

Greenlandic women's lifestyle and diet during pregnancy and child risk for asthma, eczema and allergy: an ACCEPT-substudy

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ABSTRACT

Persistent Organic Pollutants (POPs) are environmental chemicals bio-accumulating through the food chain. POPs can affect the foetal development of the immune, the neural and the reproductive system. POPs are endocrine disruptors and shown to interfere with child vaccination responses. Our hypothesis is that POPs interfere with the immune system increasing the risk of asthma, allergy and eczema. In a pilot cross-sectional study, we sent 120 questionnaires to Inuit mothers to elucidate the relation between smoking during pregnancy and the risk of child asthma, allergy and eczema, and the possible modifying effect of breastfeeding. Fifty-one mothers responded. We found that the risk of getting allergy among the offspring was higher when the mother had been smoking during pregnancy and the child being breastfed <12 months (OR = 5.67, 95% CI: 0.754; 42.58, $p = 0.092$). Furthermore, we found that children with eczema were predisposed of having asthma (OR = 19.6, 95% CI: 2.19; 176, $p = 0.008$), also allergy when breastfed >12 months (OR = 17.0, 95% CI: 1.02; 283, $p = 0.048$).

Abbreviation: ACCEPT (Adaptation to Climate Change, Environmental Pollution, and Dietary Transition).

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KEYWORDS

Pregnancy; lifestyle; diet; Inuit; ACCEPT birth cohort; asthma; eczema; allergy

Introduction

Persistent Organic Pollutants (POPs) including polychlorinated biphenyls (PCBs), organochlorine pesticides (OCPs) and perfluorinated alkyl acids have long half-lives and bio-magnify through the food chain and are found in animals and humans. The Arctic Monitoring and Assessment Programme has been performing circumpolar monitoring of POPs since the beginning of the 1990s [1]. The foetus is exposed to POPs during pregnancy and further through breastfeeding as a child. The POPs can have health impact on pregnant women and their foetus during development. Inuit dieting traditional including marine mammals have high serum concentrations of POPs being further increased upon smoking possibly due to a common pathway for metabolism via the P-450 cytochrome system [1]. Moreover, maternal serum concentrations of POPs have been reported to be associated with increased risk of asthma in the offspring [2], and studies showed that breastfeeding can modify offspring risk of asthma and current asthma reduced by month of breastfeeding [3]. The ACCEPT birth cohort, established during 2010–2015, is

a Greenlandic geographical mother-child cohort including 592 Inuit pregnant women holding data on mothers lifestyle, diet questionnaires and sampling of hair, blood and urine for POP monitoring and toxicological analyses. To investigate the effect of mothers lifestyle during pregnancy on offspring's health, a pilot follow-up study on ACCEPT children health and development at 3–5 years old was conducted using data from the Inuit mothers' questionnaire participating in the project during 2010–2011. The questions referred to child development, their achievement of milestones, social skills, diet and health status including disease diagnosis such as asthma, allergy and eczema.

Materials and methods

Out of 120 questionnaires, 51 responded of which two were not Inuit and excluded. Answers were entered into EPIDATA twice and transferred to the statistic programme SPSS. Odds ratios (ORs) were calculated using logistic regression analysis to investigate the association between smoking during pregnancy and the risk of

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Table 1. Maternal characteristics.

Maternal Characteristics: For further information about the study population: <https://doi.org/10.3402/ijch.v74.29469>; <https://www.ncbi.nlm.nih.gov/pubmed/26011616>; <https://journals.sagepub.com/doi/pdf/10.1177/1403494817714188>

Parity:	Mean 0.90, SD: 0.805, Median: 1.0, min-max: 0-2 Parity = 0: 19 (38.8%), parity = 1: 17 (34.7%), parity > = 2: 13 (26.5%)
Smoking:	<i>Smoking during pregnancy:</i> 10 out of 47 mothers were smoking during pregnancy; <i>Smoking during child age 0 – 3/5 year of age:</i> 16 current smokers (of which 7 smoked during pregnancy), 19 former smokers, 12 never-smoking; 7 quit smoking during pregnancy, but resumed smoking after giving birth.
Breastfeeding:	<i>All 49 children were breastfed:</i> 0-6 months (n = 9); 6-12 months (n = 18); >12 months (n=22)
Alcohol:	<i>Before pregnancy:</i> <1 /month: n = 23, 1 /month: n = 8 (17%), 2-3 /month: n = 10, > 1 /week: n = 6 <i>During pregnancy:</i> < 1 /month: n = 46, 1 /month: n = 1, 2-3 /month: n=1
Sum POPs (sumPCB + sumOCP) µg/kg serum lipid, median	<i>Smokers (n = 15):</i> 434.35 µg/kg lipid, <i>former smokers (n = 18):</i> 383.25 µg/kg lipid; <i>Never-smoking (n=12)</i> 351.95 µg/kg lipid. Linea regression coefficient ($\beta = -167$, 95%CI: -505, 172, p = 0.326). https://www.ncbi.nlm.nih.gov/pubmed/12747516

Allergy

(Cases defined as those with an unspecified allergy diagnosis (diagnosed by a physician) and those with symptoms of allergy but no final allergy diagnosis yet)

Risk of offspring allergy by maternal smoking during pregnancy	Case/non-case	OR	95% CI	p
All	9/38			
Non smoking	6/31	1 (ref)	-	
Smoking	3/7	2.21	0.44; 11.08	0.333
Breastfeeding < 12 months	6/20			
Non smoking	3/17	1 (ref)	-	
Smoking	3/3	5.67	0.75; 42.58	0.092**
Breastfeeding > 12 months	3/18			
Non smoking	3/14	1 (ref)	-	
Smoking	0/4	0	-	0.999

Asthma

(Cases defined as those with a diagnosis (diagnosed by a physician) and those with symptoms of asthma but no final diagnosis yet).

Risk of offspring asthma by maternal smoking during pregnancy	Case/non-case	OR	95% CI	p
All	18/27			
Non smoking	16/20	1 (ref)	-	-
Smoking	2/7	0.36	0.07; 1.96	0.236
Breastfeeding < 12 months	10/15			
Non smoking	9/10	1 (ref)	-	-
Smoking	1/5	0.22	0.02; 2.28	0.205
Breastfeeding > 12 months	8/12			
Non smoking	7/10	1 (ref)	-	-
Smoking	1/2	0.71	0.05; 9.50	0.799

Eczema

(Cases defined as those with a diagnosis (diagnosed by a physician) and those with symptoms of eczema but no final diagnosis yet).

Risk of offspring eczema by maternal smoking during pregnancy	Case/non-case	OR	95% CI	p
All	8/39			
Non smoking	7/30	1 (ref)	-	-
Smoking	1/9	0.48	0.05; 4.40	0.513
Breastfeeding < 12 months	5/21			
Non smoking	4/16	1 (ref)	-	-
Smoking	1/5	0.80	0.07; 8.91	0.856
Breastfeeding > 12 months	3/18			
Non smoking	3/14	1 (ref)	-	-
Smoking	0/4	0	-	-0.999

Asthma

(Cases defined as those with a diagnosis (diagnosed by a physician) and those with symptoms of asthma but no final diagnosis yet).

Risk of child asthma for child with eczema [#]	Case/non-case	OR	95% CI	p
All	19/28			
Non-eczema	11/27	1 (ref)	-	-
Having eczema	8/1	19.64	2.19; 176.1	0.008*
Breastfeeding < 12 months	11/15			
Non-eczema	5/15	1 (ref)	-	-
Having eczema	6/0	4.84x10 ⁹	-	0.999

(Continued)

Table 1. (Continued).

Asthma				
(Cases defined as those with a diagnosis (diagnosed by a physician) and those with symptoms of asthma but no final diagnosis yet).				
Risk of child asthma for child with eczema [#]	Case/non-case	OR	95% CI	<i>p</i>
Breastfeeding > 12 months	8/13			
Non-eczema	6/12	1 (ref)	-	-
Having eczema	2/1	4.00	0.30; 53.47	0.295
<i>Mothers smoking after birth</i>		<i>Children having both asthma and eczema</i> <i>Smokers/non-smokers: 2/5</i>		
Allergy				
(Cases defined as those with a diagnosis (diagnosed by a physician) and those with symptoms of allergy but no final diagnosis yet).				
Risk of child allergy for child with eczema ^{##}	Case/non-case	OR	95% CI	<i>p</i>
All	10/39			
Non-eczema	7/33	1 (ref)	-	-
Having eczema	3/6	2.36	0.47; 11.77	0.296
Breastfeeding < 12 months	6/21			
Non-eczema	5/16	1 (ref)	-	-
Having eczema	1/5	0.64	0.06; 6.85	0.712
Breastfeeding > 12 months	4/18			
Non-eczema	2/17	1 (ref)	-	-
Having eczema	2/1	17.00	1.02; 283.01	0.048*
<i>Mothers smoking after birth</i>		<i>Children having both allergy and eczema</i> <i>Smokers/non-smokers: 0/3</i>		
Asthma				
(Cases defined as those with a diagnosis (diagnosed by a physician) and those with symptoms of asthma but no final diagnosis yet).				
Risk of child asthma for with child allergy ^{###}	Case/non-case	OR	95% CI	<i>p</i>
All	19/28			
Non-allergy	14/23	1 (ref)	-	-
Having allergy	5/5	1.64	0.40; 6.08	0.489
Breastfeeding < 12 months	11/15			
Non-allergy	9/11	1 (ref)	-	-
Having allergy	2/4	0.61	0.09; 4.14	0.614
Breastfeeding > 12 months	8/13			
Non-allergy	5/12	1 (ref)	-	-
Having allergy	3/1	7.20	0.60; 87.02	0.121
<i>Mothers smoking after birth</i>		<i>Children having both asthma and allergy</i> <i>Smokers/non-smokers: 2/3</i>		

*: significance level $p \leq 0.05$; **significance level $p \leq 0.1$; #: Smoking during pregnancy (asthma) cases/non-case: 2/7. ##: Smoking during pregnancy (eczema) cases/non-case: 1/9; ###: Smoking during pregnancy (allergy): cases/non-case 3/7.

children's asthma, eczema or allergy the (defined in Table 1) as well as the associations between the diseases. Effect of breastfeeding was analysed by stratifying breastfeeding into two periods, less or more than 12 months, respectively. The statistical significant level was set to $p \leq 0.10$.

Results

Risk of getting allergy was higher among offspring born by mothers smoking during pregnancy and breastfed for less than 12 months (Table 1). The risk of having asthma was higher for children already suffering from eczema, although the significance disappeared when stratifying for breastfeeding duration. Furthermore, we found a higher allergy risk when the offspring also had eczema and had been breastfed for more than 12 months.

Discussion

Although we must interpret our data with cautions due to low power, we observed the following. The risk of allergy was significantly higher among children born by maternal smokers when breastfed for less than 12 months. This risk seemed attenuated upon being breastfed more than 12 months. The risk of child asthma or eczema was not significantly associated with mothers smoking during pregnancy. However, children suffering from eczema, the child had a significantly higher risk of having asthma, and higher risk of having allergy when being breastfed for more than 12 months. The data suggest that the duration of breastfeeding might modify asthma and allergy risk in the infant, when the mother has been smoking during pregnancy. The increased risk of allergy in children suffering from eczema upon breastfeeding for more than 12 months might be because longer

breastfeeding increases the child POP burden influencing allergy risk. Our study is too small to make conclusions and further study needed to elucidate the findings.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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