Report to the

U.S. Consumer Product Safety Commission

by the

CHRONIC HAZARD ADVISORY PANEL ON PHTHALATES

AND PHTHALATE ALTERNATIVES

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APPENDIX E3

PHTHALATE DIETARY EXPOSURE

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
4330 EAST WEST HIGHWAY
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Memorandum

Date: July 14, 2014

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THROUGH: Mary Ann Danello, Ph.D., Associate Executive Director, Directorate for Health Sciences MAD

FROM : Kent R. Carlson, Ph.D., Toxicologist, Directorate for Health Sciences KRC

SUBJECT : U.S. CPSC Staff Assessment of Phthalate Dietary Exposure Using Two Food Residue Datasets and Three Food Categorization Schemes[*†]

The following memo provides the U.S. Consumer Product Safety Commission's (CPSC's) Health Sciences staff assessment of the dietary exposure to various phthalates. The information in this report will be provided to the Chronic Hazard Advisory Panel (CHAP) on Phthalates.

A detailed dietary exposure assessment was requested by the CHAP in order to evaluate the relationship of dietary phthalate exposure to total phthalate exposure.

[*] These comments are those of the CPSC staff, have not been reviewed or approved by, and may not necessarily reflect the views of, the Commission.

[†] Leslie E. Patton, Ph.D., Toxicologist, who is no longer with CPSC, contributed to this report.

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ABBREVIATIONS*

3β-HSD	3β-hydroxysteroid dehydrogenase
AA	antiandrogenicity; antiandrogenic
ADHD	attention deficit hyperactivity disorder
ADI	acceptable daily intake
AGD	anogenital distance
AGI	anogenital index
ASD	Autistic Spectrum Disorders
ASTDR	Agency for Toxic Substances and Disease Registry
ATBC	acetyl tributyl citrate
BASC-PRS	Behavior Assessment System for Children-Parent Rating Scales
BBP	butylbenzyl phthalate
BIBRA	British Industrial Biological Research Association
BMD	benchmark dose
BMDL	benchmark dose (lower confidence limit)
BNBA	Brazelton Neonatal Behavioral Assessment
BRIEF	Behavior Rating Inventory of Executive Function
BSI	behavioral symptoms index
CBCL	Child Behavior Check List
CDC	Centers for Disease Control and Prevention, U.S.
CERHR	Center for the Evaluation of Risks to Human Reproduction
CF	consumption factor
CHAP	Chronic Hazard Advisory Panel
CHO	Chinese hamster ovary
CNS	central nervous system
CPSC	Consumer Product Safety Commission, U.S.
CPSIA	Consumer Product Safety Improvement Act of 2008
CRA	cumulative risk assessment
CSL	cranial suspensory ligament
cx-MIDP	mono(carboxy-isononyl) phthalate (also, CNP, MCNP)
cx-MINP	mono(carboxy-isooctyl) phthalate (also COP, MCOP)
DAP	diallyl phthalate
DBP	dibutyl phthalate
DCHP	dicyclohexyl phthalate
DDP	di-*n*-decyl phthalate
DEHA	di(2-ethylhexyl) adipate
DEHP	di(2-ethylhexyl) phthalate
DEHT	di(2-ethylhexyl) terephthalate
DEP	diethyl phthalate
DHEPP	di-*n*-heptyl phthalate
DHEXP	di-*n*-hexyl phthalate
DHT	dihydrotestosterone

* List applies to main report and all appendices.

DI	daily intake
DIBP	diisobutyl phthalate
DIDP	diisodecyl phthalate
DIHEPP	diisoheptyl phthalate
DIHEXP	diisohexyl phthalate
DINP	diisononyl phthalate
DINCH®	1,2-cyclohexanedicarboxylic acid, diisononyl ester
DINX	1,2-cyclohexanedicarboxylic acid, diisononyl ester
DIOP	diisooctyl phthalate
DIPP	diisopropyl phthalate
DMP	dimethyl phthalate
DNHEXP	di-*n*-hexyl phthalate
DNOP	di-*n*-octyl phthalate
DOTP	di(2-ethylhexyl) terephthalate
DPENP	di-*n*-pentyl phthalate
DPHP	di(2-propylheptyl) phthalate
DPS	delayed preputial separation
DSP	decrease spermatocytes and spermatids
DVO	delayed vaginal opening
ECHA	European Chemicals Agency
ECMO	extracorporeal membrane oxygenation
ED_{50}	median effective dose
EPA	Environmental Protection Agency, U.S.
EPW	epididymal weight
FDA	Food and Drug Administration, U.S.
f_{ue}	urinary excretion factor
GD	gestational day
GGT	gamma-glutamyl transferase
GLP	good laboratory practices
grn	granulin
HBM	human biomonitoring
hCG	human chorionic gonadotrophin
HI	hazard index
HMW	high molecular weight
HPV	high production volume
HQ	hazard quotient
IARC	International Agency for Research on Cancer
ICH	International Conference on Harmonisation
insl3	insulin-like factor 3
IP	intraperitoneally
JRC	Joint Research Centre
LD	lactation day
LH	luteinizing hormone
LMW	low molecular weight
LOAEL	lowest observed adverse effect level
LOD	level/limit of detection

LOQ	level/limit of quantitation
MBP	monobutyl phthalate
MBZP	monobenzyl phthalate
MCPP	mono(3-carboxypropyl) phthalate
MDI	mental development index
MECPP	mono(2-ethyl-5-carboxypentyl) phthalate
MEHP	mono(2-ethylhexyl) phthalate
MEHHP	mono(2-ethyl-5-hydroxyhexyl) phthalate
MEOHP	mono(2-ethyl-5-oxohexyl) phthalate
MEP	monoethyl phthalate
MIBP	monoisobutyl phthalate
MINP	mono(isononyl) phthalate
MIS	Mullerian inhibiting substance
MMP	monomethyl phthalate
MNG	multinucleated gonocyte
MNOP	mono-*n*-octyl phthalate
MOE	margin of exposure
MSSM	Mount Sinai School of Medicine
MW	molecular weight
NA	not available
NAE	no antiandrogenic effects observed
NCEA	National Center for Environmental Assessment
NHANES	National Health and Nutritional Examination Survey
NNNS	NICU Network Neurobehavioral Scale
NOAEL	no observed adverse effect level
NOEL	no observed effect level
NR	nipple retention
NRC	National Research Council, U.S.
NTP	National Toxicology Program, U.S.
OECD	Organisation for Economic Cooperation and Development
OH-MIDP	mono(hydroxy-isodecyl) phthalate
OH-MINP	mono(hydroxy-isononyl) phthalate
OR	odds ratio
oxo-MIDP	mono(oxo-isodecyl) phthalate
oxo-MINP	mono(oxo-isononyl) phthalate
PBR	peripheral benzodiazepine receptor
PDI	psychomotor developmental index
PE	phthalate ester
PEAA	potency estimates for antiandrogenicity
PND	postnatal day
PNW	postnatal week
POD	point of departure
PODI	point of departure index
PPARα	peroxisome proliferator-activated receptor alpha
PPS	probability proportional to a measure of size
PSU	primary sampling unit

PVC	polyvinyl chloride
RfD	reference dose
RTM	reproductive tract malformation
SD	Sprague-Dawley
SDN-POA	sexually dimorphic nucleus of the preoptic area
SFF	Study for Future Families
SR-B1	scavenger receptor class B1
SRS	social responsiveness scale
StAR	steroidogenic acute regulatory protein
SVW	seminal vesicle weight
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TDI	tolerable daily intake
TDS	testicular dysgenesis syndrome
TEF	toxicity equivalency factors
TOTM	tris(2-ethylhexyl) trimellitate
TPIB	2,2,4-trimethyl-1,3 pentanediol diisobutyrate
T PROD	testosterone production
TXIB®	2,2,4-trimethyl-1,3 pentanediol diisobutyrate
UF	uncertainty factor

1 Introduction

The Consumer Product Safety Improvement Act (CPSIA)[*] of (2008) was enacted on August 14, 2008. Section 108 of the CPSIA permanently prohibits the sale of any "children's toy or child care article" containing concentrations of more than 0.1 percent of dibutyl phthalate (DBP), butylbenzyl phthalate (BBP), or di(2-ethylhexyl) phthalate (DEHP). Section 108 prohibits on an interim basis the sale of "any children's toy that can be placed in a child's mouth" or "child care article" containing concentrations of more than 0.1 percent of di-*n*-octyl phthalate (DNOP), diisononyl phthalate (DINP), or diisodecyl phthalate (DIDP). In addition, Section 108 of the CPSIA directs Consumer Product Safety Commission (CPSC) to convene a Chronic Health Advisory Panel (CHAP) "to study the effects on children's health of all phthalates and phthalate alternatives as used in children's toys and child care articles." The CHAP will recommend to the Commission whether any phthalates (including DINP) or phthalate alternatives other than those permanently banned should be declared banned hazardous substances.

In order to fulfill part of this charge, the CHAP is considering exposure to phthalates from all routes, including the diet (food). The CHAP has requested that CPSC staff utilize phthalate residues in food items (as reported in the published literature) to calculate dietary exposure to phthalate residues.

In this memo, the CPSC staff have provided analyses for seven target populations of interest (infants, toddlers, children, teen females, teen males, adult females, adult males). For each one, the following information has been provided in either numeric or graphical constructs:

1) Total average and 95th percentile dietary exposure (organized by phthalate for the UK food item/residue dataset);
2) Total average and 95th percentile dietary exposure (organized by phthalate for the P&L food item/residue dataset);
3) The relative change in exposure (percent of #1 and #2) when some food items are removed from the analysis;
4) The relative contribution of each phthalate to the total exposure from diet (using different food categorization schemes and food item/residue datasets); and
5) The relative contribution of each phthalate to exposure for each food category (*i.e.*, breads, meats, etc; using different food categorization schemes and food item/residue datasets).

[*] Public Law 110-314.

2 Methods

2.1 Food Item Phthalate Residues: Bradley, Page and LaCroix

CPSC staff utilized two datasets of phthalate residues in food items (Page and Lacroix, 1995; Bradley, 2011) to calculate potential phthalate exposures that result from food consumption. Exposures calculated from both datasets are presented for the CHAP's consideration.

2.1.1 Bradley, 2011 (UK)

The Bradley (2011) dataset (hereafter referred to as the UK study) is a total diet study carried out in the United Kingdom and contains the most recently reported food residue data that CPSC staff could identify. In the study, 261 retail food items were analyzed for 15 phthalate diesters (dimethyl phthalate [DMP], diethyl phthalate [DEP], diisopropyl phthalate [DIPP], diallyl phthalate [DAP], diisobutyl phthalate [DIBP], DBP, di-*n*-pentyl phthalate [DPP], di-*n*-hexyl phthalate [DHEXP], BBP, dicyclohexyl phthalate [DCHP], DEHP, DNOP, DINP, DIDP, and di-*n*-decyl phthalate [DDP]). Nine phthalate monoesters and phthalic acid were also determined in food items. Distinct food items in this study were categorized as bread products, dairy products, fish and fish products, infant food, infant formula, meat and meat products, miscellaneous cereal products, oils and fat products, liver products, or eggs. Consumption estimates for these food categories were not provided, however.

2.1.2 Page and LaCroix, 1995 (P&L)

The dataset in Page and LaCroix (1995) analyzed phthalate residues in a wide variety of foods, making the data useful despite their age. The P&L study analyzed 98 food items for DEP, BBP, DBP, and DEHP, as well as the nonphthalate plasticizer diethylhexyl adipate (DEHA). The food they analyzed was primarily packaged and fell into the following general categories: cheese, meat, fish, frozen foods (meat, fish, poultry), beverages (soda, juice, bottled water, wine), fruits and vegetables, oil and fat, bread, dairy, and infant food. As with the UK dataset, consumption estimates were not published for these particular food categories.

2.2 Food Categorization and Consumption Estimates: NCEA, Clark, Wormuth

CPSC staff recombined food items from both food item/residue datasets into alternate food categories that had published consumption estimates (see Table ES-5 and Section 4.1). Unknown food items were researched online in order to bin them into the "correct" food categories.

2.2.1 NCEA, 2007

The first and simplest food categorization scheme was based on the food groups used by U.S. EPA National Center for Environmental Assessment ([NCEA], 2007) in the publication *Analysis of Total Food Intake and Composition of Individual's Diet Based on USDA's 1994–1996, 1998 Continuing Survey of Food Intakes by Individuals (CSFII).* In this reference, food was divided into the following (total) categories: grain, dairy, fish, meat, fat, vegetable, fruit, soy, nut, and eggs.

2.2.2 Clark *et al.*, 2011

The second categorization scheme, intermediate in complexity, was retrieved from Clark *et al.* (2011). This paper categorized food as tap water, beverages, cereals, dairy products (excluding milk), eggs, fats/oils, fish, fruits, grains, meats, milk, nuts and beans, other foods, poultry, processed meats, vegetables, infant formula (powder), or breast milk.

2.2.3 Wormuth *et al.*, 2006

The third, and most complex, food categorization scheme was taken from a 2006 publication by Wormuth *et al.* (2006). The authors in this study categorized food into the following groups: pasta/ rice, cereals, breakfast cereals, bread, biscuits/crispy bread, cakes/ buns/puddings, bakeries/snacks, milk/milk beverages, cream, ice cream, yogurt, cheese, eggs, spreads, animal fats, vegetable oils, meat/meat products, sausage, poultry, fish, vegetables, potatoes, fruits, nuts/nut spreads, preserves/sugar, confectionary, spices, soups/sauces, juices, tea/coffee, soft drinks, beer, wine, spirits, tap water, bottled water, commercial infant food, infant formulas, and breast milk.

2.3 Food Categories with No Food Items/Residues

Both the UK (2011) and P&L (1995) food item/residue datasets had gaps in the representation of available food commodities. These gaps in food or beverage coverage sometimes affected the number of food items per category in all categorization schemes.

A few of NCEA (2007) categories were not represented by food item/residue data. These included vegetable, fruit, soy, nut (UK dataset); and soy, nut (P&L dataset). As with NCEA groupings, a few of the Clark categories did not have food item/residue data. These included tap water, beverages, fruit, nuts and beans, vegetables, breast milk (UK dataset); tap water, nuts and beans, breast milk (P&L dataset). A few of Wormuth *et al.* (2006) categories were also not filled by food item/residue data. These were ice cream, vegetables, potatoes, fruits, nuts and nut spreads, preserves and sugar, confectionary, spices, soups and sauces, juices, tea and coffee, soft drinks, beer, wine, spirits, tap water, bottled water, breast milk (UK dataset); vegetable oils, spices, spirits, tap water, breast milk (P&L dataset). Even though the P&L dataset was comprised of fewer actual samples, representative category coverage was better than that provided by the UK dataset. Categories that were not represented by at least one food item were excluded from further analysis.

2.4 Summary Statistics from Food Item/Residue Data

Prior to data summarization, all food items in both datasets with "nondetects" were assigned a value of one-half the Level of Detection (LOD) or one-half the Level of Quantification (LOQ), depending on which was reported. Replacing nondetects into one-half the LOD/LOQ is one method commonly initially employed in conservative dietary exposure assessments to ensure that the exposures are not underestimated (by using zeros for nondetects) or overestimated (biased high by a few reported residue values) (EPA, 2000). Replacement is justified when there is the expectation that residues are present, but below the LOD (*e.g.*, a crop has been treated with a pesticide, but pesticide residues are not detected on the crop). This expectation holds for phthalates because they are ubiquitous in the environment and, therefore, ubiquitous in food commodities. Because of replacement, most categories were represented predominantly by one-

half the LOD or LOQ values. It is expected that the effects of replacement substantially affected the summary residue values for many food categories that were comprised of fewer food items (without doing a sensitivity analysis). Broader categorization schemes (*e.g.*, EPA, 2007), however, were expected to be less affected by the replacement of nondetects with one-half the LOD/LOQ.

Residues that were "not confirmed" in the UK dataset were left as is and combined with nondetects (one-half the LOD/LOQ), and detects. Many of these "not confirmed" residues had concentrations that were similar to other reported residue concentrations within the same category.

Ultimately, individual phthalate diester residues, including one-half LOD/LOQ values and values listed as "not confirmed" were combined within each food category and reported as both the average and 95th percentile. Monoester and phthalic acid residues in foods (conceivably created by catalytic activity in the food) were not considered in this exposure assessment summarization.

2.5 Calculation of Phthalate Exposure Estimates from Food

2.5.1 Phthalate Concentration in Food

For each population and residue dataset, daily average dietary exposures (µg/kg-d) and daily 95th percentile phthalate exposures (µg/kg-d) from the ingestion of food item *f* were calculated for each individual phthalate ester *i* and summed:

$$\frac{\text{Phthalate}_i \text{ Concentration in Food}_f \text{ (µg/g)} \times \text{Food Consumption}_f \text{ (g/day)} \times \text{Absorption Factor}_f}{\text{Body Weight (kg)}}$$

2.5.2 Consumption Factors for Conversion to Per-Capita (eaters + non-eaters)

Dietary exposures using the Wormuth scheme of product categorization were also expressed using a consumption factor (CF) to account for the fraction of the population eating the specific food type. Consumption factors were obtained from the Wormuth *et al.* (2006) paper and applied using the following equation:

$$\frac{\text{Phthalate}_i \text{ Concentration in Food}_f \text{ (µg/g)} \times \text{Food Consumption}_f \text{ (g/day)} \times \text{Absorption Factor}_f \times \text{CF}_f}{\text{Body Weight (kg)}}$$

No CFs were available for the Clark food categorizations, and therefore, a CF of 1 was used. This conservative assumption meant that 100% of the given population would consume a specific food item. NCEA consumption estimates were already expressed as per-capita so did not need the application of a CF.

2.5.3 Food Consumption

Population-based food consumption estimates specific to each of the seven populations of interest were extracted from the three sources of food categories (U.S. EPA/NCEA, [2007]; Clark *et al.* [2003]; Wormuth *et al.* [2006]; see Table E3-1).

2.5.4 Phthalate Absorption

Phthalate absorption was considered separately in two manners, at 100% (1), and as a factor calculated from the mean oral uptake rate (*i.e.*, the fraction of dose applied) derived from Wormuth *et al.*(2006). Both of these factors were unitless. When no information on absorption was identified for a specific phthalate, a value of 1 was used, indicating a conservative 100% absorption of the phthalate.

2.5.5 Body Weight

Body weight information used in exposure calculations was derived from each respective study (U.S. EPA/NCEA [2007]; Clark *et al.* [2011]; and Wormuth *et al.* [2006]). This information is summarized in Table E3-1 along with the associated age ranges for the populations.

Table E3-1 Population age and body weight used to calculate phthalate exposure.

Population	Age in Years (M&F combined)			Body Weights (kg; Gender)		
	NCEA (2007)	Clark *et al.* (2011)	Wormuth *et al.* (2006)	NCEA (2007)	Clark *et al.* (2011)	Wormuth *et al.* (2006)
Infant	<1	0–0.5	0–1	8.8	7.5	5.5
Toddler	1–5	0.5–4	1–3	15.15	15	13
Children	6–11	5–11	4–10	29.7	27	27
Teen	12–19	12–19	11–18	59.7	60	57.5
Adult	20+	20–70	18–80	73	71	70 (M), 60 (F)

2.5.6 Other Factors Not Considered in the Dietary Exposure Estimates

The effect of preparing, cooking, and/or baking (*i.e.*, cooking and baking factors), and the percent of food items expected to have phthalates (*i.e.*, akin to percent of crop treated in pesticide parlance) were not considered in this dietary exposure assessment because the data were either not available or the food item was already analyzed "as prepared or eaten." Application of these factors would be expected to decrease overall phthalate exposure (*i.e.*, fewer food items with phthalates, fewer phthalates in prepared food). Their exclusion, therefore, biases current results toward being more conservative.

2.6 Sensitivity Analysis to Determine the Effect of Categories with <3 Food Items

Total exposures from food categories with at least one food item were compared to those with more than three food items. This sensitivity analysis was performed in order to determine how a low N affected overall total phthalate exposure from foods.

3 Results

3.1 Total Phthalate Exposure from Food Items When Utilizing Two Food Items/Residue Data sets and Three Methods for Categorizing Food Items

Total exposure from phthalates in food was evaluated for each residue dataset (Bradley, 2011); (Page and Lacroix, 1995) food categorization scheme (Wormuth *et al.*, 2006; EPA, 2007; Clark *et al.*, 2011) and population (infant, toddler, children, teen, adult). Average and 95th percentile total exposure values were calculated assuming 100% phthalate absorption, fractional absorption (Wormuth *et al.*[2006] absorption factors), and the percent of total exposure when considering food categories with only N=3+ food items can be seen in Section 4.2.

3.2 Relative Contribution of Each Phthalate to Total Dietary Exposure

Circle graphs illustrating the relative contribution of all phthalates to total average dietary exposure were generated next. These can be seen in Section 4.3.

The relative contribution of phthalates was not substantially different when comparing total average exposures calculated assuming 100% phthalate absorption (Section 4.3) and total average exposure calculated using absorption data from Wormuth *et al.* (2006); circle graphs not shown).

3.2.1 UK Dataset

When considering the UK (Bradley, 2011) residue dataset, all three food categorization schemes resulted in average total exposures (µg/kg-d) with the same comparative relationship (DINP > DIDP > DEHP > DDP) for all populations (Section 4.3). Total average exposures from other phthalates via food were substantially less than these four phthalates.

DINP residues were present for most of the food categories, but the majority of "residues" were replacement values (one-half the LOD/LOQ). Replacement values for DINP moderated the overall total dietary exposure from DINP because these were substantially lower than actual residues. DIDP and DDP total exposures were calculated entirely from replacement values (one-half LOD/LOQ). Comparison to DINP residue values suggested that values for DIDP (at least) were reasonable. DEHP total exposure estimates were calculated using a substantial number of residue values (when compared to replacement values).

3.2.2 P&L Dataset

When considering P&L residue data (Page and Lacroix, 1995), the nonphthalate DEHA contributed to the largest portion of the average total exposure when assessing all categorization schemes and populations. Four other relationships were possible and dependent on the population and way food residues were categorized. Relationship 1 (DEHP>BBP>DEP>DBP) was primarily observed when food residues were grouped in NCEA categories (for infants, toddlers, children, female teens, and male teens). Relationship 2 (BBP>DEHP>DBP>DEP) was observed only following grouping by Wormuth *et al.* (2006; infants). Relationship 3 (DEHP>BBP>DBP>DEP) was observed when grouping with NCEA categories (EPA, 2007; female adult and male adult), Clark *et al.* (2011; infants), and Wormuth *et al.* (2006; toddler, female teen, male teen, female adult, and male adult). Relationship 4 (DEHP>DBP>BBP>DEP)

was observed following grouping residues as was done in Clark *et al.* (2011; toddler, children, female teen, male teen, female adult, and male adult) and Wormuth *et al.* (2006; children).

In this analysis, BBP exposures were calculated from only a few actual food residue data points. It is expected that this probably did not affect the phthalate order because of the moderating influence of the additional replacement values for BBP. Other phthalates (and DEHA) calculations were performed with a substantial number of residues in addition to the replacement values.

3.3 Relative Contribution of Each Phthalate to Each Food Category

Bar charts illustrating the relative contribution of all phthalates to total average dietary exposure in specific food categories were generated. These can be seen in Section 4.4. Summaries of this information can be seen in Tables E3-2, E3-3, and E3-4 below.

Table E3-2 Comparison of the contributors to exposure: NCEA (2007) categorization scheme.

Table 2. Comparison of the Contributors to Exposure: NCEA Categorization Scheme				
Population	**Residue Data Set**	**Categorization Scheme**	**Relative Commodity Contribution to Exposure**	**Relative Phthalate Relationship**
Infant	UK	NCEA	Dairy=fat>grain>meat>others	DINP>DIDP>DEHP>DMP
Infant	P&L	NCEA	Dairy>fat>grain>others	DEHP>others
Toddler	UK	NCEA	Dairy>fat>grain>meat>others	DINP>DIDP>DEHP>DMP
Toddler	P&L	NCEA	Dairy>fat>grain>meat>others	DEHP>others
Children	UK	NCEA	Dairy>fat>grain>meat>others	DINP>DIDP>DEHP>DDP
Children	P&L	NCEA	Dairy>fat>grain>meat>others	BBP>meat; DEHP>all others
Female teen	UK	NCEA	Dairy>fat>grain>meat>others	DINP>DIDP>DEHP>DDP
Female teen	P&L	NCEA	Dairy>fat>grain>meat>others	DEHP>others
Male teen	UK	NCEA	Dairy>fat>grain>meat>others	DINP>DIDP>DEHP>DDP
Male teen	P&L	NCEA	Dairy>fat>grain>meat>others	BBP>meats; DEHP>all others
Female adult	UK	NCEA	Dairy>fat>grain>meat>others	DINP>DIDP>DEHP>DDP
Female adult	P&L	NCEA	Dairy>fat>grain>meat>others	BBP>meats; DEHP>all others
Male adult	UK	NCEA	Dairy>fat>grain>meat>others	DINP>DIDP>DEHP>DDP
Male adult	P&L	NCEA	Dairy>fat>grain>meat>others	BBP>meat; DEHP>all others

Table E3-3 Comparison of the contributors to exposure: Clark *et al.* (2011) categorization scheme.

Table 3. Comparison of the Contributors to Exposure: Clark Categorization Scheme				
Population	**Residue Data Set**	**Categorization Scheme**	**Relative Commodity Contribution to Exposure**	**Relative Phthalate Relationship**
Infant	UK	Clark	Infant formulas	DINP>DIDP>DEHP>DDP
Infant	P&L	Clark	Infant formulas	DEHP>others
Toddler	UK	Clark	Milk>other foods>grains>dairy>cereal>fats and oils>meat>others	DINP>DIDP>DEHP>DDP
Toddler	P&L	Clark	Other foods>dairy>milk>cereal>vegetables>meat>others	BBP>meat; DBP>other foods; DEHP>all others
Children	UK	Clark	Milk>other foods>grains>dairy>cereal>fats and oils>cereal>meat>others	DINP>DIDP>DEHP>DDP
Children	P&L	Clark	Other foods>dairy>vegetables>milk>meat>fats and oils>others	BBP>cereal, meat; DBP>other foods; DEHP>all others
Female teen	UK	Clark	Other foods>milk>grains>fats and oils>dairy meats>others	DINP>DIDP>DEHP>DDP
Female teen	P&L	Clark	Other foods>dairy>meats>vegetables>fats>milk>beverages>others	BBP>meats; DBP>other foods; DEHP> all others
Male teen	UK	Clark	Other foods>milk>grains>fats and oils>dairy meats>others	DINP>DIDP>DEHP>DDP
Male teen	P&L	Clark	Other foods>dairy>meat>vegetables>fats and oils>others	BBP>meat; DBP>other foods; DEHP>all others
Female adult	UK	Clark	Other foods>grains>milk>dairy>fats and oils>meat>others	DINP>DIDP>DEHP>DDP
Female adult	P&L	Clark	Other foods>dairy>beverages>meats>vegetables>other	BBP>meats; DBP>other foods; DEHP> all others
Male adult	UK	Clark	Other foods>grains>milk>dairy>fats and oils>meat>others	DINP>DIDP>DEHP>DDP
Male adult	P&L	Clark	Other foods>dairy>beverages>meats>vegetables>fats and oils>others	BBP>meats; DBP>other foods; DEHP> all others

Table E3-4 Comparison of the contributors to exposure: Wormuth *et al.* (2006) categorization scheme.

Table 4. Comparison of the Contributors to Exposure: Wormuth Categorization Scheme				
Population	**Residue Data Set**	**Categorization Scheme**	**Relative Commodity Contribution to Exposure**	**Relative Phthalate Relationship**
Infant	UK	Wormuth	Infant formula>milk>cereal>bread>commerical infant food>others	DINP>DIDP>DEHP>DDP
Infant	P&L	Wormuth	Cereal>commercial infant food>milk>cakes, buns, puddins>bread>cereal>others	BBP>cereal, sausage, potatoes; DBP>biscuits, crispy bread, cakes, buns, pudding, fruits, confectionary; DEP>yogurt; DEHP>all others
Toddler	UK	Wormuth	Milk>bread>infant formula>yogurt>cereal>vegetable oils>others	DINP>DIDP>DEHP>DDP
Toddler	P&L	Wormuth	Biscuits, crispy bread>cereal>confectionary>milk>soft drinks>yogurt>bread>others	BBP>cereal, sausage, potatoes; DBP>biscuits, crispy bread, cakes, buns, pudding, fruits, confectionary; DEP>yogurt; DEHP>all others
Children	UK	Wormuth	Milk>bread>cakes, buns, puddings>meat>vegetable oil>cereal>others	DINP>DIDP>DEHP>DDP
Children	P&L	Wormuth	Confectionary>meat>cakes, buns, puddings>cereals>soft drinks>milk>others	BBP>cereal, sausage, potatoes; DBP>cakes, buns, pudding, fruits, confectionary; DEP>yogurt; DEHP>all others
Female teen	UK	Wormuth	Bakeries, snacks>cheese>bread>milk>cakes,buns, puddings>meat>others	DINP>DIDP>DEHP>DDP
Female teen	P&L	Wormuth	Bakeries, snacks>cheese>meat>confectionary>bread>vegetables>others	BBP>cereal>sausage>potatoes; DBP>cakes, buns, puddings, confectionary; DEP>yogurt; DEHP>all others
Male teen	UK	Wormuth	Bakeries, snacks>cheese>bread>milk>cakes,buns,puddings>meat>others	DINP>DIDP>DEHP>DDP
Male teen	P&L	Wormuth	Bakeries, snacks>cheese>meat>confectionary>bread>others	BBP>cereal, sausage, potatoes; DBP>cakes, buns, puddings, confectionary; DEP>yogurt; DEHP> all others
Female adult	UK	Wormuth	Breakfast cereals>bread>milk>cakes,buns,puddings>cheese>spreads>cereals>others	DINP>DIDP>DEHP>DDP
Female adult	P&L	Wormuth	Meat>cheese>sausage>confectionary>vegetables>bread>spreads>cereals>others	BBP>cereal, sausage,potatoes; DBP>cakes, buns, puddings, fruits, confectionary; DEP>yogurt; DEHP>all others
Male adult	UK	Wormuth	Bread>milk>meat>cheese>fish>cakes, buns, puddings, animal fats>others	DINP>DIDP>DEHP>DDP
Male adult	P&L	Wormuth	Meat>cheese>sausage>confectionary>bread>vegetables>spreads>others	BBP>cereals,sausage, potatoes; DBP>biscuits, crispy bread, cakes, buns, puddings, confectionary; DEP>yogurt; DEHP>all others

3.4 Effect of Removing Food Categories with N<3 Food Items on Total Exposure Estimates

Total exposure estimates from food were initially calculated using all residue data (and one-half LOD for nondetects) for either the UK (Bradley, 2011) or the Page and LaCroix (1995) datasets. This calculation included food categories that had only one food item (or composite sample).

Additional calculations for total food exposure were performed using only food categories that had N=3+ food items in order to determine how the number of items per category affected the total exposure.

Removing food categories with N<3 food items did not substantially affect the total exposures for any population (infants, toddlers, children, teens, or adults) when calculated using NCEA (EPA, 2007) or Clark *et al.* (2011) categorization schemes and the UK (Bradley, 2011) or Page and LaCroix (1995) food items/residue datasets.

Removing food categories with N<3 food items marginally reduced the total average exposure (but not the 95th percentile) when considering the Wormuth *et al.* (2006) food categorization scheme and the UK (Bradley, 2011) food item/residue dataset. Reductions of >10% of total exposure were seen for DPP (infants, toddlers, children, teens, female adults), DCHP (toddlers, female teens), DEHP (toddlers), DNOP (toddlers, female teens), DINP (toddlers, children), DIDP (toddlers, children), and DDP (toddlers, female teens).

Substantial decreases in total average and 95th percentile exposure were seen following removal of food categories with N<3 food items when considering Wormuth *et al.* (2006) food categorization scheme and the Page and LaCroix (1995) food residue dataset. Specifically, DEP, BBP, and DBP total average and 95th percentile exposures were reduced to 27–77% of the total exposure, and DEHP total average and 95th percentile exposures were reduced to 57–94% of the

total exposure for all populations when the food categories with N<3 food items were removed (calculations not shown).

4 Supplemental Data

4.1 Food Categorization Schemes Organized by Publication

Table E3-5 Food product groupings organized by study.

General Food Category	NCEA (Total)	Clark *et al.*, 2011	Wormuth *et al.*, 2006
Dairy	Dairy	Milk	Milk, milk beverage
		Dairy (excl. milk)	Cream
			Ice cream
			Yogurt
			Cheese
Meat and egg	Meat	Meat	Meat, meat product
		Processed meat	Sausage
			Soup, sauce
		Poultry	Poultry
	Fish	Fish	Fish
	Egg	Egg	Egg
Grain, fruit, nut, and vegetable	Grain	Grain	Pasta, rice
		Cereals	Cereal
			Breakfast cereal
			Bread
			Biscuit, crispy bread
			Cake bun, pudding
			Bakeries, snack
	Vegetable	Vegetable	Vegetable
			Potato
	Soy		Soup, sauce
	Fruit	Fruit	Fruit
			Preserves, sugar
	Nut	Nut and bean	Nuts, nut spread
Fat and oil	Fat	Fat and oil	Animal fats
			Vegetable oil
			Spread
Other and composite food		Other food	Confectionary
			Spice

Baby nutrition		Infant formula (powder)	Infant formula
		Breast milk	Breast milk
			Commercial infant food
Liquid (excl. milk)		Beverage	Juices
			Tea, coffee
			Soft drink
			Beer
			Wine
			Spirits
			Bottled water
		Tap water	Tap water

4.2 Total Exposure (µg/kg-d) Estimates for Various Populations (Wormuth Estimates Adjusted for the Fraction of the Population Consuming)

4.2.1 Infants

Table E3-6 Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are 100% absorbed.

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	0.061	0.304	0.056	0.201	0.351	0.200	0.156	0.157	0.548	0.194	5.033	0.375	13.814	9.291	0.656
Wormuth	Average	0.351	0.543	0.285	1.283	0.807	0.728	0.474	0.452	0.875	0.584	4.670	1.014	36.858	30.451	2.046
Clark	Average	0.096	0.116	0.064	0.302	0.132	0.182	0.074	0.124	0.212	0.111	0.818	0.190	8.157	7.325	0.334
NCEA	95th %ile	0.203	1.250	0.179	0.653	1.249	0.534	0.448	0.425	0.667	0.484	18.366	0.977	35.819	24.721	1.435
Wormuth	95th %ile	1.236	1.443	0.853	3.855	2.033	1.808	1.209	1.061	2.239	1.203	11.698	2.430	94.123	73.991	3.806
Clark	95th %ile	0.401	0.342	0.254	1.104	0.308	0.483	0.206	0.304	0.600	0.248	2.294	0.560	28.352	20.173	0.750

Table E3-7 Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth *et al*,[2006] absorption factors).

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	0.042	0.208	0.056	0.201	0.240	0.137	0.156	0.157	0.397	0.194	2.778	0.375	11.396	7.665	0.656
Wormuth	Average	0.240	0.372	0.285	1.283	0.553	0.499	0.474	0.452	0.634	0.584	2.578	1.014	30.408	25.122	2.046
Clark	Average	0.066	0.079	0.064	0.302	0.090	0.125	0.074	0.124	0.153	0.111	0.452	0.190	6.730	6.043	0.334
NCEA	95th %ile	0.139	0.856	0.179	0.653	0.856	0.366	0.448	0.425	0.484	0.484	10.138	0.977	29.550	20.395	1.435
Wormuth	95th %ile	0.847	0.989	0.853	3.855	1.392	1.238	1.209	1.061	1.623	1.203	6.457	2.430	77.652	61.043	3.806
Clark	95th %ile	0.275	0.234	0.254	1.104	0.211	0.331	0.206	0.304	0.435	0.248	1.266	0.560	23.390	16.643	0.750

Table E3-8 Percent of total exposure calculated using UK (Bradley, 2011) food residue data edited to discard food item categories with fewer than three residues.

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Wormuth	Average	97.4	98.4	97.7	97.9	95.5	97.4	85.4	95.3	95.4	92.4	91.7	92.9	90.3	90.5	93.5
Clark	Average	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
NCEA	95th %ile	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Wormuth	95th %ile	99.1	99.4	99.3	99.3	97.8	98.8	94.2	97.7	98.0	95.2	96.5	97.0	96.0	96.0	96.5
Clark	95th %ile	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table E3-9 Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are 100% absorbed.

		DEP	BBP	DBP	DEHP	DEHA
NCEA	Average	3.887	5.258	3.163	27.371	841.753
Wormuth	Average	2.162	12.867	3.868	12.820	175.134
Clark	Average	0.867	0.867	0.867	10.111	0.867
NCEA	95th %ile	7.852	10.791	7.034	87.769	2882.414
Wormuth	95th %ile	2.209	15.451	9.072	41.113	602.361
Clark	95th %ile	0.867	0.867	0.867	45.760	0.867

Table E3-10 Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth *et al.* [2006] absorption factors).

		DEP	BBP	DBP	DEHP	DEHA
NCEA	Average	2.663	3.812	2.166	15.109	464.648
Wormuth	Average	1.481	9.328	2.650	7.076	96.674
Clark	Average	1.513	11.202	6.214	22.695	332.503
NCEA	95th %ile	5.378	7.824	4.818	48.448	1591.093
Wormuth	95th %ile	1.513	11.202	6.214	22.695	332.503
Clark	95th %ile	0.594	0.628	0.594	25.260	0.478

Table E3-11 Percent of total exposure calculated using Page and LaCroix (1995) food residue data edited to discard food item categories with fewer than three residues.

		DEP	BBP	DBP	DEHP	DEHA
NCEA	Average	99.6	99.7	99.5	99.9	99.6
Wormuth	Average	37.9	39.3	61.7	83.8	95.4
Clark	Average	100.0	100.0	100.0	100.0	100.0
NCEA	95th %ile	99.8	99.9	99.8	100.0	99.8
Wormuth	95th %ile	36.6	62.8	69.1	93.8	97.3
Clark	95th %ile	100.0	100.0	100.0	100.0	100.0

4.2.2 Toddlers

Table E3-12 Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are 100% absorbed.

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	0.116	0.666	0.104	0.399	0.731	0.358	0.272	0.269	0.636	0.350	7.563	0.612	24.009	15.782	1.173
Wormuth	Average	0.095	0.164	0.086	0.369	0.286	0.199	0.173	0.131	0.285	0.201	1.758	0.354	10.611	8.371	0.735
Clark	Average	0.214	0.466	0.204	0.868	0.985	0.579	0.341	0.409	0.652	0.501	5.141	0.915	31.389	19.806	1.795
NCEA	95th %ile	0.391	2.714	0.311	1.234	2.684	0.981	0.742	0.755	1.058	0.814	25.918	1.561	69.432	44.981	2.497
Wormuth	95th %ile	0.274	0.396	0.204	0.934	0.739	0.456	0.409	0.281	0.733	0.395	4.273	0.754	21.592	19.433	1.248
Clark	95th %ile	0.618	1.315	0.496	2.253	2.912	1.590	0.925	1.306	1.347	1.087	13.885	2.312	98.535	53.600	3.561

Table E3-13 Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth *et al.* [2006] absorption factors).

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	0.080	0.456	0.104	0.399	0.501	0.245	0.272	0.269	0.461	0.350	4.175	0.612	19.808	13.021	1.173
Wormuth	Average	0.065	0.112	0.086	0.369	0.196	0.136	0.173	0.131	0.207	0.201	0.970	0.354	8.754	6.906	0.735
Clark	Average	0.146	0.320	0.204	0.868	0.674	0.396	0.341	0.409	0.472	0.501	2.838	0.915	25.896	16.340	1.795
NCEA	95th %ile	0.268	1.859	0.311	1.234	1.839	0.672	0.742	0.755	0.767	0.814	14.307	1.561	57.281	37.109	2.497
Wormuth	95th %ile	0.187	0.271	0.204	0.934	0.506	0.312	0.409	0.281	0.531	0.395	2.358	0.754	17.813	16.032	1.248
Clark	95th %ile	0.424	0.901	0.496	2.253	1.994	1.089	0.925	1.306	0.976	1.087	7.665	2.312	81.291	44.220	3.561

Table E3-14 Percent of total exposure calculated using UK (Bradley, 2011) food residue data edited to discard food item categories with fewer than three residues.

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Wormuth	Average	94.0	97.3	96.0	96.4	94.1	95.3	79.2	91.2	93.6	87.6	87.0	87.8	86.6	86.8	89.3
Clark	Average	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
NCEA	95th %ile	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Wormuth	95th %ile	97.4	98.9	98.4	98.6	96.8	97.7	91.3	95.3	97.3	91.3	94.5	94.1	92.6	94.0	93.8
Clark	95th %ile	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table E3-15 Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are 100% absorbed.

		DEP	BBP	DBP	DEHP	DEHA
NCEA	Average	7.779	9.118	6.683	54.021	1881.092
Wormuth	Average	2.504	5.044	4.279	8.506	127.384
Clark	Average	2.104	5.276	10.044	21.789	516.823
NCEA	95th %ile	14.543	16.760	15.685	175.753	6621.423
Wormuth	95th %ile	2.517	8.163	8.124	21.645	399.093
Clark	95th %ile	4.218	15.511	43.499	70.827	1914.344

Table E3-16 Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth *et al.* [2006] absorption factors).

		DEP	BBP	DBP	DEHP	DEHA
NCEA	Average	5.328	6.611	4.578	29.819	1038.363
Wormuth	Average	1.715	3.657	2.931	4.695	70.316
Clark	Average	1.441	3.825	6.880	12.028	285.286
NCEA	95th %ile	9.962	12.151	10.744	97.015	3655.026
Wormuth	95th %ile	1.724	5.918	5.565	11.948	220.299
Clark	95th %ile	2.889	11.245	29.797	39.097	1056.718

Table E3-17 Percent of total exposure calculated using Page and LaCroix (1995) food residue data edited to discard food item categories with fewer than three residues.

		DEP	BBP	DBP	DEHP	DEHA
NCEA	Average	99.3	99.4	99.2	99.9	99.4
Wormuth	Average	27.3	46.2	33.4	75.8	93.4
Clark	Average	94.8	97.9	98.9	98.0	96.6
NCEA	95th %ile	99.6	99.7	99.7	100.0	99.7
Wormuth	95th %ile	26.7	66.1	45.5	88.9	96.1
Clark	95th %ile	97.4	99.3	99.7	99.4	98.3

4.2.3 Children

Table E3-18 Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are 100% absorbed.

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	0.068	0.344	0.061	0.229	0.406	0.209	0.160	0.157	0.391	0.199	4.224	0.353	13.697	9.039	0.649
Wormuth	Average	0.045	0.086	0.042	0.177	0.154	0.101	0.079	0.065	0.151	0.096	0.940	0.174	5.588	4.122	0.354
Clark	Average	0.120	0.265	0.115	0.475	0.585	0.331	0.215	0.237	0.418	0.288	3.200	0.509	17.376	12.350	0.969
NCEA	95th %ile	0.242	1.386	0.181	0.708	1.477	0.584	0.439	0.447	0.635	0.473	14.644	0.918	40.358	25.856	1.435
Wormuth	95th %ile	0.138	0.222	0.097	0.443	0.414	0.245	0.209	0.154	0.432	0.200	2.524	0.387	11.900	10.193	0.648
Clark	95th %ile	0.358	0.777	0.279	1.209	1.811	0.892	0.561	0.720	0.797	0.616	8.736	1.289	51.247	35.163	1.939

Table E3-19 Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth *et al.* [2006] absorbtion factors).

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	0.047	0.236	0.061	0.229	0.278	0.143	0.160	0.157	0.283	0.199	2.332	0.353	11.300	7.457	0.649
Wormuth	Average	0.031	0.059	0.042	0.177	0.105	0.069	0.079	0.065	0.109	0.096	0.519	0.174	4.610	3.400	0.354
Clark	Average	0.082	0.182	0.115	0.475	0.401	0.227	0.215	0.237	0.303	0.288	1.766	0.509	14.335	10.188	0.969
NCEA	95th %ile	0.166	0.949	0.181	0.708	1.011	0.400	0.439	0.447	0.461	0.473	8.083	0.918	33.295	21.332	1.435
Wormuth	95th %ile	0.095	0.152	0.097	0.443	0.283	0.168	0.209	0.154	0.313	0.200	1.393	0.387	9.817	8.409	0.648
Clark	95th %ile	0.245	0.532	0.279	1.209	1.240	0.611	0.561	0.720	0.578	0.616	4.823	1.289	42.278	29.010	1.939

Table E3-20 Percent of total exposure calculated using UK (Bradley, 2011) food residue data edited to discard food item categories with fewer than three residues.

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Wormuth	Average	95.3	98.1	96.8	97.1	95.7	96.4	83.6	93.2	95.5	90.5	91.8	91.3	89.6	88.9	92.3
Clark	Average	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
NCEA	95th %ile	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Wormuth	95th %ile	98.0	99.3	98.6	98.8	97.8	98.2	93.4	96.6	98.3	93.7	96.8	95.8	94.4	95.1	95.7
Clark	95th %ile	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table E3-21 Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are 100% absorbed.

		DEP	BBP	DBP	DEHP	DEHA
NCEA	Average	4.052	5.371	3.642	28.485	967.766
Wormuth	Average	0.726	2.309	3.498	5.640	83.413
Clark	Average	1.443	3.576	4.776	13.282	307.143
NCEA	95th %ile	7.553	9.974	9.501	93.994	3357.234
Wormuth	95th %ile	0.724	3.985	7.555	15.430	268.840
Clark	95th %ile	2.877	10.192	19.452	42.932	1001.810

Table E3-22 Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth *et al.* [2006] absorption factors).

			DEP	BBP	DBP	DEHP	DEHA
NCEA		Average	2.775	3.894	2.495	15.724	534.207
Wormuth		Average	0.497	1.674	2.396	3.113	46.044
Clark		Average	0.988	2.593	3.272	7.332	169.543
NCEA		95th %ile	5.174	7.231	6.508	51.885	1853.193
Wormuth		95th %ile	0.496	2.889	5.175	8.517	148.400
Clark		95th %ile	1.971	7.389	13.324	23.699	552.999

Table E3-23 Percent of total exposure calculated using Page and LaCroix (1995) food residue data edited to discard food item categories with fewer than three residues.

			DEP	BBP	DBP	DEHP	DEHA
NCEA		Average	99.3	99.5	99.3	99.9	99.4
Wormuth		Average	44.7	54.9	33.3	72.9	92.6
Clark		Average	94.9	97.9	98.4	96.5	97.2
NCEA		95th %ile	99.7	99.7	99.7	100.0	99.7
Wormuth		95th %ile	44.6	72.8	40.9	87.0	95.6
Clark		95th %ile	97.4	99.3	99.6	98.9	98.4

4.2.4 Female Teens

Table E3-24 Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are 100% absorbed.

			DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA		Average	0.038	0.158	0.033	0.123	0.203	0.113	0.089	0.086	0.228	0.105	2.172	0.190	7.197	4.783	0.331
Wormuth		Average	0.030	0.109	0.028	0.105	0.152	0.091	0.065	0.064	0.121	0.081	1.083	0.139	5.768	3.815	0.248
Clark		Average	0.058	0.128	0.055	0.223	0.285	0.163	0.106	0.120	0.215	0.141	1.640	0.250	8.675	6.061	0.458
NCEA		95th %ile	0.145	0.622	0.100	0.379	0.724	0.323	0.248	0.247	0.360	0.257	7.657	0.510	21.381	13.737	0.769
Wormuth		95th %ile	0.101	0.324	0.069	0.253	0.447	0.233	0.144	0.155	0.353	0.173	2.641	0.293	13.686	9.248	0.475
Clark		95th %ile	0.186	0.383	0.137	0.576	0.892	0.453	0.280	0.373	0.398	0.306	4.613	0.646	26.190	17.346	0.950

Table E3-25 Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth *et al.* [2006] absorption factors).

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	0.026	0.108	0.033	0.123	0.139	0.077	0.089	0.086	0.165	0.105	1.199	0.190	5.937	3.946	0.331
Wormuth	Average	0.021	0.075	0.028	0.105	0.104	0.063	0.065	0.064	0.088	0.081	0.598	0.139	4.758	3.147	0.248
Clark	Average	0.040	0.088	0.055	0.223	0.195	0.112	0.106	0.120	0.156	0.141	0.905	0.250	7.157	5.000	0.458
NCEA	95th %ile	0.099	0.426	0.100	0.379	0.496	0.221	0.248	0.247	0.261	0.257	4.227	0.510	17.639	11.333	0.769
Wormuth	95th %ile	0.069	0.222	0.069	0.253	0.306	0.160	0.144	0.155	0.256	0.173	1.458	0.293	11.291	7.630	0.475
Clark	95th %ile	0.127	0.262	0.137	0.576	0.611	0.310	0.280	0.373	0.289	0.306	2.546	0.646	21.606	14.310	0.950

Table E3-26 Percent of total exposure calculated using UK (Bradley, 2011) food residue data edited to discard food item categories with fewer than three residues.

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Wormuth	Average	93.5	98.5	96.0	95.9	96.3	96.5	81.0	93.5	95.4	89.6	92.8	89.6	91.5	90.1	89.7
Clark	Average	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
NCEA	95th %ile	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Wormuth	95th %ile	97.3	99.5	98.3	98.3	98.2	98.4	91.6	96.8	98.4	93.2	97.1	94.8	95.7	95.6	94.4
Clark	95th %ile	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table E3-27 Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are 100% absorbed.

		DEP	BBP	DBP	DEHP	DEHA
NCEA	Average	1.902	3.002	1.812	13.685	440.915
Wormuth	Average	1.092	2.399	1.759	8.067	157.098
Clark	Average	0.806	2.090	2.521	6.858	163.198
NCEA	95th %ile	3.514	5.545	5.132	46.683	1476.424
Wormuth	95th %ile	1.062	3.974	3.563	20.166	481.277
Clark	95th %ile	1.621	5.902	10.285	22.274	526.376

Table E3-28 Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth *et al.* [2006] absorption factors).

			DEP	BBP	DBP	DEHP	DEHA
NCEA		Average	1.303	2.177	1.242	7.554	243.385
Wormuth		Average	0.748	1.739	1.205	4.453	86.718
Clark		Average	0.552	1.516	1.727	3.786	90.085
NCEA		95th %ile	2.407	4.020	3.515	25.769	814.986
Wormuth		95th %ile	0.728	2.881	2.441	11.132	265.665
Clark		95th %ile	1.110	4.279	7.045	12.295	290.560

Table E3-29 Percent of total exposure calculated using Page and LaCroix (1995)food residue data edited to discard food item categories with fewer than three residues.

			DEP	BBP	DBP	DEHP	DEHA
NCEA		Average	99.1	99.5	99.1	99.9	99.2
Wormuth		Average	49.5	54.3	54.8	54.8	89.3
Clark		Average	95.6	98.3	98.6	96.7	97.5
NCEA		95th %ile	99.5	99.7	99.7	100.0	99.5
Wormuth		95th %ile	48.1	65.4	58.7	75.4	93.3
Clark		95th %ile	97.8	99.4	99.7	99.0	98.5

4.2.5 Male Teens

Table E3-30 Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are 100% absorbed.

			DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA		Average	0.038	0.158	0.033	0.123	0.203	0.113	0.089	0.086	0.228	0.105	2.172	0.190	7.197	4.783	0.331
Wormuth		Average	0.039	0.156	0.038	0.141	0.189	0.119	0.081	0.084	0.154	0.103	1.332	0.177	7.693	5.024	0.323
Clark		Average	0.058	0.128	0.055	0.223	0.285	0.163	0.106	0.120	0.215	0.141	1.640	0.250	8.675	6.061	0.458
NCEA		95th %ile	0.145	0.622	0.100	0.379	0.724	0.323	0.248	0.247	0.360	0.257	7.657	0.510	21.381	13.737	0.769
Wormuth		95th %ile	0.129	0.472	0.092	0.347	0.567	0.309	0.186	0.211	0.444	0.223	3.335	0.385	18.987	12.676	0.630
Clark		95th %ile	0.186	0.383	0.137	0.576	0.892	0.453	0.280	0.373	0.398	0.306	4.613	0.646	26.190	17.346	0.950

Table E3-31 Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth *et al.* [2006] absorption factors).

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	0.026	0.108	0.033	0.123	0.139	0.077	0.089	0.086	0.165	0.105	1.199	0.190	5.937	3.946	0.331
Wormuth	Average	0.026	0.107	0.038	0.141	0.130	0.082	0.081	0.084	0.111	0.103	0.735	0.177	6.347	4.145	0.323
Clark	Average	0.040	0.088	0.055	0.223	0.195	0.112	0.106	0.120	0.156	0.141	0.905	0.250	7.157	5.000	0.458
NCEA	95th %ile	0.099	0.426	0.100	0.379	0.496	0.221	0.248	0.247	0.261	0.257	4.227	0.510	17.639	11.333	0.769
Wormuth	95th %ile	0.088	0.323	0.092	0.347	0.388	0.212	0.186	0.211	0.322	0.223	1.841	0.385	15.665	10.458	0.630
Clark	95th %ile	0.127	0.262	0.137	0.576	0.611	0.310	0.280	0.373	0.289	0.306	2.546	0.646	21.606	14.310	0.950

Table E3-32 Percent of total exposure calculated using UK (Bradley, 2011) food residue data edited to discard food item categories with fewer than three residues.

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Wormuth	Average	96.0	99.2	97.6	97.5	97.6	97.8	87.9	96.0	97.1	93.4	95.5	93.5	94.6	93.6	93.8
Clark	Average	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
NCEA	95th %ile	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Wormuth	95th %ile	98.4	99.7	99.0	99.0	98.9	99.0	94.8	98.1	99.0	95.8	98.2	96.9	97.4	97.3	96.7
Clark	95th %ile	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table E3-33 Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are 100% absorbed.

		DEP	BBP	DBP	DEHP	DEHA
NCEA	Average	1.902	3.002	1.812	13.685	440.915
Wormuth	Average	1.151	3.078	2.484	10.750	211.258
Clark	Average	0.806	2.090	2.521	6.858	163.198
NCEA	95th %ile	3.514	5.545	5.132	46.683	1476.424
Wormuth	95th %ile	1.109	5.824	5.104	26.006	658.394
Clark	95th %ile	1.621	5.902	10.285	22.274	526.376

Table E3-34 Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth *et al.* [2006] absorption factors).

		DEP	BBP	DBP	DEHP	DEHA
NCEA	Average	1.303	2.177	1.242	7.554	243.385
Wormuth	Average	0.788	2.231	1.702	5.934	116.614
Clark	Average	0.552	1.516	1.727	3.786	90.085
NCEA	95th %ile	2.407	4.020	3.515	25.769	814.986
Wormuth	95th %ile	0.759	4.222	3.497	14.355	363.434
Clark	95th %ile	1.110	4.279	7.045	12.295	290.560

Table E3-35 Percent of total exposure calculated using Page and LaCroix (1995) food residue data edited to discard food item categories with fewer than three residues.

		DEP	BBP	DBP	DEHP	DEHA
NCEA	Average	99.1	99.5	99.1	99.9	99.2
Wormuth	Average	62.9	61.8	58.9	57.2	89.7
Clark	Average	95.6	98.3	98.6	96.7	97.5
NCEA	95th %ile	99.5	99.7	99.7	100.0	99.5
Wormuth	95th %ile	61.6	72.6	62.9	76.3	93.7
Clark	95th %ile	97.8	99.4	99.7	99.0	98.5

4.2.6 Female Adults

Table E3-36 Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are 100% absorbed.

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	0.027	0.093	0.024	0.086	0.130	0.078	0.063	0.060	0.159	0.071	1.384	0.129	4.812	3.198	0.215
Wormuth	Average	0.017	0.042	0.016	0.066	0.099	0.051	0.037	0.032	0.067	0.041	0.556	0.066	2.619	2.102	0.118
Clark	Average	0.036	0.087	0.034	0.131	0.193	0.108	0.068	0.084	0.142	0.090	1.142	0.159	5.908	3.983	0.273
NCEA	95th %ile	0.108	0.357	0.071	0.261	0.459	0.227	0.175	0.175	0.255	0.176	4.916	0.356	14.518	9.259	0.524
Wormuth	95th %ile	0.052	0.114	0.036	0.151	0.254	0.117	0.084	0.078	0.186	0.086	1.423	0.144	6.018	5.860	0.243
Clark	95th %ile	0.122	0.280	0.086	0.342	0.616	0.310	0.178	0.267	0.261	0.201	3.242	0.429	18.706	11.581	0.611

Table E3-37 Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth *et al.* [2006] absorption factors).

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	0.018	0.064	0.024	0.086	0.089	0.053	0.063	0.060	0.115	0.071	0.764	0.129	3.970	2.638	0.215
Wormuth	Average	0.012	0.029	0.016	0.066	0.068	0.035	0.037	0.032	0.049	0.041	0.307	0.066	2.161	1.734	0.118
Clark	Average	0.025	0.060	0.034	0.131	0.132	0.074	0.068	0.084	0.103	0.090	0.630	0.159	4.874	3.286	0.273
NCEA	95th %ile	0.074	0.244	0.071	0.261	0.314	0.156	0.175	0.175	0.185	0.176	2.713	0.356	11.977	7.638	0.524
Wormuth	95th %ile	0.036	0.078	0.036	0.151	0.174	0.080	0.084	0.078	0.135	0.086	0.786	0.144	4.965	4.835	0.243
Clark	95th %ile	0.084	0.192	0.086	0.342	0.422	0.212	0.178	0.267	0.190	0.201	1.790	0.429	15.433	9.554	0.611

Table E3-38 Percent of total exposure calculated using UK (Bradley, 2011) food residue data edited to discard food item categories with fewer than three residues.

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Wormuth	Average	95.7	98.6	97.4	97.2	97.0	97.3	87.9	95.5	96.2	92.3	94.8	92.1	92.1	91.8	92.0
Clark	Average	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
NCEA	95th %ile	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Wormuth	95th %ile	98.3	99.5	99.0	98.8	98.4	98.7	94.9	97.8	98.5	95.1	97.9	96.3	95.9	96.6	96.1
Clark	95th %ile	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table E3-39 Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are 100% absorbed.

		DEP	BBP	DBP	DEHP	DEHA
NCEA	Average	1.139	2.091	1.179	8.472	258.454
Wormuth	Average	0.967	3.012	2.244	5.341	127.802
Clark	Average	0.741	1.847	2.018	5.826	136.634
NCEA	95th %ile	2.057	3.843	3.569	30.076	829.443
Wormuth	95th %ile	1.000	5.947	4.545	17.907	398.377
Clark	95th %ile	1.535	5.087	7.965	18.926	432.221

Table E3-40 Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth *et al.* [2006] absorption factors).

		DEP	BBP	DBP	DEHP	DEHA
NCEA	Average	0.781	1.516	0.807	4.677	142.667
Wormuth	Average	0.662	2.184	1.537	2.948	70.547
Clark	Average	0.508	1.339	1.382	3.216	75.422
NCEA	95th %ile	1.409	2.786	2.445	16.602	457.853
Wormuth	95th %ile	0.685	4.311	3.113	9.885	219.904
Clark	95th %ile	1.051	3.688	5.456	10.447	238.586

Table E3-41 Percent of total exposure calculated using Page and LaCroix (1995) food residue data edited to discard food item categories with fewer than three residues.

		DEP	BBP	DBP	DEHP	DEHA
NCEA	Average	98.6	99.2	98.7	99.8	98.6
Wormuth	Average	44.9	60.8	47.5	73.0	95.4
Clark	Average	95.4	98.2	98.3	97.3	96.4
NCEA	95th %ile	99.2	99.6	99.6	99.9	99.2
Wormuth	95th %ile	40.4	76.3	56.0	87.8	97.2
Clark	95th %ile	97.8	99.3	99.6	99.2	97.8

4.2.7 Male Adults

Table E3-42 Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are 100% absorbed.

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	0.027	0.093	0.024	0.086	0.130	0.078	0.063	0.060	0.159	0.071	1.384	0.129	4.812	3.198	0.215
Wormuth	Average	0.035	0.087	0.033	0.119	0.140	0.094	0.080	0.070	0.145	0.081	1.041	0.140	5.218	3.988	0.236
Clark	Average	0.036	0.087	0.034	0.131	0.193	0.108	0.068	0.084	0.142	0.090	1.142	0.159	5.908	3.983	0.273
NCEA	95th %ile	0.108	0.357	0.071	0.261	0.459	0.227	0.175	0.175	0.255	0.176	4.916	0.356	14.518	9.259	0.524
Wormuth	95th %ile	0.129	0.251	0.089	0.304	0.381	0.247	0.196	0.178	0.448	0.177	2.871	0.329	11.834	10.485	0.521
Clark	95th %ile	0.122	0.280	0.086	0.342	0.616	0.310	0.178	0.267	0.261	0.201	3.242	0.429	18.706	11.581	0.611

Table E3-43 Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth *et al.* [2006] absorption factors).

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	0.018	0.064	0.024	0.086	0.089	0.053	0.063	0.060	0.115	0.071	0.764	0.129	3.970	2.638	0.215
Wormuth	Average	0.024	0.060	0.033	0.119	0.096	0.064	0.080	0.070	0.105	0.081	0.575	0.140	4.305	3.290	0.236
Clark	Average	0.025	0.060	0.034	0.131	0.132	0.074	0.068	0.084	0.103	0.090	0.630	0.159	4.874	3.286	0.273
NCEA	95th %ile	0.074	0.244	0.071	0.261	0.314	0.156	0.175	0.175	0.185	0.176	2.713	0.356	11.977	7.638	0.524
Wormuth	95th %ile	0.088	0.172	0.089	0.304	0.261	0.169	0.196	0.178	0.324	0.177	1.585	0.329	9.763	8.651	0.521
Clark	95th %ile	0.084	0.192	0.086	0.342	0.422	0.212	0.178	0.267	0.190	0.201	1.790	0.429	15.433	9.554	0.611

Table E3-44 Percent of total exposure calculated using UK (Bradley, 2011) food residue data edited to discard food item categories with fewer than three residues.

		DMP	DEP	DiPP	DAP	DiBP	DBP	DPP	DHP	BBP	DCHP	DEHP	DOP	DINP	DIDP	DDP
NCEA	Average	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000
Wormuth	Average	96.948	98.909	98.043	97.836	97.683	97.975	91.052	96.665	97.126	94.353	96.182	94.460	93.684	93.466	94.255
Clark	Average	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000
NCEA	95th %ile	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000
Wormuth	95th %ile	98.860	99.609	99.252	99.123	98.812	99.077	96.266	98.437	98.901	96.520	98.459	97.427	96.791	97.350	97.215
Clark	95th %ile	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000

Table E3-45 Total exposure (µg/kg-d) calculated using Page and LaCroix (1995)food residue data and the assumption that phthalates are 100% absorbed.

		DEP	BBP	DBP	DEHP	DEHA
NCEA	Average	1.139	2.091	1.179	8.472	258.454
Wormuth	Average	0.917	3.180	2.290	5.635	129.684
Clark	Average	0.741	1.847	2.018	5.826	136.634
NCEA	95th %ile	2.057	3.843	3.569	30.076	829.443
Wormuth	95th %ile	0.950	6.256	4.540	18.775	415.293
Clark	95th %ile	1.535	5.087	7.965	18.926	432.221

Table E3-46 Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth *et al.* [2006] absorption factors).

			DEP	BBP	DBP	DEHP	DEHA
NCEA		Average	0.781	1.516	0.807	4.677	142.667
Wormuth		Average	0.628	2.305	1.569	3.111	71.585
Clark		Average	0.508	1.339	1.382	3.216	75.422
NCEA		95th %ile	1.409	2.786	2.445	16.602	457.853
Wormuth		95th %ile	0.651	4.536	3.110	10.364	229.242
Clark		95th %ile	1.051	3.688	5.456	10.447	238.586

Table E3-47 Percent of Total Exposure calculated using Page and LaCroix (1995) food residue data edited to discard food item categories with fewer than three residues.

			DEP	BBP	DBP	DEHP	DEHA
NCEA		Average	98.6	99.2	98.7	99.8	98.6
Wormuth		Average	48.5	61.8	46.0	73.9	95.3
Clark		Average	95.4	98.2	98.3	97.3	96.4
NCEA		95th %ile	99.2	99.6	99.6	99.9	99.2
Wormuth		95th %ile	43.1	76.8	54.3	88.2	97.2
Clark		95th %ile	97.8	99.3	99.6	99.2	97.8

4.3 Population-based Dietary Exposures and the Relative Contribution of Various Phthalates

4.3.1 Infants Total Phthalate Exposure from Food, Phthalate Relative Contribution (assuming 100% phthalate absorption)

Figure E3-1 Infants total phthalate exposure from food (µg/kg-d); UK data; NCEA grouping.

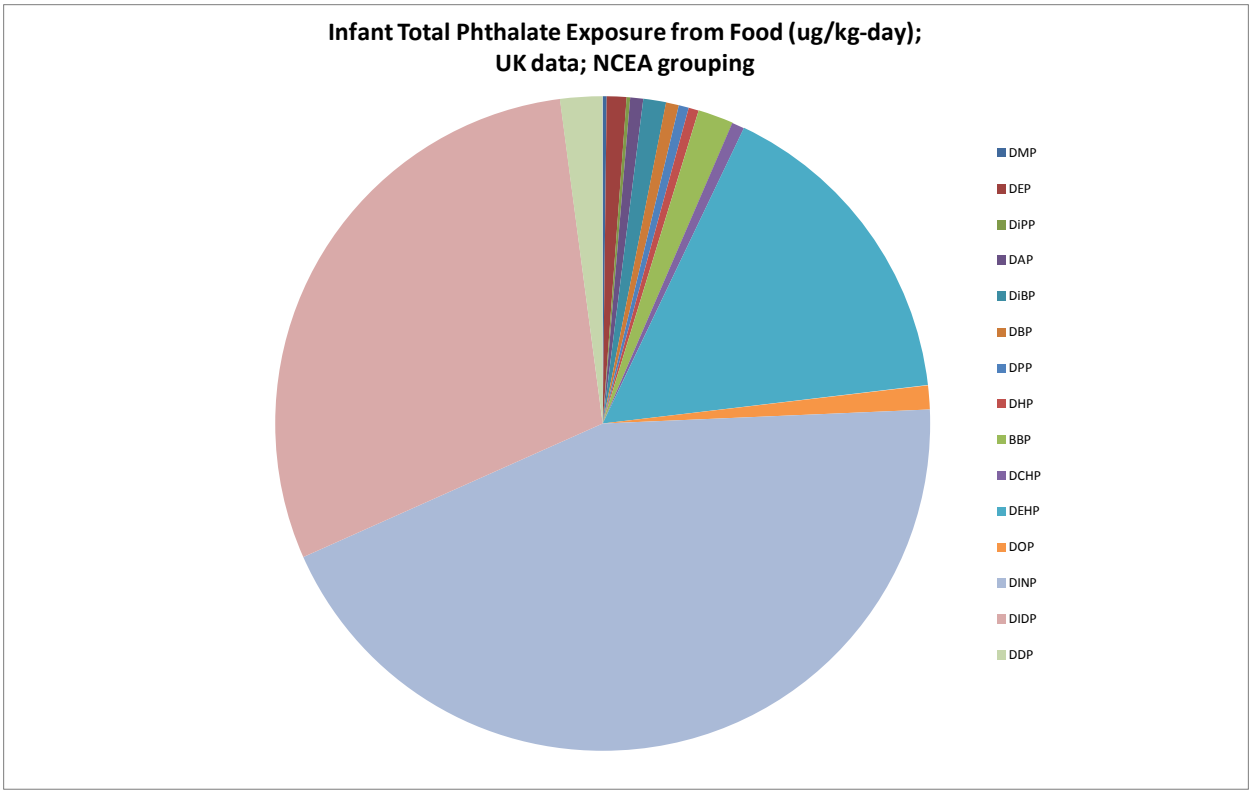


Figure E3-2 Infants total phthalate exposure from food (µg/kg-d); UK data; Clark grouping.

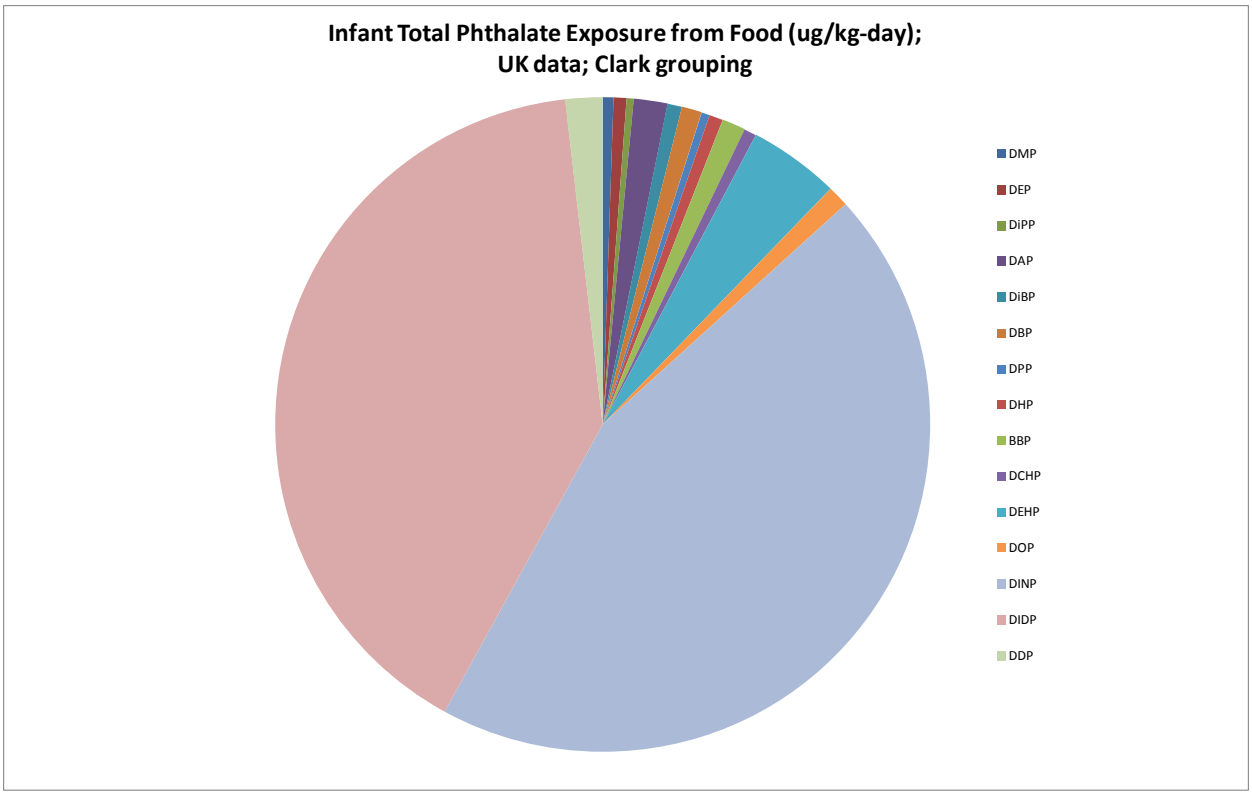


Figure E3-3 Infants total phthalate exposure from food (µg/kg-d); UK data; Wormuth grouping.

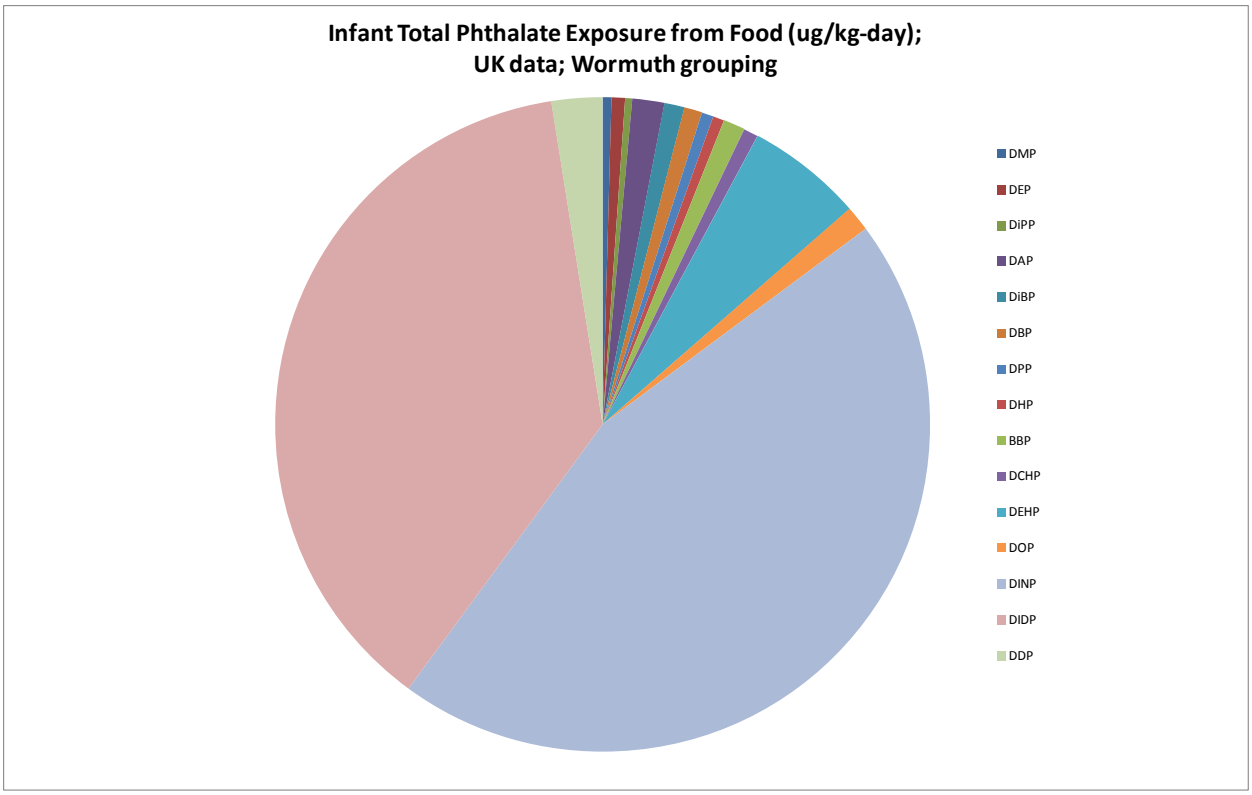


Figure E3-4 Infants total phthalate exposure from food (µg/kg-d); P&L data; NCEA grouping.

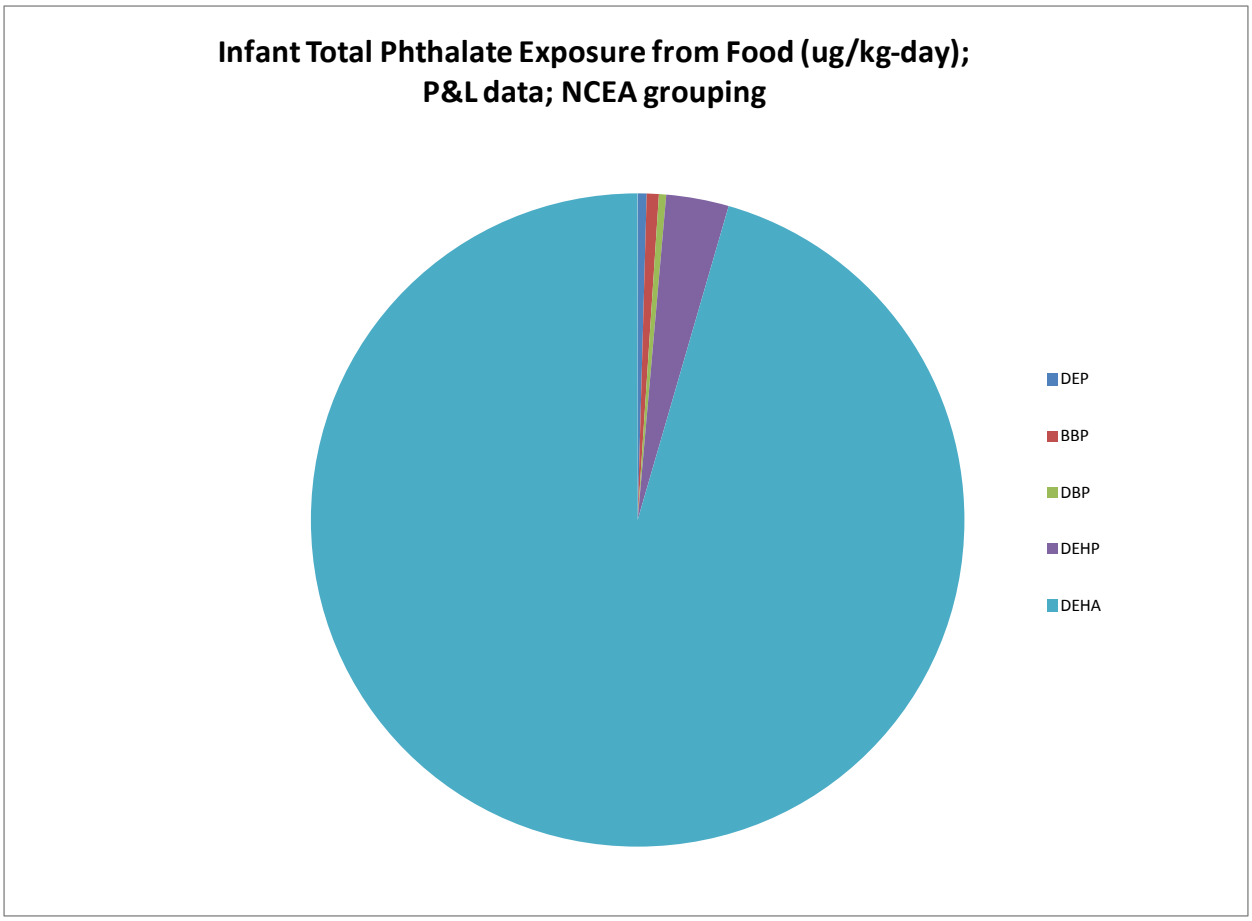


Figure E3-5 Infants total phthalate exposure from food (µg/kg-d); P&L data; Clark grouping.

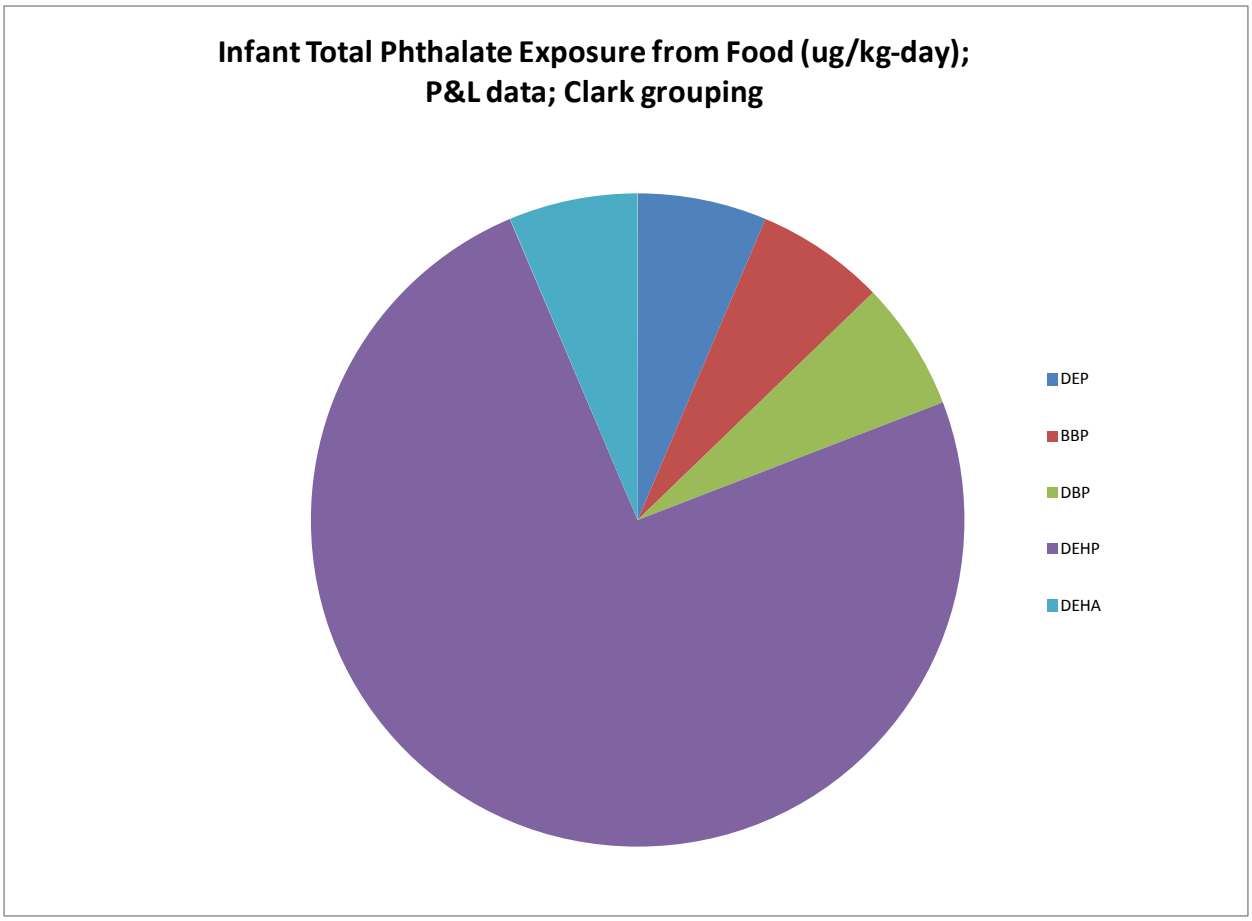
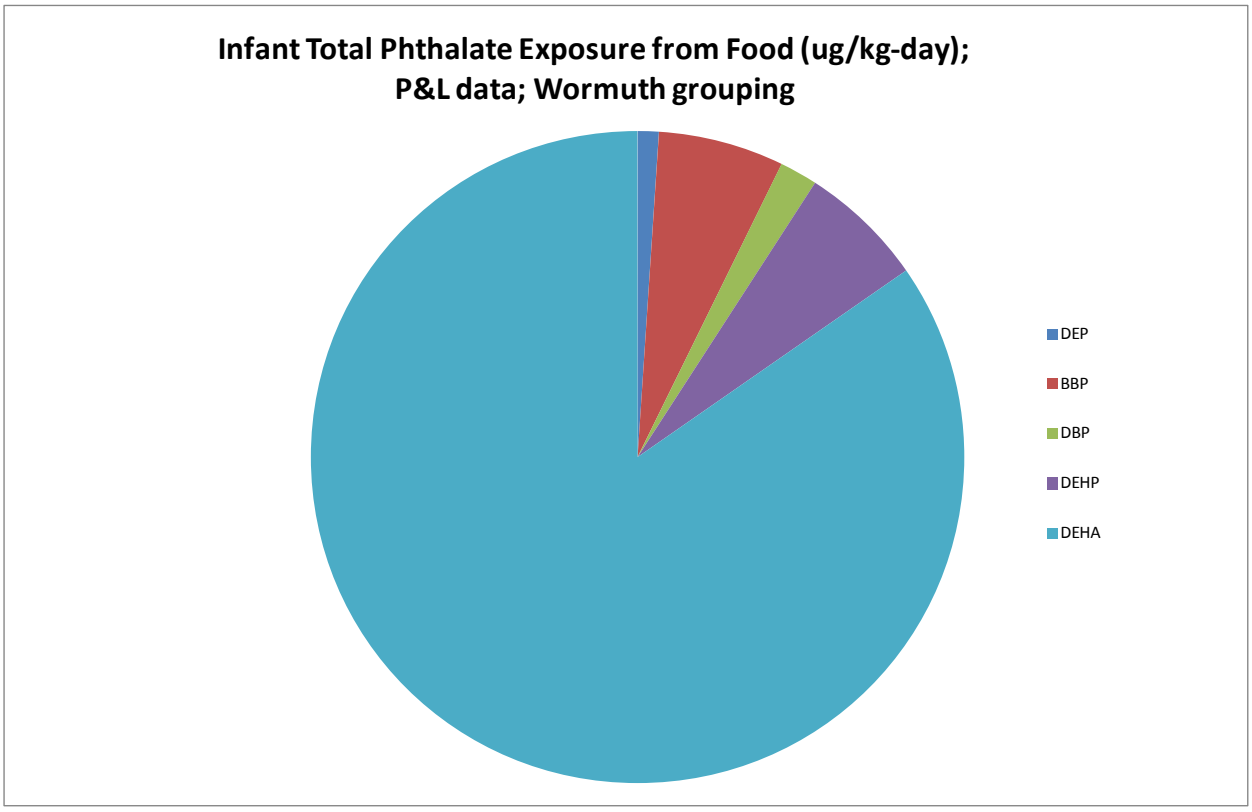


Figure E3-6 Infants total phthalate exposure from food (µg/kg-d); P&L data; Wormuth grouping.



4.3.2 Toddlers Total Phthalate Exposure from Food, Phthalate Relative Contribution (assuming 100% phthalate absorption)

Figure E3-7 Toddler total phthalate exposure from food (µg/kg-d); UK data; NCEA grouping.

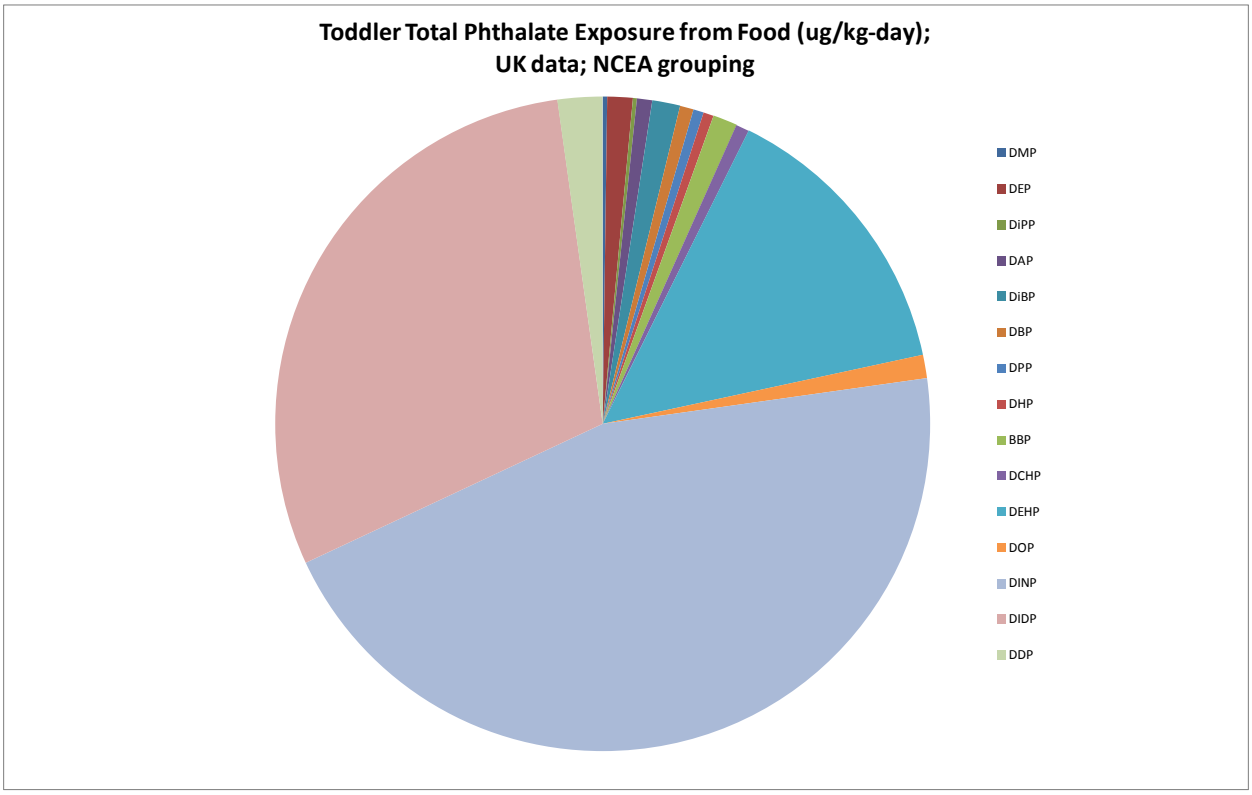


Figure E3-8 Toddlers phthalate exposure from food (µg/kg-d); UK data; Clark grouping.

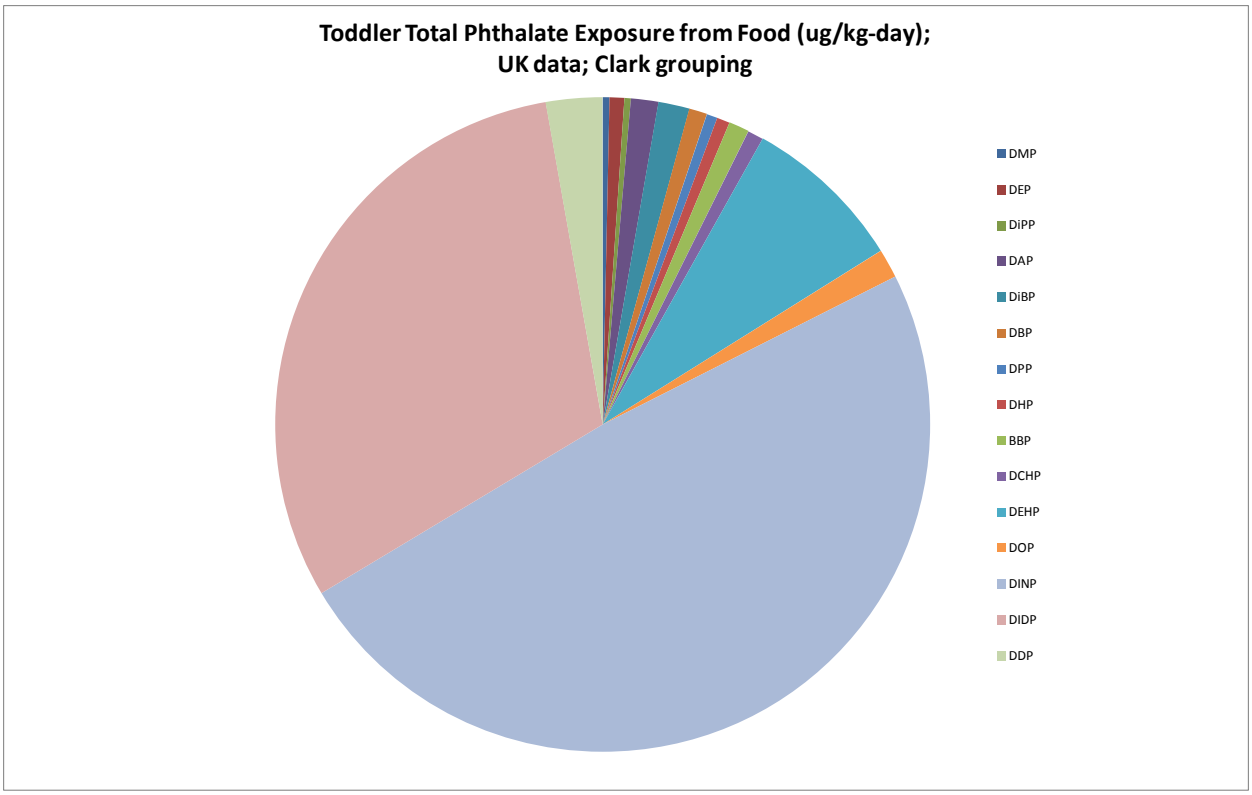


Figure E3-9 Toddlers total phthalate exposure from food (µg/kg-d); UK data; Wormuth grouping.

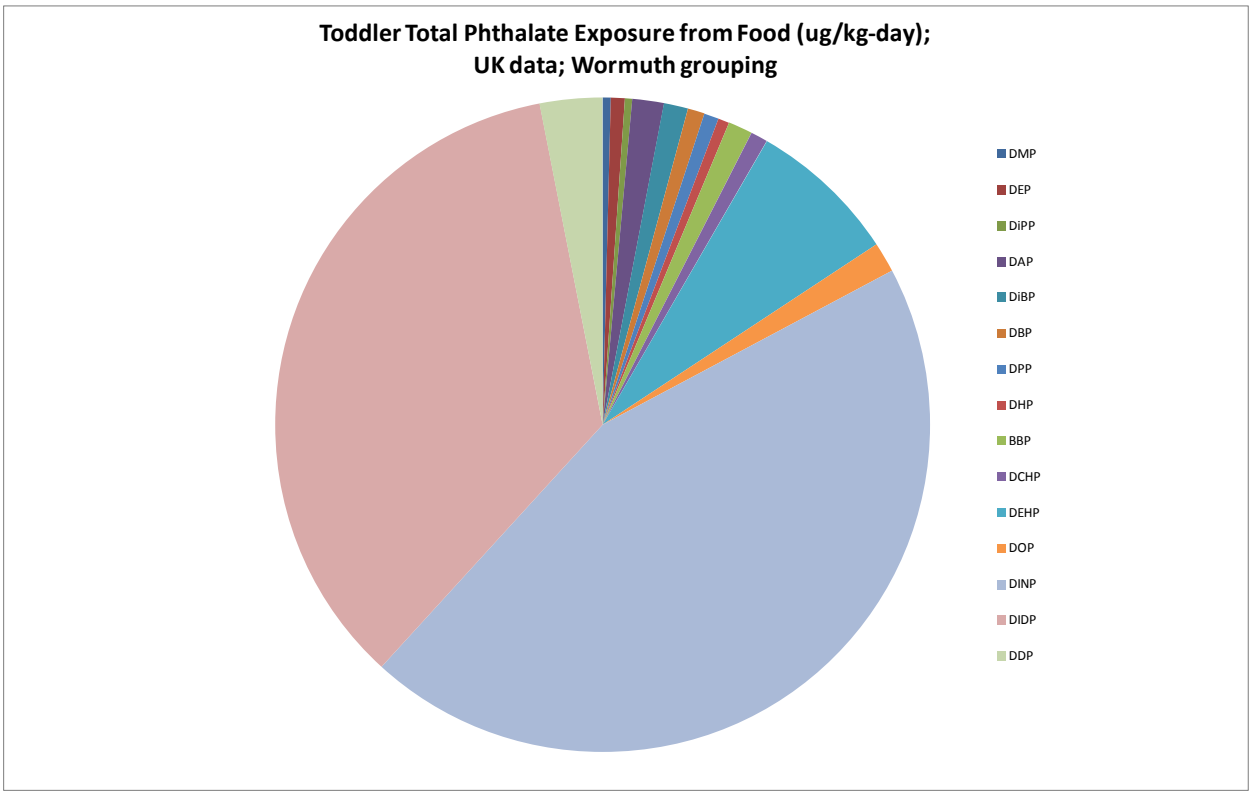


Figure E3-10 Toddlers total phthalate exposure from food (µg/kg-d); P&L data; NCEA grouping.

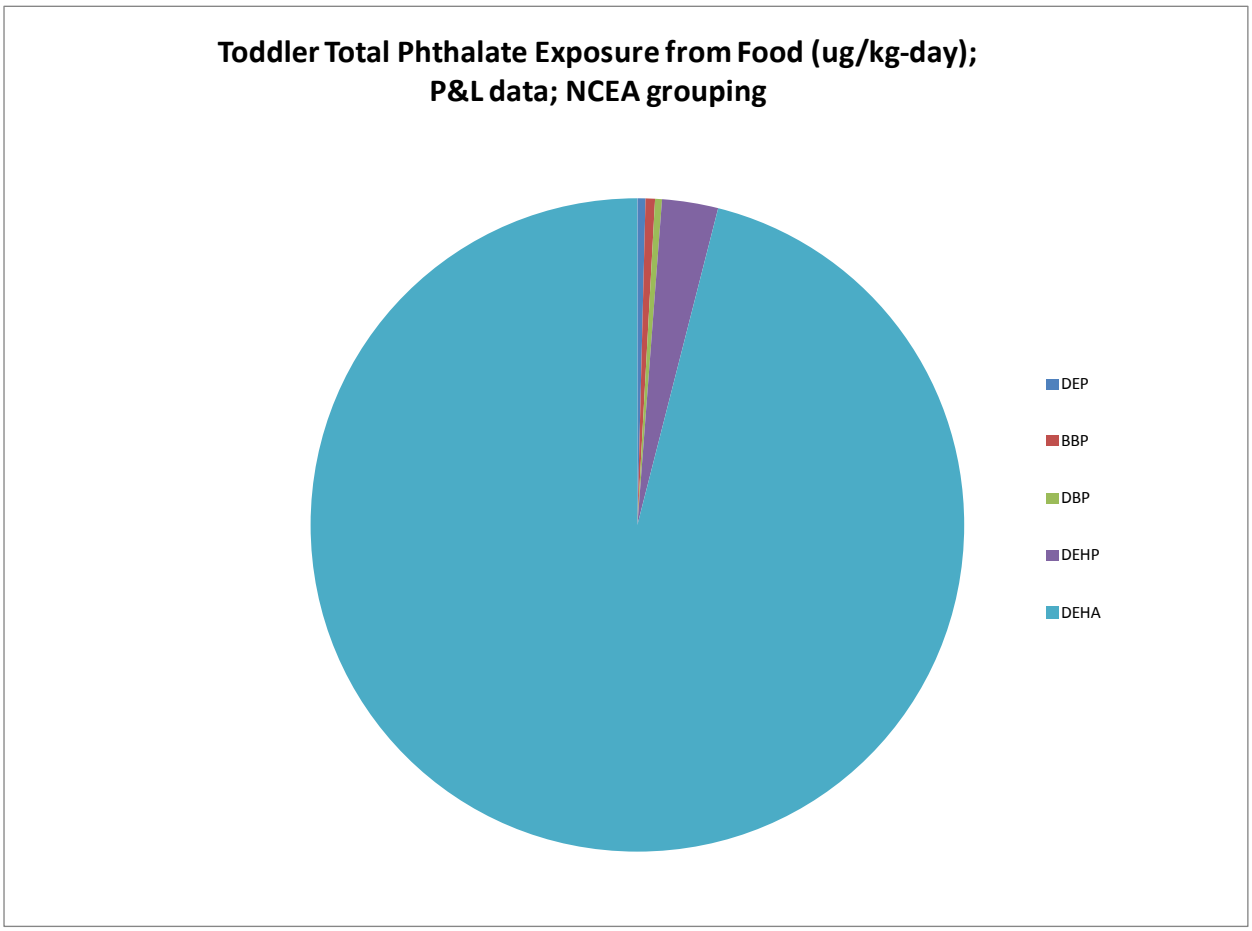


Figure E3-11 Toddlers total phthalate exposure from food (µg/kg-d); P&L data; Clark grouping.

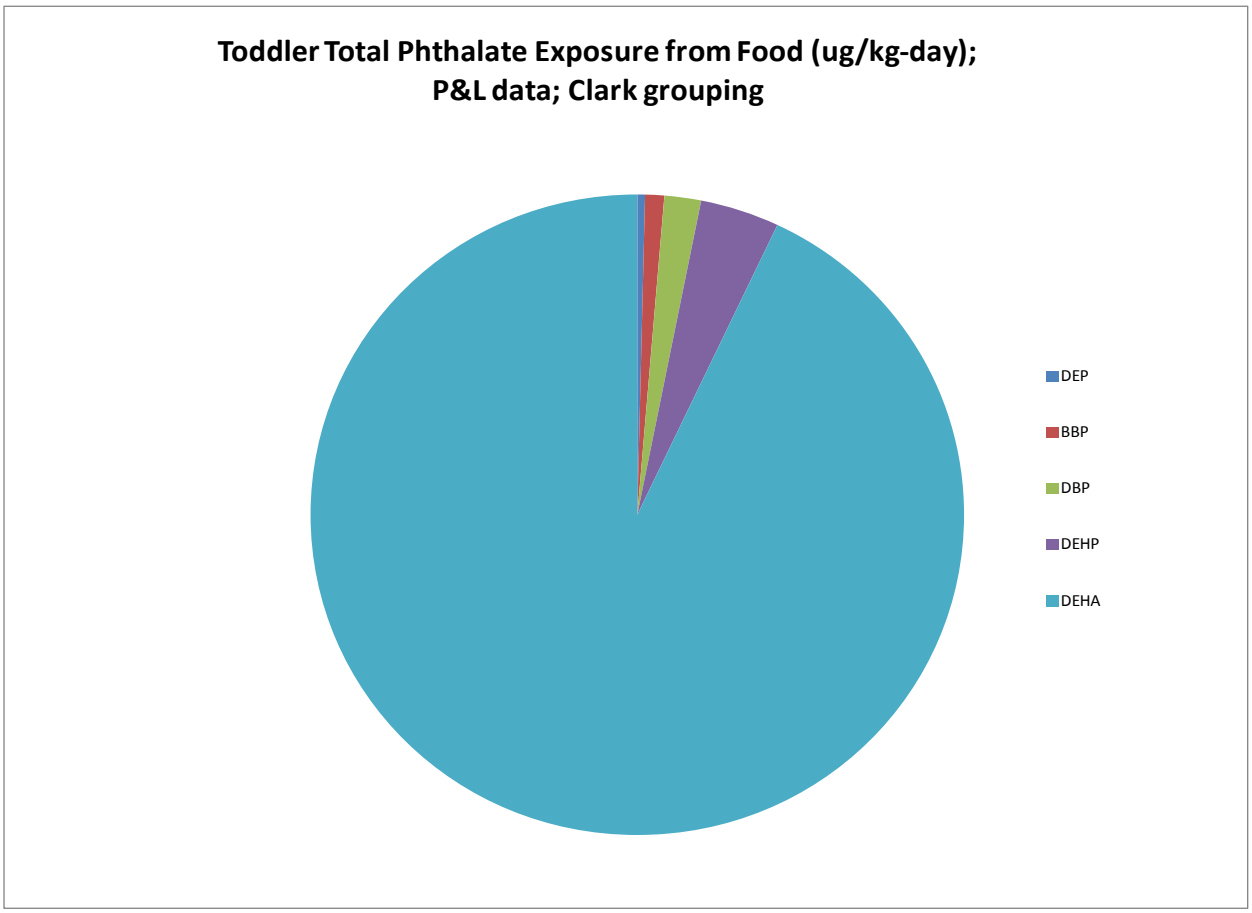
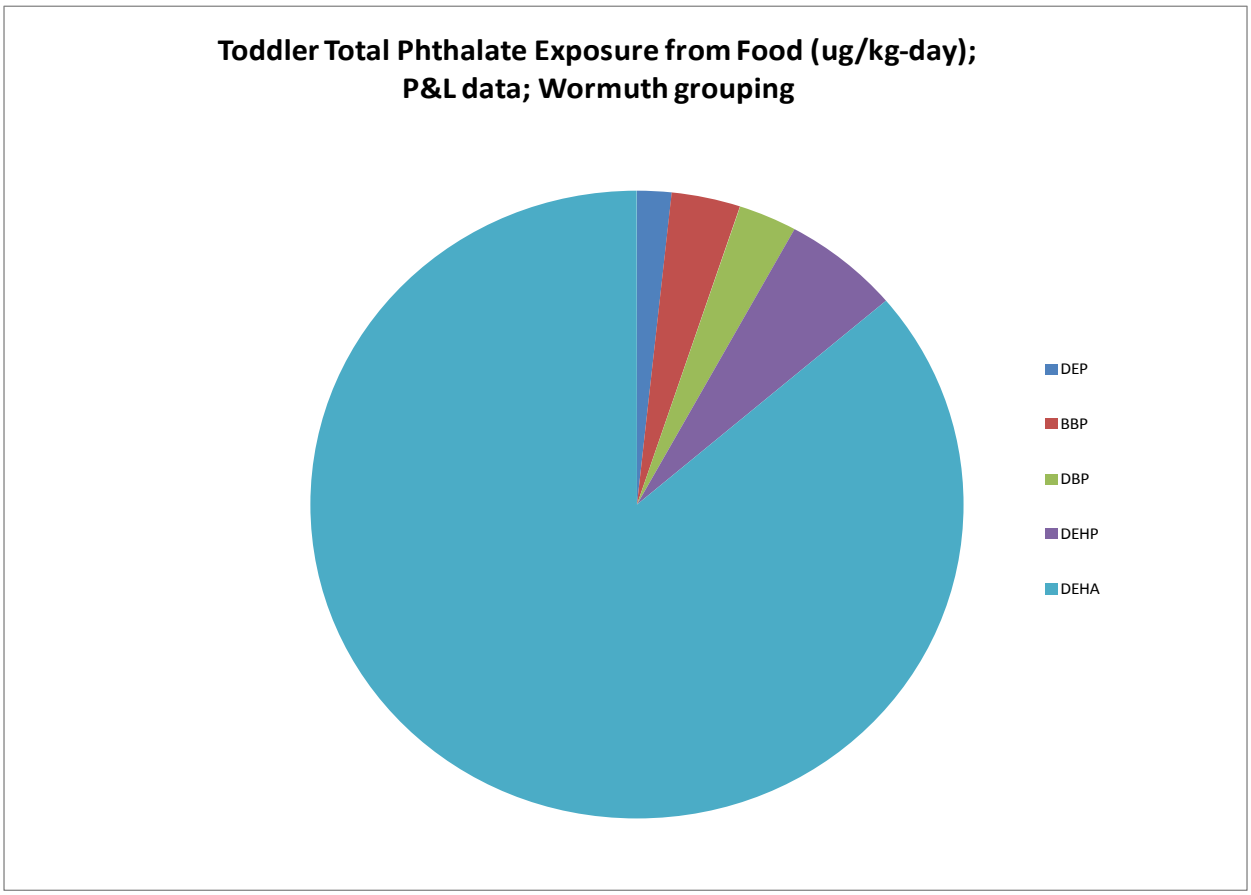


Figure E3-12 Toddlers total phthalate exposure from food (µg/kg-d); P&L data; Wormuth grouping.



4.3.3 Children Total Phthalate Exposure from Food, Phthalate Relative Contribution (assuming 100% phthalate absorption)

Figure E3-13 Children total phthalate exposure from food (µg/kg-d); UK data; NCEA grouping.

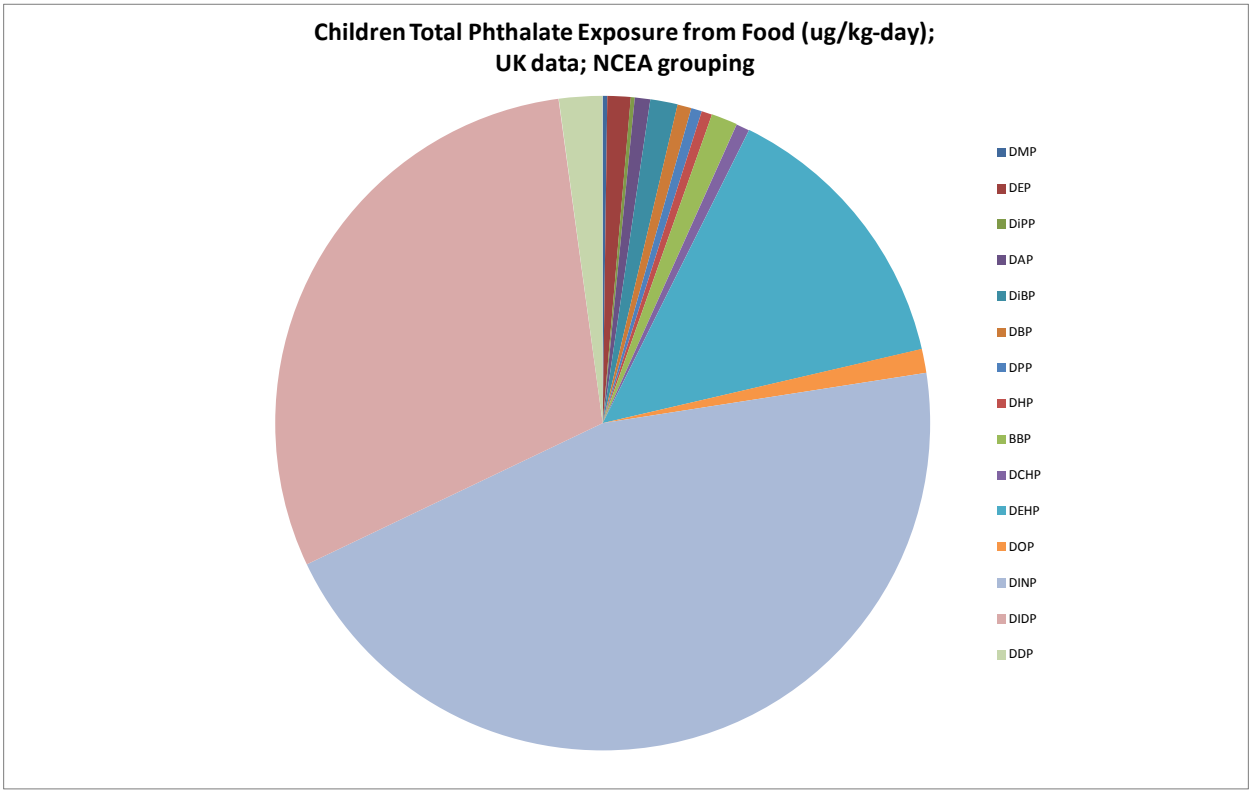


Figure E3-14 Children total phthalate exposure from food (µg/kg-d); UK data; Clark grouping.

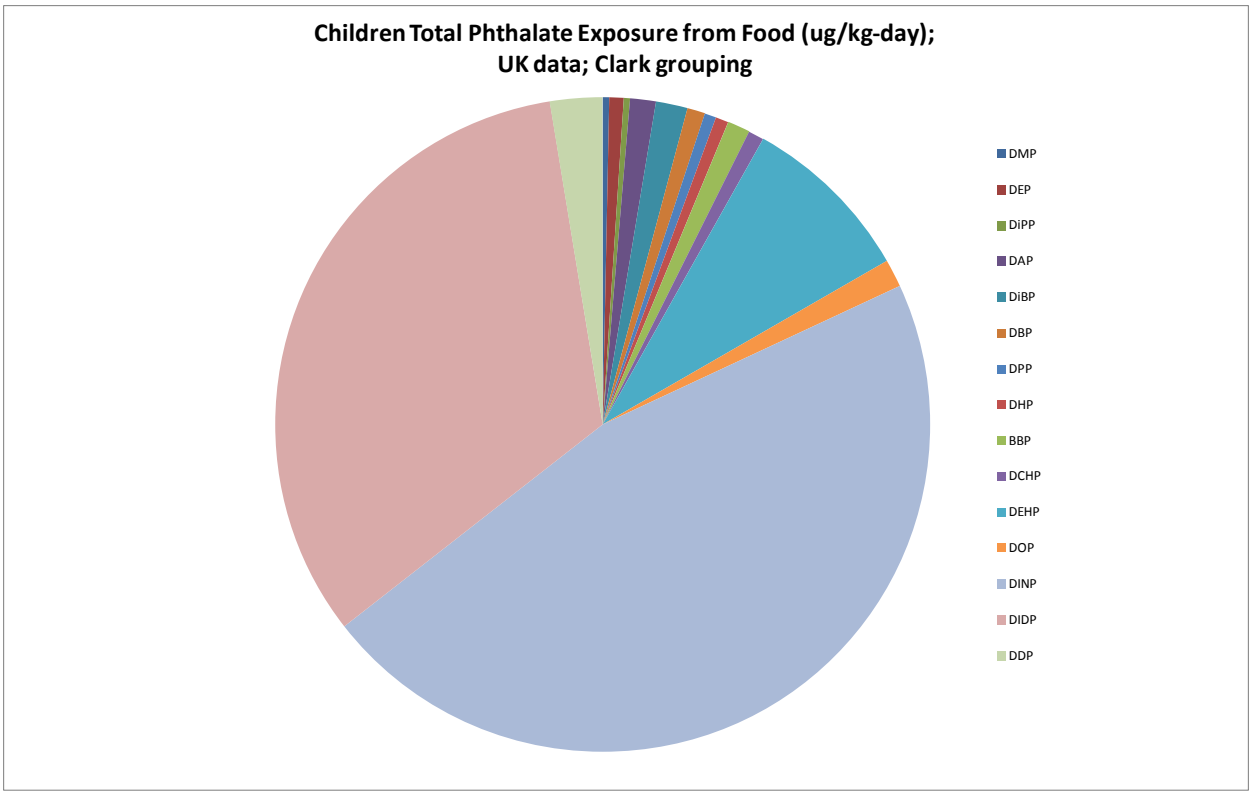


Figure E3-15 Children total phthalate exposure from food (µg/kg-d); UK data; Wormuth grouping.

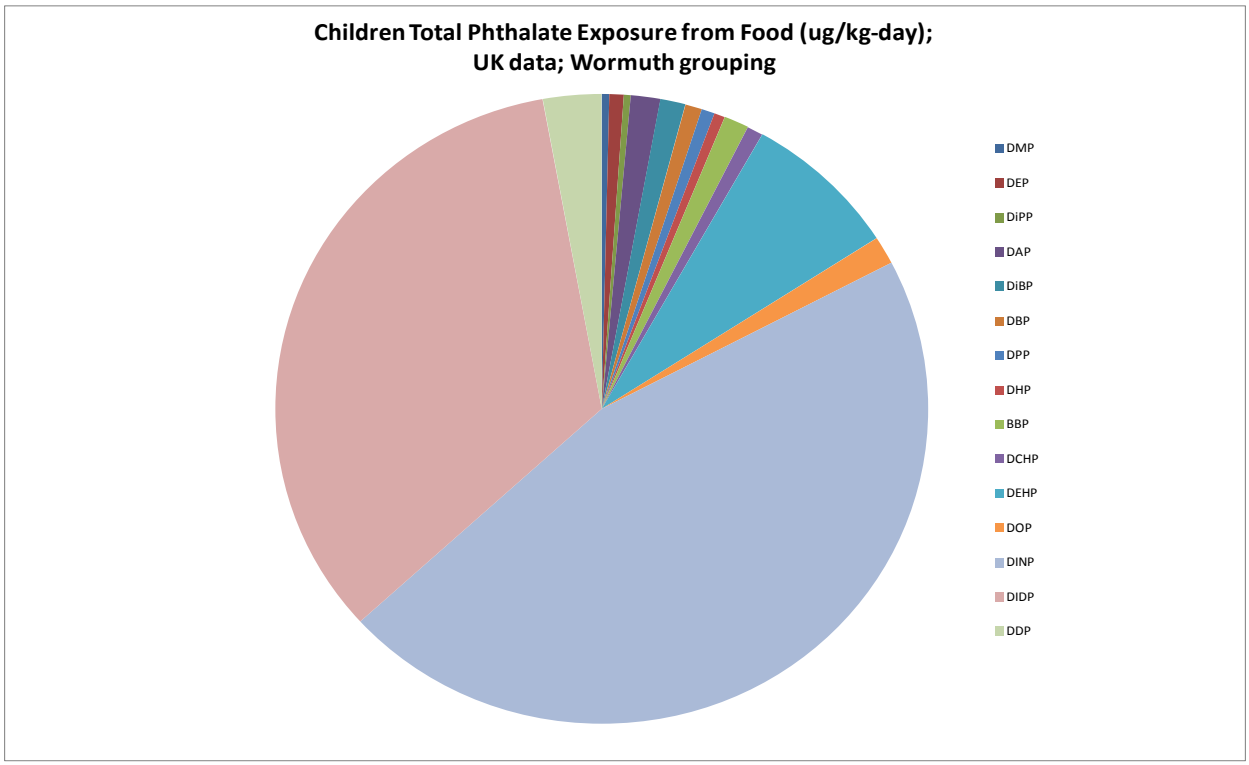


Figure E3-16 Children total phthalate exposure from food (µg/kg-d); P&L data; NCEA grouping.

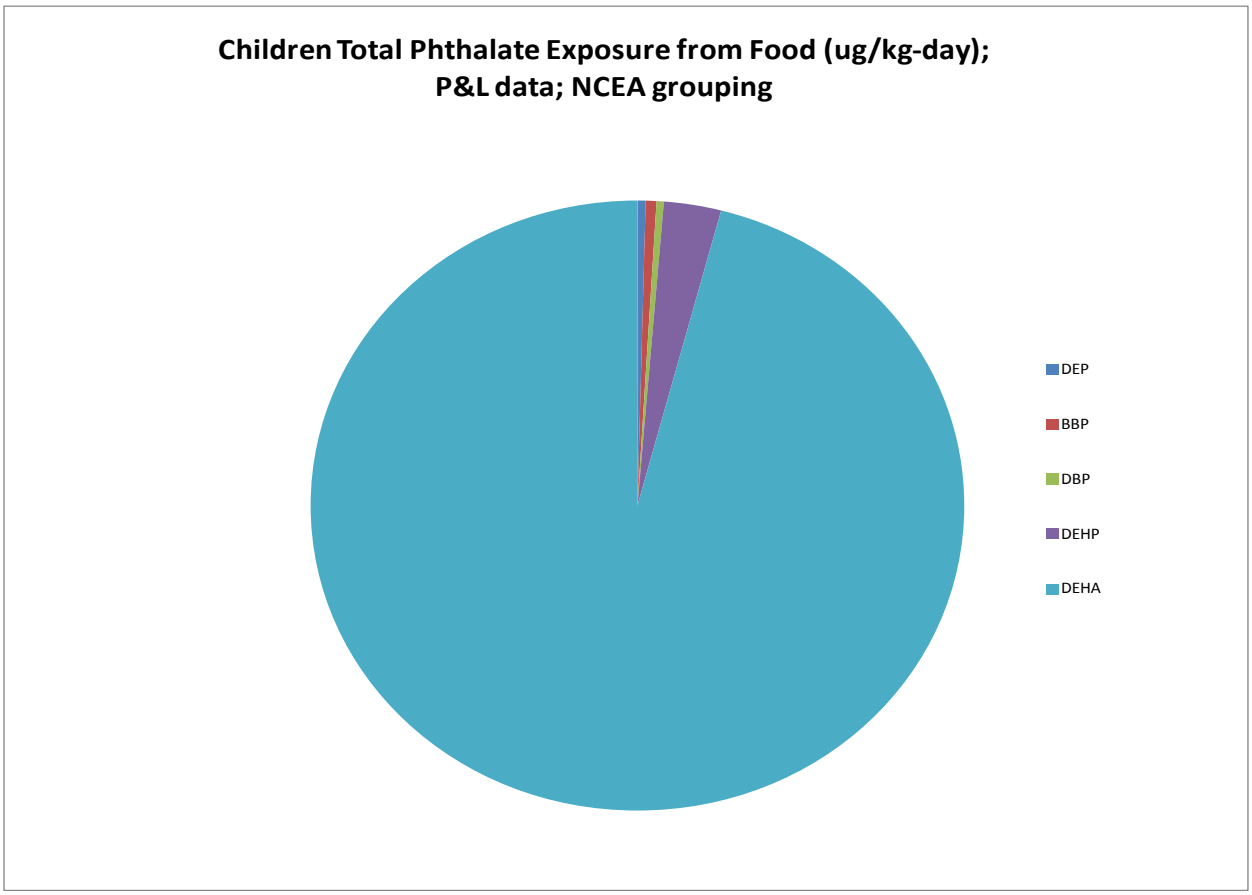


Figure E3-17 Children total phthalate exposure from food (µg/kg-d); P&L data; Clark grouping.

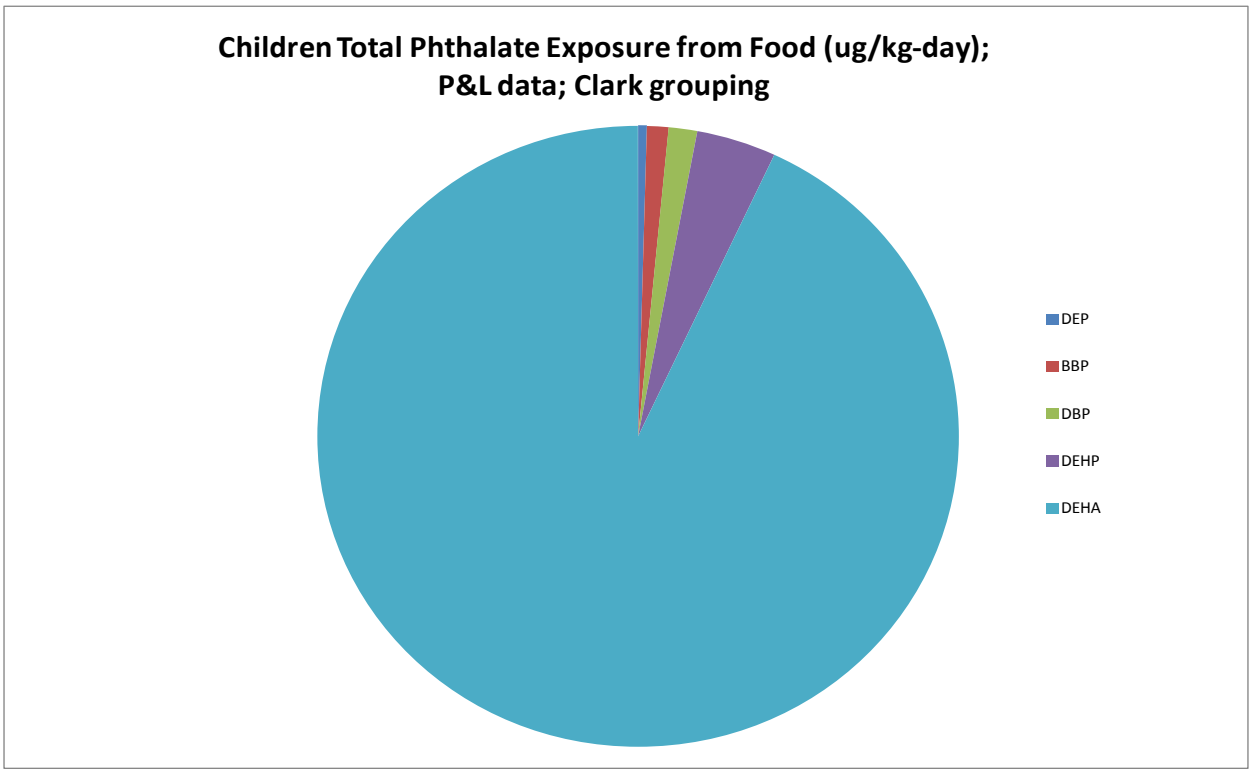
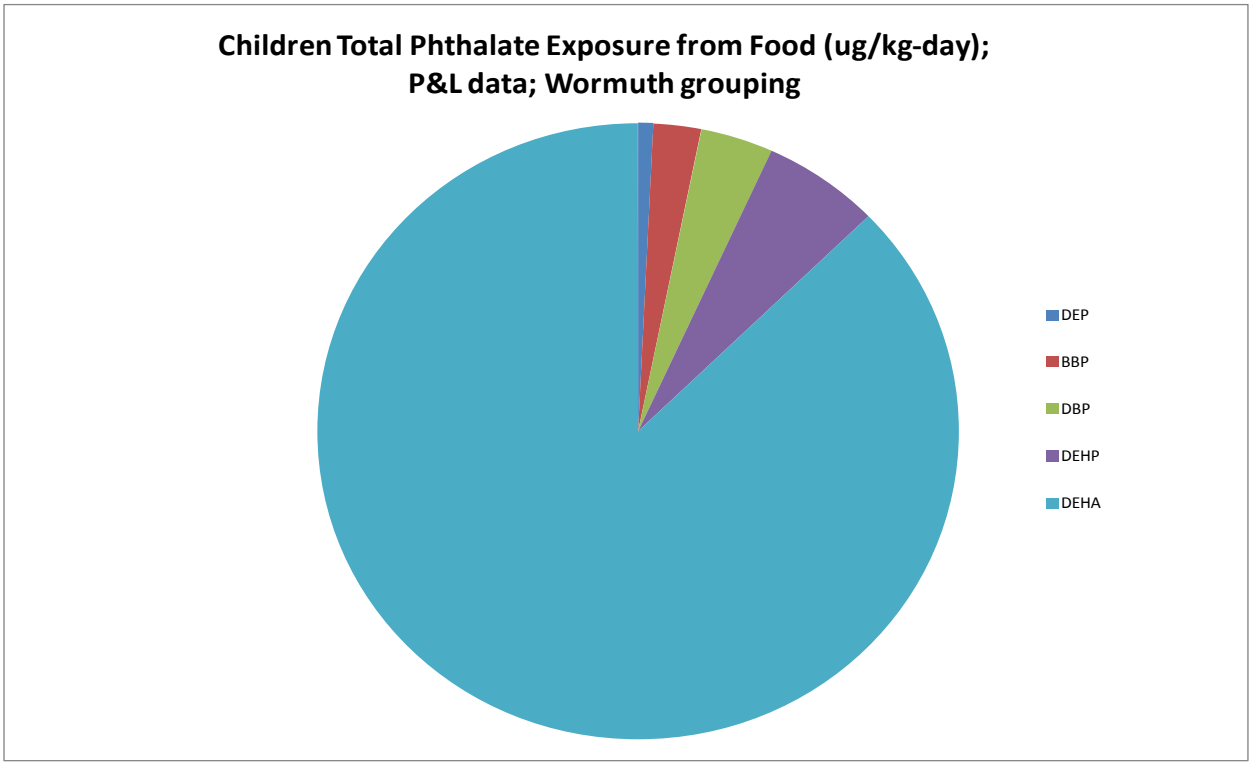


Figure E3-18 Children total phthalate exposure from food (µg/kg-d); P&L data; Wormuth grouping.



4.3.4 Female Teens Total Phthalate Exposure from Food, Phthalate Relative Contribution (assuming 100% phthalate absorption)

Figure E3-19 Female teens total phthalate exposure from food (µg/kg-d); UK data; NCEA grouping.

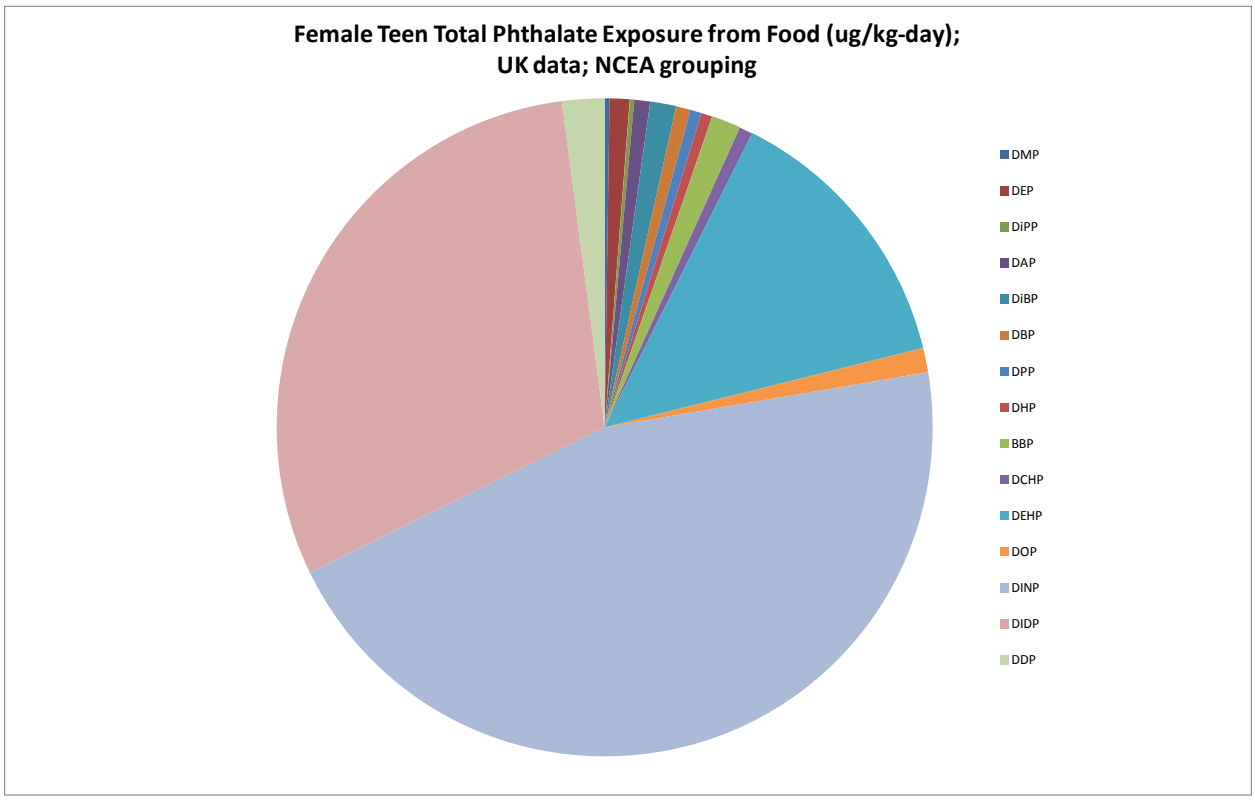


Figure E3-20 Female teens total phthalate exposure from food (µg/kg-d); UK data; Clark grouping.

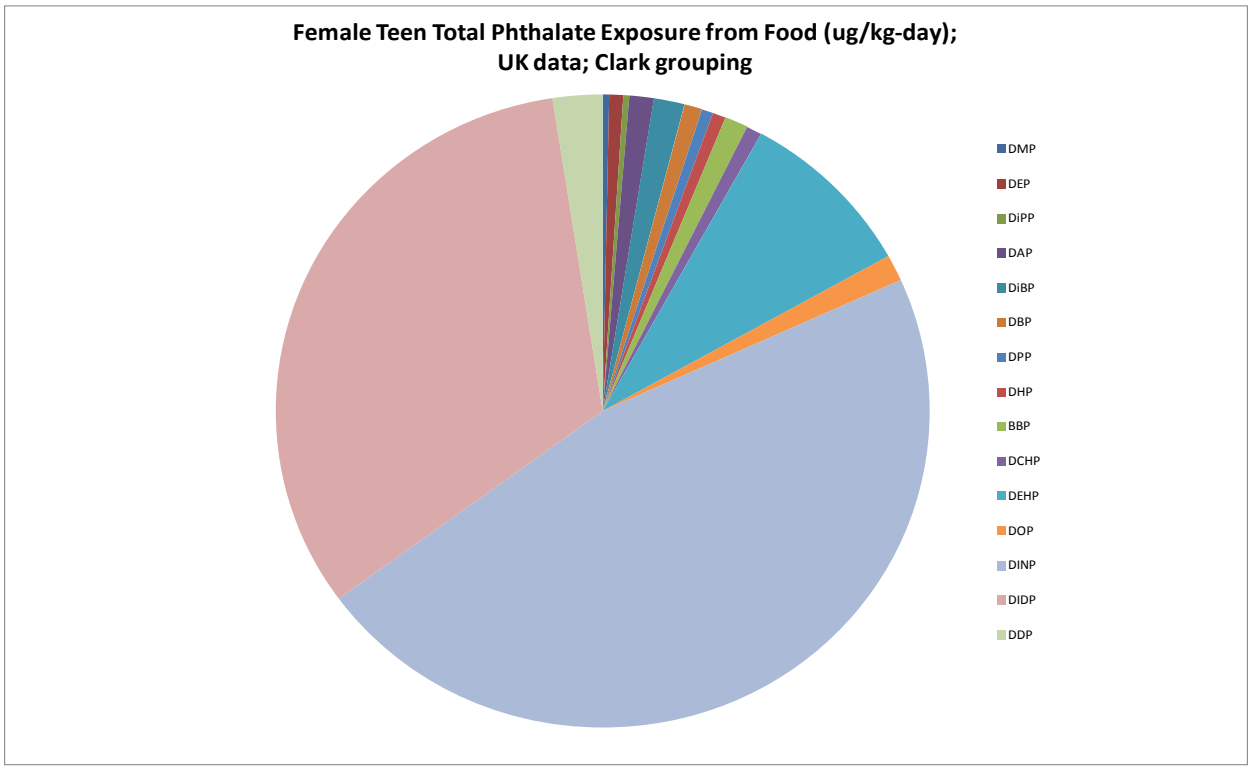


Figure E3-21 Female teens total phthalate exposure from food (µg/kg-d); UK data; Wormuth grouping.

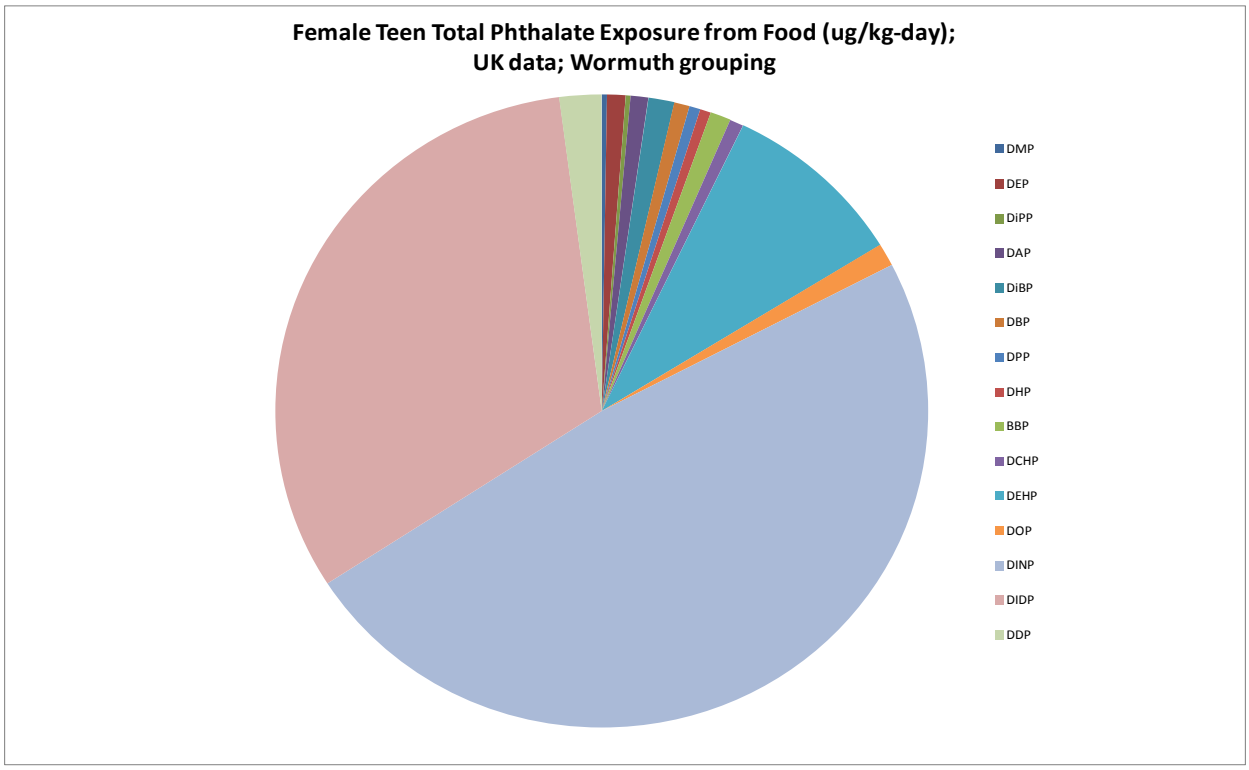


Figure E3-22 Female teens total phthalate exposure from food (µg/kg-d); P&L data; NCEA grouping.

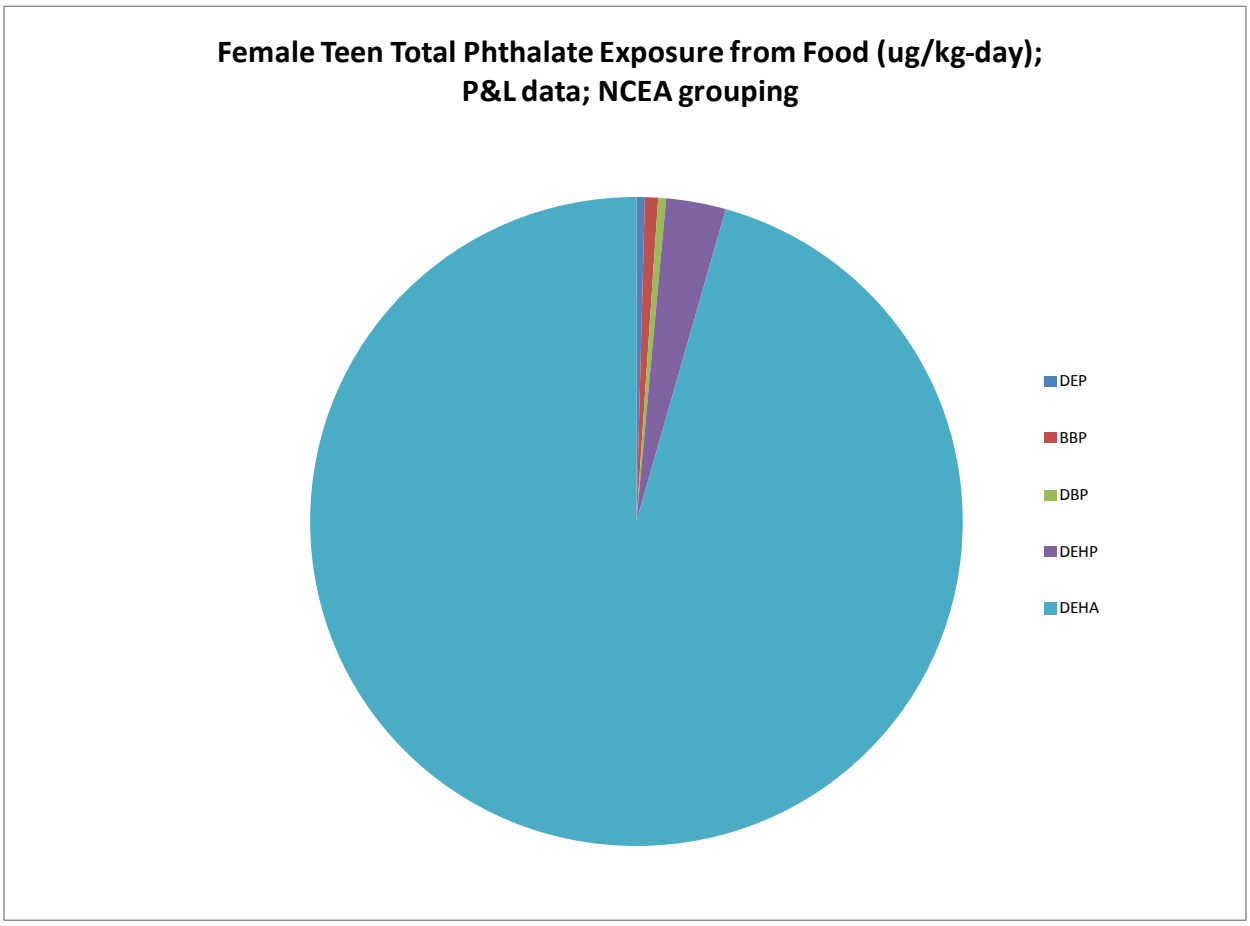


Figure E3-23 Female teens total phthalate exposure from food (µg/kg-d); P&L data; Clark grouping.

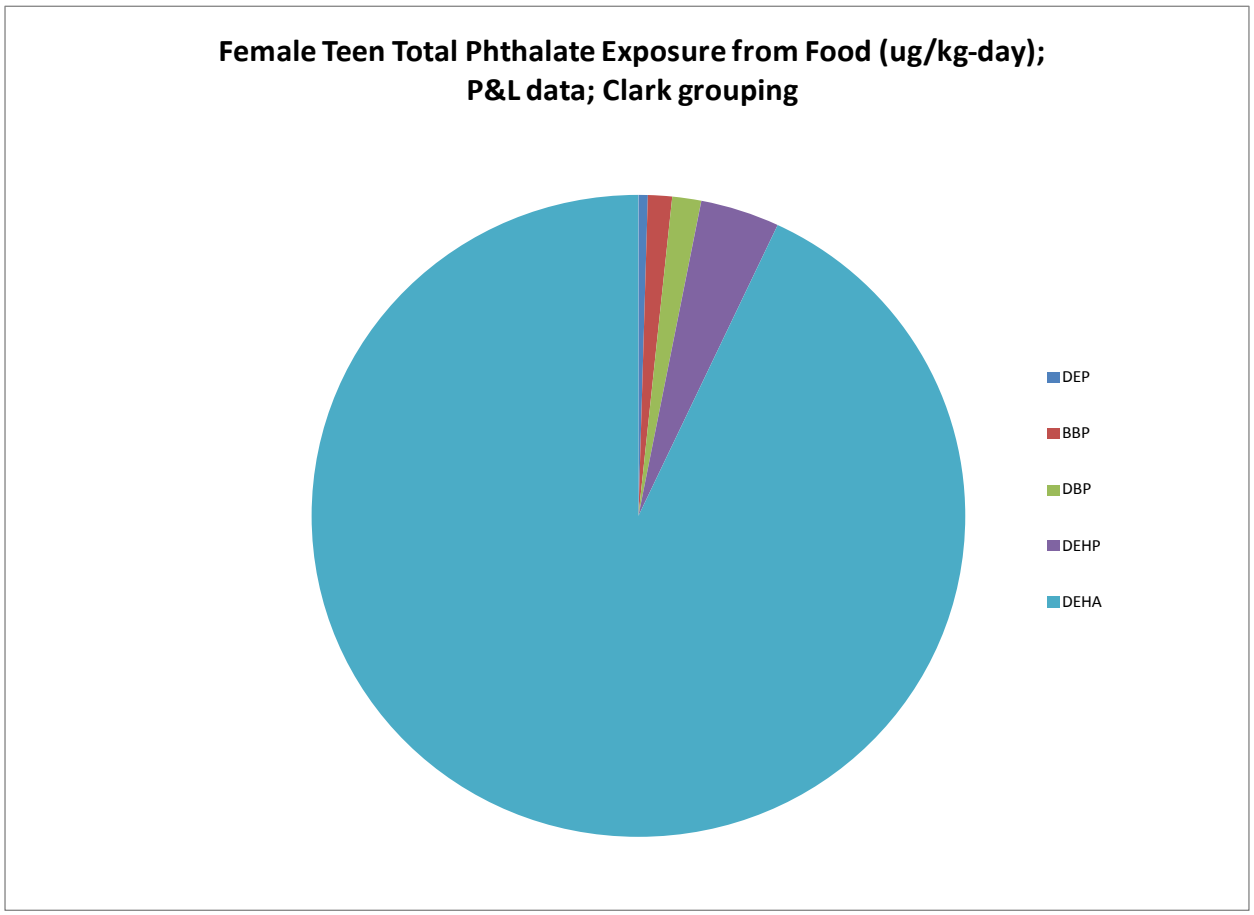
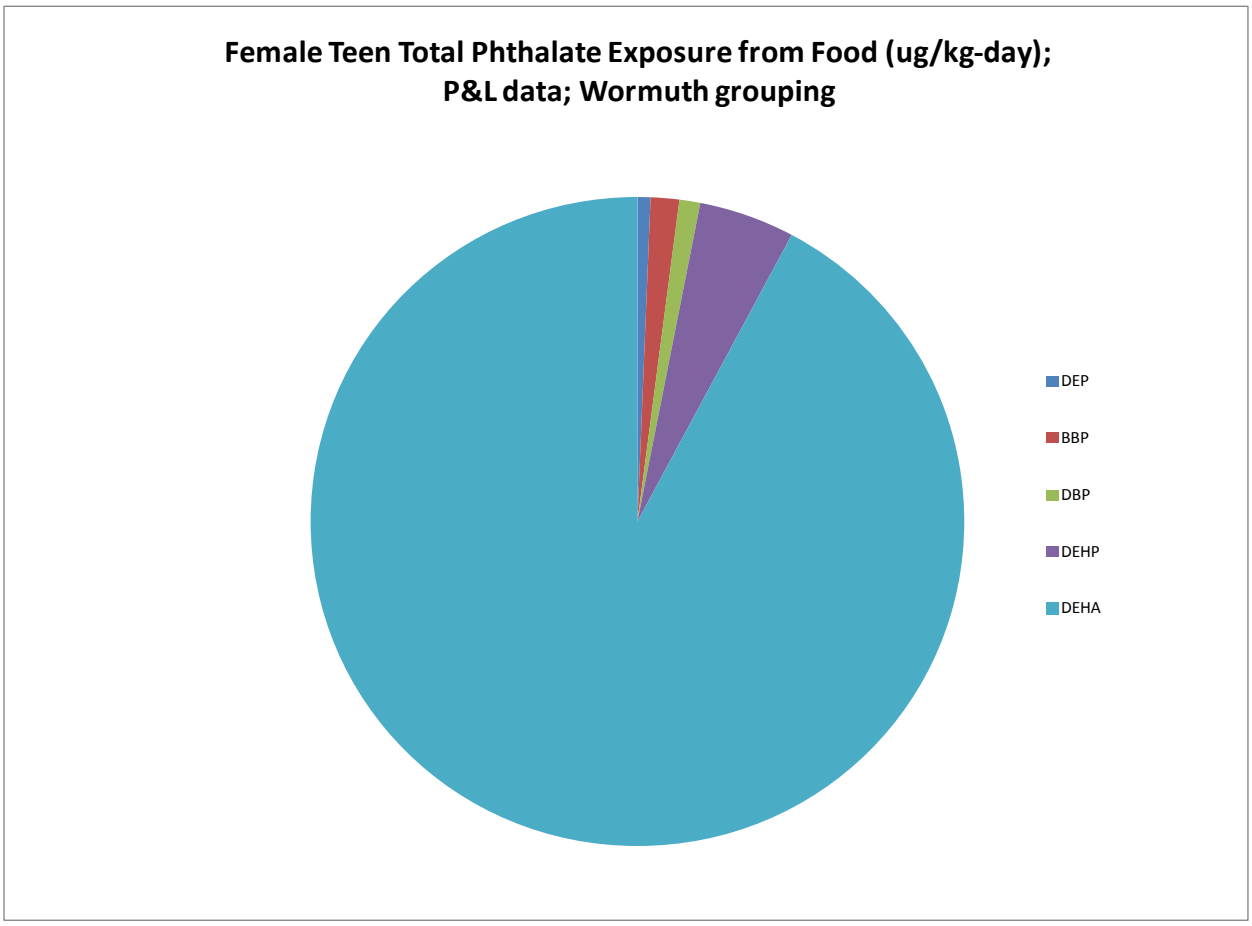


Figure E3-24 Female teens total phthalate exposure from food (µg/kg-d); P&L data; Wormuth grouping.



4.3.5 Male Teens Total Phthalate Exposure from Food, Phthalate Relative Contribution (assuming 100% phthalate absorption)

Figure E3-25 Male teens total phthalate exposure from food (µg/kg-d); UK data; NCEA grouping.

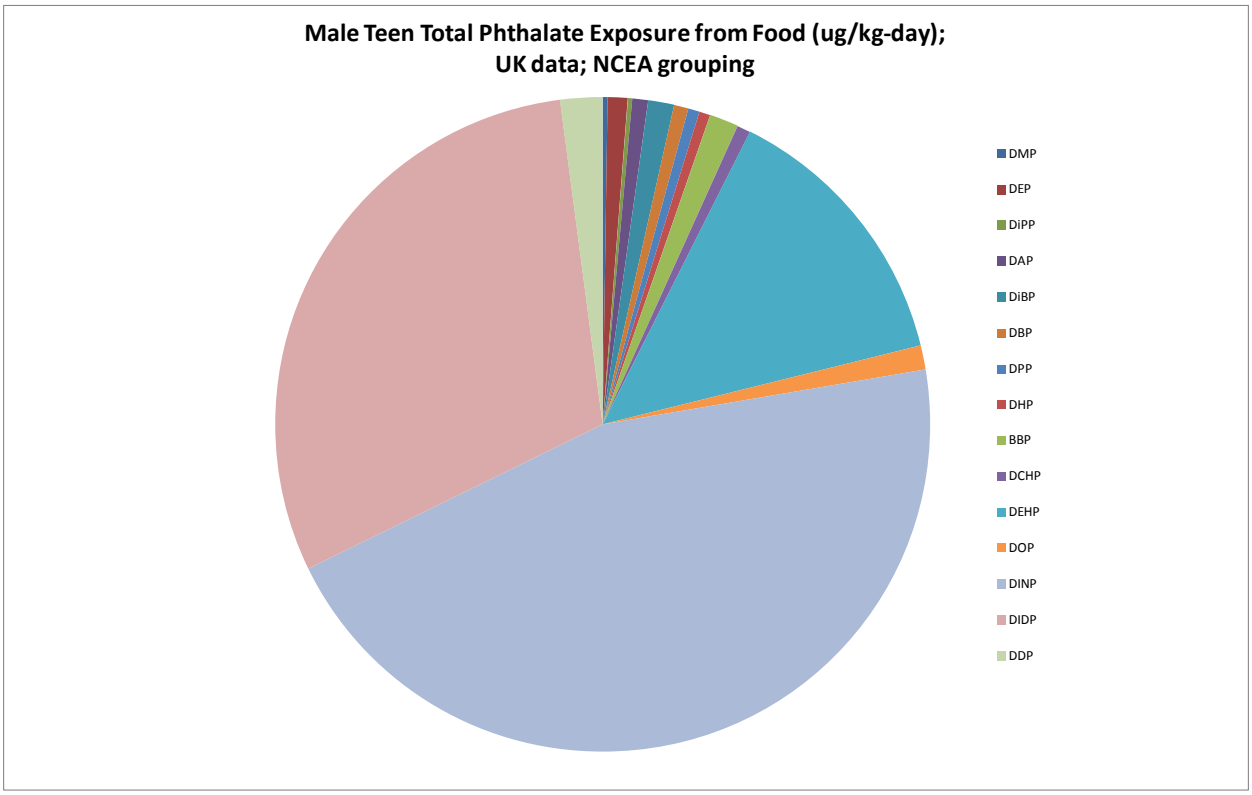


Figure E3-26 Male teens total phthalate exposure from food (µg/kg-d); UK data; Clark grouping.

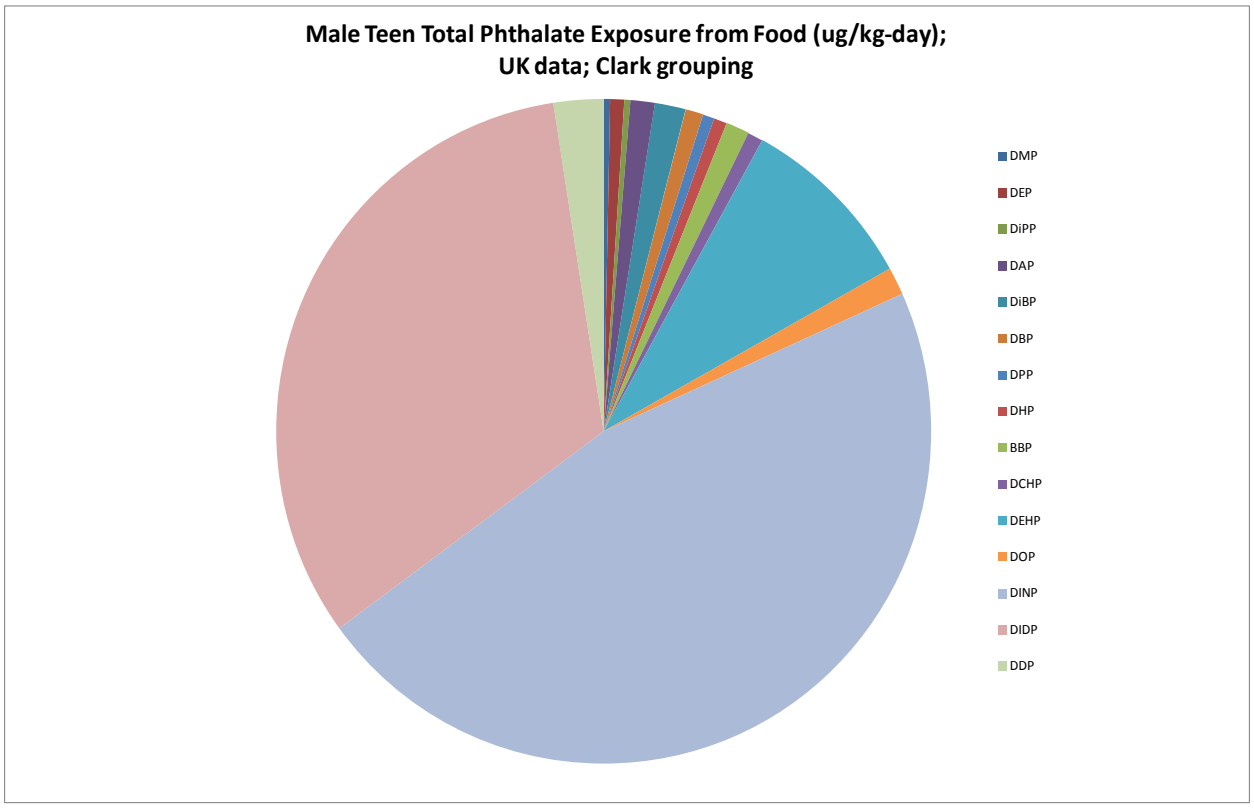


Figure E3-27 Male teens total phthalate exposure from food (µg/kg-d); UK data; Wormuth grouping.

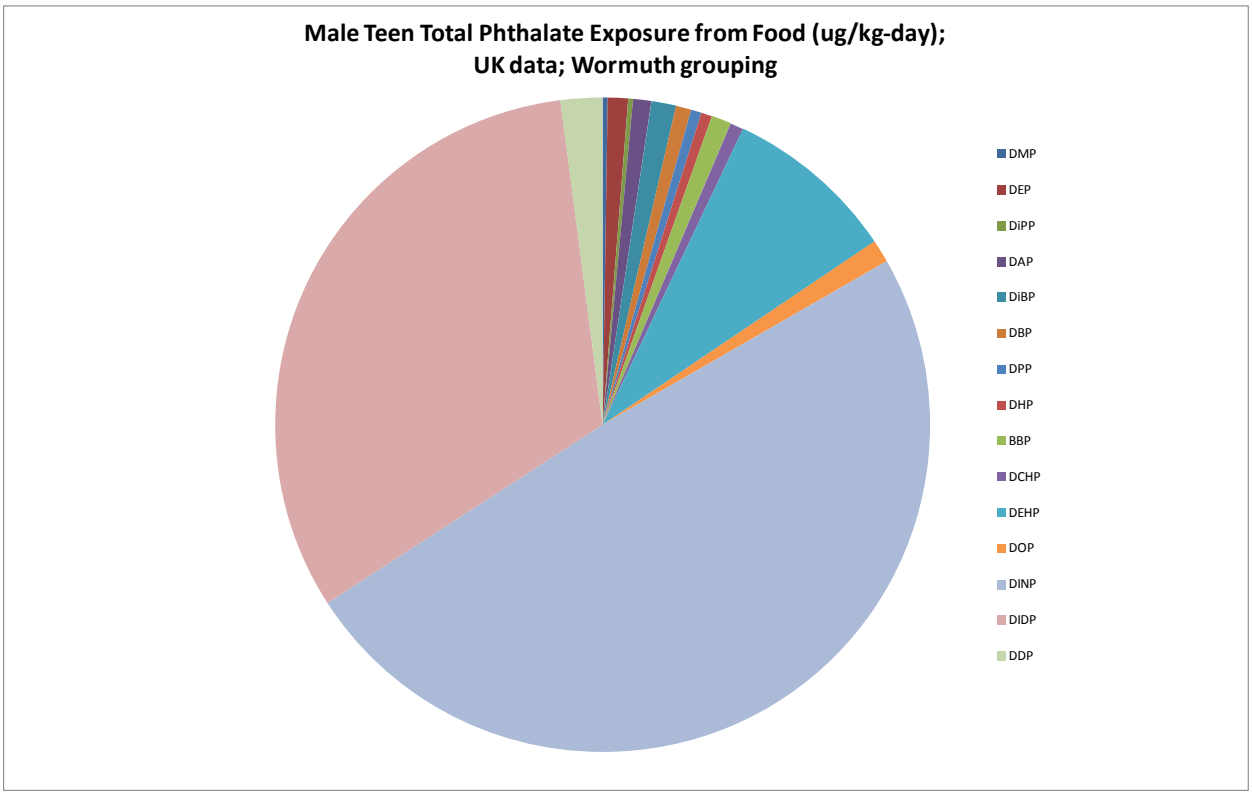


Figure E3-28 Male teens total phthalate exposure from food (µg/kg-d); P&L data; NCEA grouping.

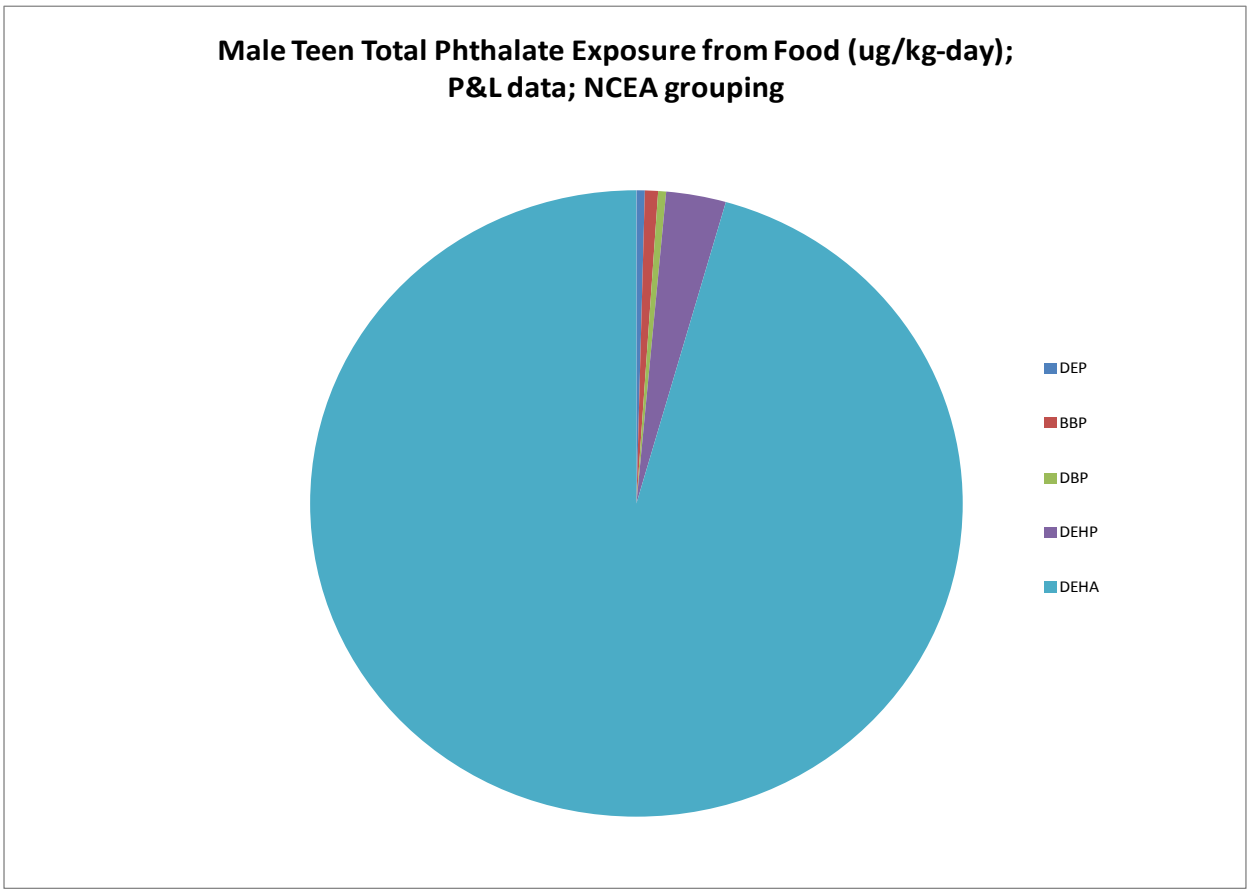


Figure E3-29 Male teens total phthalate exposure from food (µg/kg-d); P&L data; Clark grouping.

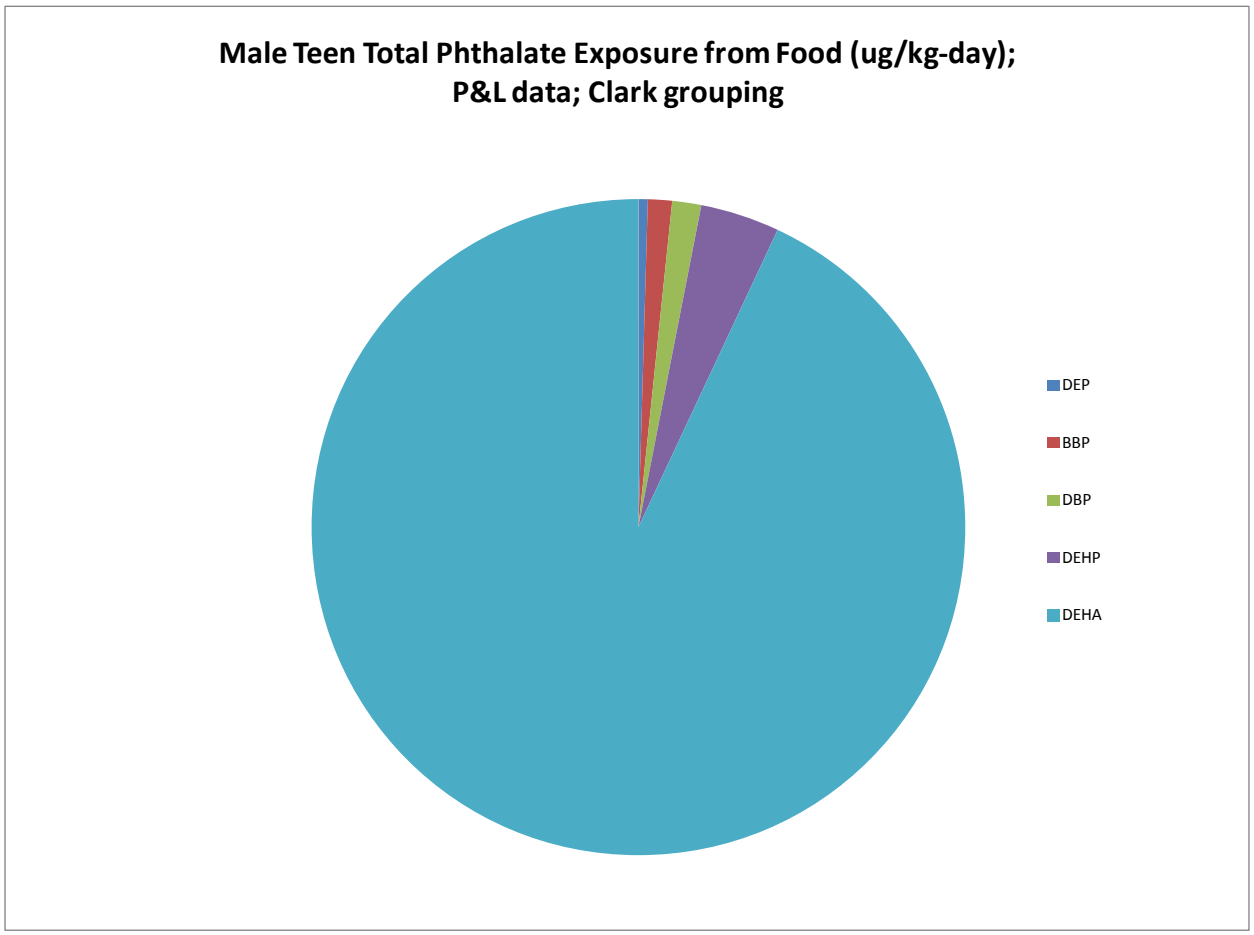
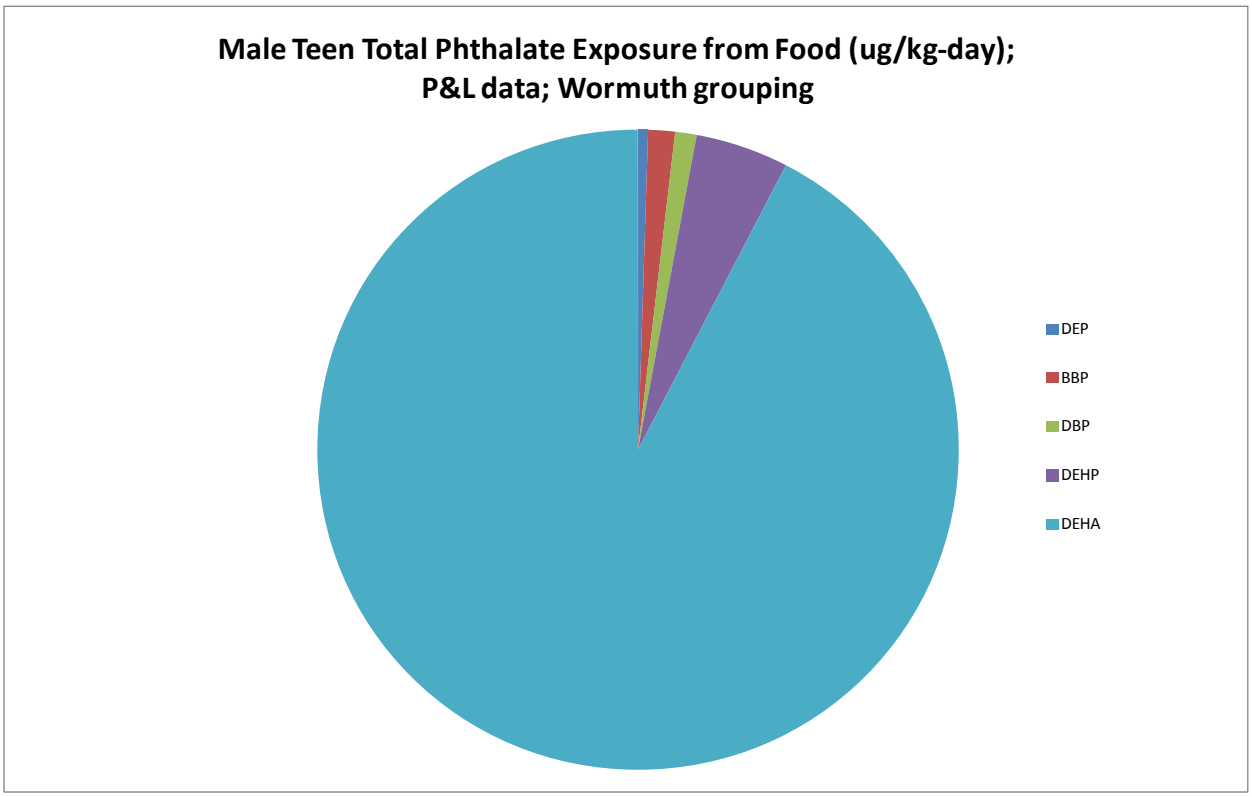


Figure E3-30 Male teens total phthalate exposure from food (µg/kg-d); P&L data; Wormuth grouping.



4.3.6 Female Adults Total Phthalate Exposure from Food, Phthalate Relative Contribution (Assuming 100% Phthalate Absorption)

Figure E3-31 Female adults total phthalate exposure from food (µg/kg-d); UK data; NCEA grouping.

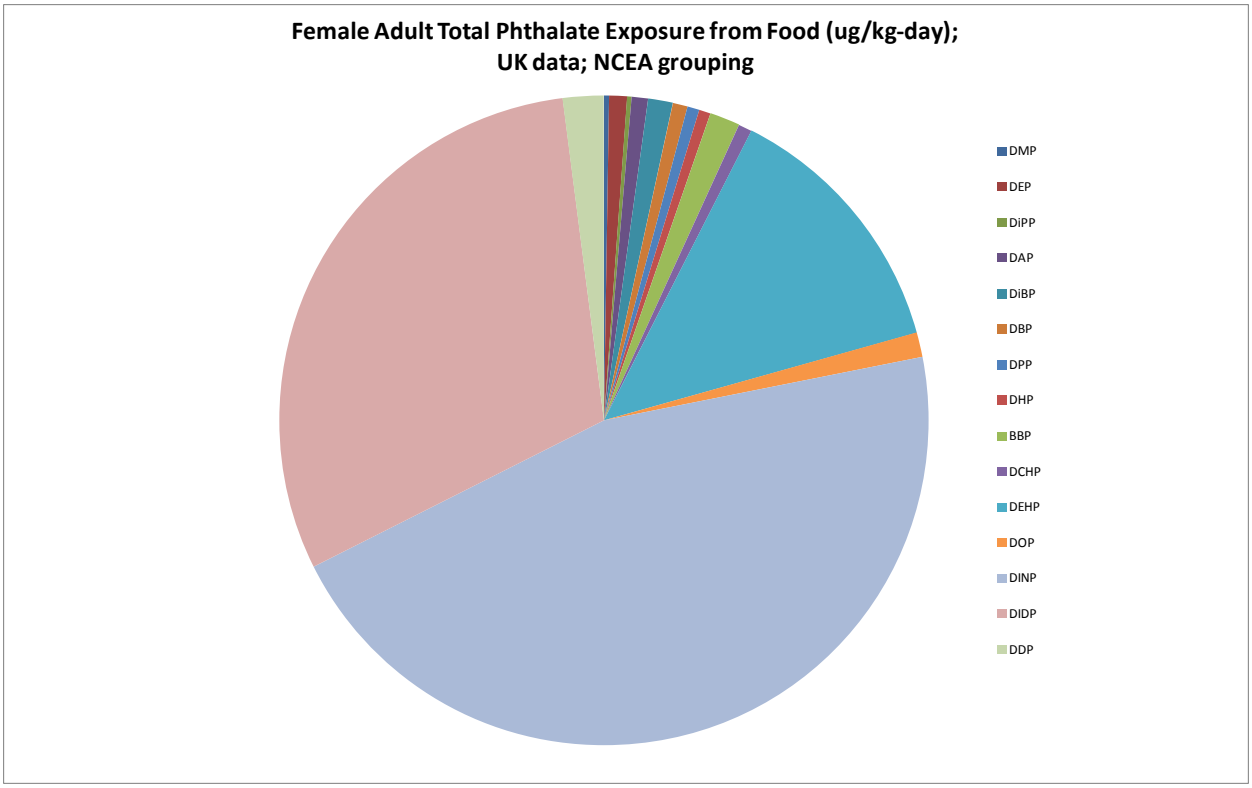


Figure E3-32 Female adults total phthalate exposure from food (µg/kg-d); UK data; Clark grouping.

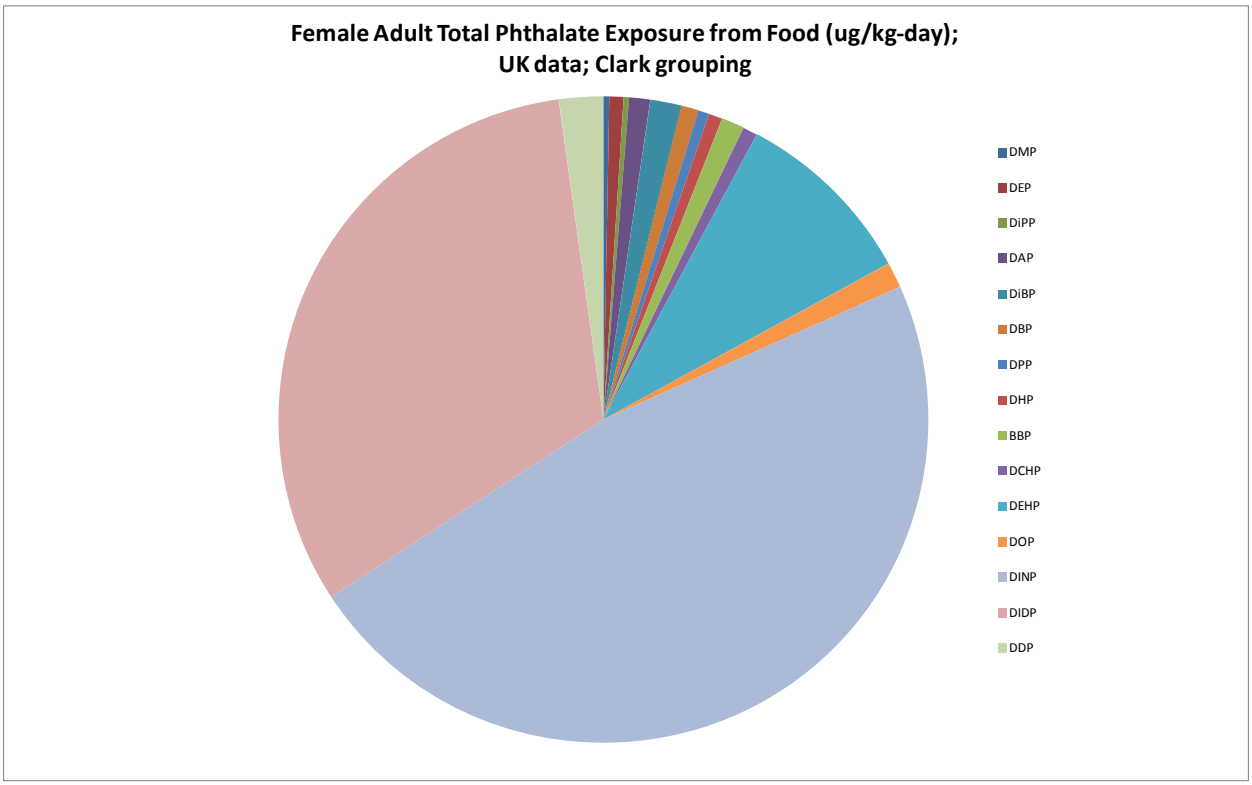


Figure E3-33 Female adults total phthalate exposure from food (µg/kg-d); UK data; Wormuth grouping.

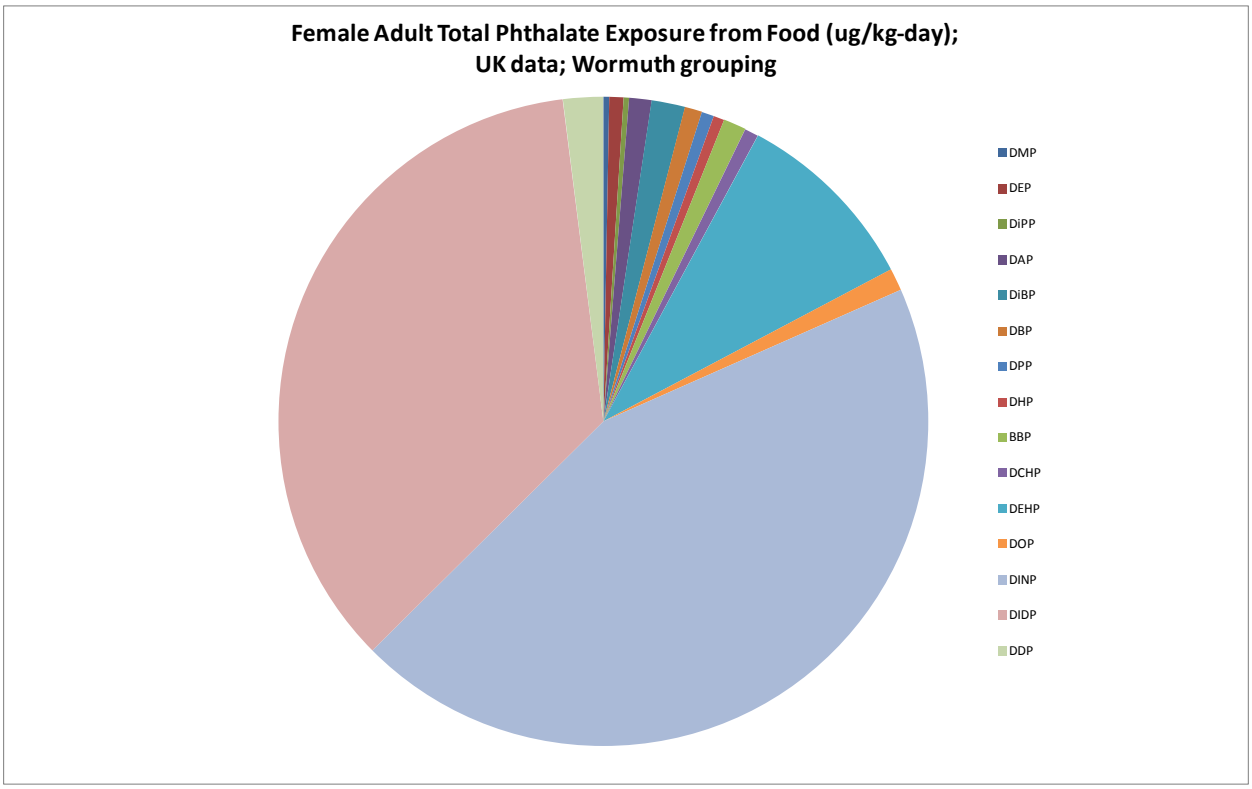


Figure E3-34 Female adults total phthalate exposure from food (µg/kg-d); P&L data; NCEA grouping.

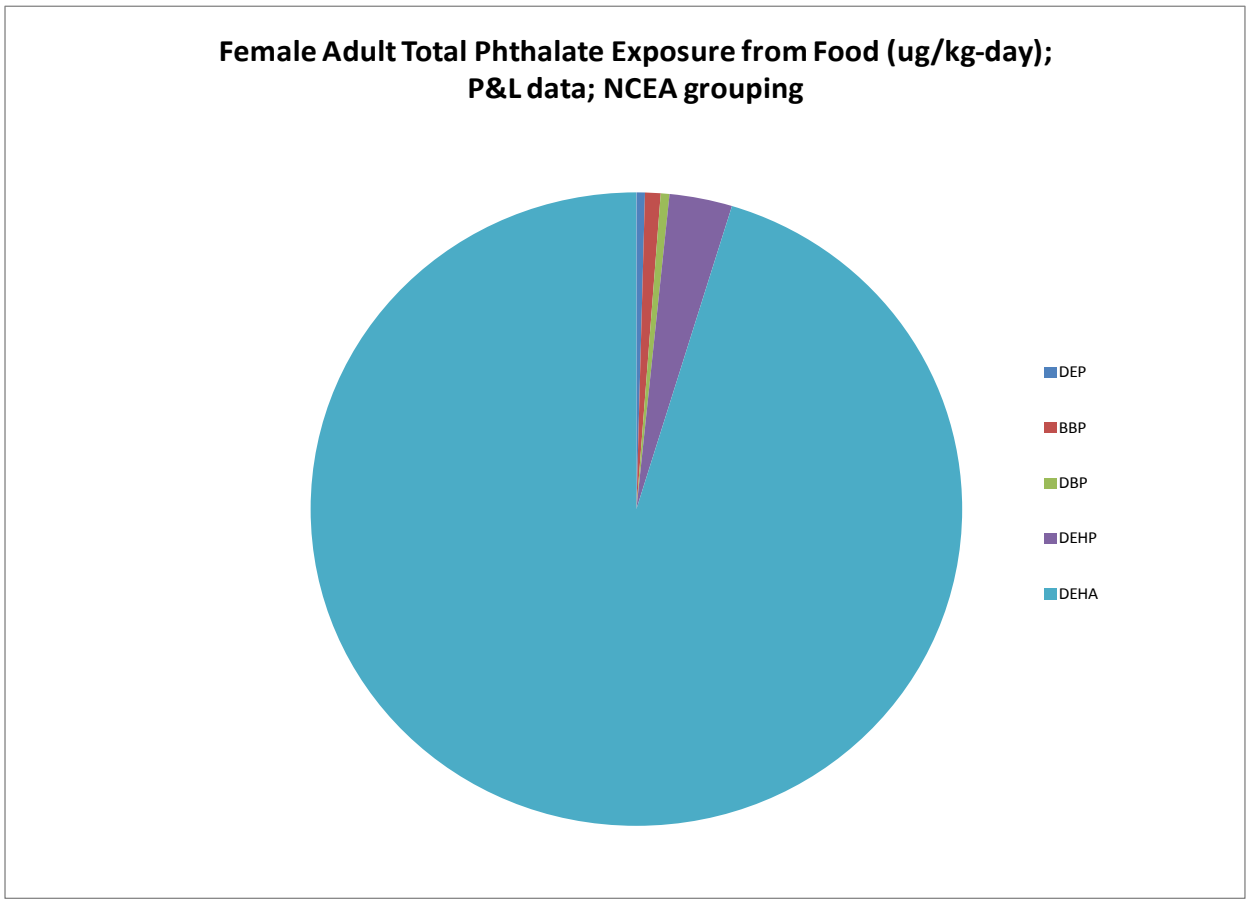


Figure E3-35 Female adults total phthalate exposure from food (µg/kg-d); P&L data; Clark grouping.

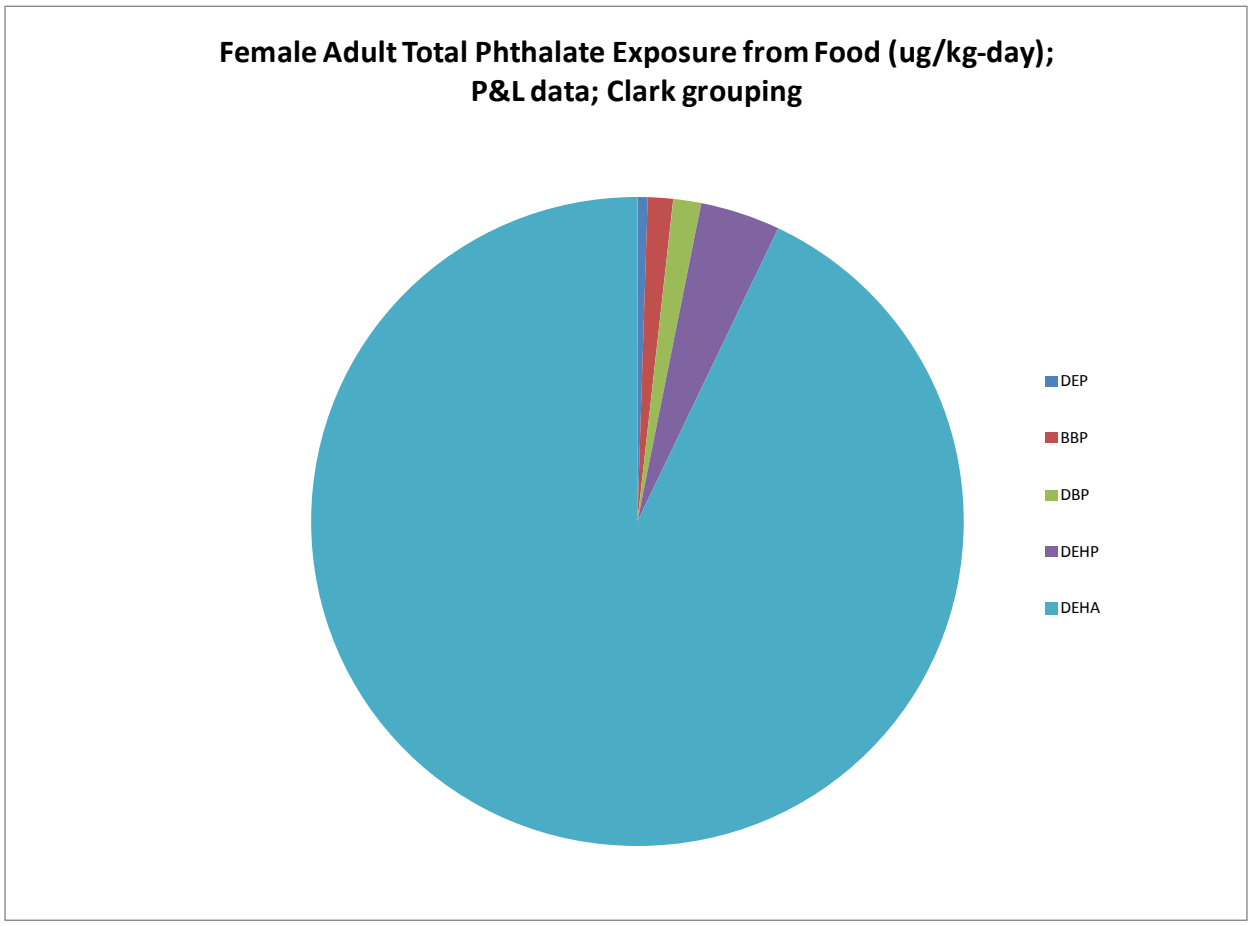
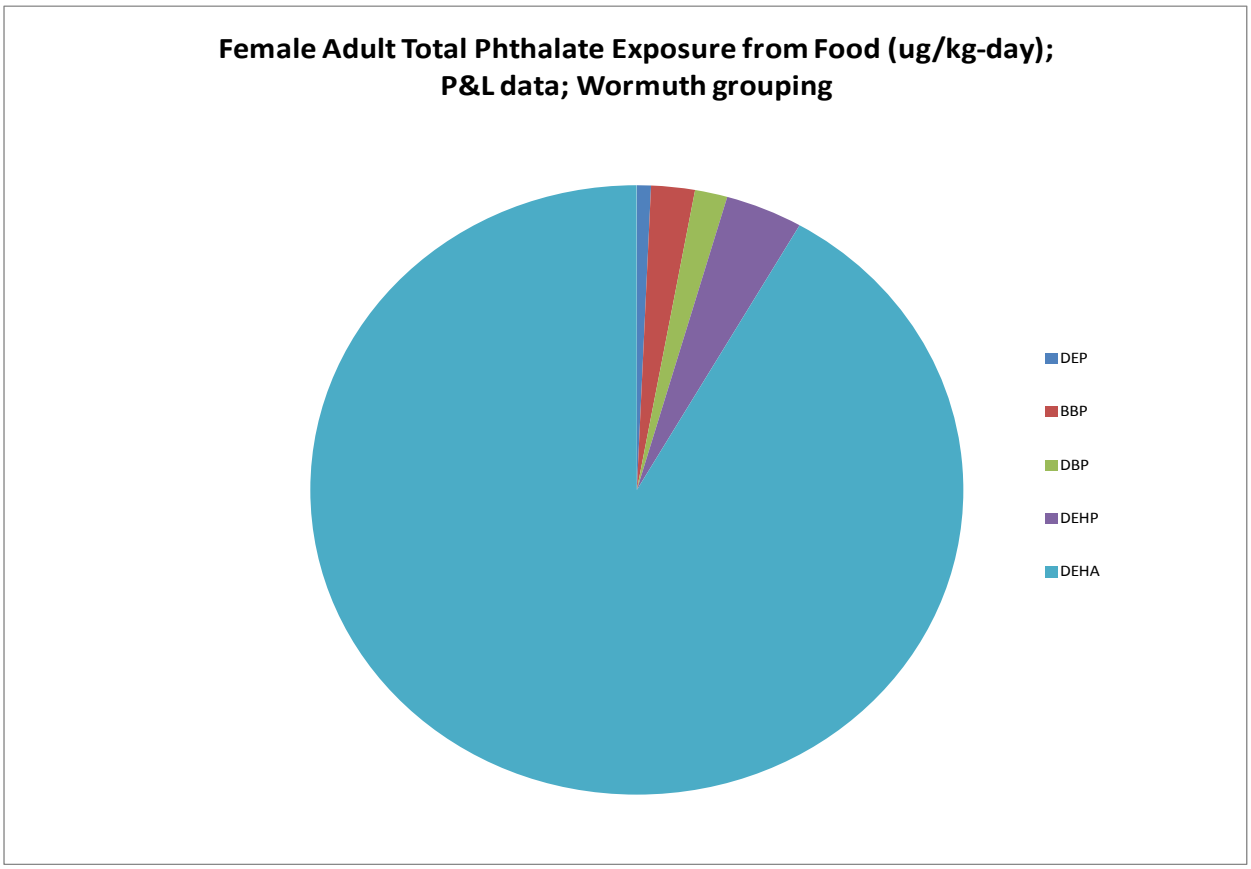


Figure E3-36 Female adults total phthalate exposure from food (µg/kg-d); P&L data; Wormuth grouping.



4.3.7 Male Adults Total Phthalate Exposure from Food, Phthalate Relative Contribution (assuming 100% phthalate absorption)

Figure E3-37 Male adults total phthalate exposure from food (µg/kg-d); UK data; NCEA grouping.

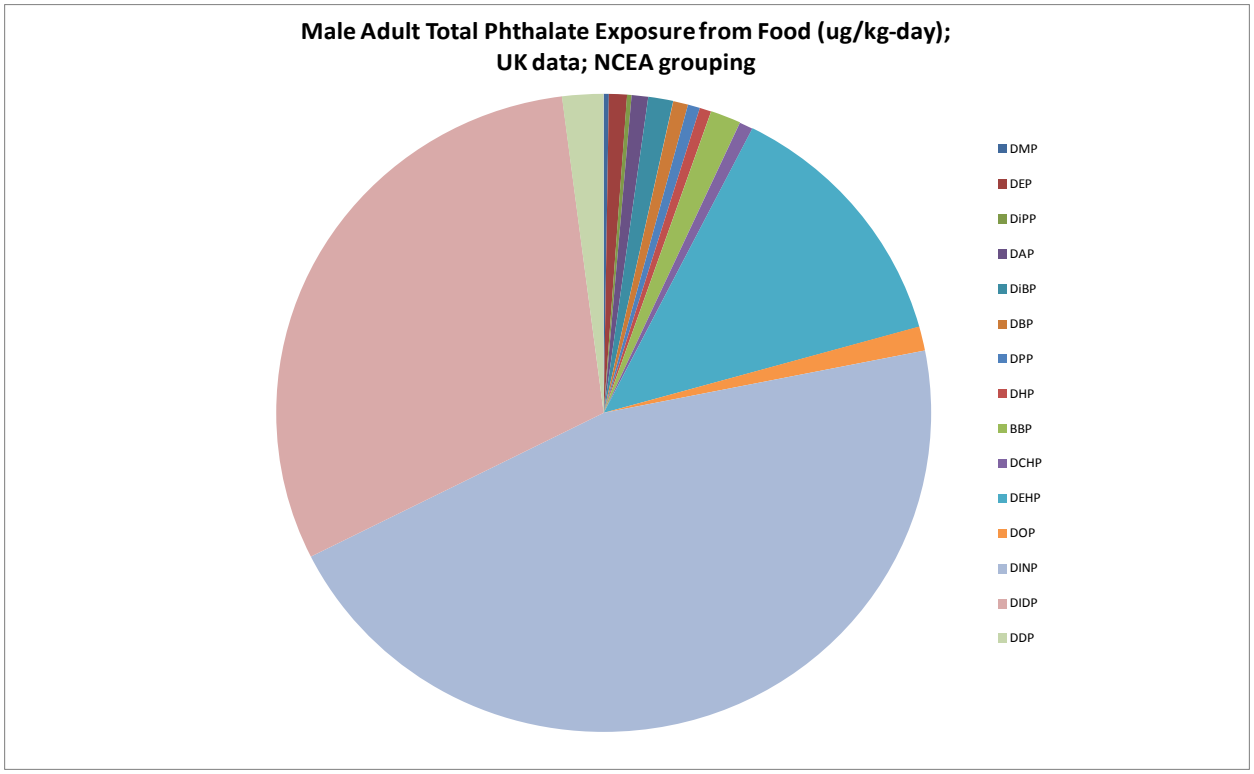


Figure E3-38 Male adults total phthalate exposure from food (µg/kg-d); UK data; Clark grouping.

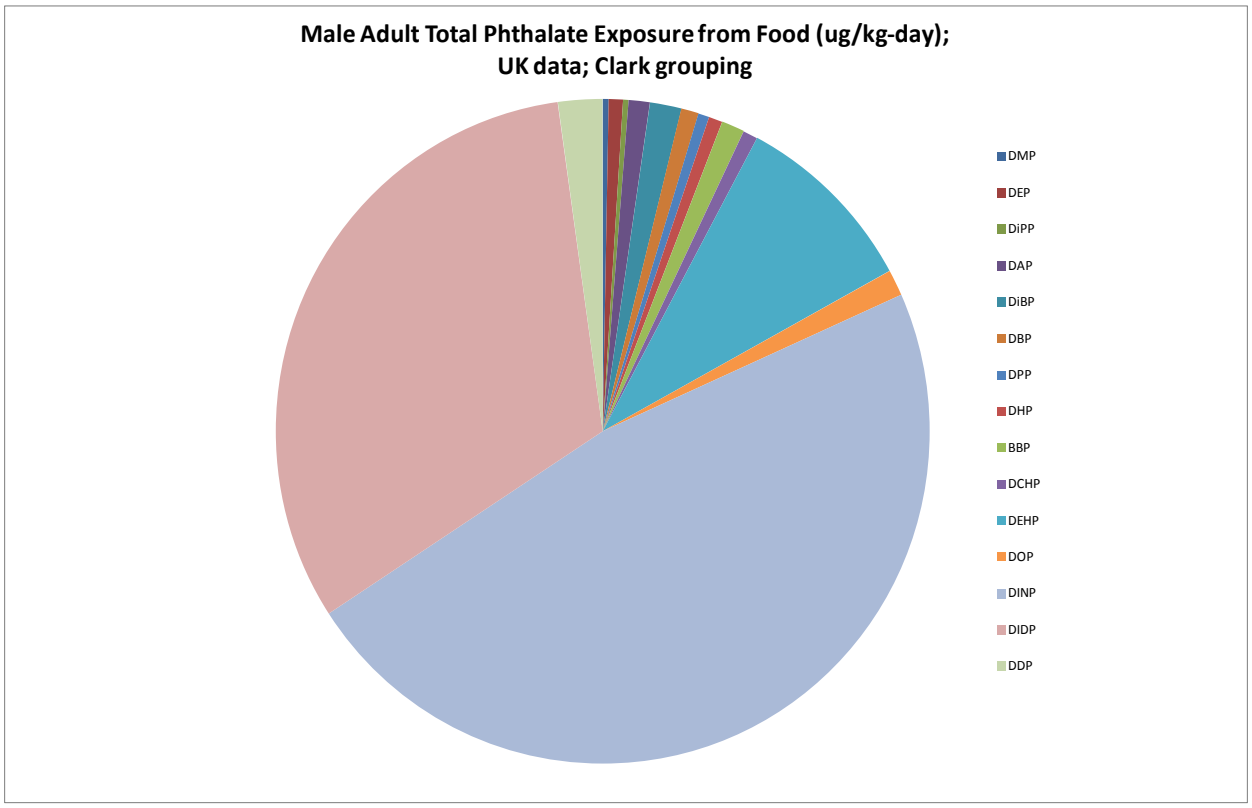


Figure E3-39 Male adults total phthalate exposure from food (µg/kg-d); UK data; Wormuth grouping.

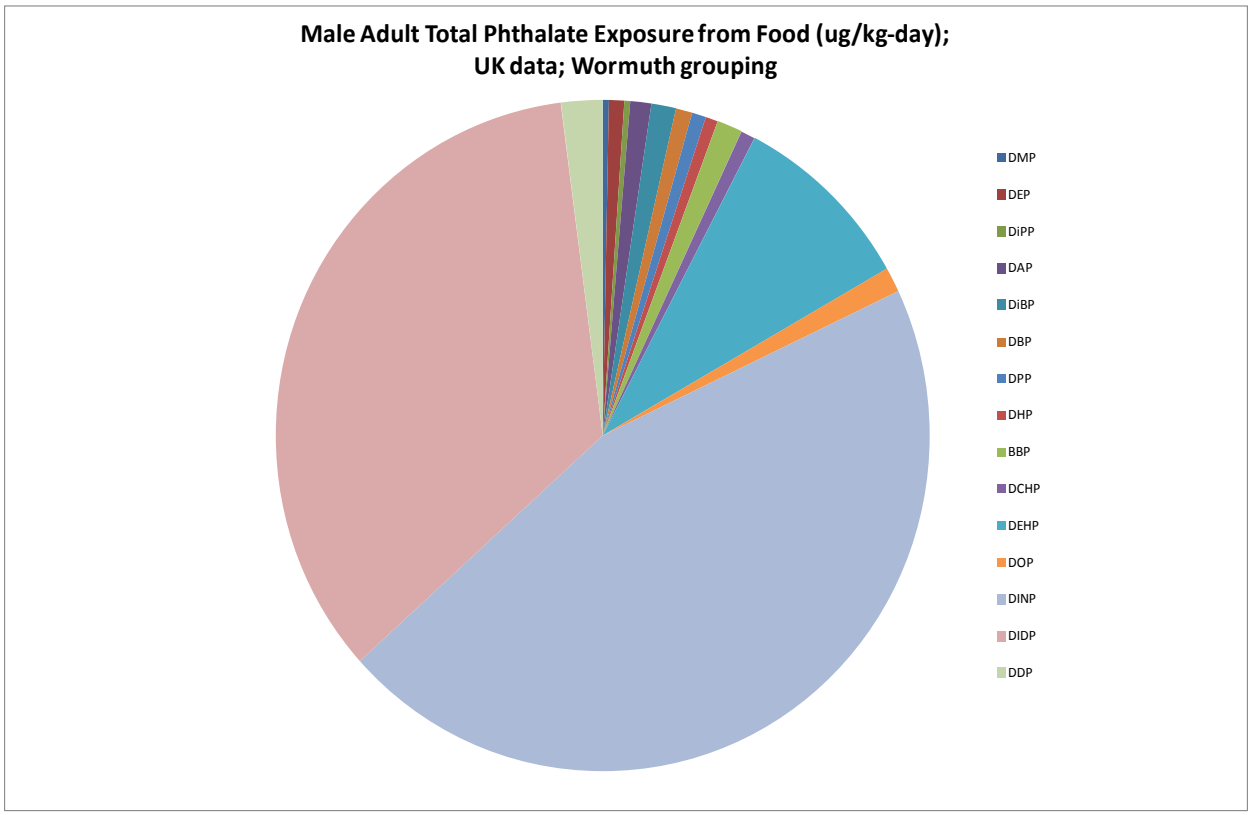


Figure E3-40 Male adults total phthalate exposure from food (µg/kg-d); P&L data; NCEA grouping.

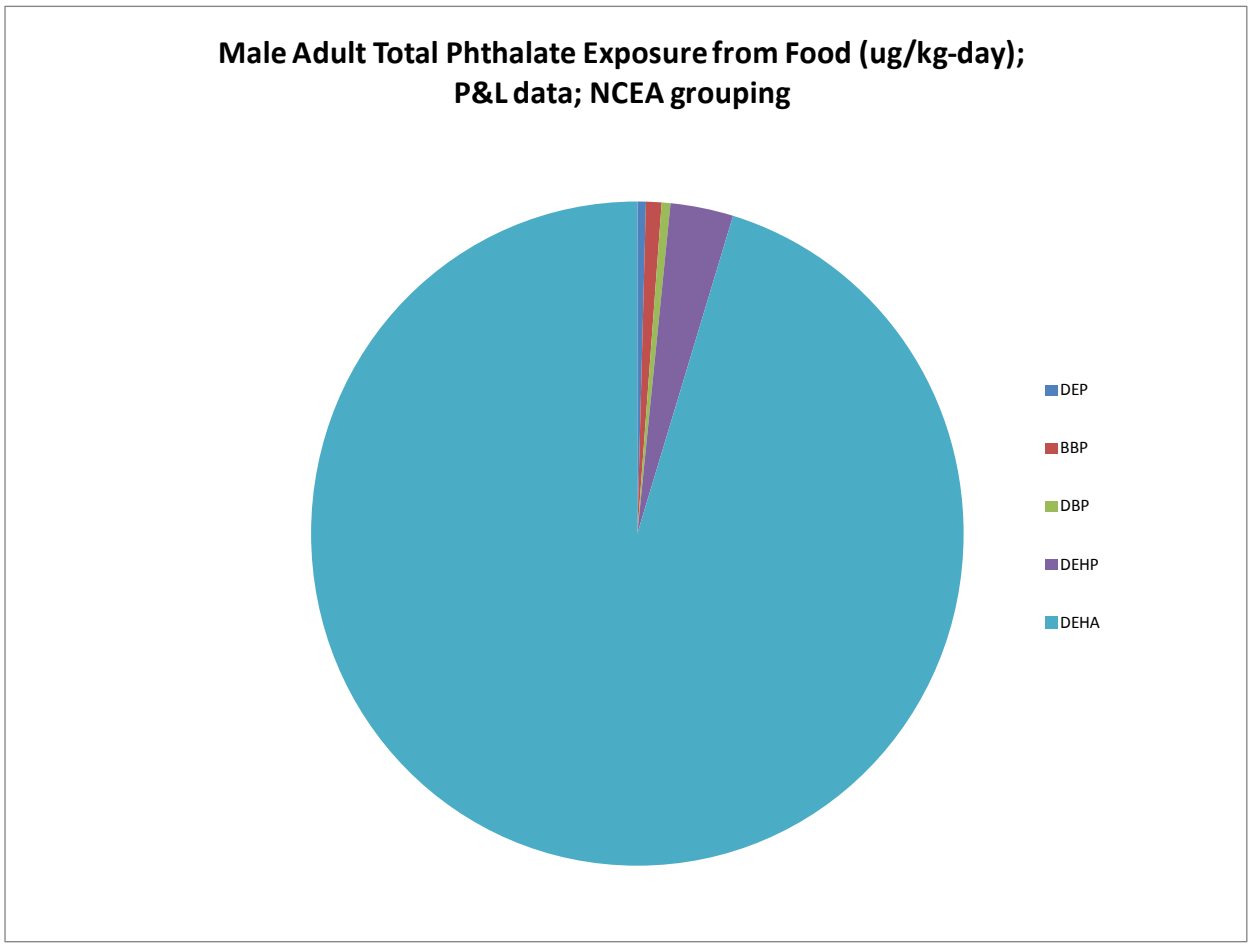


Figure E3-41 Male adults total phthalate exposure from food (µg/kg-d); P&L data; Clark grouping.

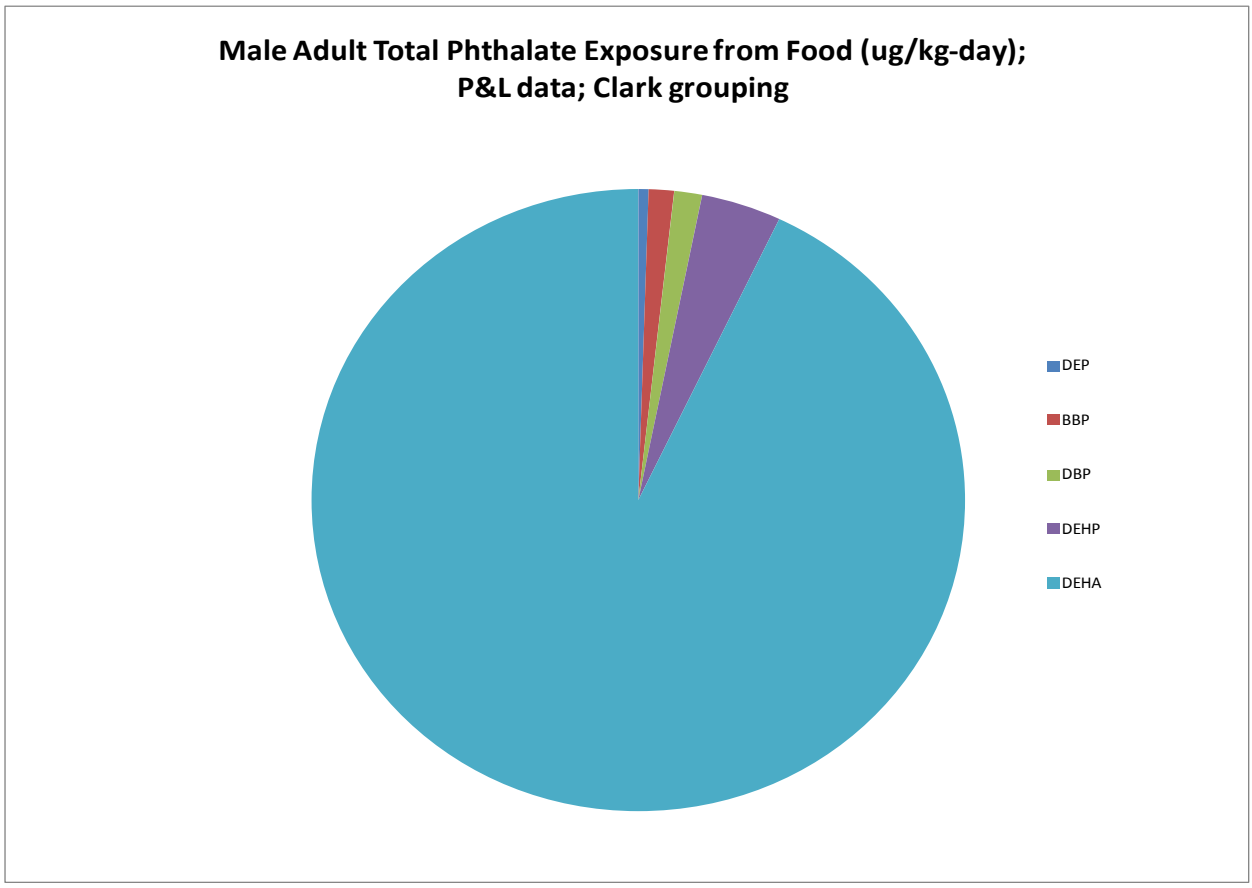
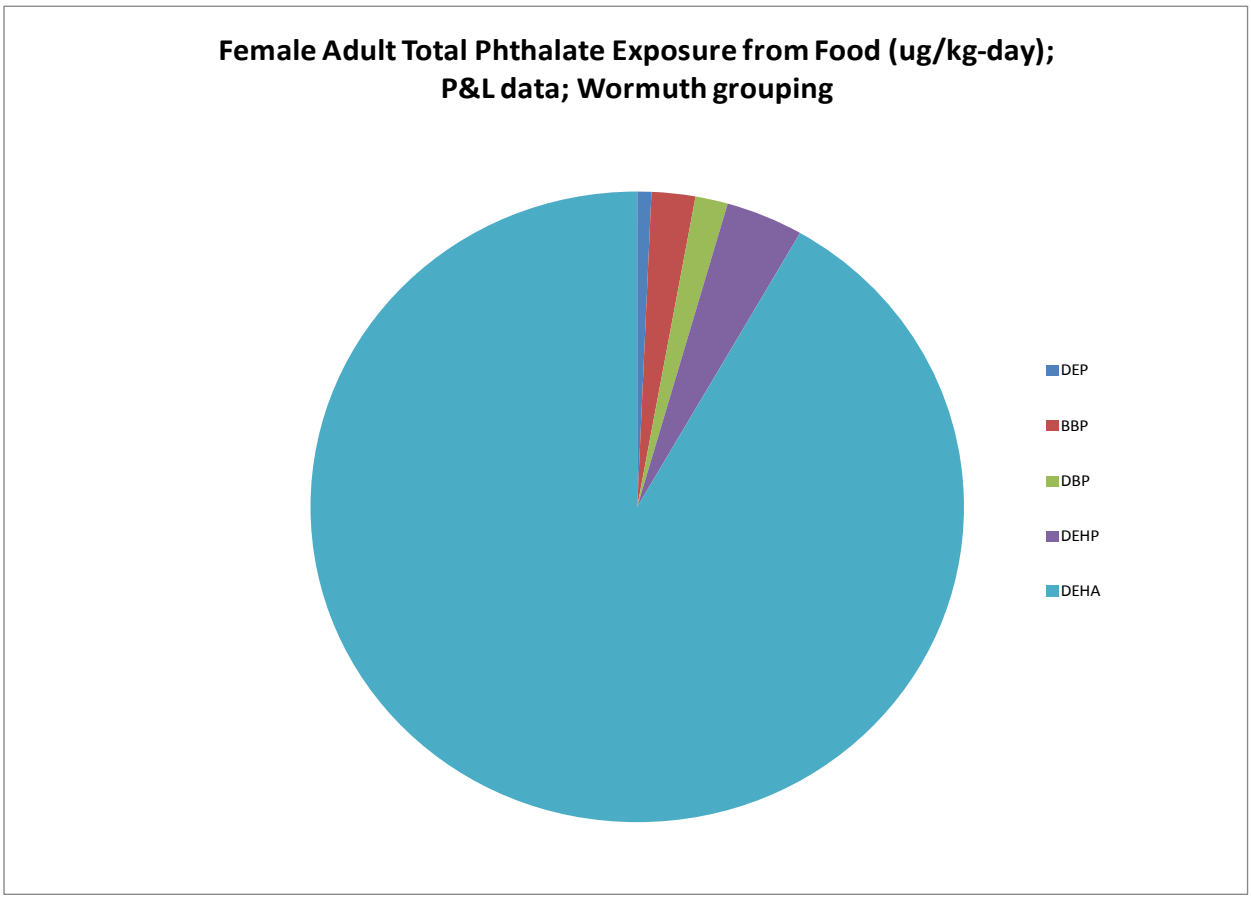


Figure E3-42 Female adults total phthalate exposure from food (µg/kg-d); P&L data; Wormuth grouping.



4.4 Population-based Average Dietary Exposures and the Relative Contribution of Various Phthalates

4.4.1 Infants Average Dietary Exposures and the Relative Contribution of Various Phthalates

Figure E3-43 Infants average dietary phthalate exposure (µg/kg-d); UK data; NCEA food grouping.

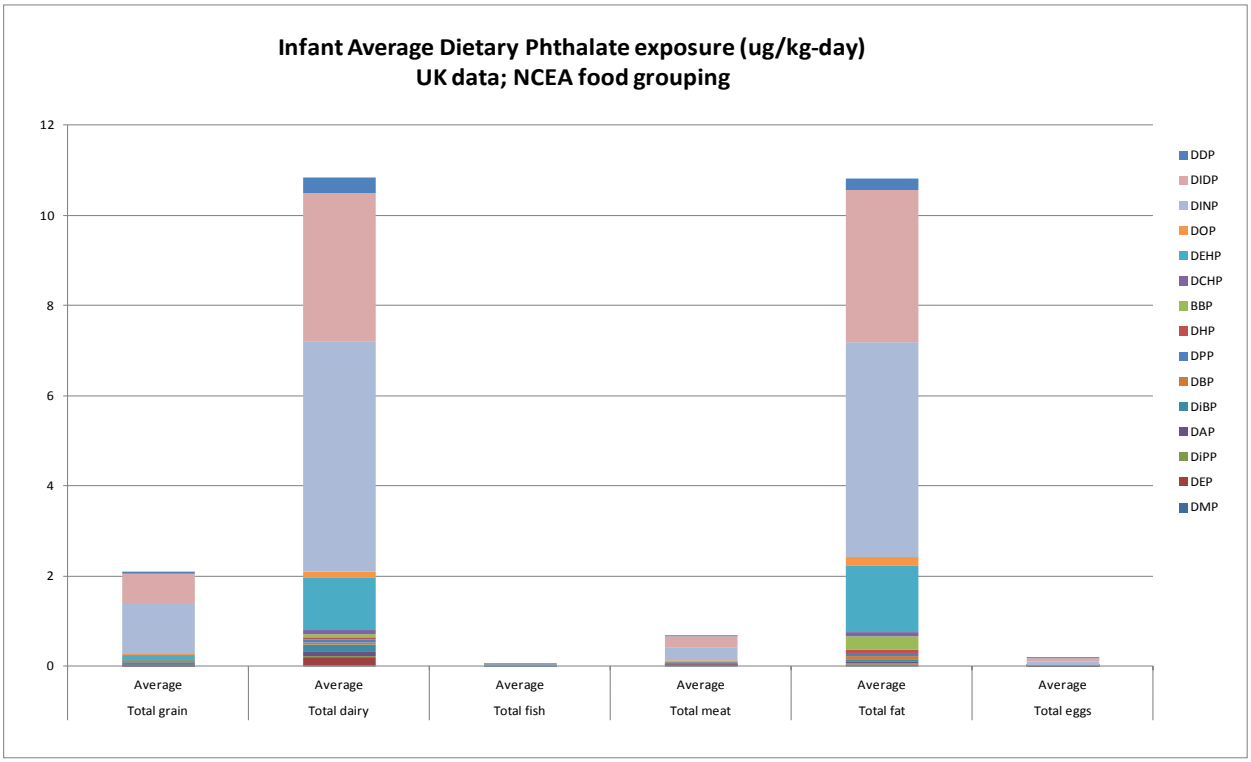


Figure E3-44 Infants average dietary phthalate exposure (µg/kg-d); P&L data; NCEA food grouping.

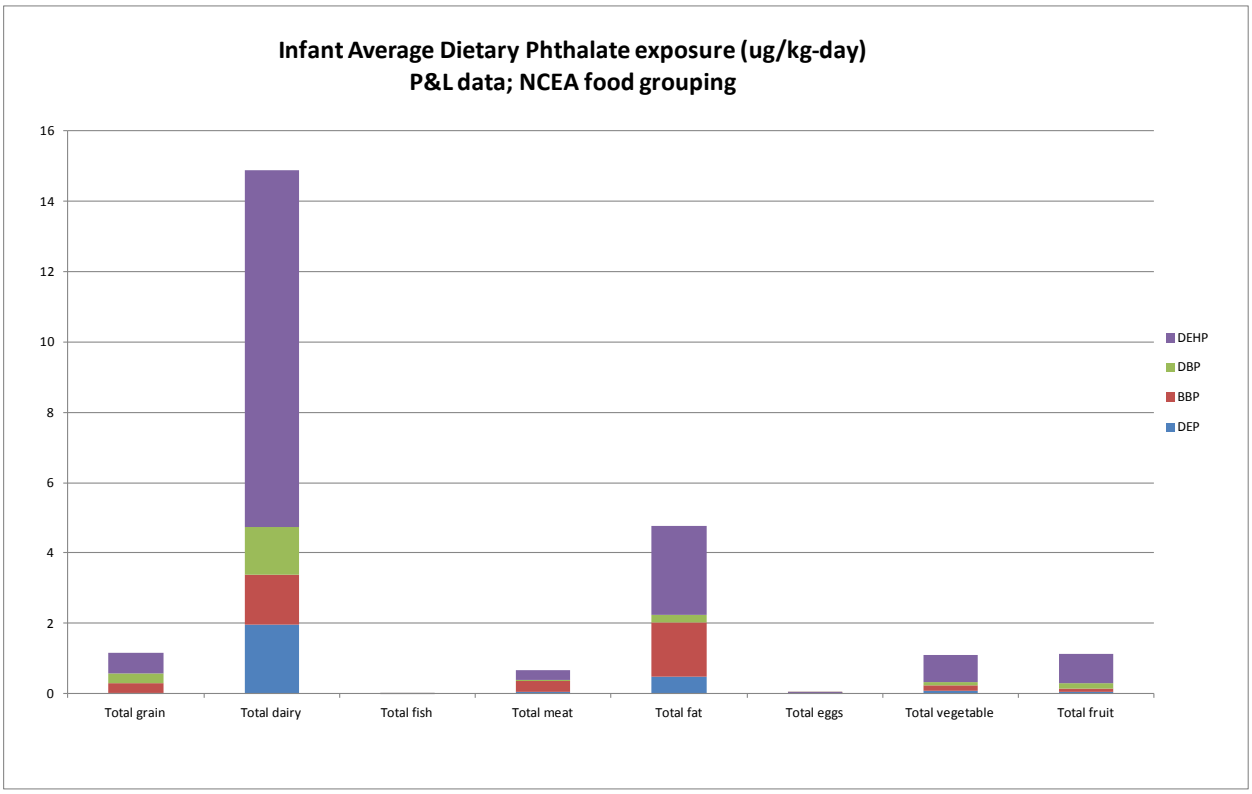


Figure E3-45 Infants average dietary phthalate exposure (µg/kg-d); UK data, Clark food grouping.

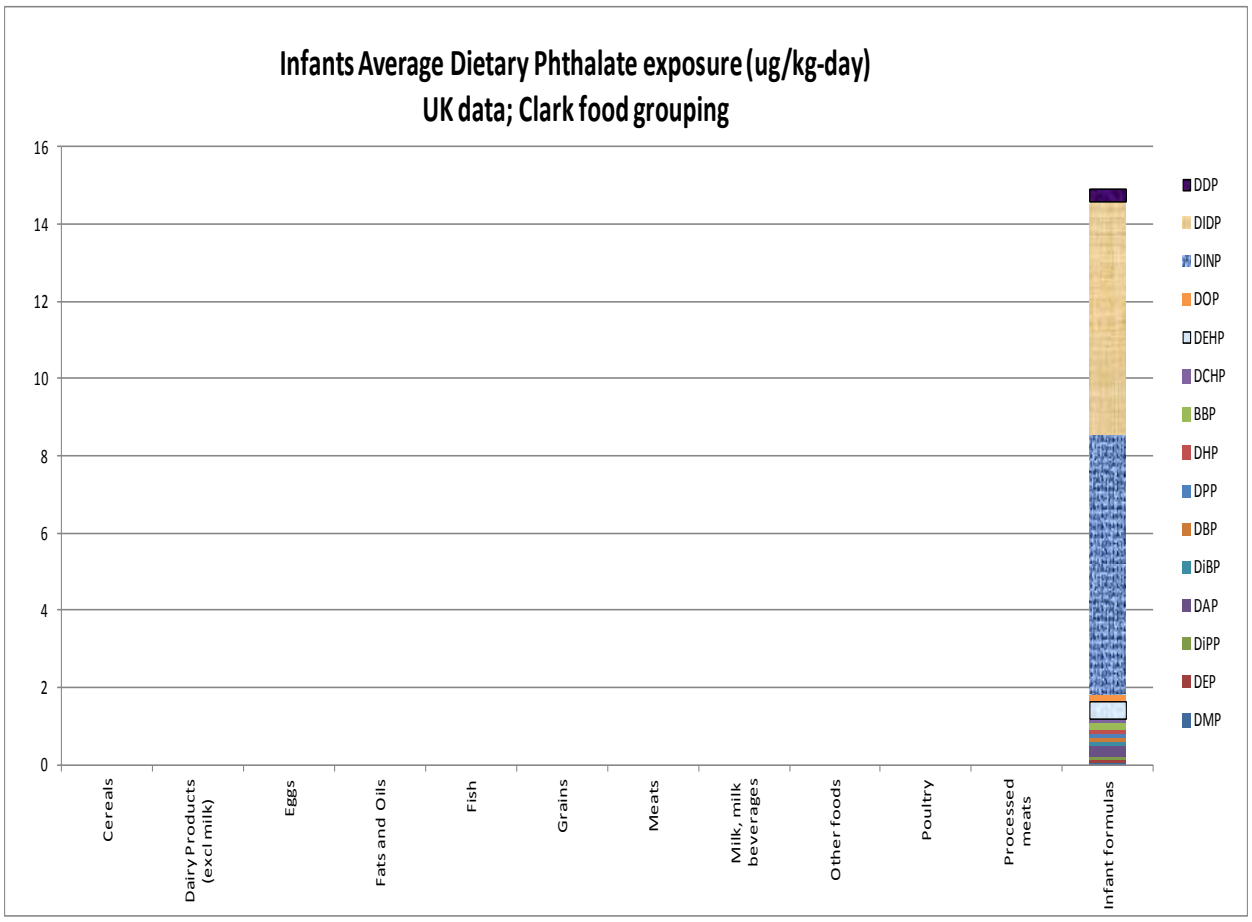


Figure E3-46 Infants average dietary phthalate exposure (µg/kg-d); P&L data; Clark food grouping.

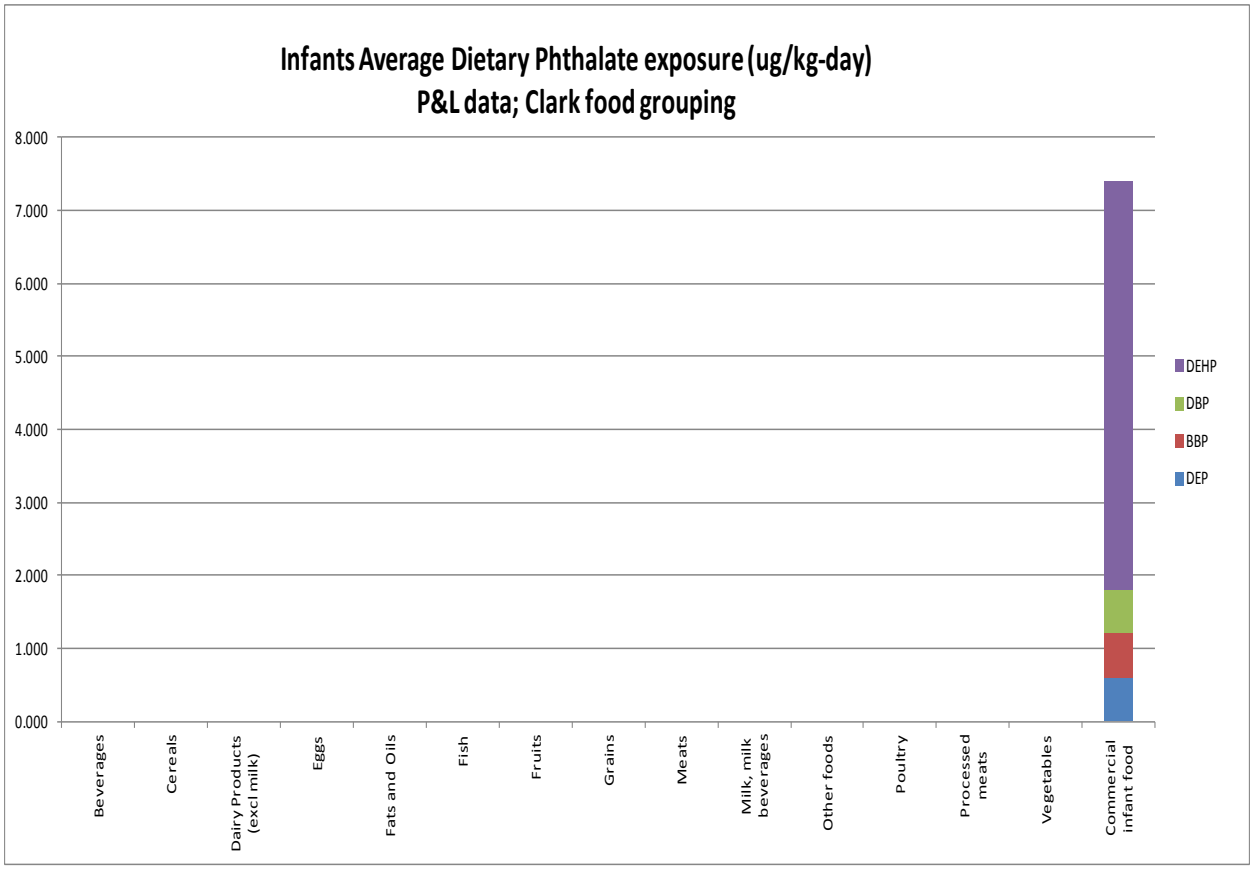


Figure E3-47 Infants average dietary phthalate exposure (µg/kg-d); UK data; Wormuth food grouping.

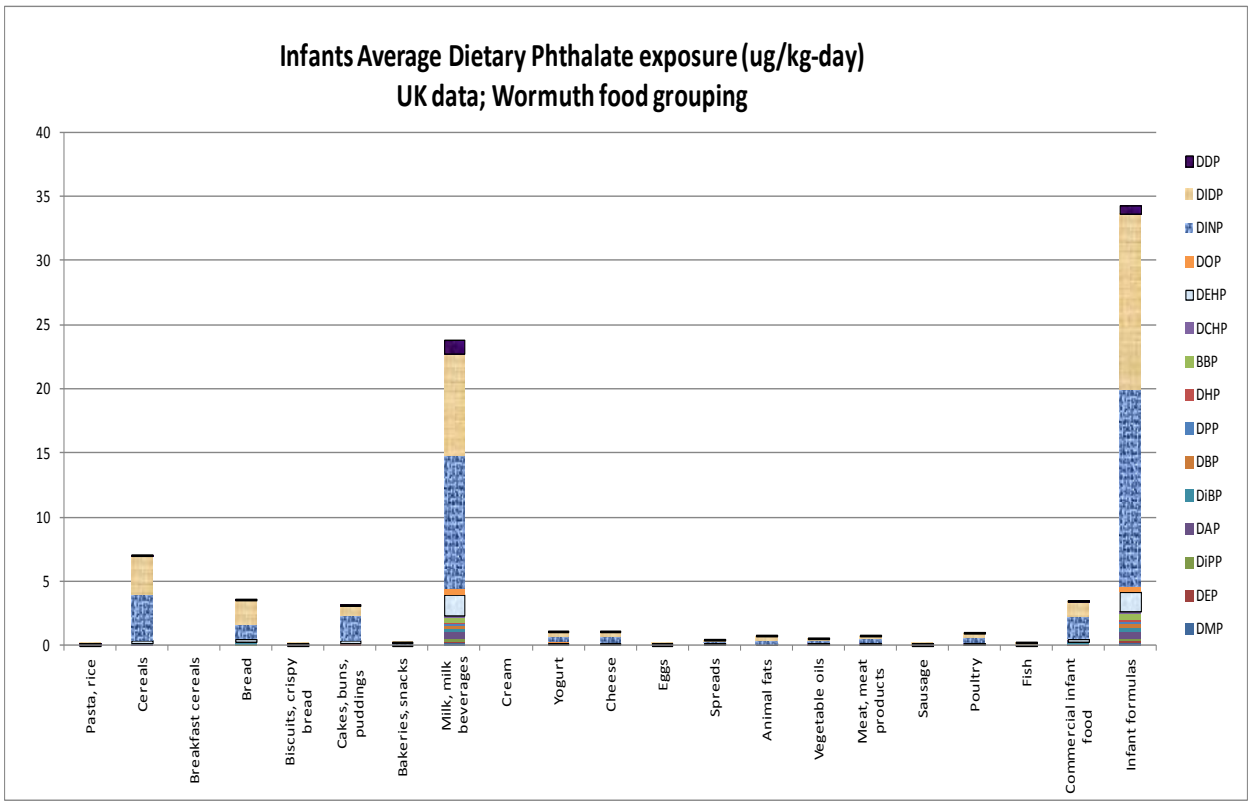
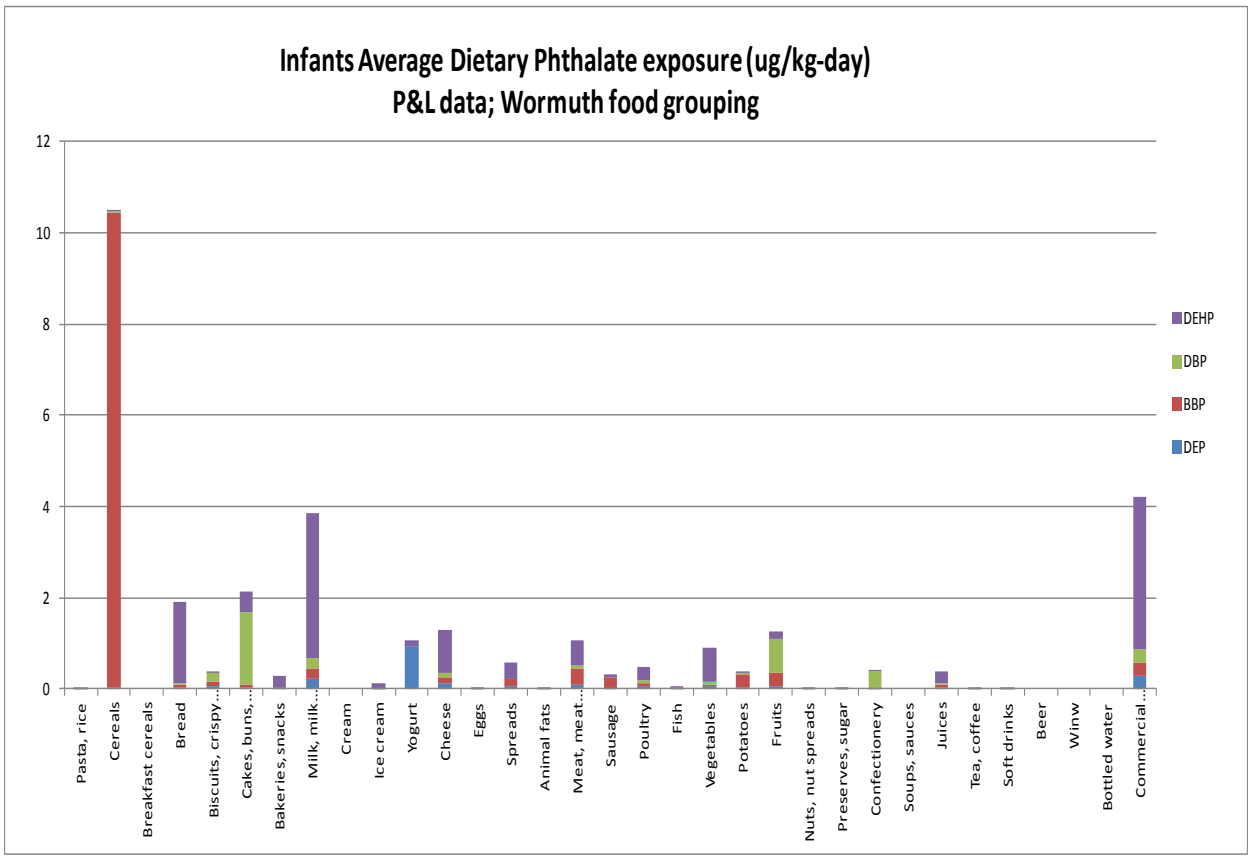


Figure E3-48 Infants average dietary phthalate exposure (µg/kg-d); P&L data; Wormuth food grouping.



4.4.2 Toddlers Average Dietary Exposures and the Relative Contribution of Various Phthalates

Figure E3-49 Toddlers average dietary phthalate exposure (µg/kg-d); UK data; NCEA food grouping.

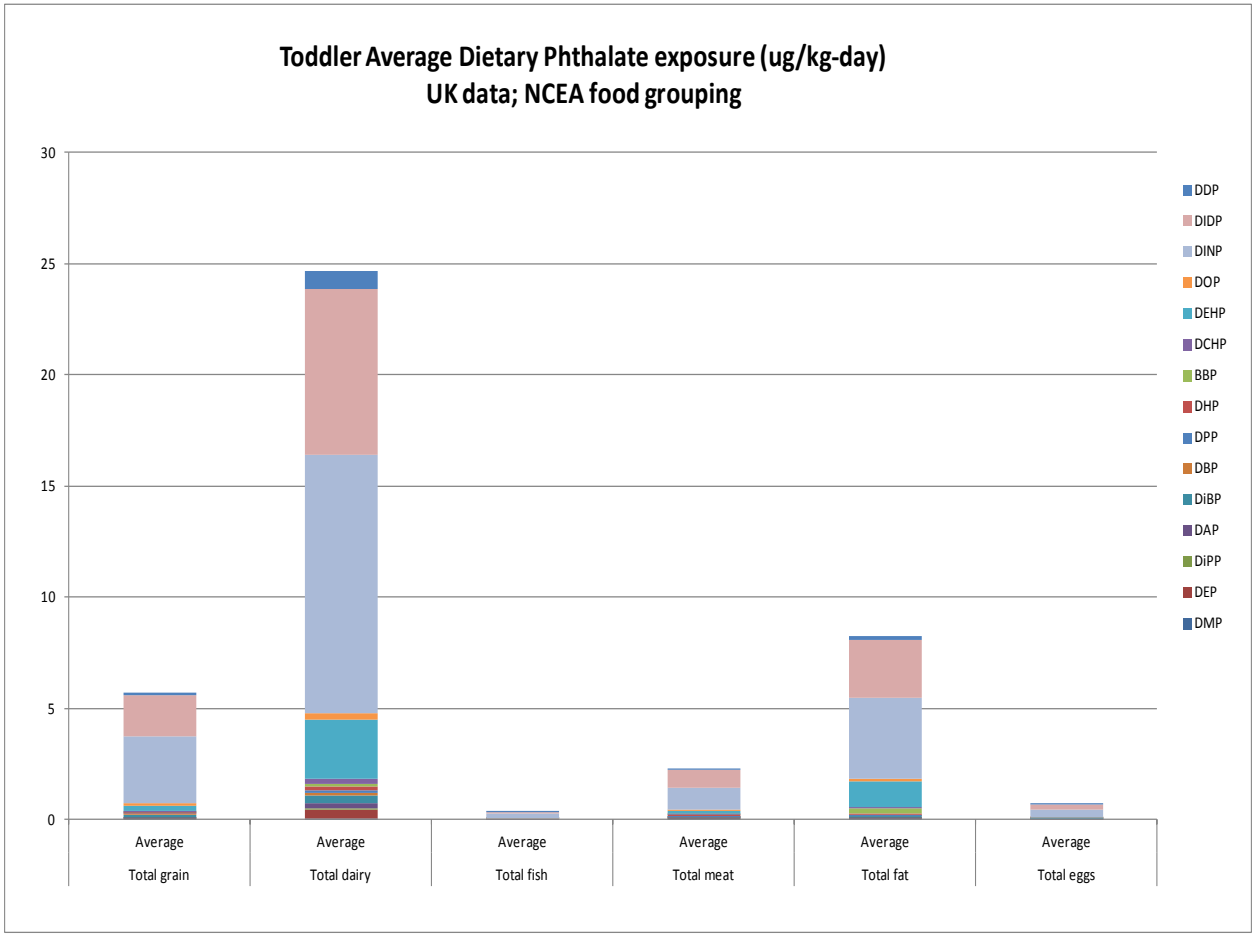


Figure E3-50 Toddlers average dietary phthalate exposure (µg/kg-d); P&L data; NCEA food grouping.

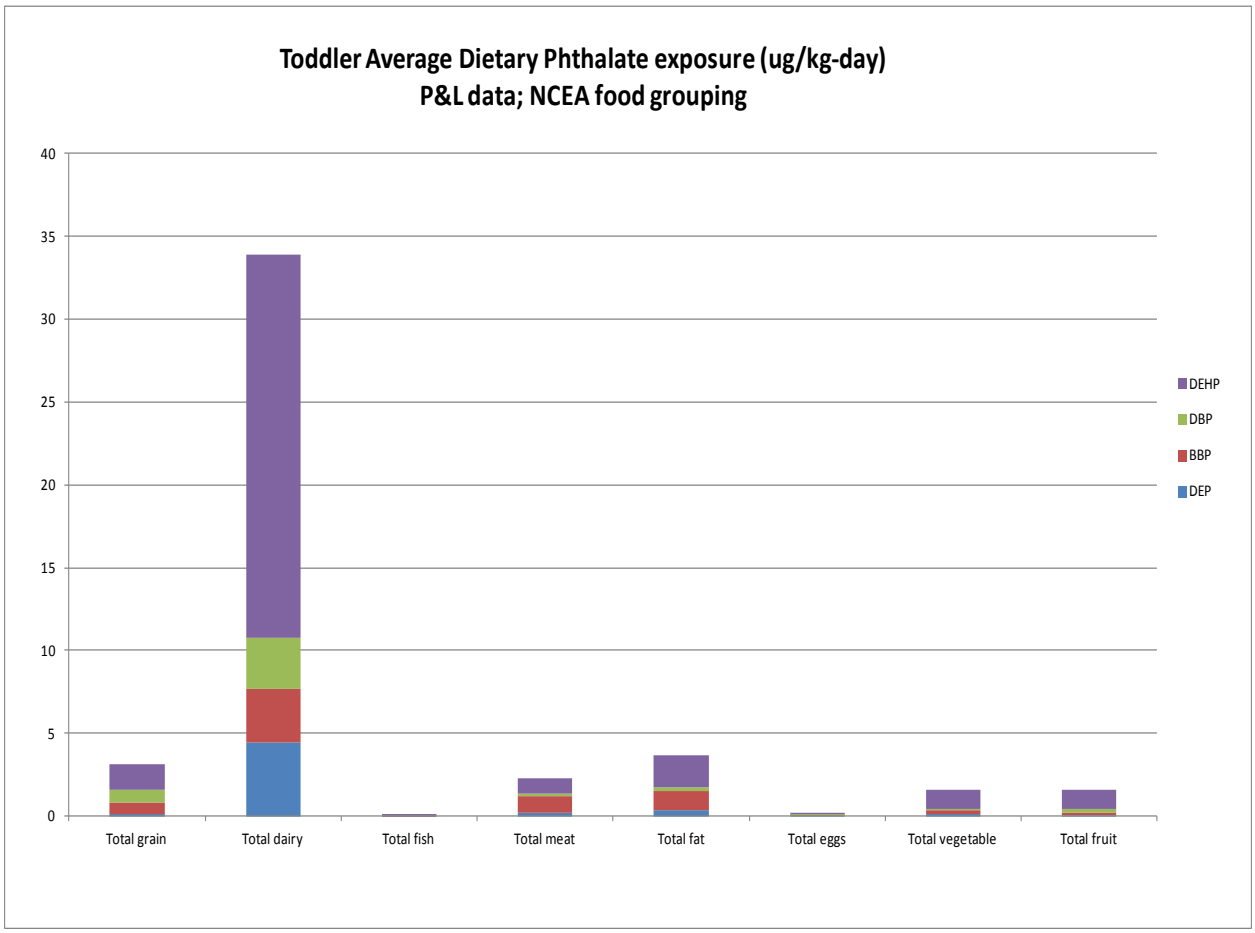


Figure E3-51 Toddlers average dietary phthalate exposure (µg/kg-d); UK data; Clark food grouping.

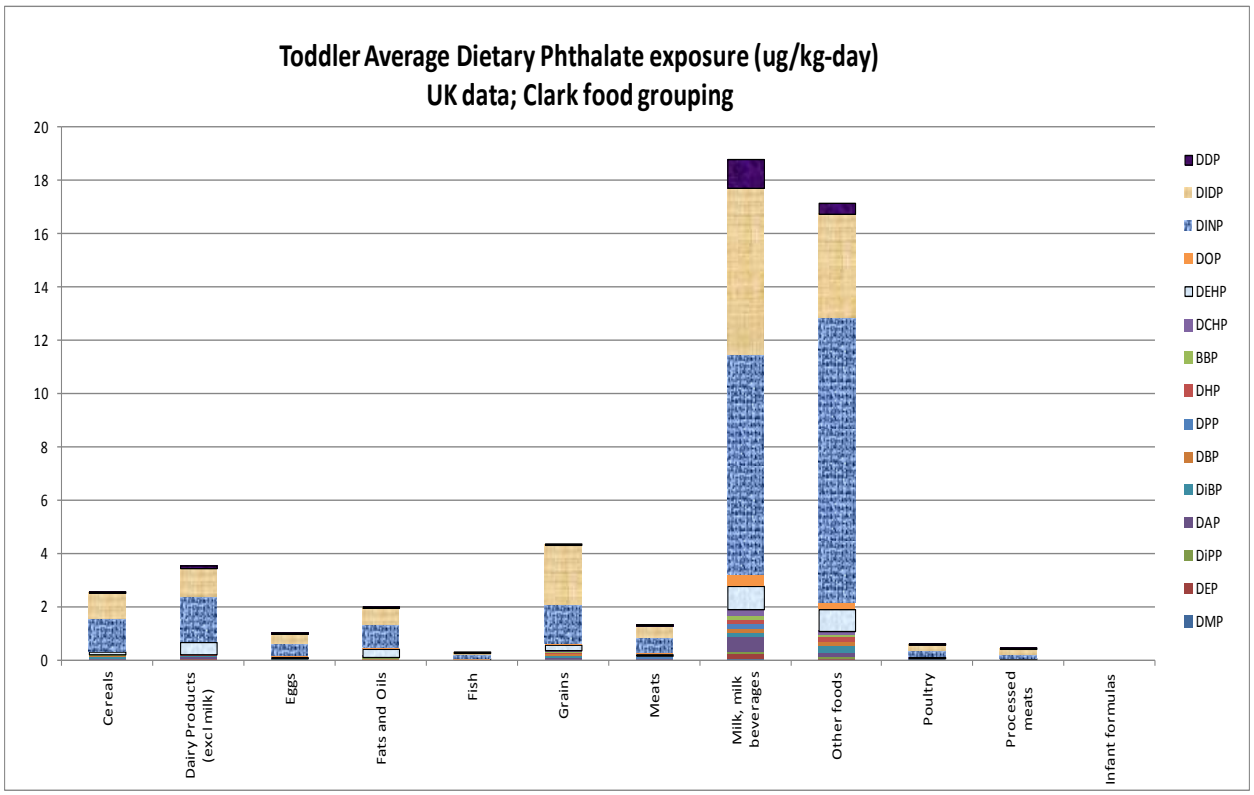


Figure E3-52 Toddlers average dietary phthalate exposure (µg/kg-d); P&L data; Clark food grouping.

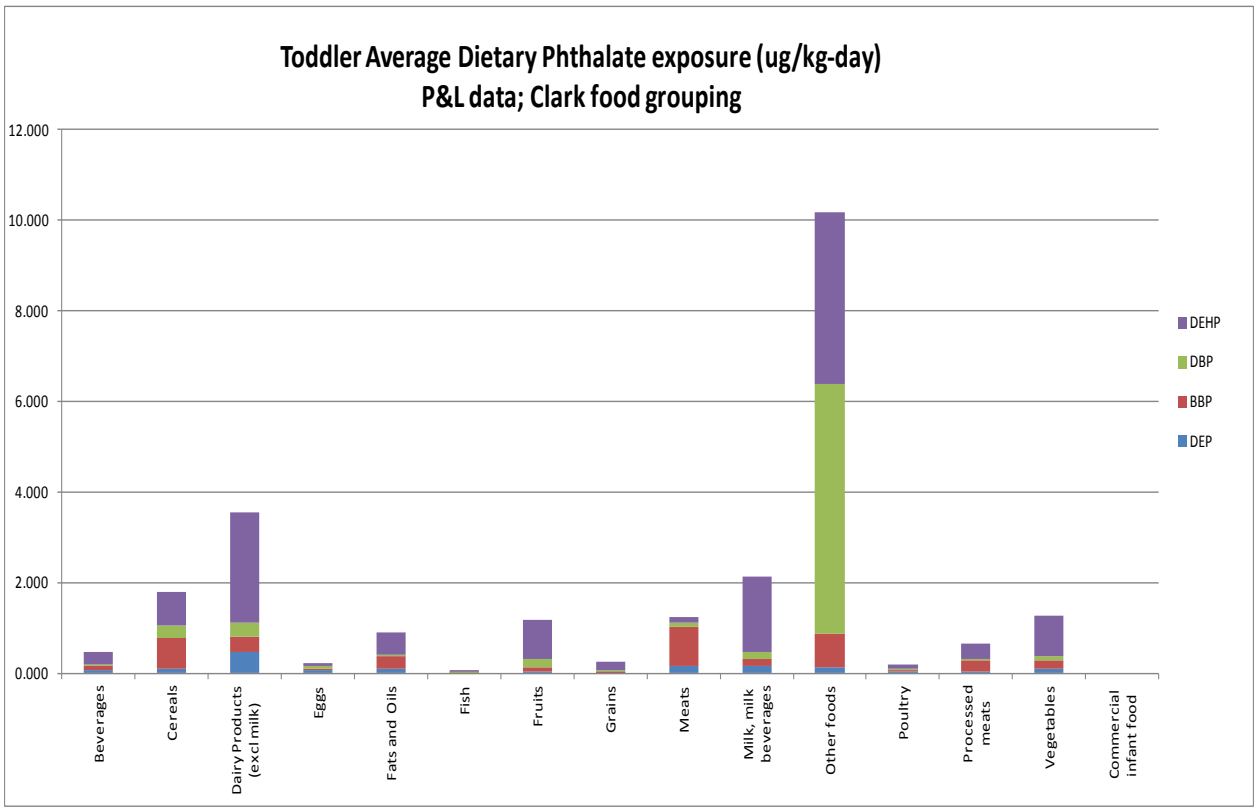


Figure E3-53 Toddlers average dietary phthalate exposure (µg/kg-d); UK data; Wormuth food grouping.

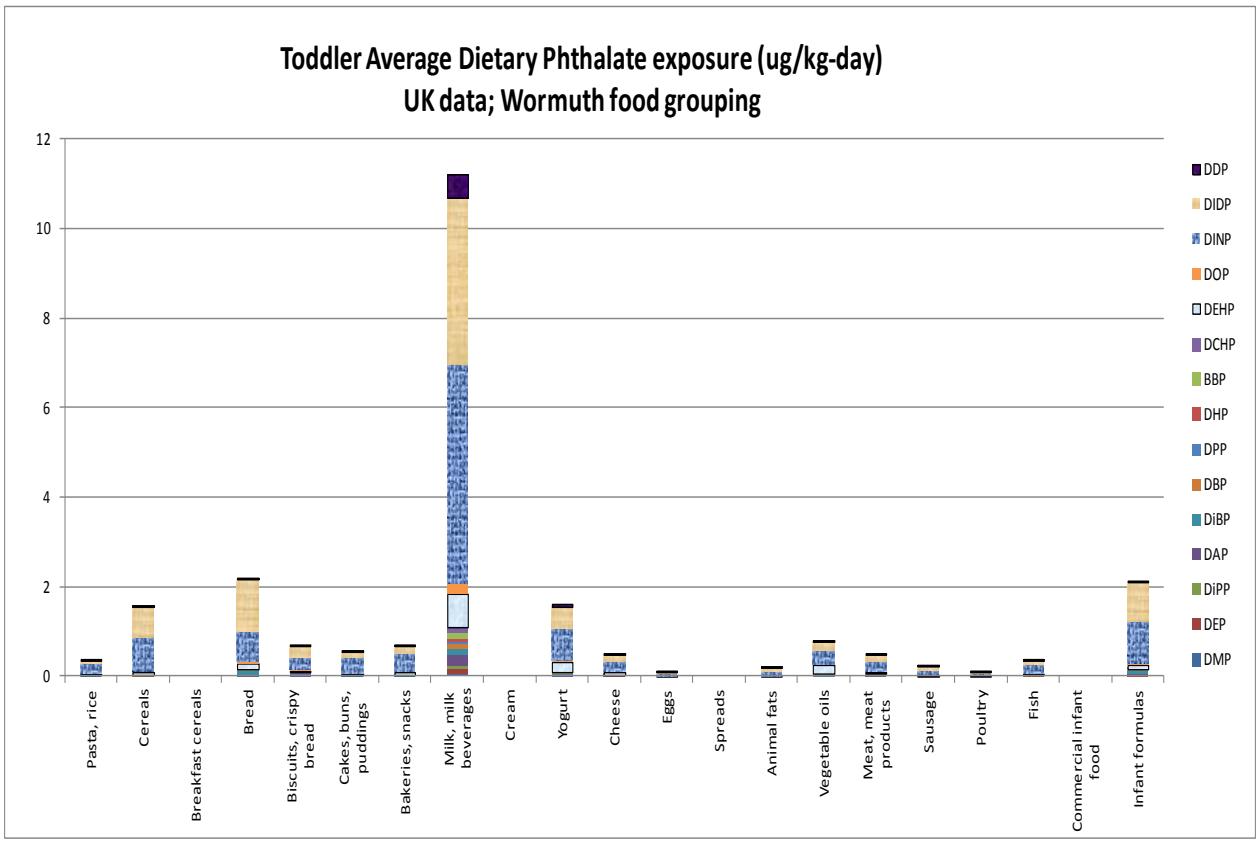
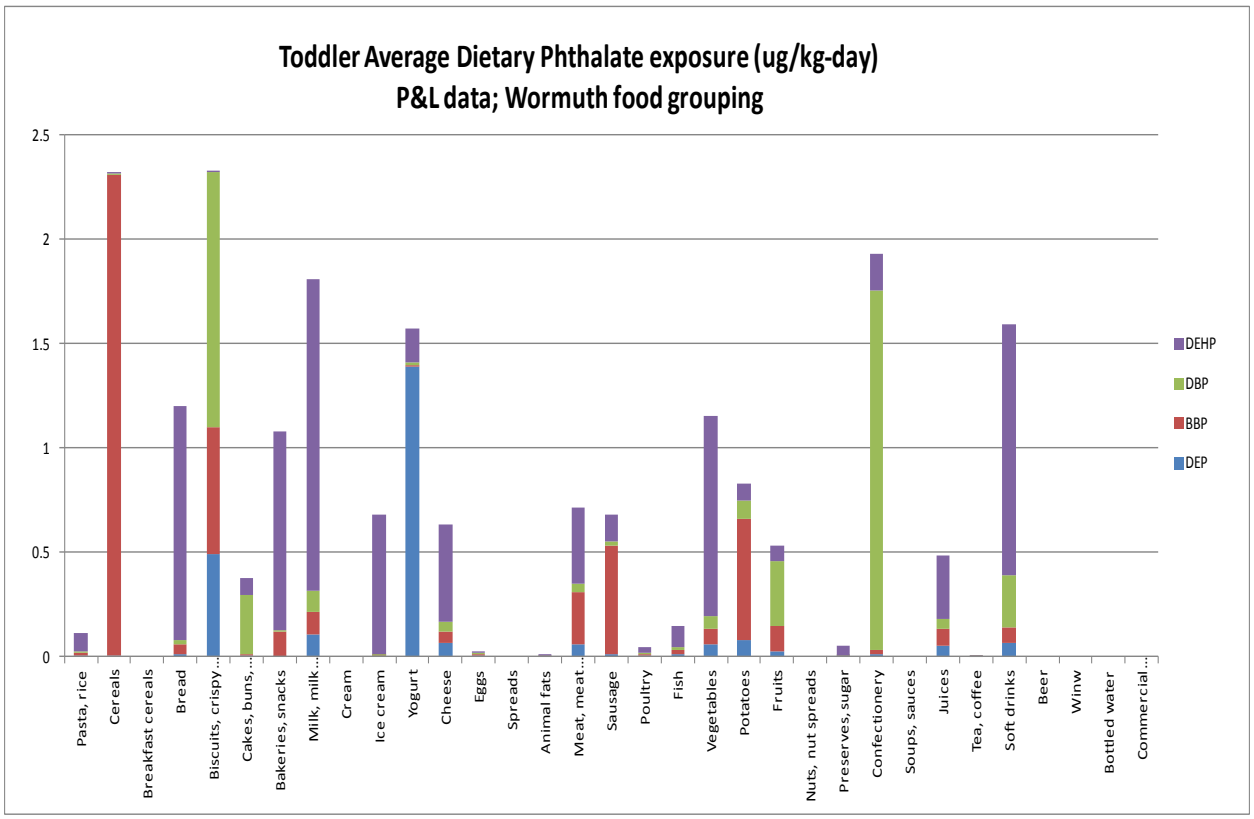


Figure E3-54 Toddlers average dietary phthalate exposure (µg/kg-d); P&L data; Wormuth food grouping.



4.4.3 Children Average Exposures and the Relative Contribution of Various Phthalates

Figure E3-55 Children average dietary phthalate exposure (µg/kg-d); UK data; NCEA food grouping.

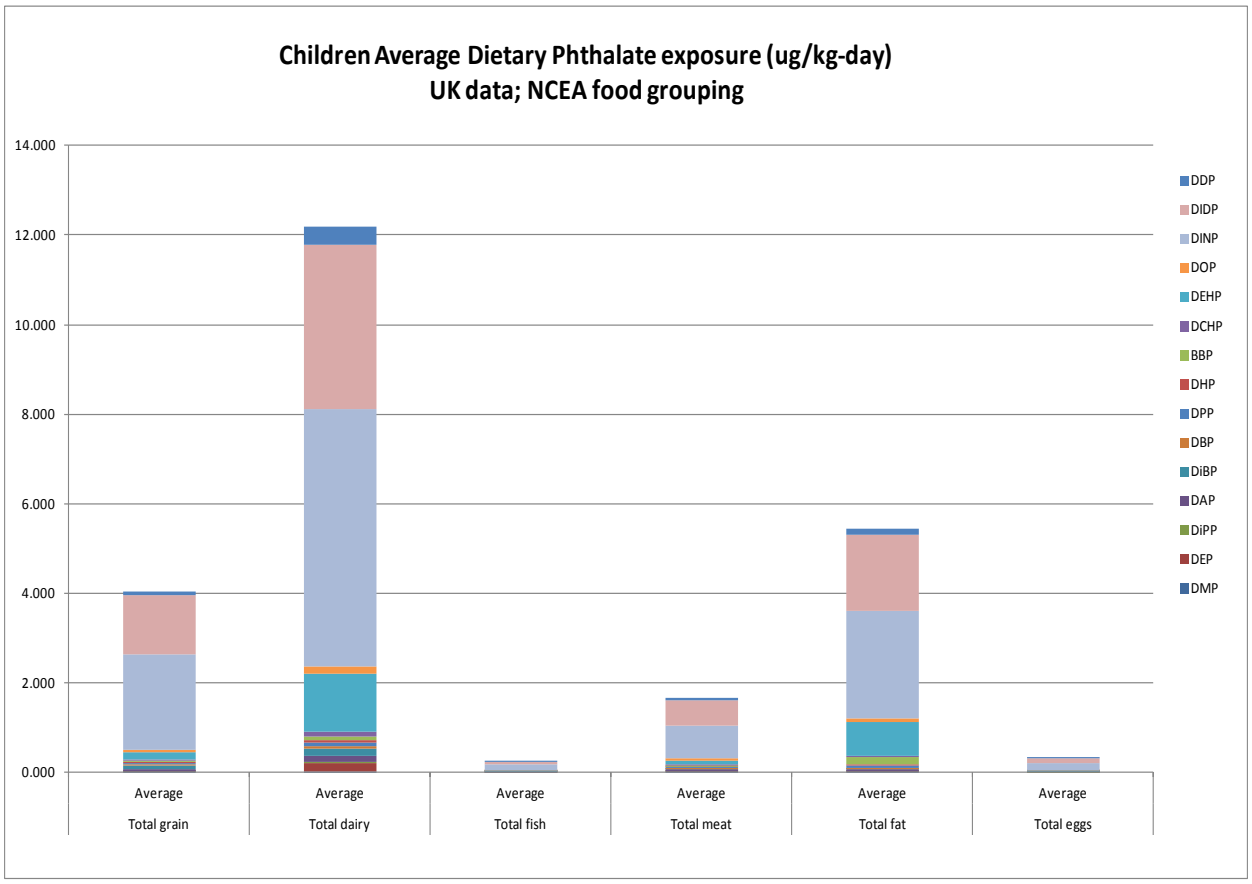


Figure E3-56 Children average dietary phthalate exposure (µg/kg-d); P&L data; NCEA food grouping.

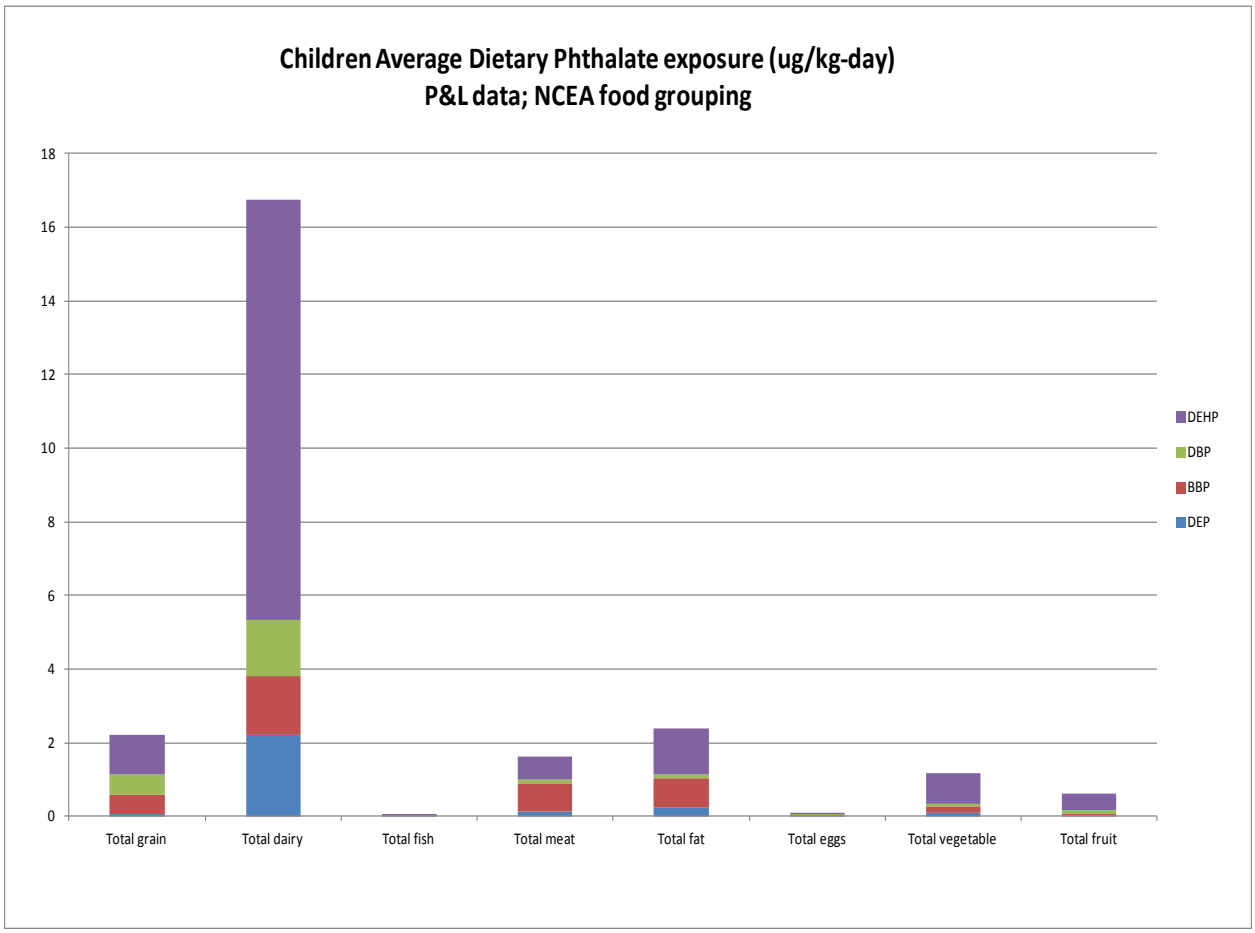


Figure E3-57 Children average dietary phthalate exposure (µg/kg-d); UK data; Clark food grouping.

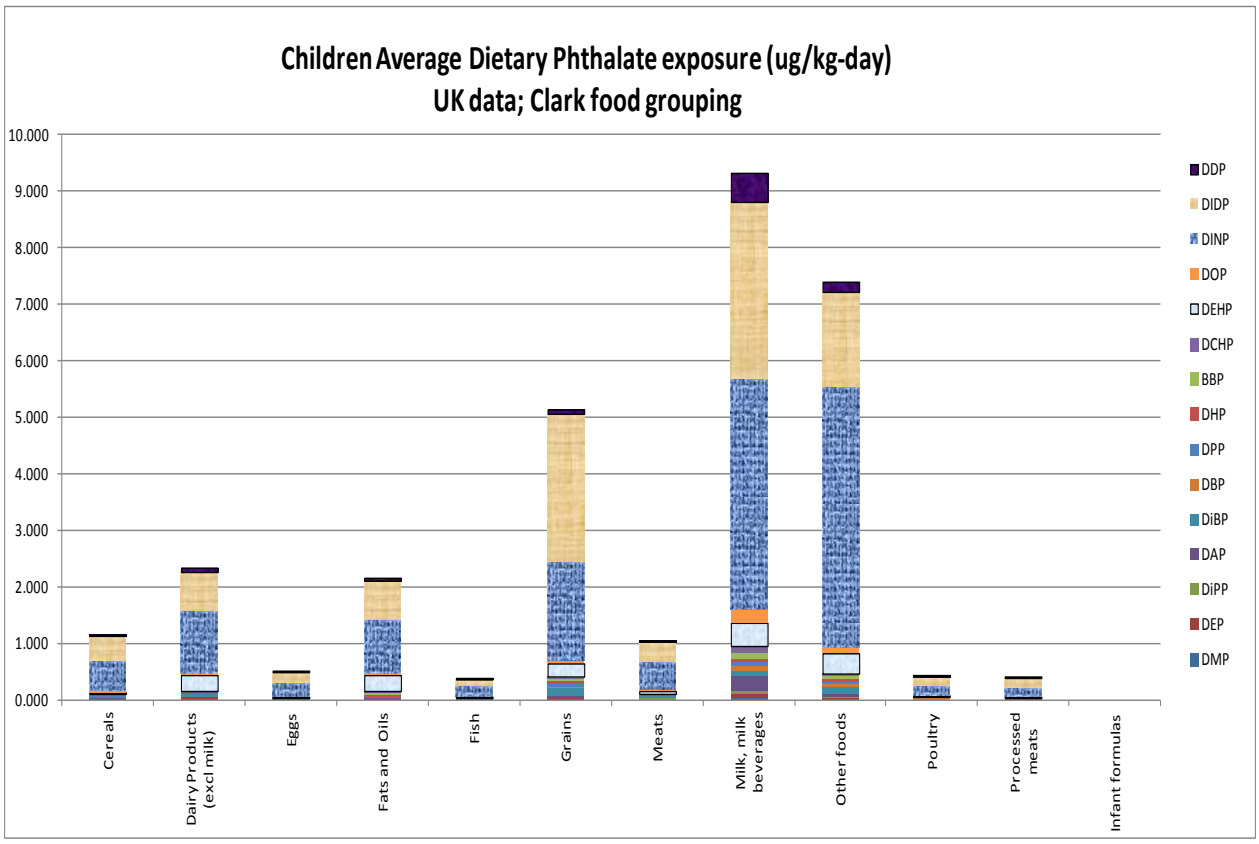


Figure E3-58 Children average dietary phthalate exposure (µg/kg-d); P&L data; Clark food grouping

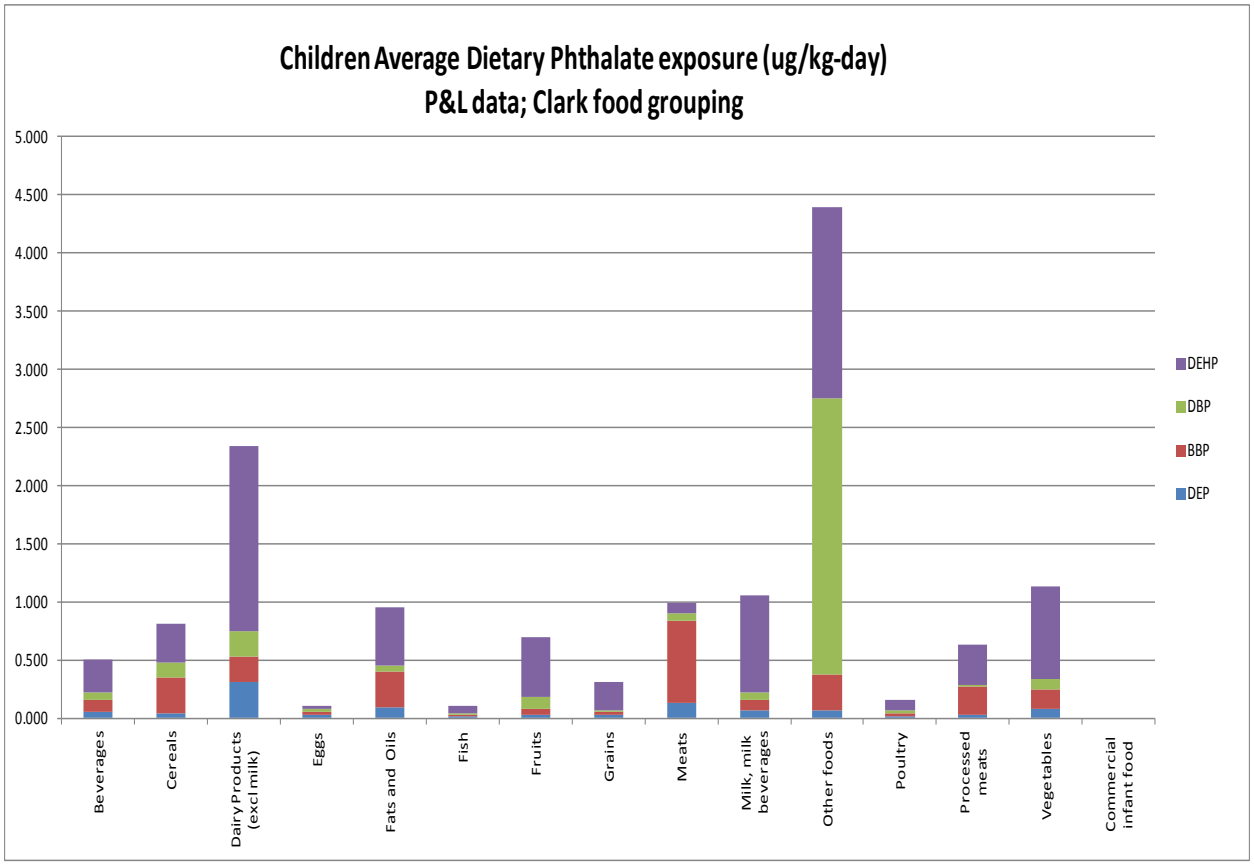


Figure E3-59 Children average dietary phthalate exposure (µg/kg-d); UK data; Wormuth food grouping.

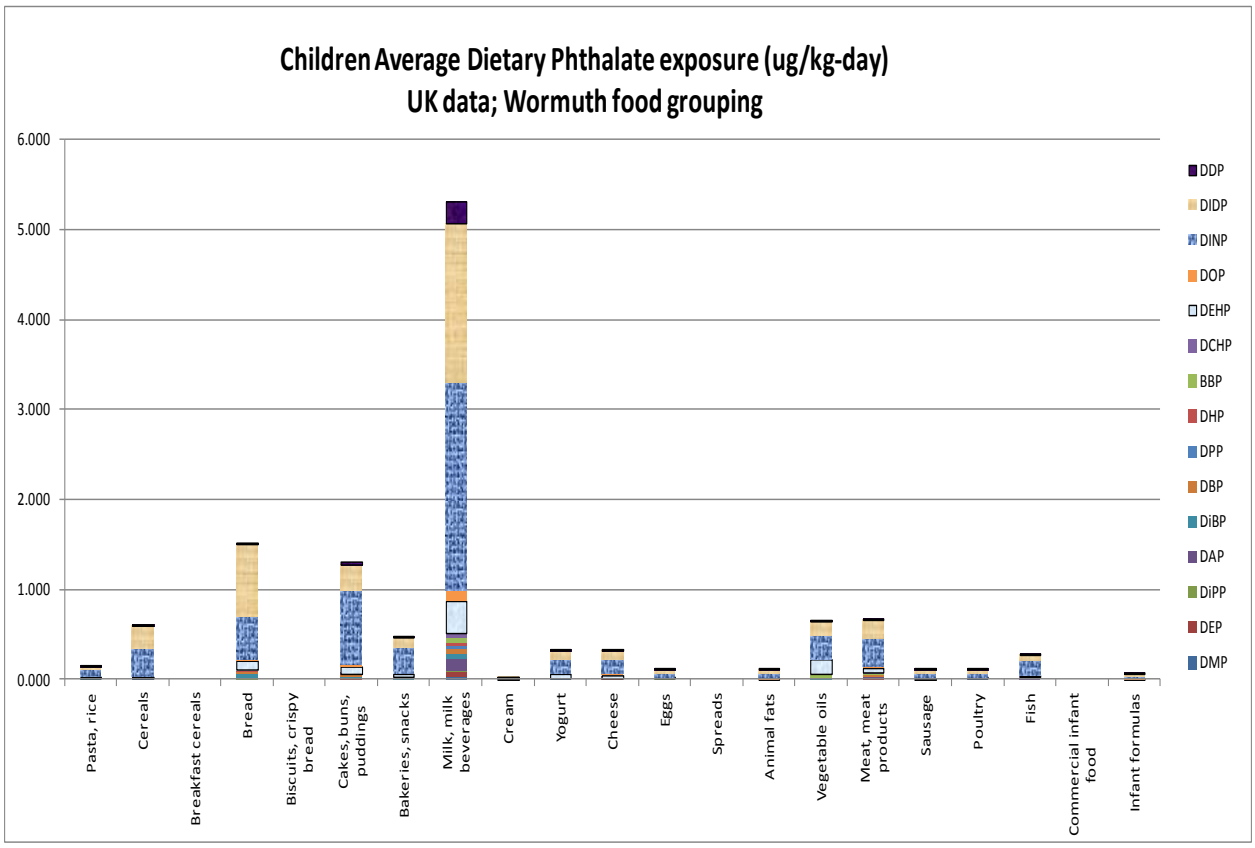
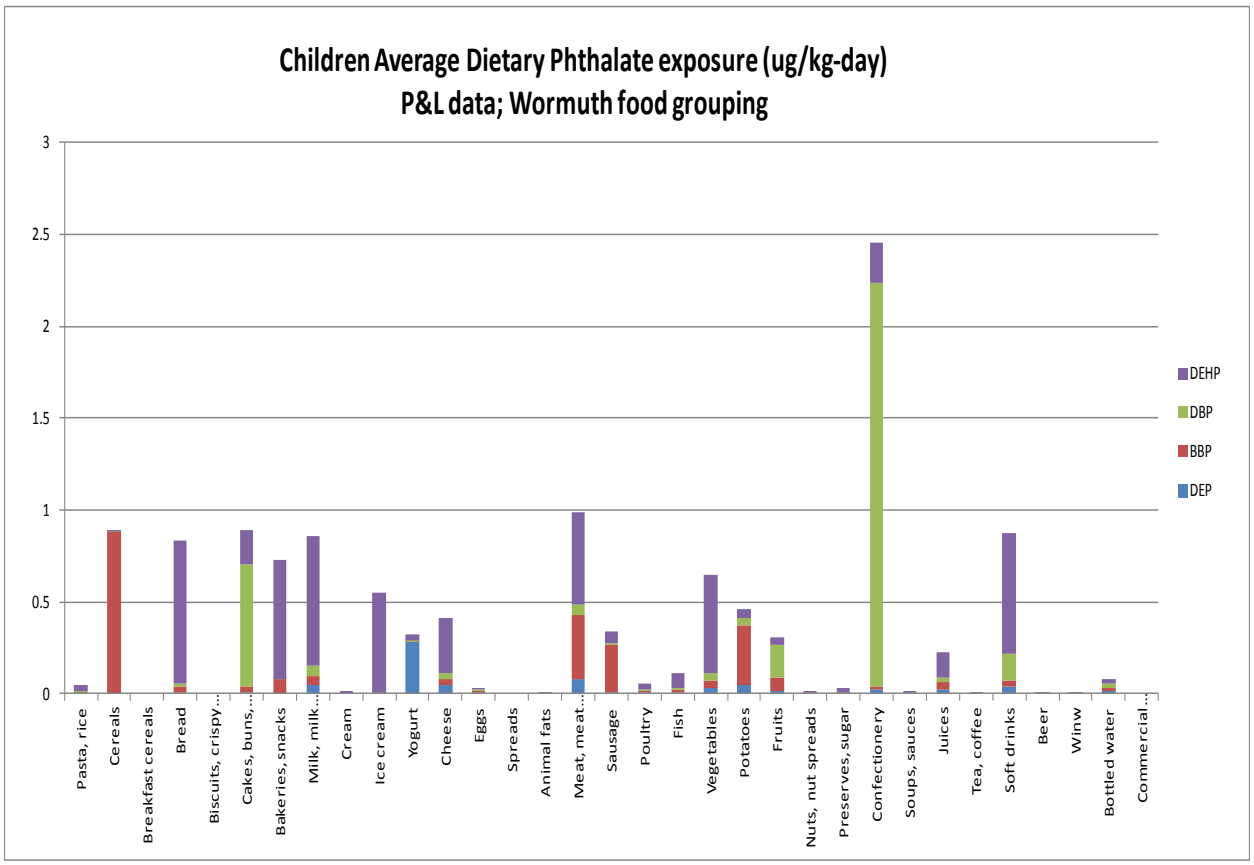


Figure E3-60 Children average dietary phthalate exposure (µg/kg-d); P&L data; Wormuth food grouping.



4.4.4 Female Teens Average Dietary Exposures and the Relative Contribution of Various Phthalates

Figure E3-61 Female teens average dietary phthalate exposure (µg/kg-d); UK data; NCEA food grouping.

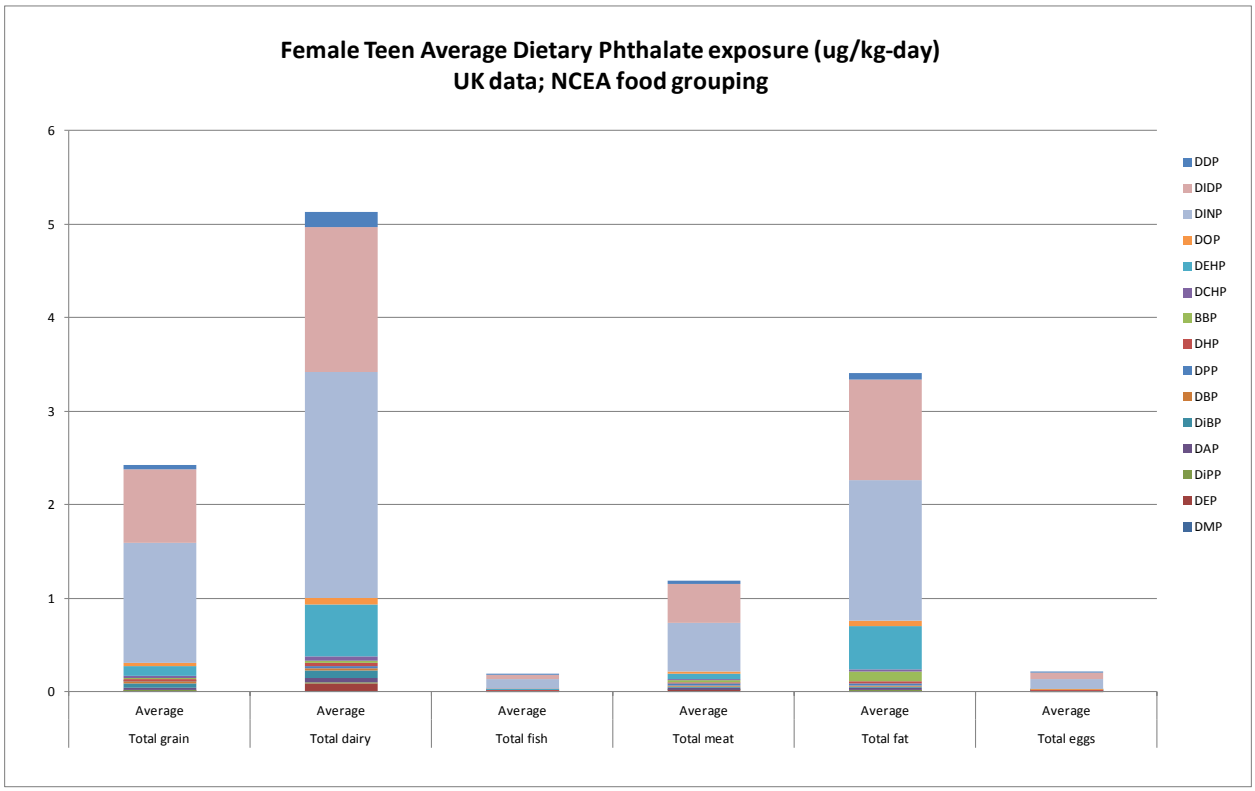


Figure E3-62 Female teens average dietary phthalate exposure (µg/kg-d); P&L data; NCEA food grouping.

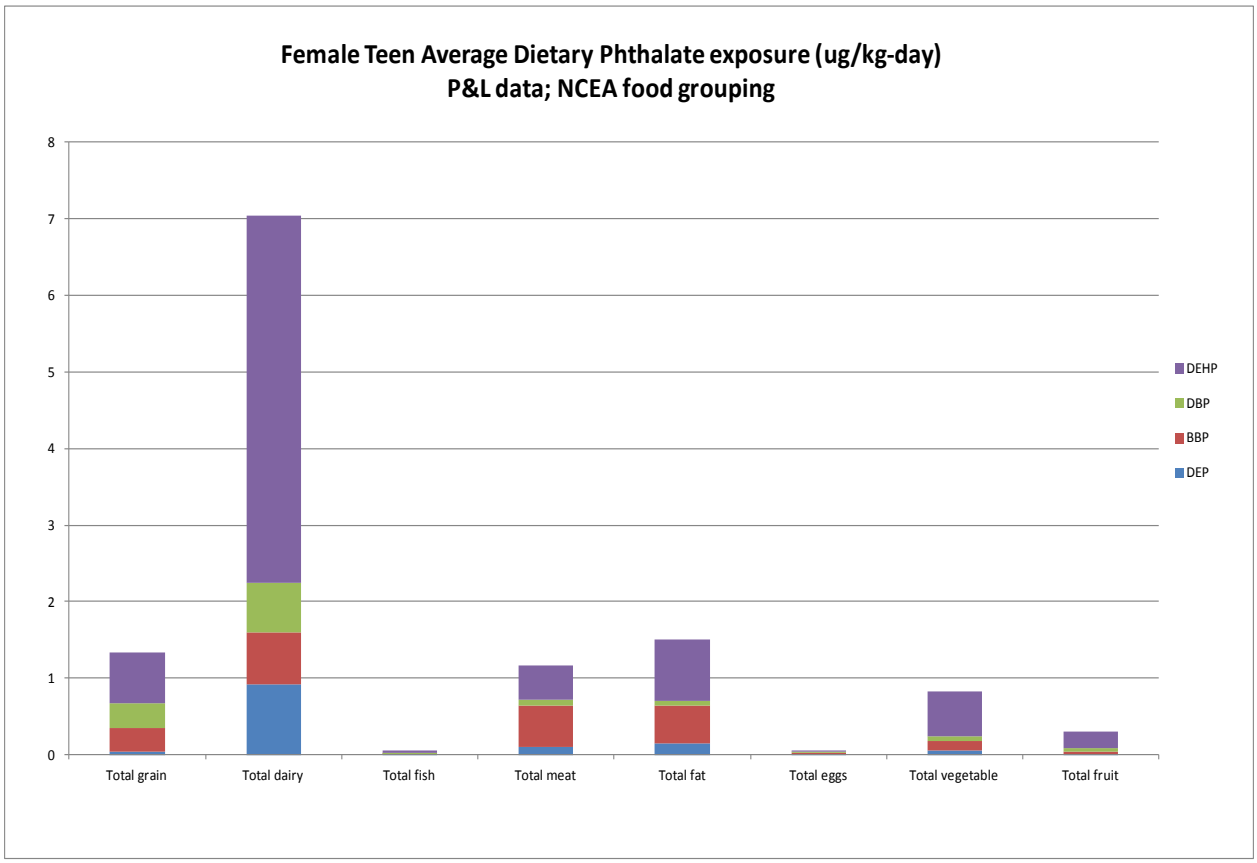


Figure E3-63 Female teens average dietary phthalate exposure (µg/kg-d); UK data; Clark food grouping.

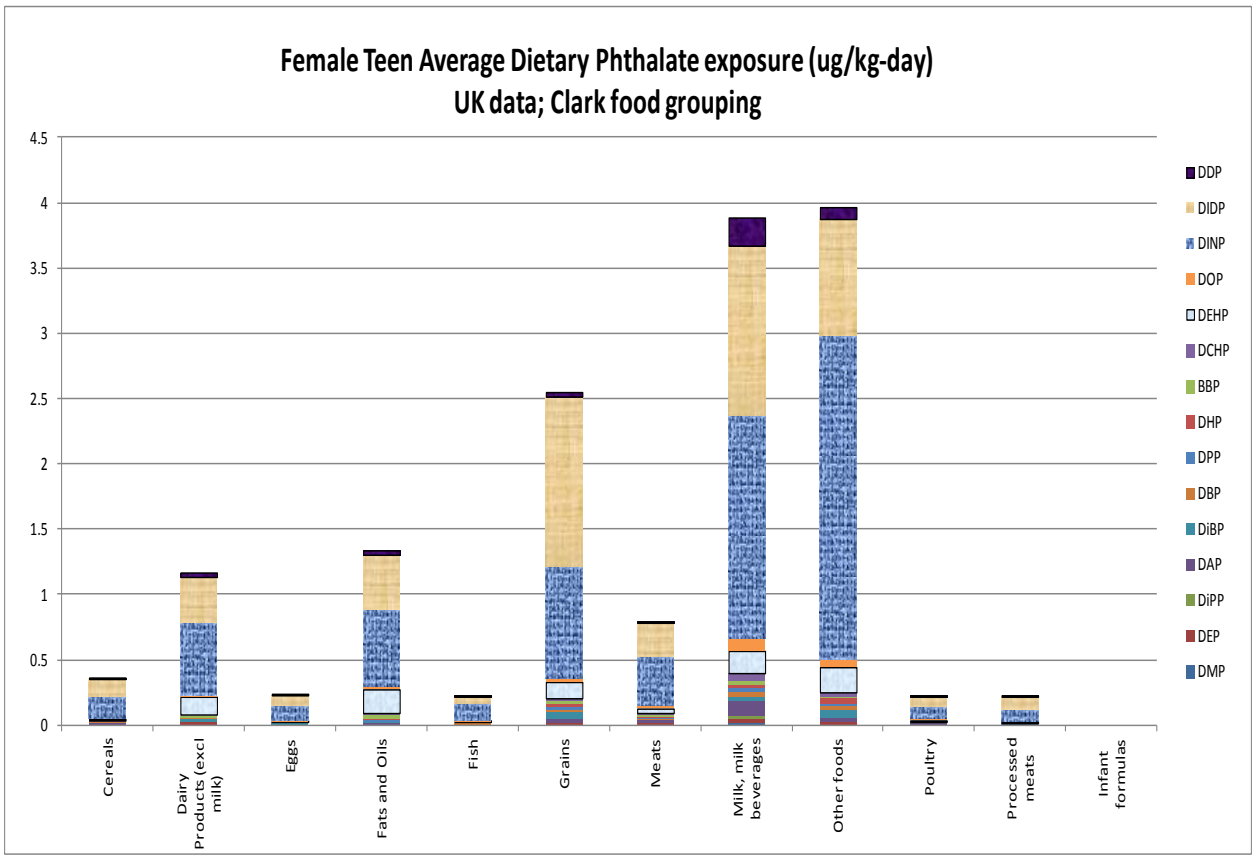


Figure E3-64 Female teens average dietary phthalate exposure (µg/kg-d); P&L data; Clark food grouping.

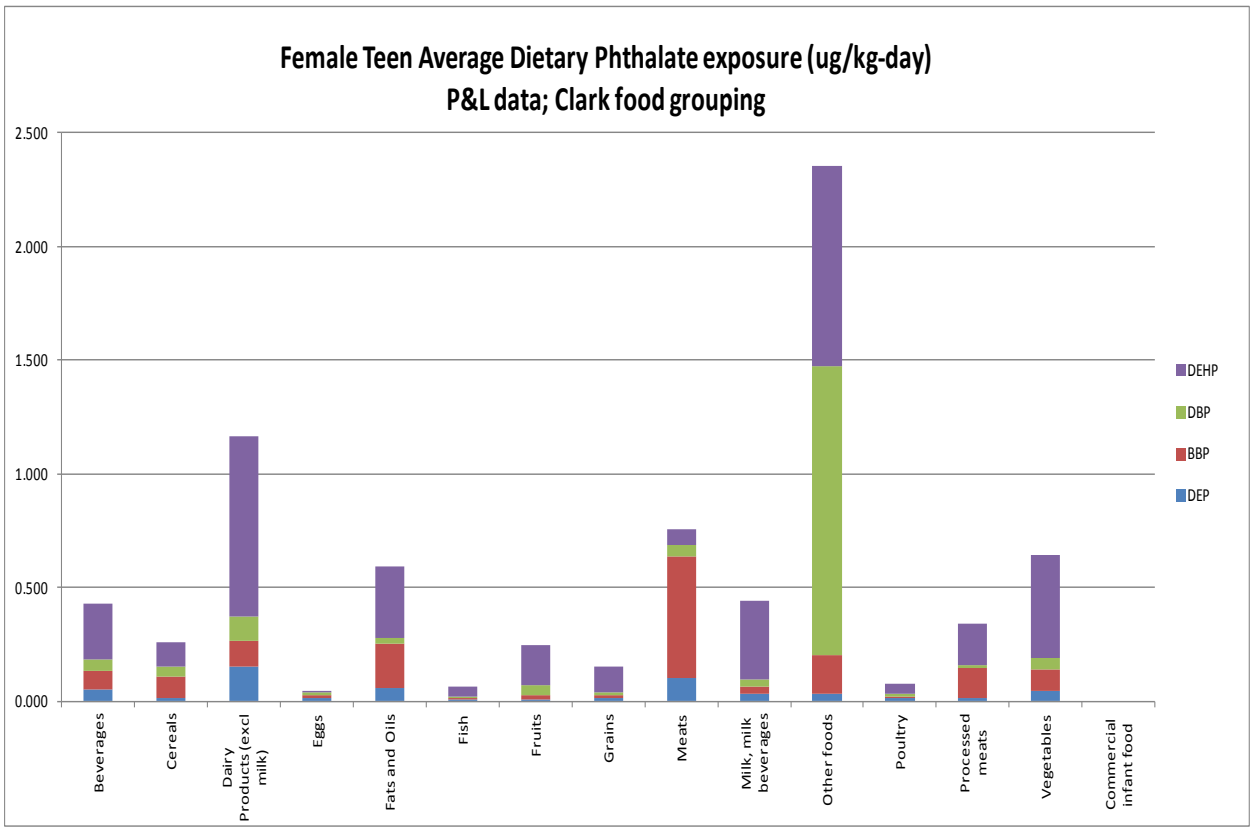


Figure E3-65 Female teens average dietary phthalate exposure (µg/kg-d); UK data; Wormuth food grouping.

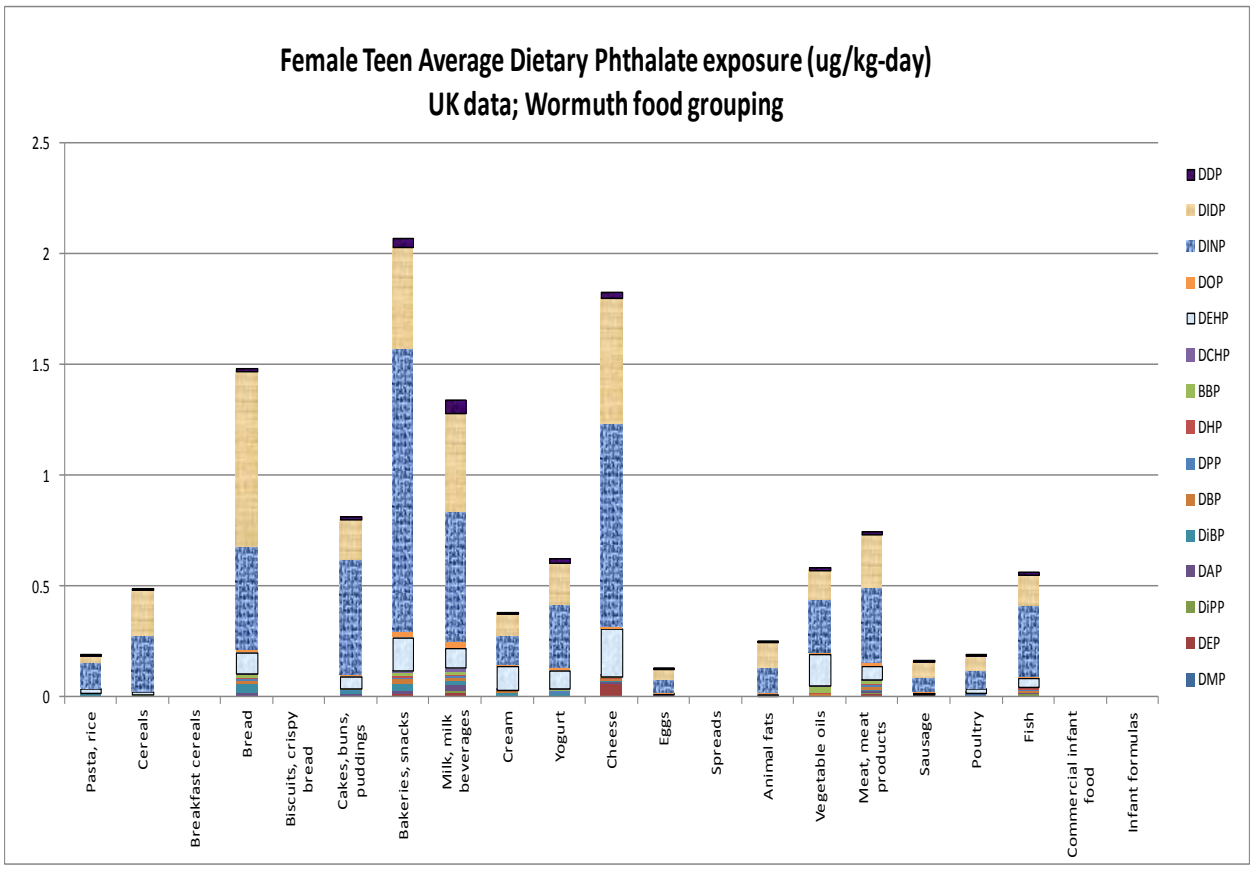
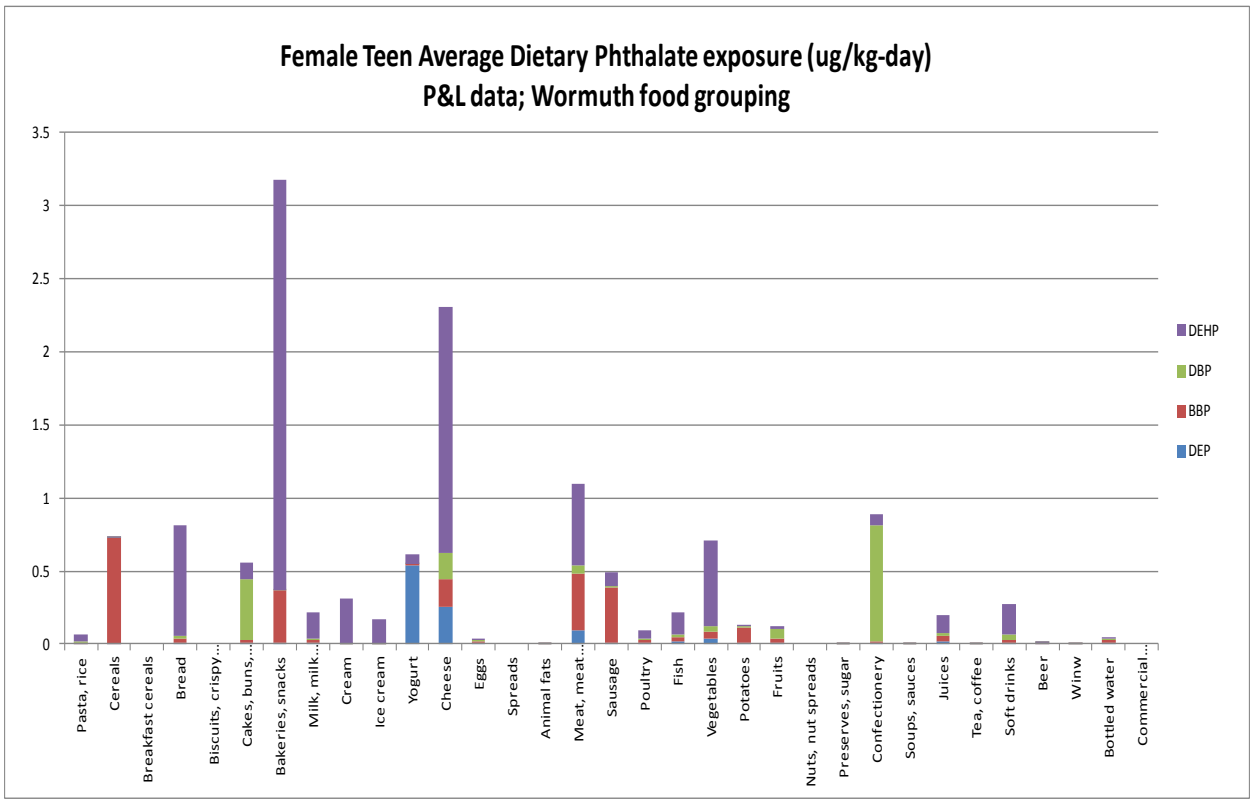


Figure E3-66 Female teens average dietary phthalate exposure (µg/kg-d); P&L data; Wormuth food grouping.



4.4.5 Male Teens Average Dietary Exposures and the Relative Contribution of Various Phthalates

Figure E3-67 Male teens average dietary phthalate exposure (µg/kg-d); UK data; NCEA food grouping.

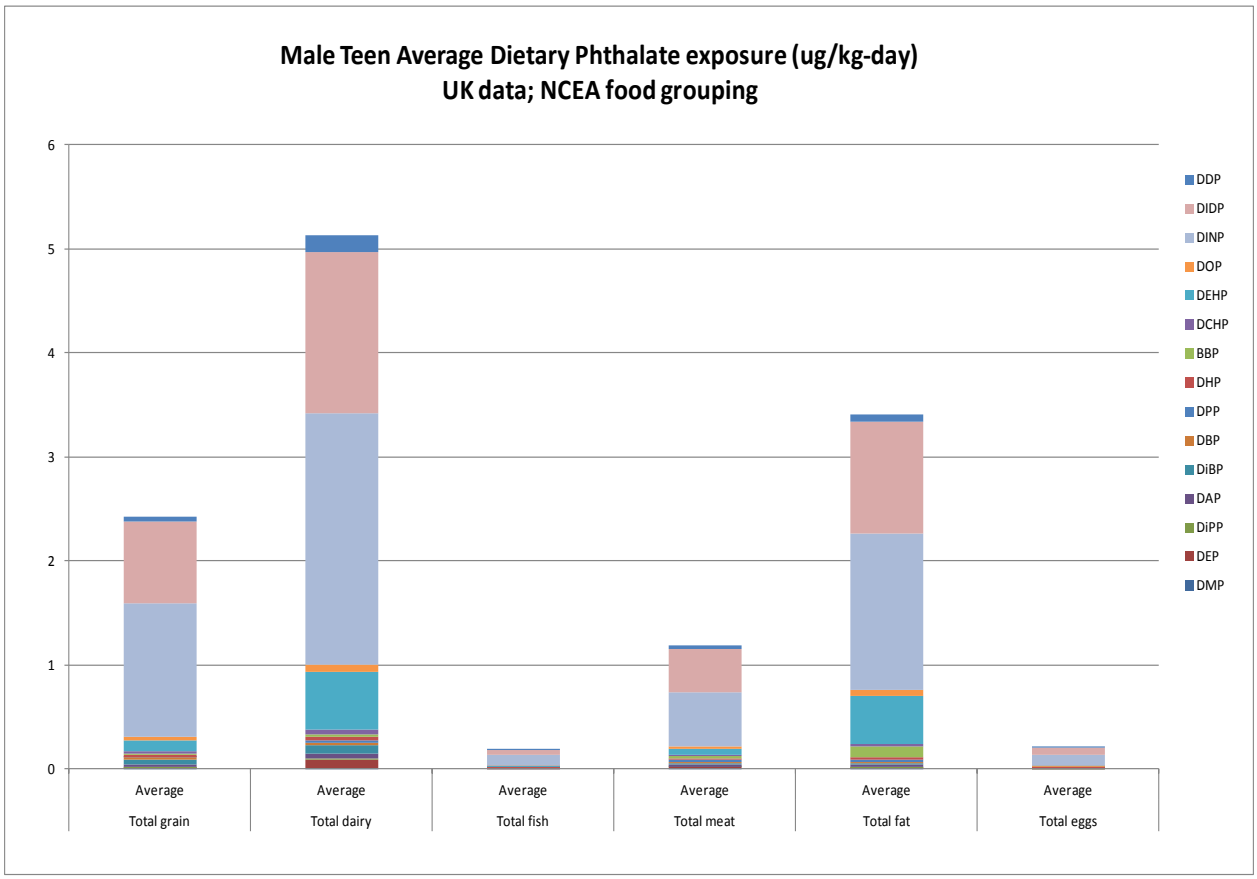


Figure E3-68 Male teens average dietary phthalate exposure (µg/kg-d); P&L data; NCEA food grouping.

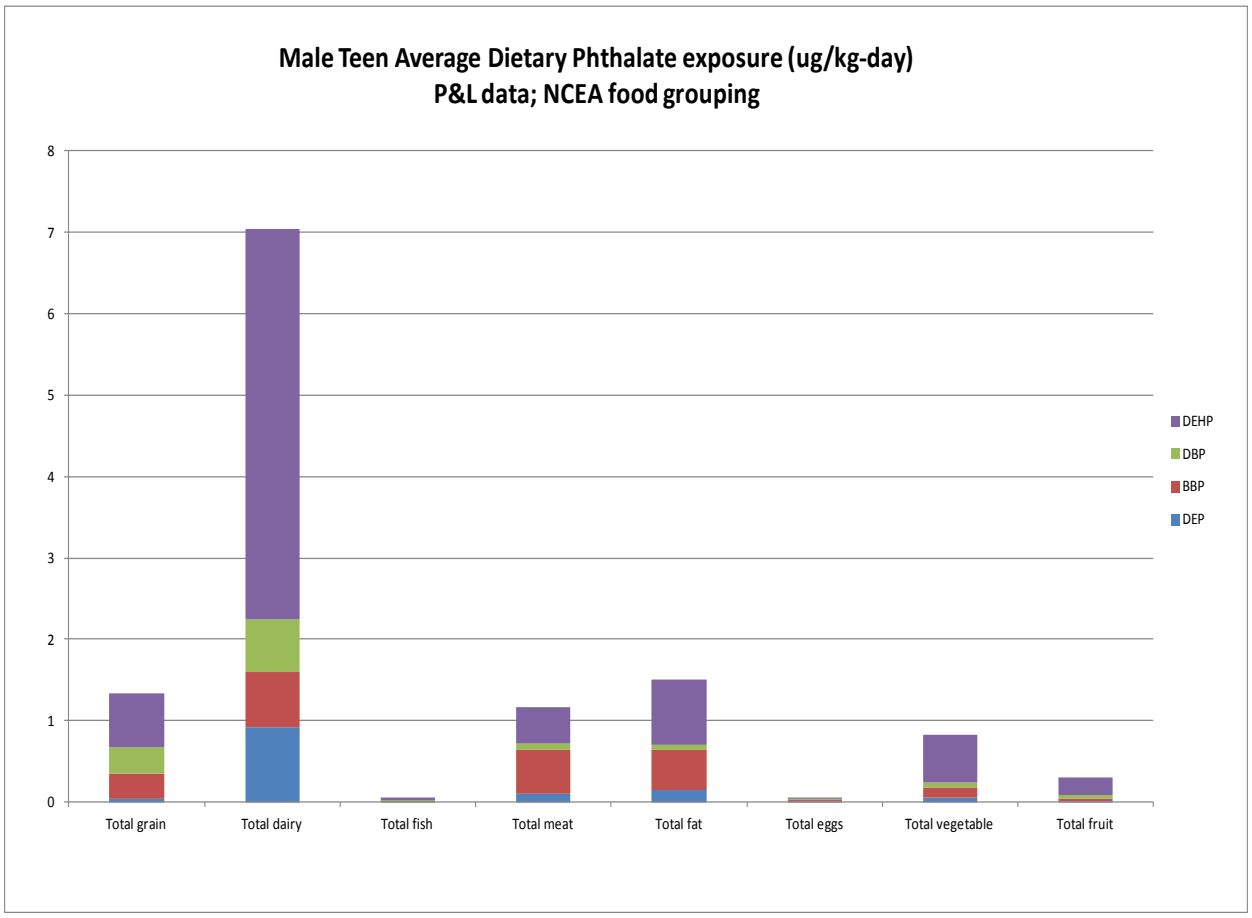


Figure E3-69 Male teens average dietary phthalate exposure (µg/kg-d); UK data; Clark food grouping.

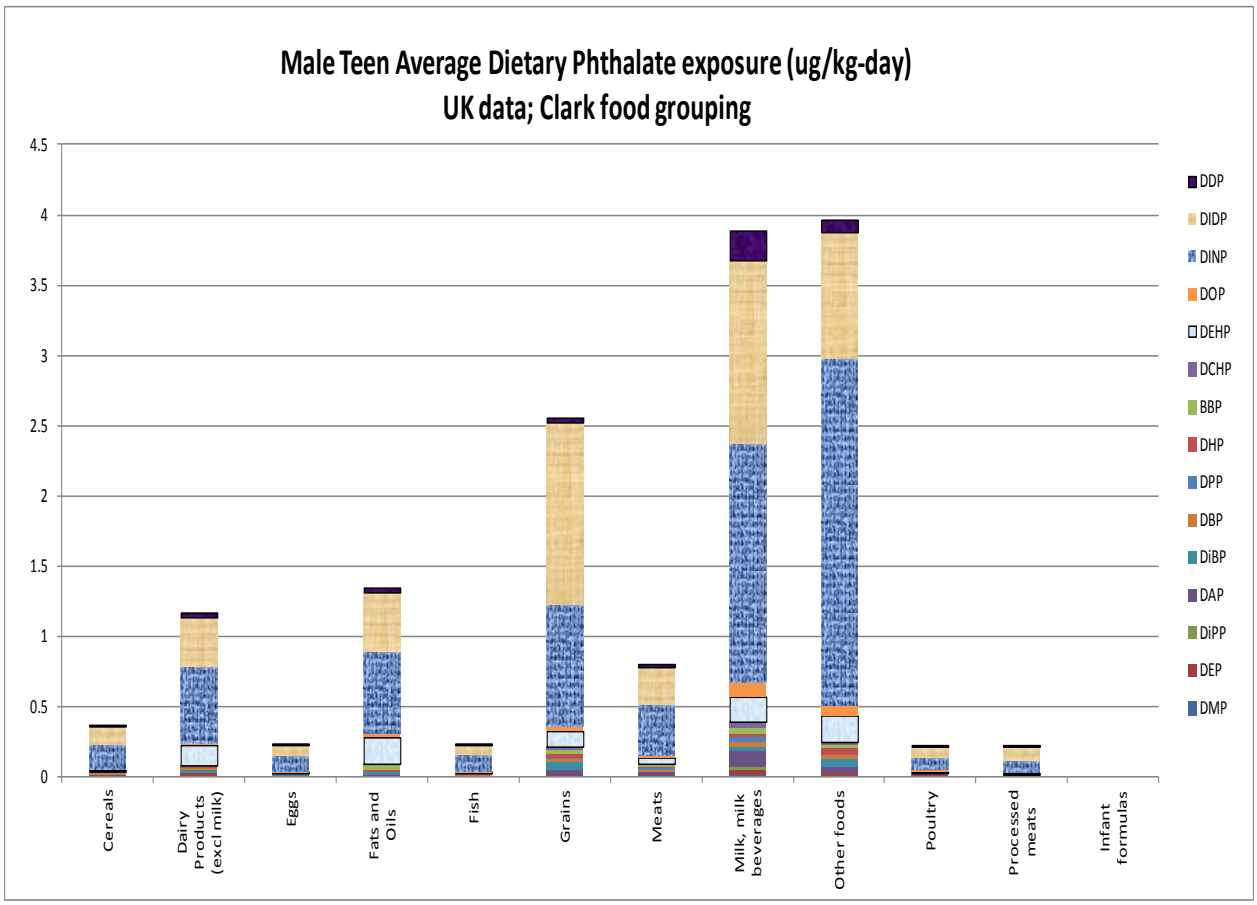


Figure E3-70 Male teens average dietary phthalate exposure (µg/kg-d); P&L data; Clark food grouping.

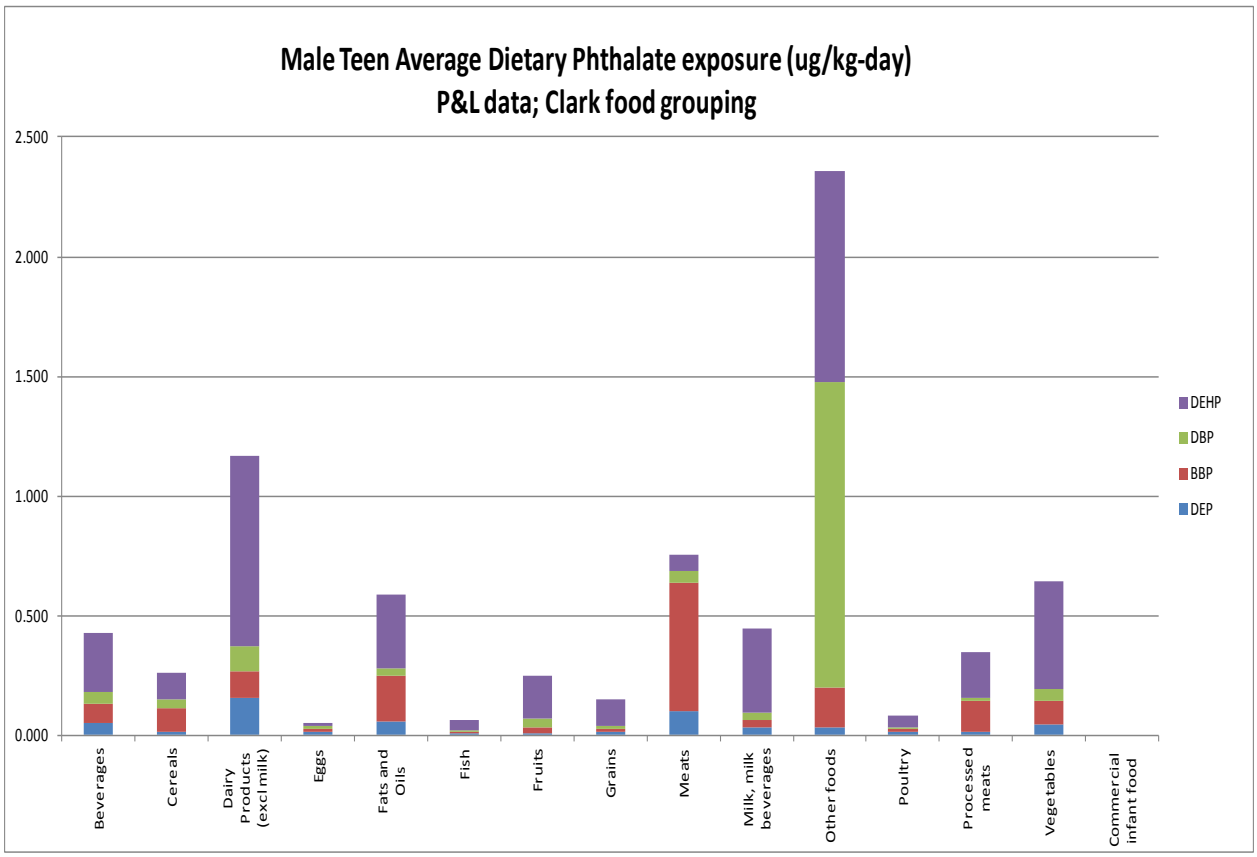


Figure E3-71 Male teens average dietary phthalate exposure (µg/kg-d); UK data; Wormuth food grouping.

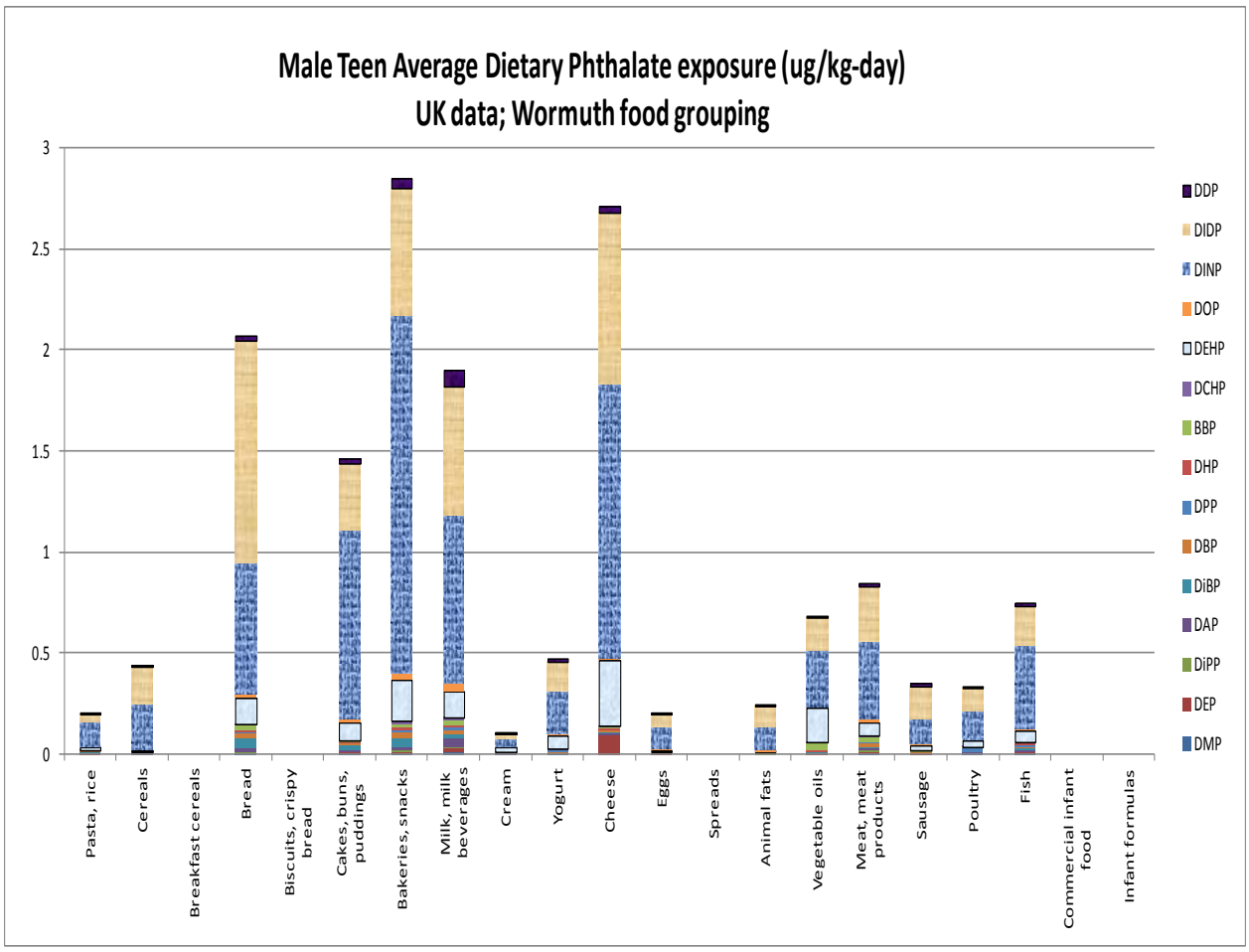
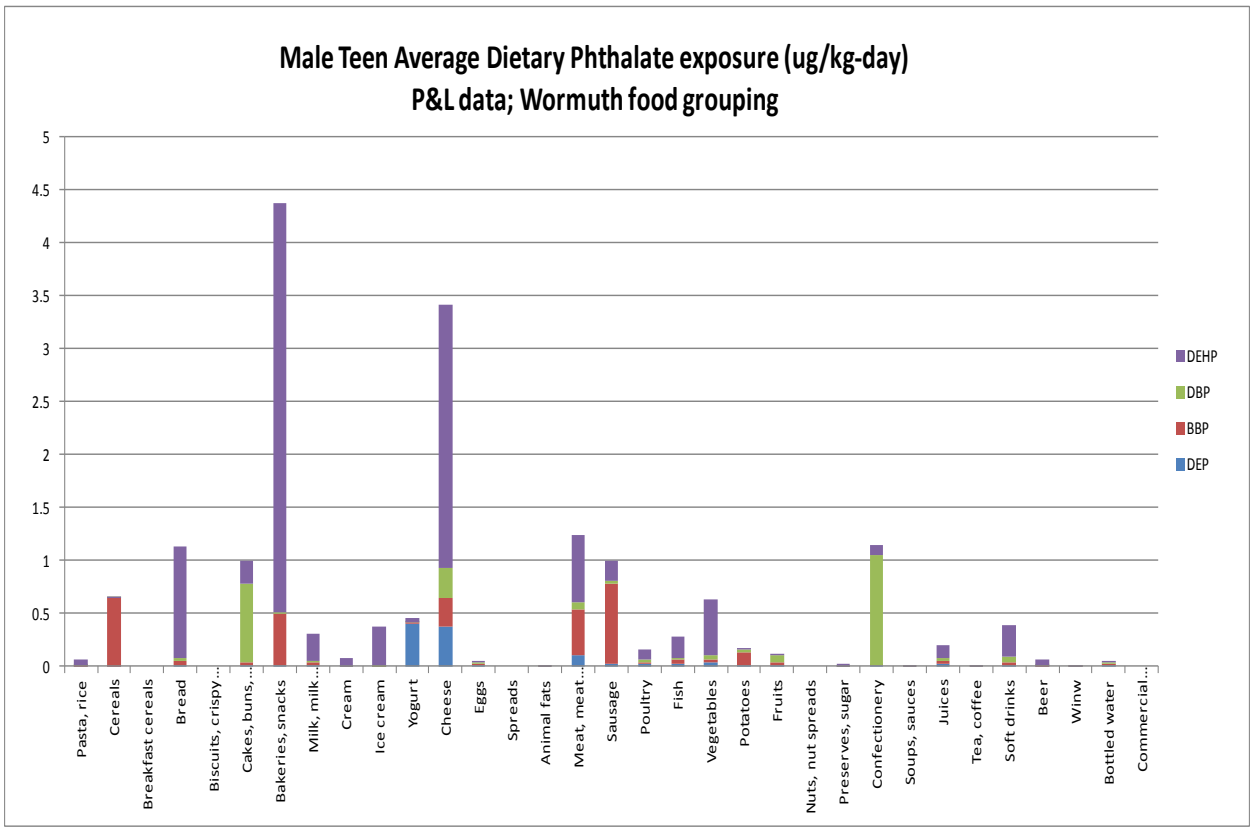


Figure E3-72 Male teens average dietary phthalate exposure (µg/kg-d); P&L data; Wormuth food grouping.



4.4.6 Female Adult Average Dietary Exposures and the Relative Contribution of Various Phthalates

Figure E3-73 Female adults average dietary phthalate exposure (µg/kg-d); UK data; NCEA food grouping.

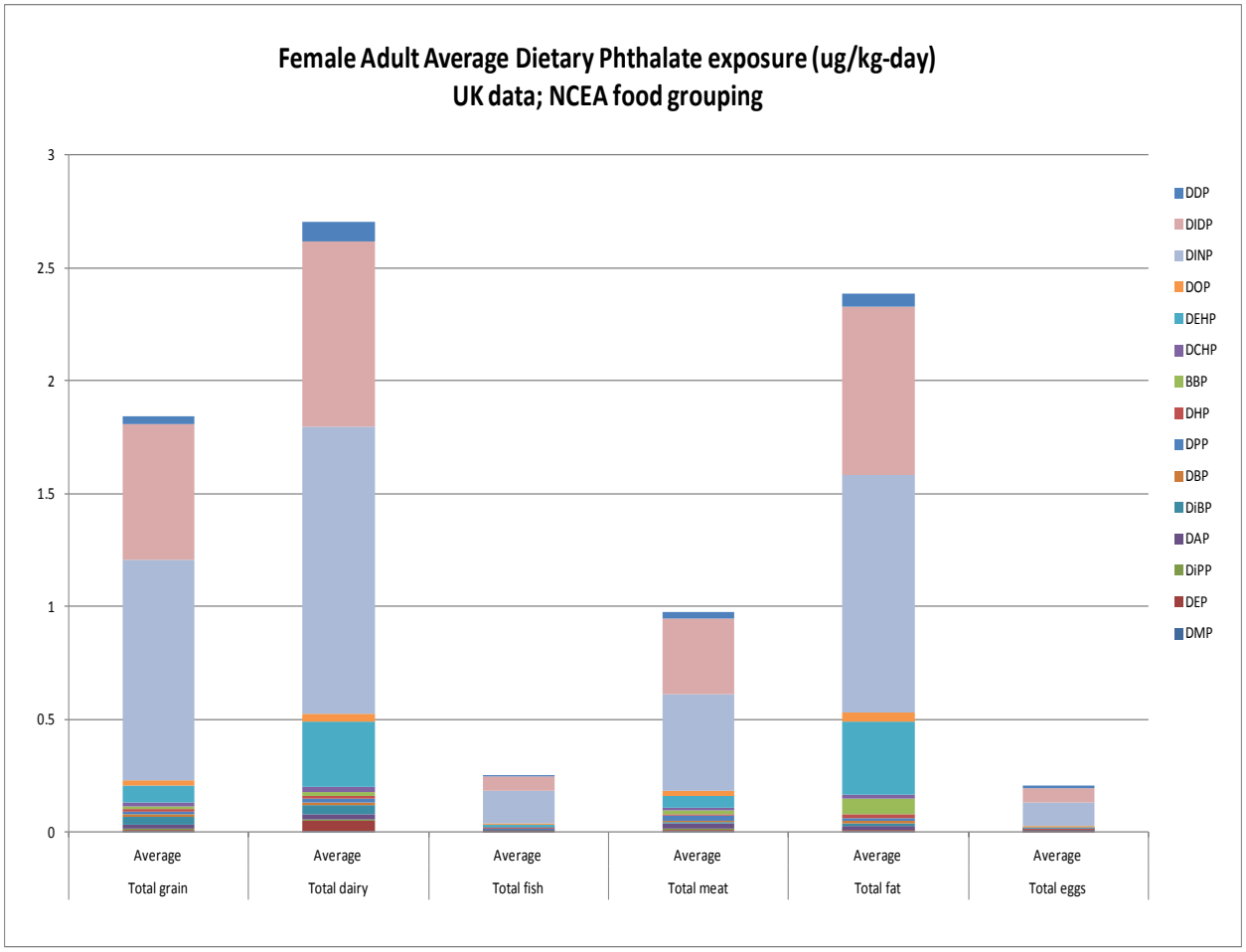


Figure E3-74 Female adults average dietary phthalate exposure (µg/kg-d); P&L data; NCEA food grouping.

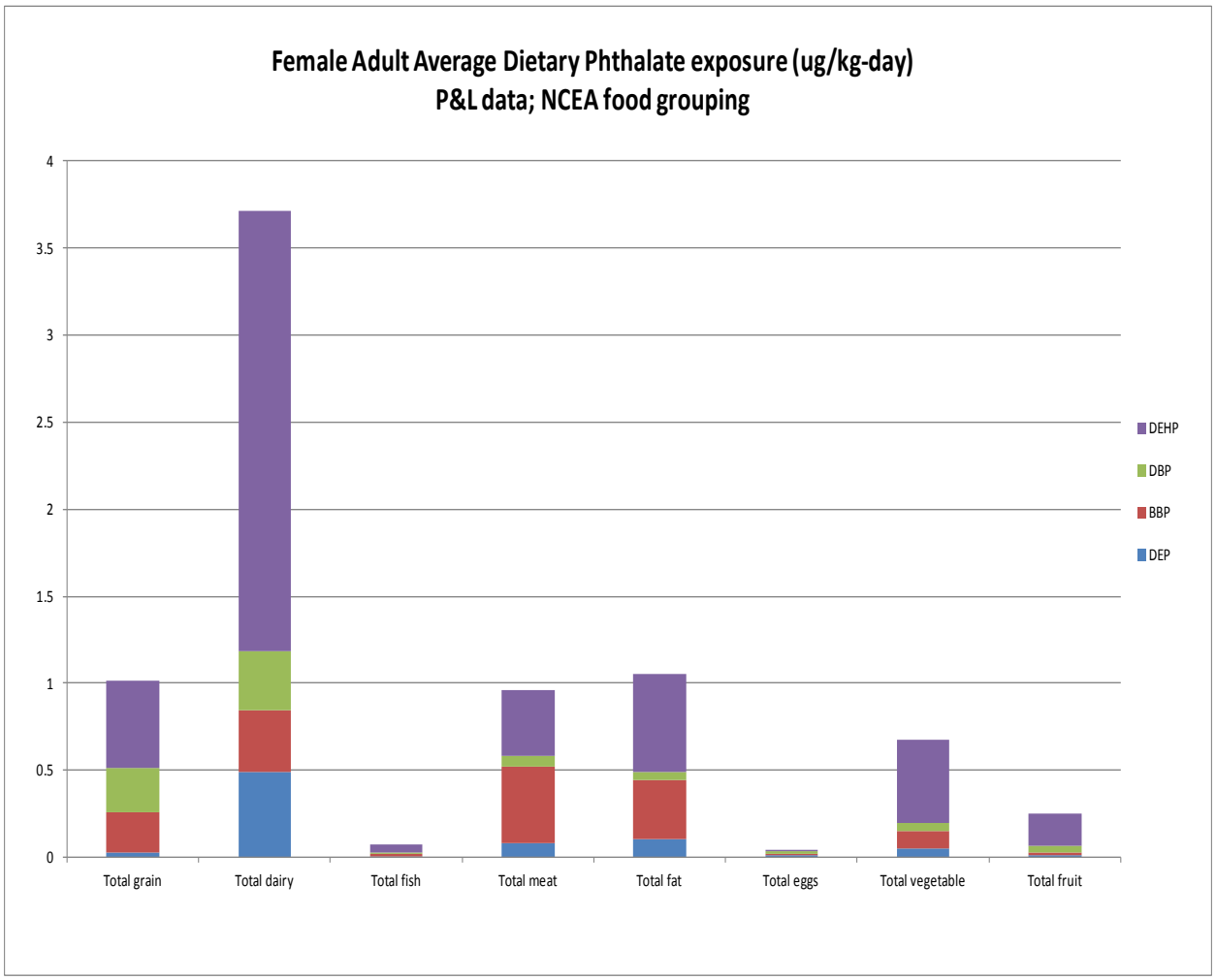


Figure E3-75 Female adults average dietary phthalate exposure (µg/kg-d); UK data; Clark food grouping.

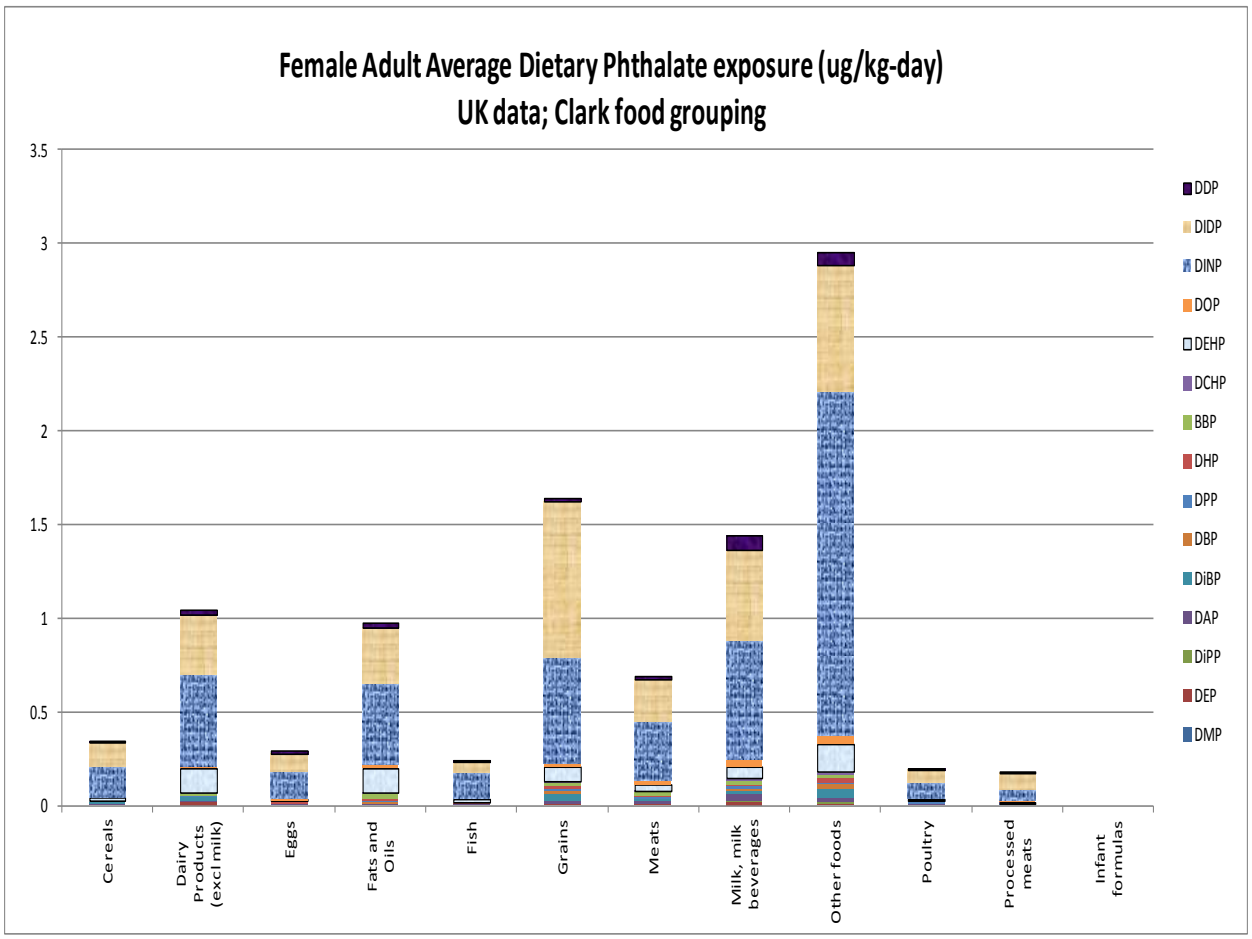


Figure E3-76 Female adults average dietary phthalate exposure (µg/kg-d); P&L data; Clark food grouping.

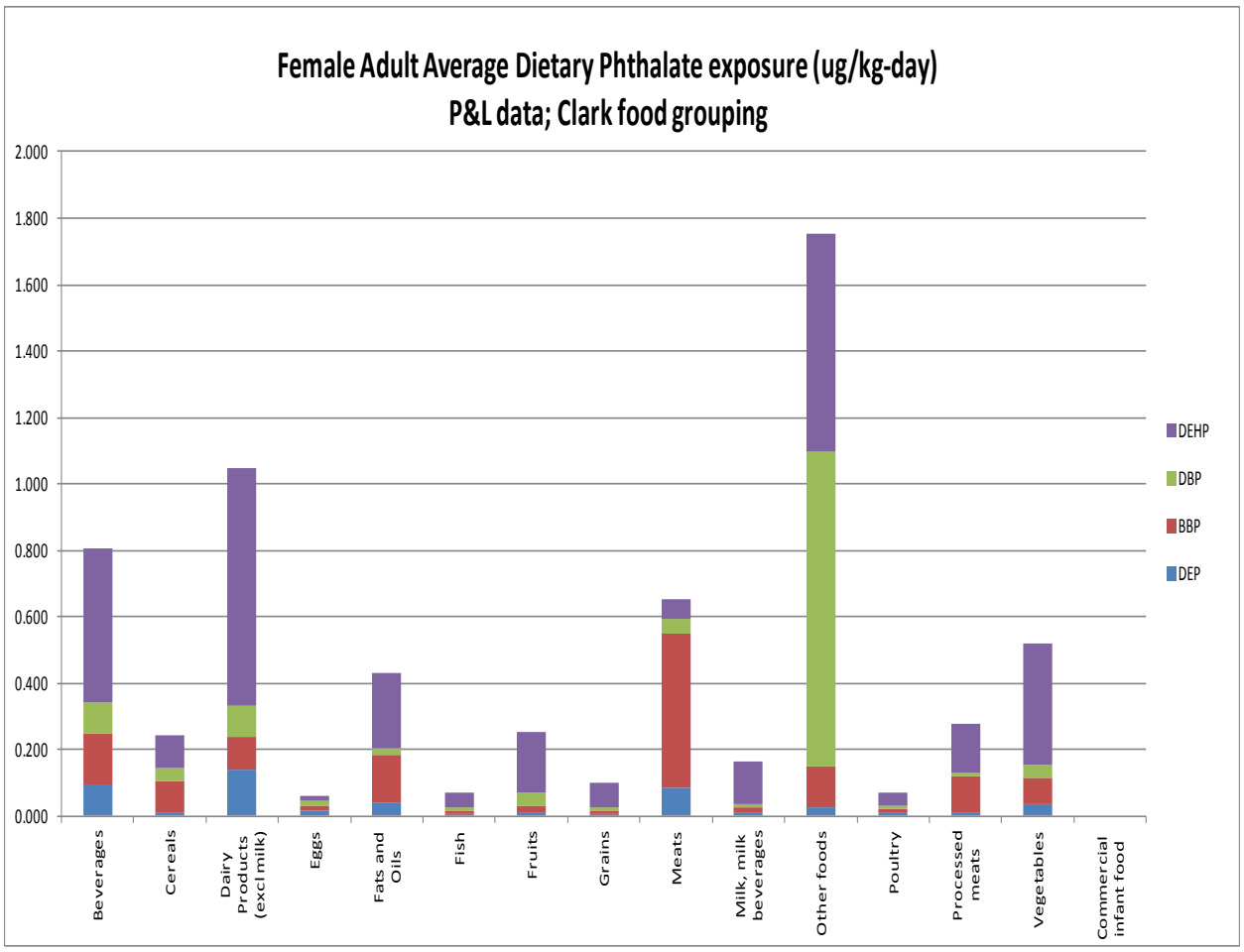


Figure E3-77 Female adults average dietary phthalate exposure (µg/kg-d); UK data; Wormuth food grouping.

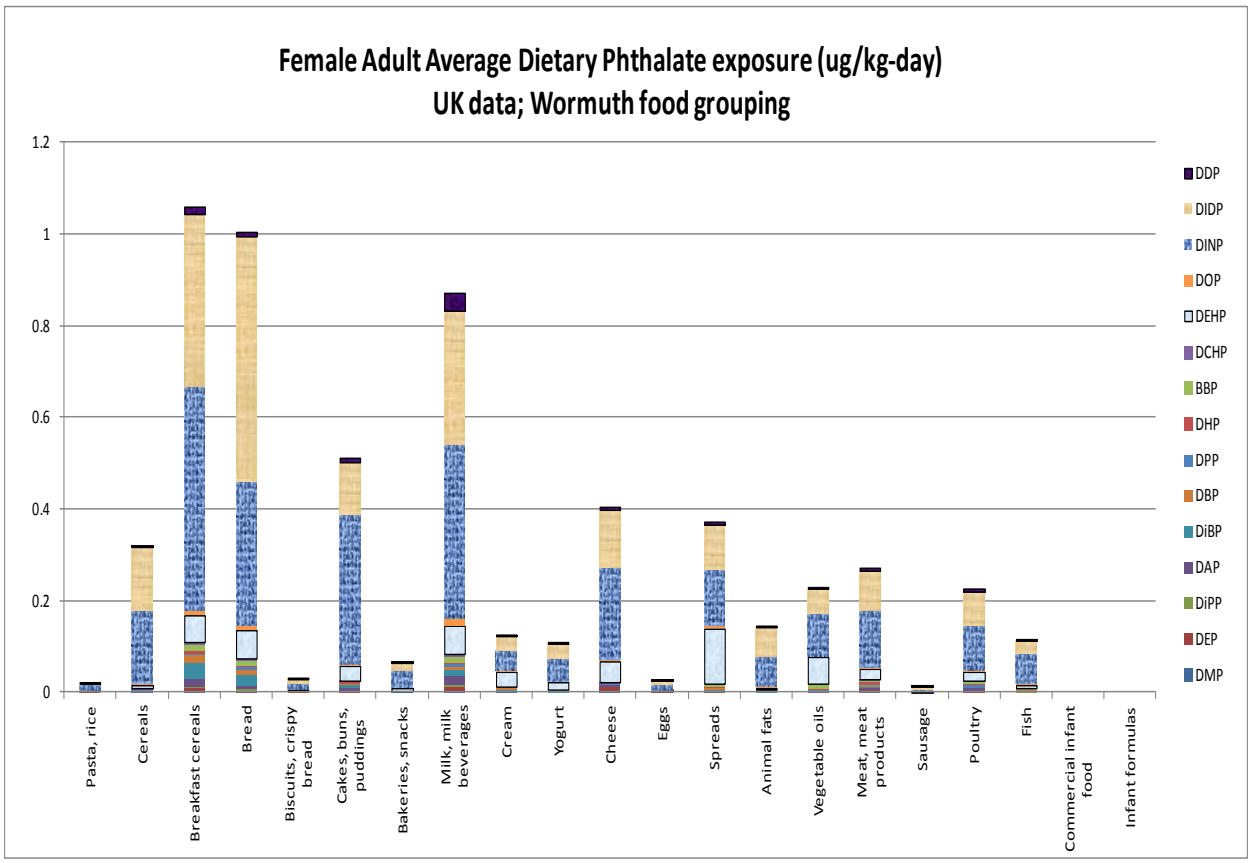
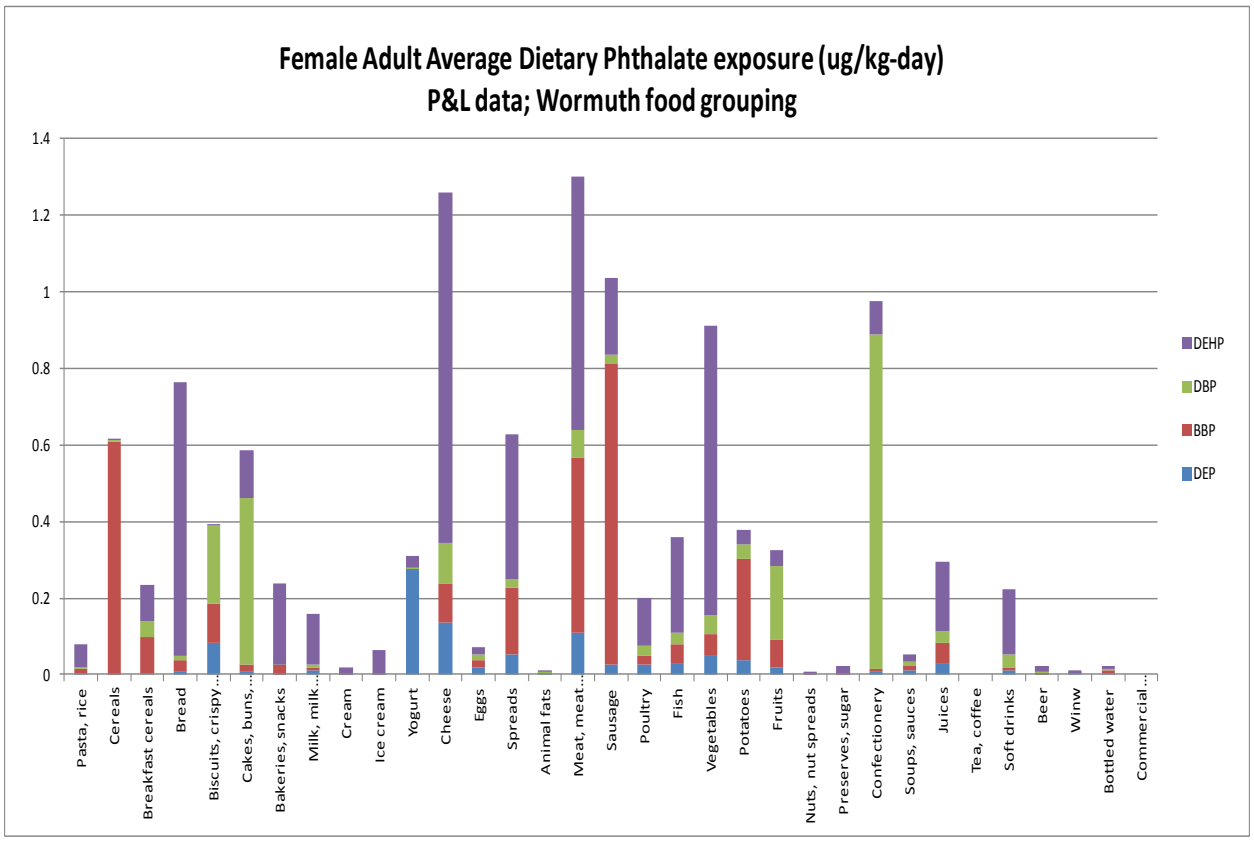


Figure E3-78 Female adults average dietary phthalate exposure (µg/kg-d); P&L data; Wormuth food grouping.



4.4.7 Male Adults Average Dietary Exposures and the Relative Contribution of Various Phthalates

Figure E3-79 Male adult average dietary phthalate exposure (µg/kg-d); UK data; NCEA food grouping.

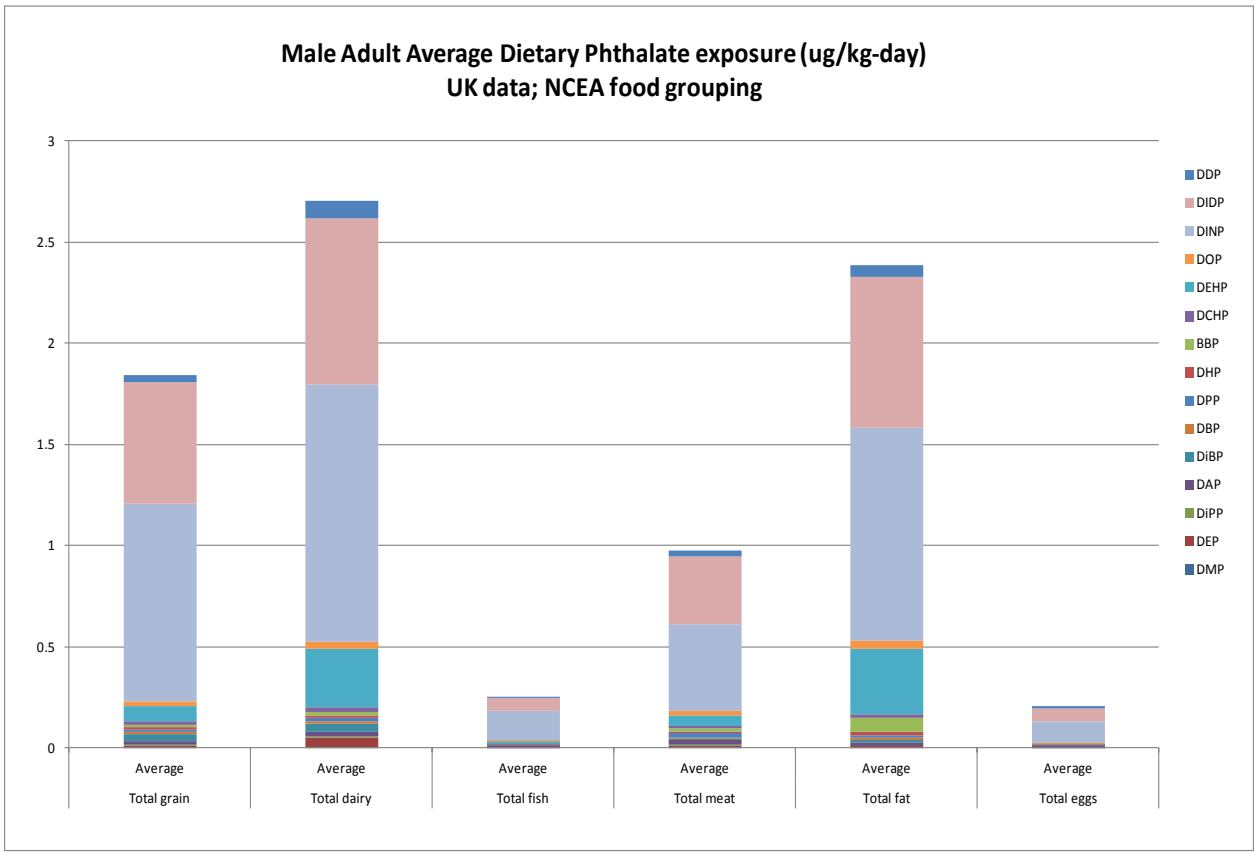


Figure E3-80 Male adults average dietary phthalate exposure (µg/kg-d); P&L data; NCEA food grouping.

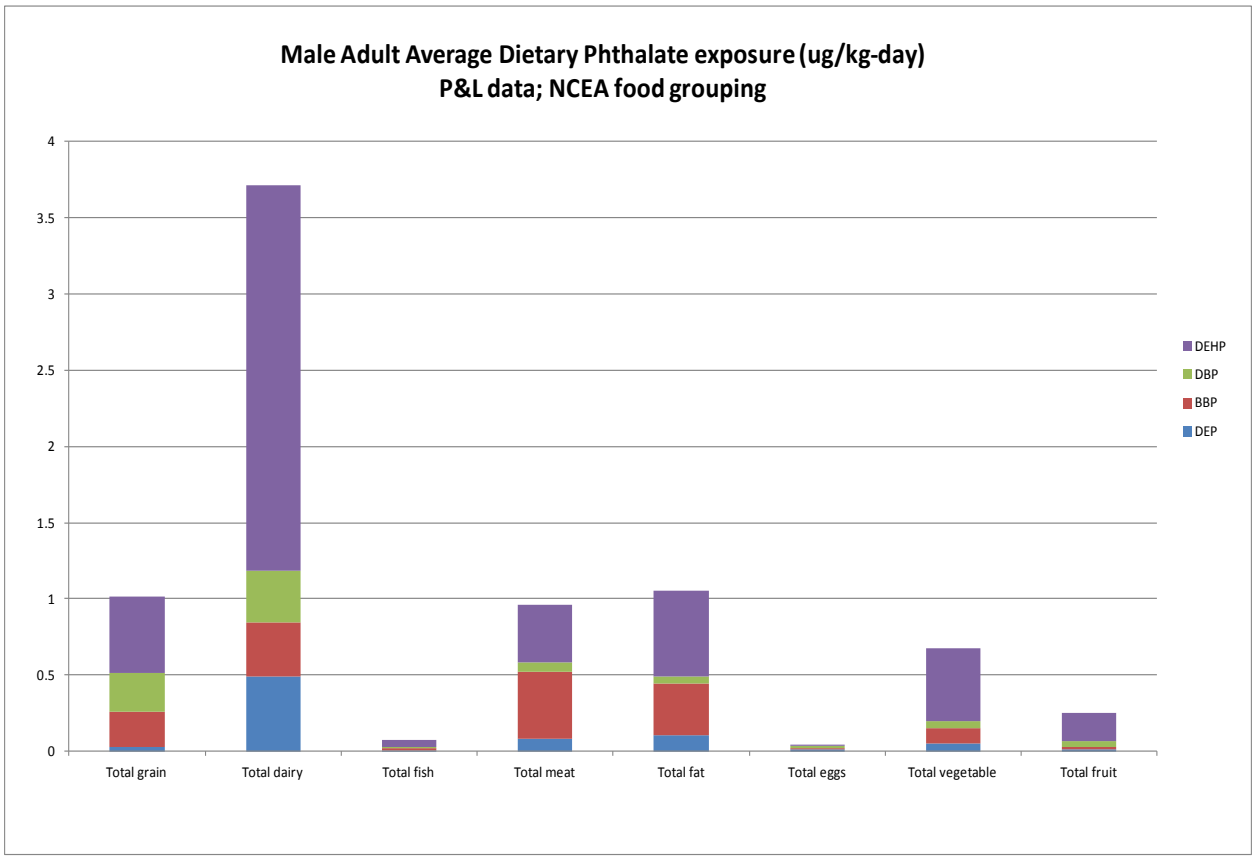


Figure E3-81 Male adults average dietary phthalate exposure (µg/kg-d); UK data; Clark food grouping.

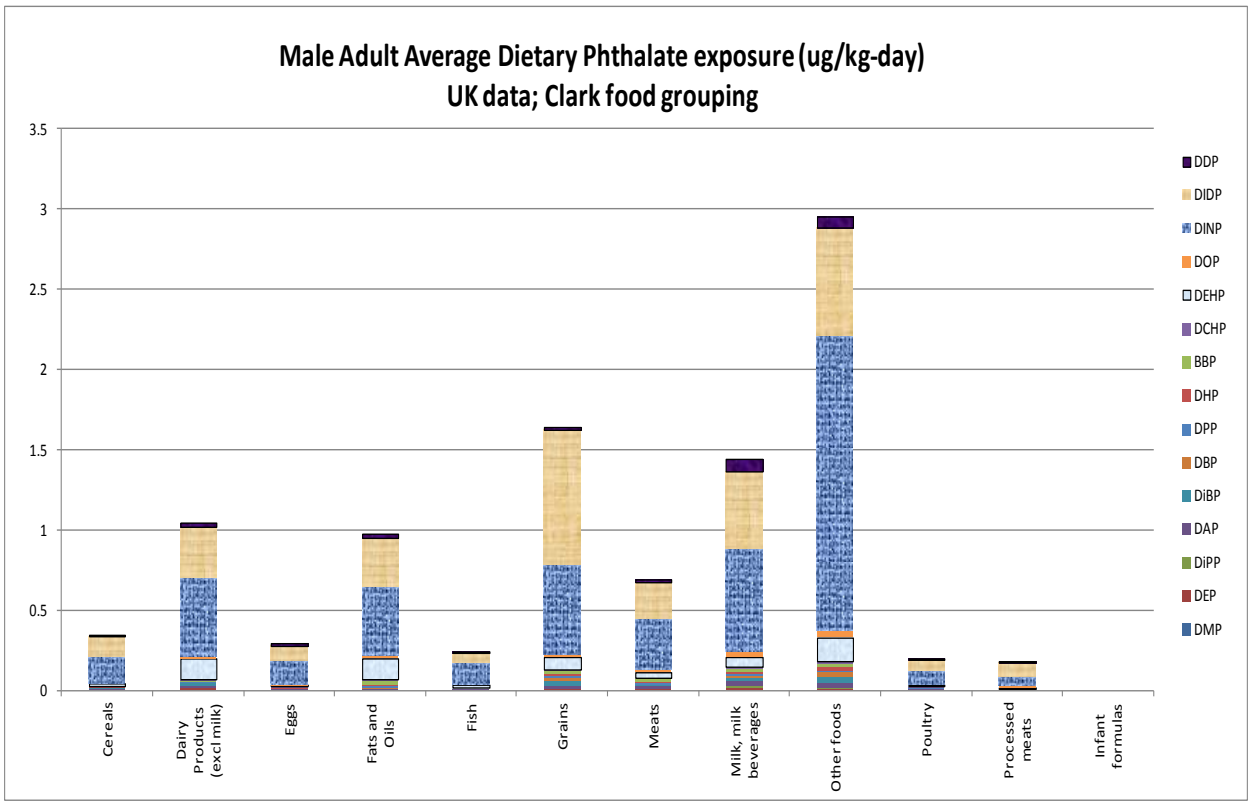


Figure E3-82 Male adults average dietary phthalate exposure (µg/kg-d); P&L data; Clark food grouping.

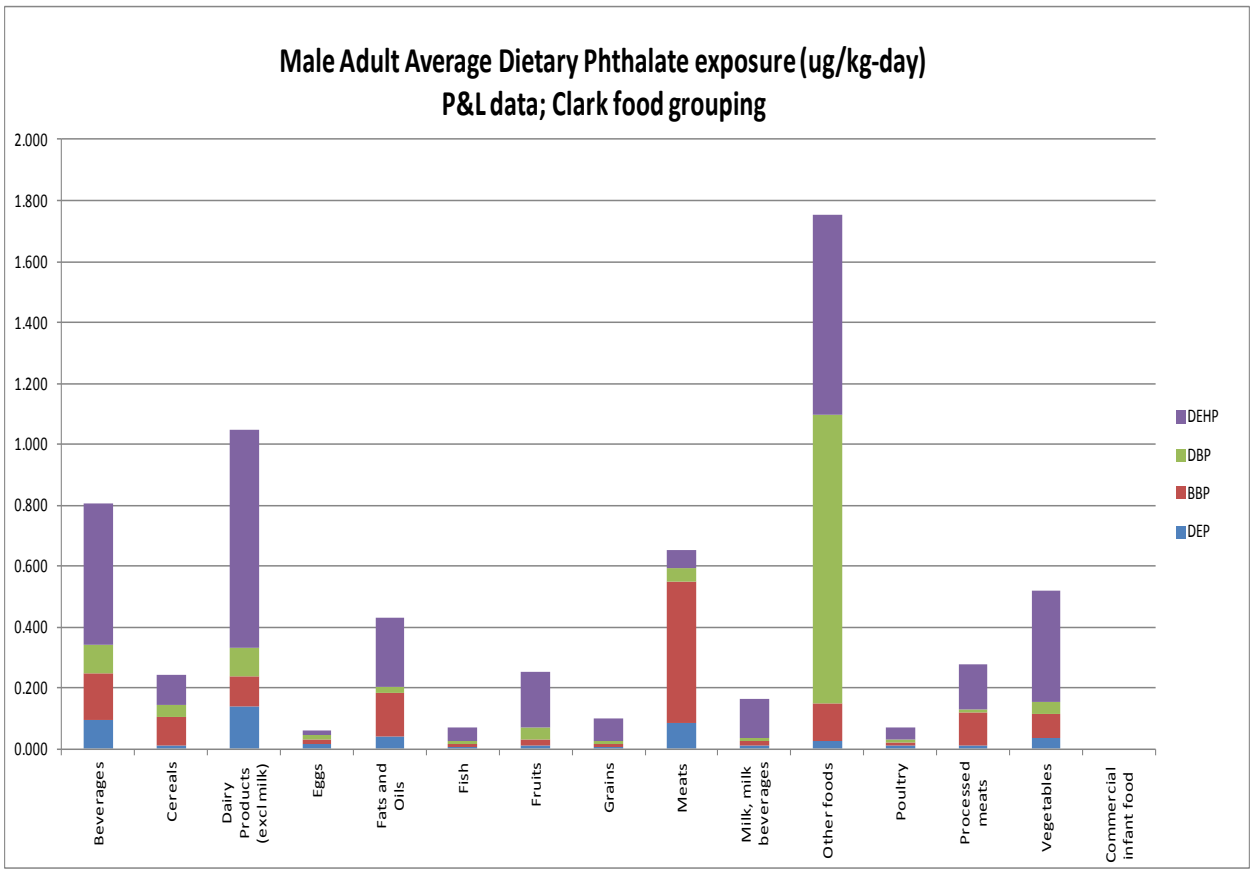


Figure E3-83 Male Adults Average Dietary Phthalate exposure (µg/kg-d); UK data; Wormuth food grouping.

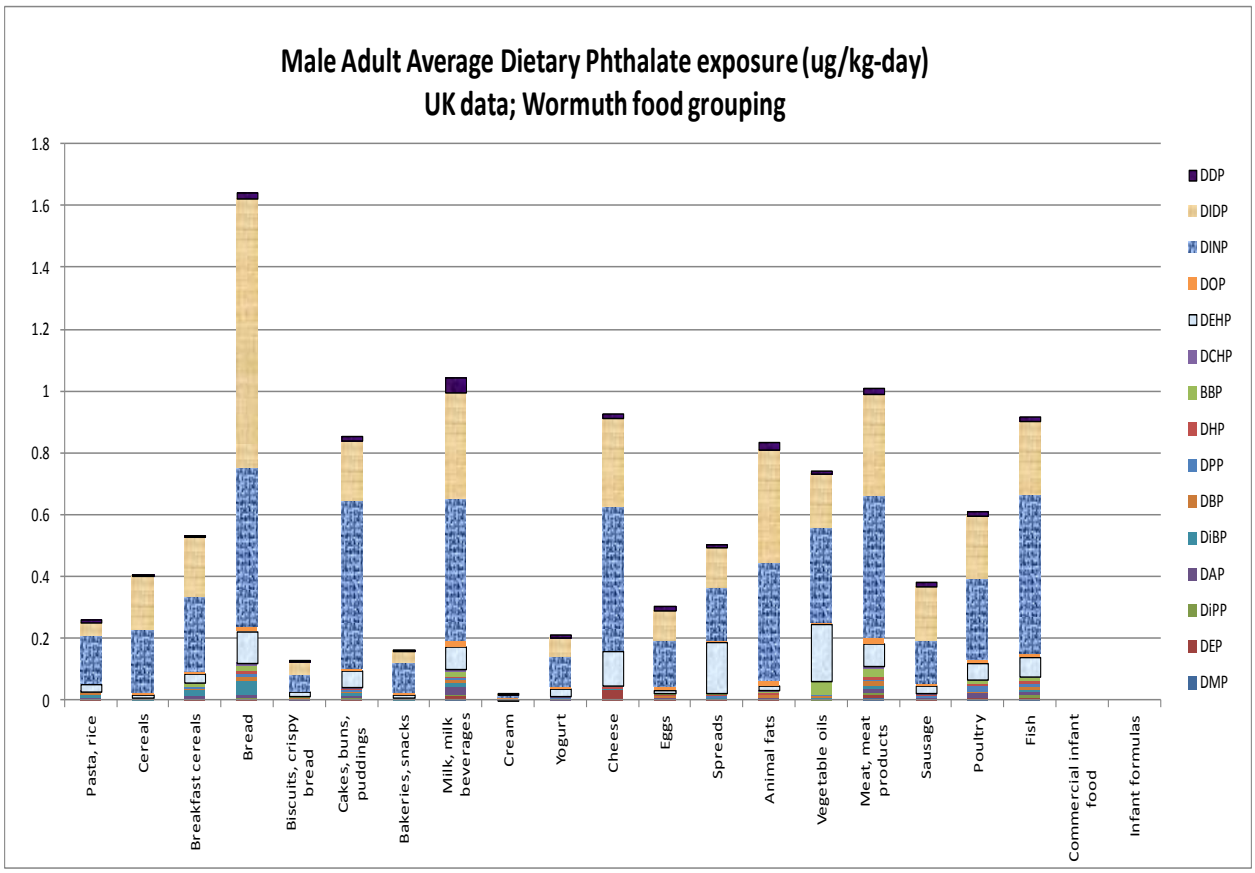
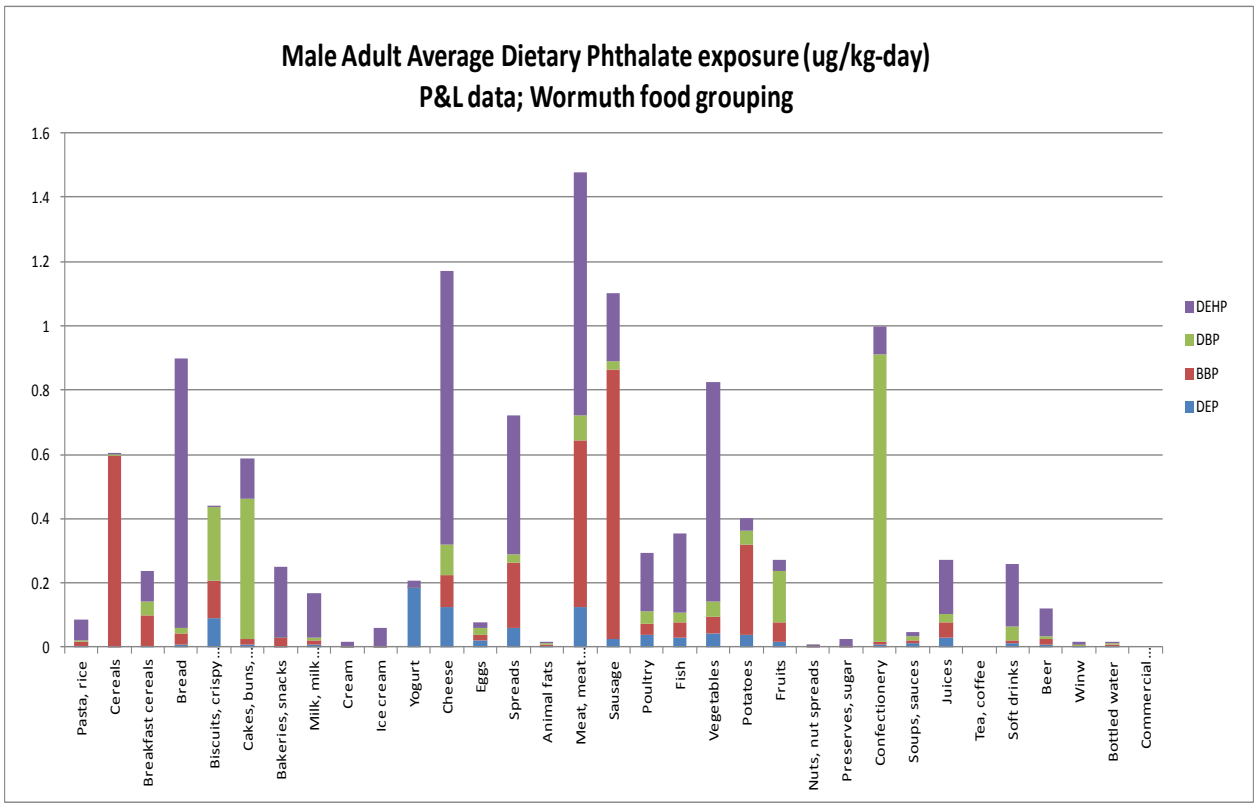


Figure E3-84 Male adults average dietary phthalate exposure (µg/kg-d); P&L data; Wormuth food grouping.



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