DOES FLYING IN COMMERCIAL AIRLINERS PRESENT A THREAT OF PBDE EXPOSURE?

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Introduction

Polybrominated diphenyl ether (PBDE) exposure can lead to increased body burden of this class of brominated flame retardant, especially in highly exposed workers.[1,2] One peer reviewed article suggests that passengers flying in airplanes might have increased exposure to PBDEs as reflected by elevated blood levels of PBDEs after flight compared to prior to flight serum levels.[3] Possible PBDE exposure in airplane cabins might originate from PBDEs in carpet liners, seat cushions, plastics used for luggage storage or in electronics, each of which is sometimes contaminated with PBDEs.[1,4] In order to expand on the Christiansson et al. study, we organized a study of potentially highly exposed airline workers, either flight attendants or pilots. We published a brief letter following a preliminary study where we found no increase in total PBDE blood levels in 9 US flight attendants and 1 US pilot.[5] This abstract expands and reports the findings from our total PBDE blood levels in 25 US professional airline workers.

Materials and Methods

The Institutional Review Committees of the University of Texas Health Science Center at Houston and the University of Texas Southwestern Medical Center in Dallas approved the research protocol. Informed consent was obtained from each volunteer prior to enrollment in the study. Recruitment was by word of mouth initially by members of the research team and then by airline workers themselves. Most volunteers were living in or around Dallas, Texas, usually for many years prior to entry in the study. Volunteers had to be in good health and between the ages of 18 and 70 years; there were no gender, ethnic or religious exclusions. All participants were healthy and worked for at least the previous 5 consecutive years in these positions. None were sampled after time off from their work. All had blood taken a short time after their last flight. Blood was collected at the Southwestern Medical Center in Dallas, Texas. A questionnaire including age, residence, present and past occupational status, and known exposure to toxic chemicals was filled out by each volunteer. Approximately 50 ml of whole blood was collected; serum was extracted by centrifugation and used for analysis. Blood was stored at -80 degrees C, was sent by express delivery to Eurofins laboratory on dry ice and kept in a deep freezer until analyzed. Methods used by Eurofins laboratory for analysis of PBDEs in blood have been described elsewhere.[6] PBDE congeners BDE 17, 28, 47, 66, 77, 85, 99, 100, 138, 153, 154, 183, and 209 were measured.

Results and Discussion

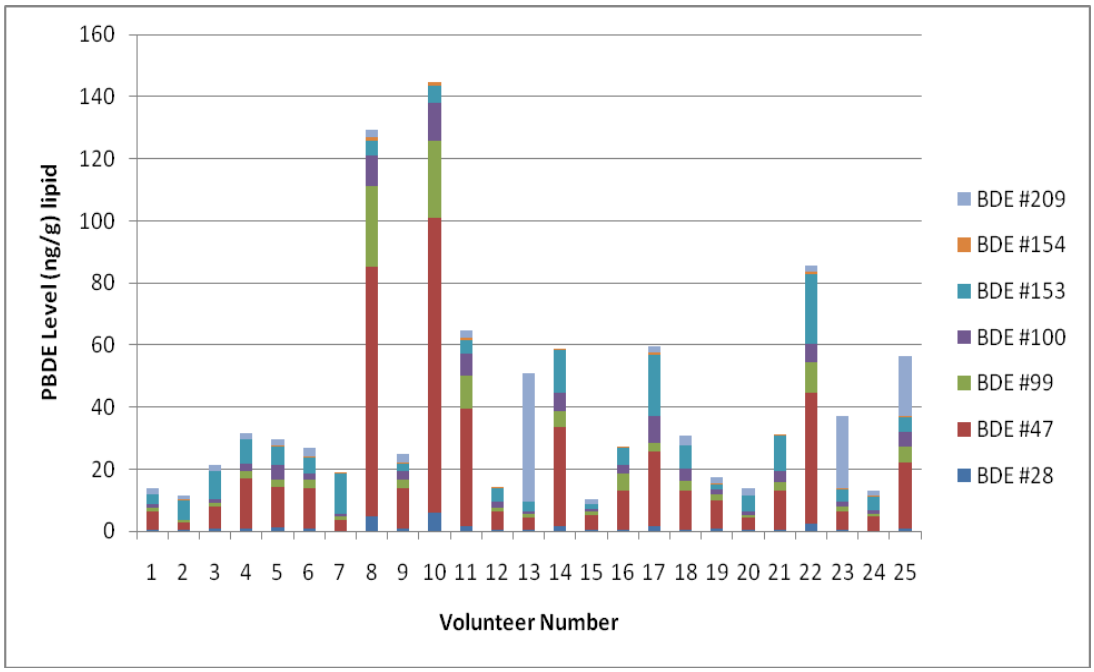
The initial volunteers' occupational and demographic characteristics are summarized in Table 1. The volunteers, 20% male and 80% female, by chance all of the same (majority) ethnic group, varied in age from 33-60 years. The group had 480 to 3,000 hours of time working in aircrafts over the past year and 2,500 to 15,000 hours over the previous five years. Figure 1 provides levels of most measured individual BDE congeners by volunteer number.

Table 1. Demographics of the Volunteers

Volunteer	Gender	Hours Flown in Past Year	Hours Flown in Past Five Years	Profession*
1	M	733	3000	P
2	F	700	3500	FA
3	F	1080	5400	FA
4	F	720	3600	FA
5	F	480	4200	FA
6	F	1500	6000	FA
7	F	1104	5520	FA
8	F	900	4500	FA
9	M	1200	5000	FA
10	F	1200	7000	FA
11	F	1450	7250	FA
12	F	1350	7500	FA
13	F	800	4200	FA
14	F	750	3250	FA
15	F	750	3250	FA
16	F	500	2500	FA
17	F	1000	5000	FA
18	M	1000	5000	FA
19	F	1000	5000	FA
20	F	1000	5000	FA
21	F	1000	5000	FA
22	M	900	4500	FA
23	M	1400	7000	FA
24	F	3000	15000	FA
25	F	960	4500	FA

* P stands indicates Pilot, FA indicates Flight Attendant

Figure 1. Levels of PBDEs in Serum in U.S. Airline Workers (ng/g) lipid



The total PBDE blood levels from the 25 volunteers were unremarkable except for elevation of BDE 209, BDE 47 and BDE 99 in some but not the same airline workers. Excluding BDE 209, the total PBDE blood level median was 27 ng/g lipid and the range was 9-149 ng/g. Including BDE 209, the PBDE blood level median was 31 ng/g and the range was 11-149 ng/g. BDE 209 had a median of 2.0 ng/g and a range of 0-41 ng/g. The three elevated BDE 209 values (volunteer numbers 13, 23, and 25) were 41, 23, and 19 ng/g, respectively. BDE 99 was elevated in 2 volunteers (volunteer numbers 8 and 10) with values of 26 ng/g and 25 ng/g, respectively; the median was 2 ng/g and the range was 1-11 ng/g. BDE 47 was elevated in 2 volunteers (volunteer numbers 8 and 10) with values of 80 ng/g and 95 ng/g, respectively; the median was 12 ng/g and the range was 3 to 38 ng/g. In our experience the general US population total PBDE range is from 6-400 ng/g lipid.[7,8] NHANES 2003-2004 reports the US general population total PBDE (excluding BDE 209) mean as 82 ng/g.[9]

No statistically significant correlations were noted between hours in airplanes in the past one or past five years and levels of individual BDE congeners or total PBDEs. These results are not consistent with the hypothesis that flying in commercial aircrafts leads to elevated PBDE exposure and body burden. The differences in our results from those presented in the prior study by Christiansson et al. 2008 might possibly be explained in several ways. There might be a difference in the chemical composition with respect to PBDEs in European airliners reported as compared to US airplanes in the first published study. There may be dietary differences where elevated PBDEs in US food overwhelmed the relatively small differences described in the European study where PBDE levels are much lower than US human levels. Dust containing PBDEs might have differed in the American versus the European study and overwhelmed small changes. Chance might have played a role in the elevation of PBDE congeners sometimes but not always noted after flying in the relatively small European study. Given the very large number of hours flown by the US volunteers, it seems to us more likely that there may not usually be a danger of elevated PBDE exposure and hence elevated body burden in those working in or flying in commercial airlines. Our findings to date do not support the hypothesis that time spent in US commercial airliners is associated with increased PBDE blood levels or elevated congeners. Further research with larger and representative samples from the USA and also Europe is indicated.

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