U.S. CURRENT PBDE LEVELS AND CONGENERS: HUMAN MILK AND BLOOD; INDIVIDUAL MILK/BLOOD PARTITIONING; LEVELS IN VEGETABLES; AND FAST FOOD PER SERVING

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Introduction

This paper updates our U.S. PBDE findings of 98 blood and 91 milk samples from a population based convenience samples. This paper also adds individual partitioning data between milk and blood from 29 nursing mothers. For the first time levels of PBDEs are measured in 14 U.S. vegetable food samples and compare these to U.S. fish, meat, dairy products and vegetable levels from other countries. Also for the first time the amounts of PBDEs are reported per serving from 13 common American fast foods.

Materials and Methods

The analytic methods based on gas chromatography and mass spectroscopy have been described elsewhere and will not be presented here[1,2]. The population based blood and milk as well as food samples were analyzed by Olaf Päpke at Eurofins ERGO laboratory and the milk and blood for partitioning were analyzed by Andreas Sjodin at CDC. Population based milk and blood samples were convenience samples obtained at Southwestern Medical Center Obstetrical Clinics in Dallas, Texas, the Mothers' Milk Bank in Austin Texas, and elsewhere in the US, and the milk and blood for partitioning was collected from volunteers at the Mothers' Milk Bank in Austin. Vegetables and vegetable foods were purchased from Dallas, Texas supermarkets. All "Fast Foods" were purchased in Dallas, Texas.

Results

Figure 1 represents total PBDE levels of 91 milk and 98 blood samples for congeners 28, 47, 66, 85, 99, 100, 153, 154 and 183. The results of total PBDE levels in milk were: 70 ng/g (mean), 36 ng/g (median) and 6.1 to 598 ng/g (range). The results of total PBDE levels in blood were: 54 ng/g (mean), 29 ng/g (median) and 1.3 to 518 ng/g (range). This constitutes all samples collected and individually analyzed by us from 2002 to 2008. Milk PBDE levels in this series are somewhat higher than blood values.

Figure 2 represents (individually analyzed) partitioning data for milk and blood from the same 29 women. It shows higher values in milk than blood for most congeners and total PBDEs. Women's age, parity, weight, body mass index (BMI) and length of nursing do not appear to contribute to levels measured. In general, total PBDE partitioning between milk and blood varies from 1.0 to 1.7.

Figure 3 represents the first data known to us on PBDE levels in U.S. vegetables and foods of vegetable origin. Levels are lower than our previously published fish, meat and dairy samples. Our previous results showed median PBDE levels in fish 616 pg/g (n=24), meat 190 pg/g (n=18) and dairy 32 pg/g (n=15). Current data shows median PBDE levels in vegetable food is 12 pg/g (n=14). Soy products including soy infant formula, tofu and soy milk are low in PBDEs and toasted oat cereal and wheat bread highest at 90 pg/g wet weight in this sample. Peanuts, carrots, green beans, and lettuce are intermediate in PBDE concentration. Median PBDE level in vegetables from our study appears to be lower compared to Japan[3], but higher compared to Spain[4].

Figure 4 represents amounts of PBDEs per serving in common U.S. fast foods. The highest amount of PBDEs was found in a Pizza Hut's Personal Pan Pizza Supreme (23,381 pg/serving, serving wt. 227 g) and the lowest amount of PBDEs was found in a Burger King's Veggie Burger (3,417 pg/serving, serving wt. 201 g).

Discussion

We have expanded the sample size for U.S. blood and milk for PBDEs and find the values similar although a little higher in range than previously found by others and us[5,6,7]. These values continue to be the highest worldwide[6]. Partitioning between milk and blood from 29 individual mothers found 1.0 to 1.7 (Milk to Blood ratio). US Vegetables are lower in concentration of PBDES than fish, meat or dairy products. And last, fast food contributes to a modest extent, depending on the amount eaten and the size of the consumer, to total intake of PBDEs per day. PBDEs continue to persist in human and food and be a potential health threat[8,9].

Acknowledgement

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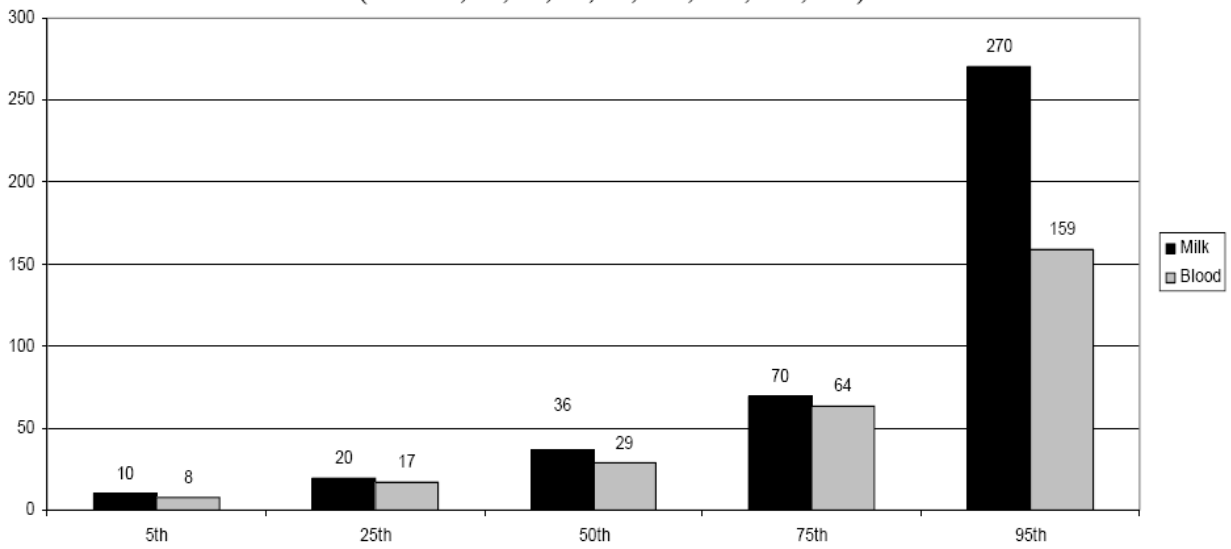
Figure 1

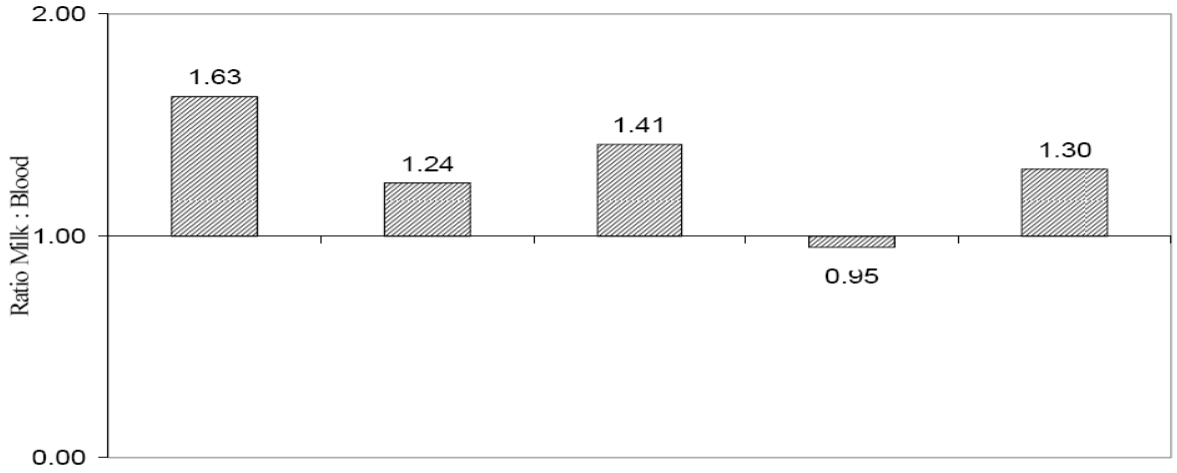
US Milk (n=91) and Blood (n=98) PBDE Levels (ng/g)
(BDE 28, 47, 66, 85, 99, 100, 153, 154, 183)



Milk- Mean - 70, Median - 36, Range - 6.1 to 598
Blood - Mean - 54, Median - 29, Range - 1.3 to 518

Figure 2

Paired PBDE Partitioning Ratios of Human Milk and Blood
(Medians, N = 25 Women)



Congener :	BDE 47	BDE 99	BDE 100	BDE 153	BDE
No. of Br :	4	5	5	6	Total
Total PBDE Levels (ng/g)	Milk: Mean – 83.8, Median – 44, Range – 15 to 580 Blood: Mean – 64.5, Median – 32, Range – 12 to 502				

Figure 3
PBDE in U.S. Vegetables and Food of Vegetable Origin

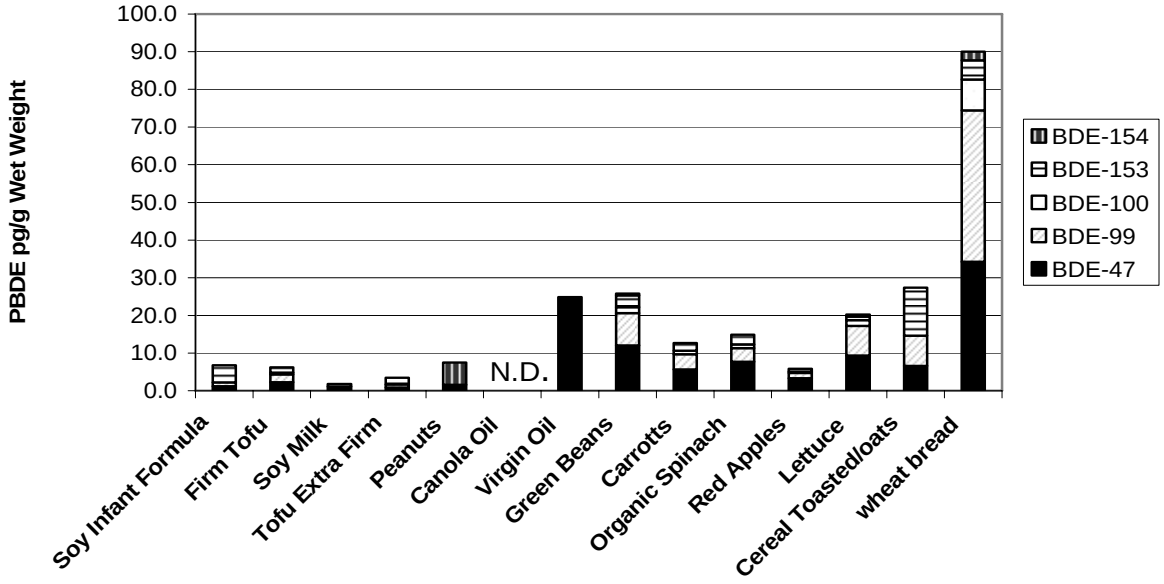


Figure 4
PBDE in U.S. Fast Food

		Mc Donald's			Wendy's		Taco Bell	Pizza Hut	Burger King	Häagan-Dazs		Fried Chicken	Foods Market
Sample	Big Mac	French Fries small size	Mc Chicken Sandwich	Filet O' Fish Sandwich	Chilli (beef)	Ham-burger	Soft Tacos (beef) N = 2	Personal Pan Pizza supreme	Veggi Burger	Frozen yogurt, vanilla	Butter Pecan Ice Cream	(Original) breast + leg	Veggi Burger (organic cheese-garlic) "365 Organic " N = 2
lipid Content (%)	13.85	17.9	9.4	13.2	2.5	12	9.2	11.8	7	2.3	20.2	13.6	1.8
Weight per Serving (g)	203	108	140	140	266	149	198	227	201	100	100	237	151
BDE #47, ppt	15	11	15	9.2	9.3	26	20	39	9.6	22	33	18	14
BDE #99, ppt	15	17	11	12	5.2	18	17	47	6.0	7.5	18	17	5.7
BDE #100, ppt	2.8	3.4	2.1	2.1	0.88	3.1	2.8	7.6	1.2	1.9	3.8	3.6	1.1
BDE #153, ppt	4.2	n.d.(2)	2.7	2.7	1.4	4.7	3.4	3.9	n.d. (0.7)	0.85	3.2	1.5	0.71
BDE #154, ppt	3.1	n.d.(2)	2.2	2.2	0.94	3.5	2.3	3.9	n.d. (0.7)	0.82	2.6	1.6	0.66
Total PBDE pg/per serving	*8120*	*3456*	*4620*	*3780*	*4788*	*8344*	*8712*	*23381*	*3417*	*3300*	*6000*	*10191*	*3473*