Exposure to Bisphenol A and diabetes risk in Mexican women

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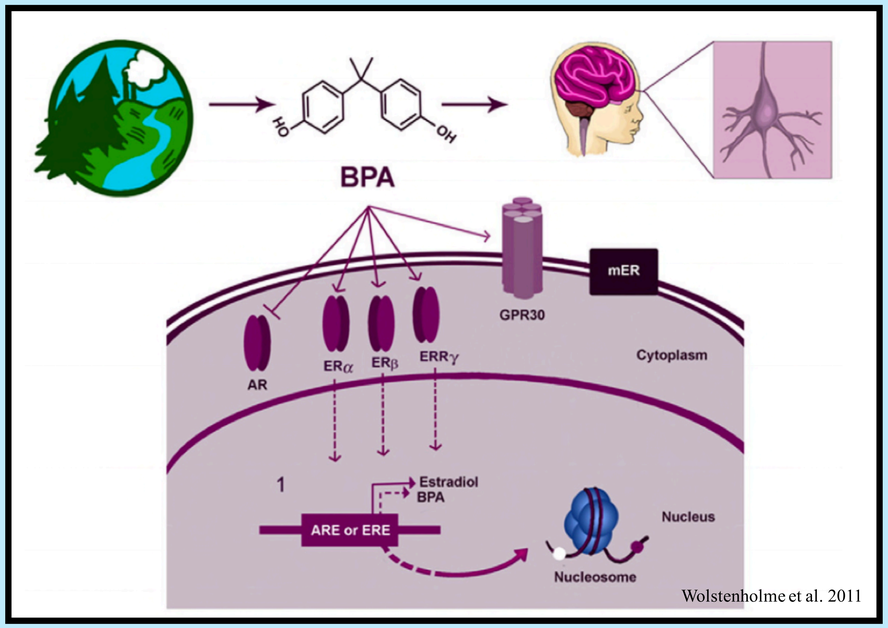
Introduction

BPA is an endocrine disrupting chemical (EDC) used in the production of polycarbonate plastics and epoxy resins. As one of the most widely produced chemicals in the world, BPA is found in cans, water and baby bottles, as well as in medical and dental equipment. BPA is widely produced and used in daily life, and has been detected in the urine of 90% of participants in studies conducted in the U.S.

BPA has been associated with infertility, neurodevelopment damage, cardiovascular disease, and diabetes. Known risk factors for diabetes include obesity, family history, lack of exercise, among others. In addition, there is growing evidence that a number of environmental factors such as arsenic, pesticides, phthalates, and BPA may be related to diabetes. It is thought that the mechanism of action by which BPA leads to the development of diabetes comes from its ability to act as a synthetic estrogen and as an epigenetic regulator. To date, no reports examining the association of BPA and diabetes in neither Mexico nor all of Latin America have been published.



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Results

Included diabetics were thinner and less educated than not included diabetics. Likewise, included non-diabetics were thinner with more family history of diabetes, cancer or, hypertension (Data not shown). Studied diabetics were significantly older, less educated, with lower urinary creatinine concentrations than non-diabetics (Table 1). Simple linear regression models showed urinary BPA-F concentrations to be significantly positively associated with age β=0.01 (95% CI 0.01, 0.02) (Table 2). After adjusting by age, the risk of diabetes was 1.85 (95% CI 1.04, 3.28) times higher among women in the highest BPA-F (µg/g creatinine) exposure level (4.06-224.53µg/g creatinine) compared to women in the reference category (0.67-4.05 µg/g creatinine), which did not reach statistical significant when BPA-F was modeled in a continuous scale (Table 3).

Table 1. Selected characteristics of participants

Characteristics	(Ca/Co)	Diabetics	Non-diabetics
Age, years (mean ± SD)	(70/334)	59.67 ± 1.19	51.49 ± 0.72*
Education, years (mean ± SD)	(70/334)	4.16 ± 0.36	5.85 ± 0.19*
Family history, (%)[a]			
No	(27/148)	38.57	44.44
Yes	(43/185)	61.43	55.56
Body Mass Index, kg/m^2 (mean ± SD)	(70/334)	28.80 ± 0.54	29.30 ± 0.33
WC, cm (mean ± SD)	(70/334)	100.70 ± 1.25	97.14 ± 0.72*
WH Ratio (mean ± SD)	(70/334)	0.94 ± 0.01	0.90 ± 0.00*
Creatinine (mg/dL) (mean ± SD)	(70/334)	48.40 ± 4.24	70.96 ± 2.95*

[a] History of diabetes, cancer or, hypertension

* *P*-value <0.05

Table 3. Odds Ratios of urinary BPA-F and Diabetes

Models	(n)	OR (CI 95%)
BPA-F (µg/g creatinine)		
Model 1		
0.67-4.05	(21/167)	1.00
4.06-224.53	(49/167)	2.33 (1.34,4.06)
Continous*	(70/334)	1.31 (1.04,1.65)
Model 2		
0.67-4.05	(21/167)	1.00
4.06-224.53	(49/167)	1.85 (1.04,3.28)
Continous*	(70/334)	1.23 (0.96,1.58)

Model 1: crude

Model 4: adjusted by age (years)

* Log-transformed

Methods

As part of a case control study for breast cancer, only controls with BPA information were included in this report. The final simple size comprises 70 self-reported diabetics and 334 non-diabetics. Urinary free Bisphenol A (BPA-F) (µg/L) was determined by solid phase extraction and HPLC/FLD analysis. Logistic regression models were used to evaluate the association between BPA-F and self-reported diabetes.

Table 2. Geometric means (CI 95%) of creatinine adjusted Bisphenol A concentrations according to selected characteristics in the study population

Factor	Diabetes			
	(n)	yes	(n)	no
Age, years (GM (95% CI)) [a]				
23-45	(8)	8.07 (3.14,20.74)	(124)	3.97 (3.25,4.85)
46-55	(15)	6.28 (3.59,10.99)	(105)	4.78 (3.97,5.76)
56-88	(47)	6.47 (4.93,8.51)	(105)	6.02 (4.91,7.38)
Education, years (GM (95% CI))				
0–4	(37)	7.49 (5.25,10.69)	(117)	5.54 (4.63,6.64)
5–6	(24)	5.19 (3.61,7.47)	(115)	4.61 (3.75,5.68)
7–16	(9)	4.40 (4.47,12.24)	(102)	4.26 (3.45,5.25)
BMI, kg/m^2 (GM (95% CI))				
<25.00	(16)	6.91 (4.20,11.36)	(87)	4.85 (3.95,5.95)
25.00 - 29.99	(26)	6.44 (4.44,9.35)	(106)	4.22 (3.51,5.08)
>29.99	(28)	6.57 (4.40,9.81)	(141)	5.25 (4.31,6.39)
WC, cm (GM (95% CI))				
62.50-90.80	(13)	8.82 (4.57,17.01)	(112)	4.45 (3.74,5.30)
90.90-102.40	(29)	7.48 (5.34,10.47)	(112)	4.41 (3.58,5.43)
102.50-134.20	(28)	5.06 (3.52,7.29)	(110)	5.64 (4.56,6.98)
WH Ratio (GM (95% CI))				
0.64-0.87	(12)	10.70 (6.19,18.49)	(112)	4.49 (3.74,5.40)
0.87-0.92	(16)	7.17 (4.03,12.78)	(111)	4.42 (3.66,5.34)
0.92-1.27	(42)	5.57 (4.20,7.38)	(111)	5.57 (4.46,6.96)
Total	(70)	6.60 (5.25,8.29)	(334)	4.80 (4.28,5.38)

[a]ß (95% CI) = 0.01 (0.01,0.02), *p*-value=0.001

Discussion

This study suggests a positive significant association between urinary BPA-F and diabetes. BPA-F is the biologically active form of BPA, that accounts for 10-32% of the total BPA in urine. Our results are consistent with some studies, but not all, where self-report diabetes and BPA exposure was evaluated. All those studies were included in a meta-analysis where a summary OR for diabetes was calculated from 16 studies in total (1.28 CI 95% 1.14, 1.44). One limitation of this report is diabetes diagnosis was self-reported and no information on the type of diabetes was gathered. The presence of some type 1 diabetics in our group of controls, may have slightly attenuated our measurements of association. In addition, it is estimated that over 23.8% of people with diabetes are undiagnosed. If some undiagnosed diabetics were included in our control group and BPA-F is related to diabetes, then, our measurements of associations may be underestimated. Another limitation of this report was the LD of 2.78 µg/L of BPA-F determination. Most other previous studies have had LDs below 1.0 µg/L. Our LD, limited our ability to assess lower levels of urinary BPA-F. BPA may be an environmental cofactor of diabetes. More studies are needed to confirm this result, especially in Latin America, as our report if the first among Latinx populations.