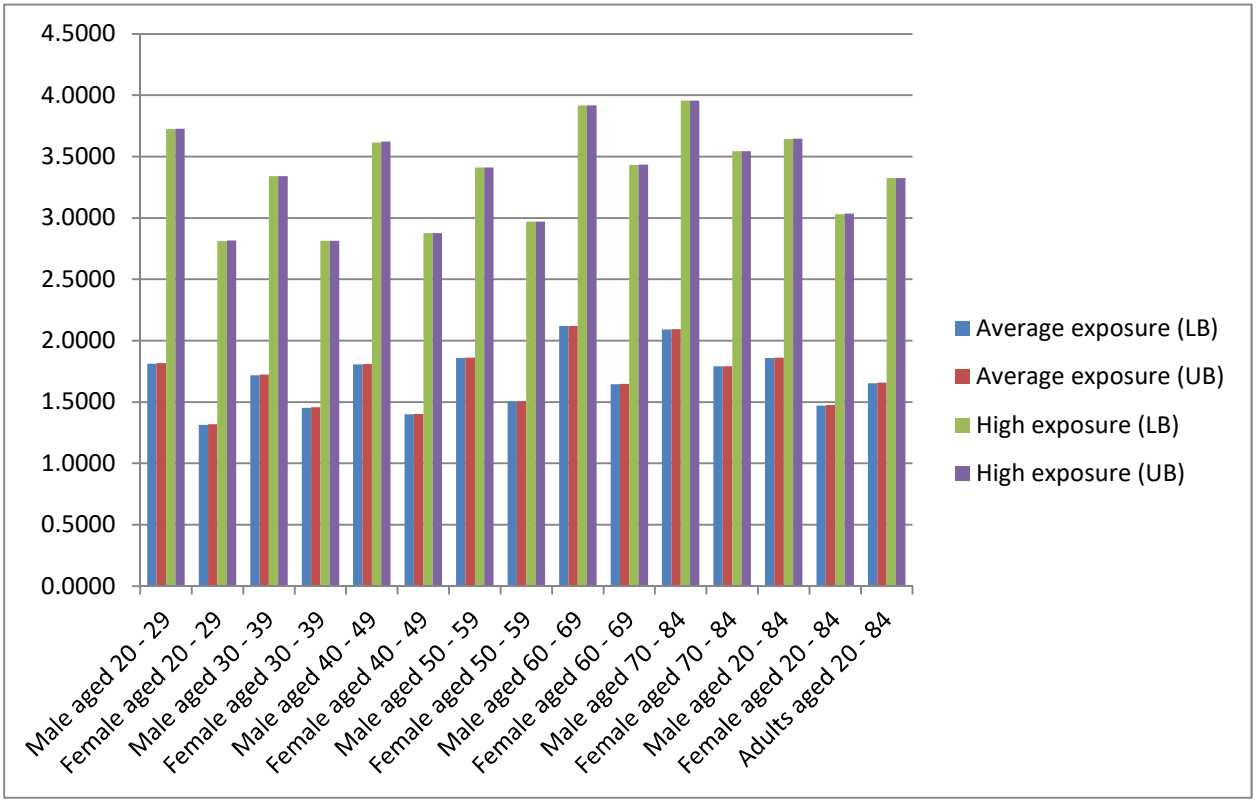
The TDI for BBP is 500 µg/kg bw/day. (EFSA, 2005b)



(D) DEHP

Age-gender Groups	Dietary Exposure to DEHP (µg/kg bw/day)	
	Average (LB-UB)	High Consumer (P95) (LB-UB)
Male aged 20 - 29	1.8115 - 1.8186	3.7236 - 3.7274
Female aged 20 - 29	1.3132 - 1.3189	2.8106 - 2.8162
Male aged 30 - 39	1.7178 - 1.7241	3.3404 - 3.3404
Female aged 30 - 39	1.4520 - 1.4565	2.8152 - 2.8152
Male aged 40 - 49	1.8067 - 1.8105	3.6139 - 3.6232
Female aged 40 - 49	1.4000 - 1.4032	2.8763 - 2.8763
Male aged 50 - 59	1.8596 - 1.8621	3.4121 - 3.4121
Female aged 50 - 59	1.5043 - 1.5067	2.9711 - 2.9711
Male aged 60 - 69	2.1198 - 2.1211	3.9185 - 3.9185
Female aged 60 - 69	1.6463 - 1.6476	3.4327 - 3.4342
Male aged 70 - 84	2.0925 - 2.0934	3.9565 - 3.9565
Female aged 70 - 84	1.7913 - 1.7925	3.5456 - 3.5456
Male aged 20 - 84	1.8588 - 1.8629	3.6450 - 3.6454
Female aged 20 - 84	1.4717 - 1.4752	3.0313 - 3.0357
Adults aged 20 - 84	1.6537 - 1.6575	3.3254 - 3.3254

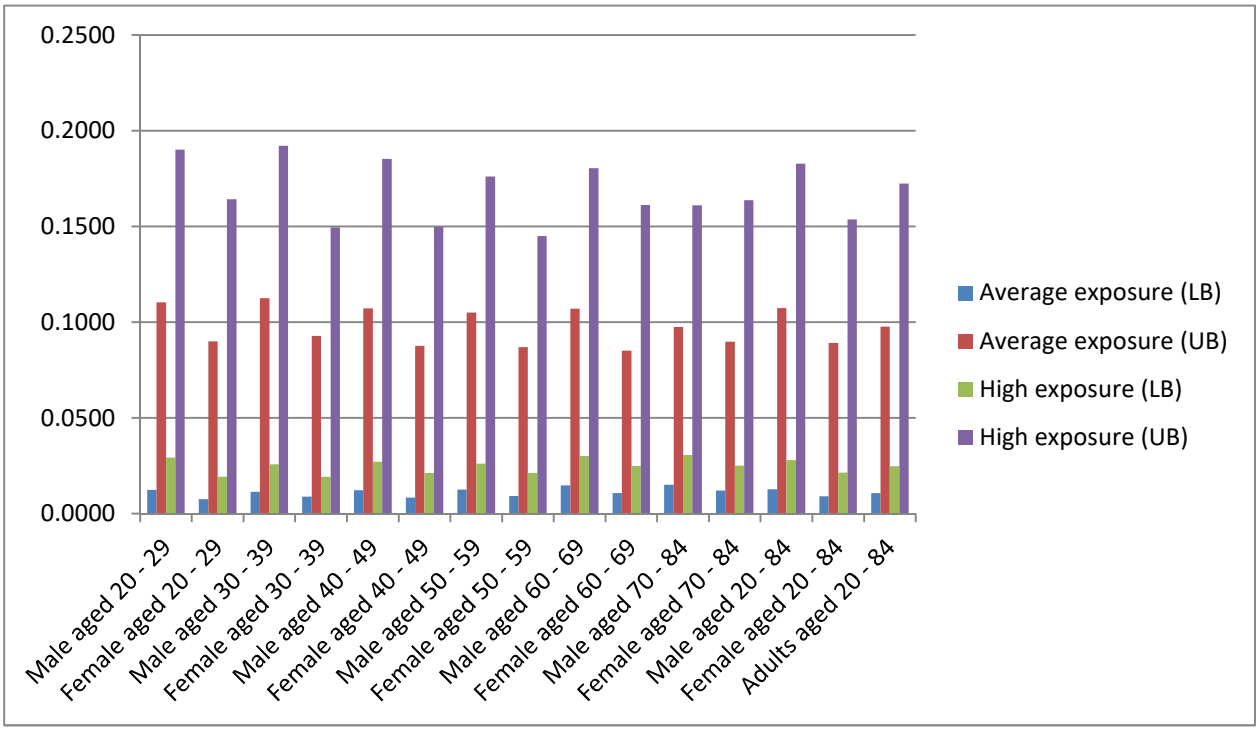
The TDI for DEHP is 25 µg/kg bw/day. (WHO, 2011)



(E) DNOP

Age-gender Groups	Dietary Exposure to DNOP (µg/kg bw/day)	
	Average (LB-UB)	High Consumer (P95) (LB-UB)
Male aged 20 - 29	0.0125 - 0.1105	0.0294 - 0.1902
Female aged 20 - 29	0.0076 - 0.0901	0.0194 - 0.1643
Male aged 30 - 39	0.0114 - 0.1127	0.0259 - 0.1921
Female aged 30 - 39	0.0089 - 0.0928	0.0192 - 0.1495
Male aged 40 - 49	0.0123 - 0.1072	0.0271 - 0.1853
Female aged 40 - 49	0.0084 - 0.0877	0.0213 - 0.1499
Male aged 50 - 59	0.0127 - 0.1050	0.0261 - 0.1762
Female aged 50 - 59	0.0093 - 0.0871	0.0214 - 0.1449
Male aged 60 - 69	0.0149 - 0.1070	0.0302 - 0.1805
Female aged 60 - 69	0.0107 - 0.0851	0.0250 - 0.1612
Male aged 70 - 84	0.0151 - 0.0975	0.0307 - 0.1610
Female aged 70 - 84	0.0121 - 0.0899	0.0252 - 0.1637
Male aged 20 - 84	0.0128 - 0.1075	0.0280 - 0.1828
Female aged 20 - 84	0.0091 - 0.0892	0.0215 - 0.1538
Adults aged 20 - 84	0.0108 - 0.0978	0.0248 - 0.1724

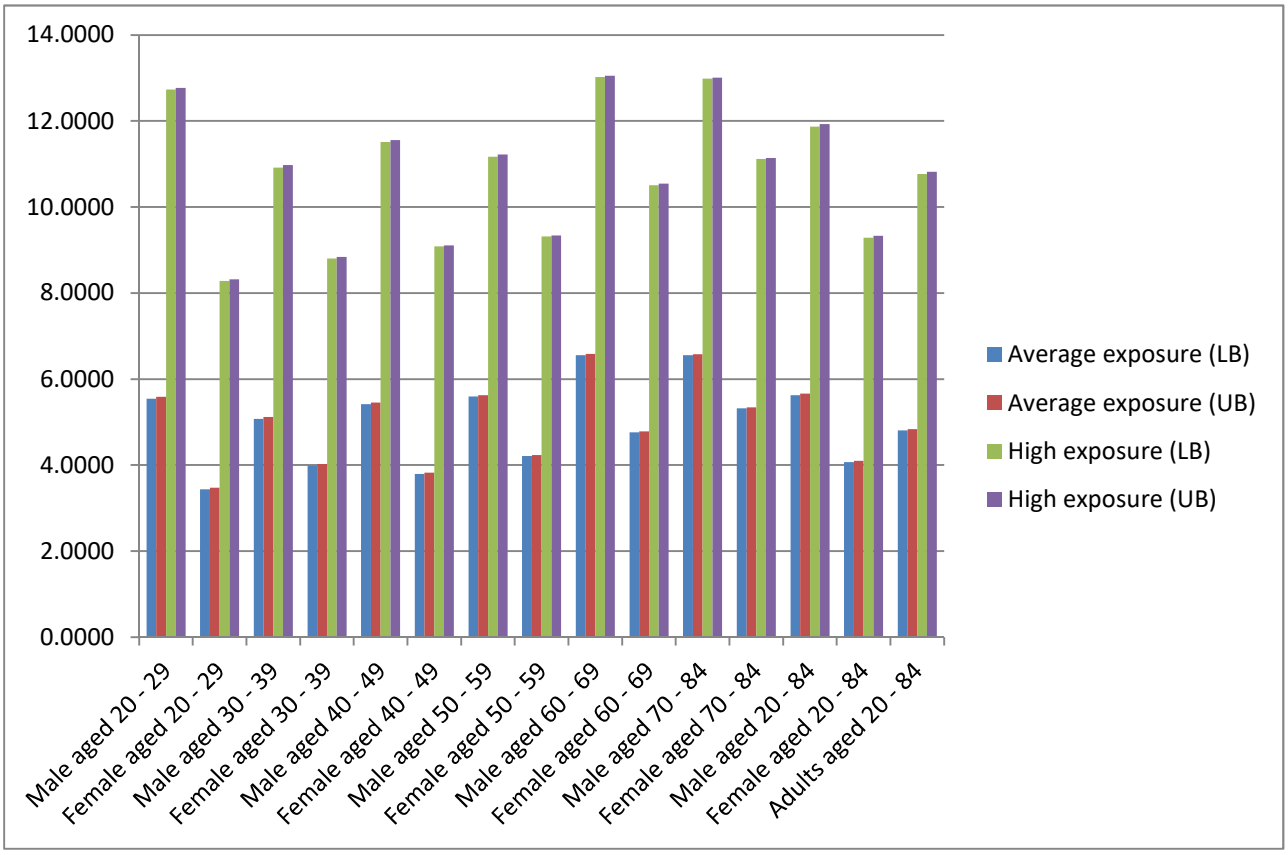
The Minimal Risk Level (intermediate duration) for DNOP is 400 µg/kg bw/day. (ATSDR, 1997)



(F) DINP

Age-gender Groups	Dietary Exposure to DINP (µg/kg bw/day)	
	Average (LB-UB)	High Consumer (P95) (LB-UB)
Male aged 20 - 29	5.5441 - 5.5860	12.7308 - 12.7701
Female aged 20 - 29	3.4408 - 3.4744	8.2834 - 8.3227
Male aged 30 - 39	5.0766 - 5.1219	10.9173 - 10.9758
Female aged 30 - 39	3.9920 - 4.0242	8.8061 - 8.8389
Male aged 40 - 49	5.4137 - 5.4521	11.5127 - 11.5525
Female aged 40 - 49	3.7970 - 3.8258	9.0855 - 9.1049
Male aged 50 - 59	5.5921 - 5.6271	11.1664 - 11.2175
Female aged 50 - 59	4.2118 - 4.2378	9.3151 - 9.3350
Male aged 60 - 69	6.5561 - 6.5860	13.0227 - 13.0526
Female aged 60 - 69	4.7653 - 4.7870	10.5065 - 10.5415
Male aged 70 - 84	6.5559 - 6.5792	12.9837 - 13.0041
Female aged 70 - 84	5.3221 - 5.3440	11.1204 - 11.1429
Male aged 20 - 84	5.6279 - 5.6653	11.8703 - 11.9268
Female aged 20 - 84	4.0737 - 4.1024	9.2833 - 9.3320
Adults aged 20 - 84	4.8044 - 4.8372	10.7642 - 10.8208

The TDI for DINP is 150 µg/kg bw/day. (EFSA, 2005d)



(G) DIDP

Age-gender Groups	Dietary Exposure to DIDP (µg/kg bw/day)	
	Average (LB-UB)	High Consumer (P95) (LB-UB)
Male aged 20 - 29	0.1336 - 0.2266	0.8899 - 0.9851
Female aged 20 - 29	0.0655 - 0.1419	0.1800 - 0.2852
Male aged 30 - 39	0.1124 - 0.2083	0.6217 - 0.7025
Female aged 30 - 39	0.0772 - 0.1550	0.3082 - 0.4124
Male aged 40 - 49	0.1072 - 0.1967	0.5871 - 0.6908
Female aged 40 - 49	0.0935 - 0.1669	0.6040 - 0.6981
Male aged 50 - 59	0.1311 - 0.2175	0.7770 - 0.8793
Female aged 50 - 59	0.1000 - 0.1718	0.3669 - 0.4340
Male aged 60 - 69	0.1040 - 0.1898	0.4828 - 0.6079
Female aged 60 - 69	0.0671 - 0.1355	0.1808 - 0.2823
Male aged 70 - 84	0.0807 - 0.1574	0.3011 - 0.3953
Female aged 70 - 84	0.0538 - 0.1255	0.1454 - 0.2473
Male aged 20 - 84	0.1145 - 0.2037	0.6810 - 0.7529
Female aged 20 - 84	0.0797 - 0.1538	0.2795 - 0.3567
Adults aged 20 - 84	0.0961 - 0.1773	0.4876 - 0.5721

The TDI for DIDP is 150 µg/kg bw/day. (EFSA, 2005e)